WESTERN SYDNEY
UNIVERSITY

School of Medicine

Summer Scholarship Research Program 2020

Project Lists

Project 1: Helicoverpa armigera (Caterpillar) as a neurodegenerative disease model

Supervisor(s): Mourad Tayebi - m.tayebi@westernsydney.edu.au
Principal Supervisor

Casey Hall - Casey.Hall@westernsydney.edu.au
Second Supervisor

Project description

Neurodegenerative disorders, such as Alzheimer`s (AD), already represent a significant health burden today, affecting the quality of life of millions of people globally. The lack of effective systems for disease modelling has hampered the development of therapies. As a consequence, the most urgent and pressing scientific challenges involved in the strategic research area for AD include the development of an experimental disease model that mimics the neuropathological lesions observed in these human disorders. Serotonin (5-hydroxytryptamine, 5-HT) is widely present in invertebrate species and is an important neurotransmitter that modulates the neural circuit. In AD, the serotonergic system is thought to play a key role in memory retention and learning. Different ligands for serotonin receptor classes were shown to reduce AD neuropathology probably via increase cholinergic neurotransmission. A recent study mapped the distribution of serotonin in the central nervous system of caterpillar Helicoverpa armigera and provided a comprehensive description of the serotonergic neuronal network in this insect. The major goal of this study is to assess the toxic effects of proteins and peptides associated with AD on the serotonergic neuronal system of caterpillar Helicoverpa armigera. The hypothesis is that the well-developed serotonergic neuronal system of this insect will help replicate the neuropathology associated with human AD. This study is a collaboration between SoM (MT and UH) and HIE (CH) and will and for the first time investigate the effects of AD-associated toxic proteins and peptides on the serotonergic neuronal system of caterpillar Helicoverpa armigera.

Project Aims

The aim of the project is to study the effect of toxic proteins / peptides on Helicoverpa armigera. This will:

- Results in novel strategies for the development of a robust disease animal model for AD.
- Provide insight into the mechanisms underlying neuropathology of the serotonergic neuronal system.
- Establish this model for drug/biologics testing for AD.

Project Methods

Histology; Immunohistochemistry; Immunofluorescence; Western blotting; ELISA.

Opportunity for Skill Development

The student will gain basic laboratory skills – writing skills and work effectively in a research intensive environment.

Students are required to have the following skills/meet the following pre-requisite(s) to apply

Positive attitude towards their work

Project 2: ‘The Gambling Bug”- gambling in Aboriginal communities

Supervisor(s): Aunty Kerrie Doyle - auntykerrie.doyle@westernsydney.edu.au
Principal Supervisor

Paul Saunders - p.saunders@westernsydney.edu.au
Second Supervisor

Project description

Gambling is problematic in Aboriginal communities. Using culturally appropriate posters, Aboriginal community members will be invited to participate in yarning circles to investigate the lived experience of gamblers who articulate with mental health services. Recruitment will be purposive snowball style, allowing participants to refer others to the program. The project will be implemented within Western NSWLHD. The findings from the yarning circles will undergo narrative analysis to answer the research questions of what are the barriers and facilitators to seeking treatment help for gambling, and what is the lived experience of Aboriginal people who gamble using mental health services. The outcomes of this project will inform models of treatment and policy recommendations for Aboriginal people with problematic gambling, and getting it right for Aboriginal people will help to get it right for everyone.

Project Aims

The research aim is to consider the lived experience of being Aboriginal, experiencing problems with gambling, and seeking treatment for mental health. to fit an indigenist approach, and design outputs for GP clinics and AMSs.

Project Methods

Literature review, community consultation (survey and interviews/yarning circles post-covid)

Opportunity for Skill Development

Indigenist research skills; cross-cultural communication; writing skills; interviewing skills; community capacity building skills.

