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Clinical Information Network

CIN INSIGHTS BRIEF 5, FEBRUARY 2025

Health system influences and interventions: Uncovering barriers and supporting improvements in hospital care

Key points

- Research conducted by the Clinical Information Network (CIN) has identified important health system challenges in Kenyan hospitals, including workforce shortages, inconsistent use of essential technologies, and resource constraints that affect the quality of paediatric and neonatal care.
- A significant proportion of paediatric admissions are managed by preregistration clinicians with limited experience, emphasising the need for training, mentorship and tools, such as the Paediatric Admission Record, to support the admission process.
- CIN has implemented several health system interventions to strengthen hospital care, including enhanced audit and feedback, standardised monitoring tools and a network approach as an inter-professional, cross-site relational intervention.
- Research has demonstrated the potential of these interventions to improve monitoring, documentation, and adherence to clinical guidelines, contributing to efforts aimed at strengthening hospital systems and improving care for children and newborns.

ABOUT THIS SERIES

This is **Brief 5** in a series exploring the evolution, implementation, and impact of the Clinical Information Network (CIN) in Kenya. Each brief focuses on a distinct aspect of CIN's work.

Laying the foundations for better care: Developing tools, guidelines, and information architecture to support learning and improvement in Kenya's hospitals

A theory-informed approach: Applying theoretical frameworks to guide the development of CIN and its interventions

Transforming care in Kenyan hospitals: Showcasing CIN's progress in improving care processes and outcomes

Assessing quality of care at scale: Demonstrating research contributions, including validating tools, evaluating guidelines, clinical trials

System influences and interventions: Presenting research on health system barriers and system interventions to improve care

Exploring behavioural and organisational dynamics: Investigating the human and organisational factors shaping care practices

Introduction

Hospitals in Kenya face significant health system challenges that hinder their ability to provide even the most basic services for children and newborns. Chronic resource shortages – including insufficient or broken equipment, a lack of essential diagnostics such as pulse oximeters and blood culture facilities, and limited capacity to accommodate high-risk patients – place immense strain on hospitals. Moreover, many clinicians lack the experience and training needed to manage critically ill children effectively, a problem further compounded by understaffing and limited opportunities for mentorship and skill development.

The CIN – a collaboration between hospitals, researchers, national organisations, and policymakers – promotes improvements in basic hospital services through the enhanced use of information in decision making and uptake of effective practices and technologies. CIN has also supported a broad range of locally-relevant research, including several studies that examine how health system factors impact the quality and implementation of care practices.

This brief focuses on CIN research on these challenges, offering insights into the constraints within health systems and their implications for newborn and child care. Observational studies supported by qualitative insights have detailed these constraints, while randomised controlled trials (RCTs) and time-series analyses have assessed the effectiveness of health system interventions to improve neonatal and paediatric care.

System insights

This section highlights CIN research examining the health system challenges faced by county hospitals in Kenya, including workforce capacity issues and the limited adoption of technologies that impact the quality of paediatric and neonatal care. The studies span the entire continuum of care, from admission and treatment to discharge and follow-up.

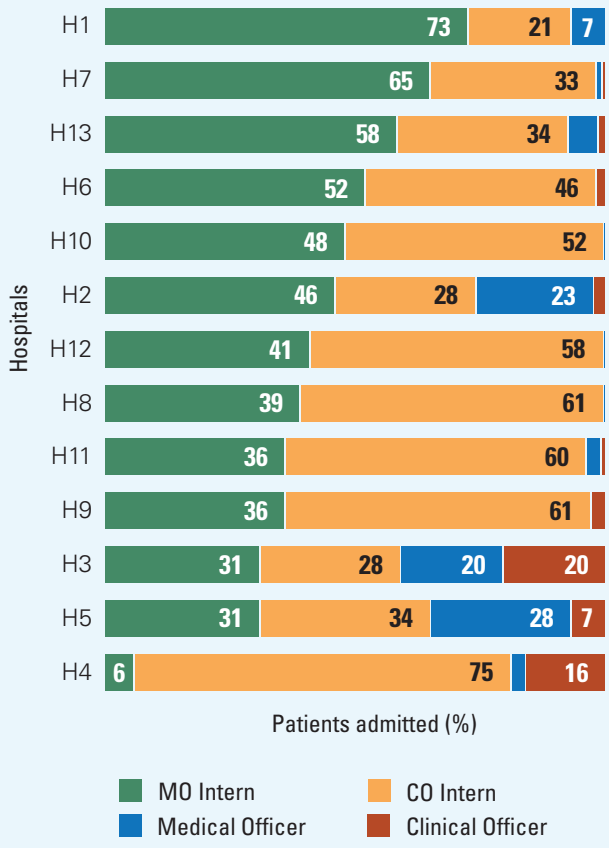
Who delivers paediatric admission care in Kenyan hospitals?

