

International Laboratory Medicine Case Contest

Video Presentation

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Acute Kidney Injury and developing the electronic patient record in India – Is it possible?

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What is Acute Kidney Injury?

A public health perspective

- Acute kidney injury (AKI) is defined as an abrupt decrease in kidney function, which results in the accumulation of metabolic waste products, as well as dysregulation of volume status, electrolyte and acid-base balance.
- *This condition is common, estimated to occur in about 5%–20% of all hospitalized patients, and carries a significant, independent risk of mortality of up to 20% in some studies.
- Acute Kidney Injury (AKI) is associated with adverse outcomes and may develop into chronic kidney disease (CKD) or even end-stage renal disease.
- **13.3 million cases every year; globally. 1.7 million deaths per year.
- Amongst them, Estimated 11.3 million cases per year in developing countries. 1.4 million deaths per year in low/middle income countries.
- Electronic health record (EHR) can modify patient outcomes, contribute to greater resource utilization, and decrease health-care costs and financial burden.

*1. Mutter M, et al. BMJ Open 2019;9:e025117. doi:10.1136/bmjopen-2018-025117

**2. Lewington JP, Cerda J, Mehta RL, Kidney Int, 2013, 84:457-467

What is Acute Kidney Injury?

A clinical laboratory perspective

- The ability to implement real-time AKI interventions such as alerts and best-practice advisories has emerged as a promising tool to fight against the harmful sequel of AKI, which include short-term adverse outcomes as well as progression to chronic kidney disease, dialysis, and death.
- Kidney Disease: Improving Global Outcomes (KDIGO) guidelines advise identification of AKI based on increases in creatinine.
- Small changes to serum levels of creatinine (sCr) are not detected by clinicians, so early intervention is unlikely.
- This further increases the burden of the disease.
- Consensus statements by experts have recommended early personalized investigations, monitoring and management for AKI.

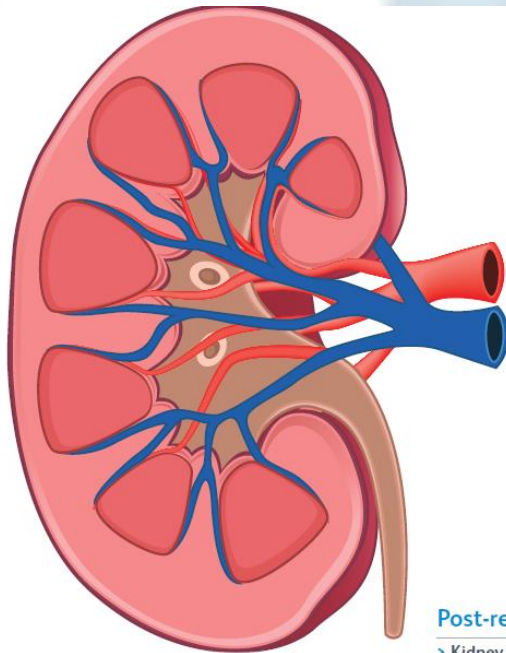
Impact: Study by Al-Jaghbeer et al.

- Mortality: 0.8% reduction
- Length of stay: 0.3 days reduction
- Dialysis Use: 2.7% reduction

Al-Jaghbeer M et al., 2018; Journal of the American Society of Nephrology, 29(2):654-60



Acute Kidney Injury Causes



Intrinsic AKI

- > Acute tubular injury
 - ~ Prolonged pre-renal AKI
 - ~ Rhabdomyolysis
 - ~ Haemoglobinuria
 - ~ Nephrotoxins
 - ~ Iodinated contrast
 - ~ NSAIDs
 - ~ Gentamicin
- > Tubulointerstitial injury
- > Glomerulonephritis
- > Myeloma
- > Vasculitis
 - ~ Lupus
 - ~ ANCA associated

Pre-renal AKI

- > Sepsis
- > Hypovolaemia
 - ~ Haemorrhage
 - ~ Burns
 - ~ Vomiting/diarrhoea
 - ~ Diuretics
- > Hepatorenal syndrome
- > Cardiac failure
- > Hypotension
 - ~ Medications

Post-renal AKI

- > Kidney stones
- > Prostatic hypertrophy
- > Tumours
- > Retroperitoneal fibrosis

ANCA = antineutrophil cytoplasmic antibody;
NSAIDs = non-steroidal anti-inflammatory drugs

