



## International Food Safety Authorities Network (INFOSAN)

18 November 2009

INFOSAN Information Note No. 4/2009 – PulseNet International

### PulseNet International

#### SUMMARY NOTES

- To address the growing concern of responding to foodborne disease (FBD) threats, other emerging infectious diseases, or acts of bioterrorism in a timely and effective manner, the PulseNet International network was established.
- PulseNet International is a network of networks dedicated to detecting and tracing foodborne infections worldwide. There are currently six independent networks within PulseNet International, with a total of 81 Member countries.
- PulseNet International can contribute to increased efficient information flow between laboratories and food safety officials to quicker identify food safety events and the establishment of an effective global early warning system through its laboratory network.
- PulseNet International and INFOSAN are working to improve information sharing between the two networks to strengthen FBD surveillance and control globally.

#### Introduction

Due to increased global trade, more outbreaks are occurring in different regions of the world than where the implicated food was produced. As a result, a greater number of dispersed outbreaks can be traced back to sources in food exporting countries with no outbreak related cases. For example, in 2007, an international outbreak of *Salmonella* Senftenberg was detected in both the United States of America (USA) and Europe by pulsed field gel electrophoresis (PFGE) analysis performed according to the PulseNet *Salmonella* protocol. The information shared by researchers in Europe and the USA through their respective PulseNet networks determined the infection was associated with the consumption of fresh basil imported from Israel<sup>1</sup>

The rate of international travel has risen simultaneously with global trade, compounding the opportunity for foodborne diseases to spread globally. In 1999, an outbreak of *Salmonella* Paratyphi B infection associated with European travellers to Alanya, Turkey was detected<sup>2</sup>. A total of 309 cases from nine European countries were reported. Five years later, in September 2004, a collaborative effort through PulseNet International linked two *Shigella sonnei* outbreaks, one in the USA and another in Japan, which were being investigated simultaneously to the same source: air travel to Hawaii. After investigators in Japan alerted PulseNet USA about the *S. sonnei* outbreak due to a suspected link to travel to Hawaii, the link was microbiologically confirmed through the exchange of PFGE patterns and strains between PulseNet USA and other countries using PulseNet International<sup>3</sup>. The epidemiological investigation pointed to salad served on-board the associated airplanes leaving from Hawaii as the most likely source of the outbreak. PulseNet data were instrumental in providing the microbiological evidence for a link between Japanese and USA shigellosis cases.

<sup>1</sup> Pezzoli L, Elson R, Little C, Fisher IS, Yip H, Peters TM, Hampton M, de Pinna E, Coia JE, Mather H, Brown DJ, Møller Nielsen E, Ethelberg S, Heck ME, de Jager CM, Threlfall J. International outbreak of *Salmonella* Senftenberg in 2007. *Euro Surveill.* 2007;12(24):pii=3218. 31 July 2008. [www.eurosurveillance.org/ViewArticle.aspx?ArticleId=3218](http://www.eurosurveillance.org/ViewArticle.aspx?ArticleId=3218).

