

# Kidney Disease and Remote Diagnostics

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# Outline

- Role of the kidneys
- Kidney disease
- Case study
- Lessons from the pandemic
- Opportunities for the future



# KIDNEYS

What is their  
role?



## Acute Kidney Injury

The NHS campaign to improve the care of people at risk of, or with, acute kidney injury

In the UK up to 100,000 deaths each year in hospital are associated with acute kidney injury. Up to 30% could be prevented with the right care and treatment

NCEPOD. Adding insult to injury, 2009



It is estimated that one in five people admitted to hospital each year as an emergency has acute kidney injury

Wang, et al. 2012



Just one in two people know their kidneys make urine

Ipsos MORI survey, July 2014



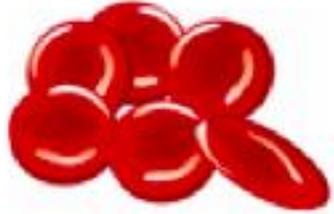
About 65% of acute kidney injury starts in the community

Selby, et al. 2012

Why we need to Think Kidneys



Kidneys are important to our wellbeing, looking after our bodies through the production of urine to get rid of excess water and toxins.



Regulation of red blood cell production



Regulation of blood pressure

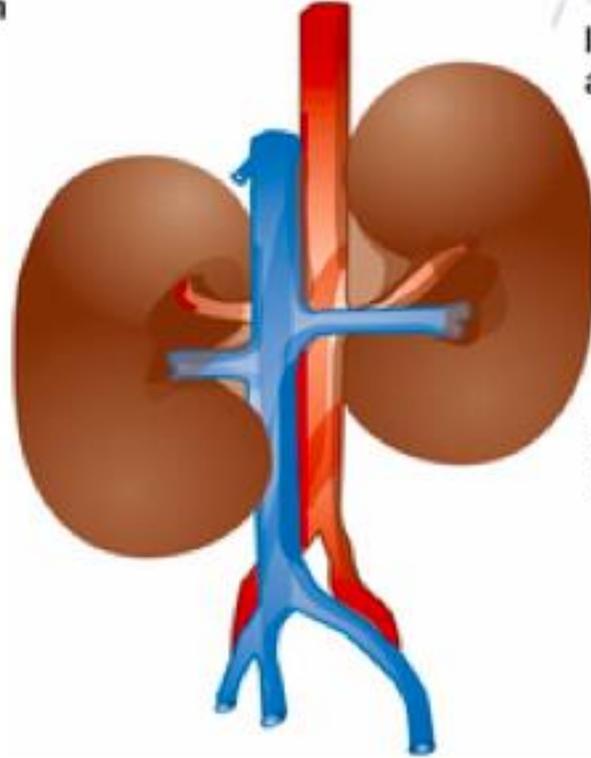


*pH-Balance*

Influence on blood pH  
acid-base-metabolism



Regulation of bone-mineral-metabolism



Excretion of metabolic waste products and water

Every minute

**1200** ml  
of blood enters  
both kidneys

**20%**

of the total blood pumped by the heart

In one day

**180 L**  
of water filtered by  
kidneys

**1.5-2 Litre of  
urine**

# Kidney Disease

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[Kidneys: The Facts](#)

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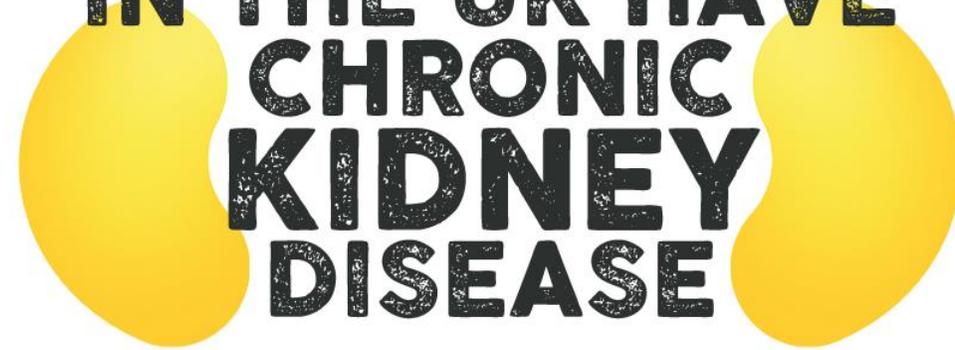


