Can rapid integrated polymerase chain reaction-based diagnostics for gastrointestinal pathogens improve routine hospital infection control practice? A diagnostic study

Louise Pankhurst,[1,2] Louissa Macfarlane-Smith,[3] James Buchanan,[4] Luke Anson,[1,2] Kerrie Davies,[3,5] Lily O'Connor,[2,6] Helen Ashwin,[5] Graham Pike,[6] Kate E Dingle,[1,2] Timothy EA Peto,[1,2,6] Sarah Wordsworth,[4] A Sarah Walker,[1,2†] Mark H Wilcox[3,5†] and Derrick W Crook[1,2,6*†]

[1]Nuffield Department of Clinical Medicine, University of Oxford, John Radcliffe Hospital, Oxford, UK
[2]National Institute for Health Research (NIHR) Oxford Biomedical Research Centre, John Radcliffe Hospital, Oxford, UK
[3]Leeds Teaching Hospitals NHS Trust, Leeds General Infirmary, Leeds, UK
[4]Health Economics Research Centre, Nuffield Department of Population Health, University of Oxford, Oxford, UK
[5]University of Leeds, Microbiology, Leeds General Infirmary Old Medical School, Leeds, UK
[6]Oxford University Hospitals NHS Trust, Oxford, UK

*Corresponding author
†Contributions considered equal

Declared competing interests of authors: The institution of DWC and TEAP received per-case funding from Optimer Pharmaceuticals to support fidaxomicin trial patient expenses for a trial in *Clostridium difficile* infection. DWC and TEAP also received honoraria from Optimer Pharmaceuticals for participation in additional meetings related to investigative planning for fidaxomicin. MHW has received consulting fees from Actelion, Astellas, AstraZeneca, Cerexa, Cubist, Durata, Merck, Nabriva, Novacta, Novartis, Optimer, Paratek, Pfizer, Roche, Sanofi Pasteur, Summit, Synthetic Biologics, The Medicines Company and VHsquared; lecture fees from Abbott, Astellas, AstraZeneca and Pfizer; grant support from Abbott, Actelion, Astellas, bioMérieux, Cubist, Da Volterra, The European Tissue Symposium, Merck and Summit; and a lecture fee from Alere paid to his department. The Medicines Company and VH Squared; lecture fees from Abbott, Astellas, AstraZeneca and Pfizer; grant support from Abbott, Actelion, Astellas, bioMerieux, Cubist, Da Volterra, The European Tissue Symposium, Merck and Summit; and a lecture fee from Alere paid to his department. Unrelated to *C. difficile* or any gastrointestinal pathogen, DWC has received research funding from BioMérieux for *Staphylococcus aureus* bacterial genome wide association studies, from Pfizer for *Streptococcus pneumoniae* surveillance, and from Microsoft Azure for cloud-based access for bacterial genomic analysis. The institution where ASW holds a part-time post (not involved or acknowledged in this study) has received funding from Gilead Sciences and ViiV Healthcare/ GlaxoSmithKline for additional assays and/or analyses within clinical trials in human immunodeficiency virus (HIV) infection; from Gilead Sciences for her lecturing on educational workshops, and from Janssen and Janssen (formerly Tibotec) for her Data and Safety Monitoring Board membership. No other author has a conflict of interest.

Published August 2014
DOI: 10.3310/hta18530

Plain English summary

Diagnostics for gastrointestinal pathogens

Health Technology Assessment 2014; Vol. 18: No. 53
DOI: 10.3310/hta18530

NIHR Journals Library www.journalslibrary.nihr.ac.uk

Plain English summary

Every year approximately 5000–9000 patients are admitted to a typical hospital with diarrhoea. The problem is that some diarrhoea is caused by infectious microbes such as *Clostridium difficile* ('C-diff'), but about 90% of cases have other, non-infectious, causes, such as taking antibiotics or laxatives. Determining which people do/do not have an infection is a slow process (typically 1–3 days). Meanwhile, patients are moved into single rooms, wherever possible, to stop them passing microbes on. These moves are often unnecessary because patients may not have an infection. Single rooms can get 'blocked' by patients without infectious diarrhoea, while other patients with true infectious diarrhoea remain close to, and therefore are a risk to, others.

