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ORIGINAL RESEARCH

Diagnostic Discordance, Health Information Exchange, and Inter-Hospital Transfer Outcomes: a Population Study

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BACKGROUND: Studying diagnostic error at the population level requires an understanding of how diagnoses change over time.

OBJECTIVE: To use inter-hospital transfers to examine the frequency and impact of changes in diagnosis on patient risk, and whether health information exchange can improve patient safety by enhancing diagnostic accuracy.

DESIGN: Diagnosis coding before and after hospital transfer was merged with responses from the American Hospital Association Annual Survey for a cohort of patients transferred between hospitals to identify predictors of mortality.

PARTICIPANTS: Patients (180,337) 18 years or older transferred between 473 acute care hospitals from NY, FL, IA, UT, and VT from 2011 to 2013.

MAIN MEASURES: We identified discordant Elixhauser comorbidities before and after transfer to determine the frequency and developed a weighted score of diagnostic discordance to predict mortality. This was included in a multivariate model with inpatient mortality as the dependent variable. We investigated whether health information exchange (HIE) functionality adoption as reported by hospitals improved diagnostic discordance and inpatient mortality.

KEY RESULTS: Discordance in diagnoses occurred in 85.5% of all patients. Seventy-three percent of patients gained a new diagnosis following transfer while 47% of patients lost a diagnosis. Diagnostic discordance was associated with increased adjusted inpatient mortality (OR 1.11 95% CI 1.10–1.11, $p < 0.001$) and allowed for improved mortality prediction. Bilateral hospital HIE participation was associated with reduced diagnostic discordance index (3.69 vs. 1.87%, $p < 0.001$) and decreased inpatient mortality (OR 0.88, 95% CI 0.89–0.99, $p < 0.001$).

CONCLUSIONS: Diagnostic discordance commonly occurred during inter-hospital transfers and was associated with increased inpatient mortality. Health information exchange adoption was associated with decreased discordance and improved patient outcomes.

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INTRODUCTION

In today's fragmented medical system, teamwork and interprofessional communication have become increasingly fundamental for a safe, efficient diagnostic process.[1–3] There are many impediments to a patient receiving coordinated, high-value care in this system; these barriers are most evident when a patient is transferred between hospitals. Approximately 1.6 million patients are transferred between hospitals yearly. This patient population is unique in its medical complexity and has disproportionately high mortality.[4] Inter-hospital transfers are complicated by incongruent information systems, indirect and asynchronous communication, and geographical distance between institutions in a setting of high patient complexity and acuity.[5, 6] This high-risk transition of care is a setting in which breakdowns in the diagnostic process are likely to occur and impact patient outcomes.[7–9]

The impact of how diagnoses change with time and across transitions of care is difficult to establish, particularly in large inpatient populations.[10–13] This is despite a renewed focus on diagnostic safety and efforts to minimize diagnostic error.[3] An important reason for this is the lack of time varying information in administrative datasets produced by hospitals. Studies investigating unexpected care transitions, such as from a clinic appointment to the hospital or readmission following discharge from the ED have shown that changes in diagnoses between each visit may help identify errors and provide feedback to improve care quality.[14–16]

Inter-hospital transfers occur within a single day and provide data from two unique assessments. This creates an opportunity to capture documented changes with respect to diagnosis that may be associated with patient risk. In an optimal setting where documentation is timely, accurate, and continually updated, there is little reason that documentation of diagnoses, especially chronic conditions should differ across a transfer except when a condition evolves, miscommunication occurs, or a diagnosis is delayed. Comparing diagnoses before and after transfer provides a unique window into changes that occur during a high-risk transition of care in the confines of a single inpatient encounter.