Students are required to have the following skills/meet the following pre-requisite(s) to apply

Cultural humility, we can do the rest

Project 3: Review of Indigenous Health Unit in the PG Diabetes Course

Supervisor(s): Professor Aunty Kerrie Doyle - auntykerrie.doyle@westernsydney.edu.au
Principal Supervisor

Paul Saunders - p.saunders@westernsydney.edu.au
Second Supervisor

Project description

Diabetes in Indigenous communities is a major cause of the gap in life expectancy and burden of disease. WSU Diabetes team led by Distinguished Professor David Simmons coordinates a post-graduate certificate course in Diabetes that includes a module on 'Diabetes in Indigenous Communities'. This course is due to be peer reviewed. Students would be required to review the teaching material for best and current practices, and suggest more updated material.

Project Aims

The PG Diabetes course is available to health professionals working in communities with Indigenous people. This course was run for the first time in 2019 and is due to be peer reviewed. Students in this course will do a literature review to identify most recent and best practice for interventions for Indigenous people with diabetes. The literature will inform the unit for 2020.

Project Methods

Literature review, researching best practice, understand how to determine strength of evidence

Opportunity for Skill Development

Indigenist research skills; cross-cultural communication; writing skills; evidence based research skills; networking with leaders in diabetic community.

Students are required to have the following skills/meet the following pre-requisite(s) to apply

Cultural humility, we can do the rest

Project 4: Scoping review of the intersection between homosexuality and religiosity

Supervisor(s): Brahm Marjadi - b.marjadi@westernsydney.edu.au
Principal Supervisor

Paul Glew - p.glew@westernsydney.edu.au
Second Supervisor

Project description

Research on gender and sexual diversity has identified the need for understanding the unique health, social and spiritual needs of people who identify as lesbian, gay, bisexual, transgender, queer, questioning, intersex, asexual or aromantic (LGBTQIA). For religious LGBTQIA people, their sexual identity and religiosity are two integral parts of their identity. Yet, acceptance of sexuality and gender diversity varies across religions and even between different groups within the same religion, and LGBTQIA people are often caught in a clash between their sexual identity and religiosity. This clash could be deleterious to mental, social, spiritual and physical health particularly when one felt pressured to choose only one of these two parts of their identity. Marginalisation, discimination and social stigma which exclude these individuals from engagement in expressions of religion may compound a lack of recognition of their wellbeing needs and personal identity with resulting negative influences on mental, emotional and physical health. Reconciliation in the intersection between sexual identity and religiosity could be vital to improved health and wellbeing for religious LGBTQIA people.

This project seeks to understand the experiences of people who identify as homosexual (gay or lesbian) in relation to their religiosity. The project aims is to discover the perspectives of these people in a multicultural context such as Australia compared to other cultural settings, and investigate how religious inclusivity of these people may contribute to their identity, health and wellbeing. Since a preliminary literature search did not yield many publications on this topic, a scoping review approach is chosen to examine what has been done in this area and identify knowledge gaps.

Project Aims

This scoping review will examine the existing literature on the intersection of homosexuality and religiosity. The aims of the review are to:

- Identify the approaches used to research this topic;
- Summarise the findings; and
- Identify knowledge gaps in this topic.

The review will focus on understanding the experiences and perspectives of people who identify as homosexual (gay and lesbian) and ways in which they reconcile their sexual diversity and religiosity. This project may become a topic for further research in a PhD project.

Project Methods

This is a scoping literature review which will use the five-stage framework from Arksey and O'Malley (Arksey H, O'Malley L. Scoping studies: towards a methodological framework. Int J Soc Res Method. 2005;8(1):19–32):

1. Identifying the research questions,
2. Identifying relevant studies,
3. Selecting the relevant studies
4. Charting the data, and
5. Collating, summarising and reporting the results.

The student will engage with WSU librarians for developing literature search strategies, and with the supervisors for content knowledge and report writing skills.

Opportunity for Skill Development

The student will learn how to conduct a scoping literature review from research question formulation, literature search, data extraction, to report writing. These research skills are transferable to many other types of research projects.

Students are required to have the following skills/meet the following pre-requisite(s) to apply

The student needs to:

- Have a high level attention to details,
- Be able to work independently following a brief,
- Maintain regular communication with the supervisors, and
- Be able to meet tight deadlines.

