



2020 Summer Research Symposium Abstract Booklet

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**Rush Summer Research Scholars Program
Rush Medical College**



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Rush Summer Research Scholars Program Abstracts

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Telemedicine meets Parkinson's Disease: Personalized in-home tele-neurorehabilitation to reduce risk of falls

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Introduction/Background: Parkinson's Disease (PD) is the second most common neurodegenerative disorder in the United States. Patients experience a variety of motor symptoms beyond tremor including falls, which are the main source of morbidity and mortality in this condition. As an increasing number of people suffer from PD with aging, there is an increasing need for specialized/personalized care, including in the realm of physical and occupational therapy.

Purpose & Aims: The primary aim of this study is to determine the feasibility of delivering PD-specific tele-physical and tele-occupational therapy (tele-PT, tele-OT) centered around gait/balance/falls reduction and home safety as this has not been investigated. The secondary aim of this study is to determine whether this type of "virtual therapy" within the subject's home is *effective* through various measures.

Methods: Patients will receive individualized tele-PT and tele-OT from PD specialized therapists, with a focus on reducing falls and promoting home safety. This will be executed through live teleconferencing with the therapists using a tablet on a mobile platform for about 10 weeks following an initial in-person full PT and OT evaluation. Feasibility is defined by *adherence*, *retention*, and *safety*. A total of 10-15 participants will participate in the study.

Results: Currently, 7 participants have been enrolled--3 patients have completed the study and 4 are actively participating. With regards to *adherence*, 100% of predicted visits were completed. With regards to *retention*, there has been a 0% drop-out-rate. With regards to *safety*, there have been no adverse events secondary to study-related activities. Measures of *efficacy* have not been analyzed.

Discussion: Telemedicine fills these gaps by providing care for patients in the comfort of their own home.

Predicting Patient Compliance of Post-Operative Patient-Reported Outcomes for Lumbar Spine Disorders: Machine Learning Modeling Analyses

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Introduction/Background: Patient-Reported Outcomes (PROs) are a well-established and essential metric for spine surgeons, which help assess patient and clinician expectations and assist in providing optimal patient care. However, little is known with respect to patient compliance (i.e. completion) of PROs.

Purpose/Aim: This study aimed to identify predictive factors related to compliance of postoperative PROs in patients undergoing lumbar spine surgery.

Methods: A retrospective study of collected data via ATHENA was performed on lumbar spine patients operated on between 2017-2020 at Rush University Medical Center. Lumbar disorders accounted for 68.7% of all surgeries. Surgical operations were performed by one of six surgeons and PROs were collected from OBERD data capturing system. Compliance was defined as the percentage of completion of VR/SF12, VR6D, VAS, and ODI preoperatively, at 3 months, and at 12 months. A linear regression model for predictive analytics was trained using the scikit-learn library and feature importance was determined through a random forest regressor.

Results: 1,680 patients(53.1% male,46.9% female;mean age:57.7years) fulfilled inclusion criteria. Random forest identified age($p=0.970$) and pain scores($p<0.001$) as important features for the linear regression(MSE:1460.14). Higher pre-operative PRO-scores and lower pain levels are associated with decreased PRO-compliance($p<0.001$). Both Asian race($p=0.027$) and number of diagnoses($p<0.001$) were associated with lower rates while radiculopathy was associated with increased compliance($p<0.001$).

Discussion: Our large-scale study is the first to assess predictive factors addressing compliance for postoperative-PROs in lumbar-spine surgery patients. Additional research is required to expand upon the initial analyses. An online predictive risk system is also being developed to assist in improving patient compliance.

Evaluation of Organ Transplant Program for Undocumented Patients in Illinois: Provider and Policy Stakeholder Views of Kidney Transplant Processes for Undocumented Patients

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Introduction/Background

Patients with End-Stage Renal Disease, have two primary treatment options: a kidney transplant or lifelong dialysis, with transplants being the optimal option due to cost saving and better outcomes. Though Medicare covers ESRD care for most patients in the U.S, patients who are ineligible for these programs or private insurance plans-primarily undocumented patients are left with few options for kidney transplants. The Illinois Transplant Fund (ITF) aims to target health inequity of access to health insurance by increasing access to organ transplants.

