

Where now for infection services in the NHS? How lessons from the pandemic should drive long-overdue integration of microbiology and infectious diseases

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ABSTRACT

In its first 2 decades, the NHS witnessed the near eradication of life-threatening community-acquired infections. However, medical advances have created different challenges (such as antimicrobial resistance and healthcare-associated infections) against a background of an increasingly ageing population. The recent COVID-19 pandemic has highlighted a lack of parity with regards to provision of NHS 'infection services' (infectious diseases, microbiology and virology) across the UK, which urgently needs to be addressed. We recommend a fundamental review of NHS infection service provision: divided into four key areas. Firstly, there should be a consideration of a single multidisciplinary specialty of infection medicine removing barriers to training and service delivery. Secondly, streamline infection training via a single pathway through to certificate of completion of training, encompassing all aspects of infection service provision, for example, infection diagnostics, clinical care (including inpatient, outpatient and community based care), and infection prevention and control. There should be flexibility within the training curriculum to facilitate combined training with general internal medicine (GIM) as well as out of programme activities. Innovative ways of providing clinical experience should be considered, acknowledging the roles that medical microbiologists working closely with GIM colleagues in district general hospitals can play in managing patients with infections. Thirdly, formally commission a national network of specialised infectious diseases units with the creation of service standards. This can facilitate future pandemic resilience

using a hub-and-spoke model utilising local infection expertise. Lastly, standardise the NHS framework to lead and coordinate development of integrated infection services at the local level.

KEYWORDS: infectious diseases, microbiology, infection prevention and control, service provision, NHS

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Background

During its first 20 years, the NHS witnessed the almost entire disappearance of epidemic, community-acquired infections (such as scarlet fever, tuberculosis and measles) with the resulting closure of hundreds of 'fever hospitals'.¹ Meanwhile, social and medical advances ushered in different problems; for example, infections related to an ageing population or proliferation of immunosuppressive treatments. An estimated 300,000 NHS patients develop a healthcare-associated infection (HCAI) each year, incurring costs estimated at up to £2 billion.² Antimicrobial-resistance (AMR) threatens to undo decades of medical progress and is predicted to cause more deaths than cancer by 2050.³ Causing over 500,000 UK hospitalisations, COVID-19 has recently highlighted that life-threatening pandemics are not consigned to history and crucial lessons must be learnt from our national response.⁴

A fundamental review of NHS 'infection services' (infectious diseases, microbiology and virology) provision is overdue and must resolve long-standing training issues that hamper integration of these key component services. Profound changes to system-wide healthcare, including the creation of integrated care systems (ICSs) and the UK Health Security Agency (UKSHA; formerly Public Health England (PHE)), create an opportunity to coordinate these distinct but integral disciplines to ensure parity of access to high-quality infection prevention, diagnosis and management expertise.

Infectious diseases

In contrast to other high-income countries, infectious diseases (ID) is a small specialty in the NHS, accounting for <2% of the consultant physician workforce. Adult NHS services are mainly delivered through approximately 24 ID units in England, the vast

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majority are funded through clinical commissioning groups (CCGs). Most are based at teaching hospitals in major cities, reflecting the central importance of education and academic research to the specialty. While ID units can competently manage the range of community- and hospital-acquired infections, there is usually a narrower focus on severe, complex or rarer conditions. This is also mirrored in the traditional approach to specialised commissioning, which contrasts with where the overwhelming burden of infection is encountered across the NHS.

Most ID units provide inpatient care, some with extended in-hospital reach through participation in the general internal medicine (GIM) emergency admissions rota. In addition to 'general' ID clinics, all offer a range of specialist outpatient services depending upon the particular unit (eg chronic fatigue syndrome, parasitic/'tropical' infections etc) and a number of conditions are sometimes managed in conjunction with other specialties, eg HIV (genito-urinary medicine), tuberculosis (respiratory) and viral hepatitis (gastroenterology). Where ID physicians exist, they work closely with microbiology colleagues serving every specialty via rapid inpatient consultations, antimicrobial stewardship (AMS) activity, remote clinical advice and multidisciplinary team meetings.