Additionally, efforts to improve communication between systems, such as by improving the interoperability of electronic health records, to allow for more efficient data sharing between hospitals may streamline the diagnostic process in this population.[17, 18] Regional adoption of health information exchange (HIE) is one such approach. Impact of HIEs on patient outcomes such as mortality remains to be clearly established.[19]

We generated a large database of inter-hospital transfers, comparing billing data of both referring and receiving hospital. We first focused on the change in Elixhauser Comorbidities, which were chosen based on their reproducibility and durability across multiple clinical settings, as well as favorable comparison to other comorbidity scores.[20–23] In this study, we describe changes in documented diagnoses that occur during inter-hospital transfers and the association between changes in documented diagnosis and patient risk. Finally, since communication is central to the diagnostic process, we tested the hypothesis that HIE adoption can improve some aspects of discordance, thereby improving outcomes.

METHODS

Data Sources

An administrative database was generated from the Health Care Utilization Projects' State Inpatient and Emergency Department Database from five states (VT, NY, FL, IA, FL) between 2011 and 2013.[24, 25] We identified inter-hospital transfers by matching discharge and admission dates, using a patient's unique identifier (visitlink).

Diagnostic Discordance

Individual comorbidities were identified from ICD-9CM codes at both referring and receiving hospital as described by Quan et al., and subsequently compared.[26] Comorbidities were classified into four categories: concordant and negative (absent in both admissions), concordant and positive (present in both admissions), gained (identified as a new diagnosis following transfer), and lost (absent after transfer).

Diagnosis Discordance Index

We developed a point scale of comorbidity discordance (Diagnosis Discordance Index) to prioritize diagnostic changes that were associated with higher patient risk.[27, 28] This additionally allowed us to address concerns of overfitting, collinearity, and non-convergence that can occur with large multivariate logistic regressions, allowing for subpopulation analysis and future verification in clinical studies. The entire cohort was divided randomly into a derivation cohort (2/3 of patients) and validation cohort (1/3 of patients). A multivariate logistic regression model including concordant, gained, and lost diagnoses was used to identify the potential association of documented diagnostic changes with inpatient mortality. We used backward variable elimination using inclusion criteria of an alpha less than 0.05 for variable retention.

Following methods described by van Walraven et al. and Sulivan et al., points were assigned to gained and lost comorbidities based on each regression coefficient divided by the coefficient with the lowest absolute value in the model.[27, 28] Discordant diagnoses were assigned points and concordant diagnoses were used as a control for illness severity. The diagnostic discordance index (DDI) is the point total for each patient.

The ability of the DDI to predict inpatient death was determined by the c-statistic. Three logistic models were compared: Elixhauser comorbidities from the referring hospital, Elixhauser comorbidities from the receiving hospital, and the combination of the DDI and concordant comorbidities. These models were tested in both derivation and validation cohorts. Ninety-five percent confidence intervals of the AUC were generated following 1000 boot strap simulations. In addition to association with mortality, we tested the association of DDI with cost of care and length of stay following transfer adjusting for patient demographics and concordant comorbidities. Finally, to be certain that discordance was not reflective of coding practices that would allow for higher reimbursement rates (i.e., upcoding), we determined if DDI remained predictive of mortality within the three most common admitting DRGs at the receiving hospital.

Health Information Exchange and Diagnostic Discordance

Responses from the American Hospital Association Health IT questionnaire were merged with individual transfers. A

Table 1 Patient Demographics and Outcomes Before and After Transfer

	Referring hospitalization	Receiving hospitalization
n	180,337	180,337
Age (%)	61.3 (18.4)	61.3 (18.4)
Female (%)	84,627 (46.9)	84,627 (46.9)
White (%)	133,216 (73.9%)	133,216 (73.9%)
Black (%)	18,612 (10.3%)	18,612 (10.3%)
Hispanic (%)	15,066 (8.4%)	15,066 (8.4%)
Other (%)	13,443 (7.5%)	13,443 (7.5%)
Private (%)	41,401 (23.0%)	42,042 (23.3%)
Medicare (%)	98,170 (54.4%)	98,069 (54.4%)
Medicaid (%)	23,060 (12.8%)	24,360 (13.5%)
Uninsured (%)	11,025 (6.1%)	8937 (5.0%)
Elixhauser comorbidities (SD)	2.48 (4.43)	3.38 (4.84)
Number of diagnoses (SD)	8.1 (5.8)	11.4 (6.4)
Length of stay (days, SD)	2.8 (6.3)	8.2 (10.6)
Total charges (SD)	$27,647 (59,610)	$69,779 (107,857)
Inpatient deaths (%)	0	9694 (5.4%)

