Modelling the value of integrating digital cellular pathology in the United Kingdom

MT71

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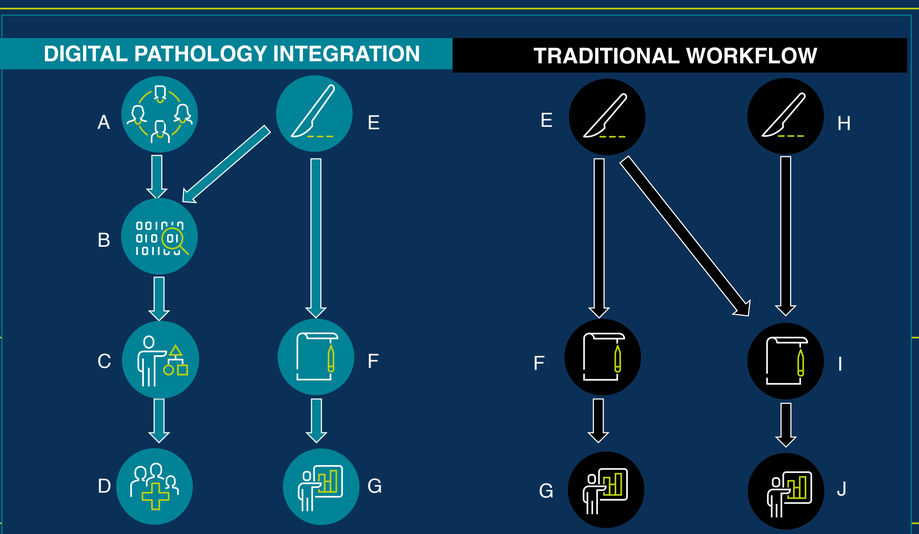
MAP Patient Access[a], Cambridge, UK; Source LDPath[b], Nottingham, UK.



The image to the left shows the P1000 scanner (stage B) which has a throughput of 100 cases per hour. The image on the right is a pathologist examining a case under a microscope in a traditional manner. However, with digital pathology the scanned cases can be easily viewed by a network of online pathologists in high resolution formats and artificial intelligence can be employed to help with accuracy of diagnosis used to pre-populated reporting forms. Key opinion leaders and company data support the conclusion that reporting times are quicker digitally.

