As the 2019-2020 academic year is coming to a close we celebrate many accomplishments in the program and are excited about the next steps. The onslaught of the COVID 19 pandemic is stretching the school, students and faculty. Fortunately, CIPCT is already 100% online so that part required no transition. We do know that many of you are in direct care and roles supportive to direct care and we acknowledge your tremendous efforts! All of us are adapting, sacrificing and coping in some way. Please stay in touch with your instructors and advisors regarding your individual challenges. We are here for you!

Summer is always an exciting time as many of our year 1 students will be developing scholarly projects. Dr. Brenda Zierler, one of the CIPCT founders, is teaching the scholarly proposal development course in summer 2020. This year we received more scholarly project opportunities from faculty than we have students; wonderful!

Work completed last summer to update the CIPCT curriculum passed all approval milestones and will be in effect for the new 2020 cohort. We updated and aligned course objectives with the American Medical Informatics Association core competencies for applied health informatics at the master's degree level. Updated syllabi will be added to new Canvas course templates that will be consistent from course to course within the curriculum. David Campbell will be coordinating this work with faculty.

We are also getting ready for our annual meeting and orientation on September 25th and welcoming our 2020 cohort. We look forward to seeing our second year students.

Spring and summer graduates, CONGRATULATIONS!
Two CIPCT Students Use Wizard-of-Oz Testing Model to Evaluate Caring of Caregivers Online Tool: Jennifer Garcia and Myra Divina

Parent caregivers of children with chronic conditions like asthma or juvenile arthritis in underserved communities have limited resources to combat common caregiver symptoms such as depression, stress, anxiety, and poor health. The University of Washington is developing and testing a theory-based web and mobile intervention, known as the Caring of Caregivers Online (CocoBot) initiative. This technology will provide caregivers with on-demand and interactive self-management skill development and social support. Two CIPCT students conducted scholarly research focused on evaluating the development and usability of CocoBot using Wizard-of-Oz (WOZ) testing. WOZ usability testing is where researchers “fake” a fully developed interface to test their prototype to identify problems and barriers in its earliest stages without having to build a complete system. The testing included collecting health dialog data, evaluating interface design usability, and describing users’ experience with the software.

Jennifer Garcia, a second year CIPCT student, worked on the project. She is an RN Compliance Analyst who has seen how technology closes communication gaps in healthcare systems. She worked as a Clinical Documentation Improvement (CDI) specialist during a time when her hospital was transitioning from paper charting to electronic health records. She found that EPIC, an electronic health record system, simplified communications and reporting. Later, she piloted the Denials Sharepoint project, tracking and sending requests for denials and appeals for cancer patients, and bypassing confusing and lengthy e-mail trails. Before beginning the CIPCT program, she became certified in Healthcare Data Analytics. This gave her a better understanding of where healthcare is going in the future: “big data collection and analysis to provide community-focused healthcare, newer and effective technology to reach rural or remote communities as well as the elderly or disabled.” Her time as a student in the CIPCT program has given her new awareness about where the worlds of healthcare and technology continually miss the mark due to a number of complex factors. According to Jennifer, “this program is an opportunity to continually learn and recognize gaps but also to acquire the skills and expertise to find solutions for it. I want to be part of the solution.”

Myra Divina, another second year CIPCT student who worked on the project, has ten years of clinical experience facilitating communications between clinical and IT staff. As a healthcare professional, the program has fit well with her career needs and interests. Although she has attended classes remotely she says she “always felt welcomed and encouraged to reach out.” She is thankful for the program staff and feels that her relationships will continue after graduation. As Myra prepares for a career in healthcare technology she feels that “informatics is crucial as it bridges the healthcare needs of data and clinical care.”

The scholarly work on WOZ testing of CocoBot was a small piece of the overall development of the CocoBot initiative. During the time the students worked on the project, the development team was also looking for other opportunities that might help the students build knowledge and skills. One opportunity that Myra took advantage of was to be part of a team that shared news about the project for the Association for Computing Machinery (ACM) CHI 2020 Conference on Human Factors in Computing Systems. Their paper is now published on the ACM digital library (https://dl.acm.org/doi/abs/10.1145/3334480.3382902)

Jennifer Garcia was selected as the Master of Science Outstanding Student by the School of Nursing. This award is given for application of theory to practice, creativity, scholarship, professional potential, leadership, and contributions to the community.
Dr. Thomas Payne is a Professor of Medicine at the University of Washington, an Adjunct Professor in Health Services and Biomedical Informatics & Medical Education, and an attending physician at the University of Washington Medical Center and Harborview Medical Center. He attended Stanford University and the University of Washington School of Medicine, completed a residency at the University of Colorado, and completed a fellowship in the Harvard Medical Informatics Fellowship program. His current focus is on clinical computing and health informatics, specifically how we effectively use biomedical data, information, and knowledge for scientific inquiry, problem solving, and decision making to improve human health.

Lately, Tom has had an interest in learning from what is within electronic health records (EHR). According to Tom, there are clues and insights contained in the records. By leveraging this information, we have the potential to improve care, which is one of the reasons EHRs were adopted. An example is risk factor information for heritable forms of breast and ovarian cancer. Another is determining when hospitalized patients are well enough to switch to oral antibiotics. Tom suspects there are many more. Another interest is simplifying and speeding ways of documenting care. VGEENS is a system he helped develop with support from the Agency of Healthcare Research and Quality (AHRQ) to provide a better, faster way to write progress notes. Tom predicts that in the future EHRs will get easier to use, but as the EHR grows we will need to find information more easily. Thus, healthcare will become more of an information management challenge. Informatics principles will help.

Tom urges health informatics students to get the best education available. Invest your time in learning and, if your interest is in health informatics, invest in the hard work of learning clinical skills. He also recommends that students not be shy about contacting people whose work interests them. Specifically, help out in informatics projects and research, network with others, and join associations such as the American Medical Informatics Association (AMIA). Then find your passion, he says. You will be the best at doing what you love.
Tokunbo Akande

Features of mHealth Apps Associated with Efficacy in Promoting a Healthy Behavior Change: A Systematic Review

Problem: Many health-related mobile applications (mHealth apps) have been developed to deliver health behavior change interventions but their clinical effectiveness is yet to be conclusively demonstrated and the knowledge of the features of the mHealth apps which are valuable in promoting health behavior change is lacking.

Objective: To perform a systematic review of literature on rigorously tested mHealth apps to summarize the literature on apps targeted towards health behavior change, synthesize the clinical evidence of efficacy and determine which features in the apps are associated with efficacy.