Purpose/Aim(s)

As part of a larger mixed-methods evaluation study of the ITF, the purpose of this qualitative study is to capture medical and policy stakeholders' views and involvements of the kidney transplant process for undocumented patients.

Methods

We conducted semi-structured interviews with 12 medical and policy stakeholders. Interviews were audio recorded, transcribed and analyzed to identify key patterns and themes.

Results/Expected outcomes

We hope to better understand what interviewees perceptions of the kidney transplant process for undocumented patients, including burdens from insurance restrictions, impacts on patients and providers' practices. Through this information, we will assess the Illinois Transplant Fund program and how it may be enhanced to provide better access to transplants and use it as a model for other states.

Discussion/Possible problems and alternative approaches

Potential risks include loss of confidentiality due to a breach in data collection, inserting unconscious biases of qualifying for insurance, and restrictions undocumented patients face when cared for by a provider.

Do Patients with Crouzon and Apert's Syndrome Have Fewer Complications When Monobloc Surgery is Performed at an Earlier Age?

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Introduction/Background: Patients with Crouzon and Apert Syndromes present with craniosynostosis, the premature closure of the skull's sutures, resulting in abnormal facial structures. Syndromic patients undergo a monobloc distraction surgery with rigid external fixation (RED II) device to alleviate the life-debilitating complications. Patients typically present with midface hypoplasia, obstructive sleep apnea, and exorbitism.

Purpose/Aim(s): The purpose of this study was to figure out the optimal age that minimizes invasive procedures. The aim was to compare younger (age < 10 years) and older (age ≥ 10 years) patients' complication rate following monobloc procedure.

Methods: Using retrospective chart review, 35 patients who underwent distraction surgery with RED II device were isolated. Complication variables were had three categories: minor - resolved with or without invasive therapy, moderate - resolved with invasive therapy, and major – needing surgical intervention. We classified patients into two groups, age < 10 and age ≥ 10 years, respectively. Using unpaired two tailed t- test, we compared the rate of complications of monobloc surgery in the two age groups.

Results: The total mean age at the time of surgery was 8.5 years, ranging from 1-17. The total complication rate for patients was 28.6%. Out of the 18 patients in group 1, 44.44%, had complication while only 2 out 17, 12.5%, group 2 patients had complications. The difference between the two groups was 31.94% with a statically significant p-value < 0.0001.

Discussion: Based on this finding and previous literatures, we believe that children should perform monobloc surgeries at an older age in order to minimize complications.

Improving Knowledge, Attitudes, and Skills of Medical Trainees in Clinical Medical Ethics

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Introduction/Background: Medical ethics aids clinicians in presenting all moral options to patients and their families to reach medical decisions. The current state of education in clinical medical ethics for medical trainees is not known.

Purpose: This study aimed to evaluate medical trainee knowledge, attitudes and self-reported skill in clinical medical ethics pre- and post a one-hour curriculum in clinical medical ethics.

Methods: Students (n=31/36, 86% participation rate) associated with large urban academic centers (19 pre-medical and 12 medical students) were surveyed to gauge baseline knowledge, attitudes and skill regarding medical ethics. A one-hour discussion-based curriculum in clinical medical ethics was conducted. All participants were surveyed afterward to evaluate for improvement in survey measures. Pre and post data were compared using chi-squared statistics.

Results: Post curriculum, improvement in knowledge was seen in “determination of a legal surrogate” (from 29% to 55%, $p=0.04$), “decision-making capacity” (9% to 61%, $p<0.0001$) and the four principles of biomedical ethics (61% to 87%, $p=0.02$). 100% of respondents agreed understanding of ethics is essential for good patient care. Self-reported skill in determining a decision-maker for a patient lacking capacity also improved (10% to 68%, $p<0.0001$), as did self-reported skill in determining decision-making capacity (23% to 71%, $p=0.0001$).

