GIG CYMRU NHS WALES | Iechyd Cyhoeddus Cymru Public Health Wales	**Name of Meeting** Knowledge, Research and Information Committee **Date of Meeting** 09 December 2025 **Agenda item:** 4

Strategic Priority 5 Deep Dive: delivering excellent public health services to protect the public and maximise population health outcomes with a focus on innovation within Infection Services

Executive lead:	Professor Fu-Meng Khaw, Executive Medical Director & National Director Health Protection and Screening Services
Authors:	Robin Howe, Director of Infection, HPSS Kelly Ward, Interim Head of Operations, Infection, HPSS Julian Rogers, Interim Deputy Head of Operations, Infection, HPSS

Approval/Scrutiny route:	HPSS Directorate Management Team – 11/11/2025 Business Executive Team – 19/11/2025

Purpose

This paper provides a comprehensive overview of innovation within the Infection Division of Public Health Wales. It highlights strategic advancements in diagnostic, workforce development, and research, all aligned with Strategic Priority 5: Delivering Excellent Public Health Services. The innovations described improve efficiency, effectiveness, equity, and resilience across Wales.

Recommendation:

APPROVE	CONSIDER	RECOMMEND	ADOPT	ASSURANCE
☐	☐	☐	☐	☒

The Committee is asked to:

- Receive **assurance** that innovation is embedded in the operations of the Infection Division, and is focused on all elements of delivering excellent Public Health Services.

Link to Public Health Wales Strategic Plan Public Health Wales has an agreed strategic plan, which has identified seven strategic priorities and well-being objectives. This report contributes to the following:	
Strategic Priority/Well-being Objective	4 - Delivering excellent public health services

Summary impact analysis	
Equality and Health Impact Assessment	There is no requirement for an Equality and Health Impact Assessment for the requests of this paper.
Risk and Assurance	No immediate associated risks and this paper is for assurance to the committee regarding the approach to innovation.
Health and Social Care (Quality and Engagement) (Wales) Act	This report shows focus on continually improving outcomes for the Infection Services.
Financial implications	No immediate financial implications.
People implications	No immediate people implications and no additional workforce required.

1. INTRODUCTION

Infection services provide the large majority of Diagnostic Microbiology and Clinical Infection and Infectious Diseases services to the NHS Wales through 14 laboratories and clinical presence in 12 acute Hospitals. In addition, the service includes UK National and Regional Specialist and Reference Laboratories: UK Anaerobe Reference Unit, UK Toxoplasma Reference Unit, Cryptosporidium Reference Unit, Welsh Centre for Mycobacteria, Mycology Reference Unit, Specialist Antimicrobial Chemotherapy Unit, Welsh Specialist Virology Centre, and the Pathogen Genomics Unit (PenGU).

Innovation has long been at the heart of the Division's work in constantly striving to develop and improve the services delivered. This is now recognised within the Trust Long Term Strategy; Strategic Priority 5, 'Delivering Excellent Public Health Services to protect the public and maximise population public health outcomes' includes innovation and continuous improvement as measures of excellence, acknowledging that excellent public health services always look to innovate and improve in order to achieve excellence.

Innovation in Infection

Innovation in Infection Division occurs in what tests we offer, how we deliver our services and through research activities in our Specialist and Reference Laboratories. There is a process, overseen by the Senior Management Team, for the identification, evaluation and introduction of innovations in the diagnostics we offer. Staff may have innovative ideas or may hear of novel tests in development elsewhere. The process then involves an initial high-level screen through an MS form to establish whether the proposal would fit within the Infection operational plans. If a novel development is endorsed by the Senior Management Team,, there will be a local evaluation and if this is favourable, and resource can be identified, the innovation goes through roll-out across the Network overseen by the Senior Management Team and the Validation and Verification Group. Laboratory innovations primarily deliver improvements in

efficiency, effectiveness, equity or timeliness, but also need to be safe and patient or population centred.

2. INNOVATION IN THE TESTS WE DELIVER

Rapid Joint Infection Molecular Testing

Septic arthritis is a medical/surgical emergency. Effective management requires commencement of antibiotics, ideally within a few hours of presentation and surgical washout within 24 hours. The conventional laboratory diagnostic pathway does little to assist emergent clinical decision-making; microscopy of joint fluid can be done within 2 hours, but routinely only gives information of whether inflammation is present but cannot differentiate between infection or gout for example. Culture is required to identify if an organism is present, but this takes 24-48 hours.