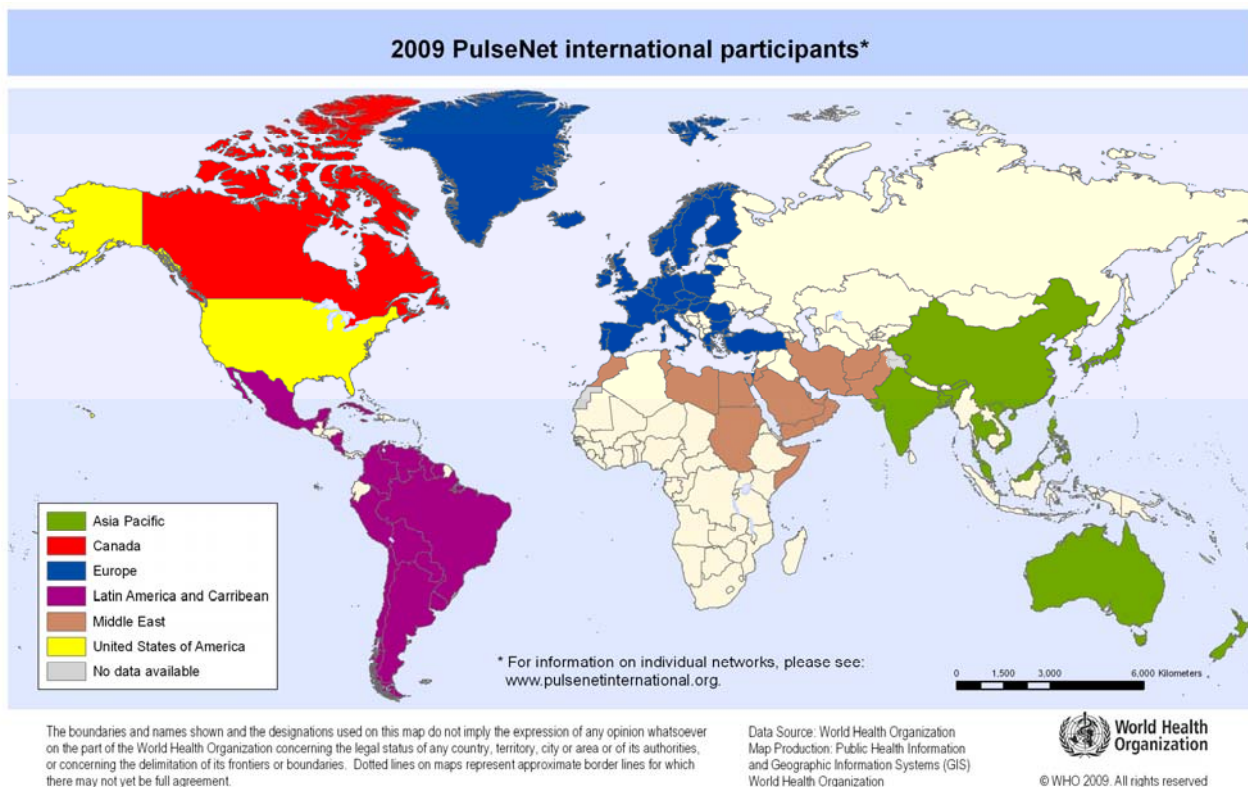
<sup>2</sup> Liefucht A, Reacher M. Case control study of *Salmonella* paratyphi B infection associated with travel to Alanya, Turkey: update. *Euro Surveill.* 1999;3(44):pii=1307.1 August 2008. [www.eurosurveillance.org/ViewArticle.aspx?ArticleId=1307](http://www.eurosurveillance.org/ViewArticle.aspx?ArticleId=1307).

<sup>3</sup> Terajima J, Tosaka N, Ueno K, Nakashima K, Kitsutani P, Gaynor MK, Park SY, Watanabe H. *Shigella sonnei* outbreak among Japanese travelers returning from Hawaii. *Jpn J Infect Dis.* 2006 Aug;59(4):282-3.

## The Rise to PulseNet International

In the early 1990's, an increasing number of foodborne disease outbreaks were detected and investigated in the USA. This increase placed a strain on the resources available at the Central Reference Laboratory of the Foodborne and Diarrheal Diseases Branch at the Centers for Disease Control and Prevention (CDC) for subtyping of outbreak-related isolates using the new gold standard for molecular subtyping of bacterial pathogens, Pulsed-Field Gel Electrophoresis (PFGE). This led to a paradigm shift in how molecular subtyping was performed: the PFGE method was standardized and the procedure was decentralized to the state public health laboratories. The images of the PFGE patterns are electronically transferred to CDC, where they are analysed. This allows for the rapid subtyping and comparison of the PFGE patterns of bacteria isolated from ill persons, food, veterinary and environmental sources throughout the country, and the detection of clusters of cases with identical patterns to indicate that an outbreak might be occurring. Support from Association of Public Health Laboratories (APHL) was instrumental in the creation of PulseNet USA.

To address the growing concern of global foodborne diseases, PulseNet USA began an informal collaboration in 1999 with Canadian laboratories leading to the formal establishment of PulseNet Canada in 2000. The successful PulseNet collaboration between the USA and Canada attracted the attention of public health officials in other regions around the world. Since 2000, PulseNet networks have been established in six regions with more than 80 PulseNet country members worldwide. These networks collaborate under the umbrella of PulseNet International.