Understanding who provides care to children and newborns at the point of admission and their adherence to clinical guidelines is critical for improving the quality of paediatric care, particularly given the high proportion of deaths that occur within the first 24-48 hours after admission. Research conducted across 13 hospitals in Kenya investigated how often preregistration clinicians – medical officer interns (MOIs) and clinical officer interns (COIs) (a cadre of mid-level health care providers distinct from physicians) – provided admission care compared to fully registered clinicians.[1] It also assessed the quality of care delivered using a cumulative correctness of Paediatric Admission Quality of Care (cPAQC) score (see box 1).

The research found that relatively junior, preregistration clinicians were responsible for more than 85% of admissions (see figure 1). While clinical assessments were well-documented, full adherence to guidelines was low, with only 12% of malaria cases meeting all key steps. Similar results were observed for pneumonia and dehydration, where the main challenge was accurately classifying illness severity. This frequently led to overdiagnosis and unnecessary treatments.

Despite these gaps, most children received first-line treatments, with MOIs showing slightly better adherence to guidelines compared to COIs. However, performance remained largely unchanged during paediatric rotations, demonstrating the need for stronger supervision and mentorship to support adherence to clinical guidelines.

Figure 1 **Patients admitted by clinicians of various cadres across hospitals**



Source: Adapted from Ayieko et al, 2011[2]

Bars without values represent cadres whose admissions were <4% in a given hospital.

Box 1 **Paediatric Admission Quality of Care (PAQC) score**

The Paediatric Admission Quality of Care (PAQC) score was developed by researchers within the CIN to measure the quality of paediatric admission care. It was designed as a tool to assess adherence to clinical guidelines for common conditions such as malaria, pneumonia, and diarrhoea with dehydration, where early intervention is vital to reducing mortality.

The score evaluates six key steps in admission care, including clinical assessment, severity classification, and treatment. A validation study confirmed that the PAQC score serves as a useful summary measure of quality of care for these three major diseases.[3] Higher PAQC scores are strongly associated with improved clinical outcomes, including reductions in inpatient mortality (see Brief 4).

The tool has been applied across hospitals in CIN to compare care quality, monitor changes over time (as shown in Brief 3, where it was used to assess improvements in care for children admitted with diarrhoea and dehydration), and evaluate care provided by preregistration clinicians.

Key publications

The Paediatric Admission Quality of Care score: designing a tool to measure the quality of early inpatient paediatric care in a low-income setting. (Opondo C, et al. 2016)[2]

Describes the process of developing a clinically logical summative measure of the quality of care provided to children admitted to hospital in Kenya.

Association of the Paediatric Admission Quality of Care score with mortality in Kenyan hospitals: a validation study (Opondo C, et al. 2016)[3]

Validates the PAQC score by demonstrating its association with reduced inpatient mortality.

Examining which clinicians provide admission hospital care in a high mortality setting and their adherence to guidelines: an observational study in 13 hospitals (Ogero M, et al, 2019)[1]

Applies the PAQC score to assess the quality of admission care provided by preregistration clinicians (MOIs and COIs) in Kenyan hospitals

Magnitude and pattern of improvement in processes of care for hospitalised children with diarrhoea and dehydration in Kenyan hospitals participating in a clinical network (Akech S, et al. 2019)[4]

Uses the PAQC score to track improvements in adherence to WHO guidelines for diarrhoea and dehydration care within the CIN.

