Survey of microbial air sampling in the NHS

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The need for air sampling is laid out in Health Technical Memorandum 2025,[1] which details the bacteriological sampling required for validation and verification of conventional operating rooms and ultraclean systems, and the requirement that ultraclean operating theatres should be monitored on an annual basis and following any high-efficiency particulate air (HEPA) filter change.

The survey reported here is designed to analyse the role of the laboratory and its staff in the provision of air-sampling services. In addition, we investigated the prevalence of air sampling in other areas, including work outside the NHS. Formal agreements between departments are examined, as are the issues of which staff groups undertake the various aspects of the air-sampling work, and how often air sampling takes place.

A total of 300 questionnaires were issued to microbiology laboratories identified in acute NHS trusts in the United Kingdom. Of these, 87 (29%) were returned, comprising one from a laboratory in Wales, 12 from Scotland and 74 from England.

Of those who responded, 82% offered a microbial sampling service, the most common areas including ultraclean theatres (85%) and plenum-ventilated theatres (75%). Other areas sampled included patient protective isolation areas, pharmacy rooms, catheter laboratories and angiography suites.

In the majority of instances (73%), sampling equipment was provided by the microbiology laboratory, as was the media used (91%) – 65% of laboratories quality controlled this media, and 99% incubated the plates. An analysis of sample collection and interpretation of the results is given in Table 1.

Frequency of testing is subject to wide variation. In general, respondents tended to sample ultraclean theatres with the same frequency as plenum-ventilated theatres, and the rates varied from 'weekly' to 'on demand'. Laboratories engaged in frequent sampling could expend up to 11 hours per month on this activity.

Of the departments questioned, 13% had formal agreements in place for the provision of these services and 13% of respondents reported that they shared microbial air-sampling equipment with other trusts. 23% of respondents used an external firm or consultant to conduct microbial air sampling, the principal reason cited being lack of the necessary equipment. Conversely, 17% of departments provided an air sampling service outside the NHS.

This study confirmed the key role of the microbiology laboratory in the provision of a microbial air-sampling service within the hospital environment, primarily in operating theatres. However, infection control staff were also involved in the ad hoc investigation of outbreaks, and provided analysis of trends. This is an important service development that has been driven, at least in part, by the report by Lidwell *et al.*,[2] which demonstrated a relationship between microbial load in the air and sepsis rates in orthopaedic theatres.

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Table 1. Staff involvement in microbial air sampling

	Sample collection (%)	Interpretation of results (%)
Medical microbiologists	23	49
Biomedical scientists	19	34
Clinical scientists	11	11
Infection control nurses	45	5
Medical technical officers	2	1

Post-operative sepsis can result in morbidity and mortality, but the lengthy period between acquisition and presentation of joint infection also means that by the time one patient presents with symptoms, large numbers of additional patients could have been infected. This can lead to the closure of operating theatres (and lengthening of waiting times for surgery), expense in treating infected patients, and a loss of confidence in the service that hospitals provide.

Routine monitoring of the air quality in ultraclean theatres is recommended, therefore, and should also take place after maintenance work.[1] There is, however, a lack of guidance, both at local and national level, on the practicalities of microbial air sampling. Responses to the current investigation demonstrated a broad range of equipment in use, and an even wider range of sampling frequencies, confirming a worrying lack of uniformity and possible suboptimal practice.

Compliance with HTM 2025[1] and other aspects of microbial air sampling would be a useful topic to include in local and regional audit programmes or benchmarking exercises.

Most respondents were able to provide a reactive microbial air-sampling service in the event of problems arising in theatres, pharmacy or on individual wards. This demonstrated flexibility in the laboratory service and its staff, especially as only 13% of respondents had a formal agreement to provide air-sampling services. Those without air-sampling equipment or staff expertise had to employ outside consultants, with resultant cost to the hospital and the inconvenience of not having the ability to sample a problem area at short notice.

Many respondents identified microbial air sampling as a means of income generation, with private hospitals being the main customers. Responses were also received from service providers who hire out their services to private organisations, particularly the food industry, and others have been involved in the investigation of 'sick building' syndrome.

Funds generated from these activities can support the acquisition of equipment that can be used for further income generation work, but can also support the core air-sampling service within the trust.

While the worth of the varied methods of microbial air sampling have been the subject of review and discussion,[3] it is

clear that the microbiology laboratory and its staff support a broad range of clinical services and initiatives within hospital trusts, despite financial constraints. This service frequently remains covert, and only comes to light when results exceed set limits, and action is required (thankfully infrequently).

