Developing new models of care at speed: learning from healthcare redesign for children with COVID-related multisystem inflammation

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INTRODUCTION

Until recently, the impact of the COVID-19 pandemic on children has mostly been indirect, relating to healthcare access and school closures. In mid-April 2020, a cluster of patients displaying multisystem inflammation and shock were admitted to the Evelina London Children’s Hospital (ELCH).2 Similar cohorts have subsequently been reported internationally.3 4 Over a 6-month period, the General Paediatrics team restructured its existing workforce to double on-site medical staffing at all levels, while other supporting clinical services, including Paediatric Rheumatology, stretched existing capacity to provide off-site support. Paediatric Cardiology doubled medical and technician provision to meet the increased demand for urgent echocardiography. Pharmacy increased on-site staffing to aid the use of unfamiliar medications.

ABSTRACT

This article describes the rapid, system-wide reconfiguration of local and network services in response to the newly described paediatric inflammatory multisystem syndrome temporally associated with SARS-CoV-2 (PIMS-TS) (also known as multisystem inflammatory syndrome in children). Developing the model of care for this novel disease, whose natural history, characteristics and treatment options were still unclear, presented distinct challenges. We analyse this redesign through the lens of healthcare management science, and outline transferable principles which may be of specific and urgent relevance for paediatricians yet to experience the full impact of the COVID-19 pandemic; and more generally, for those developing a new clinical service or healthcare operating model to manage the sudden emergence of any unanticipated clinical entity. Health service leaders in areas where COVID-19 is, or will soon be, in the ascendency, and who are anticipating the imminent influx of PIMS-TS, should use these principles and recommendations to plan an agile, responsive and system-wide model of care for these children.

CONTEXT

ELCH is a specialist children’s hospital which, together with its specialist clinical network, serves a paediatric population of 2.4 million across London and South-East England. The hospital has 215 beds, including 37 critical care beds—30 in the paediatric intensive care unit (PICU) and 7 in a level 2 (‘high-dependency’) area. ELCH hosts the critical care transport service for South-East England.

Like other acute providers, the COVID-19 pandemic forced ELCH to restructure services and workforce, with many staff redeployed to support adult critical and emergency care. PICU was reduced in physical capacity, as clinical areas were repurposed to accommodate critically ill adults. Congenital heart surgery was reconfigured among fewer London centres, effectively doubling the volume of paediatric cardiac surgery and cardiology activity in ELCH overnight.

RESPONDING TO A NOVEL CONDITION: DEVELOPING A MODEL OF CARE FOR PIMS-TS

The first seven children with multisystem inflammation presented in our region within a 2-week period. Having managed this initial cohort in an ad hoc manner, ELCH created a dedicated PIMS-TS clinical service in response to rising case numbers (see figure 1).

Reconfiguring the staffing model and physical space

The Paediatric Infectious Diseases and Immunology (PID), Paediatric Cardiology and General/Acute Hospital Paediatrics teams divided their workforce into two functioning units to support their core services as well as the new PIMS-TS demand. Out of hours, the General Paediatrics team restructured its existing workforce to double on-site medical staffing at all levels, while other supporting clinical services, including Paediatric Rheumatology, stretched existing capacity to provide off-site support. Paediatric Cardiology doubled medical and technician provision to meet the increased demand for urgent echocardiography. Pharmacy increased on-site staffing to aid the use of unfamiliar medications.
As the number of patients with PIMS-TS increased, the General Paediatric ward was redesigned to provide 17 dedicated PIMS-TS/COVID-19 beds, containing a second dedicated high-dependency area. This served as a physical hub for training and education crucial to the redeployment of specialist nurses and doctors, allowing us to double our high-dependency nursing allocations.

Redesigning clinical and operational pathways: rapid cycles of change
As the model developed, we recognised the value of regular and frequent communication, and instituted twice-daily short, multi-disciplinary, clinical and operational, goal-focused meetings, called ‘huddles’.