Failure to demonstrate the above skills will lead to an unfavourable progress report.

Project 5: Mechanism of dopamine release from dopaminergic amacrine cells in the retina

Supervisor(s): Morven Cameron - m.cameron@westernsydney.edu.au
Principal Supervisor

David Harman - d.harman@westernsydney.edu.au
Second Supervisor

Project description

Dopamine is one of the most influential neuromodulators in the mammalian central nervous system (CNS). Pathologies involving its release and action underlie many disorders including Parkinson's disease, ADHD and schizophrenia. However, the mechanism that governs dopamine release is poorly understood. Dopaminergic amacrine cells (DACs) of the retina release dopamine in response to light stimulation. Over recent years, the electrical inputs to dopaminergic amacrine cells (DACs) have been defined in great detail, showing that all three photoreceptor classes: rods, cones and melanopsin-containing retinal ganglion cells (mRGCs), provide substantial input to these cells. Conversely however, measurement of dopamine release in response to light does not correlate with these results as mRGCs input alone does not drive dopamine release. Release of dopamine from midbrain neurons has recently been shown to display similar characteristics where spiking alone is not enough to explain the release of dopamine. This suggest that dopamine can be released from the process of these neurons independent of cell firing, a process that is not widely described in the CNS. The retina represents an ideal model to study the function of dopaminergic cells of the central nervous system (CNS) in general given the well-defined and accessible nature of the tissue. In this project we will examine directly the relationship between photoreceptor activation and dopamine release using ultra-high-performance liquid chromatography and tandem mass spectrometry (UHPLC-MS/MS). Students will learn LC-MS techniques and analyse retinae for dopamine and other neuromodulators.

Project Aims

- Construction of a standard curve to accurately measure dopamine in water.
- Measurement of dopamine in retinal samples by UHPLC-MS/MS

Project Methods

Ultra-high-performance liquid chromatography and tandem mass spectrometry (UHPLC-MS/MS).

Opportunity for Skill Development

Acquisition of both general and specific lab skills: pipetting, dilutions, making up solutions, experiment planning and randomization, UHPLC-MS/MS and data analysis/statistics.

Students are required to have the following skills/meet the following pre-requisite(s) to apply

Some background in biological science or chemistry.

Project 6: Development of dopaminergic cells in the mammalian retina

Supervisor(s): Morven Cameron - m.cameron@westernsydney.edu.au
Principal Supervisor

John Morley - j.morley@westernsydney.edu.au
Second Supervisor

Project description

Dopamine is one of the most influential neuromodulators in the mammalian central nervous system (CNS). Pathologies involving its release and action underlie many disorders including Parkinson's disease, ADHD and schizophrenia. However, the mechanism that governs dopamine release is poorly understood. Dopaminergic amacrine cells of the retina release dopamine in response to light stimulation. These cells signal light-adaptation of the retina and rearrange neuronal circuits. However, dopaminergic cells are present in the retina immediately following birth in mice, well before eye-opening. It is thought that dopamine release is important for correct circuit development in the adult retina. This project will examine the morphology of dopaminergic cells in the retinae of mice at a variety of postnatal ages from P1 – P21. Further, we will examine the location of light sensitive melanopsin-containing retinal ganglion cells to determine if light information is able to reach these dopaminergic cells, before rods and cones are functional. Students will learn immunohistochemistry using fluorescent-labelled antibodies and will take images of these stained retinae using a confocal microscope.

Project Aims

- Immunohistochemistry of early postnatal mouse retinae, staining for tyrosine hydroxylase and melanopsin.
- Take images using a confocal microscope.

Project Methods

Immunohistochemistry and confocal microscopy.

Opportunity for Skill Development

Acquisition of both general and specific lab skills: pipetting, dilutions, making up solutions, experiment planning and randomization, immunohistochemistry, confocal microscopy, and data analysis/statistics.

Students are required to have the following skills/meet the following pre-requisite(s) to apply

Some background in biological science or chemistry.