A handful of ID services are commissioned to provide national services, such as tropical medicine and complex bone and joint infection. The high-consequence infectious diseases (HCID) network comprises five highly specialised ID centres for secure isolation and treatment of a relatively small, defined number of rare but serious pathogens.

Microbiology and virology

Microbiology and virology rely almost entirely upon local CCG commissioning arrangements. A small amount of laboratory microbiology and virology is centrally commissioned through the UKHSA and delivered by specialist diagnostic centres, eg the Malaria Reference Laboratory and the Rare and Imported Pathogens Laboratory, Porton Down.

Prior to the Carter report into pathology services in 2006, almost every hospital in the NHS had an on-site microbiology laboratory, but a nationwide process of diagnostic service centralisation accelerated from this point, which continues through the Pathology Modernisation Programme.^{5,6} Presently, it is commonplace to have a central pathology hub serving multiple sites, sometimes across different trusts. Centralisation has the potential to save costs but the depletion of on-site diagnostic facilities has been accompanied by a workforce crisis in microbiology, with approximately five microbiologists per 100 consultant physicians in 2011, shrinking to 2.5 per 100 in 2019.^{7,8} A British Infection Association workforce survey in 2021 found that 20% of consultant microbiology posts are vacant and that 40% of infection services have three or fewer microbiologists, with significant implications for the sustainability of 24/7 consultant on-call rotas.⁹

Smaller healthcare sites typically also lack any additional support from virology or ID and have no registrar grade training posts. This is hugely significant since microbiologists have historically been the chief providers of infection expertise to NHS hospital specialists and general practitioners.¹⁰ Infection prevention and control (IPC) and AMS activity are also traditional microbiology roles in most NHS organisations and, in the vast majority of these without on-site virology, microbiologists are first point of clinical contact for this too.

The COVID-19 pandemic

A pandemic involving a completely novel pathogen requires immediate answers to multiple critical questions at the very earliest stage, for example: How to develop diagnostic assays and roll-out at scale? Who is most at risk? What are likely to be the best treatments before trial data is available? What are the transmission characteristics and, hence, optimum infection prevention measures? How can effective vaccines be rapidly developed?

The longer that a new communicable disease can be 'contained' to prevent more widespread transmission, the more time there is for the NHS to prepare and plan. Initially, when the potential for transmission and severe disease was unquantified, it was justified to temporarily designate SARS-CoV-2 as an HCID. After diagnosis of the first cases in January 2020, all confirmed COVID-19 patients were, therefore, transferred to one of the five HCID-airborne (HCID-a) centres across England for treatment. However, the HCID-a network is relatively small (fewer than 20 commissioned beds) and even with urgent expansion plus assistance from several specialised ID services providing 'surge' capacity, diagnosed cases exceeded available beds in early March 2020. At this point, widespread admission of COVID-19 to non-specialist hospitals ensued.

There were some similarities with the situation for diagnostics, and early capacity through Public Health England (now UKHSA) laboratory services was rapidly overwhelmed. Following on from this, local testing capacity in NHS laboratory networks was developed and, although initially variable and hampered by global supply issues and staff shortages, a sustainable service was established. As a result, when the private pillar 2 laboratories were launched, they were substantially under-utilised and have now been decommissioned. The UK became a global leader in SARS-CoV-2 whole gene sequencing to track variants of concern (VoC) and was the first country in the world to surpass one million sequences, which accounted for a quarter of the world total at that point.¹¹

Later in 2020 and in responding to the emergence of a VoC identified in mink farms, a specialised ID network involving almost all of England's ID units was successfully assembled but remains a non-commissioned and temporary arrangement. It is worth highlighting that the advanced research capabilities and academic links, deeply embedded within the speciality of ID, enabled it to contribute hugely to a successful roll-out of high-priority clinical studies and guidance development, eg the COVID-19 Treatment Advice Group (CTAG) ahead of the National Institute for Care and Health Excellence rapid process.