Discussion: This curriculum led to improvement in pre-medical and medical student knowledge, attitudes, and self-reported skill in clinical medical ethics. Although, as some of these measures remained low following the curriculum, further medical ethics education is necessary for future physicians.

Empowering Residents of West Garfield Park with an Understanding of Mental Health, and its Intersection with Exercise, Nutrition, Physical Wellness, and an Overall Sense of Well-being.

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Introduction: Mental health is defined as a person's level of psychological well-being, and studies have shown that it is closely tied with physical health. It is therefore essential to understand this crucial relationship. The Westside Walk for Wellness (WW4W) was started on the Westside of Chicago at West-Garfield Park, to help residents address issues of higher comorbidity compared to the Greater Chicagoland area.

Purpose: To improve the knowledge and overall well-being of participants in the WW4W program by facilitating discussions of pertinent social and health topics, and subsequently walking together.

Methods: In addition to the program, utilize an online post-survey of 10 Yes or No questions, given to participants at the end of the 6-week program, to assess whether the goals of the program were met. We then utilize this data to study the relationship between program participation (# of weeks attended, Facebook group membership, step-tracker user) and knowledge gained (# of Yes).

Expected Results: Majority of participants surveyed had a better understanding of the intersection of mental health, physical health, and overall well-being. We expect to observe a positive correlation between program participation and knowledge gained

Discussion: The WW4W program is a unique program that exemplifies Rush's mission to community service, especially on Chicago's Westside. The program allows us to make more connections with community members and collaborate to achieve overall good health and wellness.

Characterization of Dietary Patterns, Cognitive Function and Mood in Diverse Populations of Cardiac Patients in the age of COVID-19

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Introduction/Background:

Cardiovascular disease (CVD) is the leading cause of death for both men and women in the United States, causing approximately one death every 84 seconds. Diet has an impact on variables of wellness that includes overall health, mood, and cognitive function. The MIND Diet, a combination of the Mediterranean and Dash diets, has shown to slow cognitive decline, associated with age, and prevent cardiovascular disease by reducing the prevalence of risk factors.

Purpose/Aim:

This research aims to characterize cardiac patients from the Rush systems to assess diet, mood, and cognition, and provide patients with guidance on what they should be doing to improve their overall health.

Methods:

Surveys and questionnaires were administered through the phone to 16 patients, who were selected from previously treated in this section at Rush. These tools consisted of COVID, technology usage, social distancing, Patient Health Questionnaire (PHQ-9), MIND screening, and the telephone Montreal Cognitive Assessment (MoCA). Statistical analysis was conducted via excel.

Results:

Patients are feeling isolated and worried about themselves and loved ones contracting COVID. PHQ-9 detected that the average score of 6.75. The MIND diet detected 82% of patient's diets has changed due to COVID. The average score of the patients in the MoCA was 18.6, the two lowest categories were language (70.8% correct) and delayed recall (67.5% correct).

Discussion:

Based on the preliminary data patients are feeling lonely, are mildly depressed, diet has changed might be due to "pandemic shopping" buying non-perishable foods high in sodium, and have mild cognitive impairment during COVID.

Characterizing the Meniscus Microvasculature in a Human Cadaver with Radiographic Techniques

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Background: Research on the microvasculature of the meniscus has been growing as its importance to regeneration after injury has been recognized. Studies have shown that blood supply helps heal meniscal injuries naturally whereas avascular portions fail to heal. While there have been advancements in technology, minimal evidence has furthered our understanding of meniscal vascular anatomy.

Purpose: The aim of this study is to characterize the meniscus microvasculature in cadavers using conventional CT and MicroCT analysis.