Project 7: Validation of a children's healthy lifestyle questionnaire

Supervisor(s): Kate McBride - k.mcbride@westernsydney.edu.au
Principal Supervisor

Freya MacMillan - f.macmillan@westernsydney.edu.au
Second Supervisor

David Simmons - da.simmons@westernsydney.edu.au
Third Supervisor

Project description

Our research team have an NHMRC Partnership grant (P00025457) focused on reducing the impact of diabetes on Pacific communities in Greater Western and South Eastern Sydney through a church-based community intervention (ethics application approved by South Western Sydney Local Health District [LHD]). Health Promotion and Population Health Units from LHDs in South Western Sydney, Western Sydney, Nepean Blue Mountains and South Eastern Sydney are partners in this NHMRC project. As part of the overall project, we are seeking to evaluate lifestyle behaviours of children and adolescents aged <16 years old using questionnaires originally developed for face to face data collection. As a sub-study of this wider project, the summer scholar will be aiming to validate administration of these questionnaires in a digital format. This is because data collection for the wider NHMRC project likely to be predominantly conducted online due to ongoing concerns about infection transmission due to COVID-19.

We have ongoing regular contact with the leaders of these churches through a Community Activator (who is Samoan and led delivery of our pilot intervention) that has been recruited by our team to oversee community engagement and intervention delivery for this project. In addition, we have a Pasifika Community Reference group formed in 2016 and made up of 25-30 community leaders who steer all aspects of our research. The summer scholar will work with our Community Activator to engage members of the initial pilot intervention through social media and telephone in order to test and validate administration of the existing surveys through a digital format. Queensland Health, who originally developed this questionnaire, will also be partners on this project and will be simultaneously testing the questionnaire in a similar cohort in Brisbane. The summer scholar will analyse the data collected both form our local setting and form Queensland to assess the efficacy of online administration of the questionnaire. The summer scholar is expected to gain skills in data collection, recruitment, community engagement, working in partnership with stakeholders, questionnaire validation and data analysis.

Project Aims

- To establish ease of recruitment of the local Pasifika Community using social media
- To explore the acceptability of delivery of an online questionnaire to members of the local Pasifika community
- To determine the reliability and validity of a pre-existing survey instrument designed to assess lifestyle behaviours among children and adolescents <16 years old
- To determine the response rate to the online questionnaire
- To identify ways of optimising engagement with online data collection strategies among the local Pasifika community

Project Methods

Working alongside our existing Community Activator, the summer scholar will recruit members of our pilot study churches to take part in the online surveys. To ensure that we fulfil our obligation to this community in providing ongoing opportunities to engage with our health lifestyle programme, the student will administer the questionnaires as part of broader online activities designed to not only engage young people, but which also aim to provide additional opportunities for younger members of our pilot study to engage in activities designed to improve lifestyle behaviours. The student will also conduct one on one interviews with younger members of the community to assess acceptability of the questionnaire and assess feasibility of online administration The student will conduct a mixed methods analysis by examining qualitative data from the interviews and will also conduct a series of quantitative evaluations to assess validity of the survey in its online format.

Opportunity for Skill Development

The summer scholar is expected to gain skills in:

- Mixed methods data collection and analysis
- Purposive recruitment
- Community engagement
- Working in partnership with stakeholders
- Questionnaire validation
- Advanced literature reviewing methods
- Report and journal article writing
- Working as part of a wider research team

Students are required to have the following skills/meet the following pre-requisite(s) to apply

Students are expected to have basic knowledge in use of Excel and Word and preferably have an interest in working with CALD communities. Their communication skills should be of high quality and experience with basic statistics would be seen as advantageous.