A multiplex test has been developed for the BioFire rapid molecular platform (present in laboratories across Wales) that detects 31 common and less common pathogens plus 8 antimicrobial resistance genes. Infection Division was involved in a positive International Multi-centre evaluation clinical benefits of the assay.[1] Following clinical and laboratory evaluation, this has been rolled-out across the laboratory Network. It gives results within 2 hours of receipt in the laboratory and has already been shown to deliver significant clinical benefits in terms of clinically-relevant timeliness of diagnosis, but also increased detection of pathogens that are difficult to grow conventionally (e.g., *Kingella kingae, Neisseria gonorrhoeae*).

[1] S Pascual, et al. Potential value of a rapid syndromic multiplex PCR for the diagnosis of native and prosthetic joint infections: a real-world evidence study. J. Bone Joint Infect., 9, 87–97, 2024

Roll-out of this test improves efficiency, effectiveness, and timeliness of our service and, given the availability across Wales, supports geographic equity of access.

Case Study

An 18 month old child presented with a limp following a coryzal illness. Initially thought to have a reactive (non-infective) arthritis due to him being relatively well and afebrile, his symptoms persisted, and he developed a large hip effusion. This was subsequently washed out in theatre and the same-day Biofire JI test was positive for *Kingella kingae*, a pathogen consistent with his presentation.

Subsequent extended cultures available 10 days later were negative as is common for this fastidious organism. The early positive Biofire JI result enabled targeted antibiotic therapy and an early oral antibiotic switch facilitating discharge from hospital.

The positive test result also increased confidence in the diagnosis for both the parents and the surgeon and allowed a specific follow-up plan to be actioned.

Genital Ulcer Molecular Testing

In May 2024 the World Health Organisation (WHO) released their Strategic Framework for enhancing prevention and control of MPOX, which recommended that ongoing surveillance of MPOX be continued. At the same time, there are continuing challenges in the diagnosis of some less common causes of genital ulceration. The introduction of a routine multiplex molecular test for genital ulcer diagnosis can give more accurate data on MPOX prevalence and improve early detection and management of cases, while improving and streamlining diagnosis of genital ulcers in general.

A multiplex assay has been developed for the SeeGene platform that the Network has in laboratories across Wales. The assay has targets to identify *Haemophilus ducreyi* (cause of Chancroid), Herpes simplex virus types 1 and 2, invasive serovars of *Chlamydia trachomatis* (Lymphogranuloma venereum), *Treponema pallidum* (Syphilis), and Varicella-zoster virus. Collaborating with Sexual Health colleagues, the assay has been validated and introduced into routine practice in Cardiff and is in process of roll-out across Wales. This will improve efficacy, efficiency, and timeliness of diagnostics and roll-out will ensure a geographically equitable service.

Expanded Molecular Testing for Sexually Transmitted Diseases

There is increasing recognition of Mycoplasma genitalium as a cause of non-gonococcal urethritis and Pelvic Inflammatory Disease, and guidance from the British Association of Sexual Health and HIV (BASHH) for circumstances when this organism should be tested. Currently tests submitted from Sexual Health services are sent to a laboratory in England for PCR testing at a cost of >£90.

Trichomonas vaginalis is a sexually transmitted flagellate protozoan. Conventional laboratory diagnosis is difficult, using either time-consuming microscopy which has poor sensitivity. Culture is possible, but very time-consuming.

A new molecular assay that tests for *M. genitalium* and *T vaginalis* is now available for the Roche platforms that are situated in our regional laboratories. These tests have been validated, and it is planned to roll them out to the regional laboratories and work with Sexual Health colleagues to optimise their use. This will significantly improve availability and sensitivity of testing, and will provide significant cash savings compared to the current referral test.

The strategy will improve timeliness, efficiency, and effectiveness, and there will be equitable access through the regional deployment.

AI-supported diagnostic pathway for Faecal Parasitology

Faecal parasitology is based heavily on manual microscopy of stool samples for ova, cysts, or parasites. The process relies on pattern recognition, and it is a continual challenge to develop and maintain these skills within the workforce.

