CENTER FOR PATIENT SAFETY RESEARCH AND PRACTICE

TRANSFORMING PATIENT CARE

Volume 10, Issue 2

Autumn 2018

Special points of interest:

- **Practicing effective dignity and respect in the ICU**
- **Exploring transitions of care**
- **Reducing fall injuries and developing confidence in elders**
- **Clinical decision support**
- **Medication reconciliation**
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- **Recent publications from Center members**

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Center Updates: a seasonal review

Hospital-Level Care at Home for Acutely Ill Adults: a Pilot Randomized Controlled Trial

Summary by J.P. Garcia, Research Assistant

The framework for and care delivered by hospitals in the United States today remains similar to that provided half a century ago, despite periodic advancements. Hospital costs are growing, while hospital wards are crowded and have prolonged wait times, leading to expensive, untimely care. "Home hospitals" make up a care model that is unfamiliar to the US but has been utilized in other developed countries to address these issues by delivering hospital-level care to patients in their own homes instead of the traditional hospital setting. In their article for JGIM, Dr. David Levine et al. report on a pilot study they conducted to test the effect of providing hospital-level care in the home on cost, safety, quality, and patient experience.

Twenty Brigham and Women's Hospital/Brigham and Women's Faulkner Hospital patients with a primary diagnosis of any infection, heart failure exacerbation, COPD exacerbation, or asthma exacerbation were selected and analyzed for a period of two months in the Fall of 2016. Nine patients were assigned to the pilot home hospital care, while the remaining eleven were admitted to the hospital for usual care. Intervention patients received one daily physician visit and two daily visits from home health registered nurses, at a minimum. They could receive further visits, and other amenities such as medical meals and the services of a home health aide, social worker, physical therapist, and/or occupational therapist as needed. All participants had their vital signs and other important measures, including movement and sleep, tracked using continuous monitoring systems. Communication between home hospital patients and their care providers occurred through telephone, encrypted video, and encrypted short message service.

There was no significant difference between the study groups in severity of illness or amount of care required. However, Levine et al. found significant differences in their study outcomes between the groups, despite their homogeneity. For home hospital care patients, median direct costs for acute care episodes and for the acute care plus

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The Elusive and Illusive Quest for Diagnostic Safety Metrics

Summary by Srijesa Khasnabish, Research Assistant

Diagnostic errors are one of the top patient-reported types of errors and a leading reason for malpractice suits. Despite their prevalence, diagnostic errors are underrecognized as a patient safety concern. Interest in improving the metrics for diagnostic performance has grown recently, though, and more reports focused on this topic are being published. In an article from the Journal of General Internal Medicine (JGIM), Andrew Olson, Mark Graber, and Hardeep Singh address the need for creating standardized criteria to measure diagnostic safety by outlining seven "Undesirable Diagnostic Events" (UDEs). Olson et al. developed a framework to identify conditions that are most often misdiagnosed and the circumstances under which these mistakes occur. Such metrics can be used to evaluate institutional performance and assess interventions to reduce diagnostic errors. In their recent JGIM editorial, which hereafter will be summarized, Gordon Schiff and Elise Ruan reflect on the proposed UDE framework and use their own expertise to offer insight on how to enhance existing models to more effectively reduce diagnostic errors.

Schiff and Ruan critique how Olson et al. use tuberculosis (TB) as a candidate for their UDE framework and highlight the intricacies involved with identifying valuable diagnostic safety metrics. First, misdiagnosing TB would have severe detrimental impacts on the patient and on those exposed to the patient. The challenge is to discern which factors to

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The Practice of Respect in the ICU

Summary by Zoe Burns, Project Coordinator

Although demonstrating dignity and respect in the healthcare setting may seem obvious, the authors found violations of both to be common in the ICU.