Project 8: Evaluation of the Diabetes Contraception and Pre-Pregnancy Program (DCAPP) among health care professionals

Supervisor(s): David Simmons - da.simmons@westernsydney.edu.au
Principal Supervisor

Jincy Immanuel - j.varghese@westernsydney.edu.au
Second Supervisor

Freya MacMillan - f.macmillan@westernsydney.edu.au
Third Supervisor

Project description

WSU Theme-Health and Wellbeing-First 2000 Days

Women with type 1 or type 2 diabetes who become pregnant, have an increased risk of adverse pregnancy outcomes (1). Congenital malformation rates are 2% in the general population (2), 4% overseas with diabetes pre-pregnancy management (PPM) (3), but 4–18% in Australia (4,5). The Diabetes Contraception and Pre-Pregnancy Program (DCAPP) has been developed and rolled-out across primary (general practitioners (GPs) and pharmacists) and secondary (endocrinology and obstetric/gynaecology) healthcare facilities throughout South Western Sydney (SWS) to develop a more integrated approach to effective contraception and PPM among women of childbearing age (16–50 years) with known diabetes. It aims to enhance awareness of the risk of unplanned pregnancy and contraception options among healthcare professionals (HCPs) and women of childbearing age with diabetes. It also aims to enhance the practice of PPM in women planning to become pregnant via encouraging them to attend pre-pregnancy clinics and to manage their diabetes before conception. This will, in turn, aim to reduce rates of congenital malformations (and other adverse pregnancy outcomes) which has been an observed outcome seen in similar regional programs implemented overseas. We previously conducted a one-year evaluation of the project, which exhibited suboptimal penetration of the program among GPs and private specialists. The project now requires a 3-year evaluation to identify its impact, uptake, weaknesses, and opportunities for improvement. The evaluation involves qualitative analysis (interview surveys) to assess the program reach and identify enablers and barriers to DCAPP uptake among GPs, practice nurses, and private specialists.

Project Aims

To evaluate the implementation and uptake of DCAPP among HCPs (GPs, practice nurses, and private specialists) in SWS and identify important barriers that affected the delivery of the program to public and private care settings.

Project Methods

This is a qualitative study comprising interview surveys with GPs, practice nurses, and private specialists.

Participating sites:

1. Interested GP surgeries
2. Interested relevant SWS private health services (endocrinology, and obstetric/gynaecology clinics)
3. SWSLHD public facilities (Campbelltown Hospital, Liverpool Hospital, Bankstown-Lidcombe Hospital, and Fairfield Hospital)

A previously developed DCAPP compliance survey will be sent via email or fax to all practices that have joined DCAPP. This survey can also be conducted as a telephone interview. Individuals will be selected through purposeful sampling. All telephone interviews will be recorded using a voice recording device. No identifiable characteristics will be requested during the recording or via email or fax. The survey has 19 questions that cover areas including DCAPP resources, barriers to the implementation of DCAPP or PPM in practices, knowledge of PPM, and perceptions of the importance of PPM and contraception before and after DCAPP exposure. The interviews will be transcribed by a professional transcriber.

Statistical analysis:

A thematic analysis will be undertaken to systematically identify, analyse, and report patterns (themes) in the data. Dr. Freya MacMillan, a Senior Lecturer at Western Sydney University, will help with the supervision of the student for conducting the qualitative analysis.

Opportunity for Skill Development

The project will provide opportunities to learn the skills necessary for conducting qualitative research, including purposive sampling and mixed-method data collection and analysis. By doing this project, students will also learn how to conduct a program evaluation and the strategies required for program development. Further, students will learn about the importance of contraception and PPM among women with diabetes. They will also become familiar with the role of health care professionals in health promotion activities.

Students are required to have the following skills/meet the following pre-requisite(s) to apply

Students are required to have basic knowledge of statistics and Microsoft Word and Excel and an interest in the study of diabetes health promotion.