**Disclaimer:** Although this Map has been produced by the World Health Organization, the regional and sub-regional data classification of PulseNet International participants is the sole responsibility of PulseNet International. The World Health Organization has not been involved in any manner whatsoever in the design of such data classification and does not imply any opinion on the part of the World Health Organization on neither PulseNet International's data classification nor its participants.

## Vision and Mission of PulseNet International

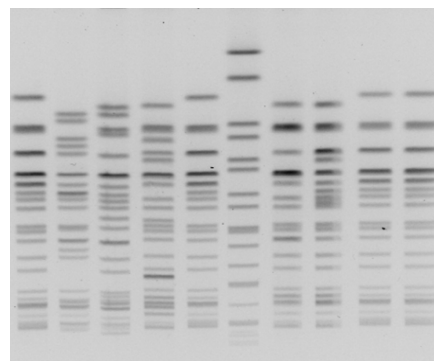
The vision of PulseNet International is to save lives and reduce global social and economic loss due to food and waterborne diseases. PulseNet International aims to achieve this vision through its mission of worldwide regional and national laboratory networks utilizing standardized genotyping methods and sharing information in real-time to enhance surveillance and provide early warning of food and waterborne disease outbreaks, emerging pathogens, and acts of bioterrorism.

The objectives of PulseNet International are to participate in the investigation of outbreaks of foodborne infections and to facilitate early recognition of foodborne disease clusters that may represent common source outbreaks through molecular surveillance of infections at the global level by:

- Partnering with reference laboratories throughout the world
- Building capacity for molecular surveillance of foodborne infections
- Collaborating on the development, validation and implementation of internationally standardized subtyping methods to be used in the networks
- Performing collaborative studies on the geographical distribution and spread of different clones of foodborne pathogens.

### **How Does PulseNet work?**

PulseNet participants perform DNA 'fingerprinting' by PFGE on disease-causing bacteria isolated from humans and from suspected food, animal, and environmental sources using standardized equipment and methods. Once these PFGE patterns are generated, they are entered into a local electronic database of DNA fingerprints. Certified PulseNet participants submit their results directly to a central server in their country or region, as well as share cluster information on their regional PulseNet discussion forum. In this manner, PulseNet plays an important role in the detection of geographically dispersed outbreaks.



Picture by Dr Kara Cooper

### **Laboratory Capacity Building**

#### **Training**

Regional training workshops are given to all PulseNet members to ensure that all participants become proficient in the PulseNet methods and to facilitate full participation in PulseNet activities. During the workshops laboratory theory and hands-on training of standardized PFGE procedures and data analysis are provided. With increasing interests in data analysis and data management, software training workshops have also been organized.

#### **Quality Assurance/Quality Control**

The objective of the Quality Assurance/Quality Control (QA/QC) programme within PulseNet International is to 'ensure the quality and integrity of the results obtained with the standardized PFGE techniques used to subtype foodborne bacterial pathogens'<sup>4</sup>. Adherence to these standardized procedures is essential to ensure the data submitted to national or regional PulseNet databases are of the utmost quality to enable comparisons with data already present in the databases. PulseNet USA has developed a QA/QC manual that is also available for use as a template to assist all PulseNet International participating laboratories in the development of their own QA/QC manuals and programmes. The manual includes standard operating procedures such as general PulseNet laboratory duties and responsibilities', becoming a PulseNet laboratory, PulseNet laboratory equipment and supplies, PulseNet image analysis, and PulseNet proficiency testing. PulseNet laboratories are encouraged to adopt these standards whenever possible and to modify them in a manner consistent with the internal policies or guidelines established by their institution, country or region.

Individuals preparing PFGE gels and/or analysing PFGE gels must be certified before submitting gel images to a PulseNet database in their country or region. Certification documents an individual's highest level of competence in producing and imaging PFGE gels and/or in analysing the image (or TIFF) of PFGE gels. Individuals can be certified for each PulseNet organism in one of three ways:

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<sup>4</sup> PulseNet USA. American Public Health Laboratories. PulseNet Quality Assurance/Quality Control (QA/QC) Manual. May 2005.