Table 2 Frequency of Elixhauser Comorbidity Gain and Loss, Association with In-Hospital Mortality Following Transfer, and Subsequent Point Score Used to Calculate the Diagnostic Discordance Index

	Gain				Loss			
	n (%)	OR (95% CI)	*p*	Points	*n* (%)	OR (95% CI)	*p*	Points
Congestive heart failure	15,131 (8.3%)	1.58 (1.47–1.69)	< 0.001	4	6505 (3.6%)	1.61 (1.46–1.77)	< 0.001	4
Cardiac arrhythmias	21,218 (11.8%)	1.78 (1.68–1.90)	< 0.001	5	9433 (5.2%)	1.60 (1.47–1.74)	< 0.001	4
Valvular disease	10,197 (5.6%)	0.88 (0.80–0.96)	0.004	− 1	4504 (2.5%)	(−)	(−)	0
Pulmonary circulation disorders	7717 (4.3%)	1.32 (1.21–1.44)	< 0.001	2	3030 (1.7%)	1.16 (1.01–1.33)	0.038	1
Peripheral vascular disorders	9302 (5.2%)	1.23 (1.13–1.34)	< 0.001	2	4112 (2.3%)	1.14 (1.01–1.29)	0.041	1
Hypertension uncomplicated	30,604 (17.0%)	0.82 (0.76–0.88)	< 0.001	− 2	18,126 (10.1%)	1.12 (1.04–1.21)	0.002	1
Paralysis	4105 (2.2%)	1.69 (1.51–1.88)	< 0.001	5	1581 (0.9%)	1.76 (1.47–2.10)	< 0.001	5
Other neurological disorders	11,604 (6.4%)	3.52 (3.31–3.74)	< 0.001	11	4606 (2.6%)	1.70 (1.52–1.90)	< 0.001	5
Chronic pulmonary disease	20,142 (11.2%)	(−)	(−)	0	7976 (4.4%)	1.29 (1.17–1.42)	< 0.001	2
Diabetes, uncomplicated	13,503 (7.5%)	(−)	(−)	0	9346 (5.2%)	1.27 (1.15–1.41)	< 0.001	2
Diabetes, complicated	5971 (3.3%)	0.66 (0.57–0.76)	< 0.001	− 4	3357 (1.9%)	(−)	(−)	0
Hypothyroidism	10,050 (5.6%)	0.87 (0.79–0.97)	0.008	− 1	3324 (1.8%)	1.27 (1.11–1.44)	< 0.001	2
Renal failure	11,919 (6.6%)	1.35 (1.21–1.52)	< 0.001	3	4903 (2.7%)	1.45 (1.31–1.62)	< 0.001	3
Liver disease	4829 (2.7%)	2.79 (2.56–3.05)	< 0.001	9	2621 (1.5%)	1.32 (1.14–1.53)	< 0.001	2
Peptic ulcer disease	1150 (0.8%)	0.75 (0.59–0.96)	0.021	− 3	802 (0.4%)	(−)	(−)	0
AIDS/HIV	169 (0.1%)	(−)	(−)	0	97 (0.1%)	(−)	(−)	0
Lymphoma	903 (0.5%)	1.49 (1.17–1.88)	0.001	3	348 (0.2%)	(−)	(−)	0
Metastatic cancer	3291 (1.8%)	1.55 (1.36–1.77)	< 0.001	4	875 (.5%)	2.12 (1.73–2.60)	< 0.001	7
Solid tumor without Mets	5126 (2.8%)	1.42 (1.28–1.59)	< 0.001	3	2359 (1.3%)	(−)	(−)	0
Rheumatoid arthritis/collagen vascular disease	2700 (1.5%)	(−)	(−)	0	1090 (0.6%)	(−)	(−)	0
Coagulopathy	9471 (5.3%)	1.88 (1.76–2.02)	< 0.001	6	4297 (2.4%)	1.41 (1.26–1.56)	< 0.001	3
Obesity	13,986 (7.8%)	0.71 (0.64–0.78)	< 0.001	−3	5537 (3.1%)	(−)	(−)	0
Weight loss	10,598 (5.9%)	1.47 (1.38–1.58)	< 0.001	3	3398 (1.9%)	1.98 (1.78–2.20)	< 0.001	6
Fluid and electrolyte disorders	29,018 (16.1%)	2.52 (2.38–2.66)	< 0.001	8	17,687 (9.8%)	1.69 (1.57–1.81)	< 0.001	5
Blood loss anemia	1454 (0.8%)	0.74 (0.59–0.93)	0.01	− 3	1079 (0.6%)	(−)	(−)	0
Deficiency anemia	3781 (2.1%)	0.52 (0.44–0.61)	< 0.001	− 6	2266 (1.3%)	0.80 (0.68–0.96)	0.013	− 2
Alcohol abuse	7241 (4.0%)	0.72 (0.63–0.82)	< 0.001	− 3	3061 (1.7%)	0.71 (0.59–0.87)	0.001	− 3
Drug abuse	7516 (4.2%)	0.52 (0.44–0.62)	< 0.001	− 6	3049 (1.7%)	0.68 (0.54–0.84)	0.001	− 3
Psychoses	3880 (2.2%)	0.79 (0.66–0.95)	0.011	− 2	2672 (1.5%)	0.60 (0.47–0.77)	< 0.001	− 4
Depression	17,421 (9.7%)	0.56 (0.51–0.61)	< 0.001	− 5	8567 (4.8%)	0.82 (0.73–0.92)	< 0.001	− 2
Hypertension, complicated	13,290 (7.4%)	0.65 (0.58–0.73)	< 0.001	− 4	5910 (3.3%)	(−)	(−)	0