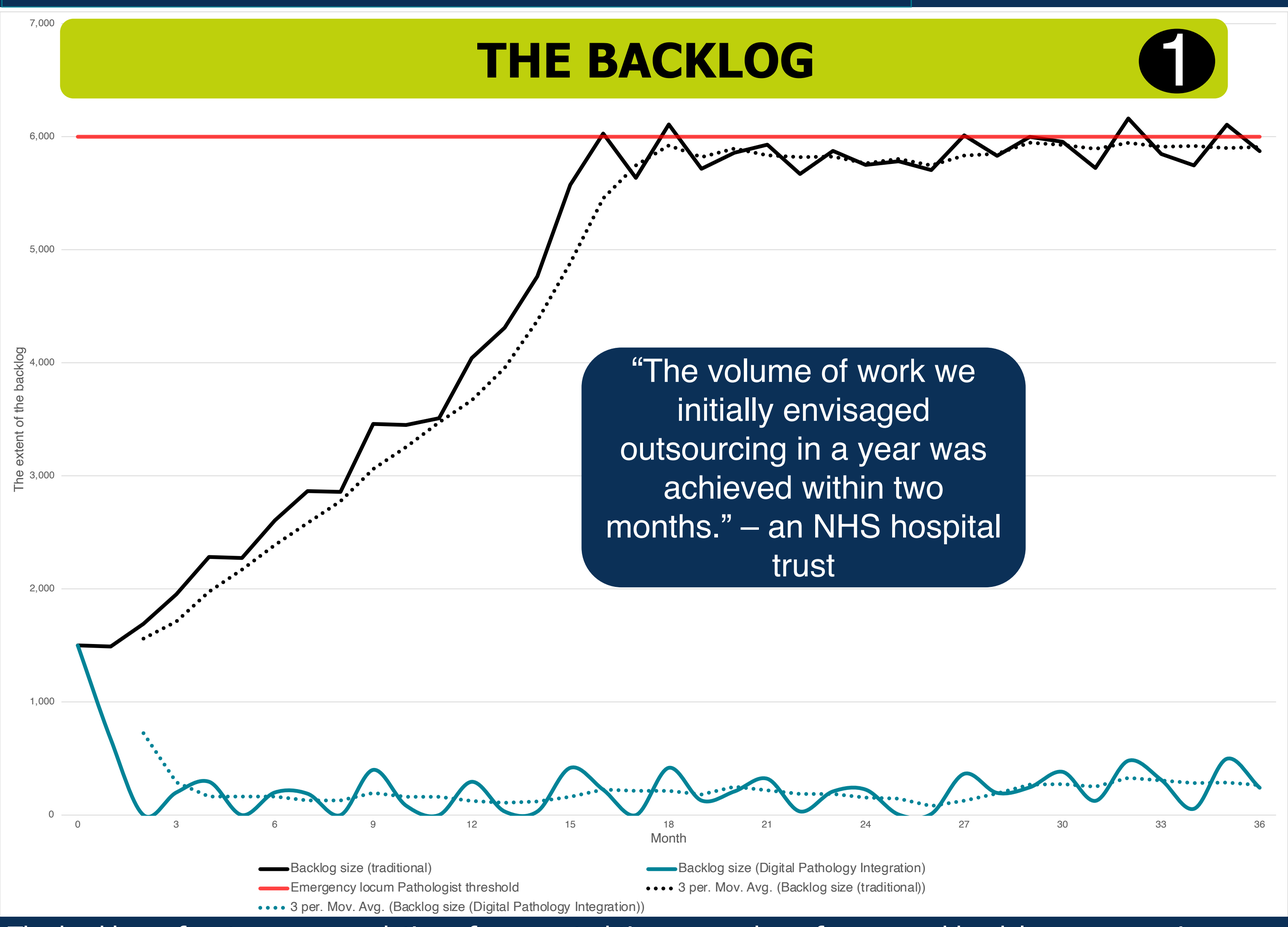
Pathology diagnostic investigations are now a significant part of over 80% of all patient care pathways.[1] With the arrival of genomic testing and personalised medicine, this role is expected to grow. However, the nationwide pathologist shortage within the UK is delaying cancer diagnoses and straining an already burdened workforce.[2] This is evident in the 4.5% annual demand growth for pathology services nationwide.[3,4] It is crucial that the rising backlogs are decreased to reduce the strain on laboratory reporting and subsequently the delivery of patient care.[5] Digital integration of pathology offers significant potential for improved patient care, enabling streamlined services, increased case reporting efficiency and bridging the gap between case formulation and treatment delivery. This involves the acquisition, management, sharing and interpretation of pathology information, including slides and data in a digital environment. Slides are made digital by scanning slides for high-resolution images that can be viewed on any device.

A budget impact model was developed using Microsoft Excel to assess the value of digital cellular pathology integration compared to traditional pathology. The model considers reductions in backlog, shorter wait times, cost reduction and life-years saved due to faster diagnosis. The model uses data from Sud et al. (2020)[6] to show that a one-day delay over a 14-day horizon results in a loss of 2.13 life-days per referred patient. The inputs for the model and the structure were sourced from formal engagements with key opinion leaders within the field such as histopathologists and lab managers.

The model has two arms. The digital pathology integration (DPI) arm is a modular extension to the traditional workflow that is present in current pathology departments. In-house preparation (E) is common to both arms. Slides can be scanned at stage B from in-house or Source LDPath labs (A). Stage C covers the reporting of scanned cases and stage D is digital additional reporting. Cases that are prepared in-house can undergo the traditional reporting and additional reporting through stages F and G. Stages H, I and J are competitors which provide external reporting. Each stage of the modelling is designed to best reflect clinical practice, such as differentiating between urgent and non-urgent cases to report.

The budget impact model provides the flexibility to choose from a range of digital solutions, and it accommodates the inclusion of hospital-specific inputs to examine the value of implementing the digital solution. The key inputs from the representative NHS hospital include; Incoming daily cases (200), average slides per case (2.2), the number of in-house pathologists (11) and the initial backlog (1500). Expected savings for this NHS hospital amount to £284,000 and further outcomes are examined below, where each outcome can further benefit from assigning more cases digitally.