As healthcare becomes more patient-centered, greater emphasis is placed on the importance of practicing respect during care encounters, as well as its personal, social, and psychological effects on patients and their families in the ICU. The field of critical care has witnessed numerous advances which have reduced mortality for many conditions. But for some with an incurable prognosis, these advances have prolonged the dying process. The dignity of dying individuals is vital to patient-centeredness. In an article for the American Journal of Respiratory and Critical Care Medicine, Brown et al. consult experts and examine the literature to summarize the current state of the interrelated concepts of respect and dignity in ICUs and propose solutions to address existing failures.

According to the authors, the most useful definition of dignity as it relates to healthcare is the inherent worth of all human beings, while respect is comprised of the concrete actions that recognize this dignity. Dignity and respect of all people are both ethically called for in the healthcare setting and associated with measurable positive effects. For instance, perceived dignity is linked to greater patient satisfaction and even increased appropriate preventive care. Likewise, a respectful approach to communication and orientation to bereavement is associated with reduced symptoms of depression and post-traumatic stress disorder.

Although demonstrating dignity and respect in the healthcare setting may seem obvious, the authors found violations of both to be common in the ICU. Disrespect may not present as outright rudeness, but may be more subtle, such as referring to patients by their conditions or room numbers instead of their names. The authors describe barriers to the practice of respect in the ICU, which include competing priorities, disagreements over treatment, cultural or training differences, burnout, and empathy fatigue. Dehumanization overlaps significantly with disrespect; and occurs when one is perceived to have lost his or her positive human qualities. ICU patients who lack consciousness, independence, and autonomy are particularly susceptible to dehumanization, which has been associated with negative effects such as withdrawal and feelings of powerlessness. Perceived disrespect is a common theme in surveys of ICU patients and is too often tolerated or not acknowledged as patient harm.

The authors propose several ways to improve respect in the ICU based on feedback from multidisciplinary stakeholders such as clinicians, policy makers, and patient advocates. They assert that further research on understanding and improving respect in the ICU is needed, particularly around quantifying respect and dignity events. They suggest treating disrespect in the ICU similarly to patient safety events, and further identifying both potential benefits and unintended consequences of improvement efforts. An example of an unintended consequence would be that advantaged groups are more likely to report disrespect, potentially increasing resources that may not address the concerns of disadvantaged groups. To combat this risk of inequity, the authors suggest implementing

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Home Hospital

Levine et al. conducted to test the effect of providing hospital-level care in the home on cost, safety, quality, and patient experience.

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30-day post-discharge period were 52% and 67% lower than those for the hospitalized patients, respectively. Furthermore, the intervention group received less frequent consultations and fewer laboratory orders than did the control group. Home hospital patients exhibited more minutes of physical activity per day, and trended toward more sleep, than their counterparts. There were also no adverse safety events or transfers back to hospital in this group, while one adverse event occurred in the hospital care group. For both groups, median length of stay was 3.0 days.

Levine et al. observed that the provision of care to acutely ill patients in the home setting instead of a conventional hospital reduced cost, decreased utilization of care (e.g., laboratory orders, consultations), and improved physical activity without sacrificing quality, safety, or patient experience. Home hospital care provides greater flexibility to the care model. It allows provided care to be more patient-centered, and gives patients the opportunity to receive hospital-level care within the comfort of their own homes, surrounded by their loved ones. This model also creates an excellent opportunity for providers to empower patients and caregivers in self-management during and after the care episode. Providers can perform medication reconciliation and dietary education on site with the patient's medicine cabinet and kitchen only steps away. To the authors' knowledge, this study was the first randomized controlled trial of its kind performed in the US. Its novelty coupled with its positive findings reveal the need for a larger trial to provide more definitive results.

Levine DM, Ouchi K, Blanchfield B, Diamond K, Licurse A, Pu CT, et al. Hospital-Level Care at Home for Acutely Ill Adults: a Pilot Randomized Controlled Trial. J Gen Intern Med. 2018 May;33(5):729-736.