Consensus on treatment strategies for this emerging clinical condition was urgently needed. This required extensive review of literature from related conditions such as Kawasaki disease, and both internal and external clinical expertise. As more data became available, we scheduled weekly service development meetings to assess the cumulative impact of treatment strategies, modifying guidelines and pathways in response to emerging evidence.

Referral and discharge: managing pathway flow
As other cases were reported, the National Health Service in England released a national alert, leading to a surge in queries from network hospitals seeking advice or transfer of suspected patients. These came via existing referral pathways, directed to different medical and surgical specialties depending on the most salient presenting symptom or the referring clinician’s referring habits. At this point, patients were presenting to health professionals relatively late, meaning that a proportion of referrals were very unwell children with established signs of significant inflammation and cardiovascular instability. In response, a network referral pathway was rapidly devised and disseminated, with all queries routed through the critical care paediatric retrieval service. Over time, recognition of PIMS-TS signs and symptoms improved across the network, and the referral pathway was altered to divert network queries away from the retrieval service to the general paediatric and PID teams.

Follow-up pathways were agreed, and included laboratory testing, imaging and clinical review in a joint PID and cardiology clinic (in person and subsequently virtually), as well as a dedicated telephone advice line.

WHAT CAN WE LEARN FROM RAPID REDESIGN IN THE FACE OF UNCERTAINTY?
Analysis of the process of developing a model of care for this new condition reveals some transferable principles for redesigning care at speed.

Clinical pathways and operating models: implementing an agreed standard of practice
Despite their benefits in standardising care processes, clinical pathways remain a contentious concept among many clinicians who view them as straitjackets confining their expert, patient-centred practice. This antipathy is amplified in the context of an emergent disease, where incomplete evidence can lead to divergent clinical opinions. Agreeing a shared mode of practice in this context is time-critical. Clinical consensus, while imperfect, may be the highest level of evidence available—indeed, even the first national guidance, published 6 months after our case cluster presented, took the form of a consensus statement. In the absence of other evidence, the process of agreeing a clinical
1. Individuals and interactions over processes and tools
Rapid cycle design requires engagement of the right individuals, relationships and skills. Prioritising people over processes means embedding human factors and a user-centred approach (eg, standard laboratory order sets and prescription pathways embedded in the clinical workflow).

2. Working software (product) over comprehensive documentation
The product is more important than documentation of how the product came to pass. Rather than laboriously ‘minuting’ meetings, or crafting detailed referral pathways to cover every eventuality, documentation was kept simple and of practical utility—and always subservient to the clinical judgement of the team at the point of care.

3. Customer collaboration over contract negotiation
Improvements to the pathway were collaborative, and involved a wide range of medical specialties, and nursing and allied health professionals, and were responsive to the changing nature of the problem we faced. For instance, as the service needs evol ved, changes were made to the point of referral (from critical care to PID/generic paediatrics); and clinical psychology quickly became integral to service design team once the impact on children’s and families’ mental health became increasingly obvious.

4. Responding to change over following a plan
This encapsulates the fluidity and flexibility of the process, which underlies the need to respond to an impending clinical challenge in which there is uncertainty both in the outcome and the optimal care process.

pathway can set an agreed, shared baseline of practice (the ‘standard work’) from which all subsequent improvements can then be planned, executed and measured.7

Delineating the clinical pathway allows the individual steps and clinical tasks involved in care to be clearly articulated, and widely communicated. It represents a written representation of the current state of our knowledge, and delineates where key uncertainties lie. By defining the clinical components of care (eg, treatments, investigations schedules), it allows the parallel development of the operating model (staffing, capacity planning, patient flow) to deliver that care. It empowers staff to practice according to the full range of their skills. For instance, by describing the day-to-day care that children with PIMS-TS require, our paediatric nurse practitioners were able to take them to adapt.

Blending scientific method with agile business practices
The parallel development of our clinical management model (eg, treatment regimes, imaging protocols) and operating model (eg, patient flow, staffing and resources) had to match the pace and urgency of rising demand. Our rapidly iterative, incremental approach mirrors the tenets of ‘Agile’, pioneered in software development and increasingly adopted in healthcare innovation.6 Agile principles emphasise speed and responsiveness, prioritising the product, the people—and in our case, the patient—over the process10 (box 1).