We have identified a CE-marked system that uses AI-supported pattern recognition to exclude negative samples and provisionally identify samples with faecal parasites. This would allow local screening microscopy to be performed and potential positives to be reviewed by Biomedical Scientists anywhere in Wales, thereby removing the need to maintain parasitology skills in all laboratories. The evaluation and roll-out is being supported by the Digital, Data, Technology, Innovation & Value team in NHS Performance & Innovation (NHSP&I). When further advanced it is intended this will become an early example of a CE marked device used to trial the developing

organisation processes for oversight of AI, currently in development by AIDA (AI Design Authority).

The planned roll-out should improve efficiency by changing the skill mix of staff required for local testing, improve effectiveness by improving accuracy of diagnosis of faecal parasites, and should support service resilience.

Value-Based Healthcare (VBH)

The effective use of laboratory diagnostics is a significant concern for the Infection Division. There is significant variability in sampling practices suggesting potential inappropriate sampling in some cases, and often inadequate information with samples to facilitate optimal laboratory processing and result interpretation. We have established a Value-Based Healthcare (VBH) programme under the Senior Management Team to address issues in the pre-analytic, analytic, and post-analytic phases of testing for the main sample types received. A number of innovative strategies are being progressed with a view to promoting more efficient and effective laboratory diagnostics to improve patient care and deliver financial savings to the NHS.

VBH - Pre-analytic phase

The estimated annual spend on wound care in Wales across the health system is £5.3 billion. Wound care accounts for 68,000 outpatient visits and 15,000 patient admissions each year. The annual cost of prescriptions issued for wounds accounts for 6% of the annual NHS budget.

The Microbiology laboratory Network receives more than 60,000 wound swabs each year and we know that many samples are not clinically appropriate and not taken optimally. In addition, we do not receive adequate clinical information for appropriate laboratory processing or clinical interpretative reporting. One of our Clinical Liaison Biomedical Scientists (now a Higher Specialist (clinical) Scientist Trainee) is leading a number of innovative initiatives from our Swansea team that are being rolled-out across Wales.

Resources have been developed with stakeholders across Wales for identifying and managing wound infections and for how best to take a wound swab. These resources

are hosted on the PHW website and are promoted through the Welsh Wound Innovation and All Wales Tissue Viability Networks.[2]

Further learning materials have been developed to educate wider staff groups who may be involved in taking wound swabs about the diagnostic process. This is now available to all NHS staff through ESR.[3]

In a collaboration with Swansea Bay University Health Board a digital wound management app called Healthy io Minuteful for Wound (MfW) has been piloted with District Nurses. The pilot identified significant clinical benefits alongside cash-releasing and non-cash-releasing benefits. We are now working with the Digital, Data, Technology, Innovation & Value team in NHS Executive with the aim to roll this out across Wales.

All of these innovations promote appropriate use of the laboratory to improve effectiveness and efficiency, improve patient outcomes and release financial savings.

VBH – Analytic phase

The laboratories in Wales process samples according to all-Wales Standard Operating Procedures that are regularly reviewed. Nevertheless, there are small methodological tweaks that arise in laboratories as staff explore potential improvements. There are number of sample-specific workstreams that are reviewing implementations of the all-Wales SOPs to roll-out any improved processes and maximise efficiency.

VBH – Post-analytic phase

Many Microbiology results can only be interpreted within the individual clinical context. Limited sharing of clinical information by requestors means that appropriate interpretive reporting is frequently difficult or impossible. As a result, reports may be microbiologically accurate but clinically unhelpful, leading to inappropriate use of antibiotics and sub-optimal patient management. A novel strategy of Narrative

[2] Resources - Public Health Wales
[3] https://my.esr.nhs.uk:443/OA_HTML/RF.jsp?function_id=18931&resp_id=-1&resp_appl_id=-1&security_group_id=0&lang_code=US&oas=OI83EuglzbfL9rf4rtqBpA..&params=B9Etvt8Z-BtJq7fLN4ocEQKKNHhwuLdhnIBcmRxKYpLjqmc8GjONz5gXLyN7DUgpolGCdLYoiv5z9-CiuyyplscZXUiFSbGwKJ2TS0fMk1c

Reporting was developed in our West Wales Clinical Team to apply complexity science and nudge theory to reporting of urine investigations to improve use of the laboratory, the information shared by requestors and the clinical quality of our results. The initial pilot in our Hywel Dda service showed a significant improvement in laboratory use with reduced submission of negative samples and no change in positive samples, with annual resource release of £145,000.[4] Thus delivering improved effectiveness and efficiency.