Design: We conducted a literature search in 5 databases (Cochrane Central Register of Controlled Trials, MEDLINE, Embase, CINAHL, and PsycINFO). Inclusion criteria: Randomized controlled studies evaluating mhealth apps designed to deliver interventions to promote health and behavior change; for any health condition; and published in English or Spanish between 2008 and 2018. Exclusion criteria: Studies on wearables, web applications, or on mHealth apps targeted towards providers; not rigorously tested (e.g., include a control group comparator); and published in outside the specified timeframes or in languages other than those specified in the inclusion criteria.

Results: We identified 8220 articles through the database search. After deduplication and screening we included 120 studies in our review. 116/120 (96.7%) were RCTs. The papers evaluated app use in a variety of disease conditions with the top 3 being weight management (23.3%), mental health (21.5%) and diabetes (15.7%). 109 of 120 articles evaluated app features as their primary outcome, of these 70 (65.4%) reported better outcomes with app, 35 (32.7%) reported no difference in outcomes and 2 (1.9%) reported worse outcomes with the app. The modal number of features in the app was 3, a median of 5 and a range of 1-10. The feature most commonly included and least commonly included were self-monitoring (69.6%) and messaging (12.5%) respectively. There was no association between feature type or number and positive clinical efficacy of the app. Studies which had multiple tech components in their intervention had a lower odds of reporting better outcomes than those studies which used only apps in their intervention (OR=0.5, CI: 0.22-1.2, P=0.09). There was a slight inverse relationship of the length of follow up and the odds of reporting a positive outcome.

Conclusions: There is no evidence of correlation between number or type of feature in apps and clinical efficacy of app in behavior change interventions. Efficacy is thus more likely linked to an interplay of other factors not evaluated in this study. Efficacy of app are inversely
related with length of follow up, suggesting a waning of efficacy over time. There is a need to simplify behavior change strategies involving mHealth technologies.

Committee: Sarah Iribarren, Bill Lober

David Alt

Therapy Dosage for Mood Disorders in Military Personnel: Metric Design

Importance: Research has shown that psychotherapy has a dose-response effect and that few patients receive the minimum appropriate therapy. Without the ability to monitor whether patients receive the right “therapy dose,” patients may be at increased risk of treatment failure or suicide and military readiness is reduced. However, there is little practical guidance on how this should be measured. The Defense Health Agency plans to standardize existing Army metrics across all military branches, but the current metrics are based on older literature and may need updating.

Objectives: This scholarly project has two major objectives. The first is a literature review and discussion of the concepts surrounding therapy dosage. The second is the development of a therapy dosage metric for major depressive disorder (MDD), post-traumatic stress disorder (PTSD), and other anxiety disorders. This metric will replace the prior therapy dosage metric at Madigan Army Medical Center (MAMC) that is no longer compatible with the military’s new Cerner-based electronic health record (EHR). The new metric will be compared with an established Army enterprise metric, along with a brief discussion of optimization strategies.

Design, Setting, and Target Population: A cross-sectional study design is proposed to test the metrics by evaluating for therapy dosage, which is a prevalence measure. The study population consists of active duty personnel with MDD, PTSD, or other anxiety disorders treated at MAMC Behavioral Health clinics to allow comparison between local and enterprise measures of the same population.

Committee: Peter Tarczy-Hornoch, Thomas Patterson
Christopher Cabrera

Patient Portal Usage Outcomes for Older Adult Patients; a Scoping Review

**Problem statement:** According to the CDC, 25% of older adults are diagnosed with Diabetes (Kirkman, et al., 2012). Although patient portals have shown some promise in assisting patients with disease management, it is still uncertain if patient portals can assist older adults with diabetes self-management. With the increasing number of individuals that are 65 and older in the US (i.e., older adults), the use of patient portals can potentially impact the health outcomes for this patient population.

**Significance statement:** With the rising costs associated with chronic diseases, patient portals can be an additional tool that can be used to manage chronic diseases including diabetes for older adults.

**Purpose (Specific Aims):** The purpose of this project is to conduct a scoping review to better understand the literature regarding how patient portals can be used to manage the care of older adult diabetic patients and identify barriers to adoption by this patient population. Specific aims are to conduct a scoping review to better understand the published research to:
1. Identify how patient portals are being used to manage diabetes for older adult patients;
2. Identify barriers for use of patient portals by older adult patients; and
3. Provide recommendations to address barriers identified that could improve the use by older adults for diabetes self-management.

**Study Design (methods):** This scoping review follows the PRISMA-ScR (Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews) checklist (Tricco, et al., 2018) to search medical, engineering, and nursing literature databases, including Cumulative Index to Nursing and Allied Health Literature (CINAHL), PubMed, Compendix, and EMBASE.

**Results:** This review found evidence of increased use of patient portals by older adults as more healthcare organizations implement electronic health records and provide access to this tool. In addition, evidence supports the growing interests by older adults in utilizing the patient portal. Evidence also found that the use of patient portals positively impacts older adults with management of Diabetes Mellitus. However, there are barriers found that impact utilization of the tool by this patient population. These barriers include usability, negative attitudes and beliefs toward the use of technology, health literacy, and access to technology.

**Conclusion:** The goal of this report is to help organizations promote the importance of patient portals and can also help organizations improve the design of the patient portal for older adults with chronic diseases such as diabetes. The studies found in this scoping review support the notion that patient portals have the potential to improve outcomes for patients with diabetes and that older patients have a growing interest in using patient portals. Given the potential of patient portals, it is important to understand the barriers preventing or making it challenging to use patient portals by older adults. This review identified barriers and provided recommendations to address the issues. Addressing the identified barriers can potentially increase the usage of patient portals by older adults and possibly improve health outcomes for older adults with chronic diseases such as diabetes.
Olivia Condotta

**Nursing Perceptions of Smart Pumps: A Qualitative Study**

**Problem:** Smart pump usage has not eliminated medication administration errors. At this acute care facility, BUMCP, quarterly generated reports illustrating smart pump usage are not appropriately utilized to steer quality improvement projects. Nursing staff, as the primary users of smart pumps, have not been contacted to understand practices with and attitudes towards smart pumps.

**Purpose:** The purpose of this project is to examine common practices with and attitudes towards smart pumps in a 95-bed progressive care unit (PCU) and 40-bed ICU 2017 at an academic Level 1 Trauma Center, BUMCP.

**Aims:** Summarize data from quarterly smart pump reports to describe the prevalence of alert overriding, near misses, Basic Infusion use, and total Guardrails, or drug library, compliance. Identify common practices with and attitudes towards smart pumps utilizing a cross-sectional survey based. Develop a priority list of recommendations to inform future quality improvement projects aimed at reducing medication administration errors by examining smart pump data and survey results.

