study examined associations between each of the three BQ domains, independently and jointly, in relation to gestational diabetes (GDM) and hypertensive disorders of pregnancy (HDP).
Methods: Pregnant third-trimester women aged at least 18 years with a single fetus were recruited from a tertiary medical center. All women completed the BQ, which includes three domains: snoring; sleepiness; and obesity/high blood pressure (BMI/BP). The latter domain was further examined as two separate sub-domains: obesity or chronic hypertension. A positive response in 2-of-3 domains identifies high OSA risk. Medical records were accessed for diagnoses of GDM and HDP.
Results: Of 1,588 women, 44% had a positive BQ. Women with positive domains of snoring exclusively, sleepiness exclusively, or their combination did not have an increased risk of GDM or HDP. However, women without snoring or sleepiness, but with a positive score on the BMI/BP domain had increased odds of GDM (OR 2.0, 95%CI 1.3–3.3) and HDP (OR 2.9, 95%CI 1.6–5.5). Any positive score in domain combinations that included BMI/BP had increased odds of GDM and HDP compared with negative scores in all domains. A positive score in BMI/BP-alone, BMI/BP-and-sleepiness, BMI/BP-and-snoring, and an intersection of all three domains, had increased HDP odds compared with controls: OR 2.9 (95%CI 1.6–5.5), OR 2.2 (95%CI 1.1–4.4), OR 2.9 (95%CI 1.5–5.7), and OR 4.6 (95%CI 2.6–8.6), respectively. Women absent of positive BMI/BP domain but with a positive score in the other two domains (or their combination) had similar odds of GDM and HDP as controls.
Conclusion: The poor performance of the BQ in screening for OSA risk in pregnant women may be attributed to its predominant reliance on identification of obesity.
Support (if any): NIH NHLBIHL089918

419

STOP-BANG SCORE AND HISTORY OF RADIATION PREDICTS RISK OF OBSTRUCTIVE SLEEP APNEA IN CANCER PATIENTS: A MACHINE LEARNING STUDY

Ankita Paul,[1] Karen Wong,[2] Anup Das,[1] Diane Lim,[3] Miranda Tan[4]
[1]Drexel University, [2]Mark Sloan Kettering Cancer Center, [3]University of Miami, [4]Memorial Sloan Kettering Cancer Center

Introduction: Cancer patients are at an increased risk of moderate-to-severe obstructive sleep apnea (OSA). The STOP-Bang score is a commonly used screening questionnaire to assess risk of OSA in the general population. We hypothesize that cancer-relevant features, like radiation therapy (RT), may be used to determine the risk of OSA in cancer patients. Machine learning (ML) with non-parametric regression is applied to increase the prediction accuracy of OSA risk.
Methods: Ten features namely STOP-Bang score, history of RT to the head/neck/thorax, cancer type, cancer stage, metastasis, hypertension, diabetes, asthma, COPD, and chronic kidney disease were extracted from a database of cancer patients with a sleep study. The ML technique, K-Nearest-Neighbor (KNN), with a range of k values (5 to 20), was chosen because, unlike Logistic Regression (LR), KNN is not presumptive of data distribution and mapping function, and supports non-linear relationships among features. A correlation heatmap was computed to identify features having high correlation with OSA. Principal Component Analysis (PCA) was performed on the correlated features and then KNN was applied on the components to predict the risk of OSA. Receiver Operating Characteristic (ROC) - Area Under Curve (AUC) and Precision-Recall curves were computed to compare and validate performance for different test sets and majority class scenarios.
Results: In our cohort of 174 cancer patients, the accuracy in determining OSA among cancer patients using STOP-Bang score was 82.3% (LR) and 90.69% (KNN) but reduced to 89.9% in KNN using all 10 features mentioned above. PCA + KNN application using STOP-Bang score and RT as features, increased prediction accuracy to 94.1%. We validated our ML approach using a separate cohort of 20 cancer patients; the accuracies in OSA prediction were 85.57% (LR), 91.1% (KNN), and 92.8% (PCA + KNN).
Conclusion: STOP-Bang score and history of RT can be useful to predict risk of OSA in cancer patients with the PCA + KNN approach. This ML technique can refine screening tools to improve prediction accuracy of OSA in cancer patients. Larger studies investigating additional features using ML may improve OSA screening accuracy in various populations
Support (if any):

420

EVALUATING THE RATE OF REFERRAL FOR OBSTRUCTIVE SLEEP APNEA IN A PRE-DOCTORAL DENTAL CLINIC USING THE STOP-BANG QUESTIONNAIRE

Nathan Guess,[1] Henry Fischbach,[1] Andy Ni,[1] Allen Firestone[1]
[1]The Ohio State University