As well as being slow, currently many labour-intensive, separate tests (for each possible microbe) have to be done on diarrhoea specimens. Development of a single quick test that could determine which of the 10–15 different microbes is responsible for causing a patient's diarrhoea could, therefore, provide major benefits to patients.

This study investigated two quick tests that look for multiple microbes. One (called MassCode) was not able to accurately detect the presence of microbes, which were known (from results of slow tests) to be in diarrhoea samples. Even worse, it suggested the presence of many other microbes in samples that were known not to contain them. The other (called Luminex) was better, but still failed to find one particular type of important microbe in about half of all tests. Unfortunately, neither test therefore meets the needs of the NHS.

In addition to assessment of the quick tests, a questionnaire survey which examined the current practice and cost of managing infectious diarrhoea was completed by infection control teams, microbiologists and microbiology laboratory managers. The survey suggested that infection control staff spent a lot of time managing infectious diarrhoea.

Health Technology Assessment

HTA/HTA TAR

ISSN 1366-5278 (Print)

ISSN 2046-4924 (Online)

Impact factor: 5.116

Health Technology Assessment is indexed in MEDLINE, CINAHL, EMBASE, The Cochrane Library and the ISI Science Citation Index and is assessed for inclusion in the Database of Abstracts of Reviews of Effects.

This journal is a member of and subscribes to the principles of the Committee on Publication Ethics (COPE) (www.publicationethics.org/).

Editorial contact: nihredit@southampton.ac.uk

The full HTA archive is freely available to view online at www.journalslibrary.nihr.ac.uk/hta. Print-on-demand copies can be purchased from the report pages of the NIHR Journals Library website: www.journalslibrary.nihr.ac.uk

Criteria for inclusion in the *Health Technology Assessment* journal

Reports are published in *Health Technology Assessment* (HTA) if (1) they have resulted from work for the HTA programme, and (2) they are of a sufficiently high scientific quality as assessed by the reviewers and editors.

Reviews in *Health Technology Assessment* are termed 'systematic' when the account of the search appraisal and synthesis methods (to minimise biases and random errors) would, in theory, permit the replication of the review by others.

HTA programme

The HTA programme, part of the National Institute for Health Research (NIHR), was set up in 1993. It produces high-quality research information on the effectiveness, costs and broader impact of health technologies for those who use, manage and provide care in the NHS. 'Health technologies' are broadly defined as all interventions used to promote health, prevent and treat disease, and improve rehabilitation and long-term care.

The journal is indexed in NHS Evidence via its abstracts included in MEDLINE and its Technology Assessment Reports inform National Institute for Health and Care Excellence (NICE) guidance. HTA research is also an important source of evidence for National Screening Committee (NSC) policy decisions.

For more information about the HTA programme please visit the website: http://www.nets.nihr.ac.uk/programmes/hta

This report

The research reported in this issue of the journal was funded by the HTA programme as project number 08/13/35. The contractual start date was in April 2010. The draft report began editorial review in September 2013 and was accepted for publication in January 2014. The authors have been wholly responsible for all data collection, analysis and interpretation, and for writing up their work. The HTA editors and publisher have tried to ensure the accuracy of the authors' report and would like to thank the reviewers for their constructive comments on the draft document. However, they do not accept liability for damages or losses arising from material published in this report.

This report presents independent research funded by the National Institute for Health Research (NIHR). The views and opinions expressed by authors in this publication are those of the authors and do not necessarily reflect those of the NHS, the NIHR, NETSCC, the HTA programme or the Department of Health. If there are verbatim quotations included in this publication the views and opinions expressed by the interviewees are those of the interviewees and do not necessarily reflect those of the authors, those of the NHS, the NIHR, NETSCC, the HTA programme or the Department of Health.

Published by the NIHR Journals Library (www.journalslibrary.nihr.ac.uk), produced by Prepress Projects Ltd, Perth, Scotland (www.prepress-projects.co.uk).