**Design:** This project is grounded by the Sociotechnical Systems Theory, which was used to develop the survey instrument, and the Technology Acceptance Model. The Infusion Perception Scale Survey (IPSS), which uses a 5-point Likert Scale, was sent to all nursing staff currently employed in PCU and ICU and data was gathered regarding nursing attitudes and practices related to smart pump usage. This study examines data regarding the incidence of manual alert overrides, near misses, the use of the Basic Infusion function, and total Guardrails compliance in the smart pumps from a quarterly report generated by the smart pump company to further identify areas for improvement.

*Committee: Sarah Iribarren, Louann Mace*

Amanda Cox

**The Creation and Usability Analysis of Custom Tools Focused on Mindfulness and Sleep During Pregnancy**

**Problem:** Sleep deficiency during pregnancy has been associated with adverse maternal and fetal outcomes. The OPTIMISM study will test the effectiveness of an online mindfulness-
based insomnia treatment during pregnancy. A large number of surveys and modules must be completed for the study making it difficult for participants to track their progress.

**Aim:** The aim of this scholarly project was to customize tools and surveys to help both researchers and participants track their progress. A usability analysis was completed with a preliminary group of researchers and participants to determine the tools’ ability to support effective use in the OPTIMISM study.

**Methods:** A secure website was used to collect information and surveys from participants and then to customize the dashboard and survey queue. A usability analysis comprised of a think aloud, the System Usability Scale, and open-ended feedback was to evaluate the tools.

**Results:** Researchers had a mean SUS score of 59 (sd= 6.24), and participants had a mean SUS score of 69 (sd=20.44). These results placed the researcher SUS score in the not acceptable range and the participant score in the acceptable range. Qualitative feedback included inputting times in the surveys was difficult, the formatting on some of the surveys was difficult to read, and people wished there was a Not Applicable option on questions.

**Conclusion:** The quantitative data and the feedback from participants determined there are some things which need to be fixed and some preferences people would like to see in order to make these tools easier to use. All of the feedback received can help guide the researcher in changing the tools to better serve this population.

*Committee: Ira Kantrowitz-Gordon, Andrea Hartzler*

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**Michaela D’Avilar**

**Telemedicine and Gestational Hypertensive Disorders: Systematic Review of Platform Feasibility and Patient Acceptance**

**Objective.** To systematically review the literature on feasibility and acceptance associated with patient use of telemedicine platforms for gestational hypertensive disorders (GHD).

**Data Sources:** Studies in PubMed and CINAHL from November 2008 to November 2018.

**Study Eligibility Criteria:** Full text, English, primary studies that report on feasibility and patient acceptance associated with use of telemedicine platforms, specifically remote monitoring and mobile health (mHealth), by women with GHD.

**Study Appraisal and Synthesis Methods:** Primary studies were selected and data was extracted independently by the author using the Mixed Methods Appraisal Tool (MMAT) and Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA).
Results: Of the 473 studies returned from the search, five were included. All studies reported that patients felt their interventions were easy to use, beneficial, and were overall satisfied with their care. Three of the studies reported patients preferred the use of telemedicine versus traditional care and would not only recommend the intervention but would be interested in utilizing the intervention again in the future.

Conclusion: Telemedicine is feasible and accepted in patients with gestational hypertensive disorders. Telemedicine should be further explored as an acceptable alternative to traditional care of GHD patients, in addition to health outcomes and cost savings.

Committee: Andrea Hartzler, Angela Balistrieri

Myra Divina

Wizard-of-Oz (WOZ) Testing on Caring of Caregivers Online (CocoBot) Prototype: A Mixed-Method Usability Study

Background: The role and duties of caregiving for a child with a chronic condition can have a significant impact on a caregiver’s physical and mental health and overall wellbeing. Although these problems are recognized issues, little is known about the use of implementing artificial intelligence (AI) technology for family caregivers of children with chronic conditions. Furthermore, there is a lack of knowledge in the testing and evaluation of usability and user experience in health dialog systems (HDS) for this population. This paper describes findings from a mixed-methods study on the development and evaluation of a prototype chatbot, CocoBot, an HDS web-based tool intended to facilitate caregivers to self-manage common caregiver symptoms (e.g., fatigue, sleep disturbances, and stress) and better care for themselves.

Objectives: We evaluated the development and usability of CocoBot, which provides real-time feedback to the user via chat-based interaction. The aims of this study were to 1) collect health dialog data using CocoBot with scenario-based interactions with standardized patients (SPs) acting out the role as a caregiver persona, 2) evaluate the usability of the interface design of CocoBot prototype, and 3) describe users’ experience interacting with chatbot CocoBot.

Methods: We conducted a study using the Wizard-of-Oz (WOZ) technique with two SPs. We assigned each SP to two caregiver personas to simulate their role as a family caregiver to engage in dialog on a set of symptoms with CocoBot. These sessions were recorded to enable the analysis of dialog and usability. After completion of sessions, each SP answered a set of open-ended interview questions and questionnaires in the usability and user experience of CocoBot.

Results: From the two SPs, the health dialog data collected during this WOZ testing
provided data that was not initially available in the existing design of CocoBot and was a significant find to add to the system’s response back to improve the AI in CocoBot. The qualitative data from the post-study interview questions identified four key usability issues of CocoBot and determined the scope of usability issues to be a minor effect in usability. Overall, the SPs reported a positive user experience, even encouraging to recommend this program to a family member or friend.

**Conclusion:** This initial work with SPs provides early evidence that user interaction with an HDS chatbot can be simple to use, convenient, and provide an excellent user experience in supporting the self-management of reducing a caregiver’s symptoms. Tools, such as CocoBot, could enhance self-management access for caregivers around the world.

*Committee: Weichao Yuwen, Andrea Hartzler*

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**Natalie Donahue**

**User-Centered Design in Developing the Sleep Innovations for Preschoolers with Arthritis**

For my scholarly project, I participated in the design, data collection and data analysis for a larger research project through the University of Washington School of Nursing called Sleep Innovations for Preschoolers with Arthritis (SIPA). The goal of the study was to develop a web-based sleep intervention for parents to use to improve sleep in their young children (ages 2-5) with juvenile idiopathic arthritis (JIA). I participated in the first aim of the study to conduct in-person participatory design (PD) sessions with pediatric rheumatologists and parents. Additionally, I designed the mail-out packets that included prompts and a series of activities done in the in-person sessions. After PD data were collected, I performed a preliminary qualitative content analysis by categorizing them into three domains: intervention content, features and functions, and other aspects. Themes were then identified within each of the domains. Engaging with the stakeholders and the end-users early in the development process through PD sessions and packets yielded valuable information that will be incorporated into our web-based intervention and empirically tested. Through this project I learned about user-centered design approaches and the preliminary steps of developing an intervention to improve care in a clinical population.