Etiology	Frequency, n (%)
Sepsis	56 (24.5)
Snake Bite	37 (16.2)
Acute Gastroenteritis	29 (12.6)
Cirrhosis	16 (7)
Congestive Cardiac Failure	12 (5.2)
Malaria	11 (4.7)
CV Stroke	10 (4.4)
Acute Respiratory Distress Syndrome	8 (3.5)
Sickle Cell Disease	7 (3.1)
Obstructive Uropathy	10 (4.4)
Dengue	7 (3.1)
Organophosphorus poisoning	6 (2.6)
Acute pancreatitis	5 (2.2)
Contrast - induced	4 (1.7)
Scrub Typhus	3 (1.3)
Hemolysis, Elevated Liver enzymes, Low Platelet count (HELLP)	3 (1.3)
Hemolytic Uremic Syndrome	2 (0.9)
Bee sting	2 (0.9)
Eclampsia	1 (0.4)

Source: Royal College of Physicians

[Indian J Crit Care Med.](#) 2018 Apr; 22(4): 231–237.
doi: [10.4103/ijccm.IJCCM_462_17](#)

AKI warning systems

- In March 2015, NHS England mandated that all NHS trusts in England must have biochemistry department laboratory systems that issue an AKI warning, based on rises in serum creatinine level, for patients in secondary care
- Each trust must determine how they communicate this AKI warning to clinicians caring for individual patients, eg e-alerts, AKI care bundles, AKI outreach teams
- Acute Kidney Outreach to Reduce Deterioration and Death (AKORDD) study, a large pilot study of AKI outreach



E-alert system

- “Electronic alerts” (“e-alerts”) are key interventions in patients with AKI to improve management of the patients.
- It is important for an early diagnosis of AKI via e-alerts to improve the diagnosis of AKI.
- Studies have shown that e-alerts can affect the behavior of clinicians, reduce the use of nephrotoxic drugs and improve the prognosis of AKI.
- An automated screening process that reports AKI has already been implemented throughout the NHS in England.
- It is driven by an algorithm based on the NICE clinical guideline CG169.
- NICE (National Institute for Healthcare Excellence) guideline [NG148], Published date: 18 December 2019

E-alert system

- The efficacy of an AKI alert is dependent on multiple inter-related factors as schematized in the conceptual model in Figure.
- Alerts are least effective when a provider is already aware of the clinical situation being alerted (endogenous recognition) or when the alert is not actionable (e.g., there are no alternative therapies available).
- Conversely, alerts may be most effective when providers are unaware of AKI (e.g., in situations where the creatinine is rising slowly) or when actionable steps are immediately evident.
- Several studies have shown the potential efficacy of alerts in the hospital setting.
- **Factors for e Alert success:** include the speed of the information system, timing of the alert (real time and STAT), minimal disruption of and integration into provider workflow, simplicity and clarity of the message, and provision of references and sufficient information within the alert.

AKI DEFINITION

AKI is defined as any of the following:

- **Increase in SCr by ≥ 0.3 mg/dl (≥ 26.5 μ mol/l) within 48 hours; or**
- **Increase in SCr to ≥ 1.5 times from the previous measurement, which is known or presumed to have occurred within the prior 7 days; or**
- **Urine volume <0.5 ml/kg/h for 6 hours**



STAGING OF AKI

- AKI is staged for severity according to the following criteria

Stage	Serum creatinine	Urine output
1	1.5–1.9 times baseline OR ≥ 0.3 mg/dl (≥ 26.5 μ mol/l) increase	< 0.5 ml/kg/h for 6–12 hours
2	2.0–2.9 times baseline	< 0.5 ml/kg/h for ≥ 12 hours
3	3.0 times baseline OR Increase in serum creatinine to ≥ 4.0 mg/dl (≥ 353.6 μ mol/l) OR Initiation of renal replacement therapy OR, In patients < 18 years, decrease in eGFR to < 35 ml/min per 1.73 m ²	< 0.3 ml/kg/h for ≥ 24 hours OR Anuria for ≥ 12 hours

- The cause of AKI should be determined whenever possible.