In this setting, Agile was a helpful paradigm which values adaptation (to changing circumstances) over prediction (planning for known risks).

That acknowledgement of uncertainty is the raison d’etre for every component part of Agile: for example, the frequency of the cycles of change, or creating a prototype (the clinical pathway) which is ‘good enough and ready now’—and can then be improved on—rather than ‘perfect and ready later’. Uncertainty is inherent in the science and practice of medicine, and Agile principles of adaptation and responsiveness to uncertainty are reflected in the approach shared by many learning healthcare systems.32

‘Teaming’
The Agile approach describes a ‘self-organising, cross-functional’ team, flexibly and informally structured, based on skills and functions rather than role, hierarchy or positional authority.13 However, this does not fully capture the urgency with which the PIMS-TS team was convened, nor how the membership evolved in response to clinical need and growing experience. The development of diagnostic and management strategies for this novel disease required rapid coordination of evolving specialist expertise across multiple disciplines.14

A more fitting description might be the concept of ‘teaming’: the rapid development of a collaborative approach to solve a complex, changing problem.35 This describes a time-limited, informally affiliated group, put together to solve an evolving problem at speed. An example is the arrival of the emergency response team to a cardiac arrest, in which individuals with specific skills, but little prior interaction with each other, rapidly ‘self-organise’ into temporary, flexible roles and work cohesively to resuscitate, diagnose and treat. This is in stark contrast to, for example, convening a committee of established experts to create clinical guidelines for a condition that is well described and extensively studied.

Communication
Such an open-ended, collaborative methodology requires accurate, timely communication. Initially, our decision-making process was fragmented, and the outcomes communicated in a haphazard manner via myriad different channels. This gave the appearance of speed but often delayed or duplicated key decisions, many of which were not relayed to the bedside consistently.

Over time, our communication strategy became both more inclusive and more focused. We instituted twice-daily goal-directed huddles (known in Agile as ‘stand-ups’ or ‘scrum’s),16 with multispecialty membership and well-defined agendas. Imposing a structure on the communication process paradoxically facilitated innovation and pace of change.

Rapid cycle change is founded on timely feedback loops, and digital capability was a key facilitator—in particular videoconferencing tools, which made it possible for socially distanced teams to come together frequently.
Box 2 PIMS-TS service design: recommendations for service leaders

A: Strategy and approach to change
Take an agile approach to service design, focusing on responsiveness, adaptability and staff.

Define the condition and delineate the pathway early on. Early implementation of a model of care frames the scope of the service, helps to define the ‘standard work’ and facilitates task allocation based on skills not roles. Even if the first iteration is imperfect, it provides a common starting point from which subsequent improvements can be made.

Learn from others and share experience, both internally and externally. Adapt ideas, test and reflect on their impact. Update the pathway as often as necessary and communicate the updates widely.

Prioritise data collection. Invest time and administrative support in robust and detailed data collection (clinical and operational), to support primary research and service planning, delivery and evaluation.

B: Operating model design
Change the model of staffing as the clinical model dictates. A pathway is nothing without skilled professionals to deliver it. Prioritise any changes to the staffing model as early as possible. Be prepared to change staffing or task allocations as the pathway evolves.

We used the service pathway as a basis on which to identify clinical needs and allocate staff not according to role, but to skills, allowing us to maximise limited staffing resource.

Design the clinical and the operating model side by side. The clinical care model (eg, diagnostic and treatment protocols) and the operating model (eg, staffing, resources, patient flow) must be internally aligned, and therefore should be designed in tandem.

Take a risk-averse approach to clinical care, but a risk-tolerant one to designing the operating model of care. New clinical treatment models must be subject to rigorous assessment of evidence, stringently adhering to primum non nocere. By contrast, the operating model (ie, how that care is delivered) should be adaptable, with a low threshold to instigate changes and test new ideas.

