Methods We developed five trigger algorithms to detect delays in diagnostic evaluation of possible bladder, breast, colorectal, hepatocellular, and lung cancer. Each used structured clinical data to identify patient records with red-flags (abnormal test results warranting further diagnostic evaluation). Red-flags included high-grade hematuria (>50 red blood cells/high powered field; bladder cancer trigger), abnormal mammograms (breast cancer trigger), iron deficiency anemia or positive fecal immunochemical tests (colorectal cancer trigger), elevated alpha-fetoprotein (hepatocellular trigger), or chest imaging flagged as suspicious for malignancy (lung cancer trigger). Algorithms excluded records where follow-up was unnecessary (e.g., hospice patient) and records where follow-up was documented within 30 (lung cancer trigger) or 60 days (all others). We validated triggers by applying them retrospectively to EHR data (see table 1 for timeframes and sample sizes).

Results The five triggers yielded PPVs ranging from 56.0–82.3%, NPVs ranging from 88.0–98.0%, sensitivity from 64.1–91.7%, and specificity from 81.1–96.5% (see table 1). We estimated that these triggers have the potential to identify 1192 diagnostic errors in the VA network studied per year.

Conclusions Our triggers have potential to identify large numbers of patients experiencing delays in diagnostic evaluation. Implementing prospective electronic trigger-based measurement systems using these algorithms could support health systems in reducing delays in delays in cancer diagnosis.

IHI ID 05 BOARDING TIME IS A GAME WON IN MINUTES

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10.1136/ihisciabs.5

Background Rapid growth in patient volumes led to operating above 85% capacity with increased frequency. This growth strained antiquated patient flow processes that had not matured as patient demand increased. With limited options to increase physical capacity, a centralized effort to optimize patient throughput was prioritized at both the macro – and the microsystem level.

Objectives Getting the patient to the right place, at the right time, meant instituting a measurement system and standardizing bed management practices across the organization. Targeting delays in patient progression led to defining hospital boarding time as the time when a patient meets medical criteria to transfer to another level of care to the time the patient is transferred.

Methods Multiple plan-do-study-act cycles were completed during a pilot. An Xbar-S statistical process control chart assessed the impact of key interventions over time with a primary goal to reduce process variation to improve flow. Key interventions focused on process re-design, standardization of operational definitions, mistake proofing, and education for sustainability.

Intervention #1: Pilot

Mann-Whitney Test and CI: Pre, Post

	N	Median
Pre	2066	85.000
Post	678	80.000

Point estimate for $\eta_1 - \eta_2$ is 5.000
 95.0 Percent CI for $\eta_1 - \eta_2$ is (2.002, 7.001)
 W = 2899643.5
 Test of $\eta_1 = \eta_2$ vs $\eta_1 \neq \eta_2$ is significant at 0.0003
 The test is significant at 0.0003 (adjusted for ties)

Abstract IHI ID 05 Figure 1 Xbar-S chart of hospital boarding time by intervention (2016–2018)

Test for Equal Variances: Pre, Post

Method

Null hypothesis All variances are equal
 Alternative hypothesis At least one variance is different
 Significance level $\alpha = 0.05$

95% Bonferroni Confidence Intervals for Standard Deviations

Sample	N	StDev	CI
Pre	2066	36.4546	(34.3615, 38.7174)
Post	678	34.6988	(30.8902, 39.1063)

Individual confidence level = 97.5%

Tests

Method	Test Statistic	P-Value
Multiple comparisons	-	0.375
Levene	4.72	0.030

Abstract IHI ID 05 Figure 2

Intervention #2: Launch Measurement System

Abstract IHI ID 05 Figure 3

Summary Report for Hospital Boarding Time Improvement (December 2017 - July 2018)

Abstract IHI ID 05 Figure 4

Process Capability Report for HBT (Boarding 1.5 hours or less)
Calculations Based on Weibull Distribution Model

Abstract IHI ID 05 Figure 5

Results Pilot results showed decreased process variation by 10% and reduced median boarding times by five minutes (statistically significant; $p=0.0003$), increasing capacity by over 1100 hours. Based on proof of concept, hospital boarding time became an organizational priority. Results showed median boarding time decreased from 140 min to 71 min (49%) and standard deviation decreased from 107 min to 70 min (35%) over a 7 month period.

Conclusions Achieving efficient patient throughput is a complex process that impacts organizational operations. Establishing a measurement system allows for building upon a foundation for continuous improvement.

IHI ID 06

IMPROVED GROWTH OF VERY LOW BIRTH WEIGHT (VLBW) INFANTS IN THE NEONATAL INTENSIVE CARE UNIT (NICU)

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Background Extreme variation in provider nutritional practices in the NICU leads to poor growth of premature infants. Standardization of current feeding practices through quality

Global Aim

Improve patients' long term developmental outcomes

Smart Aim

For infants with a BW<1500 g and admitted within the first 7 days of life, increase the mean delta z score for weight from -1.8 to -1 within 6 months and sustain for 1 year.

Key Drivers

KEY
Completed intervention: taupe boxes
Ongoing intervention: red boxes

Abstract IHI ID 06 Figure 1 Key driver diagram

	GAIN STATUS CRITERIA	SUGGESTED INTERVENTIONS
RED	<ul style="list-style-type: none"> Below birth weight DOL >19 <50% of weight gain velocity to maintain Z- score Decline of 2 Z-scores from birth weight or length 	<ul style="list-style-type: none"> Huddle with MD, RD, RN to discuss strategies to stabilize/reverse growth failure Assess catch-up needs and compare to current provision Double check length data
YELLOW	<ul style="list-style-type: none"> Below birth weight DOL 15-18 50-75% of weight gain velocity to maintain Z-score 	<ul style="list-style-type: none"> Assess risk factors and individualized weight gain goals Liberalize fluid goals if feasible Increase calories from PN support Fortify feeds if previously delayed/off protocol
GREEN	<ul style="list-style-type: none"> Regained Birth Weight by DOL 14 >75% of weight gain velocity to maintain Z-score 	<ul style="list-style-type: none"> Continue nutrition plan Weight adjust calories and protein with new weights Increase caloric concentration of feeding

Abstract IHI ID 06 Figure 2 Growth assessment for individualized nutrition (GAIN) status tool