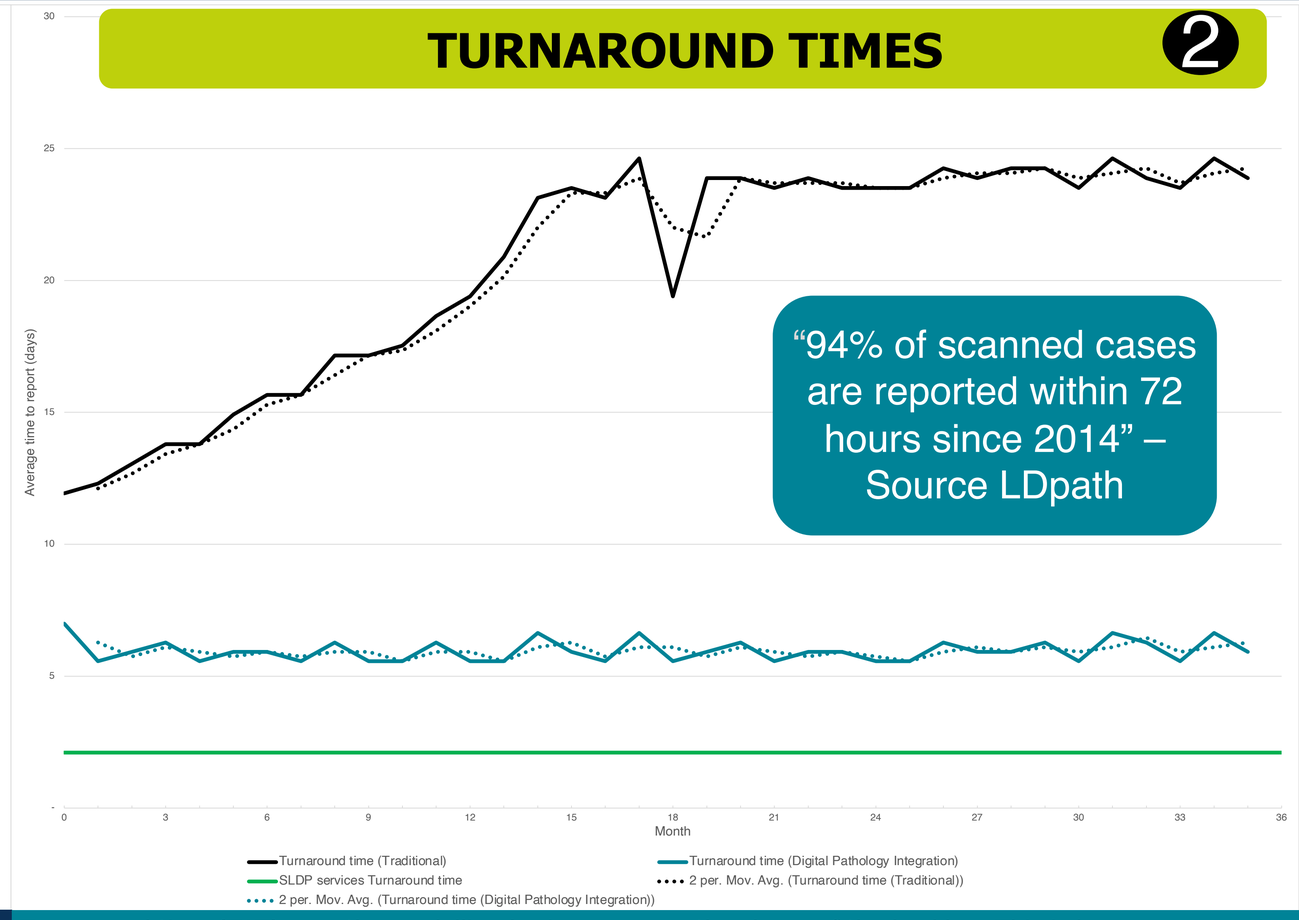
THE BACKLOG 1



"The volume of work we initially envisaged outsourcing in a year was achieved within two months." – an NHS hospital trust

The backlog refers to an accumulation of unreported tissue samples, often caused by delays or excessive demand. Using digital pathology increases reporting capacity as shown in graph (4) due to a wide digital network of pathologists, and this is evident as the backlog is reduced and maintained at low levels following implementation of digital pathology. This contrasts with the high backlogs traditional departments face.