Introduction: The STOP-Bang Questionnaire is a validated instrument to assess an individual's risk for obstructive sleep apnea (OSA). The prevalence of OSA is estimated at 20% in the US with only 20% of those individuals properly diagnosed. Dentists are being asked to screen and refer patients at high risk for OSA for definitive diagnosis and treatment. The aim of this study was to determine whether patients in a dental school student clinic who were identified as high-risk for OSA, were referred for evaluation of OSA.
Methods: All new patients over the age of 18 admitted to The Ohio State University - College of Dentistry complete an "Adult Medical History Form". Included in this study were 21,312 patients admitted between July 2017 and March 2020. Data were extracted from the history form to determine the STOP-Bang Score for all patients: age, sex, BMI, self-reported snoring-, stopped breathing/choking/gasping while sleeping-, high blood pressure-, neck size over 17" (males) or 16" (females)-, and tiredness. Each positive response is a point, for a maximum of 8 points possible. Additionally, any previous diagnosis of sleep apnea, and the patient's history of referrals were extracted from the health record. According to clinic policy, if the patient did not have a previous diagnosis for OSA noted in the health history, and scored 5 or more on the STOP-Bang Questionnaire, they should receive a referral for an evaluation for OSA. Notes and referral forms were reviewed to determine if the appropriate referrals occurred for patients at high risk without a previous diagnosis.
Results: Of the 21,312 patients screened; 1098 (5.2%) screened high-risk for OSA, of which 398 had no previous diagnosis of OSA. Of these 398 patients, none (0%) had referrals for further evaluation for OSA.
Conclusion: The rate of appropriate referrals from a student dental clinic with an electronic health record was unacceptably low. Continued education and changes to the electronic health record are needed to ensure those at high-risk for OSA are appropriately referred and managed.
Support (if any):

421

ELUCIDATING CIRCADIAN AND SLEEP PHENOTYPES AND RELATION TO COGNITIVE IMPAIRMENT IN ALZHEIMER'S DEMENTIA

Catherine Heinzinger,[1] Lu Wang,[2] James Bena,[1] Lynn Bekris,[1] Nancy Foldvary-Schaefer,[1] Jagan Pillai,[1] Sujata Rao,[1] Stephen Rao,[1] James Leverenz,[1] Reena Mehra[3]

[1]Cleveland Clinic, [2]Department of Quantitative Health Sciences, Cleveland Clinic, [3]Sleep Disorders Center, Neurological Institute, Cleveland Clinic

Introduction: Although sleep disruption in Alzheimer's disease (AD) pathogenesis has been described, the role of circadian rhythm dysfunction (CRD) is less understood. We hypothesize greater CRD and sleep disruption with poorer cognitive function in AD compared to normal cognition.
Methods: We examined 3 groups:1)mild cognitive impairment with positive AD biomarkers(MCI-AD),n=18, 2)cognitively normal at high risk for AD(HR)(APOEε4 carriers),n=19, 3)cognitively normal APOEε4 non-carriers(CL),n=16 (National Institute of Aging, IMMUNE-AD). DNA extraction and APOEε4 genotyping were performed under the Cleveland Clinic Lou Ruvo Center for Brain Health Aging and Neurodegenerative Disease Biobank. We evaluated actigraphy-based (Motionlogger MicroWatch, Ambulatory Monitoring,Inc®) sleep (wake episodes(WE), total sleep time(TST), sleep efficiency(SE), sleep fragmentation index(SFI)) and circadian (mesor, amplitude, robustness, sleep regulatory index(SRI), intradaily stability) predictors and sleep study-based (ApneaLink Air by ResMed®) predictors (apnea hypopnea index(AHI,3% desaturation) and recording time<90%SaO2) across the groups and assessed association with cognition (Mini-Mental State Exam(MMSE)). Analysis of variance (ANOVA) or Kruskal-Wallis with Bonferroni adjustment was used for cross-group comparisons. ANCOVA assessed cross-group association of MMSE and sleep/circadian indices. Models were adjusted for age, sex, race, education, and BMI.
Results: Age differed across MCI-AD, HR, and CL groups (68.4±6.2,71.2±3.7,73.7±3.7 respectively,p=0.008). MCI-AD had more WE than HR and CL (14.4±5.6,10.9±3.9,10.9±3.5 respectively,p=0.033). In MCI-AD, the following associations were observed: 5% increase in SE was associated with 0.49 point higher MMSE (coefficient0.49, 95%CI[0.03,0.95],p=0.038), 1 hour increase in TST was associated with 0.81 point higher MMSE (coefficient0.81, 95%CI[0.24,1.37],p=0.006), and 1 unit increase in SFI was associated with 0.36 point lower MMSE (coefficient-0.36, 95%CI[-0.64,-0.08],p=0.013). Key measures differed: CLs had lower AHI, MCI-AD had less TST SaO2<90%, MCI-AD had the largest and HR the lowest SFI, and MCI-AD had lesser robustness but higher mesor and amplitude.
Conclusion: In this comparative study of carefully AD biomarker-phenotyped and APOEε4-genotyped patients and normal cognition controls, less sleep time and more fragmented sleep are associated with poorer MMSE scores in MCI-AD. Preliminary results show cognitively normal participants at risk of AD(HR) do not show CRD seen in MCI-AD and are more consistent with controls (CL).
Support (if any): Catalyst Award. MCI cohort: Alzheimer's Association, 2014-NIRG-305310. IMMUNE-AD, R01AG022304. CADRC, P30 AG062428. Jane and Lee Seidman Fund.