The pandemic experience, thus, underscores the importance of being able to mobilise a multifaceted, 'infection' response, coordinating the distinct but interdependent disciplines of ID, the diagnostic laboratories and IPC at regional and national levels. It is also essential that these are closely linked with UKHSA to align priorities and ensure consistency in rapidly changing clinical guidelines and effective communication to patient-facing staff. Translational research and a rapid diagnostic development 'pipeline' are also paramount.

Infection training

Junior doctors seeking to train in infection have traditionally faced two very distinct pathways with ID training (often as joint with GIM) beginning after attaining membership to the Royal College of Physicians (MRCP) and medical microbiology (MM) / virology training starting straight from pre-registration and working

towards fellowship of the Royal College of Pathologists (FRCPath). Genitourinary medicine has remained a third distinct pathway in the UK, albeit with close clinical relationships in many situations, well-illustrated by the current situation with monkeypox.

Although the Academy of Medical Royal Colleges proposed a single certificate of completion of training (CCT) in infection in 2011, the introduction of the 'combined infection training' in 2014 requires trainees to complete 2 years of core medical training plus MRCP before diverging towards nine different potential infection CCT combinations.

This myriad of routes to different infection CCTs is out of kilter with the needs of the NHS. Consultant posts are typically advertised with broad CCT options to increase the chances of recruitment. CCT holders in ID/MM are being appointed into ID/GIM consultant posts and CCT holders in MM and/or ID enter posts with a significant virology component. Employers recognise that what matters is that the doctor is competent for the scope of their practice, in line with General Medical Council advice.

In 2021, the RCP introduced commendable changes to increase flexibility and breadth of training across different medical specialties, but this still retains eight possible training scheme combinations with substantial overlap in ID and MM/virology (MMV) curricula and competency assessments (capabilities in practice.)¹² Importantly, though, all trainees will be required to achieve level 4 (entrusted to act unsupervised) in core areas such as IPC and AMS.¹³

A further issue is that ID training posts are chiefly confined to specialised ID units. This both limits training numbers and prevents ID services from expanding beyond their traditional teaching hospital base and into DGHs.

Recommendations

The combined challenges of future pandemics, rising AMR, climate change, global travel and refugee health in an era of heightened conflict, means that infection will continue to remain a foremost UK health threat. In response, the NHS needs to develop an integrated infection strategy with four core features.

- **A single multidisciplinary specialty of infection medicine** removing barriers to training and service delivery. The reality is that outside of specialist centres, the distinction between either ID and MM is a false dichotomy. A centrally funded accreditation process for infection services should be also be developed, building on the British Infection Association standards for delivery of NHS infection services in conjunction with the RCP and RCPATH and complementing existing UK medical laboratory accreditation through the United Kingdom Accreditation Service (www.ukas.com).¹⁴
- **Infection training** should be streamlined into a single pathway through to CCT, covering core areas including clinical syndromes; inpatient and outpatient care; imported infections; IPC; AMR/AMS; and diagnostics (across microbiology, virology, mycology and parasitology). Combined training with GIM should be an option, as well as flexibility to accommodate out-of-programme activity. Importantly, this should recognise that a high-quality ID inpatient training environment can be provided by a DGH if configured appropriately, eg a microbiologist and ID–GIM physician working closely together and linked to a regional ID unit.
- **A national network of specialised ID units** should be permanently established by formal commissioning, which will involve creating service standards for the first time. This is

necessary for future pandemic resilience (by maximising surge capacity and specialist containment resources) and to support local delivery of high-quality care utilising a hub-and-spoke model. In recent months, such a clinical network has proven essential to the successful control of the UK's recent monkeypox outbreak (over 3,300 cases), which, following derogation of HCID status, can now involve admission to non-ID settings with remote access to ID expertise, if required. Review of commissioning arrangements for national services within the ID portfolio (such as tropical medicine and HCID) will be essential, and this should also support growth of DGH-based ID services. Lastly, by virtue of close academic and research partnerships that currently exist within infection specialties, the network provides an infrastructure that could be harnessed for the efficient roll-out of high-priority clinical trials in a future pandemic scenario.