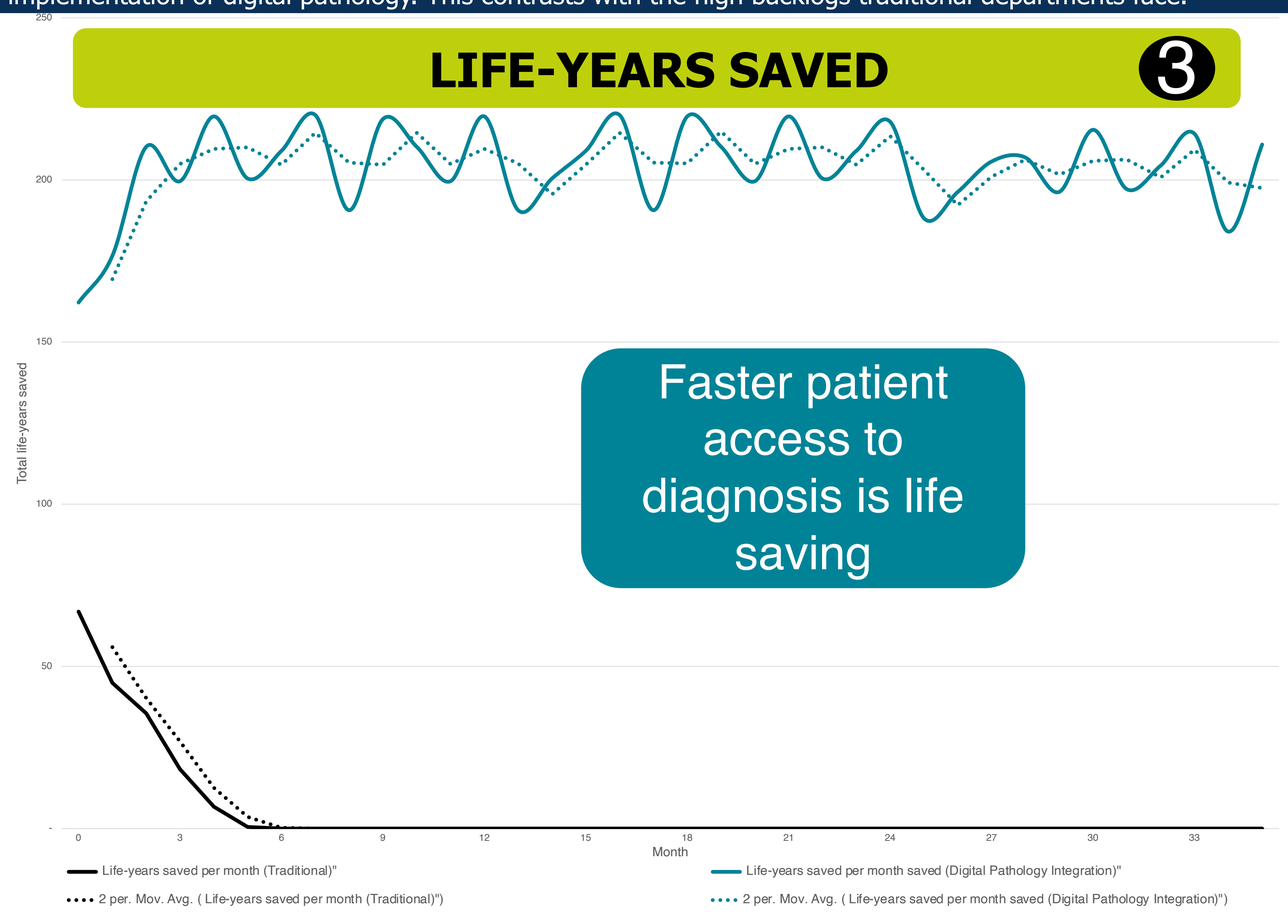
TURNAROUND TIMES 2



"94% of scanned cases are reported within 72 hours since 2014" – Source LDpath

Turnaround time (TAT) over the modelling horizon express the shape of the backlog. This is because a case in the backlog is not receiving a diagnosis and is accumulating a delay. The TAT express by DPI is consistently lower than traditionally as a certain portion of cases are reported digitally at the TAT shown by the green line of 2-3 days. More cases can be allocated to DPI to avoid the increase in TAT in year 4 onwards.