hospital was determined to participate in HIE if they reported both a fully implemented electronic health record and participation in a health information exchange. The impact of HIE participation from both referring and receiving hospital on diagnostic discordance and patient outcomes was assessed by logistic regression, specifically using a Poisson Regression with discordance as the dependent variable and the primary exposure variables as HIE participation at receiving, referring, and both hospitals. We adjusted for age, race, insurance status, and prior hospital length of stay. Sensitivity of discordance of individual diagnoses to HIE participation was assessed by multivariate logistic regression.

Statistical Analysis

Demographic information is presented as a number and percentage if a dichotomous variable and mean and standard deviation for continuous variable. Multivariate logistic regression was used to evaluate the effect of diagnostic discordance on inpatient mortality, controlling for age, demographics, insurance status, concordant comorbidities, length of stay at the referring hospital, and emergency department origin of transfer. Other outcomes including total charges and length of stay were assessed utilizing a generalized linear model following log transformation, adjusting for patient demographics, and illness severity.

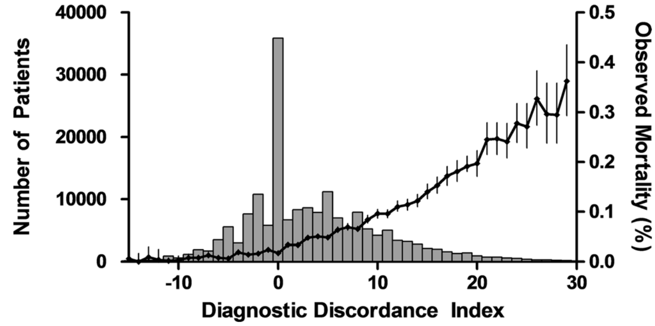

Fig. 1 Population distribution (left axis) of diagnostic discordance index and association with observed mortality (right axis) in the validation cohort

RESULTS

Patient Population

A total of 180,337 patients were identified as inter-hospital transfers using strict criteria. Demographics of transferred patients are summarized in Table 1. We observed a decrease in the uninsured rate following transfer, but otherwise demographics were similar. Most of the total length of stay (74.5%) and of total charges (71.2%) occurred following transfer. A total of 5.4% of patients died following transfer.