*Committee: Weichao Yuwen, Uba Backonja*

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**Kathleen Estrada**

**Consumer-Focused Electrocardiogram Mobile Health Application Use in Atrial Fibrillation Detection and Monitoring: A Systematic Review**

**Problem:** Atrial Fibrillation (afib) is a common cardiac dysrhythmia that leads to other life-threatening medical conditions and frequent hospital admissions. Consumer-focused electrocardiogram (ECG) mobile health (mHealth) applications have been developed to help
patients detect and monitor their afib within real-world settings. However, little is known about the use and effectiveness of these mobile health technologies.

Purpose: The goal of this study is to systematically explore and summarize the literature available on consumer-focused ECG mHealth application use in identifying and monitoring afib.

Aims: Specific aims of the study include: (1) examining existing consumer-focused ECG mHealth applications and technologies aimed at afib detection and monitoring; (2) evaluating the effectiveness of various consumer-focused ECG mHealth applications and technologies in accurately identifying afib; (3) assessing reported clinical outcomes of utilizing consumer-focused ECG mHealth apps in afib detection and monitoring.

Methods: A comprehensive and structured literature review process was conducted according to PRISMA guidelines. Seven bibliographic databases and grey literature were searched. Eligibility criteria included primary sources of information reporting on consumer-centric ECG mHealth app use in identifying afib, published in English. The Cochrane Collaboration Risk of Bias Tool (CCRBT) was used to assess quality of studies included in this review.

Results: Searches identified 500 sources, of which 150 full-text sources were assessed for eligibility. A total of 21 studies investigating 5 different consumer-facing ECG mHealth apps were included in the study. Quality assessment using the CCRBT revealed a moderate risk of bias in 1 study and a high risk of bias in the other 20 studies. Reported clinical data show that all devices demonstrated generally high sensitivity and specificity. There was limited evidence available on significant clinical outcomes.

Conclusions: Despite the need for more published studies providing scientific, clinical data supporting the use of current and the most-recently available consumer-focused ECG mHealth apps used in afib detection and monitoring, the results of this review suggest that these mHealth technologies are generally reliable tools when used in combination with the standardized gold-standard 12 lead-ECG in detecting and monitoring afib.

Committee: Brenda Zierler, Sarah Iribarren

Jordana Frenck

Formal Scoping Review of Predictive Analytics and Heart Failure Readmissions

Problem/Background: Heart failure is one of the leading causes for admissions and readmission in healthcare and is projected to increase over time. Heart failure readmissions are considered to be a correctable source of inadequate quality of care and increased medical costs (Ziaeian & Fonarow, 2016). It is important to know which patients that are admitted for heart failure are going to be readmitted before the readmission encounter occurs. Healthcare systems should develop predictive analytics so that heart failure admissions may be identified in order to prevent or reduce readmission. A scoping review was conducted in order to identify studies on predictive analytics, in order to categorize and summarize the literature.
Objective: Conduct a scoping review of the literature on predictive analytics for heart failure readmissions. The purpose of a scoping review is to catalog and summarize data pertaining to a topic, and to present information in an organized way so that many routes of literature categorization can occur (Dijkers, 2015). The objective of this study is to describe and catalogue the literature on predictive analytics for heart failure readmissions so that researchers and health care systems may use the information to address heart failure readmissions.

Sources of Evidence and Eligibility Criteria: This scoping review utilized four different online databases to categorize studies published on predictive analytics for heart failure readmissions. A total of 49 studies were located and used for final analysis. Heart failure readmission was used as a primary or secondary outcome variable for inpatient readmissions. Articles were researched from 2005 to 2019.

Charting Methods: Forty-nine total studies had a primary or secondary outcome of heart failure readmissions. Three were systematic reviews or meta-analyses. Studies were characterized in a table according to author, year, study design, data source, study location, number of hospitals and patients, study outcome, readmission period, analytic model and C-Statistic, if known. Studies were scoped for variable variety, differing data variables, and variance in data.

Results: Studies were able to be categorized by study design and data characteristics. Finding included type of analytical model, variables used, study type, data extraction type, readmission type, comparison of predictive models, readmission period and systematic reviews and meta-analyses.

Conclusions: This scoping review met objectives to catalog and summarize available data on predictive analytics for heart failure readmissions. This review concluded that it is difficult to compare many predictive models to determine which ones have higher predictive capabilities, due to the vast differences in model type, variables chosen, geographic location and patient demographics. Studies on predictive analytics and heart failure readmissions can be categorized and summarized. Limitations of the study and gaps in the researched literature were also identified.

Committee: Brenda Zierler, Adam Wilcox

Jennifer Garcia

A Mixed Methods Study about Evaluation Methods of Wizard of Oz (WOZ) Testing on Caring of Caregivers Online (CocoBot) Prototype

Background: Parent caregivers of children with chronic conditions in underserved communities have limited resources to combat common caregiver symptoms such as depression, stress, anxiety, and poor health (National Alliance for Caregiving, 2015). A
caregiver’s poor well-being can negatively impact a child, justifying the need for caregiver access to support and resources. Both parents and children routinely use technology as a source of health information (National Alliance for Caregiving, 2015). Even in low-income communities, access to the Internet and mobile technology use is high and well-received (Chi & Demeris, 2015). The value of investment in health technology to combat caregiver burden through self-care management and support would greatly benefit this population.

Objectives: The University of Washington (UW) is developing “Caring of Caregivers Online” or CocoBot, an evidenced based health dialog system (HDS) tool to provide caregivers with on-demand, interactive self-management skill development. Conducting preliminary testing of CocoBot using the Wizard of Oz (WOZ) method, this testing supports the development to generate a more “human-like” conversation with the end-user (Kearns, Yuwen, Divina, & Kaura, 2020). However, due to the lack of research demonstrating WOZ specific methods to evaluate HDS tools, there is unclear guidance of evaluation methods that accurately inform the researcher about improvements for more human-like exchange of dialogue content in an HDS.

Methods: Using a mixed methods design, this project addresses the following research question: Through WOZ testing, what method(s) provide the most useful information to evaluate the CocoBot prototype about HDS improvements regarding personality, tone and attitude?

Results: Quantitative methods used in this WOZ testing study, as SUS and PSSUQ questionnaires and eye tracking heat map, were more usability focused. Additional Statements to Rate were a helpful tool but reliability could not be validated with the small study sample. Overall, qualitative exit interviews were the most insightful and helpful evaluation method, providing information about perceived personality of CocoBot during WOZ testing.

