Acute kidney injury (AKI) is recognized globally as a major determinant of Chronic Kidney Disease (CKD) and cardiovascular mortality. Thus, care for patients with AKI is an area of improvement. Approximately one out of ten patients treated in the hospital develops AKI. In-hospital mortality for AKI range from 20 to 25%. In addition, AKI contributes to complications in the hospital with increased costs and length of stay. Long-term consequences of AKI can be severe and may cause fast progression of kidney function decline associated with substantially accelerated atherosclerosis.

Acute kidney injury, when detected early, can be treated effectively, avoiding short- and long-term complications. The Potsdam AKI-care Initiative implemented a hospital-wide electronic AKI alert based on increase of serum creatinine according to KDIGO-AKI practice guideline in patients during their hospital stay. Delta creatinine is determined using a computer based system in the Pathology Database. Treating physicians and nephrologists are informed about detected patients. Patients with an episode of AKI will receive nephrologist-optimized treatment recommendations. Also, patients will be educated about AKI and preventive measures including suggestions for medication intake/pause on sick days and ongoing medical follow-up.

Leveraging increases in serum creatinine as a screening tool for all patients admitted to the hospital has led to the identification of 4.5% of all hospitalized patients with previously undiagnosed AKI. This care program combines AKI detection at an earlier, actionable stage with implementation of targeted therapy and specialty consultations, in-hospital AKI documentation, and patient awareness to improve outcomes and achieve preservation or restoration of kidney health.

The Potsdam AKI Care Initiative is a group of Internists, Pathologists and Nephrologists/Hypertension specialists that lead high-quality research for effective treatment of patients with acute or chronic kidney disease to the highest standards of care. Their aim is system-wide awareness of kidney health including adherence to hospitalized care pathways, standardized management, reduced care variation and improved quality of care across the health system.
DISCOVERY
Systematic reviews as well as observational and interventional studies as part of this care initiative confirmed the following:

- IN-HOSPITAL AKI is common (incidence of 4-9%)
- Poor recognition leads to poor management
- Poor management leads to poor outcomes

Associated with:
- Doubled patient length of stay in hospital (median 15 days)
- Poor prognosis (in-hospital mortality rate of 15-23%)

Patients with unrecognized AKI

- 75% have complications
- 81% nephrotoxic medication
- 63% anti-hypertensive medication
- NOT PAUSED

HYPOTHESIS
Electronic AKI alerts combined with an AKI nephrologist-led response team armed with patient education about AKI accelerated detection and treatment pathway (ADTP) would improve detection and management of patients with AKI.

1. RECOGNITION
An alert system enabled by the laboratory would improve AKI detection rate. Alert is based on longitudinal analysis of serum creatinine levels in hospitalized patients using KDIGO practice guideline recommendations for AKI.

2. KIDNEY HEALTH MANAGEMENT
Personalized treatment plans from nephrology would preserve kidney function, prevent complications and improve AKI documentation in patient medical records.

FLAGGING A CLINICALLY SIGNIFICANT RISE WHEN DELTA CREATININE EXCEEDS:

- 26 µmol/L WITHIN 48 HOURS (ABSOLUTE CRITERIA)
- OR 50% RISE (1.5x) COMPARED TO THE BASELINE WITHIN 7 DAYS (RELATIVE CRITERIA)

PARTNERS
A multidisciplinary team is needed to achieve the integrated clinical care objectives of early AKI detection and implementation of sustained targeted therapy and specialty consultations. Critical stakeholders for the AKI alert included pathology, nephrology and hospital IT (Information Technologists). Sustained patient management also includes patient and family engagement via education and compliance.
SUCCESS FACTORS

- Serum creatinine is the preferred blood test for AKI diagnosis
- Hospital-wide electronic alerts can reliably detect relevant increases in serum creatinine that inform ward physicians and nephrologists about patients with risk for AKI
- Patient-specific care plans driven by nephrologist treatment recommendations within hours of the AKI alert can drive immediate care and improve outcomes
- Nephrology-directed and endorsed educational materials for patients and their families about their kidney health problems, risks and self-preventive measures is crucial for sustained success and improved health

EXECUTION

Based on routinely available serum creatinine concentrations and the prevalence of undetected disease at Ernst-von-Bergmann Hospital Potsdam, the number of patients that would need to be screened in order to detect one unknown case of AKI is 20 patients. With every department detecting similar proportions of patients with undetected AKI, the implementation of the eAlerts to earlier identify AKI risk was implemented across departments with hospital-wide value.