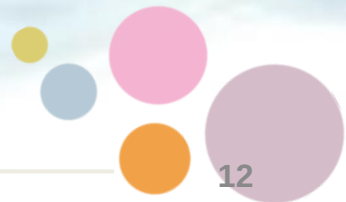


Every Blood Sample **TELLS A STORY**



E alerts for acute kidney injury: Our Study

- Period of study: 20 days
- Inclusion: All inpatients 18 years of age or older who develop AKI
- Exclusion: Patients with initiation of dialysis prior to AKI onset; end-stage kidney disease (ESKD) diagnosis code; initial serum creatinine ≥ 4.0 mg/dl; patients within 6 months of kidney transplant
- **Criteria for triggering E-Alert in our hospital set up:**
 - Following are the criteria for triggering an E-alert for AKI:
 - 1) 1.5X rise in serum creatinine from the lowest creatinine value in the last 7 days
 - 2) A 0.3 mg/dl rise in serum creatinine from the most recent creatinine value in the last 48 hours



PATIENT SAFETY ADVISORY AKI ALERT

Please rule out the possibility of ACUTE KIDNEY INJURY.

I] Relevant creatinine values over the last 7 days are listed below:

Most recent: ____ mg/dl

Lowest in last 7 days: ____ mg/dl

Highest in last 7 days: ____ mg/dl

II] Relevant creatinine values over the last 48 hours are listed below: Most recent:

____ mg/dl

Lowest in last 48 hours: ____ mg/dl

Highest in last 48 hours: ____ mg/dl

Note: Exclusion criteria for the above algorithm are:

i) If creatinine value level in the past was ≥ 4.0 mg/dl

ii) Patient has a history of dialysis

Options for AGREE or DISAGREE

In case the physician disagrees with the alert, an additional pop-up box to explain the reason of disagreement.

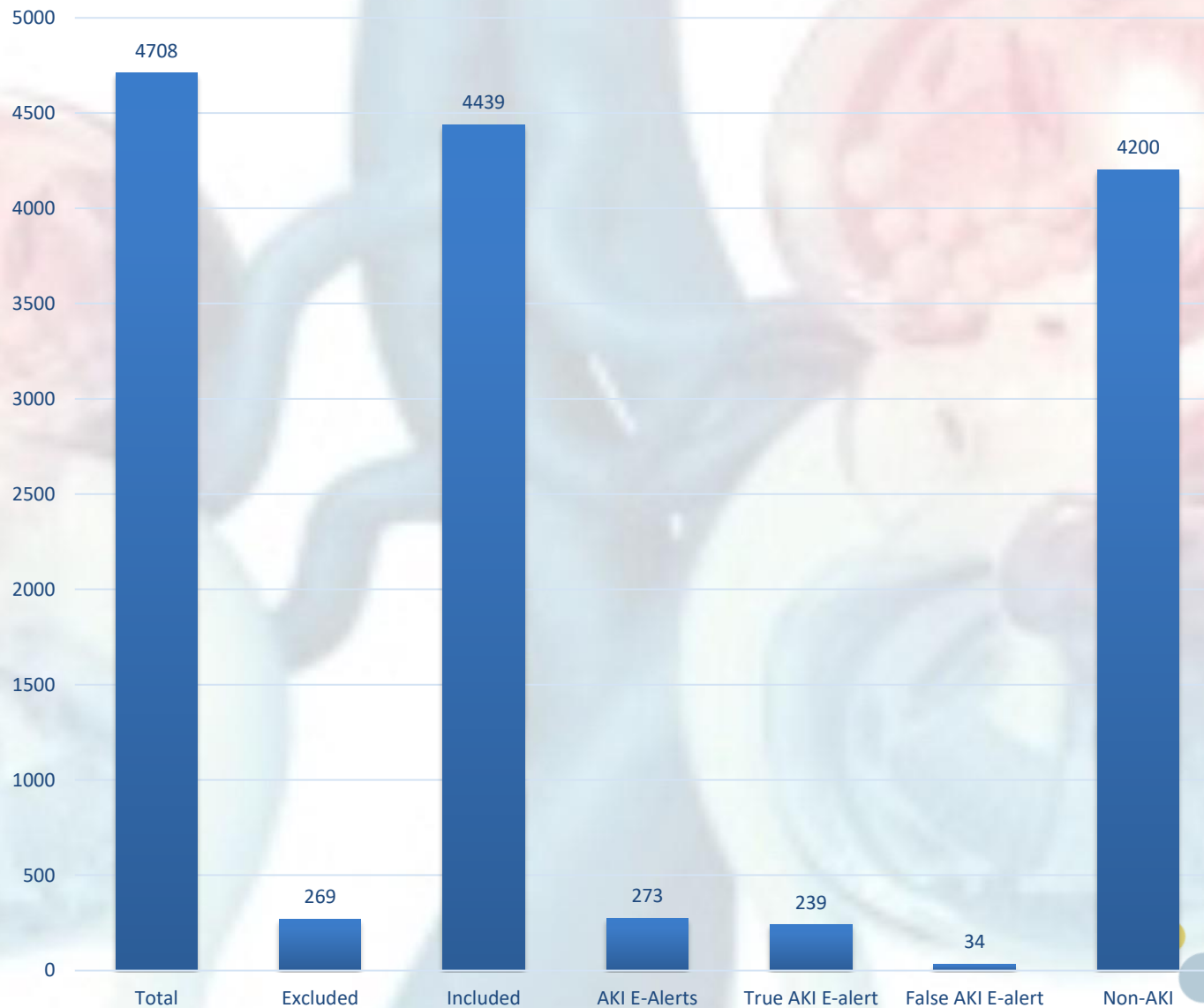
E alerts for acute kidney injury: Our Study

