56th ANNUAL MIDWEST STUDENT BIOMEDICAL RESEARCH FORUM

Saturday, March 8, 2025

ROOM 3048

1:30 p.m.	O-47	ENSITRELVIR (ESV) POPULATION ON PHARMACOKINETICS (PK) IN NONHOSPITALIZED ADULTS WITH COVID-19 Presenter: Ukamaka Modebelu
1:45 p.m.	O-52	EVALUATING BARRIERS AND INCREASING FAMILY MEDICINE PROVIDER COMFORT IN PRESCRIBING SUBOXONE Presenter: Austin Osborn
2:00 p.m.	O-65	THE ASSOCIATION BETWEEN BODY WEIGHT CHANGES AND PHYSICAL ACTIVITY AFTER ANTERIOR CRUIATED LIGAMENT RECONSTRUCTION Presenter: Manuel Romero-Padron
2:15 p.m.	O-64	TRENDS IN THE MORTALITY OF VASCULAR INTESTINAL DISORDERS IN THE UNITED STATES: A CDC WONDER ANALYSIS Presenter: Ashley Rensted
2:30 p.m.	O-63	OPERATING ROOM EXTUBATION AT A REMOTE COMMUNITY CARDIAC SURGERY CENTER Presenter: Dominic Regli
2:45 p.m.	O-62	A PREDICTIVE MODEL FOR EARLY IDENTIFICATION OF NEONATAL ENCEPHALOPATHY USING CLINICAL DATA Presenter: Jack Rausch
3:00 p.m.	O-68	MEDICAL COMPLEXITY OF PATIENTS WITH A TRACHEOSTOMY THROUGHOUT TRANSITION FROM PEDIATRIC TO ADULT CARE Presenter: Sydni Springer
3:15 p.m.	O-73	Investigating the Relationship Between KOOS JR and PROMIS Scores in the Treatment of Chronic Knee Pain through Total Knee Arthroplasty Presenter: Benjamin Tischleder
3:30 p.m.	O-77	MRI-MEASURED KNEE EFFUSION VOLUME AND ITS RELATIONSHIP TO SERUM BIOMARKERS AND CARTILAGE T2 RELAXATION TIMES BEFORE AND 6 MONTHS AFTER ACLR Presenter: Lauren Vatter
3:45 p.m.	O-80	IN-OUT-IN PEDICLE SCREW TRAJECTORIES PERFORMED USING ROBOTICS IN PEDIATRIC SPINAL FUSION SURGERY Presenter: Nicole Welch
4:00 p.m.		**ADJOURN**

ENSITRELVIR POPULATION ON PHARMACOKINETICS IN NONHOSPITALIZED ADULTS WITH COVID-19.

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Background, Hypothesis, Significance: The repurposing of existing antiviral agents for the treatment of severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) has faced significant challenges, particularly in safety and efficacy. Many of these agents exhibit limited potency, often requiring antiviral boosters to achieve therapeutic effects. Recently, a novel investigational oral main protease inhibitor, Ensitrelvir (ESV), has emerged as a promising treatment for COVID-19. ESV has demonstrated potent antiviral activity, including efficacy against the SARS-CoV-2 Omicron strain, highlighting its potential as a broad-spectrum of action. A population pharmacokinetic (PK) study on a subset of participants demonstrated that ESV has a favorable PK profile and has shown safety and efficacy in Phase 3 clinical trials.

Experimental Design: SCORPIO-HR is a placebo-controlled, Phase 3 global trial in non-hospitalized adults with COVID-19 with or without risk factors for progression to severe disease. Participants were randomized (1:1) to receive once-daily ESV (375 mg on Day 1, 125 mg on Days 2–5) or matching placebo. In Group 1 (n=150), PK samples were collected on Day 1:1 and 1.5h postdose; Day 4: predose and 1.5h postdose; and Day 8, anytime postdose. In Group 2 (n=250), samples were collected Day 1: 1h postdose; Days 4 and 8: anytime. Population on PK analysis used nonparametric methods (Pmetrics, www.lapk.org); covariates investigated were age, sex, race, and weight.

Results: PK samples were quantified from participants receiving ESV. 16% were excluded as all samples were below the limit of quantitation (BLQ). 23 (10%) were excluded as not evaluable, sporadic non-adherence (≥ 2 samples BLQ), or inconsistent/not reported dose-sample collection times. The final data set was 166 participants with 579 detectable ESV levels. These 166 participants [n or mean (SD)] were: male, 106 (64%); age, 39.5 ± 13.8 yrs; weight, 68.4 ± 12.8 kg; Asian, 125 (75%); Black, 14 (8%); White, 25 (15%); unknown, 2. The final base model was an oral absorption (with lag), 2-compartmental model. Covariate analysis identified no race effect, but power was poor to detect an effect in other racial groups as 75% were Asian. In the final covariate model, there was an ≈13% effect on apparent clearance (CL/F) by sex, where CL/F in males was > females. Additionally, an effect on median central volume (Vc)/F by weight (centered to a 70kg person, 6.8L vs 7.3L) was found where Vc decreased as weight decreased and concentrations could increase. Covariate-adjusted final model PK estimates (median) were: CL/F, 0.313L/h; Vd/F, 18.66L; and terminal half-life 41h. Day 4 predose and 1.5h postdose mean (SD) concentrations were 17.5 (±5.8) and 20.5 (±6.7) µg/mL, respectively.