Diagnostic Discordance

Discordance in documented comorbidities occurred in 85.5% of all patients transferred between hospitals with 73% of patients gaining a new documented diagnosis and a 47% of patients losing a diagnosis. Fluid and electrolyte abnormalities were the most commonly discordant diagnosis (25.3% of all transfers), followed by cardiac arrhythmias (17%) and chronic pulmonary disease (15.6%).

Comorbidity changes before and after transfer and the impact on inpatient mortality fell into several patterns (Table 2). Overall, the association between the gain of a new diagnosis and inpatient mortality had the same directionality as a concordant diagnosis (Supplemental Table 1). A large number of documented comorbidities were associated with higher mortality whether they were gained or lost. Conversely, several diagnoses conferred lower risk either when lost or concordant. In only two instances did gain and loss seem to have opposing impacts on mortality: uncomplicated hypertension and hypothyroidism, the loss of each was associated with higher mortality, while concordance (or gain) predicted lower risk.

Diagnostic Discordance Index

We generated a point scale following the fitting of diagnosis gain and loss to inpatient mortality while controlling for concordant comorbidities. The DDI point attribution is illustrated in Table 2. The mean DDI was 3.6, with a median of 2.0, and range of −23 to 49 out of a theoretical range of −36 to 127. Population distribution of the validation cohort and association with unadjusted mortality is shown in Fig. 1. When controlling for patient demographics, insurance status, duration of prior hospital stay, transfer from an emergency department, higher DDI was associated with higher inpatient mortality (OR 1.11 95% CI 1.10–1.11, $p < 0.001$), higher cost (coef 0.05 95% CI 0.049–0.051, $p < 0.001$), and longer post transfer length of stay (coef 0.03 95% CI 0.03–0.032, $p < 0.001$) (Supplemental Table 2–4).

We verified the ability of the DDI improve discrimination of patients who died following transfer. We found that comparing AUC of a model containing concordant comorbidities and the DDI had improved discrimination when compared against Elixhauser comorbidities at either the accepting or receiving hospital (Table 3). Finally, we confirmed that DDI remained associated with higher mortality within common DRG groups (Supplemental Table 5–7).

Impact of Health Information Exchange

We investigated the impact of hospital HIE participation on discordance between the two hospital stays and patient outcomes as a proxy for improved information transfer. Transfers (130,539) occurred between hospitals were both responded to the AHA annual IT survey. A minority of patients, 5027, were transferred between hospitals where both reported HIE participation. HIE adoption by both hospitals was associated with significant reductions in diagnostic discordance (coef −1.7

Table 3 Adjusting for Diagnoses Changes Across Inter-Hospital Transfers Improves Prediction of Inpatient Mortality when Compared to Static Diagnosis at Either Referring or Receiving Hospital

	Derivation sample		Validation sample	
	AUC	95% CI	AUC	95% CI
Elixhauser at referring hospital	0.696	(0.688–0.703)	0.707	(0.697–0.717)
Elixhauser at receiving hospital	0.798	(0.793–0.804)	0.806	(0.798–0.813)
Elixhauser concordance and DDI	0.817	(0.812–0.822)	0.823	(0.816–0.830)

95% CI − 1.9 to − 1.5, $p < 0.001$), subsequent length of stay, total charges, and adjusted inpatient mortality (OR 0.75 95% CI 0.64–0.88, $p < 0.001$, Table 4). Individual participation in an HIE at either referring receiving hospital was not associated with decreases in mortality, length of stay, or diagnostic discordance.

We investigated the mechanism of reduced discordance, stratifying by individual comorbidity gain, and loss, focusing on inpatient to inpatient transfers which had the highest degree of discordance. HIE participation at both hospitals was associated with mitigated diagnosis loss (OR 0.83, 95% CI 0.77–0.90, $p < 0.001$), but not diagnosis gain (OR 1.07, 95% CI 0.98–1.17, $p = 0.531$). We performed a sensitivity analysis to identify which individual comorbidities were significantly changed by HIE participation (Supplemental Fig. 1–2). Diagnosis loss weighted toward higher mortality were more likely to be reduced by HIE participation (43%) than those with no weight (30%) or were associated with lower mortality (20%).