We have trained Clinical Liaison Biomedical Scientists and Physician Assistants to provide a central team for delivery of Narrative reporting for Urine samples and are rolling this out to additional sample types across the Network. Currently only positive samples can have this treatment due to numbers. There is an aspiration to use an AI-supported rules base to extend Narrative reporting to negative samples.

3. INNOVATIVE WAYS OF WORKING

Robotic Bacteriology

Bacteriology remains largely based on culture of organisms and is therefore very manual, labour-intensive and slow. We have run a successful prolonged pilot of introducing robotic bacteriology in our Rhyl Laboratory. The existing robotic system has now reached and of life and we aim to refresh this and implement robotics in our other regional laboratories, and develop some of the innovative options that can be realised through the new robotic platforms.

The overarching goal is to modernise PHW's microbiology estate by integrating automation, robotics, and AI to enable:

- End-to-end automation of resource-heavy manual processes.
- Reduced turnaround times for diagnostic results
- Improved antimicrobial stewardship.

[4] Mike Simmons, et al. How to manipulate friends and influence practice: Application of complexity science leads to quality improvement in laboratory sample submissions. Journal of Infection Prevention 2019, Vol. 20(2) 91–98

- Financial savings through shorter hospital stays.

Automation/robotics is also seen as a way to free up scientific staff to focus on complex, specialist tasks, aligning with the IMTP aspiration for staff to work at the top of their license.

Automation/robotics is seen as a solution to:

- Overcome fragmented estate upgrades.
- Enable consistent service delivery across Wales.
- Support transformation and innovation in clinical microbiology.
- Automation must be deployed equitably to ensure modern working environments across all sites.
- Enhancing diagnostic speed and accuracy.

The introduction of automation/robotics further allows innovative approaches to ways of working. Culture plates can be read remotely, giving geographic flexibility to the deployment of our staff.

Stock control integration

North Wales Infection Laboratories as part of the Scan for Safety Programme, with support from NWSSP and the SupplyX team are trailing Omnicell SupplyX a web-based inventory management system designed to automate and simplify the tracking of kits, reagents and consumable across its three sites.

Key features include:

- Real-time stock visibility across all sites.
- Automated reordering based on current stock levels.
- Expiry tracking and alerts for out-of-date items.
- Batch-level traceability for recalls and compliance.

This innovation is intended to improve efficiency of the stock control system and reduce wastage.

A Blended Multi-Professional Clinical Workforce (with remote working where appropriate)

The expansion in demand for clinical microbiology and infectious disease services in eth UK has coincided over the last 15 years with a shortage of Consultant Microbiologists. This has manifest as significant pressures, particularly in areas where the Clinical Microbiology service has been wholly delivered by consultant medical microbiologists such as North and West Wales. We have developed a number of innovative solutions to support effective delivery of clinical services:

- In 2019, we were the first service to introduce Physician Assistants into the Microbiology clinical service. We now have 10 PAs across the network.
- In 2021, we developed a novel role of Clinical Liaison Biomedical Scientist. These individuals are charged to liaise with clinical teams to improve the use of our laboratories.
- Since 2020 we have established Medical Training in Microbiology and Infectious Diseases in Swansea to increase the local output of trainees.
- We support and promote non-formal medical training through the GMC portfolio route to facilitate overseas colleagues development within NHS Wales. We now have Specialist Grade and Specialty Doctors in North and Wets Wales who are working towards applying for entry onto the GMC Specialist Register.
- We have significantly expanded training for Clinical Scientists across the Network, both to take-up posts within Specialist and Reference Units, but also to be able to join the routine clinical services.
- We have developed models for remote working. Much of the clinical role requires on-site presence, but there are elements that can be delivered remotely. Narrative authorising is now delivered as a remote service for North and West Wales with colleagues in Cardiff, Swansea, Hywel Dda, and North Wales. We have also developed remote working for medical teams so that we have colleagues resident in Kuwait and USA who deliver services to West and North Wales respectively. Closer to home, we have medical

trainees in Cardiff and Swansea providing weekend services for North Wales.