Conclusions: ESV population on PK parameters with covariate adjustment compared well with literature values from participants without COVID-19, indicating ESV PK disposition was not affected by COVID-19 in nonhospitalized symptomatic adults. The 16% of participants with all PK samples BLQ indicated no doses were taken and highlighted the importance of objective adherence assessment in future COVID-19 studies.

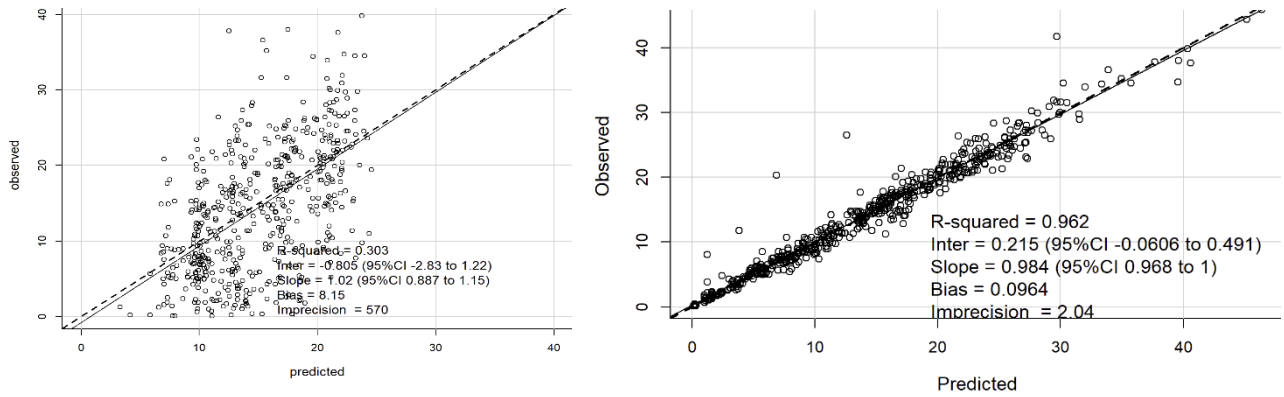

Figure 1: Population (A) and Bayesian (B) observed vs. predicted plots from final covariate adjusted population PK model.

Title: EVALUATING BARRIERS AND INCREASING FAMILY MEDICINE PROVIDER COMFORT IN PRESCRIBING SUBOXONE

Authors: Austin Osborn, Jennifer Liu; University of Nebraska Medical Center, Omaha, NE

Background, Significance, Hypothesis: The Opioid Use Disorder (OUD) workforce suffers from a high turnover rate, high burnout, and reduced reimbursement. Access to care remains a huge barrier for patients with OUD and increasing access to medications for opioid use disorder in primary care is an area of focus. Elimination of the X waiver has not increased interest in prescribing buprenorphine. Many doctors and practitioners are still hesitant to prescribe this medication. A recent systemic review showed that physicians are reluctant to treat patients with SUD for several reasons; chief among them a lack of institutional support, knowledge and skills, and time. Our project had three primary objectives 1.) conduct a needs assessment of UNMC family medicine physicians regarding their comfort level and self-efficacy for the care of patients with substance use disorder; 2.) provide said physicians with training about treating OUD and prescribing suboxone; 3.) develop a workflow to transfer long-term Suboxone patients with a low likelihood of relapse from psychiatrists to physicians to allow said psychiatrists to accept more new patients.

Methods: The needs assessment contained metrics using a 7-point Likert scale to determine physician attitudes towards the care of patients with substance use disorder, their perspective on the efficacy of Suboxone, and their moral views about addiction and Suboxone. Participants were also asked if they currently prescribe Suboxone. Those who don't were asked to rank the top reasons why they don't prescribe Suboxone and if they would be interested in accepting chronic and stable OUD patients who take Suboxone. Physician training is being provided via Nebraska's Project Echo.

Results. Initial results show that only 13% of surveyed providers currently prescribe Suboxone with only one physician treating more than two patients. Furthermore, 43% of those who don't prescribe Suboxone ranked insufficient education as their first or second concern. Also, 53% of providers said they are interested in assuming care of OUD patients who are chronic and stable on Suboxone.

Conclusion. The survey results reflect the expected educational barriers to Suboxone prescribing practices. Also, we are attempting to gain funding for a Patient-Centered Medical Home pharmacist (0.1 FTE) to provide comprehensive medication reviews, discuss potential adverse effects of Suboxone with patients, and inquire about their experiences at each refill. Efforts are underway to coordinate patient transfers from the Department of Psychiatry to Family Medicine providers via Patient-Centered Medical Home (PCMH).