Identifying factors that affect the uptake of low-cost technologies

Pulse oximeters, a low-cost technology used to detect low oxygen levels in the blood, are not consistently used in Kenyan hospitals. Research conducted between 2013 and 2016, analysing over 27,000 paediatric admissions and interviews with 30 health care workers, found that pulse oximeters were more likely to be used when children exhibited severe symptoms, when structured admission records like the Paediatric Admission Record (PAR) prompted their use, or when hospital leadership actively supported their integration into care.[5]

However, health care workers identified several barriers to their use. Key factors preventing appropriate use include inadequate supply, delays in repairing broken equipment, and insufficient training on when, how, and why to use pulse oximeters and how to interpret their results. Variations in usage between hospitals were largely influenced by differences in leadership support, resource availability, and repair delays. Feedback from the CIN also helped increase usage over time.

These findings highlight significant health system weaknesses, such as fragmented procurement processes and insufficient training, which hinder the integration of pulse oximetry into routine care. Addressing these areas – through better resource management, improved staff training, and stronger leadership engagement – is essential for ensuring pulse oximeters are effectively used to enhance diagnosis, treatment, and health outcomes for children.

Hospital Capacity for Critical Illness During COVID-19

The COVID-19 pandemic exposed significant gaps in the capacity of hospitals to care for critically ill patients, especially in low and middle-income countries. Research conducted in Kenya and Tanzania evaluated hospitals' readiness to provide Essential Emergency and Critical Care (EECC), a set of basic but critical interventions designed to improve outcomes for severely ill patients in all areas of a hospital.[6]

The study found that resources like oxygen, though available, were often unreliable or non-functional – mirroring the issues observed with pulse oximeters. Care processes, including triage and monitoring, were often unstructured or entirely absent, limiting the effective use of these resources. Health workforce challenges further exacerbated the situation, with severe staffing shortages and some nurses managing over 20 patients at a time. Additionally, most admission care was provided by very junior clinicians who lacked the experience to handle severe illnesses, reflecting similar circumstances seen in paediatric admissions, where junior clinicians were responsible for critical care decisions.

Interviews and observations tracking patient journeys revealed frequent delays in care transitions and poor interdepartmental coordination. These findings reinforce the need for a whole-system approach, viewing EECC as a continuous and integrated process that spans the entire hospital. Strengthening hospital systems requires reliable provision of essential resources (such as oxygen and pulse oximeters), improved care pathways, and enhanced resource management to build resilience and preparedness for future health crises.

Post-discharge follow-up needs for sick newborns

Advances in neonatal care have led to increased survival rates among small and sick newborns in Kenya, but effective post-discharge follow-up care is essential to ensure optimal long-term health and developmental outcomes. A retrospective study across 23 hospitals examined the post-discharge needs of newborn unit survivors to identify the scale and scope of follow-up care required. The study found that nearly half of the 136,249 newborns discharged between 2018 and 2023 required at least one follow-up service, with many needing multiple interventions including general paediatrics, nutrition, auditory screening, and ophthalmology care.[7]

However, follow-up services remain limited in Kenya due to insufficient infrastructure, a lack of trained personnel, and inadequate frameworks for long-term holistic care. These findings underscore the need for integrated and resource-sensitive follow-up services within neonatal care systems to address these gaps and support newborns' long-term health. This study exemplifies how CIN data is being used to identify areas for strategic planning in health service development.

System interventions

This section highlights system-level interventions within the CIN designed to enhance the quality of care for newborns and children (see Brief 2 for more information about these interventions). Below are insights into the interventions including their effects on care practices and the health system challenges they revealed.