DISCUSSION

High-quality care delivery depends on timely and accurate diagnosis. Understanding diagnostic safety and assessing quality of inpatient delivery requires an appreciation for how diagnoses change in the inpatient setting. We compared billing data before and after inter-hospital transfer as a cross-sectional window into the evolving diagnostic process. We established that changes in diagnoses frequently occur in the hospitalized patient undergoing transfer, even when limited to broad categories reflecting chronic illness. We additionally showed that discordance in diagnosis is associated with patient risk and is improved when communication is facilitated by a health information exchange. There are several implications of these findings.

A major limitation of claims data is that diagnoses have no timestamp or other time-varying information and instead are linked to episodes of care which are applied following discharge. We used a single time point of an inter-hospital transfer, for which two separate episodes occur closely in time to capture diagnostic changes that occur in the inpatient setting. We find that accounting for changes in documented diagnoses improved the ability to predict inpatient mortality and resource utilization. The ability to know when a diagnosis was identified relative to presentation would be immensely useful for risk and quality measures reflecting diagnostic safety[29]; time-stamped diagnosis codes would be potentially a worthwhile step in that direction.

The association between the gain and the existence of a diagnosis on mortality was similar, likely reflecting new diagnoses and downstream complications of disease. The loss of documented chronic comorbidities following transfer has three plausible explanations. First, the diagnosis at the referring hospital was incorrect or had resolved and thus appropriately absent at the accepting hospital. Second, diagnostic priorities at the second hospital were different than the first; for example, if a patient were transferred to another institution for sepsis, less important comorbidities such as depression may not be documented. Third, communication between the two hospitals may be suboptimal, leading to inadvertent change in documented diagnoses at the receiving hospital reflecting a loss in information at the new care facility.

If diagnosis loss reflected disease resolution, we would expect a loss of a high-risk diagnosis to be associated with

Table 4 Demographics, Patient Outcomes, and Diagnostic Discordance of Inter-Hospital Transfers Stratified by Hospital Participation in a Health Information Exchange

	No HIE at receiving hospital		HIE at receiving hospital	
	No HIE at referring hospital	HIE at referring hospital	No HIE at referring hospital	HIE at referring hospital
N	106,042	12,031	7439	5027
Age (%)	61.3 (18.2)	61.8 (18.4)	60.9 (18.1)	61.2 (18.3)
Female (%)	49,722 (46.9%)	5536 (46.0%)	3547 (47.8%)	2378 (47.3%)
White (%)	78,268 (73.8%)	8,80 (73.1%)	5813 (78.1%)	3700 (73.6%)
Black (%)	11,239 (10.6%)	1286 (10.7%)	901 (12.1%)	638 (12.7%)
Hispanic (%)	8343 (7.9%)	826 (6.8%)	423 (6.2%)	415 (8.3%)
Other (%)	8192 (7.7%)	1119 (9.3%)	263 (3.5%)	284 (5.4%)
Private (%)	25,260 (23.8%)	2942 (24.4%)	1510 (20.3%)	1231 (24.5%)
Medicare (%)	56,418 (53.2%)	7049 (58.5%)	4418 (59.3%)	26,28 (52.2%)
Medicaid (%)	15,431 (14.6%)	1363 (11.3%)	814 (10.9%)	778 (15.5%)
Uninsured (%)	4500 (4.2%)	288 (2.4%)	475 (6.4%)	324 (5.4%)
Elixhauser comorbidities at referring hospital (SD)	2.45 (2.09)	2.85 (2.26)	2.65 (2.13)	2.43 (1.96)
Elixhauser comorbidities at receiving hospital (SD)	3.36 (2.18)	3.71 (2.30)	3.63 (2.18)	3.25 (2.07)
Length of stay (days, SD)	11.0 (14.1)	11.2 (13.3)	11.5 (12.0)	10.6 (10.8)
Total charges (SD)	$95,170 (133,921)	$100,806 (142,593)	$112,924 (128,073)	$81,603 (102,287)
Diagnostic discordance index (SD)	3.69 (7.04)	4.25 (7.07)	4.22 (6.85)	1.87 (6.88)*
Unadjusted mortality (%)	6122 (5.8%)	712 (5.9%)	391 (5.3%)	175 (3.5%)
Adjusted mortality (OR, 95% CI)	1.0 (Ref)	0.927 (0.85–1.01)	0.88 (0.89–0.99)	0.75 (0.64–0.88)*