Importantly, displaying ‘AKI-diagnosis’ as part of the hospital pathology program as a first interventional step was not enough to drive change, demonstrating no initial improvement of AKI-stages or increase in nephrology consults. Thereafter, however, when the care initiative also included nephrology recommendations for treatment, outcomes improved.

DIAGNOSIS OF AKI IN THE HOSPITAL

An automated summary report of suspected AKI episodes from the same day was implemented into daily rounds, initiating immediate management and intervention if a patient’s pathology results were clinically correlated.

DAILY REPORTS INCLUDED:

1. AKI alerts grouped by the patient’s unit and bed location
2. Each patient’s:
   - Baseline creatinine concentration
   - Serum creatinine concentration meeting the AKI criteria
3. Explanation of the delta criteria for the flag with treatment recommendations

All patients meeting AKI criteria were flagged and clinically assessed to confirm diagnosis, allowing clinicians to more efficiently triage patients and initiate appropriate care.

FOLLOW-UP OF HOSPITALIZED PATIENTS

Information about AKI is included in the patients discharge report. A kidney health flyer is handed out to and discussed with the patient including recommendations for regular follow-up in the outpatient sector.

PROOF OF VALUE

Identification of AKI patient risk drives optimal treatment and patient pathways that guide care and accurate documentation. ATPD identified undetected disease, reduced complications and prevented decline of kidney function with most AKI patients.

<table>
<thead>
<tr>
<th>RATE OF UNKNOWN CAUSE OF AKI REDUCED BY 80%</th>
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<tbody>
<tr>
<td>25% 80% 5%</td>
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<tr>
<td>1 in every 4 patients 1 in every 20 patients</td>
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<table>
<thead>
<tr>
<th>IMPROVED AKI DOCUMENTATION AND CODING</th>
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<tbody>
<tr>
<td>2-FOLD increase in AKI documentation</td>
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<tr>
<td>3-FOLD increase in AKI coding post-AKI eAlert implementation</td>
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<table>
<thead>
<tr>
<th>AKI COMPLICATIONS REDUCED BY &gt;50%</th>
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<tr>
<td>4 in every 10 patients</td>
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<tr>
<td>1-2 in every 10 patients</td>
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<td>&gt;50%</td>
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1 in every 20 patients
SPOTLIGHT ON STAKEHOLDER SUCCESS

**PATIENT**

**IMPROVED PATIENT WELLNESS**

Patients with undetected AKI have increased in-hospital mortality vs. no AKI. The AKI-eAlert detected 4.5% of all hospital patients with previously undetected AKI, enabling improved treatment plans through nephrologist referral and patient-specific treatment recommendations.

**IMPROVED SAFETY**

100% of patients were educated about AKI and preventive measures as part of the program compared to <5% before the program started. AKI complications were reduced by ~50% from 4 in 10 patients with complications before ADTP compared to 1-2 per 10 patients with ADTP. ACE-/AT-inhibitors were paused or reduced in more than half of patients with ADTP compared to every fourth patient before ADTP.

**CLINICIAN**

**INCREASED CLINICIAN CONFIDENCE**

All departments with at-risk patients are a part of the Accelerated Detection and Treatment Protocols (ADTP).

During the pilot study, in-hospital adherence to ADTP was confirmed in approximately three quarters of patients with AKI, compared to approximately 15% of patients before ADTP, demonstrating reinforced clinical confidence in ADTP pathway.

“We believe that in-hospital kidney emergencies are reduced by ADTP.”

— Saban Elitok, MD, Medical Director, Department of Nephrology & Endocrinology, Ernst-von-Bergmann Hospital Potsdam

**IMPROVED SATISFACTION**

“Most of my non-nephrologist colleagues and Heads of Department at the Hospital really appreciate our nephrology service where we see their patients who have AKI and help to develop individualized care plan.”

— Saban Elitok, MD, Medical Director, Department of Nephrology & Endocrinology, Ernst-von-Bergmann Hospital Potsdam

“Patients with AKI are often anxious as they fear dialysis. It is meaningful to educate patients and their families on how they can avoid kidney function decline on their own.”

— Annemarie Albert, MD, Physician & Postdoc Research Fellow, Department of Nephrology, Ernst-von-Bergmann Hospital Potsdam

**HOSPITAL ADMINISTRATION**

**IMPROVED REIMBURSEMENT**

25% increase in documentation of AKI (from every fourth patient to more than half of patients with ADTP).

**IMPROVED DOCUMENTATION**

~3-fold increase in coded AKI after the AKI-eAlert was established.

**PAYOR**

**LOWER COSTS**

>50% reduction in AKI complications (from ~4 in every 10 patients to 1-2 per 10 patients with ADTP).

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