Plan for the whole pathway. The service has points of entry (referral) and exit (discharge and follow-up). In configuring the model it is crucial to actively manage upstream demand and anticipate the inevitable need for follow-up (downstream capacity).

Proactively manage the demand on the service through active and two-way communication with the regional network. This results in children being managed in the right setting, and ultimately a better use of limited resources. The strength of our regional network certainly helped with this, although arguably we could have engaged network clinicians on this pathway much earlier on.

C: People
Identify all relevant teams early, and collaborate to create the pathway. This should include support services such as radiology, pharmacy, psychology and play specialists.

Engage front-line staff early to co-design the process. Service design, especially at pace, is an adaptive rather than a technical change, and staff need to feel shared ownership of the service’s creation and implementation. Our clinical pathway being drafted from the outset by a wide multidisciplinary team certainly aided implementation.

Continued

Box 2 Continued

D: Key enablers
Communication. Implement an early communications strategy (both internal and external) to include method, frequency and purpose of communications, and the target audiences and key stakeholders. Our failure to do so early on cost us valuable service planning time, and compromised our communication with colleagues across the network.

Digital tools are key to rapid cycles of change. Virtual meetings and instant messaging support the timely and responsive communication which is so vital to the agile approach.

Cost: It is important to acknowledge that this service is resource-intensive, developed at a time when the National Health Service dramatically reduced its non-urgent activity and was able to divert the majority of its resources to the COVID-19 pandemic. The opportunity cost in staff time will be more challenging as routine health services are restored. Financially, non-publically funded health systems internationally may find it more difficult to replicate such a rapid regional response.

Executive support. This is critical to facilitate rapid, large-scale changes in physical infrastructure and staff redeployment. Early recognition of uncertainty surrounding the condition helped to secure this support, which gave us licence to immediately begin work on developing new models of care, rather than having to implement or adapt pre-existing ones.

Demand and flow
The capacity and flow within a clinical service are dependent variables over which service designers can exert control. We were able to increase our capacity (both physical and staffing) and standardise our patient flow, through the early implementation of clinical guidance, including a nurse specialist-led follow-up pathway to free up inpatient capacity.

Demand is dictated both by disease prevalence, over which we have no control, and also by referral behaviour—over which we can exert some influence. Not surprisingly, for a novel, poorly understood condition subject to intense media scrutiny, the threshold of referral among network clinicians varied considerably. To conserve limited resource for the most appropriate patients, we put in early measures to manage demand, through: education with webinars; clear referral indications; published network referral pathways—all underpinned by telephone advice and decision-support for clinicians across the region.

IMPLICATIONS FOR ACTION
The themes which emerged from our experience have practical implications for rapidly designing and delivering a clinical service, whether for PIMS-TS or other novel conditions, and are equally applicable to local hospitals as they are tertiary specialist hospitals. Box 2 distils the lessons we learnt, and outlines key actions and approaches which service leaders should consider taking under similar circumstances.

CONCLUSION
The COVID-19 pandemic has seen adult services reconfigure at great scale and pace. However, there were distinct challenges to developing the model of care for PIMS-TS—a novel disease whose natural history, characteristics and treatment options are still not completely understood. First, unlike most adult services who could draw lessons from international experiences of COVID-19, PIMS-TS was a previously unreported condition...
for which we had to develop the model of care even as we were discovering its clinical characteristics. Second, unlike the first reports of COVID-19 affecting adults which primarily focused on the respiratory syndrome, \(^1^9\) PIMS-TS was a multisystem disease from the outset, \(^1^9\) requiring early, flexible teaming to create a ‘self-organising, cross-functional’ service. Third was the challenge of creating a new service model in the context of diminished healthcare resources which had been redirected towards adult care.

In the face of uncertainty, a wait-and-see approach is tempting but potentially catastrophic. \(^1^9\) Instead, health service leaders in areas where COVID-19 is, or will soon be, in the ascendency should anticipate the imminent influx of PIMS-TS, and use the principles and recommendations outlined here to plan an agile, responsive and system-wide model of care for these children.

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