THE ASSOCIATIONS BETWEEN BODY WEIGHT CHANGES AND PHYSICAL ACTIVITY AFTER ANTERIOR CRUCIATED LIGAMENT RECONSTRUCTION

Romero-Padron MA, Fuentes-Rivera-Lau L, Jorgensen A, Tao M, Wellsandt E (UNMC, Omaha, NE)

Background: Anterior cruciate ligament reconstruction (ACLR) is a common procedure performed on active individuals, but the postoperative period often involves reduced physical activity (PA), which may contribute to weight gain. Weight gain can have long-term consequences, complicating recovery and increasing the risk of health issues such as post-traumatic osteoarthritis. While previous studies have explored the relationship between PA and weight gain after ACLR, they have largely relied on self-reported data. Objective, quantitative assessments of PA and weight gain relationship are limited.

Significance: Investigating the relationship between objective PA levels and weight gain after ACLR is needed to optimize rehabilitation strategies and preventing long-term health complications. The purpose of this study was to determine if body weight (BW) changed from pre-ACLR to 6 months after ACLR across sex and further determine whether objective PA levels after ACLR associated with changes in BW at 6 months.

Hypothesis: We hypothesized that there would be an overall weight gain after ACLR, and that males would experience more pronounced weight gain compared to females. Additionally, we hypothesized that lower post-operative PA levels would be associated with significant weight gain (≥5%) at 6 months following ACLR.

Experimental Design: A secondary analysis was conducted using data from two previous studies. For both aims, a total of 74 participants (ages 13–35) who underwent ACLR were included, respectively. BW was measured pre-ACLR and 6 months after ACLR. PA was assessed using a 3-axis accelerometer worn at the right hip for 7 days after 2 timepoints: 2- and 6- months after ACLR. Post-operative PA was defined as the average of each PA metric (percent sedentary time, daily steps, daily minutes of moderate-to-vigorous PA (MVPA)) across the 2 timepoints after ACLR. A two-way mixed ANOVA was used to determine the effects of time and sex on BW. Next, 3 binomial linear regressions were used to determine the relationship of sex, age, and each PA metric on the odds that participants increased BW at least 5% from pre-ACLR to 6 months after ACLR. A p-value of 0.05 was set *a priori*.

Data and Results: There was a significant interaction effect between sex and time between BW from pre-ACLR to 6 months after ACLR (p: 0.021). While both increased weight from pre-ACLR to 6 months, males gained more weight (3.41 kg, $p<0.001$) compared to females (1.13 kg, $p=0.030$). All three logistic regression models were statistically significant (percent sedentary time: $\chi2(3) = 9.832$, $p = .020$; daily MVPA: $\chi2(3) = 13.806$, $p =0.003$; daily steps: $\chi2(3) = 11.238$, $p = 0.011$). Of the variables in each model, only sex was a significant predictor of gaining at least 5% BW from pre-ACLR to 6 months after ACLR. Percent sedentary time, daily MVPA and daily steps were not significant predictors. Across models, males had a 4.65 to 7.365 times higher odds to gain 5% BW compared to females.

Conclusion: Consistent with our hypothesis, both females and males gained BW from pre-ACLR to 6 months after ACLR. Notably, males gained 2.3 kg more weight and had 6 times greater odds of gaining 5% BW compared to females at six months after ACLR. Neither age nor any of the three PA measurements predicted 5% gains in BW. Further research is needed to investigate limitations in BW measurements (e.g., body composition changes) and PA measurement techniques (e.g., tools that capture stationary cycling) after ACLR. Addressing weight management alongside function recovery may improve both short-term (e.g., return to sport) and long-term (e.g., joint health) patient outcomes after ACLR.

TRENDS IN THE MORTALITY OF VASCULAR INTESTINAL DISORDERS IN THE UNITED STATES: A CDC WONDER ANALYSIS

Ashley Rensted, Marlaena Nooney, Taylor Billion, Abubakar Tauseef (Creighton University, Omaha, NE)

Background: Vascular intestinal disorders (VID) are a broad category of diseases including mesenteric ischemia, angiodysplasia of the colon, ischemic colitis, and necrotizing enterocolitis, among other conditions. Globally, there has been an increase in the prevalence of VID from 1990 to 2019 but a decrease in age-standardized mortality rates. However, a 2024 study noted that the incidence of VID is also increasing globally in younger individuals. The current literature lacks a comprehensive population-based evaluation of demographic and geographic trends in VID mortality. Thus, we used the US Centers for Disease Control and Prevention's Wide-Ranging Online Data for Epidemiologic Research (CDC WONDER) database to examine trends in mortality in the United States from 1999-2022. This study aims to identify which groups of patients have the highest mortality and examine the underlying reasons behind these trends, enabling physicians to more effectively diagnose and treat these conditions in which rapid intervention can reduce mortality.