# World Kidney Day



Thursday 11 March 2021

**3 MILLION PEOPLE  
IN THE UK HAVE  
CHRONIC  
KIDNEY  
DISEASE**



**IN 2019 FIVE PEOPLE  
DIED EVERY WEEK WAITING  
FOR A KIDNEY TRANSPLANT**





**THE AVERAGE WAIT  
FOR A KIDNEY IS**

**3 YEARS**

# International Society of Nephrology

([www.theisn.org](http://www.theisn.org))

- **850 M** people have kidney disease globally
- Kidney disease is the **3<sup>rd</sup> fastest growing** cause of death globally
- Projected to be the **5<sup>th</sup> ranked cause of death** globally by 2040 (16<sup>th</sup> currently)
- **1.7 M die** from acute kidney injury globally/year
- **3 M** people on dialysis
- **3-7 M** people with kidney failure die without dialysis/year



# NIHR Leeds MIC Case Study

# Point of Care Creatinine Testing: CT Imaging Pathway Implementation



Contents lists available at [ScienceDirect](#)

European Journal of Radiology

journal homepage: [www.elsevier.com/locate/ejrad](http://www.elsevier.com/locate/ejrad)



Research article

Point of care creatinine testing in diagnostic imaging: A feasibility study within the outpatient computed tomography setting



Beverly Snaith<sup>a,b,\*</sup>, Martine A. Harris<sup>a</sup>, Bethany Shinkins<sup>c</sup>, Michael Messenger<sup>c</sup>, Andrew Lewington<sup>d</sup>, Marieke Jordaan<sup>a</sup>, Nicholas Spencer<sup>a</sup>

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## ARTICLE INFO

### Keywords:

Computed tomography

Contrast media

Point of care

Creatinine

Patient safety

## ABSTRACT

**Introduction:** Although the risks associated with iodinated contrast administration are acknowledged to be very low, screening of kidney function prior to administration is still standard practice in many hospitals. This study has evaluated the feasibility of implementing a screening form in conjunction with point of care (PoC) creatinine testing as a method to manage the risks of post contrast acute kidney injury (PC-AKI) within the CT imaging pathway.

# Point of Care Creatinine Testing: CT Imaging Pathway Implementation

DE GRUYTER

Clin Chem Lab Med 2018; 56(8): 1269–1276

Beverly Snaith\*, Martine A. Harris, Bethany Shinkins, Marieke Jordaan, Michael Messenger and Andrew Lewington

**Point-of-care creatinine testing for kidney function measurement prior to contrast-enhanced diagnostic imaging: evaluation of the performance of three systems for clinical utility**

**Nova - StatSensor**



**Radiometer - ABL800 FLEX**



**Abbott - i-STAT**



# Case Study



[Home](#) > [NICE Guidance](#) > [NICE Advice](#) > [Medtech innovation briefings](#)

## Point-of-care creatinine tests before contrast-enhanced imaging

Medtech innovation briefing [MIB136] Published date: January 2018

### Advice

This advice has been replaced by [NICE diagnostics guidance 37](#).

# Case Study



Home > NICE Guidance > Conditions and diseases > Kidney conditions > Acute kidney injury

## Point-of-care creatinine devices to assess kidney function before CT imaging with intravenous contrast

Diagnostics guidance [DG37] Published date: November 2019 [Register as a stakeholder](#)

[Evidence-based recommendations](#) on point-of-care creatinine devices to assess kidney function before CT imaging with intravenous contrast. The tests are ABL800 FLEX, i-STAT Alinity and StatSensor, ABL90 FLEX PLUS, Dri chem NX500, epoc Blood Analysis System, and Piccolo Xpress.