Patient and Physician Experience with Interhospital Transfer: A Qualitative Study

Summary by Julia Snyder, Research Assistant

In the modern healthcare system, hospitalized patients often undergo interhospital transfer, whereby they transfer from one acute care hospital to another. Transfers often occur to increase patients' access to specialized care or to second opinions. They may also occur due to patient or provider preference. Interhospital transfer may benefit patients, but can also lead to discontinuity of patient care, as information transfer and communication between institutions can be difficult. Transfer practices are also not standardized, leading to variability in transfer processes. In a recent article published in the Journal of Patient Safety, authors Mueller et al. explore key stakeholder perspectives about this care transition to better understand the process and identify areas for improvement.

The researchers performed individual interviews with recently-transferred patients, their accepting attending physicians, their transferring physicians, and their accepting/admitting resident physicians. The interviews focused on three domains of interhospital transfer: 1) Decision to transfer, 2) Communication during interhospital transfer, and 3) the Transfer process.

Within the first domain, Decision to transfer, researchers found that transferring to receive more specialized care, whether it was for a procedural intervention or care from specialists, was identified by both physicians and patients as a common reason for transfer. The secondary reasons for transfer included patients' familiarity with a physician at the receiving hospital and expediting a diagnostic workup. These results reveal some of the underlying drivers of interhospital transfers that are not always apparent in typical evaluations of the transfer process.

Themes gathered about the second domain, Communication during interhospital transfer, include: 1) Unpredictability and dissatisfaction with time of transfer, 2) Expectation of adequate information transfer (patients), 3) Disorganized chains of communication (physicians), and 4) Unreliable information exchange (physicians). Patients as well as physicians were dissatisfied with the timing of transfers, and lack of advanced notification. The researchers note that the un-predictability of the transfer process represents a potential target for an intervention to better prepare physicians, patients, and families for transfers. They also found that physicians and patients had different views regarding the communication of clinical information. Patients were often "blindly accepting" that the correct information was being transferred between institutions and care teams, while physicians did not express this same confidence. Physicians had differing views on the level of communication during patient transfers. The resident physicians accepting transferred patients felt dissatisfied, noting that a frequent inability to access information at critical points caused them to feel unprepared. However, the transferring physicians and accepting attending physicians (those who are directly involved in communicating clinical information during transfer) were generally more satisfied with the level of communication surrounding transfer. Together, these link to disorganized chains of *intra*-hospital communication rather than communication between hospitals, more commonly blamed for poor information transfer during such care transitions. All interviewed physicians perceived an overall unreliability of information exchange.

Two major themes emerged from the third domain, the Transfer process: 1) Focus on physical comforts (patients), and 2) Inopportune timing of arrival (physicians). Patients often commented on physical aspects of their transfer experience (for example, their ambulance ride or hospital room location). Physicians focused more on the poor timing of patient arrivals, noting that patients often arrive in the evening when less resources are available.

While this study was conducted at a single site and focused on select services within the hospital, it describes valuable key-participant perspectives on interhospital transfer. It also identifies important vulnerabilities of interhospital transfer, including unreliable information exchange between institutions, disorganized intra-hospital chains of communication, and poor timing with lack of advanced notification of transfers. These may all serve as potential targets for quality and safety improvement initiatives in the future.

Mueller SK, Shannon E, Dalal A, Schnipper JL, Dykes P. Patient and Physician Experience with Interhospital Transfer: A Qualitative Study. J Patient Saf. 2018 Jun 12.

Interhospital transfer may benefit patients, but can also lead to discontinuity of patient care, as information transfer and communication between institutions can be difficult.

Respect in the ICU

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culturally competent mechanisms for the identification and reporting of disrespect. Work in the ICU is physically, mentally, and emotionally challenging. With the addition of a quality improvement intervention, there is potential for increased burnout due to extra reporting and investigation requirements. On the other hand, the hope is that a more respectful work environment would actually reduce clinician burnout. The authors lay out a framework for continued research that will minimize unintended consequences while furthering our understanding of dignity and respect as vital to truly patient-centered care.

Brown SM, Azoulay E, Benoit D, Butler TP, Folcarelli P, Geller G, et al. The Practice of Respect in the ICU. Am J Respir Crit Care Med. 2018 Jun 1;197(11):1389-1395.

