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undiagnosed significant depression, result in earlier diagnosis and treatment, and, subsequently, decrease morbidity, mortality, and disease burden. However, primary care settings continue to rarely screen patients for depression. Harnessing machine learning to analyze speech samples for signs of depression has been shown to identify depressed individuals. This cross-sectional study aims to evaluate the feasibility of developing a neural network to detect signs of depression from speech samples and represents one of the first attempts to understand whether voice biomarker technology might be useful in the diagnosis of patients with depression.

Methods: Both males and females 18 years in the United States and Canada, recruited via social media, provided demographics and were enrolled in a cross-sectional study to develop a machine learning model to detect signs of depression using at least 45 second voice responses to the prompt, how was your day?, and self-reported PHQ-9 scores. The PHQ-9 instrument has demonstrated both a sensitivity and specificity of 0.88 and currently, primary care physicians correctly identify patients for screening 47.3% of time. To determine the model, predictive performance, all authentic and unique completed responses that met audio quality and length requirements were included in this training and validation analysis. Preliminary performance was measured using sensitivity, specificity, and both positive predictive value (PPV) and negative predictive value (NPV) metrics with 95% confidence intervals (CI). Before inputting, responses were individually reviewed for authenticity, converted to homogeneous audio quality, transformed into numerical representations, and divided: 80% training (n= 12,947) and 20% validation (n= 3,246) without sample overlap. Prediction outputs were scaled between 0 and 1. Quantitatively, signs of depression corresponded to a value 0.573 or equal to 1 and anticipated PHQ-9 score 10. Signs of depression not detected corresponded to values equal to 0 to 0.427, and PHQ-9 score 10. Values between 0.427 and 0.573 were labeled, further evaluation recommended.

Results: Evaluating the model, ability to detect signs of depression from at least 45 seconds of free speech demonstrated a sensitivity of 0.74 (95% CI: 0.72,0.77) and specificity of 0.75 (95% CI 0.72,0.77). The PPV was 0.75 (95% CI: 0.73, 0.77) and the NPV was 0.74 (95% CI: 0.71, 0.76). A total of 653 participants were labeled, further evaluation recommended.

Conclusions: This cross-sectional study to train and validate a machine learning model was feasible for detecting signs of depression utilizing at least 45 seconds of a free speech sample when compared to performance metrics for the PHQ-9 and/or clinician judgment for assessment alone. This study suggests voice biomarker technology may be a viable method to improve identification of depressed patients for screening and subsequent treatment in primary care settings. Further feasibility and acceptability studies to pilot clinical implementation of this technology are warranted.

5 Racial Disparities in Emergency Restraint Use for Agitated Patients

Daniel Stone

Background: The COVID 19 pandemic and the murder of George Floyd have prompted healthcare organizations to reexamine racial inequities in their care, challenging us to produce lasting, fundamental change. Mental health disorders, both diagnosed and undiagnosed, have increased in volume and developed new challenges for acute care practitioners during the pandemic. Additionally previous research has suggested that there are intrinsic and extrinsic biases that affect how care is delivered to patients presenting with mental health crises.

Methods: Through nominal group technique, we identified topics for equitable-care-oriented QI in the emergency department (ED) of our Level-1 Trauma center. Initial review of triage, left-without-being-seen, and fast-track data did not demonstrate significant racial disparities in standard benchmarks. We therefore focused on behavioral codes and restraint use. We prospectively collected data on all behavioral codes over a 3-month period, including demographics, visit characteristics, and certain aspects of restraint use including type of restraint, length of restraints, medication use, and re-initiation of restraints. In addition to tracking these metrics, employee perceptions of the psychiatric mental health emergencies were polled and evaluated.

Results: Our QI process identified varying levels of disparities in care. Over the study period, white, non-white, and black patients comprised 50.5%, 49.5%, and 28.7% of the ED patient population, respectively, and 50%, 50%, and 44% of the patients who were subject to behavioral codes. Of those patients who had behavioral codes called, restraints were used for 64.8% of white patients, 64.3% of non-white patients, and 67.2% of black patients. Of those arriving by ambulance or police, 20% arrived with pre-hospital restraints or handcuffs, and of those, 90.9% were placed in restraints on arrival to the ED. Of those patients who had restraints placed, 4-points were used for 34.1%, 26.1%, and 25.5% of white, non-white, and black patients, respectively, and the restraint chair was used for 30.7%, 38,6%, and 41.8% of those same groups. Medications were given to 80.7%, 88.7%, and 91.4% of white, non-white, and black patients who were placed in restraints, respectively, and to 77.4%, 80.6%, and 83.3% of those same groups of patients who were not placed in restraints. None of the differences were statistically significant. Of those patients who had restraints placed and then discontinued, 13% were re-restrained at some other point during their visit. Among other responses, nearly half of all ED employees thought that patients should ideally not be restrained during behavioral codes and that, if necessary, the restraint chair provides a better experience than 4-point restraints.