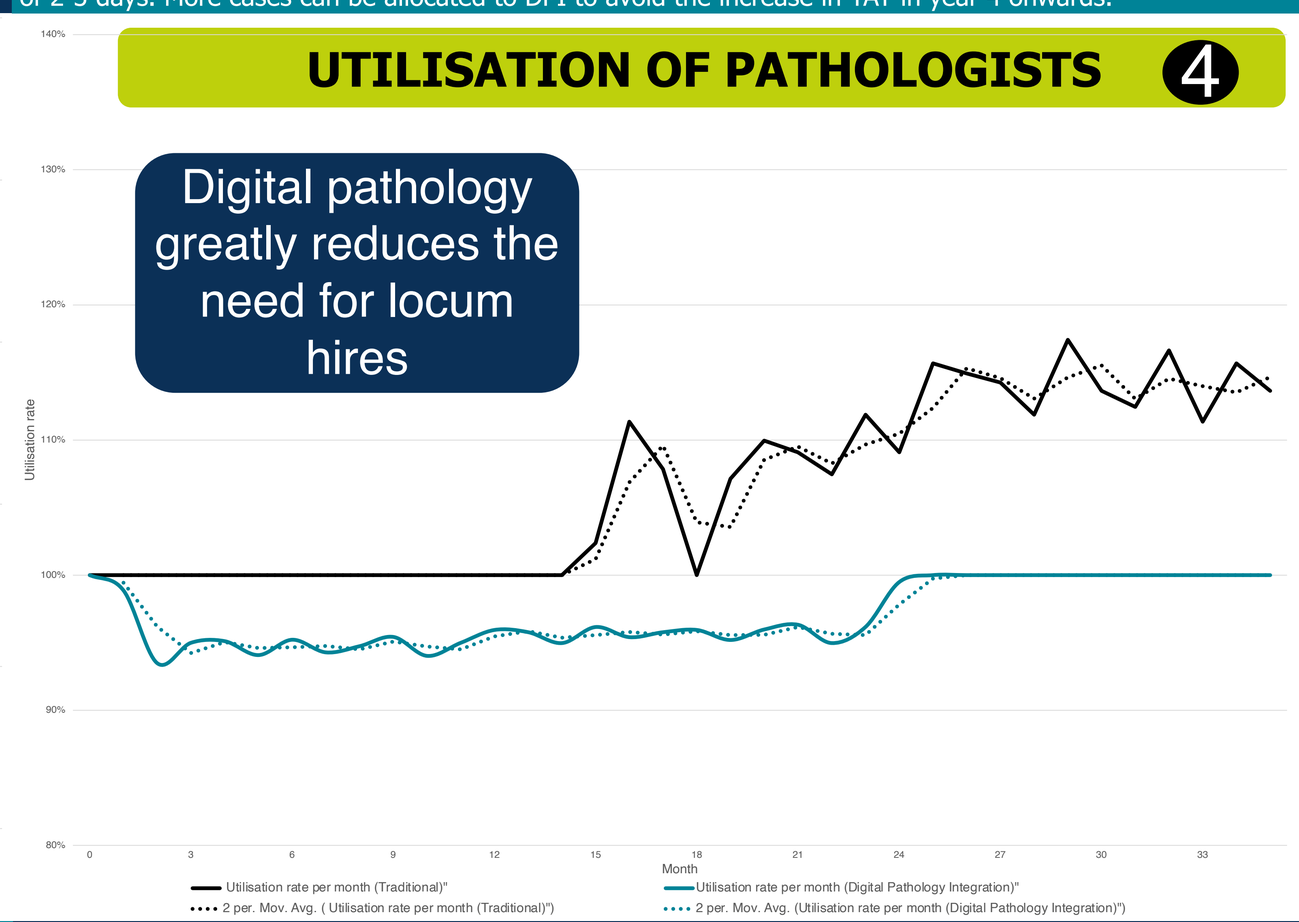
LIFE-YEARS SAVED 3



Faster patient access to diagnosis is life saving

The literature suggests that for each day reported under 14-days, a patient gains 2.13 life-days. This graph shows the cumulative life-years saved each month for the cohort of cases that are propagated through the NHS pathology department in question. In line with figure 2, the timeframe for which the DPI workflow manages to report cases in under 14-days, patients' lives are being saved through quicker access to treatment.

UTILISATION OF PATHOLOGISTS 4



Digital pathology greatly reduces the need for locum hires

Utilisation rates of in-house pathologists traditionally are significantly higher than DPI, with an increasing average of 100-120%, compared to 95-100% approximately. The growing utilisation of in-house pathologists traditionally is increasing due to a need for hiring locum pathologists, while with the digital method there is sufficient capacity to satisfy demand. Locums are hired when the backlog reaches the red line in graph (1).

1) Institute of Biomedical Science (IBMS), 2023. Long Term Biomedical Scientist Workforce Plan. https://www.ibms.org/resources/documents/ibms-long-term-workforce-plan/ 2) Martin, J., 2018. Meeting pathology demand: Histopathology workforce census. London: Royal College of Pathologists. 3) Keele University Independent Study, The National Pathology Benchmarking scheme. https://www.smvn.scot.nhs.uk/wp-content/uploads/2012/10/KUBS.pdf 4) NHS data March 2022: https://www.england.nhs.uk/statistics/wp-content/uploads/sites/2/2022/05/DWTA-Report-March-2022_17J0T4.pdf 5) The transition to digital pathology is happening. How are you going digital? Sanj Lallie of Source LDPath - https://content.yudu.com/web/1u0jl/0A1up6l/PiP-December-2022/html/index.html?page=34&origin=reader 6) Sud, A., Torr, B., Jones, M.E., et al. (2020), *Effect of delays in the 2-week-wait cancer referral pathway during the COVID-19 pandemic on cancer survival in the UK: a modelling study*, Lancet Oncology, Vol. 21

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