Strategies to Reduce Injuries and Develop Confidence in Elders (STRIDE): A Cluster-Randomized Pragmatic Trial of a Multifaceted Fall Injury Prevention Strategy: Design and Methods

Summary by Kerrin Bersani, Research Assistant

Falls continue to be a major public health concern, serving as the leading cause of injury in older adults. Evidence-based interventions have been developed to prevent falls. However, only one-third of today's elderly patients are screened for fall risk. In 2014, the Patient Centered Outcomes Research Institute partnered with the National Institute on Aging to fund the Strategies to Reduce Injuries and Develop Confidence in Elders (STRIDE) study to address this health concern. The study pairs nurse Falls Care Managers (FCMs) with older patients and their caregivers to assess fall risk and develop an individualized intervention to reduce serious fall injuries. In their recent paper for The Journals of Gerontology, Bhasin et al. describe the Design and Methods of the STRIDE intervention.

STRIDE is the largest trial of fall injury prevention with a focus on being evidence-based, patient-centered, and scalable.

The clinical trial is set in 86 primary care practice sites in 10 health care systems across the US that reflect the racial and ethnic diversity of the country. Each practice was randomized to either an intervention or control group before participant enrollment. Patients were eligible if they were over the age of 70 and were identified as being high risk for fall injuries by a clinic screening during a primary care visit. Over 20 months, the trial recruited and enrolled 5,451 participants with a mean age of 80 years and 39% reporting a fall with injury over the past year.

FCMs met with each participant in the intervention to assess them for the following fall-related risk factors: 1) Strength, balance, and gait impairment; 2) Medications; 3) Vitamin D deficiency; 4) Home safety; 5) Orthostatic hypotension; 6) Visual impairment; 7) Foot problems or unsafe footwear; 8) Osteoporosis. After risks were identified and explained, a patient-specific Falls Care Plan was developed consisting of fall risk reduction interventions, recommendations for the patient's primary care physician, and referrals to health providers or community-based organizations for implementation. Participants in the control group received a falls informational booklet, titled "Stay Independent," and were encouraged to discuss fall prevention with their primary care doctors. Their physicians received results of the screening questions and were referred to a training webinar about fall prevention. Recruitment for participation in the study has completed, and researchers are currently conducting follow-up visits and phone calls to collect data on falls for both intervention and control groups.

Patients, caregivers, representatives from patient- and family-centered care programs, representatives from government agencies on aging, health care professionals, and advocates from consumer groups formed one national and 10 local Patient and Stakeholder Councils, to aid in patient engagement. These groups provided input during project planning and have continued to meet throughout the implementation to give feedback and insight into various aspects of the study, such as screening, recruitment, and retention.

The primary outcome for the STRIDE study will be time to first serious fall-related injury, defined as falls leading to medical attention. Secondary outcomes will be all falls and fall injuries, and well-being measures, such as concerns about falling, anxiety and depression, and physical function and disability. Other outcomes include hospitalizations and admissions to nursing homes. Data on these outcomes is collected every 4 months through phone call interviews, Centers for Medicare & Medicaid Services claims and health system encounter data, and electronic medical records.

STRIDE is the largest trial of fall injury prevention with a focus on being evidence-based, patient-centered, and scalable. The STRIDE team has developed tools, such as manuals and training videos, for use by other health care systems to identify those at risk for falls and prevent falls and fall injuries. As their study is still ongoing, the researchers hope the results will impact clinical practice as it relates to fall injury prevention on a national level.

Bhasin S, Gill TM, Reuben DB, Latham NK, Gurwitz JH, Dykes P, et al. Strategies to Reduce Injuries and Develop Confidence in Elders (STRIDE): A Cluster-Randomized Pragmatic Trial of a Multifactorial Fall Injury Prevention Strategy: Design and Methods. J Gerontol A Biol Sci Med Sci. 2018 Jul 9;73 (8):1053-1061.