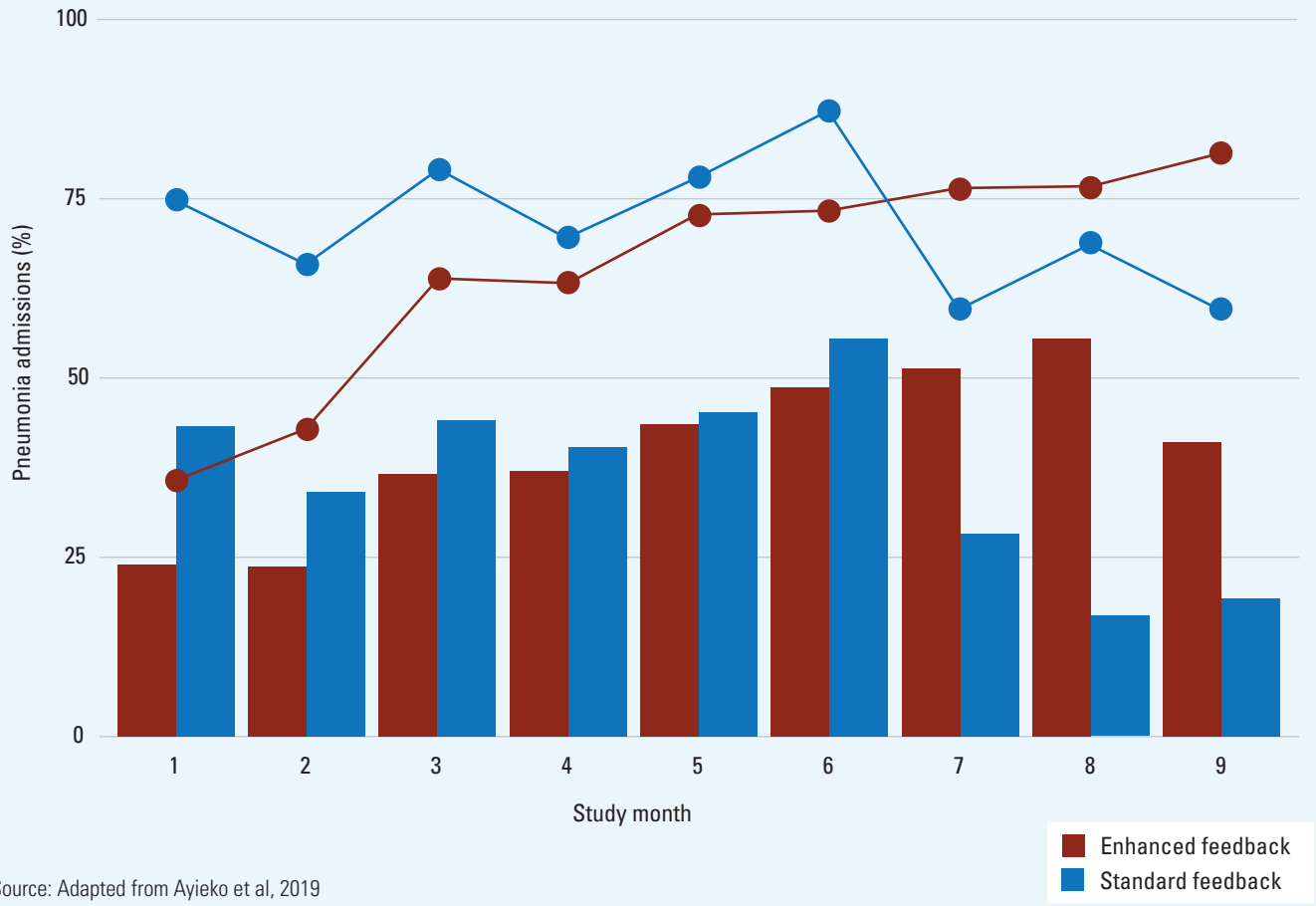
Enhanced audit and feedback (A&F) for pneumonia guidelines

Pneumonia remains a leading cause of childhood mortality in Kenya. In response to updated pneumonia guidelines introduced in 2016, a cluster-randomised trial evaluated whether enhanced A&F could accelerate guideline adoption.[8] A&F, a core component of CIN interventions, involves collecting and analysing routine clinical data, generating tailored performance reports, and sharing actionable feedback with hospital teams to promote reflection and improvement.

The trial tested enhanced A&F in 12 hospitals involving over 3,500 child pneumonia admissions. The enhanced A&F package included increased feedback frequency, clear messaging aligned with treatment goals, and outreach from senior paediatricians. Despite these measures, the intervention did not significantly improve overall adherence to pneumonia treatment guidelines compared to standard feedback. However, enhanced A&F appeared to promote more sustained improvements over time, suggesting a potential cumulative effect of repeated feedback cycles (see figure 2).

The research also highlighted broader health system challenges affecting all hospitals including high staff turnover and gaps in clinical training. These issues disrupted the continuity of care and hindered the consistent adoption of new guidelines, underscoring the need to address systemic barriers to enable sustained improvements in clinical practice.