Despite the variation in practice noted in this survey, it is important that the contribution made by the laboratory is not underestimated, especially in terms of infection control within the hospital setting, and the results presented here demonstrate, once again, the flexibility and commitment of laboratory staff. □

References

1 Health Technical Memorandum 2025. *Ventilation in health care premises*. London: HMSO, 1994.

2 Lidwell OM, Lowbury EJL, Whyte W, Blowers R, Stanley SJ, Lowe D. Airborne contamination of wounds in joint replacement operations: the relationship to sepsis rate. *J Hosp Infect* 1983; **4**: 111–31.

3 Pasquarella C, Pitzurra O, Savino A. The index of microbial air contamination. *J Hosp Infect* 2000; **46**: 241–56.

Infective discitis due to *Staphylococcus lugdunensis* – a case of missed opportunity

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Bone or joint infection due to *Staphylococcus lugdunensis* is rare, there being only a small number of case reports in the literature.[1-9] In six cases, infection was either a local complication of recent surgery[2-4] or associated with an underlying prosthetic joint.[7,8] However, in other reports, particularly relating to vertebral osteomyelitis[5,8,9] and an epidural abscess,[6] there were no apparent risk factors. These cases demonstrate that bone and joint infection due to *S. lugdunensis* may be associated with severe clinical manifestations and therapeutic difficulties. Furthermore, the bacteriological diagnosis may prove elusive due to the potential for *S. lugdunensis* to be misidentified.

To illustrate this point, an unusual case of infective discitis due to *S. lugdunensis* is described in a patient who similarly had no apparent risk factors. In this patient, the diagnosis of *S. lugdunensis* bacteraemia was missed, and the subsequent diagnosis of *S. lugdunensis* infective discitis delayed by six months, due to the lack of a laboratory screening strategy to distinguish *S. lugdunensis* from other coagulase-negative staphylococci (CNS) isolated from blood culture.

In addition, recommendations for laboratory procedures to avoid such misdiagnoses are discussed.

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A 73-year-old woman with severe osteoarthritis underwent corrective foot surgery in July 2000. Apart from penicillin allergy, she was otherwise well. Four weeks later she presented with diffuse low back pain, constipation and painful retention of urine. She was afebrile and general examination was normal. Her erythrocyte sedimentation rate (ESR) and C-reactive protein (CRP) were both elevated at 138 mm/hr and 231 μg/mL, respectively.

She was treated for five days with intravenous cefuroxime for a presumed urinary tract infection. At the time of admission, however, urine culture was negative but a penicillin-sensitive CNS (clumping factor- and protein A-negative; Pro-Lab Diagnostics, Canada) was isolated from two separate blood culture sets. The CNS isolates had similar antibiograms but were not speciated because they were thought to reflect skin contamination.

A plain X-ray at presentation demonstrated degenerative changes at multiple levels within the lumbar spine, with loss of disc height at L4/L5; however, the vertebral endplates were well preserved. Subsequently, a magnetic resonance imaging (MRI) scan of the lumbosacral spine showed high signal within the L4/L5 intervertebral disc, which was of reduced height.

Disc degeneration most commonly leads to loss of hydration and therefore low signal on the T2 weighted images. The appearance of high signal within this disc raised the suspicion of discitis. Minimal enhancement after gadolinium was demonstrated, however, and therefore the appearances were thought clinically to be most likely due to degenerative changes.

The patient was re-admitted six months later with a five-day history of severe low back pain. ESR and CRP remained elevated at 100 mm/hr and 97 ng/mL, respectively. A repeat MRI examination of the lumbosacral spine showed extensive marrow signal abnormality within the L4 and L5 vertebral bodies, with extensive enhancement within the L4 and L5 vertebral bodies and within the peripheral margin of the L4 / L5 disc and adjacent endplates.

A lumbar spine X-ray obtained prior to computed tomography (CT)-guided biopsy now demonstrated ill-defined lytic destruction of the vertebral endplates around the L4/L5 disc, with features in keeping with infective discitis and osteomyelitis. CT-guided bone biopsies of the L4/L5 intervertebral disc space and superior endplate of L5 both yielded penicillin-sensitive CNS (clumping factor- and protein A-negative). Isolates were identified as *S. lugdunensis* by API 20 Staph (bioMérieux, SA, France), and were confirmed by the Division of Hospital Infection, Public Health Laboratory Service, London.

Antibiotic profiles of the *S. lugdunensis* isolates and the previous penicillin-sensitive CNS grown from blood cultures were identical. All strains were sensitive to penicillin, erythromycin, clindamycin, gentamicin, fusidic acid, tetracycline, rifampicin, ciprofloxacin, chloramphenicol and vancomycin.

Following the biopsy procedure, blood culture was repeated and this grew *S. epidermidis* (penicillin- and fusidic acid-resistant), which was considered to be a contaminant. The patient was treated with clindamycin for a total of four weeks and made a good clinical recovery. There was no clinical evidence of infective endocarditis and an echocardiogram showed no abnormality. Two months later her CRP had returned to normal.