Project 9: Scoping inclusive terminology for diversity in Australian health services

Supervisor(s): Brahm Marjadi - b.marjadi@westernsydney.edu.au
Principal Supervisor

Project description

The terminology used in health services for minority groups in Australia varies and has caused some debate. At times the terminology inadvertently excludes some groups, or even cause offence to some community members which the sector serves. This problem extends beyond service provision when policies and publications use a particular terminology which is contestable. Three sectors are particularly caught in this predicament: disability, gender and sexuality, and ethnic services. In the disability sector there has been an unresolved debate over the use of person-first language (e.g. 'a person with disability') and identity-first language ('a disabled person'). In the gender and sexuality sector many arguments arise around what should be included in the 'alphabet soup' (e.g. LGBTIQQAA+) while other terms both older (e.g. 'sexual minorities') and newer (e.g. 'sexuality and gender diversity') have their own proponents and opponents. In ethnic services the term 'Non-English-Speaking Background' (NESB) has largely been replaced by 'Culturally and Linguistically Diverse' (CALD) but the term 'People of Colour' has started to gain popularity; yet their use in the contemporary Australian demographics could be contested.

This project aims at recommending best practices in inclusive terminology by Australian services providers and peak bodies. The project will include: black literature review of research works in this area, particularly those involving the targeted populations; identification of Australian organisations in disability, gender & sexuality and ethnic services; and grey literature review of their websites and reports to identify their terminology of choice. The expected outcome of this project is two-fold: (1) a possible research paper to be published in a peer-reviewed journal and (2) a draft policy for the Public Health Association of Australia on inclusive terminology in diversity-related services. Overall, this project will contribute to the development of more inclusive services which will reduce inequity and increase the sense of belonging of the target communities.

Project Aims

This project aims at recommending best practices in inclusive terminology by Australian services providers and peak bodies.

Project Methods

The project will include:

- Black literature review of research works in this area, particularly those identifying the preferences of services in disability and gender & sexuality sectors and their targeted populations;
- Identification of Australian organisations in disability, gender & sexuality, and ethnic services;
- Grey literature review of their websites and reports to identify their terminology of choice; and
- Synthesising the findings of the above into a critical summary report and a draft policy document.

The student will develop skills on the above under the guidance of the supervisor and the WSU Medical Librarian, and in consultations with the leadership group and Senior Policy Officers of the Public Health Association of Australia.

Opportunity for Skill Development

- Black and grey literature search and review skills
- Journal article writing skills
- Policy development skills → this is a unique feature of this project because not many research projects include an opportunity to be directly translated to a policy document which will be a clear impact of the project.

Students are required to have the following skills/meet the following pre-requisite(s) to apply

Students from any discipline may apply. Applicants need to have strong interest in diversity in health and have successfully completed Unit(s) which included the basics of academic literacy. Attention to details, good communication skills and ability to work with tight deadlines are required.

Project 10: Factors associated with mortality rates among admitted patients with Diabetes in South Western Sydney (2011-2018)

Supervisor(s): David Simmons - da.simmons@westernsydney.edu.au
Principal Supervisor

Osuagwu Uchechukwu Levi - L.Osuagwu@westernsydney.edu.au
Second Supervisor

Project description

Over the past decade, diabetes has remained a significant and growing global public health issue, accounting for an estimated 1.5 million deaths and 925.8 disability-adjusted life years (DALYs) per 100,000 populations in 2015 1-3. In Australia, the prevalence of diabetes has more than doubled over the past three decades 4 with an estimate of around 1.3 million people living with diabetes in 2016–2018 making up to approximately 5.1% of the national population 5. A large proportion of this burden is experienced by older people6, 7, Indigenous people8 and those from culturally and linguistically diverse backgrounds9. Diabetes and its associated complications and comorbidities impose a substantial burden on healthcare expenditure10, 11 and in most cases, people with diabetes who experience complications require admissions and spend significantly longer days in hospital care compared to those without diabetes12, 13 and such longer stays were associated with higher cost of hospitalisation 14, 15. The cost of hospitalisation is higher in older patients (about 1.5 times higher cost of hospitalization in people aged ≥60yrs compared to those aged 40 years or younger) and further increases in the presence of complications16. Although the hospitalisation rate due to diabetes as a primary indication has remained stable over time across the district as shown in our recent report, it was disproportionately high in people with T1DM (affecting 8% of the diabetes population but accountable for 31% of hospitalisations with diabetes as a primary cause) and in some areas including Bankstown, where the rate of hospitalisation was double the NSW rate in 2015-16 (309 vs 149 per 100,000 people), an indication of the geographical differences in the district.