Medication-related clinical decision support alert overrides in inpatients

Summary by Zoe Co, Research Assistant

Adoption of electronic health records (EHRs) equipped with computerized physician order entry (CPOE) systems has become more widespread since the federal government introduced the meaningful use incentives program in 2011. A major benefit of installing an EHR with CPOE is its medication-related clinical decision support (CDS) features, which enable prescribers to access patient data at the point of care and aid them in safely and accurately ordering medications. CDS assists prescribers by providing them with advice and warnings about the medication orders they are entering into their CPOE system to more greatly prevent medication errors and subsequent adverse drug events. For example, if a prescriber orders a drug that the patient is allergic to, the CDS function will trigger an alert about the allergy and present the prescriber with multiple options on how to proceed.

As Nanji et al. explain in their recent publication for JAMIA, there is great variability in how prescribers can interpret and respond to a CDS alert. One way to respond is to override the alert, meaning the prescriber "cancels" or "rejects" it, and then continues fulfilling that order. The reasoning behind these overrides may be appropriate or inappropriate, depending on the patient and the situation. Having previously examined outpatient CDS alerts and overrides, Nanji et al. sought to assess the types and rates of CDS alerts delivered in an inpatient setting, outline providers' reasons for overriding those alerts, and determine the appropriateness of those reasons.

At the time of this study (2009-2012), Brigham and Women's Hospital (the study site) had a home-grown EHR, in which CDS alerts were categorized into 3 levels. Nanji et al. looked at "level 2" alerts, which were interruptive and required physicians to provide rationale when overridden. The types of level 2 alerts included in this review were drug allergy, drug-drug interactions, renal- and age-based medication substitutions, duplicate medications, and non-formulary medications. Within all of these categories, the team identified which alerts were overridden, along with the reasoning behind each.

To determine the appropriateness of the override reasons, Nanji et al. built upon a tool they had previously developed and used in the outpatient setting, making necessary adjustments based on literature and chart reviews to equip it for inpatient use. They decided that appropriate override reasons were ones that fit the criteria of their tool and could be validated through chart review. For example, an overridden allergy alert would be considered appropriate if the patient's chart had a note stating that the patient had tolerated the medication before. Nanji et al. found several cases where alerts did have appropriate reasons, but at the same time, there was a considerable amount of inappropriate override reasons.

The research team calculated override rates for 156,283 alerts. They found that the overall alert override rate was 73.3%, with an unequal distribution of overrides across allergy, drug-drug interaction, and duplicate drug alerts (81.9%, 68.2%, and 51.9% respectively). The percentages of appropriate and inappropriate reasons behind these overrides also varied greatly by alert category. Much of the duplicate drug, patient allergy, formulary substitution, and drug-drug interaction alerts were found to be appropriate (98%, 96.5%, 82.5%, and 62.0% respectively). Conversely, though, only 26.4% of age-based suggestion alert overrides were appropriate, while a mere 2.2% of overridden renal-based suggestion alerts were appropriate. The most common override reason between all types of alerts was that the patient had taken the medication before with no complications. However, override reasons still varied greatly, depending on the alert type. Overall, the researchers found that, on average, 61.3% of the override reasons were appropriate, indicating that 38.7% of those reasons were inappropriate.

The results of this study are in parallel with other findings. With such low percentages of appropriateness, it is pertinent that more work be done to further develop and configure these alerts. This will make alerts more clinically applicable and decrease false positives so that prescribers will not miss any important alerts. Lastly, override rates should be consistently analyzed to ensure that they are appropriate and that actions taken to reduce alert fatigue are being implemented effectively.

Nanji KC, Seger DL, Slight SP, Amato MG, Beeler PE, Her QL, et al. Medication-related clinical decision support alert overrides in inpatients. J Am Med Inform Assoc. 2018 May 1;25(5):476-481.

A major benefit of installing an EHR with CPOE is its medication-related clinical decision support (CDS) features, which enable prescribers to access patient data at the point of care and aid them in safely and accurately ordering medications.