- **A standardised NHS framework** to lead and coordinate development of integrated infection services is necessary at the local level. This could be mapped to NHS England ICS footprints, for example, with a funded specialist lead (ID physician, microbiologist or virologist) supporting on to three neighbouring ICS boards with involvement from key stakeholders (eg local pathology networks, ID services, UKHSA, primary care, community pharmacy etc). Priorities should include pandemic preparedness; equal access to diagnostics and clinical expertise; driving high-quality IPC by standardising best practice / benchmarking performance; matching laboratory outputs with the needs of clinical services; ensuring strategic and operational alignment with UKHSA; and coordinating important initiatives spanning the hospital–community interface (eg AMS). The

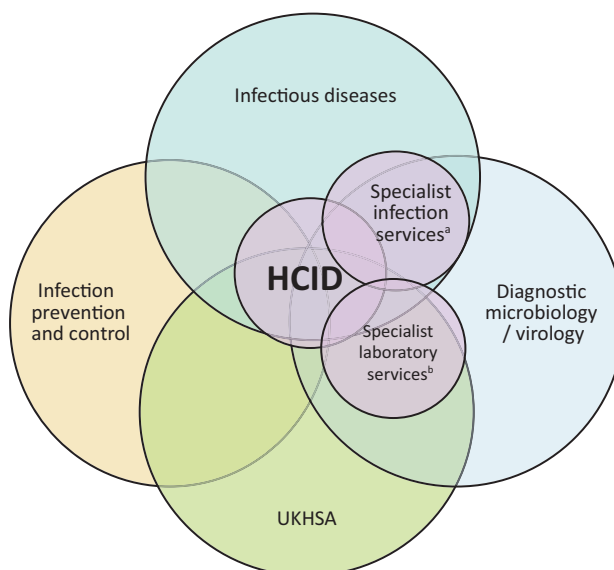


Fig 1. Co-dependency of infection services and expertise in the NHS.

Key stakeholders: NHS integrated care systems; pathology provider networks; laboratory regulatory bodies; NHS England commissioning and clinical reference groups; UK Health Security Agency; specialist societies (eg British Infection Association and Healthcare Infection Society); royal colleges; deaneries; and universities / academic partners. ^aeg HIV, genitourinary medicine, tropical medicine, and bone and joint infection. ^beg Rare and Imported Pathogens Laboratory and Malaria Reference Laboratory. HCID = high-consequence infectious diseases; UKHSA = UK Health Security Agency.

changes to the Health and Social Care Act (www.gov.uk/government/publications/working-together-to-improve-health-and-social-care-for-all) should streamline funding by aligning ICSs and specialised commissioning more closely. A schematic of this goal is shown with key stakeholders in Fig 1. ■

Conflicts of interest

Martin Llewelyn is former president of the British Infection Association and chairs the Royal College of Physicians Infectious Diseases Joint Specialty Group. Nicholas Price is director of the NHS England High-Consequence Infectious Diseases (Airborne) Network, chair of the London Infection Prevention and Control Advisory Group, NHS England ID Clinical Reference Group member. Natasha Ratnaraja is co-chair of the Clinical Services Committee, British Infection Association and chair of the Medical Microbiology and Medical Virology Specialist Advisory Committee, Royal College of Pathologists. Bridget Atkins was manpower and training representative, British Infection Association 2015–2022, chair of the Microbiology Training Committee, RCPATH 2017–2021, vice chair of the Infectious Diseases Training Committee Joint Royal College of Physicians Training Board (JRCPTB) 2016–2021, co-chair of the Combined Infection Training Committee, JRCPTB, 2017–2021, and co-chair of the Infection Curriculum Development Group 2018–2021. David Partridge is vice president of the British Infection Association. Katie Jeffery is president of the British Infection Association.

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