Experimental Design: Age-adjusted mortality data for VID were stratified by year (1999-2022), gender, race/ethnicity, geographic region, state, urban versus rural environment, and patient age (15-85+). Data were pulled from the CDC WONDER database and analyzed via Joinpoint regression models.

Results: Overall, there were 375,938 deaths due to VID from 1999-2022 in the United States, with 231,230 deaths occurring in females (61.5%) and 144,708 deaths occurring in males (38.5%). The overall age-adjusted mortality rate (AAMR) was highest in 1999 and lowest in 2018, increasing from 2019-2021. Black or African American patients had the highest overall AAMR in 1999 and 2000, with American Indian and Alaska Native patients otherwise having the highest overall AAMR for the remainder of the study period (2001-2022). In contrast, Asian or Pacific Islander individuals had the lowest overall AAMR. While all census regions showed a decrease in AAMR, the South saw the greatest decrease and the West saw the smallest decrease. On average, the AAMR was highest in the Midwest and lowest in the Northeast. The only two states to show an increase in AAMR during the study period were Montana and Nebraska. In contrast, from 2020-2022, twenty-nine states showed increases in their AAMR, the largest being in North Dakota, New Hampshire, and Maine. Throughout the study period, urban areas saw a larger decline in AAMR than rural areas. With the exception of 1999, 2000, 2001, and 2004, AAMR in rural areas remained higher than that in urban areas.

Conclusions:
The overall trend of a decreasing AAMR in VID since 1999 is encouraging and likely reflects a more widespread understanding of VID with earlier detection and intervention. The increase in mortality between 2018 and 2021 is likely explained by the concurrent COVID-19 pandemic, which increased in-hospital mortality of cardiovascular diseases. Females had a higher AAMR than males for the entire study duration, which can be explained by several factors. Women have an increased risk of cardiovascular disease with age, particularly following menopause. Women also have a longer life expectancy and tend to be older at the time of diagnosis of VID. Additionally, women have smaller blood vessels than men, which can complicate efforts at revascularization. Among different racial and ethnic groups, American Indians and Alaska Natives had the highest AAMR for the majority of the study period, a finding possibly explained by the higher rates of smoking and tobacco use among this population in comparison to other racial groups in the US. Finally, the lower AAMR in urban areas compared to rural could be due to accessibility to healthcare, including access to both preventative care as well as specialists such as gastroenterologists and cardiologists. In this study, we have identified key trends in mortality from VID, which will help healthcare providers better target interventions and preventative measures towards the population groups in need of them most.

OPERATING ROOM EXTUBATION AT A REMOTE COMMUNITY CARDIAC SURGERY CENTER

Dominic C. Regli, Mark E. Pridmore, Jeffrey S. Johnston, Thach D. Mai, Stephen R. Dieker, Jr., Eric J. Kuttler, Joseph M. Arcidi, Jr. (Creighton University School of Medicine, Omaha, NE)

Background, Significance, Hypothesis: Successful implementation of operating room extubation (ORE) after open-heart surgery has been recently documented from major academic cardiac centers, and these centers reported that this has primarily been achieved following coronary artery bypass grafting (CABG). At our remote community cardiac surgery program in Northern California, however, we successfully adopted ORE in January, 2021. Moreover, this practice of ORE has been rapidly generalized beyond CABG cases at our institution.

Experimental Design: We performed a retrospective review on all 66 patients from 1/2021-3/2023 who had calculated Society of Thoracic Surgeons (STS) risk scores. At our program, all cardiac surgical patients have been considered candidates for ORE. This practice has even included emergent and preoperative intra-aortic balloon pump (IABP) patients. Anesthesia management for successful ORE has included total fentanyl dosing of 500-1000 mcg, avoidance of long-acting narcotics, and isoflurane for anesthesia maintenance. During the closing process, reversal of neuromuscular blockade, oxygenation, and spontaneous ventilation were assured. Analgesia ~~is~~ was supplemented with intravenous acetaminophen. Patients may temporally receive BiPAP support in the ICU.

Results/Data: ORE was successful in 88% of patients (58/66) with no reintubations experienced. Operative mortality was 0% and STS observed/expected morbidity was 0.56. Isolated CABG patients (43/66; 65%) had marginally lower EF and particularly high surgical urgency (p=0.017,Table) compared to Isolated Valve/CABG+Valve patients (23/66; 35%), but equivalently high rates of ORE. Univariate analyses showed that successful ORE was paradoxically associated with higher mean age (67.6 vs 57.4 yrs, p=0.026) and trends toward lower EF and higher STS predicted mortality risk. Our experience has now been extended through 10/2024 with successful ORE in 87% of CABG cases (60/69) as well as in 87% of all other cardiac cases (34/39). There has been 1 reintubation in a patient who required an emergent neurosurgical procedure on postoperative day 2. We continue to experience a 0% operative mortality in either group.

