Urine sample collection: issues and a solution

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Urine is probably the most common specimen collected for analysis every day. To the clinician, it can represent liquid gold, providing valuable evidence of myriad conditions across urology, antenatal health, STIs, diabetes and increasingly certain cancers. Despite its importance there is no standard for urine collection. In this article the author discusses the problem of inadequate samples and describes a collection system that can help.

The traditional method of midstream urine collection is for the healthcare professional to give the patient some sort of pot in which to collect their urine; this could be a universal container, a small tub or a plastic vending machine cup (Figure 1). I have seen cardboard cartons being given to patients who then have to decant the specimen into a universal container. In the laboratory, the specimen will be decanted again, into a 10ml primary tube. One specimen can therefore be decanted and handled two or three times before it reaches the laboratory, and there is no guarantee it has not been sitting on a shelf in ambient temperatures before the first decant.

Guidelines stipulate that the patient should be asked to produce a midstream urine sample (MSU). In other words, let the first flush of urine go into the toilet, put the container under the stream, and remove it when it is full, and complete the urination. Although some patients are able to interrupt their stream after the initial flow, collect the midstream, and interrupt the flow again to move the container away, the process is difficult for most people to accomplish – not least pregnant women and the elderly. Inevitably, they get urine down the side of the pot, on their hands, and sometimes over the toilet and floor. It is messy, it is unhygienic, and it does little to help infection control in healthcare settings.

The feedback from patients is that they are embarrassed about handing the container back to the nurse or doctor because the outside of it is wet with their urine. They often try and wash it down, meaning that it is then difficult, and sometimes impossible, to write the patient's details on the actual bottle because it is wet; and if a label is applied, it may peel away.

As an observation on general clinical procedure and perception, given the budget and training devoted to the much needed and highly successful National Patient Safety Agency’s ‘clean your hands’ campaign, it seems anomalous that patients are still expected to soil their hands with urine in order to provide an essential diagnostic specimen.
PROBLEMS OF CONTAMINATION
Some healthcare professionals do not bother to ask for midstream samples as it takes time to explain, they know it is hard to achieve, and they do not believe that it really matters. The result is often a specimen containing epithelial cells and debris from the urethra washed out with the first void. This can lead to questionable results: none at all, false-positive or false-negative.

Urine sample contamination rates in the UK range from 0.3% to over 70% according to data gathered through a Freedom of Information Act Request to 174 Trusts in 2016, a variance that belies the importance of the specimen to the diagnostic process. Haematology would be unlikely to tolerate this specimen quality variance, yet blood and urine are taken for the same diagnostic purpose.

This range of unreliability leads to diagnostic difficulty: delayed and untargeted treatment, waste of valuable NHS time and resources, and postponed good health for patients. As over 65 million specimens are delivered to the NHS annually, the scale of the problem becomes obvious. Over 14 million patients are potentially left undiagnosed every year, with significant time, resources and money wasted.

Waiting times for GP appointments could be reduced by fewer repeat visits from patients with urinary tract infections (UTIs) resistant to broad-spectrum antibiotics that guidelines recommend with empirical prescribing. Untreated UTI is reported to be the second highest reason for out-of-hours GP consultations – a costly burden on a struggling NHS.

IMPROVEMENTS OVERDUE
Urine collection methods have not changed in decades and improvement is long overdue. With NHS resources being squeezed at every level, the need to bring basic urological diagnostic practice into line with other areas of medicine cannot be ignored.

Medicine is grappling with an increase in healthcare-associated infections, antimicrobial resistance, UTIs, blood infections, sepsis and other life-threatening medical conditions – all of which could be ameliorated by the creation of a national standard around accurate urine collection and reliable analysis.

Most importantly, however, the continuing emergence and spread of antimicrobial resistance is a real threat to public health. High levels of broad-spectrum antibiotic use, both in hospitals and primary care, is the main driver. Every opportunity to educate the public and reduce and manage overuse should be seized. This applies to hospital clinicians, GPs, frontline nursing staff, health visitors, and all who deal directly with patients.