The combination of these innovations mean that we have been able to expand the Clinical team from 22.6 consultants in 2018 to a blended multi-professional team of 66. This has significantly improved the resilience of the service, but also, the introduction of other professional groups has improved the timeliness and efficiency of the system.

4. INNOVATION THROUGH RESEARCH

The Research agenda in Infection Division is determined by subject matter experts, many of whom work within our Specialist and Reference Units. The role of the Divisional Leadership and Senior Management Teams is to foster an environment to support research. There is great support from the Research, Development and Strategy Lead and team. Two examples of innovation through research are given below.

Multi Locus Variable-number tandem repeat Analysis (MLVA) for Cryptosporidium parvum

Conventional standard typing of *C. parvum* by sequencing part of the hyper-variable 60 kDa glycoprotein (gp60) gene was not ideal for the investigation of outbreaks in England and Wales as these have tended to be caused by a few common gp60 subtypes. A more discriminatory typing method was required. Colleagues in the Cryptosporidium Reference Unit (CRU) worked with partners in CDSC, UKHSA, and academic partners to develop a MLVA scheme for Cryptosporidium parvum which is

now used routinely in Wales and is being rolled-out across the England.[5][6] The method is available on the CRU page of the PHW internet site for open access (https://phw.nhs.wales/services-and-teams/cryptosporidium-reference-unit/mlva-assay-protocol/). The method is being evaluated in other countries and was recently used to investigate outbreaks in Finland and Sweden.[7]

This innovation has potential global reach to improve the effectiveness of investigations of Cryptosporidium outbreaks to give Public Health benefits.

Molecular diagnostics for the prevention and diagnosis of invasive aspergillosis

Invasive aspergillosis (IA) is the most common life-threatening opportunistic invasive mould infection in immunocompromised people. Early diagnosis of IA and prompt administration of appropriate antifungal treatment are critical to the survival. Previous strategies involved poorly tolerated prophylaxis of haematology patients with anti-fungals at considerable express and with associated risk of the development of resistance. Colleagues in the Mycology Reference Unit not only developed molecular blood tests for aspergillus, but developed a novel strategy of regular 'prophylactic' testing of severely immunocompromised patients to facilitate early diagnosis and treatment, and avoid the use of prophylactic anti-fungals.[8] This innovative strategy has delivered improved efficacy and efficiency in Wales through pre-emptive diagnosis of IA and financial savings. The work in this area also has global reach and has established the Mycology Reference Unit as an International Centre for research in fungal molecular diagnostics.

5. CONCLUSION

[5] Robinson G, et al. Validation of a multilocus genotyping scheme for subtyping Cryptosporidium parvum for epidemiological purposes. Food Waterborne Parasitol. 2022 Apr 11;27:e00151.
[6] Risby H, et al. Application of a new multi-locus variable number tandem repeat analysis (MLVA) scheme for the seasonal investigation of Cryptosporidium parvum cases in Wales and the northwest of England, spring 2022. Curr Res Parasitol Vector Borne Dis. 2023 Oct 18;4:100151.
[7] Suominen K, et al. Multilocus Variable-Number Tandem-Repeat Analysis as an Investigation Tool in Cryptosporidium parvum Outbreaks in Finland and Sweden in 2022. Microorganisms. 2025 Apr 4;13(4):821.
[8] Rosemary A Barnes, et al. Prevention and diagnosis of invasive fungal disease in high-risk patients within an integrative care pathway. J Infect. 2013 Sep;67(3):206-14.

The examples given above are by no means exhaustive, with significant innovations occurring in our delivery of infection assessment of displaced persons, of our delivery of Outpatient Parenteral Antimicrobial Therapy (OPAT), and across our other Specialist and Reference Laboratories. In addition, the whole area of Genomics, delivered through PenGU and wider collaborations has been omitted as this includes a broad range of innovations and could be a focus for a future update.

In conclusion, innovation is embedded in the operations of the Infection Division, and is focused on all elements of delivering an excellent service.

Recommendation:

The Committee is asked to:

- Receive **assurance** that innovation is embedded in the operations of the Infection Division, and is focused on all elements of delivering excellent Public Health Services.