Conclusions: Our extended experience with ORE, the first to be reported from a remote community cardiac program, demonstrates that this practice can be successfully and safely undertaken in centers with modest case volumes but moderate proportions of challenging, high-risk patients. We also demonstrated that ORE anesthesia management was readily transferable beyond Isolated CABG patients. Success with ORE was additionally accompanied by program achievements in morbidity and mortality.

Group Comparison	Isolated CABG	Valve/CABG+Valve	p
Age (mean; % ≥75 yrs)	67.7; 24%	63.9; 26%	0.227
Sex (% female)	22.2%	43.5%	0.069
Surgical Timing (% urgent/emergent)	80.0%	52.2%	0.017
Ejection Fraction (EF) (mean; % ≤40%)	49.9; 24.4%	56.3; 17.4%	0.055
STS Predicted Operative Mortality Risk	2.1%	3.6%	0.144
STS Predicted Prolonged Ventilation Risk	11.7%	15.9%	0.255
Operating Room Extubation	90.7%	82.6%	0.337

Figure 1. Initial pilot study results in 1/2021-3/2023 patients with STS risk scores.

A PREDICTIVE MODEL FOR EARLY IDENTIFICATION OF NEONATAL ENCEPHALOPATHY USING CLINICAL DATA

Jack Rausch, Nick Townley, Joshua C. Euteneuer, Eric S. Peeples (Creighton Omaha, NE)

Background, Significance, Problem**:** Neonatal encephalopathy (NE), including hypoxic-ischemic encephalopathy (HIE), is a significant cause of neonatal morbidity and mortality, affecting 2 to 3 in every 1,000 live births in high-income nations. Therapeutic hypothermia (TH) is the primary treatment, but its effectiveness hinges on prompt diagnosis within six hours of birth, posing a challenge due to the lack of sensitive and specific bedside tests or clear inciting sentinel events in most infants with NE. Some studies have attempted to create models to address this issue; however, they focus on differentiating NE from healthy neonates. Our cohort is populated by neonates with a high clinical suspicion of encephalopathy. Using this cohort, this study developed a practical predictive model for distinguishing those infants requiring resuscitation in the delivery room who ultimately develop NE from those who are not diagnosed with NE, utilizing commonly gathered early clinical data.

Design**:** We conducted a retrospective analysis of 437 neonates who were enrolled at the eight sites participating in the Midwest Neonatal Encephalopathy Registry. Infants were eligible for inclusion if they received TH or required positive pressure ventilation in the delivery room and did not have a pH>7.1 on umbilical cord blood gas. For the purposes of this study, NE was determined by those infants receiving TH. Subjects were stratified into three groups: NE with sentinel events, NE without sentinel events, and no NE. Variables for comparison between groups included: alanine transaminase (ALT), aspartate transaminase (AST), creatinine, lactate, C-reactive protein, nucleated red blood cells, and lowest pH obtained in the first hour of life. A logistic regression model was developed to discriminate between those with and without NE.

Results**:** ALT, AST, creatine, lactate, nucleated red blood cells, and base excess were all higher in neonates with NE, and their lowest blood pH was lower compared to those without NE. In neonates with NE, we found no differences in the laboratory values evaluated between those with and without sentinel events. A logistic regression model incorporating base excess, sentinel event occurrence, and Apgar scores at ten minutes achieved an area under the receiver operating characteristic curve of 0.834, indicating robust discriminative power.

Conclusions**:** Although it requires validation in a larger cohort, this model provides a clinically relevant and practical screening tool for NE using only data available within the first hour after delivery.

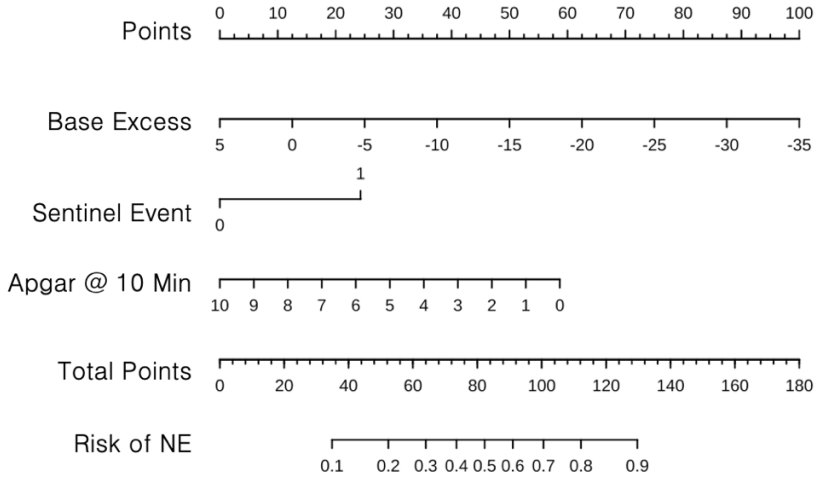

Figure 1. Nomogram for predicting the risk of neonatal encephalopathy (NE). Points are assigned based on base excess, presence of a sentinel event, and Apgar score at 10 minutes. The total points are calculated by summing the points from each predictor, which corresponds to the estimated risk of NE shown at the bottom. This visual tool provides a clinical prediction model for assessing the likelihood of NE based on these variables.