422

INFLUENCE OF SEX-SPECIFIC DIFFERENCES IN INPATIENT SLEEP TESTING APPROACH FOR DIAGNOSIS OF OBSTRUCTIVE SLEEP APNEA

Cinthya Pena Orbea,[1] Cody McIntire,[1] Lu Wang,[2] Reena Mehra[1]
[1]Sleep Disorders Center, Neurological Institute, Cleveland Clinic, [2]Department of Quantitative Health Sciences, Cleveland Clinic

Introduction: Increased attention has been focused on sex-specific differences in approaches to diagnostic testing for obstructive sleep apnea (OSA) given differences in hypoxia, arousal thresholds and sleep state dependent influences, but with sparse data available for inpatient testing. We postulate that women are more likely to have a lesser degree of sleep apnea on inpatient home sleep apnea testing (HSAT) versus polysomnography (PSG).
Methods: The Cleveland Clinic Sleep Laboratory registry was queried for inpatient sleep testing (HSAT or PSG conducted over the last 15 years. Demographics, comorbidities, and sleep study (Nihon Kohden®) data were collated. Logistic regression was used to examine sleep study type predictive of OSA at various severity thresholds (apnea hypopnea index (AHI, 3 or 4% hypopnea rule)>5,>15 and >30 and hypoxia (11% (median) time spent with SaO2<90%) adjusted for age, race and body mass index and comorbidities (hypertension, coronary artery disease, arrhythmias, heart failure, diabetes, stroke, chronic obstructive pulmonary disease, mood disorders, respiratory failure and epilepsy with a sex interaction term) (OR, 95%CI presented).
Results: The analytic sample was comprised of 639 patients: age:55.8±16.3 years, 45% female, 73% Caucasian, BMI:37.5 ± 13.3kg/m2, 74% had OSA and 51% HSAT. Men had higher AHI:16.2 [5.9, 42.3] vs 8.2 [2.9, 20.7]p<0.001, higher arousal index:33.1[18.9,.54] vs 25.3 [15.6, 39.2]p=0.003. Women had higher BMI:40.2 ±14.7, vs 36 ±11.7kg/m2,p<0.001. Unlike AHI>5, at AHI>15, men had lower odds of OSA: OR=0.51:0.32–0.80,p=0.004 for HSAT versus PSG compared to women: OR=1.03:0.61–1.72,p=0.92; interaction p-value=0.046. Men had lower odds of OSA (AHI >30): OR=0.57(0.35,0.92,p=0.022) in HSAT vs PSG; albeit sex-interaction was not statistically significant. Men versus women had 2-versus 3-fold higher hypoxia ie. OR=2.04:1.22–3.41,p=0.006 in men undergoing HSAT versus PSG with strength of association higher in women: OR=3.03:1.68–5.46,p=0.001, interaction p-value=0.32
Conclusion: We unexpectedly observe sex-specific differences in inpatient sleep testing such that men had an overall lower odds of detection of moderate to severe and OSA and nocturnal hypoxia relative to women with HSAT versus PSG. Future investigation focused on concurrent inpatient PSG and HSAT should verify these sex-specific findings and clarify potential biophysiologic rationale
Support (if any): Transformative Neuroscience Research Development Program: Multimodal Neurocardiorespiratory Physiologic Sleep Signal Repository Transformative Resource Facilitating Transdisciplinary Research Opportunities

423

EVALUATION OF ELECTRONIC MEDICAL RECORD ARTIFICIAL INTELLIGENCE SCREENING TOOLS FOR UNDIAGNOSED OSA

Sam Rusk,[1] Yoav Nygate,[1] Fred Turkington,[1] Chris Fernandez,[1] Nick Glattard,[1] Nathaniel Watson[2]
[1]EnsoData Research, EnsoData, [2]Department of Neurology, University of Washington School of Medicine,

Introduction: The STOP-Bang is a concise, simple and widely adopted obstructive sleep apnea (OSA) screening tool. However, it has limited predictive ability and is susceptible to subjective reporting bias. Artificial Intelligence (AI) methodologies can be utilized together with existing data in electronic medical records (EMRs) to create new screening tools to increase diagnostic sensitivity and facilitate discovery of preclinical OSA phenotypes.
Methods: The study comprised two independent retrospective sleep study datasets: 1) Type III HSATS (N=5583) and, 2) Type I polysomnograms (N=1037). Each contained raw sleep study waveforms, manually scored sleep events (respiratory, arousal, sleep staging), and standard report indices (apnea-hypopnea index; AHI, arousal index). Additionally, the first dataset contained 90 EMR based