Total Patients	4708	
Excluded (Pediatric Patients)	269	
Included	4439	94.29%
AKI E-Alerts	273	6.15%
True AKI E-alerts	239	5.38%
False AKI E-alerts	34	
Total Non-AKI Patients	4200	94.62%

	AKI	No AKI	Total
E-Alert	239	34	273
No E-Alert	0	4166	4166
Total	239	4200	4439

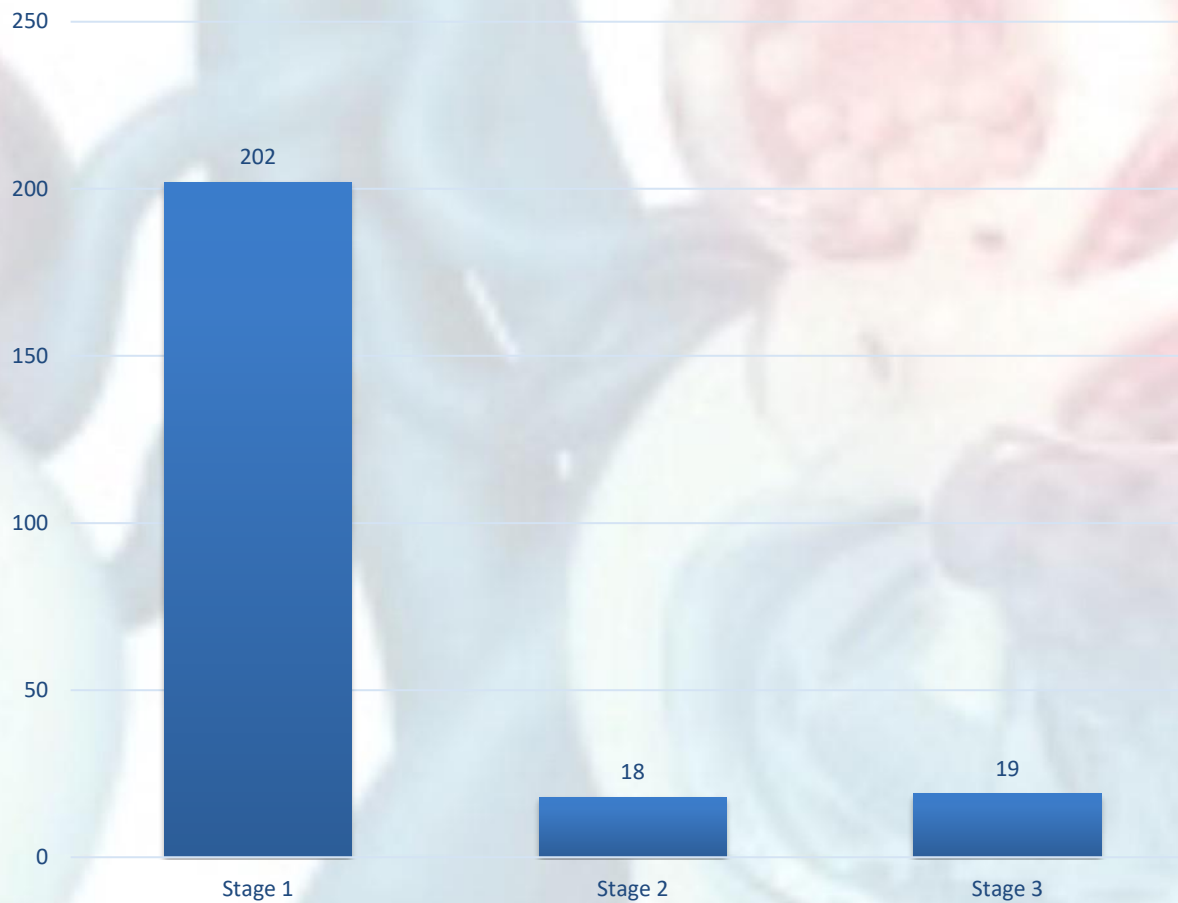
E alerts for acute kidney injury: Our Study