MEDICAL COMPLEXITY OF PATIENTS WITH A TRACHEOSTOMY THROUGHOUT TRANSITION FROM PEDIATRIC TO ADULT CARE

Sydni Springer, Jana Wardian, Jayme R. Dowdall (UNMC Omaha, NE)

Background, Significance, Problem: Within the pediatric population, a tracheostomy is most often carried out for patients with upper airway abnormalities or prolonged mechanical ventilation. Many pediatric tracheostomy patients have several comorbid conditions requiring complex medical care. As these children grow into adulthood, many face the challenge of transitioning from pediatric to adult-oriented care. This process can be emotionally distressing for patients and caregivers as they leave the pediatric team that they formed close relationships with, and it can be especially difficult for patients with medical complexity. To better understand the challenges faced by patients with tracheostomies transitioning to adult-oriented care, it is important to first recognize the medical complexity of this patient population and how that can play a role in the difficulty of the transition.

Experimental Design: A retrospective chart review was performed, analyzing eleven patients with a tracheostomy who have transitioned from pediatric to adult care and have received care from Nebraska Medical Center. The definition of medical complexity was broken down into three components: comorbidities, needs for healthcare services, and technological dependence. Comorbidities were measured utilizing ICD-10 codes in the medical record, where the information was categorized into the organ systems involved in each diagnosis. Healthcare utilization was measured by counting the number of providers on a patient's care team in the medical record as well as their medical specialty and if that provider requires transition to adult care. Lastly, technological dependence was recorded by counting the number of patients that utilize a ventilator, gastrostomy tube, or wheelchair in addition to the tracheostomy.

Results/Data: Young adults with tracheostomies who have transitioned into adult care are medically complex. On average, patients have 25.3 diagnoses involving 8 organ systems. The most common comorbidities to respiratory diagnoses were digestive system (100%) and genetics (82%) diagnoses. Additionally, patients have received care from an average of 13.9 services, with 5.2 of those services requiring transition into adult care. Lastly, patients are technologically dependent or assisted by ventilators (73%), gastrostomy tubes (91%), and wheelchairs (64%).

Conclusions: Patients with tracheostomies who transition from pediatric to adult care are medically complex, which can add difficulty to the transition process. Future directions include analyzing the effectiveness of the current transition process by understanding the patient and caregiver perspective to inform healthcare teams on the best practices to facilitate this transition.

RELATIONSHIP BETWEEN KOOS JR AND PROMIS SCORES IN TKA

Benjamin Tischleder, Dennis Chakkalakal
Creighton University School of Medicine

Abstract

Background

Chronic knee pain is a prevalent condition in the U.S., affecting an estimated 53.2 million individuals and accounting for nearly 4 million annual primary care visits. Non-surgical interventions, such as NSAIDs, weight loss, and physical therapy, are the first line of treatment but are not always effective, with approximately 20% of patients ultimately requiring total knee arthroplasty (TKA). Patient-reported outcome measures are commonly used by providers to guide clinical decisions. The Knee Injury and Osteoarthritis Outcome Score for Joint Replacement (KOOS-JR) is widely used, but due to its knee specific focus, it may be limited in its ability to capture overall patient health. Alternatively, the Patient-Reported Outcomes Measurement Information System (PROMIS) offers a broader assessment of the patients physical and mental health, but its utility in tracking knee-specific outcomes remains under-evaluated. This study seeks to compare the responsiveness of PROMIS to KOOS-JR in detecting changes in patient knee health from preoperative TKA to 3 and 12 months postoperatively.

Significance

The ability to accurately and efficiently measure patient health and well-being post TKA is critical for both patient care and healthcare observation. Confirming the validity of PROMIS as an alternative to KOOS-JR could reduce the need for multiple assessment tools, reducing the burden on both the patient and the provider, while simultaneously offering additional insight in the overall mental and physical well-being of the patient. PROMIS's applicability to other health conditions also offer an opportunity to streamline assessments among many different providers and specialties.

Question

Can PROMIS serve as a comprehensive alternative to KOOS-JR in tracking postoperative knee health, while also offering insight into the patient's overall physician and mental health? By determining if PROMIS is as responsive as KOOS-JR in measuring patient reported knee outcomes, this study may be able to address a potential redundancy in orthopedic care.

Design

This retrospective study analyzed 112 patients who underwent TKA within the CHI Health System between December 2022 and May 2023. Scores from KOOS-JR and PROMIS forms were collected preoperatively and at 3 and 12 months postoperatively. Changes in scores, minimal clinically important differences (MCID), and responsiveness, as measured by Effect Size Indices (ESI), were compared. Pearson correlation coefficients were calculated to assess the relationship between the two metrics.