Conclusion: The limited range of methods available to evaluate human-like interaction between emerging technology and user populations needing health guidance and interventions are mainly focused on evaluating usability or are still yet to be developed. Future implications of this study can lead to guidance and the creation of successful WOZ specific evaluation tools for evaluating HDS in the setting of WOZ. The dialogue data collected from the preliminary WOZ testing session expanded our HDS’s dialogue database and provided a rudimentary framework of how to conduct a more human-like conversation during a therapeutic session for caregivers.

Committee: Weichao Yuwen, Andrea Hartzler

Carla Kimberlin

Documentation of Social Determinants of Health in the Electronic Health Record

Introduction: Tracking social determinants of health (SDOH) information within the electronic health record (EHR) can help improve direct patient care, healthcare disparities, and
research endeavors. However, challenges occur because this information is not collected and documented utilizing a systematic process resulting in difficulty extracting data for clinical use.

**Purpose:** In our first aim, we will characterize the documentation and location of selected SDOH variables, identified in prior research (Kimberlin, 2020), within the EHR of a non-profit hospital system in the Pacific Northwest. In the second aim, we will explore the utility of the EDW Data Dictionary for locating SDOH elements in the Data Warehouse. In the third aim, selected SDOH elements and demographics variables will be extracted from the Enterprise Data Warehouse (EDW) to describe a cohort of heart failure patients.

**Methods:** This study will employ mixed methods. A content analysis of the inpatient clinician facing EHR and selected SDOH variables within the Enterprise Data Warehouse (EDW) data dictionary will be performed. Structured Query Language (SQL) will be utilized to explore selected SDOH variables and demographics of a sample of heart failure patients.

**Results:** Aim one: selected SDOH variables are documented in both free text and discrete fields of certain inpatient forms within the inpatient EHR. Aim two: information regarding the content and location of inpatient forms containing SDOH variables were not located utilizing the EDW data dictionary because corresponding tables and views did not consistently contain this information. Aim three: resulted heart demographic characteristics of heart failure cohort.

**Conclusions:** Documentation of SDOH variables within the inpatient EHR is incomplete and further complicated by data quality issues associated with field controls that allow free text additions or omission of documentation. The lack of comprehensive data dictionary descriptions and corresponding table content further complicates the extraction of this information from the EDW. Utilization of SQL to extract clinically actionable SDOH variables from the EDW is complicated by sparseness of documentation, form controls allowing the use of free text, and incomplete mapping of variable location.

*Committee: Seth Wolpin, Brenda Zierler*

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**Kirsten Kincaid**

**Literature Review of mHealth Diabetes Apps, including Gamification**

**Background:** Long-term treatment adherence is challenging for those struggling with chronic diseases. For people with diabetes, complicated medication regimens, poor health literacy, lack of access to services, and cultural barriers can present challenges to managing their disease and successfully engaging in a long-term treatment plan. Advancements in technology have given rise to a proliferation of mobile health (mHealth) apps and gamification techniques, which may help address these barriers.
Objective: The purpose of this nested systematic review was to evaluate the characteristics and efficacy of rigorously evaluated mHealth apps that: deliver behavior-change interventions, focus on diabetes management, and incorporate gamification elements.

Methods: A comprehensive literature review process was conducted according to PRISMA guidelines. Five health science and interdisciplinary databases from 2008 to July 2018 were searched. Eligibility criteria included rigorously conducted studies using diabetes mHealth apps, inclusive of gamification, to deliver a behavior change intervention in order to improve a health outcome.

Results: Searches identified 5,707 sources, of which 122 were selected for extraction. Of those studies, 3 met the inclusion criteria, and were identified for the primary analysis. The studies evaluated apps that promoted self-monitoring of blood glucose, dietary intake, and physical activity. The study explored, but could not demonstrate, that gamification consistently led to improvements in treatment or behavioral outcomes.

Conclusions: The results showed mixed evidence regarding the benefits of gamification in the diabetes app-based interventions, and the number of selected studies were small. More high-quality studies should be conducted in order to demonstrate whether gamification has any direct effect on behavior change for those with diabetes, and, if so, what mechanics work best to support that change. Based on this review, there is limited evidence of any direct relationship between the presence of gamification elements in an app and the app’s potential to support improved clinical outcomes.

Committee: Sarah Iribarren, Brenda Zierler

Lauren Mikell

Usability Study of a Mobile Application for Recovery after Tonsillectomies

Background: Non-adherence to surgical teaching can cause poorer post-operative recovery outcomes. It is in the best interest of healthcare organizations to continue to strive for improved methods to give patients and their caregivers appropriate instruction to manage a safe recovery. At Seattle Children’s Hospital, tonsillectomies are one of the most common ambulatory procedures, but have several risks postoperatively. These risks include delayed postoperative bleeding, re-admission for dehydration, and pain control (Canto et al., 2015). The incidence of dehydration post tonsillectomy is 5.4% and is often related to severe pain. There are some interventions that can be attempted at home prior to seeking care for some of these risks. Mobile health technology is a potential tool for teaching and helping decrease these risks. Seattle Children’s Hospital Otolaryngology Department has recently developed a mobile application named “P.O.P. Care” with these concerns in mind to assist caregivers during their child’s recovery after a tonsillectomy. However, usability of this application had not been evaluated. This usability study allowed for evaluation of the mobile application from the user’s perspective and help inform future development of this application for future use. This study examined usability by characterizing usage patterns, evaluating caregiver acceptability, and identify design improvements for the application.
Results: The results showed that roughly 25% of users discontinued use of the application after only one day, which is consistent with most mobile health applications. “Pain and Comfort” was the most clicked page within the app with 414 views, with the least clicked being “Surgery Day” with only 6 views. Roughly, 40% of input for the pain scale log feature was the skip function versus a number logged from 0-10. The mean usability score calculated was 92 with a standard deviation of 10.57 and a 95% confidence interval ranging from 85.31 to 99.13. Only one outlier was identified after accumulating all SUS data with a total of 67.5.

Conclusion: The P.O.P. Care app showed high perceived usability and we were able to determine areas necessary for improvement. Recommendations include continuing to allow users to track pain and log pain on a pain scale, but making the skip button more clearly marked. Other recommendations include evaluating bugs when logging pain administrations and also evaluating the potential of allowing multiple user access and enabling clinician messaging. The completion of more usability work is recommended to more thoroughly evaluate the application and its use.

Committee: Andrea Hartzler, Bill Lober

Arpit Patel

Machine Learning-based Prediction of Outcomes in Patients with Surgically Managed Perforated Appendicitis

Problem/Significance: Despite centuries of documented disease management, the optimal treatment of perforated appendicitis in children remains unknown and is typically dictated by the surgeon’s experience or common convention at the place of care. Patients with perforated appendicitis are at significant risk of complications. Early surgical management, potentially facilitated by predictive analytics, can remove the source of infection sooner than conservative management, but increases the risk of complicated surgery requiring extensive resection, recurrent or distal infections, or surgical complications.

