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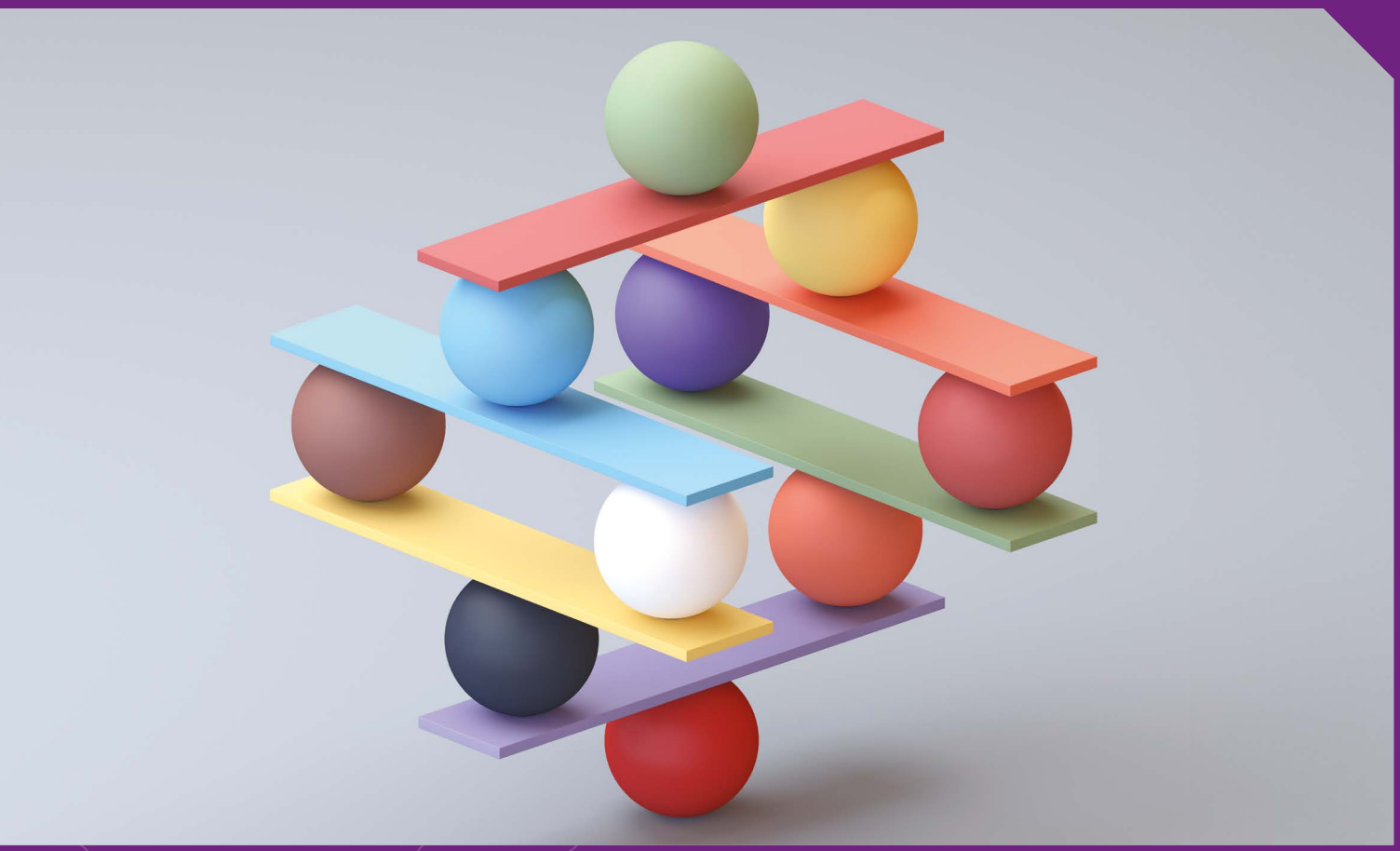
Roundtable report



Outpatient parenteral antimicrobial therapy: how to approach stability

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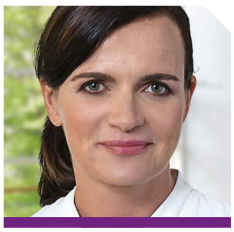

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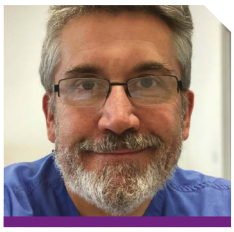