Conclusions: Continuous QI around a variety of measures can identify disparities and targets for sustained anti-racist improvements in emergency department care. This study will guide further intervention and education around inequities in care in our department and has prompted further consideration of, when restraints are deemed necessary, preferentially using less invasive measures like the restraint chair over 4-point restraints. Although decision-making around chemical and physical restraints for mental health emergencies is complex and difficult to study, EDs should carefully examine their use through continuous QI in order to optimize patient-centered outcomes.

6 Emergency Department Use of a Restraint Chair is Associated with Shorter Restraint Periods and Less Medication Use than the Use of 4-point Restraints

Kurt M. Isenberger, Bjorn C. Westgard, Joe Uzpen

Background: Physical and chemical restraints are commonly used in the emergency department, but ongoing quality improvement is needed to improve patient experience by minimizing their use and ensuring equity in their administration. Prior research in inpatient settings has suggested that restraint periods are shorter, fewer adjuvant medications are used, and staff perceptions of patient experience are improved when a restraint chair is used as compared to 4-point restraints.

Methods: We prospectively collected data for all patients who had a behavioral code called in the emergency department of our Level-1 Trauma Center over a 3-month period. We recorded their demographics, visit characteristics, and certain aspects of restraint use including type of restraint, length of restraints, and medication use. In addition to tracking these metrics, employee perceptions of the psychiatric mental health emergencies were polled and evaluated.

Results: Out of 175 behavioral codes, 35.4% of patients were not placed in restraints, 34.9% were placed in the restraint chair, and 29.7% were placed in 4-point restraints. Average time in restraints was 56.1 minutes for those in the restraint chair (IQR 30-62.5 minutes) and 91.6 minutes for those in 4-point restraints (IQR 54.5-115.5 minutes). Medications were given to 70.8% of those who were not restrained, 82.0% of those placed in the restraint chair, 90.4% of those placed in 4-point restraints. Repeat medications were given to 32.3% of those who were not restrained, 21.3% of those in the chair, and 30.8% of those in 4-point restraints. In a follow up questionnaire of all emergency department staff of varying job classifications involved in behavioral codes, 89.6% reported that the restraint chair is a better patient experience than use of 4-point restraints.

Conclusions: This quality-improvement project at our Level-1 Trauma Center suggests that the use of a restraint chair during behavioral codes is associated with shorter times in restraints for patients than when standard 4-point restraints are used. Patients who are placed in the restraint chair also required less initial and repeated medication than those who are placed in 4-point restraints. In addition, the impression of a majority of emergency department staff involved in behavioral codes is that that patient experience is better in with use of the restraint chair than 4-point restraints. This project did not account for confounders of patient presentation that may influence care providers, decisions to use restraints or medications in behavioral codes or to call them in the first place.

7 Virtual Schooling and Pediatric Mental Health During the COVID-19 Pandemic

Thomas Leith, Reni Forer, Leah Rappaport, Nasuh Malas, Harlan McCaffery, Julie Sturza, Kristen Kullgren, Alana Otto, Kimberly Monroe

Introduction: The first six months of the COVID-19 pandemic saw a nearly 50% increase in pediatric mental health emergencies. Specific factors contributing to this rise remain poorly characterized. One frequently cited contributor is pandemic-related interruptions of in-person schooling. Early studies indicate that students have experienced significantly greater psychological distress during such disruptions. We set out to investigate what correlation, if any, exists between school modality (ranging from exclusively virtual to exclusively in-person) and pediatric mental health status.

Methods: This is a retrospective, descriptive study combining patient chart review and parental telephone survey, exploring the prevalence and severity of mental illness among inpatients at a single urban, academic, midwestern tertiary care center. The study population included all patients ages 6-18 admitted to the study site during the 2015-19 and 2020-21 school years who received Psychiatry and/or Psychology consults and/or were admitted to the inpatient psychiatry unit. Parents/guardians of participants from 2020-21 were surveyed regarding their child, educational experiences. We describe and compare participants between school years prior to and during the pandemic using descriptive demographic data and clinical data highlighting monthly admission rates and proxies for illness severity. We then assess for any correlation between these measures and recent virtual schooling.

Results: Total mental health-related admissions rose from an average of 1070 during pre-pandemic school years to 1111 in 2020-21. Patients admitted in 2020-21 were more likely to be female, non-white, and from ZIP codes with higher median income. Primary diagnosis was more likely to be a mood or eating disorder. Patients were less likely to present primarily for suicidal ideation or self-harm. Proxies of illness severity, including utilization of PRN antipsychotics/benzodiazepines and readmission rates, rose in 2020-21. 255 of 800 (31.9%)