# Case Study

## 1 Recommendations

- 1.1 Point-of-care creatinine devices ABL800 FLEX, i-STAT Alinity and StatSensor, which calculate estimated glomerular filtration rate (eGFR), are recommended to assess kidney function to guide decisions on whether to use intravenous contrast during an outpatient CT scan in adults. They should only be used when current practice is that a recent eGFR result must be available before a person has a CT scan with intravenous contrast and if all the following apply:
- a person presents for a CT scan without a recent eGFR result
  - the person has risk factors for acute kidney injury
  - clear governance structures for point-of-care testing are in place.

# Lessons From The Pandemic

# Covid-19 and Kidney Disease

- Patients with kidney disease lives changed in many ways
  - more vulnerable to infection
  - high risk of complications and death
- Patients on dialysis
  - attend hospital based dialysis units
- Patients with kidney disease on immunosuppression
  - shielding since the beginning of the pandemic
  - less protection from vaccination
  - still need to have regular blood tests and medical reviews

[nature](#) > [nature reviews nephrology](#) > [comment](#) > article

Comment | [Published: 27 September 2021](#)

# COVID-19 vaccination in kidney transplant recipients

[Sophie Caillard](#)  & [Olivier Thaunat](#) 

[Nature Reviews Nephrology](#) 17, 785–787 (2021) | [Cite this article](#)

**Kidney transplant recipients receive therapeutic immunosuppression that impairs their immune responses to the COVID-19 mRNA vaccine. For this reason, this vulnerable patient population is insufficiently protected by the standard two-dose COVID-19 vaccination programme and requires a specific follow-up to guide personalization of an intensified vaccination approach.**

# Home Care Delivery and Remote Patient Monitoring of Kidney Transplant Recipients During COVID-19 Pandemic

Jae-Hyung Chang, MD<sup>1</sup> , Sharlinee Sritharan, MSN, AGPCNP<sup>1</sup>, Kevin Schmitt, MS<sup>2</sup>, Shefali Patel, MSN, NP<sup>1</sup>, R. John Crew, MD<sup>1</sup>, and Demetra S. Tsapepas, PharmD<sup>2</sup>

Progress in Transplantation  
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CKJ REVIEW