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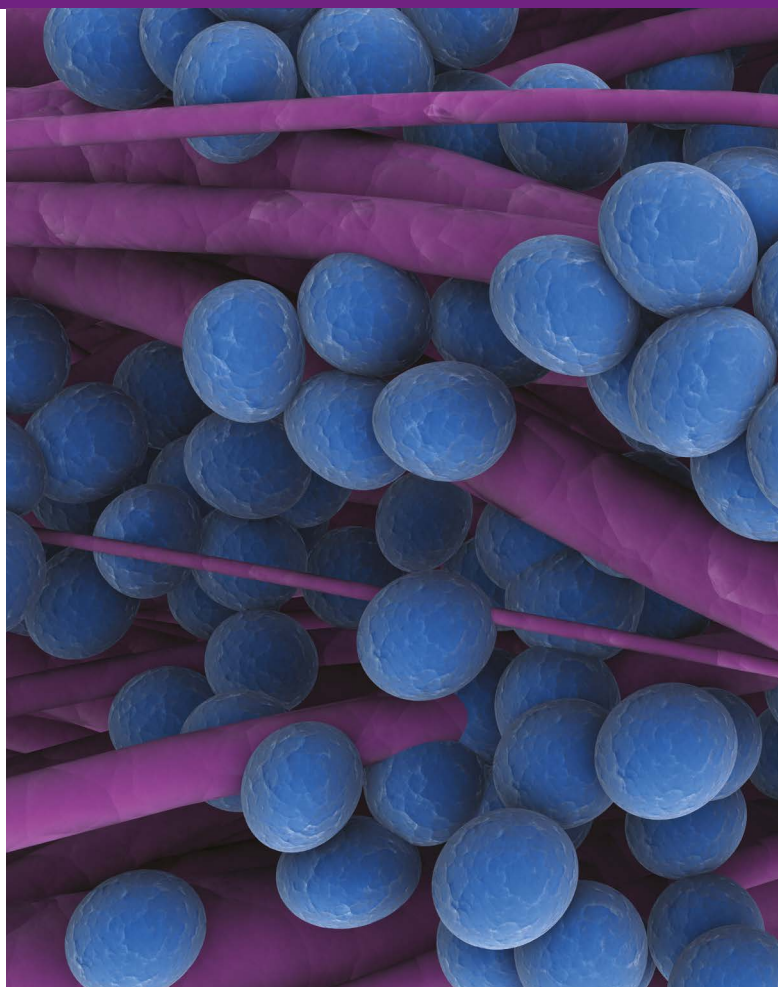


As the demand for outpatient parenteral antimicrobial therapy (OPAT) grows across Europe and beyond, the stability of antimicrobials used in these settings has become a critical concern. In July 2025, *Hospital Pharmacy Europe* convened an international multidisciplinary panel of eight experts to explore the challenges, limitations and opportunities in antimicrobial stability and shelf life in OPAT. This report captures the key themes, debates and calls to action from that discussion

Outpatient parenteral antimicrobial therapy (OPAT) has become an established approach for medically stable patients who require intravenous antimicrobial treatment outside the hospital, whether to avoid admission or to support early discharge. In addition to enabling care closer to home, OPAT is recognised as a cost-effective strategy and reduces the risk of hospital-associated infections.

However, delivering OPAT is not without challenges. Patients may encounter complications related to infusion devices, adverse drug effects or the need for drug level monitoring. Issues such as antimicrobial instability, non-adherence and variations in health service models also affect outcomes. Together, these challenges increase the risk of treatment failure and unplanned hospital readmission.[1] A particular concern is the scarcity of stability data for antimicrobials used in patient-worn devices, which can limit antimicrobial choice and act as a barrier to wider OPAT provision.[2]

Stability encompasses both chemical and physical dimensions.[2,3] The European Medicines Agency defines stability testing as the process of determining how a medicine's quality changes over time under environmental factors, such as temperature, humidity and light, to establish a retest period or shelf life and appropriate storage conditions.[4] In OPAT, this refers to ensuring a preparation retains its composition, potency and purity throughout storage, transport and administration.[5] And it's down to a multidisciplinary team (MDT) of healthcare professionals to ensure optimal outcomes.

Roundtable chair and UK pharmacist Abi Jenkins opened the meeting by outlining four key areas for discussion among the multidisciplinary group of pharmacists and clinicians:

1 Pharmaceutical stability and data limitations
2 Shelf life and storage in real-world settings
3 Regulatory and governance frameworks
4 Innovation, research and future directions.