Effects of a multifaceted medication reconciliation quality improvement intervention on patient safety: final results of the MARQUIS study

Summary by Nicholas Piniella, Research Assistant

One of the largest health safety risks that hospitalized patients face is unexplained discrepancies in their documented medications, which can ultimately lead to adverse drug events (ADE) and patient harm. Previous research has found that nearly two-thirds of inpatients have at least one discrepancy in their admission medication history. These inconsistencies can be caused by incorrect determination of a patient's medications upon admission, or by errors in the patient's medication orders. In their publication, "Effects of a multifaceted medication reconciliation quality improvement intervention on patient safety: final results of the MARQUIS study," authors Jeffrey Schnipper et al. describe their efforts to design an "evidence-based toolkit of best practices in medication reconciliation" to minimize medication discrepancies.

The MARQUIS study sought to evaluate the effects, the most important components, and the potential barriers of implementing an evidence-based medication reconciliation toolkit. The individual components of the toolkit were centered around a "best possible medication history" (BPMH), which is an accurate medication history obtained from the patient and other sources. From there, providers were trained in BPMH and medication counseling upon patient discharge, while patients and caregivers were empowered to take ownership of their medication lists. Components also included effective health information technology (HIT), social marketing techniques, and forwarding patient medication lists to future providers.

Nearly two-thirds of inpatients have at least one discrepancy in their admission medication history.

The study evaluated the effects of this high-quality medication reconciliation protocol on unintentional medication discrepancies at five locations across the United States. Sites varied in size, academic affiliation, geographic location, and use of HIT. Each site chose one or more non-critical medical or surgical inpatient units to study. Two of the sites had concurrent control units and intervention units, which allowed for the reduction of confounding variables by comparing each unit to itself over time. All patients admitted to these units were eligible to participate, and a "gold standard" medication history was taken for 22 randomized patients each month. In addition, sites were able to choose which toolkit components they implemented.

The study's primary outcome was unintentional medication discrepancies with the potential to cause patient harm. The total number of medication discrepancies per patient, regardless of patient harm, was a secondary outcome. Statistically, the study's use of a multifaceted medication reconciliation quality improvement initiative did not reduce potentially harmful medication discrepancies per patient after adjusting for temporal trends, patient factors, and clustering by site (adjusted incidence rate ratio (IRR) 0.97 per month (95% CI 0.86 to 1.08), p=0.53). However, the intervention was associated with a decrease in total medication discrepancies (IRR 0.92 per month (95% CI 0.87 to 0.97), p=0.002).

The authors cite a low percentage of potentially harmful medication discrepancies (14%) as a possible reason their results were not statistically significant. In an analysis of the two sites with control and intervention units, potentially harmful discrepancies decreased greatly after implementation, but were not statistically significant, likely due to small sample size. Interestingly, there were large increases in medication discrepancies at sites that implemented new electronic health records (EHRs), with one control unit increasing from 0.46 potentially harmful discrepancies in admission and discharge orders per patient to 0.98. Those EHRs are widely used by hospitals in the United States, and while these negative effects are not conclusive, they are concerning and should be investigated further.

Proper medication reconciliation requires abundant resources to allow for multidisciplinary workflows and increased job responsibilities. The MARQUIS researchers found that it took approximately 21 minutes to obtain a BPMH for each patient. By conducting a "real world" study without added personnel or artificial conditions, they provide a realistic assessment of medication reconciliation implementation efforts and likely benefits. The authors emphasize that if hospitals were to allocate more resources towards these efforts, the costs may be offset if the results are fewer ADEs and readmissions.

In conclusion, the MARQUIS study examined the potential benefits of an improved medication reconciliation process across a variety of hospitals, and while potentially dangerous medication discrepancies were not statistically lowered, the total number of medication discrepancies were. Schnipper et al. seek to make improvements to their toolkit, and are currently implementing their intervention at 18 additional sites. Going forward, hospitals will need to investigate which interventions are most likely to benefit their patients, and how they can implement them through safe, systematic, and cost-effective means.