** p<0.05 for a positive interaction betweein HIE at both referring and receiving hospital* lower mortality. We observed the opposite. Following transfer, the risk associated with that diagnosis persisted. This suggests that the loss of documented diagnoses after hospital transfer reflects miscommunication or changing priorities rather than clinical resolution of disease.

To show that discordance between hospitals was related to communication, we investigated whether HIE participation, and thus improved information transfer, was associated with reduced diagnostic discordance. We found that discordance was reduced only when both referring and receiving hospitals participated in a HIE, and this was associated with reduced inpatient mortality. Prior studies have demonstrated a relationship between documentation loss following inter-hospital transfer and higher mortality[30]; mitigating loss of information through EHR interoperability may be one method of improving the safety of transfers. Moreover, our data suggests that the diagnostic process may be aided by HIE adoption as diagnoses highly associated with mortality were preferentially improved relative to those associated with minimal risk.

We developed a point score, the diagnostic discordance index to simplify the assessment of changes that occurred across an individual transfer. We showed that this score correlated with mortality and resource utilization and was improved when information transfer was facilitated by HIE participation. This score allows the identification of patients where high-risk diagnostic changes or miscommunication occurred and may allow enrichment of charts for quality assessment and validation of our findings in a smaller heterogeneous population.

In addition to serving as a model system for high-risk care transitions, inter-hospital transfers represent an important population for additional study. Hospitals vary widely in their approaches to triage, communication, and acceptance of transferring patients.[5, 31] Our data suggest that implementation of regional health information networks has the potential to improve patient outcomes and reduce cost of care.

This study has multiple limitations such as a reliance on the accuracy of ICD9 coding. Coding inconsistencies vary significantly by diagnosis, and rates of coding issues have been reported as high as 80%.[32] Additionally, comorbidities cannot fully capture the time-dependent, dynamic nature of the diagnostic process. Patient-level validation, where risk stratification is based on physiologic parameters, utilization of health technology, and diagnostic accuracy can be prospectively assessed, is a necessary next step.[33]

The observational nature of our study opens the possibility for unadjusted confounding. Variations in coding practice, motivated by attempts at higher reimbursement rates may contribute significantly to discordance. We attempted to adjust for this, demonstrating the association between diagnostic discordance remained robust within individual DRG groups. Similarly, the reduction in discordance and associated reduced mortality with HIE participation may be driven by the selection of lower risk or patients. Changes in acceptance rates, case-mix, and patient stability needs to be assessed in a prospective study to better understand the impact of HIE participation in this population.

Patients transferred between hospitals are complex, frequently transferred to a higher level of care due to acuity, wherein responsibilities for care are ambiguous and miscommunication a frequent occurrence.[5, 6, 34–37] This important population is a model system to study the relationship between technology, communication, and the diagnostic process. This study represents a first step, both illustrating the importance of diagnosis changes and the potential impact of health information technology on improving diagnosis and outcomes.[17]

CONCLUSION

We demonstrate that documented diagnoses frequently change across the short duration of an inter-hospital transfer. This change in diagnosis is associated with higher inpatient risk, length of stay, and cost and allows more accurate mortality prediction. Improving communication through adoption of health information exchange mitigated the loss of diagnoses and was associated with improved mortality.

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Compliance with Ethical Standards:

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