Results

KOOS-JR and PROMIS-Physical Health (PROMIS-P) demonstrated significant improvements from preoperative to postoperative time points, with high responsiveness (ESI > 0.8). PROMIS-Mental Health (PROMIS-M) showed limited responsiveness, with a significant change only at 12 months. MCID was achieved in a higher percentage of KOOS-JR assessments (82% at 3 months, 91% at 12 months) compared to PROMIS-P (63% and 72%, respectively). Correlations between KOOS-JR and PROMIS-P were moderate to strong ($r = 0.52–0.63$).

Conclusions

Both KOOS-JR and PROMIS-P effectively measure functional improvements following TKA, with PROMIS-P offering additional insights into overall patient health. Despite its broader application, PROMIS-P showed lower specificity for knee-specific outcomes compared to KOOS-JR. PROMIS-M provided limited utility in this setting. Future research should further validate PROMIS-P's applicability to TKA and explore objective measures for MCID to enhance clinical relevance.

MRI-MEASURED KNEE EFFUSION VOLUME AND ITS RELATIONSHIP TO SERUM BIOMARKERS AND CARTILAGE T2 RELAXATION TIMES BEFORE AND 6 MONTHS AFTER ACLR

Vatter L, Minchow A, Chinweze R, McManigal M, Manzer M, Sajja B, Tao M, Wellsandt E. (UNMC Omaha, NE)

Background, Significance, and Hypothesis: Knee joint effusion is a common inflammatory sequela following anterior cruciate ligament (ACL) injury and reconstruction (ACLR). Effusion can result in pain and arthrogenic muscle inhibition, which can lead to quadriceps weakness and poor knee function. The role of persistent knee effusion after ACLR with early signs of knee osteoarthritis is unknown. Therefore, this study aimed to investigate the relationship between knee joint effusion with serum biomarkers (inflammation, bone degradation, and articular cartilage breakdown) and T2 relaxation times (cartilage breakdown) before and 6 months after ACLR. We hypothesized that a larger knee effusion would correlate with an increase (worsening) in serum biomarkers and T2 relaxation time.

Experimental Design: Thirty-three participants 15-35 years old with primary ACL injury underwent bilateral knee magnetic resonance imaging (MRI) and blood draws within one month of ACL injury (pre-ACLR) and 6 months after ACLR. Volume quantitative measurements were completed using axial fat suppressed proton density weighted MRI images using custom MATLAB code, and the interlimb difference (involved minus uninvolved) was calculated at each time point. T2 relaxation times maps were generated by fitting the MRI data with a spin echo sequence with multiple echoes to the associated signal equation at each pixel. Manual segmentation of the knee cartilage on the MRIs was conducted, which was confirmed by a board-certified musculoskeletal radiologist. The mean T2 relaxation time in six regions of interest (ROIs) were calculated: weightbearing (WB) regions of the lateral femoral condyle (LFC), lateral tibial condyle (LTC), medial femoral condyle (MFC), and medial tibial condyle (MTC); trochlea, and patella (PAT). The MRI variables of interest in each ROI was the interlimb difference at pre-ACLR and percent change in the involved limb from pre-ACLR to 6 months after ACLR. Blood samples were analyzed using ELISA assays to test for the following biomarkers: amino-terminal cross-linked telopeptide of type I collagen (NTX), cartilage oligomeric matrix protein (COMP), matrix metalloproteinase 3 (MMP-3), and interleukin 6 (IL-6). A two-way (limb) repeated measures ANOVA was used to compare between-limb effusion levels from pre-ACLR to 6 months after ACLR. Pearson correlations were used to determine the relationship between the interlimb difference in effusion volume with NTX, COMP and MMP-3 levels and cartilage T2 relaxation times. Independent t-tests were used to determine the relationship between effusion volume and high (>1.56 pg/mL) compared to low (<1.56 pg/mL) levels of IL-6. A p-value of 0.05 was set *a priori*.

Data and Results: The interlimb difference in knee effusion volume decreased from pre-ACLR to 6 months in the involved limb but remained higher than the uninvolved limb at both time points (involved pre-ACLR:15.9$\pm$1.7; involved 6 months post-ACLR: 7.3 $\pm$0.7; uninvolved pre-ACLR:2.1$\pm$ 0.2; uninvolved 6 months post-ACLR: 2.3 $\pm$ 0.2). There was no significant correlation between knee effusion and any of the serum biomarkers or the interlimb difference in cartilage T2 relaxation times at pre-ACLR (Table 1). There were too few participants with high levels of IL-6 at pre-ACLR (N=3) to complete analysis. At 6 months after ACLR, there was also no significant correlation between knee effusion and NTX, COMP, and MMP-3. Knee effusion was also not different between participants with high compared to low IL-6 levels ($t(31)=0.95$; two-sided $p=0.348$). However, knee effusion at 6 months after ACLR was correlated to a greater percent change in T2 relaxation time in the trochlea ($r: 0.361$, $p=0.039$) and patella ($r:0.377$, $p=0.031$) regions. There were no significant correlations with the other regions (LFC, LTC, MFC, and MTC) at 6 months.