Schnipper JL, Mixon A, Stein J, Wetterneck TB, Kaboli PJ, Mueller S, et al. Effects of a multifaceted medication reconciliation quality improvement intervention on patient safety: final results of the MARQUIS study. BMJ Qual Saf. 2018 Aug 20.

Using whole genome scores to compare three clinical phenotyping methods in complex diseases

Summary by Taylor Christiansen, Research Assistant

One goal of precision medicine is to use genomic data to predict health status. This is based on research which shows that genomic factors drive many human complex disorders. Correct phenotyping of patients is crucial to the accuracy of genome-wide association studies (GWAS). Without accurate phenotyping, researchers lose the ability to match the genomic information with the phenotype. The challenge is that phenotyping is difficult and can be expensive. To improve genomic study, development of an optimized phenotyping method should be part of the study design at the onset. In the article, "Using whole genome scores to compare three clinical phenotyping methods in complex diseases," Wenyu Song et al. sought to evaluate different phenotyping methods to help future GWAS improve the accuracy of phenotyping.

As explained by the authors, many studies rely on self-reported binary phenotypic descriptions or administrative data, which are often inaccurate. Using phenotypes from the electronic health record (EHR) could be more precise for genome-phenome association studies. However, there are some limitations to using EHR data. EHR information can be incomplete, inconsistent, and sometimes contradictory because the information is pulled from different sources. Previous research shows, for example, that clinical problem lists from EHRs are more specific than billing data, but lack sensitivity for disease identification.

In this study, whole genome mutation patterns were used to evaluate three major clinical phenotyping methods: billing data, clinical problem lists entered by providers into the EHR, and curated phenotypes drawn from diverse EHR data (a.k.a. the "phenotyping algorithm"). The researchers selected and genotyped over 16,000 Caucasian subjects, then collected their phenotype data. They chose to investigate four complex diseases with different genetic heritabilities: type 1 diabetes mellitus, type 2 diabetes mellitus, coronary artery disease, and breast cancer. The three clinical phenotyping methods (billing data, problem lists, phenotyping algorithm) separated the overall cohort into three case cohorts. A genetic model that predicted whether patients had a disease of interest was developed to compare the three phenotyping methods. The researchers used a polygenic approach to design their predictive model because the four diseases in this study are all

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To improve genomic study, development of an optimized phenotyping method should be part of the study design at the onset.

Selected Publications by members of the Center

Automatic population of eMeasurements from EHR systems for inpatient falls. Cho I, Boo EH, Lee SY, Dykes PC. J Am Med Inform Assoc. 2018 Jun 1;25(6):730-738.

Drug-Induced Anaphylaxis Documented in Electronic Health Records. Dhopeshwarkar N, Sheikh A, Doan R, Topaz M, Bates DW, Blumenthal KG, et al. J Allergy Clin Immunol Pract. 2018 Jun 30. pii: S2213-2198(18)30411-2.

Using drug knowledgebase information to distinguish between look-alike-sound-alike drugs. Cheng CM, Salazar A, Amato MG, Lambert BL, Volk LA, Schiff GD. J Am Med Inform Assoc. 2018 Jul 1;25(7):872-884.

Physician Burnout in the Electronic Health Record Era: Are We Ignoring the Real Cause? Downing NL, Bates DW, Longhurst CA. Ann Intern Med. 2018 Jul 3;169(1):50-51. Epub 2018 May 8.

Behavioral Economics Interventions in Clinical Decision Support Systems. Cho I, Bates DW. Yearb Med Inform. 2018 Aug;27(1):114-121. Epub 2018 Aug 29. Review.

Use of Medical Scribes to Reduce Documentation Burden: Are They Where We Need to Go With Clinical Documentation? Bates DW, Landman AB. JAMA Intern Med. 2018 Sep 17. [Epub ahead of print]

Development of the individualised Comparative Effectiveness of Models Optimizing Patient Safety and Resident Education (iCOMPARE) trial: a protocol summary of a national cluster-randomised trial of resident duty hour policies in internal medicine. Shea JA, Silber JH, Desai SV, Dinges DF, Bellini LM, Tonascia J, et al.; iCOMPARE Research Group. BMJ Open. 2018 Sep 21;8(9):e021711.