The NSW Ministry of Health keep records of admissions to public hospitals for NSW residents hospitalised in the state and interstate in the Admitted Patient Data Collection (APDC) registry. The record includes all inpatient separations (discharges, transfers and deaths) from all public, private, psychiatric and repatriation hospitals in NSW, as well as public multi-purpose services, private day procedure centres and public nursing homes. This project will provide an understanding of the drivers of admission trends in SWS. Studies including a cross-sectional, retrospective audit in a hospital in the UK have reported found that people with diabetes are more likely to die when inpatients17.The present study will investigate whether mortality rate is higher among inpatients coded with diabetes compared with non-diabetes patients in SWS as well as identify the factors associated with high mortality rate among inpatients in an existing dataset of N=554,422. Comparing between people with and without diabetes may provide an indication of burden of the disease and target population to reduce the burden in the community.

Project Aims

- To examine the temporal and geographic trends in mortality rates among inpatients with and without diabetes
- To identify the characteristics of people with & without diabetes admitted to hospitals in SWS

Project Methods

The NSW Ministry of Health provided data on the records of all inpatient separations (discharges, transfers and deaths) from all public, and private hospitals. Public hospital APDC data are recorded in terms of episodes of care (EOC). An episode of care ends with the patient ending a period of stay in hospital (e.g. by discharge, transfer or death) or by becoming a different “type” of patient within the same period of stay. The categories of types of care are listed under a variable “Episode of care type”. Data, explanation of variables and registry and approval to use the data for research purposes were obtained. The student will aim to understand the variables in the data and use them in the analysis. Over time, the aim is to understand the mortality rates among admitted patients and the associated factors which will help in targeted approach to reduce mortality rate and improve outcomes of patients in hospital over time. This is a retrospective study involving the use of datasets. Student will be expected to study the data, understand basic statistics and with help from our team analyse the data set to produce a report for publication.

Opportunity for Skill Development

The student will have the opportunity to learn and develop a number of research skills including:

- Data cleaning and quantitative analysis skills
- Teamwork and collaboration skills
- Report and journal article writing
- Literature review skills

Students are required to have the following skills/meet the following pre-requisite(s) to apply

Students are expected to have basic knowledge in use of Microsoft office and Excel and preferably have an interest in diabetes. Experience using any statistical software is an advantage. Students should have excellent writing skills to be able to produce a publishable report.

Project 11: Coventry Diabetes Study Follow Up: Diabetes in UK South Asians-A Systematic Review and Meta-Analysis

Supervisor(s): David Simmons - da.simmons@westernsydney.edu.au
Principal Supervisor

Osuagwu Uchechukwu Levi - L.Osuagwu@westernsydney.edu.au
Second Supervisor

Project description

Diabetes and impaired glucose tolerance1 are more common in South Asians than white Europeans in the United Kingdom and inspite of their known dietary, cultural, and socioeconomic differences, Asians still have high prevalence of diabetes. The effects on metabolic control, diabetic complication rate or indeed the underlying pathogenesis has yet to be explored. South Asians are at higher risk of obesity and obesity related diseases than white Europeans or the development of obesity and obesity-related diseases including insulin resistance, the metabolic syndrome, type 2 diabetes mellitus (T2DM) and coronary heart disease. T2DM is two to three times more common in South Asians than in the White Europeans in the UK and up to three times more common among people of African origin. Furthermore, South Asians with T2DM develop the condition 5–10 years earlier than White Europeans, have increased prevalence of diabetes complications at presentation, worse outcomes and die at a younger age. Furthermore, SA comprise 20% of the global population and 7% of the UK population, there is a need to understand the effect of ethnicity on the progression of type 2 diabetes.