In her introductory remarks, Dr Jenkins noted that OPAT 'is a topic that sits at an intersection of clinical care, pharmaceutical science and also patient safety', making it 'a very hot and interesting topic at the moment'.

She stressed that antimicrobial instabilities have far-reaching implications for stewardship, how services are designed and developed, patient adherence and clinical outcomes. Ensuring antimicrobial stability is therefore central to safe and effective OPAT care – whatever model is being used.

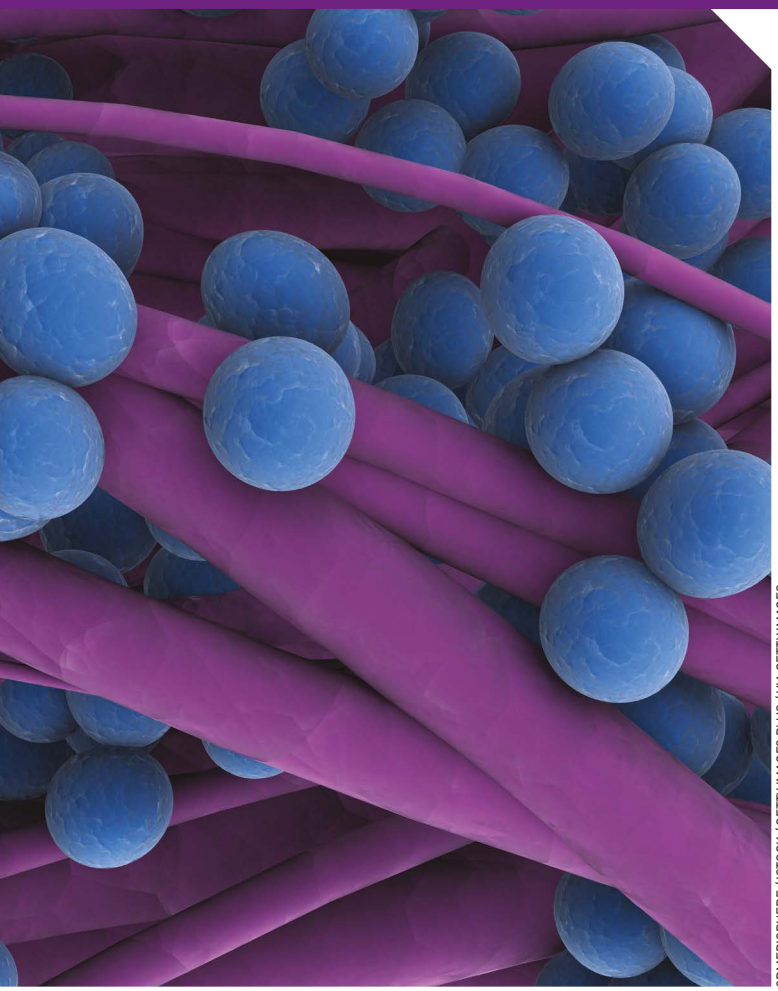
Why stability matters

When it comes to drug stability, Professor Alain Astier, a pharmacist based in France, noted the importance of considering chemical and physical stabilities, as these are distinct, as well as the role of concentration. 'For antibiotics, it is demonstrated that if you use dilute solution or concentrated solution, the shelf life of the same drugs could be totally different,' he said. This has clear implications in OPAT, where concentration adjustments are often required to accommodate device limitations or patient needs.[3]

Device type and administration conditions add further complexity. Elastomeric infusers and other body-worn devices often operate close to body temperature. According to UK guidance, if evidence shows the solution will not exceed 32°C, stability testing should be performed at 32°C ± 1°C.[6] However, as Australia-based pharmacist Dr Fekade Sime observed, 'most of the available data do not simulate actual in-use conditions'.

While studies may use room temperature or high-temperature stress testing, in practice, sequential conditions are experienced – refrigerated storage followed by infusion at body temperature, for example. Dr Sime described this lack of sequential stability testing as a significant limitation.

Environmental conditions in hospitals and patients' homes also matter, as Barcelona-based pharmacist Dr Sonia Luque-Pardos explained. 'In our case, in Spain, temperatures are quite high inside the hospital and especially in patients' homes without any air conditioners,' she said. 'You cannot be sure the temperature stays below 32°C, which is a very common temperature tested in studies.'