Ten Principles for More Conservative, Care-Full Diagnosis. Schiff GD, Martin SA, Eidelman DH, Volk LA, Ruan E, Cassel C, et al. Ann Intern Med. 2018 Oct 2. [Epub ahead of print]

Take a look at some recent publications by members of the Center!

Genome Scores

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associated with multiple genetic mutations. Polygenic scores association models based on the three phenotyping methods were used to make comparisons.

The researchers learned that the phenotyping algorithm was the most accurate genomic prediction model, outperforming the problem list and billing data. To further examine the performance of each phenotyping method, the researchers used a receiver operating characteristic curve and area under the curve to look for patterns in the sensitivity and specificity of each model. The results showed a clear pattern among the models. For each disease, the phenotyping algorithm led to the most accurate polygenic model, with the billing data alone performing the worst in each disease group.

In summary, Song et al. demonstrated that advanced EHR-derived phenotypes are more accurate and can improve GWAS. Future GWAS should consider using curated phenotypes drawn from diverse EHR data, rather than just billing data or problem list data alone. Improving the accuracy of phenotyping could assist researchers in identifying genetic mutations that are associated with diseases. These associations are essential for precision medicine and gene therapies, which the authors claim have the potential to revolutionize medical therapy.

Genome Scores Citation (right):
Cheng CM, Salazar A, Amato MG, Lambert BL, Volk LA, Schiff GD. Using drug knowledgebase information to distinguish between look-alike-sound-alike drugs. J Am Med Inform Assoc. 2018 Jul 1;25(7):872-884.

Diagnostic Safety Metrics Citation (below):
Schiff GD, Ruan EL. The Elusive and Illusive Quest for Diagnostic Safety Metrics. J Gen Intern Med. 2018 Jul;33(7):983-985.

Diagnostic Safety Metrics

(Continued from page 1)

use to create UDE performance metrics. In the context of TB, factors to consider include: active versus latent TB and false positive versus false negative results of TB tests. While Olson believes finding TB on an autopsy is the key identifier for this metric, Schiff and Ruan point out that autopsies are rare in the US. Therefore, using Olson et al.'s UDE framework would lead to selection bias and lower likelihood of finding missed TB. Furthermore, evaluating for TB after death means it is too late to ameliorate the error. Identifying TB in living patients would be a better way of uncovering diagnostic improvement opportunities.

Moving on from the complexity of creating a UDE framework, Schiff and Ruan discuss the recent change in culture of measuring the quality of care. The shift has made front line staff the key players in ensuring safe diagnoses, as opposed to inspectors visiting the institution. To illustrate this change, Schiff and Ruan use an example of US Pharmacopeia (USP). USP traditionally evaluated the quality of drug products once each manufacturer submitted a drug product sample. This process has now been replaced by continuous process verification, in which USP sends each manufacturer precise formulas, preparation guides, and samples for testing. This makes the manufacturers themselves responsible for measuring the quality of their products. Continuous process verification thus ensures that high-quality drugs are made consistently. The authors use the USP example because it provides a model dependent on front line staff that can be applied when designing diagnostic safety metrics.

Schiff and Ruan urge readers to think about what expectations, processes, and conditions organizations could identify to ensure a high-quality diagnosis and promote a culture that encourages learning from mistakes. The authors imply that diagnostic errors can be reduced using a metrics- versus culture-based approach; or perhaps both, as they are not mutually exclusive. While more work is needed to identify which metrics will yield meaningful performance results, Olson et al.'s article on a UDE framework indicates a step in the right direction along the quest for diagnostic safety metrics. The task to develop these metrics is a challenging one, but much needed if health care systems are to observe any improvements in diagnostic safety.

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