Analysis of all patients



E alerts for acute kidney injury: Our Study

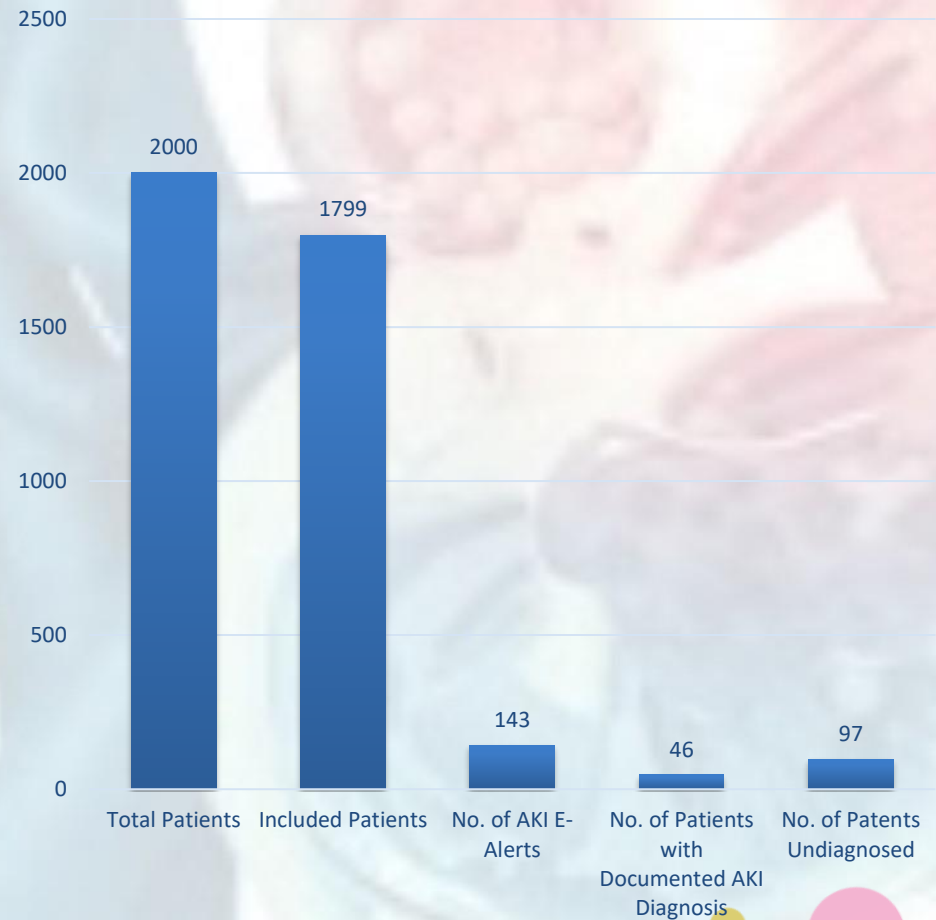
Stage-Wise AKI Patients

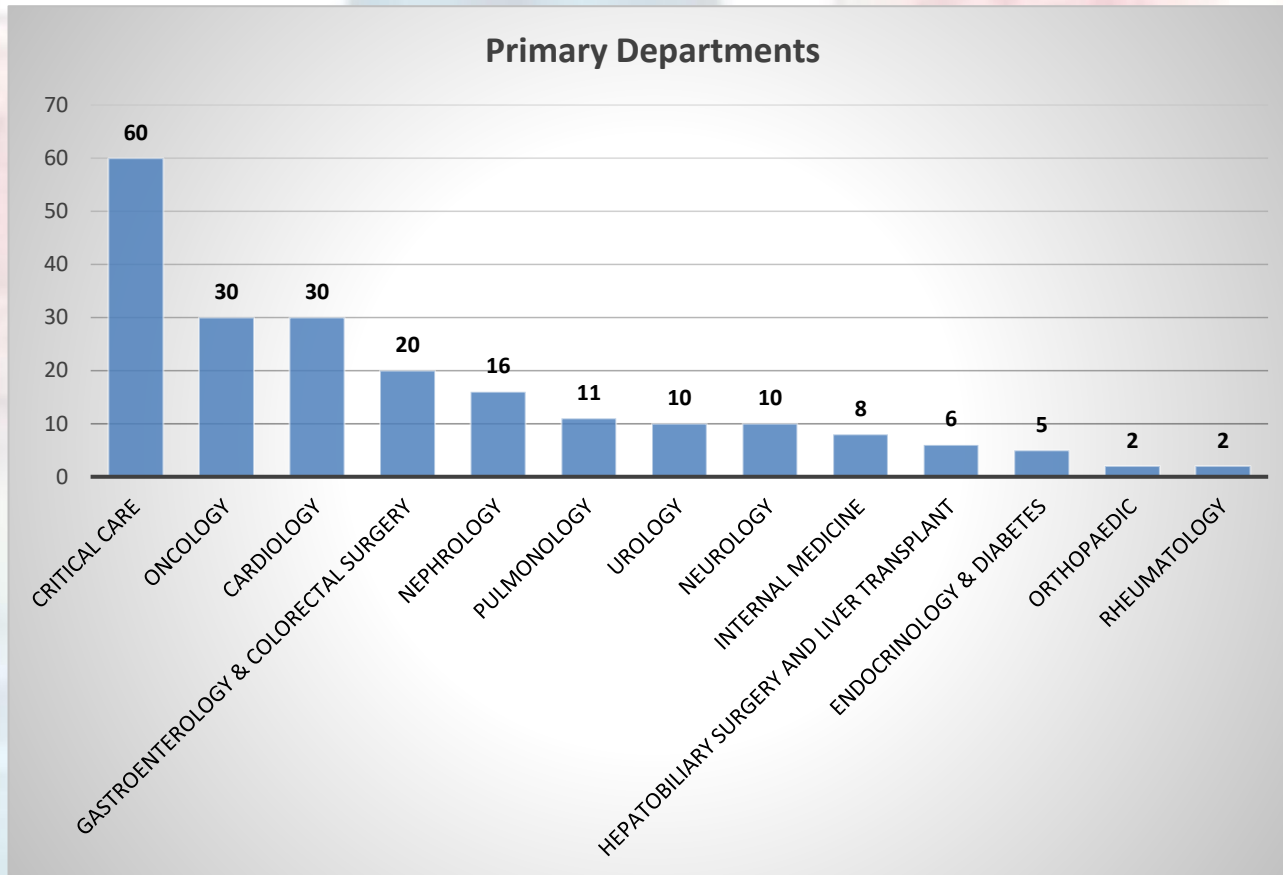


E alerts for acute kidney injury: Our Study

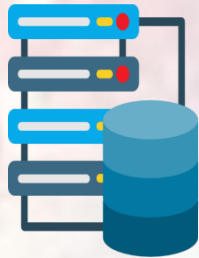
Total Patients	2000	
Included Patients	1799	89.95%
No. of AKI E-Alerts	143	7.95%
No. of Patients with Documented AKI Diagnosis By Clinicians	46	32.17%

Sub-group analysis for clinical validation of a randomized sample of 2000 patients





AKI Electronic Health Record (EHR) Advantages



Gets Data

EHR combines text
and numeric data
from available data
sources



Applies Rules

Rules developed by
subject matter experts



Delivers

1. Deliver high-quality care with patient-centric insights
2. Reduce variability through consistent, guideline-driven recommendations
3. Improve workflow and efficiency

AKI EHR: Benefits to your Hospital



Improve Revenues

Suggest Patient Specific Next Steps, Tests and Discharge Advice



Improve Quality

Standardized Treatment Protocols as per Local and International Guidelines

Repository of guideline-based recommendations available across multiple key stakeholders



Improve Patient Satisfaction

Provide patient specific interpretation and next steps

Improve standardized care by flagging patients, apply risk algorithms and provide better interpretation
Decrease Length of Stay and Economic Burden.

The Healer