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There is also a significant gap in research regarding the stability of drug combinations, particularly antibiotics, when mixed in the same solution. Professor Astier emphasised this point, stating that there are limited data on the stability of combinations of two or three antibiotics, particularly in terms of visual stability and aggregation.

Beyond visible changes such as precipitation, drug interactions can involve complex chemical and physical transformations. These changes can have clinical implications, such as triggering immune responses. For instance, cephalosporins and related drugs may cause immunogenic reactions due to aggregation, even when not visibly apparent, and Professor Astier stressed the need for more research into these subtle forms of aggregation, especially in combinations involving cephalosporins and aminopenicillins.

Uniform guidance and country-specific protocols

The evidence base is also fragmented across stakeholders, with UK pharmacist Professor Mark Gilchrist highlighting systemic challenges in that pharmaceutical companies, academia and healthcare providers each have a role, but they operate in different contexts. Industry is bound by regulations, academics generate studies that may not align with licensing standards, and providers are left trying to implement with limited specialist knowledge,

> **OPAT is a topic that sits at an intersection of clinical care, pharmaceutical science and also patient safety**
>
> Dr Abi Jenkins

he said. And he warned that without more uniform guidance, services risk compromising antimicrobial stewardship in their aim to discharge patients quickly.

Dr Jenkins agreed, adding that while many countries look to the UK for parameters for conferring stability, 'in reality, stability assessment protocols were designed for the UK and weren't necessarily designed for a global audience'.

Indeed, Dr Luque-Pardos has studied differences between countries in terms of brands, doses and chosen infusion duration, with notable results – even between different centres within the same country. 'It's another difficulty to standardise, try to document or [to develop] guidelines that can help all of us,' she said.

This underlines the need for flexible approaches that reflect diverse clinical environments and allow for country-specific protocols to be adapted for different healthcare systems and requirements.

Shelf life and storage: regulation vs need

The roundtable highlighted the complexity of applying drug stability standards in OPAT, particularly when balancing strict regulatory requirements with real-world patient needs. The participants agreed that stability standards exist to protect patients and must remain the foundation of practice. Yet, as several noted, there are situations where careful consideration of shelf life or storage excursions outside licensed parameters may benefit patients.

While no one supported tolerating exposure to toxic degradation, some felt that limited degradation could be acceptable in specific contexts. As UK-based clinician Professor Andrew Seaton observed: 'We don't want a wild west of drug administration in the non-hospital setting so we do rely on regulation… but there is an amount of degradation that can be tolerated in the context of giving a continuous infusion of drugs, where the PK/PD is so much better and outcomes may actually improve with a continuous infusion of ß-lactams.'

He added that clinicians don't know how much degradation is clinically significant, but this continuous infusion is almost certainly advantageous for patients. Nevertheless, 'from my standpoint, I would want to be sticking to regulations,' he concluded.

To this end, Dr Sime highlighted the need for 'clear guidance' on the circumstances that may warrant clinicians using their 'own clinical experience to avoid the worst-case scenarios that would potentially trigger under exposure and worsen and the antimicrobial resistance situation'.

Differences in national regulation were raised by Berlin-based clinician Dr Caroline Isner. Describing the position in Germany, which is subject to particularly stringent stability regulation, she said that if stability cannot be guaranteed to a narrow tolerance of around 5%, manufacturers are not allowed to produce it. 'If I would produce it myself, and I couldn't guarantee the stability data, the insurance company would come after us and we would have to pay the costs,' she explained. 'Even if we do off-label use, they are trying to make us pay.' This reflects a national system where strict adherence to stability data is not only a clinical necessity but also an important financial imperative.

A collaborative effort

A point on which there was no disagreement was the importance of the MDT within the OPAT landscape. All three clinicians noted →

invaluable support from specialist pharmacists, nursing colleagues and others.

Dr Isner stressed that many OPAT services rely heavily on pharmacists to guide decisions about stability. 'My pharmacist is just next door to me, and he's the most important person in my team, so we work very close together,' she explained. 'We also have microbiologists in our team, and people from epidemiology who do daily hygiene and infection control. We benefit a lot from this MDT.'

But Dr Isner also noted that they had a 'hard time' getting all the relevant people to work together to achieve the requisite funding. As such, not every hospital in Germany has this multidisciplinary approach, despite its perceived benefits.

'[Management] want to see hard facts. How can we earn money?' she said. 'But we can show how good our numbers are to get patients out [of hospital] very quickly and that we can earn money with this MDT, and especially with OPAT.'