- Gel only (gel-certified). An individual can submit TIFFs to an analysis-certified person to analyse and upload to the PulseNet databases.
- Analysis only (analysis-certified). An individual can analyse TIFFs of gels generated by gel-certified individuals and upload those analysed images to a PulseNet database.
- Both gel and analysis (gel and analysis-certified). An individual can perform PFGE and analysis of TIFFs, and can upload the analyses to the PulseNet database.

For each PulseNet organism, at least one person from each PulseNet participating laboratory should be gel-certified and one person should be analysis-certified. This can be the same person. Laboratories need both analysis-certified personnel and gel-certified personnel; gel certification must occur before or at the same time as analysis certification. PulseNet laboratories can obtain certifications by contacting the coordinating laboratory for their PulseNet regional network.

### **Communication and Exchange of Information**

Face-to-face meetings and conference calls are the key to successful collaboration within the PulseNet International Networks. PulseNet International representatives collaborate and work together to overcome barriers to data sharing of information across jurisdictions. These barriers may be complex involving laboratory issues, differences in informatics platforms or language, policy, legal issues, and political will. All PulseNet members are responsible for the confidential exchange of information and communication between PulseNet member countries and regional networks of PulseNet International. Both internet-based discussion forums and e-mails are used to communicate to PulseNet Network members in between face-to-face meetings. All regional and national networks have created or are in the process of creating their own secure, internet-based discussion forums for their members as the primary means of communication. The objectives are to allow for the exchange of current and active information on laboratory issues, e.g. PFGE troubleshooting, and to alert laboratory members when local or national clusters/outbreaks have been detected. The image of PFGE patterns associated with clusters found within their jurisdictions can also be sent via the discussion board or through an alert e-mail sent to all of the PulseNet members in the network.

### **Looking into the future**

As the networks of PulseNet International mature, the networks will continue to meet new opportunities and challenges in the area of foodborne disease detection and response worldwide. At the 2008 PulseNet International Steering Committee Meeting held in Halifax, Canada, discussions began between the Steering Committee and the Enteric Diseases Reference Unit of the South African National Institute for Communicable Diseases (NICD) on a new PulseNet Network for Southern Africa. It has also become a Steering Committee Member of the World Health Organization Global Salm-Surv Network (WHO-GSS), a network of institutions and individuals committed to enhancing the capacity of countries to detect, respond and prevent foodborne and other enteric infections. PulseNet International also strives to define its role in relation to the new WHO International Health Regulations (2005). PulseNet International and INFOSAN are working to improve collaboration between the two networks. Linking INFOSAN and PulseNet International more closely together will ensure a more efficient information flow between laboratories and food safety officials, across more countries, leading to quicker identification of food safety events.

Finally, PulseNet International remains dedicated to:

- Maintain and strengthen collaboration during international outbreak investigation
- Increase the number of PulseNet regional networks and participants in each network
- Achieve real-time subtyping and real-time communication in all PulseNet regional networks
- Increase communication between microbiologists and epidemiologists at the national and international levels
- Improve the subtyping methods used by PulseNet International
- Develop and expand PFGE protocols to include additional organisms (e.g. *Yersinia enterocolitica*, *Cronobacter sakazakii*, *Shigella flexneri*)

- Develop new faster and more simple subtyping methods such as:
  - Multiple-locus variable-number tandem-repeats analysis (MLVA)
  - Single nucleotide polymorphism (SNP) analysis
- Use PulseNet data to study the geographical distribution of major clones of foodborne bacteria and to assist in studies attributing the sources of sporadic foodborne infections, and,
- Establish and strengthen collaboration with other stake holders for food safety, e.g. academia, food industry, non-profit national and international organizations worldwide.

*INFOSAN serves as a vehicle for food safety authorities and other relevant agencies to exchange food safety information and to improve collaboration among food safety authorities at both the national and international level.*

*INFOSAN Emergency, embedded in INFOSAN, links official national contact points to address outbreaks and emergencies of international importance and allows for the rapid exchange of information. INFOSAN Emergency is intended to complement and support the existing WHO Global Outbreak Alert and Response Network (GOARN).*

*INFOSAN is operated/managed by WHO, Geneva. It currently includes 177 Member States.*

*More information is available at: [www.who.int/foodsafety](http://www.who.int/foodsafety)*