Figure 2 **Correct classification and treatment of childhood pneumonia admissions according to duration of intervention and type of feedback intervention (enhanced or standard)**



Source: Adapted from Ayieko et al, 2019

Tuberculosis case detection in children

Tuberculosis (TB) remains a significant health challenge in Kenya, with many childhood cases going undiagnosed due to inconsistent diagnostic practices. Previous CIN research, conducted between 2015 and 2018 in 13 hospitals, revealed that while over half of more than 42,000 paediatric admissions exhibited symptoms suggestive of TB, less than 3% were diagnosed with the disease. Diagnostic investigations were inconsistently applied, and available tools were often underutilised (see Brief 4 for more details).[9]

To address these gaps, researchers collaborated with 14 hospitals to design a contextually appropriate, theory-informed intervention, guided by a Behaviour Change Wheel framework.[10] This approach recognises that individual and collective change is essential for implementing new practices and improving health outcomes.

The resulting multi-faceted intervention package included:

- Redesigned TB training for health care workers.
- Selection of local champions to support and advocate for the intervention.
- Use of audit and feedback linked to group problem-solving sessions.
- Workflow restructuring with clearly specified roles and responsibilities.

Intervention components were chosen for their effectiveness, affordability, acceptability, and practicality, ensuring they could be implemented by TB programme officers and hospital managers alongside their daily duties.

The intervention offers a roadmap for improving TB detection and care in resource-constrained settings and demonstrates the CIN's role in developing solutions to health system challenges.

Comprehensive Newborn Monitoring Chart

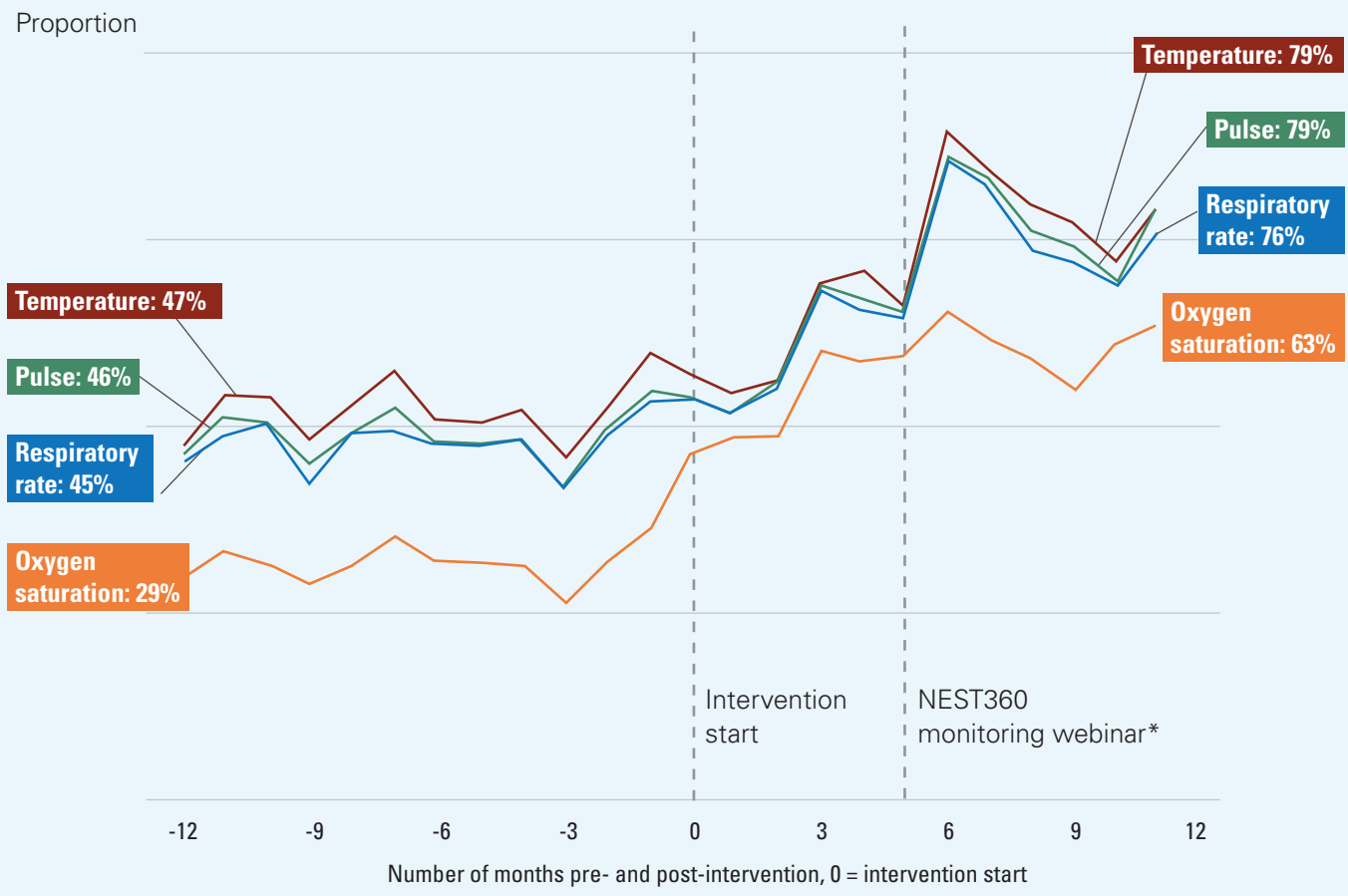
Accurate and consistent monitoring of newborns is critical to reducing complications, yet hospitals often face challenges such as fragmented documentation and duplication of effort. To address these challenges, 19 hospitals and a research team within the CIN collaborated to develop a standardised newborn monitoring chart.[11] By consolidating vital sign tracking, feed and fluid monitoring, and shift notes into one integrated tool, the chart streamlines documentation processes and replaces multiple separate recording tools. Due to COVID-19 restrictions, the chart was launched virtually in July 2020, with subsequent learning sessions held online for nurses and health care staff to support its implementation.