> **Without more uniform guidance, services risk compromising antimicrobial stewardship**
>
> Professor Mark Gilchrist

Professor Eavan Muldoon – a clinician based in Ireland – also championed pharmacists' input in OPAT, adding 'it's imperative that this is an MDT for the best patient care'. She explained that in many parts of the world, services are led by general physicians without specialist infectious diseases input, reinforcing the need for pharmacy expertise.

'It's one of the things that I don't like about how the Irish system was set up – that the pharmacy piece was outsourced, rather than there being a defined pharmacist with each OPAT team,' Professor Muldoon said. 'We're part of a team; we each have different skill sets. No one person can do this on their own… we need to all be rowing in the same direction to try and get the best for the patient.'

Dr Isner added: 'I would say that's the future, and I would always recommend anyone to work with an MDT.'

Emerging best practice and educational support

Dr Sime highlighted cases where meropenem has been used as a prolonged infusion despite limited supporting stability data.[1,7] He noted that some clinicians reported favourable outcomes when minimum inhibitory concentrations were low, even if degradation occurred. However, he cautioned that such practices must be balanced carefully against the risk of underexposure and antimicrobial resistance.

Practical challenges around therapeutic drug monitoring (TDM), which could theoretically support more targeted continuous infusions, were also discussed. Professor Gilchrist acknowledged the potential of TDM but noted this as a 'classic antimicrobial stewardship dilemma' with logistical barriers, such as delays in sample transport and a general reluctance for change.

For targeting the latter, he called for the right conversations to be had to shift people's minds towards new and emerging best practices to overcome some of the established processes that keep people in hospital for longer than necessary.

Part of this, Professor Gilchrist said, involves a pragmatic approach to education and training. 'We're asking people to do things with limited knowledge, with limited resources, and we're wondering why it's not done,' he said, stressing the need for pharmacists to receive targeted training in stability assessment. This would allow for 'consensus and pragmatism but operating within the envelope of national or regional guidance', he added.

Both Drs Jenkins and Sime argued for the greater integration of stability into undergraduate curricula and ongoing professional development to support future best practice. Dr Jenkins reflected that the increasing use of elastomeric devices in OPAT has created new challenges for pharmacists, where current training focuses more on clinical applications than on pharmaceutical science.

Participants universally agreed on the value of sharing best practices internationally. While consensus has been reached for certain antibiotic classes, notably penicillins,[8] gaps remain for other agents with less favourable degradation profiles. As Professor Seaton concluded, absolute harmonisation may be unrealistic, but recognition of common principles across health systems is essential, with national consensus adapted to local contexts.

Regulatory and governance frameworks

The roundtable discussion emphasised the critical role of regulatory and governance structures in ensuring safe and equitable OPAT practice, especially in aligning antimicrobial stability with good stewardship practices.

A key theme was the need for greater transparency and information sharing. Professor Muldoon underlined this point, highlighting 'a need to understand what companies are doing, what knowledge they may have gained that can be applicable to a wider context'.

She noted that while commercial interests are a reality, there should be a greater emphasis on a dialogue between OPAT stakeholders. Sharing knowledge, she argued, is vital not only for physicians making day-to-day treatment decisions but also for ensuring equity of care and expanding OPAT to under-resourced populations internationally.

The group also discussed the potential of existing platforms such as the Stabilis database.[9] Professor Astier suggested that although manufacturers may not contribute extended stability data to such repositories, leveraging these tools could provide a pathway towards greater consensus without compromising commercial sensitivities. Dr Jenkins echoed the value of this approach but acknowledged current limitations, observing that, 'we're given the headline data, but we can't scrutinise the raw data ourselves – and that would be very valuable.'

Striving for international consensus

Despite pockets of progress, the lack of global consensus was evident, making it challenging for OPAT teams to balance patient benefit with strict regulatory adherence.

Professor Gilchrist proposed that a happy medium could be achieved through pragmatic national or international consensus frameworks and 'unlocking some of that regulation'. Such an approach would respect legal standards and licensing requirements

while creating workable solutions that support clinicians in real-world practice.

Looking forward, Professor Seaton suggested an innovative strategy: an international 'amnesty on all drug stability data'. He proposed that all stakeholders, including pharmaceutical companies, device manufacturers and independent researchers, contribute their stability data to a free, open-access repository. This would include 'all the detail that's required to give confidence and assurance to practitioners', he said.