A report on preventing healthcare-associated gram-negative bacterial blood infections, published by Public Health England (PHE) and NHS Improvement in May 2017, cites untreated UTIs as responsible for 47% of gram-negative blood infections of *E. coli*, which can lead to sepsis and even death.1 Untreated UTI can also lead to a chronic condition or bladder cancer.

Treating a ‘simple’ UTI relies on accurate urine specimen collection as outlined by PHE’s UK Standards for Microbiology Investigation of Urine 2017, which stipulated that samples should be midstream and collected by a non-touch method.2 However, no guidance on how this can be achieved is given.

Urology professionals have an important job, and unreliable urine specimens do not help achieve the best outcomes for patients. It is time to modernise the urine collection process and establish a standard that will deliver much-needed consistency around such essential and basic medicine.

A NEW INNOVATION
The Peezy Midstream is an innovative and novel urine collection device conceived and designed by NHS GP Dr Vincent Forte (Figure 2). He came up with the device in response to repeat visits from patients who he thought he had treated, but whose conditions returned after a course of broad-spectrum antibiotics had been completed. Patients also complained to him about the messy collection process of start-stop-start urination into a small container.

We decided to trial Peezy Midstream at Barts Health NHS Trust, Royal London Hospital site, to see if its use could improve the urine samples collected, reduce contamination, and therefore get a better representation of what was happening with the bladder. Up until this point, our contamination rates were running at 17.4% – below average but still too high. Microbiology reports would often refer to ‘scanty growth’ or ‘mixed growth’ – growth indicates contamination. Reports, ideally, should say that there is either ‘no growth’ or that there is growth of a particular organism (often *E. coli*).

In particular the trial aims to ascertain:
- Does use of the device result in the collection of proper midstream specimens?

Figure 2. The Peezy Midstream catches a clean midstream urine sample without the need to stop and start urination

1. www.trendsinmenshealth.com
• Does the device make it easier for patients to collect the sample, especially for women?
• Does use of the device make the process of collection cleaner and drier?

The trial is ongoing, but so far we have found contamination significantly reduced to 1.5% (Table 1). The Microbiology Department are convinced that the device delivers a higher quality specimen.

Most patients like the device and find it easy to use, appreciating the hygiene, dry hands and dry container. Our patients’ experience has been borne out by a recent usability study by the NHS National Institute for Health Research.1

Adoption of new processes in the NHS can be complex and, of course, there are upfront cost implications that challenge the silo budget systems endemic across both public and private healthcare systems, and which can prevent innovation being adopted. In this case, we believe that the better and more accurate diagnosis and treatment that result are worth the initial investment, and that it will prove to be cost-effective in due course. The economic model for Peezy Midstream points to direct national savings of over £55 million and efficiency savings of approximately £1.5 billion (Forte Medical, personal communication 2017).

Devices such as the Peezy Midstream can help to provide more accurate diagnosis and treatment, improve the patient experience and save money. It is to be hoped that the many years between conception and adoption seen with other new ideas in medicine can be foreshortened.

Declaration of interests: none declared.

REFERENCES


Table 1. Results of an ongoing trial at Barts Health NHS Trust showing the improvement in urine contamination data with the use of the Peezy Midstream urine collection device

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<thead>
<tr>
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<th>Historical (%)</th>
<th>Peezy (%)</th>
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<tr>
<td>Flow cytometry indicates no culture needed</td>
<td>38.8</td>
<td>77.3</td>
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<tr>
<td>Heavy mixed growth</td>
<td>7.7</td>
<td>0.0</td>
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<tr>
<td>Profuse mixed growth</td>
<td>3.8</td>
<td>1.5</td>
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<tr>
<td>Moderate mixed growth</td>
<td>6.5</td>
<td>0.0</td>
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<tr>
<td>No significant growth</td>
<td>14</td>
<td>4.6</td>
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<tr>
<td>No growth</td>
<td>7.6</td>
<td>15.2</td>
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<td>Urine cultured and yielded a significant result</td>
<td>22.7</td>
<td>1.5</td>
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<tr>
<td>Average contaminated sample rate (heavy, profuse and moderate mixed growth)</td>
<td>17.4</td>
<td>1.5</td>
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