Conclusion: Quantitative measures of knee effusion preoperatively and 6 months after ACLR are not related to serum biomarkers of NTX, COMP, MMP-3, and IL-6. Greater levels of knee effusion at 6 months were correlated with a greater worsening in T2 relaxation times in only the cartilage of the patellofemoral joint, but not the weightbearing portions of the joint. Because T2 relaxation time is sensitive and specific for cartilage degeneration consistent with knee osteoarthritis, our findings indicate that higher levels of persistent knee effusion may be related to early signs of OA in the patellofemoral joint. Thus, these data further support evidence and the need for clinical attention to minimize knee effusion after ACLR.

IN-OUT-IN PEDICLE SCREW TRAJECTORIES PERFORMED USING ROBOTICS IN PEDIATRIC SPINAL FUSION SURGERY

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Background, Significance, Hypothesis: Pedicle screw placement in pediatric spinal fusion surgery may require “in-out-in” (IOI) trajectories, which involve a deliberate breach of the lateral cortex before re-entering the vertebral body due to unfavorable pedicle anatomy. The execution of this trajectory carries risks, including damage to surrounding tissues, deviation from the planned screw trajectory, and postoperative instrumentation failure. Enabling technologies, such as robotics coupled with navigation (RCN), may help mitigate these risks by using radiographic imaging to plan and execute these trajectories. Evaluating the success rate of RCN in the placement of IOI screws and the associated long-term outcomes in a pediatric population is essential as the use of technological advancements for clinical purposes is increasingly considered. It is hypothesized that IOI screw trajectories can be safely placed using RCN resulting in low rates of postoperative instrumentation complications.

Experimental Design: A retrospective review of data from a multicenter surgical outcomes registry from 2021 to 2024 was conducted. Patients with at least 1 IOI pedicle screw placed using RCN during posterior spinal fusion were included. Demographics, disease etiology, and baseline radiographic data were summarized. The rate of screw malposition (assessed by comparing intraoperative fluoroscopy to RCN software plan), the proportions of IOI screw placement across vertebral levels and laterality, and the rate of instrumentation complications were estimated using generalized estimating equation (GEE) models to account for within-patient clustering.

Results/Data: The cohort included 144 patients (77% female, mean age 15±3 years), mostly with idiopathic scoliosis (78%), and a median preoperative major curve angle of 60° (IQR, 52°-72°). A total of 700 IOI pedicle screw placements were executed using RCN, 693 of which were successfully implanted (99%). The GEE-estimated rate of malposition was 1% (95% CI: 0.4-2.1%). The 7 malpositioned screws were noted on fluoroscopy imaging and redirected prior to closure, of which 3 were lateral, 3 medial, and 1 superior. IOI screw trajectories occurred most frequently in the thoracic spine at T6 (17%), T7 (15%), and T8 (16%) (Figure 1). Three patients experienced postoperative instrumentation complications, none directly related to IOI screws placed using RCN (Table 1).

Conclusions: When a small pedicle diameter necessitates an IOI screw trajectory, especially in thoracic vertebrae, RCN can effectively minimize screw malposition and long-term postoperative instrumentation complications. The 1% misplacement rate observed in this study is significant compared to the 1.9-11% misplacement rate for standard-trajectory pedicle screws placed without RCN reported in the literature.

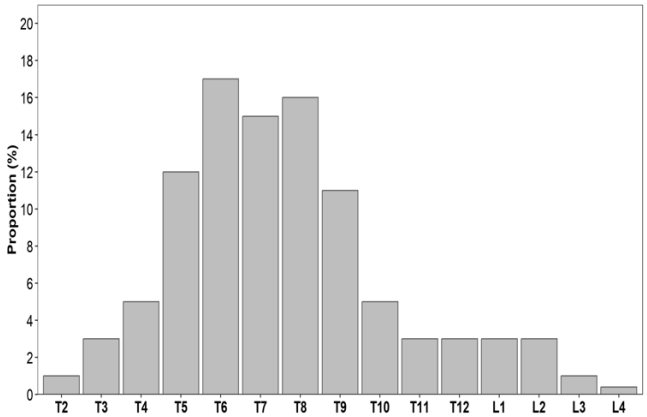

Figure 1: GEE estimated proportion of IOI screw placements at each vertebral level

Characteristic	Patient 1	Patient 2	Patient 3
Age	16 years	14 years	14 years
Sex	Male	Female	Female
BMI	33	-	26
Major Cobb angle	-	70°	-
Etiology	Congenital	Neuromuscular	Idiopathic
In-Out-In Vertebra level	T10, T11	T6, T7, T8, T9, T10, T11, T12	T9
In-Out-In Malposition	No	No	No
Complication	Both rods fractured at 2 years (Resolved with operation)	Asymptomatic right rod fracture and left SI screw (No reoperation)	Proximal screws loose (Resolved with reoperation)

Table 1: Characteristics of 3 patients with postoperative instrumentation complications