A qualitative study involving interviews and focus group discussions found the chart was well received by nurses, paediatricians, and data clerks.[12] Health workers highlighted benefits such as reduced writing, consolidated information, and improved communication. However, challenges such as inconsistent chart supply and inadequate equipment limited its effectiveness.

A quantitative evaluation used interrupted time series analysis to examine the impact of the chart on the documentation of vital signs before after its introduction.[13] The study analysed data from 34,986 newborn admissions across 16 hospitals over two years (September 2019 to October 2021). Results showed an increase in vital sign documentation with incomplete sets reducing from 50% to 37% (see figure 3). While the chart improved documentation practices, health system issues like poor nurse-to-baby ratios and inconsistent implementation processes continued to hinder universal uptake.

These findings demonstrate the chart's potential to improve care practices but emphasise the need to improve staffing ratios, improve chart supply systems, and provide sustained mentorship to achieve lasting improvements.

Figure 3 **Documentation of individual vital signs over time for 19 hospitals**



Source: Muinga et al, 2023

*The NEST360 program, which supports newborn care through training and equipment, held a webinar on April 29, 2021, to improve newborn monitoring and documentation. It was open to all health workers, including those outside the CIN-N network.

Conclusion

CIN has employed diverse research methods to uncover health system factors that hinder the quality of care and impact health outcomes for children and newborns, including resource shortages, fragmented documentation systems, and challenges in workforce capacity.

The network has also implemented and evaluated a range of system-level interventions, such as enhanced A&F and the development of standardised newborn monitoring tools, demonstrating their potential to improve care quality when systemic barriers are addressed. However, workforce shortages and the reliance on very junior clinicians to make critical decisions present significant challenges in providing care for complex, severe illnesses – a recurring issue in everyday paediatric admissions and during health crises such as the COVID-19 pandemic.

CIN research highlights the need for a 'whole-system approach' to improving care, which includes addressing workforce shortages, enhancing supervision, and ensuring effective mentorship for junior clinicians.

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Acknowledgements: The CIN and the research covered in this series were supported by Wellcome through fellowship funding to Mike English (076827/Z/05/Z; 097170/Z/11/Z; 207522/Z/17/Z) with additional support for specific research from UKRI, WHO, FCDO/UKAID and the NEST360 initiative (funded by the Gates Foundation, The ELMA Foundation, and The Children's Investment Fund Foundation). A full list of funding sources is available at https://cin.kemri-wellcome.org.

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