# Point-of-care testing technologies for the home in chronic kidney disease: a narrative review

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ELSEVIER

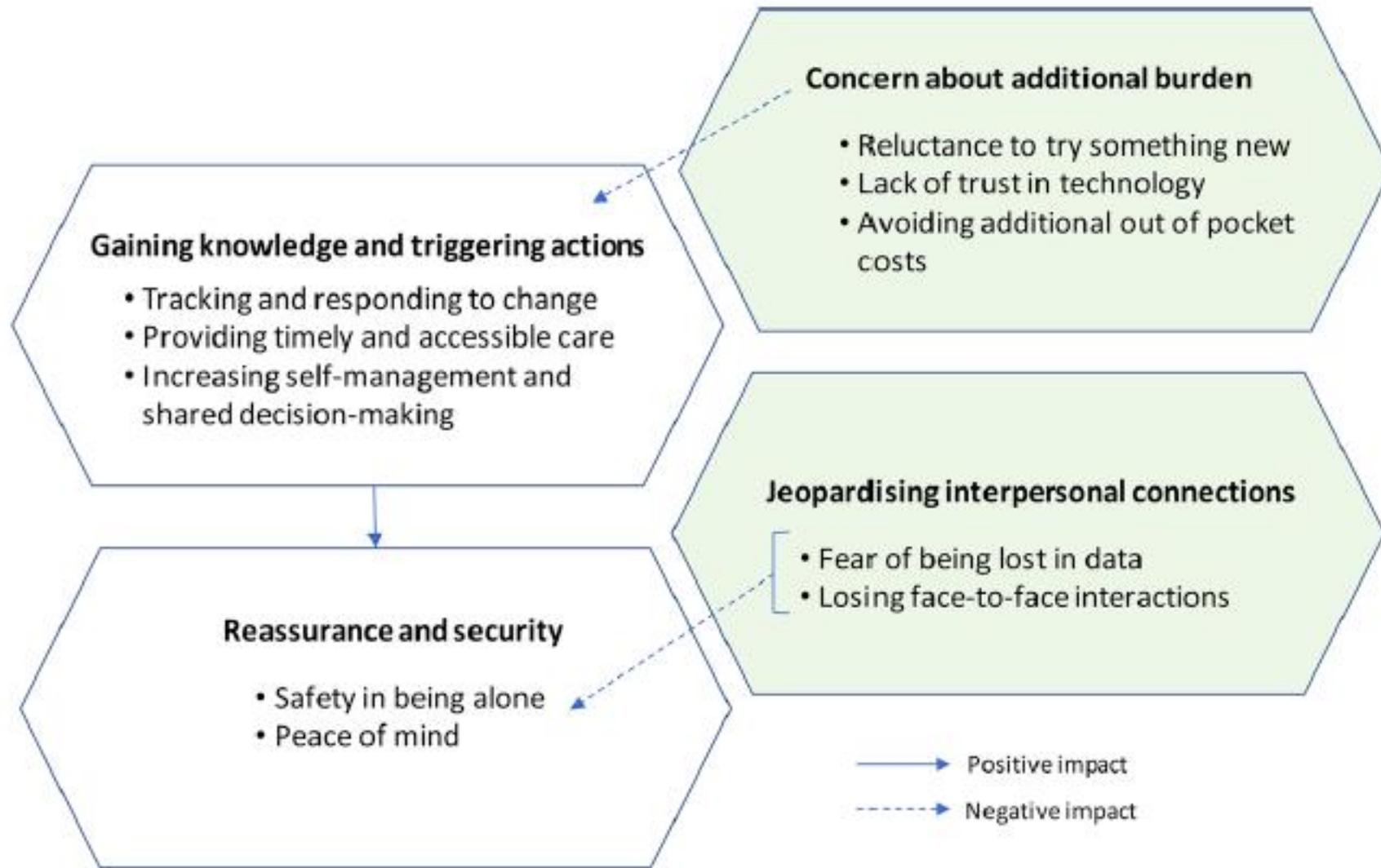
Contents lists available at [ScienceDirect](#)

## International Journal of Medical Informatics

journal homepage: [www.elsevier.com/locate/ijmedinf](http://www.elsevier.com/locate/ijmedinf)

Patient expectations and experiences of remote monitoring for chronic diseases: Systematic review and thematic synthesis of qualitative studies

Rachael C. Walker<sup>a,\*</sup>, Allison Tong<sup>b,c</sup>, Kirsten Howard<sup>c</sup>, Suetonia C. Palmer<sup>d,e</sup>



# Conclusions

- For patients with chronic disease, remote monitoring
  - increased their disease-specific knowledge,
  - triggered earlier clinical assessment and treatment
  - improved self-management and shared decision-making
- However, these potential benefits were balanced against
  - concerns about losing interpersonal contact
  - and the additional personal responsibility of remote monitoring

# Kidney Transplant Unit in Leeds

- Largest kidney only transplant centre - regional
- 200 transplants/yr
- 1100 kidney transplant out-patients
- Adaption to the pandemic
  - Suspended programme for 50 days – 140 transplants – covid secure environment
  - Telephone consultations were widely adopted, and were found to be accepted by patients
- Blood tests
  - Weekly for first 3 months extending to 3 monthly
  - Local hospital/GP – increased risk