The Coventry Diabetes Study, was at the time the largest study of diabetes in the UK. The study was established to answer key research questions including whether differences in ascertainment of diabetes existed among ethnic groups. The study involved a cross-sectional house to house screening for diabetes in the electoral ward of Foleshill, Coventry. Subjects with a high blood glucose and others were referred for a 75 g oral glucose tolerance test. By the end of the study, 10 304 adult residents aged 20 years or above (5508 White Europeans and 4395 Asians) have participated and were either screened for diabetes or already had diabetes. Findings were reported in more than 16 published articles and largely confirmed that the Asian excess of diabetes was due to non-insulin-dependent diabetes [1], and that whereas an excess of females with diabetes occurs in White Europeans, a male excess occurs in Asians.

Project Aims

- To systematically review available literature on diabetes exploring the association of South Asian ethnicity with comorbidities, microvascular and macrovascular complications and mortality compared with other ethnic groups in people with type 2 diabetes mellitus (T2DM).

Project Methods

A systematic literature search strategy will be designed and carried out using selected databases including Medline and Embase. Full-text and abstract studies published in English from 1986 to 2020."

This is a review study involving the database searches. Student will be expected to conduct literature searches across databases, study the data presented in selected articles, understand basic statistics and with help from our team analyse the data extracted from those studies to produce a report for publication.

Opportunity for Skill Development

The student will have the opportunity to learn and develop a number of research skills including:

- Knowledge of various databases and how to navigate using the Mesh terms
- Applying strict exclusion and inclusion criteria
- Data cleaning and quantitative analysis skills
- Teamwork and collaboration skills
- Report and journal article writing
- Literature review skills

Students are required to have the following skills/meet the following pre-requisite(s) to apply

Students are expected to have basic knowledge in use of Microsoft office and Excel and preferably have an interest in diabetes. Experience using any statistical software is an advantage. Students should have excellent writing skills to be able to produce a publishable report.

Project 12: Machine learning for proteomic mass spectrometry

Supervisor(s): Paul Hurley - Paul.hurley@westernsydney.edu.au
Principal Supervisor

Mourad Tayebi - m.tayebi@westernsydney.edu.au
Second Supervisor

Project description

A recently established cross-school collaboration between the Centre for Research in Mathematics and Data Science and the School of Medicine is investigating improving the accuracy of proteomic identification. The ultimate goal is to develop a pipeline combining disease modelling together with learning feedback for systematic identification of proteins expressed in patients with a particular disease. This is linked to the potentially ground-breaking work into protein identification for Multiple Sclerosis, a significant project within the School of Medicine.

Current analysis is heuristic and runs into the problem of missing expressed proteins (false negatives) as well as erroneously statistically linking proteins with disease (false positives). This is linked to the ad-hoc statistical nature. They either become candidates or not due to an arbitrary p-value threshold. Their likelihood is not quantified. Moreover, the non-linear nature of the peak value selection is not factored into the statistical analysis.

Assessing multiple candidates with such p-value analysis with the standard threshold ($p<.05$), even in the over-simplified statistical assumptions, is problematic, as in any mass analysis such as this many false positives are likely due to simple randomness (coincidence).

To cater for randomness in processing, repeat samples are as standard entered into the machine. This redundancy in itself is a promising way to increase detection in noise, but current statistical analysis is not even aware of the multiple sample injection, and thus necessarily introduces errors in identification.

Ultimately, the current method is far from the optimal way to learn what proteins are present, given the mass spectrometer which induces a forward model, the pre-processing, and underlying biology. We need not only to identify candidate proteins, but also to establish a measure of how likely they are.

Project Aims

This project aims to test current mass spectrometry proteomic identification methods to quantify weaknesses, and to propose statistical learning algorithms to improve performance. The goal is also to provide a measure of uncertainty on what has been observed.

Project Methods

Simulation, conceptual algorithms, analysing mass spectrometry data

Opportunity for Skill Development

- Skills in algorithm development
- Presentation skills of research analysis
- Writing skills

Students are required to have the following skills/meet the following pre-requisite(s) to apply

Masters level Projects. Suitable for students in the areas of data science, AI, mathematics and other numerate areas.