Dr Jenkins agreed that this could be transformative, adding that many manufacturers already hold unpublished data. 'For the greater good, it would be a lovely call to action to make that data freely accessible,' she said.

Consensus among the participants was clear: while existing regulatory frameworks are essential for ensuring safety, they must evolve to support OPAT practices in a way that is transparent, collaborative and globally inclusive. Without this shift, inequities in access to stability data risk undermining both stewardship efforts and patient care outcomes.

Innovation and emerging research

The final part of the roundtable continued looking to the future, considering how investment, innovation and digital solutions could close existing information and practice gaps in antimicrobial stability for OPAT and support the evidence-based expansion of services.

Professor Seaton drew attention to the subscription-based payment model from the National Institute for Health and Care Excellence, which was designed to stimulate innovation in tackling antimicrobial resistance and bring new agents to market.[10] 'Drug stability is one of the factors woven into that model,' he said. 'There are some specific criteria about use to enable discharge from hospital or avoidance of admission and part of that is for companies to be able to produce data on stability to allow that to happen.' This approach embeds stability within the wider policy agenda of antimicrobial stewardship and service redesign.

Dr Sime emphasised that progress depends on more substantial evidence of benefit and more investment in stability research. He argued that without demonstrable impact – such as reductions in bed days or absolute cost savings – it is challenging to drive policy or regulatory change. Therefore, much more work is still required to highlight the priority areas of research and generate sufficient evidence that will persuade policymakers to consider change, he said, adding that at present that data is still outstanding.

Enablers for OPAT

The discussion also highlighted potential for leveraging procurement frameworks to drive transparency from industry. Drawing on oncology practice in Paris, Professor Astier explained that large purchasing groups can negotiate not only on price but also on the provision of external stability data. He described their approach for anti-cancer drugs in which pharmacies don't buy the product if its manufacturer doesn't provide any external stability data – something that Dr Isner was keen to try in her own negotiations for OPAT. Such strategies incentivise pharmaceutical companies to make stability data more routinely available as it offers them a route to market.

Digital tools were identified as another priority area for progressing best practice. Dr Jenkins described how her hospital in Birmingham has begun integrating stability information directly into its electronic prescribing system, prompting her to ask the group about their own experiences.

Dr Luque-Pardos shared that her team had implemented alerts for solution compatibility and concentrations but she acknowledged limitations in the scope. 'We need much more information about, for example, time limits for use, or device-specific considerations,' she said, adding that having a comprehensive overview would 'make the job faster and [more] reliable', particularly if 'new data could be automatically updated'.

It was a resounding 'yes' from Dr Isner and Professor Muldoon on the question of whether stability data being incorporated into electronic prescribing systems would be useful. Professor Muldoon added: 'You often feel like you're working a little in a little bit of a vacuum sometimes, so the more available information, the better.'

Overall, participants agreed that innovation must operate on several fronts: embedding stability data into health policy frameworks, investing in robust and harmonised research, incentivising industry to share data through procurement mechanisms, and enhancing digital systems to provide clinicians with real-time, evidence-based decision support.

Without such changes, OPAT services risk being constrained by incomplete evidence, leading to inconsistent practice and inequities in patient access.

> **We need to all be rowing in the same direction to try and get the best for the patient**
>
> Professor Eavan Muldoon

Conclusion

This roundtable underscored antimicrobial stability as a defining factor in the safe and effective delivery of OPAT. While regulatory standards remain essential to safeguarding patients, discussions highlighted the frequent tension between rigid adherence to licensed shelf lives and the realities of home-based care. Participants agreed that carefully managed flexibility, supported by robust monitoring, could enable better patient outcomes without compromising safety.

Across the key themes explored, several priorities emerged: closing evidence gaps for prolonged and continuous infusions; improving data sharing across industry, academia and clinical practice; and enhancing education and training. Even small advances in these areas could reduce readmissions, optimise antimicrobial stewardship and expand access to OPAT services.

Achieving progress will require alignment between regulators, manufacturers, researchers and frontline healthcare professionals. Innovative approaches such as stability-linked procurement models, open-access data repositories, and the integration of real-time stability information into electronic systems are promising avenues.

Ultimately, strengthening the evidence base and fostering collaborative solutions among the MDT and other stakeholders will be essential to ensure that OPAT continues to evolve as a safe, effective and sustainable component of modern antimicrobial therapy.

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