# Kidney Transplant Project

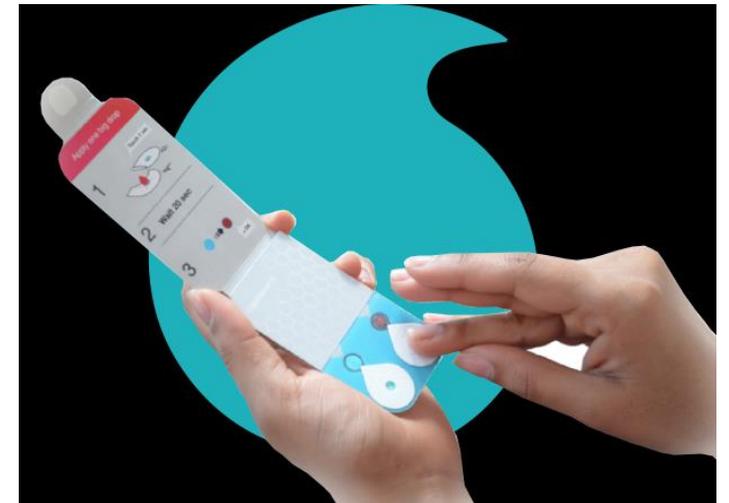
- Remote Tacrolimus and Creatinine sampling:
  - Using a lancet and capillary blood micro-sampler
  - Patient provides samples at home
  - Samples are sent by post to the clinical laboratories
- Potential benefits:
  - Removes risk of exposure from 'high risk' infection locations
  - Provides safe environment
    - blood tests can be missed due to mental health conditions, fear of needles and fear of contamination
  - Provides a choice
  - Reduces cost in terms of patient time and travel expenses
    - reducing health inequalities
  - Reduces phlebotomy staff costs
  - Increases the chance of receiving timely samples (no delays due to illness or isolating)

# Kidney Transplant Project

- ***‘Bringing it Home: validation of a microsampling tip method for measuring tacrolimus and creatinine remotely’***
  - £5K, Kidney Research Yorkshire
- Pilot in a small number of paediatric patients (Wythenshawe Hospital laboratory)
- Leeds Teaching Hospitals NHS Trust Laboratory now aim to see if we can measure creatinine and tacrolimus accurately and reliably using this method (technical and clinical validity testing)
  - Our results from will provide data for a larger grant application to assess if this approach is clinically effective, cost effective and acceptable to patients

# Technology

- Mitra ® at home specimen collection kits
- Capitainer qDBS blood collection device for microsampling with predefined blood volume
- This study provides the first step to improving patient engagement and empowerment with self-management
- Ultimately, we hope this method will be adopted in the NHS for transplant patients
- Additional value in multiple other disease areas and for vulnerable patients
  - E.g. Giant cell arteritis, multiple myeloma, mental health conditions



# Mental Health Illness and Remote Diagnostics

- Depression, anxiety and other mental health issues are **common** among people living with kidney disease
- People with severe mental illnesses have a **life expectancy 15–20 years below** the general population
- This **mortality gap** is mainly caused by comorbid physical illness and additional risk through the effects of antipsychotic medication, chronic stress, unhealthy lifestyle diagnostic overshadowing and symptom misattribution
- For some mental health conditions, NICE guidelines recommend an annual health check, but completion is poor: **32.3% of patients with SMI receive a full check**, with blood tests the most commonly missed component
- **Barriers** include difficulties communicating, ‘navigating the system’ and symptoms of mental illness exacerbating fear of attending appointments
- This results in **unequal access to healthcare**, delayed diagnosis and poorer health outcomes

# Mental Health Illness Project

- **An investigation into the use of remote blood sample collection to reduce health inequalities in patients with mental health disorders**
  - NIHR, £122,689
- Collaboration with **YH AHSN** and **Leeds and York Mental Health Trust**
- **Aim:** quantitatively and qualitatively evaluate the impact of capillary blood sampling as a surrogate for venous blood sampling
- to determine if remote sampling could
  - *increase disease-modifying anti-rheumatic drug (DMARD), including glucocorticoid, monitoring rates in patients with immune-mediated inflammatory diseases (IMID) with co-existent mental health conditions and reduce inequality in health care access*

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