

EFSA Scientific Colloquium n°20

Use of Whole Genome Sequencing (WGS) of food-borne pathogens for public health protection

Parma, Italy, 16-17 June 2014

Why WGS based approach

Infectious diseases are responsible for >25% of all global deaths

An increasing number of infectious diseases, including foodborne diseases have a global or international epidemiology (*Salmonella*, VTEC, MRSA, etc.).

Rapid detection, identification and exchange of comparable information between Veterinary, food and public health laboratories, as well as national and international authorities globally, are crucial to detect outbreaks, determine trends and control global and local spread.

- WGS may provide a common language that may be exchanged in real-time

WGS the money / time question

- WGS of bacterial isolates
 - 50-100 €
 - 1-2 days
 - Complete information (might even go directly on samples)
 - Seems easy to standardise
- Traditional:
 - Identification – 10 €
 - Serotyping – 25 €
 - Susceptibility testing – 15-25 €
 - PFGE – 50 €
 - MLST – 250 €
 - Molecular characterisation – 10 – 1000 €
 - Several days to weeks

Already competitive

Is a global solution feasible?

- Technically
 - Hardware and software
 - Local or global analysis and repositories
- Scientifically
 - What should we look for and when are isolates related
 - What about antimicrobial resistance or is that not relevant for OB-detection
 - Need for species specific knowledge and curation
 - Novel taxonomy (Gene-by-gene, k-mers, SNP) – where and when
 - Need to combine WGs with epidemiology and need for real-time meta-data
- Politically
 - Access and data-sharing (Political, legal) (complete information or selected) (meta-data)
 - How do we implement in practice and how do we handle more out-breaks
 - The selfish scientist

Objectives

- Discuss in an open scientific debate:
 - Current issues, benefits and future challenges of WGS of foodborne pathogens in public health protection in comparison with current methods.
 - Analysis and interpretation of WGS data (e.g. SNPs, gene-by-gene, kmer, etc.) in the ascertaining of diversity, similarity and relatedness of foodborne bacterial pathogens and to predict pathogenicity and other relevant characteristics (e.g. virulence, AMR).
 - Curation and analysis of WGS data, bioinformatics solutions.
 - Coordination of efforts between the food, veterinary and human health sectors in order to obtain maximum benefits from the use of WGS for food safety.

The three WGs

- **WGS of foodborne pathogens in action**
 - *Chair Martin C.J Maiden*
 - *Rapporteur John Rossen*
- **Curation and analysis of WGS data: bioinformatics solutions**
 - *Chair Jonathan Green*
 - *Rapporteur João André Carriço*
- **WGS of foodborne pathogens: cross-sectorial coordination and international cooperation**
 - *Chair Dorte Lau Baggesen*
 - *Rapporteur Johanna Takkinen*

WG 1 – discussion points

- WGS methods available for food borne pathogens with respect to: cost; speed; accuracy; convenience; practicality and feasibility.
- Means available for the interpretation of WGS data for different applications (research and public health), including the accuracy of different approaches and the ways in which plain language reports can be generated for public health action.
- How should these data be curated and stored in a way that ensure continuity of existing datasets. How to derive information from WGS data to predict e.g. serotype, phagetype, PFGE type, MLST, resistome, virulome?

WG 2 – discussion points

- Challenges linked to the quality evaluation, annotation, interpretation and storage of the huge amount of information provided by WGS, from raw data to genome assembly and analysis results.
- Harmonisation of approaches used for WGS data analysis, including development of genome analysis pipelines and software availability (e.g. open source versus commercial) and including the feasibility of international standards for WGS data analysis
- Benefits for public health of specialised online genomic databases for sharing this WGS data and potentially associated metadata and algorithms allowing for real-time data analysis and visualisation.

WG 3 – discussion points

- Challenges to integrate WGS analysis into routine monitoring, surveillance and outbreak preparedness as basis for integrated analysis within and across sectors?
- Coordination of efforts between the food, veterinary and human health sectors in order to obtain maximum benefits from the use of WGS for food safety and public health protection.
- The speed and opportunities for collaboration towards development and validation of WGS applications across sectors (i.e. human, animal and food). Discuss the capacity building and transition management challenges in introducing new WGS technologies versus old typing technologies.