Purpose: The objective of this study is to use machine learning to create a predictive model that can inform surgeons of the risk of complications from surgical management of complicated appendicitis. Specifically, the aims are to determine the feasibility of using machine learning with preoperative patient data to create a predictive model, estimate the risk of a negative outcome following surgical treatment, report the performance of the optimal model, and identify which patient features are strongly associated with negative outcomes.

Study design: Features were created from retrospective EHR data collected from patients who underwent surgical management of perforated appendicitis at Seattle Children’s Hospital from 2012 to 2019. Predictive models were created using machine learning analysis, specifically from the PyCaret and scikit-learn libraries in Python.

Results: 790 patients were included in this study, of which 252 has negative outcomes.
The area under the curve for AdaBoost model was 0.69±0.04, while the AUC for the logistic regression model was 0.65±0.07. Feature selection and reduction, outcome label restriction, and hyperparameter tuning were not able to improve the performance, although bagging of the LR model did.

**Conclusions:** Machine learning algorithms were able to create a borderline acceptable model to predict post-operative outcomes in perforated appendicitis. A more complete dataset and inclusion of additional features will likely improve performance further.

*Committee: Trevor Cohen, Michael Leu, Erik Van Eaton*

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**Nikita Pozdeyev**

**Machine Learning Classifier of Thyroid Nodules based on the Neural Network Analysis of Thyroid Ultrasound Images**

Thyroid nodules are common, and the evaluation of thyroid nodules to exclude malignancy is frequently needed. The decision to proceed with invasive testing with fine needle aspiration biopsy depends on the identification of sonographic features suspicious for malignancy. This is operator-dependent and requires significant training and expertise. We have used convolutional neural net to train classifier that distinguishes benign and malignant thyroid nodules and will assist radiologists and endocrinologists in making management decisions. Throcy nodules images and cine clips were extracted from the picture archiving and communication system (PACS), annotated, de-identified, cropped and resized. Seven hundred ninety-six 224x224 px transverse and longitudinal thyroid nodule images were used to fine tune pre-trained ResNet152 convolutional neural net. The classifier layer of ResNet152 was modified to output two classes. Parameters of the layer 3 and layer 4 of ResNet152 were trained in the PyTorch 1.4 deep learning environment. Five-fold cross-validation was used to evaluate trained model and performance metrics were averaged across folds. The classifier accuracy was 82%, positive predictive value 83%, negative predictive value 81%, sensitivity 76% and specificity 86%. We plan to further improve model performance and utility by training an ensemble of classification networks, acquiring additional thyroid nodule images for training, training model with high negative predictive value and develop classifiers to annotate ultrasound features per American College of Radiology TIRADS system.

*Committee: Trevor Cohen, Michael Leu*

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**Barbara Presley**

**Use of Mobile Technology for Immunization Tracking: A Systematic Review**

**Background:** Immunization against vaccine preventable diseases is one of the most effective health interventions and has been shown to lower costs for healthcare systems
globally, yet recent outbreaks in vaccine preventable diseases have been on the rise. SMS text reminders have shown effective to increasing timeliness on vaccine uptake and series completion. Integration of mobile technology with immunization information systems, vaccine registries or provider electronic health records are discussed in more recent studies.

**Objectives:** The aim of this study is to synthesize the available evidence for use of mobile technology for immunization tracking and integration with immunization information systems (IIS), vaccine registries and provider electronic health records.

**Methods:** *Inclusion criteria:* Randomized controlled trials, pilot studies, and other articles published in peer-reviewed journals 2010 - 2019 with the following criteria: adult participants receiving vaccinations, or parents of adolescents and children eligible for vaccination.

*Exclusion criteria:* Studies using mobile technology for immunization SMS text reminders without discussion of tracking immunizations.

**Results:** This review identified 25 studies in which mobile technology was utilized in randomized controlled trials or pilot studies for improvement in vaccine uptake and series completion including immunization tracking with integration of immunization information systems, vaccine registries, or provider electronic health records.

This review supports the usefulness of digital technologies in improving vaccine uptake and with integration, has potential to enhance vaccine registries and immunization information systems.

**Conclusion:** Peer-reviewed literature provides evidence of impact of mobile technology on improving vaccine uptake and series completion, with potential opportunity to enhance immunization information systems with integration, and evidence of patient engagement with empowerment of patient-centered technology and data residing with the patient.

*Committee: Donna Berry, Michael Leu*
tools and workflows implemented at City of Hope National Medical Center that aim to address this gap by better standardizing the capture and use of patient preference information.

**Design:** Descriptive statistics were used to evaluate utilization of standardized EHR tools and workflows intended to improve end of life care at this organization. Findings will ultimately be used to guide the continued refinement of advance care planning tools and workflows to support the delivery of high quality, compassionate end of life care.

**Results:** Critical illness treatment preference documentation in the DNR population increased from 2.3% to 6.6% and overall, 98% of DNR patients received care concordant with their stated preferences. The comfort care order set was used during 30.9% of all terminal admissions with the Supportive Care specialty being the highest utilizer. Appropriate action was taken in response to roughly half of all alerts received.

**Conclusion:** Results suggest continued monitoring and enhancement of advance care planning and comfort care tools are necessary to drive adoption and ultimately promote alignment of care with patient preferences.

*Committee: Peter Tarczy-Hornoch, Annie Chen*

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**Reza Sadeghian**

**Systematic Review of EMR Training**

**Background:** The most effective methods by which to teach physicians how to use an EMR is still up for debate. I conducted a systematic review of the literatures from 2008 till 2019 of the current training techniques for and the metrics used for evaluation of EMR training. Librarian assistance was obtained. Pubmed was searched using key words training, curriculum, education instruction, workshop, electronic health record, electronic medical record, health records, electronic medical records. 466 references resulted and reviewed. Articles were excluded if they were not in English, were conducted in other countries, were based solely on opinion but not expert consensus, were not exclusively about training providers on EMR, or did not have a formal assessment of their training model.

**Method:** Twelve articles were ultimately included for review. Of the 12 articles, 3 articles focused on medical resident training, 3 described training in practicing physicians, 4 described training for a mix of providers (Practicing physicians, residents, and advanced practice practitioners). 2 articles were best practices of how to use simulation to teach EHR.