Methods: A thorough literature review was conducted to establish the procedure. Fresh- frozen cadavers were dissected to expose the popliteal artery. The popliteal artery was cannulated and flushed with warm saline solution to dislodge clots. The distal aspect of the cadaveric tibia was clamped, and a mixture of Barium sulfate and gelatin warmed to 49 deg C was injected and allowed to perfuse to the meniscus microvasculature. The cadaveric knee underwent conventional CT, and afterwards the meniscus was extracted and sent for microCT analysis to examine vessel diameter and cross sectional area.

Results: Injecting Barium sulfate/gelatin allowed for appropriate visibility of the lateral meniscal artery on 3D CT reconstruction, however, the medial meniscal artery was absent. MicroCT analysis demonstrated appropriate perfusion of the meniscal capillary plexes.

Discussion: This study established the first protocol for identifying meniscal vasculature viewable on a radiographic imaging. Analysis of obtained CT and microCT images will further describe meniscal vascular anatomy which will influence surgical procedures and patient outcomes after meniscal repair and meniscectomy.

Exploring Colorectal Cancer Genetics Between African American and Caucasian Populations

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Introduction: Colorectal Cancer (CRC) is the third most common cancer, and second most common cause of cancer-related deaths in the United States. African Americans (AA) have worse outcomes compared to Caucasians. The genomic determinants of these disparities are unknown.

Purpose: Our study aims to determine the differences in somatic genomic alterations between AA and Caucasians with CRC. These differences in genetic mutations may account for the disparities seen in CRC outcome between both populations.

Methods: In this study, we used publicly available data on CRC patients from The Cancer Genome Atlas (TCGA). We analyzed somatic mutation differences between 22 AA's and 226 Caucasian patients.

Results: African-Americans and Caucasians share well known mutations including APC, PTEN, KRAS, SMAD4, TTN, PIK3CA and KRAS. However, unique to African American patients, KIT (50%) and PTCH1 (41%) were significantly mutated, whereas in Caucasian samples, NEFH and ATM genes were significantly mutated. KIT gene mutations have previously been seen to promote colon proliferation and invasiveness in mural models. PTCH1, a receptor of Hedgehog signaling pathway, is correlated with metastatic potential of colorectal cancer

Discussion: Although African American and Caucasian CRC patients share major genomic mutations, some unique mutations such as cKIT and PTCH1 may explain the disparity in the subset of patients. Further studies incorporating gene expression profiling, methylation, and proteomics is needed to further elucidate the comprehensive genomic and proteomic differences between African-Americans and Caucasians.

Assessing Diet, Engaging in Physical Activity, and Raising Stroke Awareness during COVID-19

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Department of Neurological Sciences

Introduction: Stroke is the fifth leading cause of death in the U.S. with disparities found in African-American and Hispanic communities. Within the Hispanic community, stroke mortality rates have increased compared to the decrease in stroke mortality found in white populations. Key factors that can lead to a decrease in stroke mortality disparities and aid in the prevention of stroke are stroke awareness and physical activity.

Purpose: The overarching goal was to implement an educational program – to raise stroke awareness – and an exercise dance program – to combat sedentary lifestyles – for residents at A Safe Haven – a non-profit shelter for the homeless and displaced in Chicago.

Methods: Surveys were the primary means of assessment. To gauge stroke awareness, surveys regarding an individual's knowledge of stroke symptoms, risk factors, and underlying health conditions were distributed. Information regarding dietary habits and the effects of COVID-19 on day-to-day life, activity levels, and social habits, was also collected via survey. Surveyed individuals were invited to attend free bi-weekly dance classes and stroke awareness sessions in conjunction with Walk with a Doc.

Results: Forty surveys were distributed to residents. Of those forty participants, twenty have participated in a dance program session.

Discussion: As this project is in its nascent stages, more work must be conducted to complete the project. Primarily, survey data must be analyzed and grouped to look for trends in responses. Furthermore, post-program surveys must be disseminated to participants of the dance programs. Data from post-surveys must be analyzed for trends and to draw comparisons to the pre-program surveys.