

Assessing the potential of novel molecular epidemiological approaches for managing foodborne disease outbreaks

Area of research interest: [Foodborne pathogens](#)

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Conducted by: Laboratory of the Government Chemist

Background

Outbreaks of foodborne disease can cause serious public health consequences and significant political and trade issues. Current methodology used in the identification of a foodborne disease outbreak tends to be based on traditional microbiological techniques. These can result in certain unavoidable delays which can hamper identification of the source.

From a public health, policy and regulatory perspective, it is important to exploit any advances in knowledge and understanding of emerging technological developments which may assist the control of foodborne disease outbreaks.

Alternative molecular approaches such as Polymerase Chain Reaction (PCR) have been around for many years and have the potential to reduce timescales and improve investigation outcomes. However, such techniques are often only used in outbreak situations as a secondary investigative or confirmatory tool once traditional approaches such as culture have been conducted. The reasons for this are complex and include cost, validation considerations, concerns around variability and robustness, comparability to traditional approaches and 'regulatory' acceptance of non-reference methods.

Molecular microbiological techniques could play an increasing role in the microbiological risk assessment (MRA) in foods. Correct use of MRA should allow foods to be produced more safely and reduce the incidence of food poisoning outbreaks in the future.

The project considered techniques that could result in useful inputs into risk assessment models in the future.

Research Approach

The work aimed to improve the response of health professionals, industry and government to a foodborne disease outbreak, improve public health and prevent potential economic loss.

It consisted of a desk based exercise, to consider current, new and emerging molecular microbiological methods that could be employed within the epidemiological process. This would be for identifying and tracing the source of a food poisoning outbreak.

The challenges that were considered are as follows:

- the rapid and accurate detection of the presence of particular organisms

- techniques that may allow detection or identification of multiple pathogens (this may be genera, species or strains) in one test
- techniques that can be used to detect or identify particular virulence or pathogenicity determinants within organisms
- sub-typing or characterisation methods used within outbreaks to pinpoint causal links

Results

The field of genomics is currently evolving rapidly with new generations of technologies, such as ultra-high throughput sequencing being developed, that may provide improved knowledge and reduce outbreak investigation timescales further.

This review outlines current and emerging genomic approaches that may have the potential to improve the management of foodborne disease outbreaks. It also provides examples of specific stages in the outbreak investigation process which would benefit from the use of molecular approaches. Current capability and expertise in the UK is also highlighted while the review also discusses routes and barriers to implementation.

In conclusion, these newer molecular approaches have the potential to significantly improve outbreak investigations and their use as a frontline tool is plausible. However, there remains a need for parallel development of standards and method validation approaches to determine accuracy, comparability, robustness and 'fitness for purpose'.

Harmonised validation of these new 'alternative' methods across the different laboratories providing data in to outbreak investigations is a critical requirement alongside the need for inter-operable databases.

To facilitate adoption of molecular approaches, robust datasets need to be generated to demonstrate 'fitness for purpose'. A review of current practice should also be undertaken to harmonise approval of novel tests, in line with industrial guidelines, and help reduce the burden on individual laboratories to implement and validate alternative technologies.

Research report

England, Northern Ireland and Wales

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