**Result:** Of the 10 studies that took part in an experimental model, 1 study focused teaching inpatient EMR only, and a second focused on teaching outpatient EMR. The remainder of the studies either specifically stated they were teaching mixed inpatient and outpatient EMR, or they did not specify but by the description of the providers involved and metrics assessed mixed instruction could be surmised.

Of the studies that took part in an experimental model (10), 9 studies assessed perceived
efficiency, self-efficacy, or learner satisfaction, and were assessed by pre, post surveys and real time feedback. 2 studies assessed effectiveness by tracking specific EHR usage functions. These included the use of specific order sets, medication lists and problem lists.

**Conclusion and suggestion:** A good training approach is a short in class training, in proximity to the actual go live date using real case based scenarios pertinent to each provider’s specialty followed by ongoing eLearning and onsite support through clinicians. We could also consider clinician training support via Zoom rather than submitting tickets through IT.

*Committee: Michael Leu, Jane Fellner*

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**Shayni Saftler**

Translation Assistance for Patients With Limited English Proficiency: An Assessment of Clinician Needs During an Intake Visit in a Primary Care Clinic

For patients with limited English proficiency (LEP), professional language assistance services are an essential aspect of a clinical visit. When professional language services are not accessible, ad hoc translation assistance is needed. However, little is known about what clinicians need from these ad hoc options to be able to communicate effectively with LEP patients. The aims of this project were to (1) characterize current barriers, facilitators, and clinician needs for effective communication with LEP patients during an intake visit in a primary care clinic, and to (2) illuminate which features of currently utilized translation assistance resources may best meet clinician needs. I conducted a needs assessment consisting of contextual interviews and a survey to investigate the needs of clinicians for effective communication with LEP patients in a primary care clinic. Participants included a convenience sample of clinicians who regularly interact with patients during an intake visit.

I identified 6 major themes from interviews that, combined with survey findings, pointed to 13 clinician needs for effective communication with LEP patients. Participants currently use three different translation assistance resources. Resources that use certified interpreters may best meet the clinician’s need for translation accuracy; however, appropriate and consistent use of certified resources is limited by time, reliability, and unique language situations. The study clinic may benefit from implementing a backup plan and training to clinicians about the appropriate use of ad hoc translation assistance resources. Primary care clinics in general may benefit from partnering with external entities, such as Google and national health policy makers, to support the needs for translation accuracy and extra time to communicate effectively with LEP patients. Future studies should continue to investigate clinician needs for effective communication with LEP patients in clinical settings beyond primary care.

*Committee: Andrea Hartzler, Tabessa Lee*
Nicholas Sich

Standardizing Surgical Admission across an Evolving Healthcare Enterprise with Disparate Electronic Health Record Platforms

**Background:** Successful long-term adoption of an electronic medical record requires ongoing maintenance and content management. For composite order sets, there is typically no automated pathway or timeline for review. This can lead to order sets that are inefficient, outdated, and set up for potential safety risks.

**Methods:** This was a quasi-experimental study where the surgical admission order set was redesigned to reflect current work flows across the northern tier of Jefferson Health. All existing orders and sub-order sets were individually reviewed to assess usage per surgical admission to create a new order set. Each element of the new template was reviewed in depth with surgical leadership and front line providers at each site as well as pertinent committees. Design philosophy minimized sub-nested orders and duplicate lines.

**Results:** The existing surgical order set consists of 1,178 orders across multiple sub-nested order sets. For un-nested orders, 57% were used for <5% of admissions. There were 13 independent admission sets nested inside of the master order set of which 10 were used <5% of admissions. Dependent nested order sets contained anywhere from 15 to 60 orders of which only 1-3 were used >5% of admissions. Excluding navigation clicks, the existing order set required 103 clicks and 5 additional orders outside of the master order set for 28 individual orders using a standard surgical patient.

The new surgical admission order set removed 9 of the 13 independent order sets and un-nested all dependent order sets. After removal of duplicate orders, the remaining nested order sets were further condensed to a total of 285 total orders, a 76% reduction from the existing surgical order set. The new order set included orders that were routinely accessed from outside of the order set. In the same standard surgical patient, excluding navigation clicks, the new order set required 36 clicks for 28 individual orders representing a 65% reduction.

**Conclusions:** Computer physician order entry requires on-going maintenance in order to remain efficient and safe. In this case study of surgical admission, we were able to reduce the total number of orders and clicks by a dramatic margin while improving the capture and utility of the order set. Order sets should be systematically reviewed and revised in a periodic fashion in the context of existing work flows.

*Committee: Michael Leu, Jonathan Sternlieb*
John Song

Scoping Review of Improving Ambulatory of Medication Reconciliation in an Era of Electronic Health Records

Purpose: Scoping review of scholarly literature on interventions impacting ambulatory medication reconciliation (med rec) since 2017 when last generalizable scoping review was reported and, since then, almost 90% adoption of electronic medical records (EHR) by office-based physicians was reported. Purpose of this scoping review is to gain knowledge of current research regarding interventions to improve medication reconciliation in ambulatory care since the wide-adoption of EHR and possible EHR-adoption implications on interventions.

Methods: A scoping review was conducted in terms of study design, elements of interventions as characterized by the Effective of Practice and Organization of Care criteria, and outcomes characteristics. Exclusively English-language articles from January 2016 to March 2020 involving interventions with quantitative data.

Results: From 519 publications, only 3 studies met the criteria. Excluded were mostly exclusively involving expert opinions, usability testing, and user satisfaction survey. All three involved organization intervention. Only one also combined with professional intervention, and structural intervention was not used. Process measures were reported in all 3 studies, but only one also planned and reported outcome measures. All three involved the use of EHR, but only one attempted to test an EHR tool. One study examined facilitators and barriers in detail.

Conclusion: Continued limited publication examining ambulatory care med rec interventions despite the wide-adoption of EHR and much effort on various EHR clinical decision functions. Of reported findings, clinical outcome of these research is poorly focused.

Committee: Peter Tarczy-Hornoch, Robert Marshall, Chris Weissman

Justin Stewart

Evaluating the Relationship between Initial Injury, Referral to a Pain Clinic and Medical Retirement from the Army: a Retrospective Analysis

Problem: Soldiers are expected to deploy worldwide and must be medically ready in order to accomplish their mission. Soldiers unable to deploy for an extended period of time due to chronic pain or other condition undergo an evaluation for medical retirement called a medical evaluation board. Improving access to pain management may improve medical readiness of the Army. Chronic pain and opioid use could be decreased with more efficient use of the Interdisciplinary Pain Management Center (IPMC). Earlier IPMC interventions may help decrease chronic pain and keep service members in active duty.
Purpose: A retrospective analysis of existing longitudinal data from an IPMC was used to evaluate the temporal relationship between the time of initial injury and referral for comprehensive pain care to receiving a permanent 3 or higher profile.

Methods: Patients were selected if they were adults (>18 years old), cared for in the Madigan IPMC, and completed the PASTOR at least once between May 2014 – February 28, 2018. All eProfiles available in the system were requested for the patients in the cohort. Only those that are on active duty for the Army can be in the eProfile system so all other branches of service and civilians within PASTOR were excluded with a total of 1,764 patients evaluated in the final analysis. Logistic regression was used to evaluate the predictors of duration of time between date of first profile in system and IPMC referral date, gender, and presence of a permanent 2 profile to the outcome variable of having a permanent 3 profile present.

Results: A total of 1,764 patients were evaluated with 82.0% being male. Gender was not correlated with the presence or absence of a permanent 3 profile. There is a 4% increased risk of medical retirement for each month that IPMC referral was delayed. The presence of a permanent 2 profile increased the risk of a permanent 3 profile 1.5 times and was statistically significant. Up to 19 months duration between injury and referral there is a slight increase in probability of permanent 3 profile with longer delay, but for those waiting longer than 19 months, it is less likely to have a permanent 3 profile with longer duration of waiting.

Discussion: This is the first time the hypothesis of the relationship between time of initial injury to referral to IPMC and permanent 3 or higher profile has been tested. This was a preliminary analysis and were unable to obtain medical conditions listed on the profile to see if they were the cause of referral to the IPMC. Other confounding factors include frequent moves to different locations increasing difficulty in accessing an IPMC.

Conclusion: Referral to an IPMC within 19 months of injury may lead to a decreased chance of receiving a profile that requires a medical evaluation board.

Committee: Ardith Doorenbos, Peter Tarczy-Hornoch, Robert Marshall

Darshan Thota

Evaluating the Relationship between Fitbit Sleep Data and Self-reported Mood, Sleep and Environmental Contextual Factors in Healthy Adults

Problem: Mental Health (MH) disorders can disrupt a person’s sleep resulting in a lower quality of life. Early identification and referral to MH services is a critical need for Active Duty Service Members (ADSM). Wearable technologies like the Fitbit can potentially help address this problem.

Significance: If Fitbit proves to be an appropriate clinical tool in a military setting, it could provide a potential cost savings, improve clinician access to patient data and create real time treatment options for the greater ADSM population.
Purpose: To assess the relationship between Fitbit sleep data, self-reported mood and environmental contextual factors which may disrupt sleep as a means to determine if the Fitbit device can be used to identify early markers of mental health disorders.

Study Design: This observational cohort study was conducted at the Madigan Army Medical Center. 17 healthy adults wore a Fitbit Flex for 2 weeks completing a daily self-reported mood and sleep log. Contextual factors were collected with interim and post surveys. Study aims included determining the correlation between Fitbit sleep data and self-reported sleep, number of waking events and self-reported mood and contextual factors of disruptive sleep.

Results: The Spearman correlation between Fitbit sleep time and self-reported sleep time was moderate (r=0.643, p=0.005). The Spearman correlation between number of waking events and self-reported mood was weak (r=0.354, p=163). Top contextual factors disrupting sleep were “pain”, “noises” and “worries”. A subanalysis of participants reporting “worries” found evidence of potential stress resilience and outliers in waking events.

Conclusion: Findings contribute valuable evidence on the strength of Fitbit flex as a proxy that is consistent with self-reported sleep data. Mood data alone does not predict number of waking events. Mood and Fitbit data combined with further screening tools may be able to identify markers of underlying mental health disease.

Committee: Peter Tarczy-Hornoch, Robert Marshall

William Toth

Self-Reported Burnout and EMR Event Data in Military Clinicians

Problem: Identifying burnout has relied upon self-reporting tools which can be time-consuming, expensive, asynchronous, and prone to bias. The use of electronic medical records (EMR) is associated with an increase in physicians reporting symptoms of burnout, but there is little objective data to support the association between use of electronic medical records and burnout.

Significance: Clinician burnout is increasingly recognized as having a substantial negative impact on the healthcare system. It not only affects individual clinicians, but also patient care outcomes and subsequently, the entire healthcare organization. Identifying appropriate event data that can continually and objectively identify EMR-related risk factors for burnout could enable healthcare organizations to identify, target, treat, and ultimately
reduce burnout in the clinical staff.

**Purpose:** The purpose of this study is to determine the feasibility of utilizing EMR data to identify clinicians who may be at risk for burnout. This study aims to determine the correlation between clinician's self-reported burnout symptoms and event data captured by the EMR at a military medical treatment facility. Features of the event data that most strongly correlate with features of burnout will be identified.

**Study Design:** This quantitative cross-sectional study compares military clinician's self-reported burnout scores using the Mini-Z survey with available vendor generated objective EMR event log data at a military treatment facility.

**Results:** 62% of military physicians reported self-identified burnout and only 2% reported Joy in Workplace based on the AMA Mini-Z definitions. Burnout was negatively correlated with patients seen per day ($r=-0.200\ P<0.1$), satisfaction of EMR use at home and satisfaction with documentation time was negatively correlated with time in EMR after hours ($r=-0.198\ to \ -0.396P<0.1 \ to \ P<0.001$) while self-determined proficiency was positively correlated with EMR after hours use ($r= 0.238\ P< 0.05$).

**Conclusion:** No objective vendor generated EMR measure of documentation burden sufficiently captures the subjective measures of physician burnout, although patient per day may be associated with both burnout and joy in the workplace. Vendor objective findings do correlate with subjective measures of time in the EMR after hours and holds promise as a surrogate measure for subjective findings. Self-determined proficiency is also correlated with vendor data, but this is positive correlation with after-hours EMR use runs contrary to conventional wisdom and needs additional investigation.

*Committee: Trevor Cohen, Peter Tarczy-Hornoch, Robert Marshall*

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**Layla Zagey**

**Improving User Ratings for Nomie Pro: a Mobile Health Sleep Application: A Content Analysis on User Reviews**

The increasing use of smartphones and mobile devices offer consumers an advanced communication method allowing them to track their personal health data. Mobile health (mHealth) sleep applications have the potential to support sleep self-management and deliver comprehensive healthcare information involving a person's daily routine, behavior and mental status.

The purpose of this paper is to assess if user reviews of a sleep app are congruent with previously published ratings using standardized criteria. Methods: User ratings and comments of one sleep app, Nomie Pro, were exported for analysis from February 2017 to
June 2017. User comments were analyzed for themes in order to identify strengths, barriers, and ways to improve the app. Evidence-based recommendations for app improvement are provided.

*Committee: Hilaire Thompson, George Demiris*
