



**Real-time international surveillance of antimicrobial resistance by the Enter-net surveillance network**

**Ian ST Fisher, ON Gill, WJ Reilly, HR Smith, EJ Threlfall,  
on behalf of the Enter-net participants**

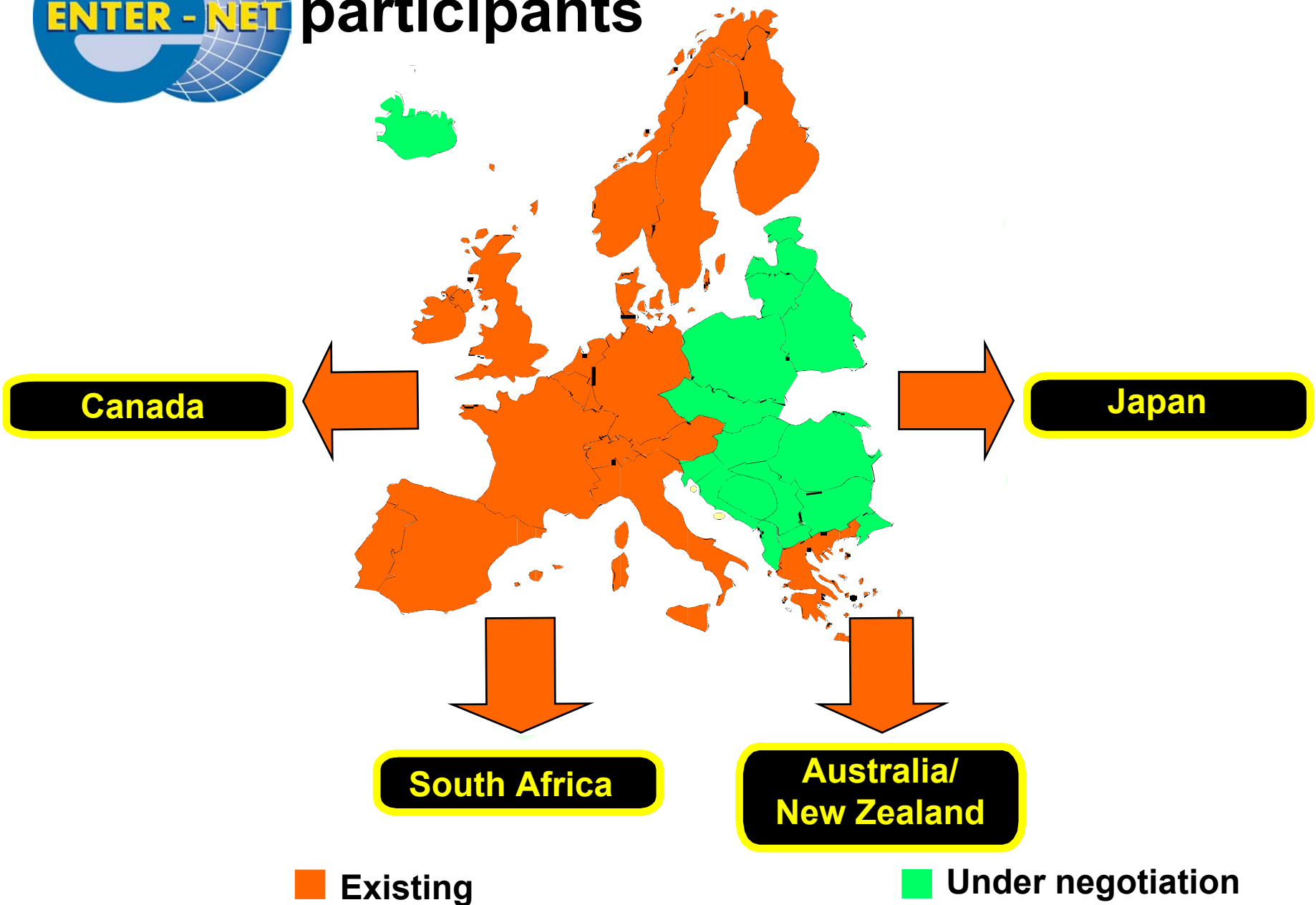


**The International network for the surveillance of Enteric Infections - Salmonella and VTEC O157**

**Funded by the European Commission, DG Health and Consumer Protection (SANCO)  
(previously by DG 12 under Framework 4)**



# participants





## Objectives

### For human isolates:

- **Maintain timely international salmonella and VTEC O157 databases**
- **Rapidly recognise, investigate and report international outbreaks**
- **Monitor salmonella antimicrobial resistance**



## Methods

- **Standardisation of accompanying data**
- **Rapid data collection and information exchange**
- **Harmonisation of National Reference Laboratory (NRL) methods and results**



## Microbiological achievements

- **Harmonisation of salmonella phage-typing,**
- **Countries routinely reporting phage-type data increased from five to nine,**
- **Study to harmonise results of antimicrobial susceptibility testing,**



# Epidemiological achievements

- **Creation of the international *E.coli* database.**
- **Application of new software to improve outbreak recognition,**
- **Development and maintenance of the international salmonella database,**
- **Expansion of the database to incorporate antimicrobial resistance testing results,**



# Salmonella database specification.

- Country
- Serotype
- Specimen
- Sex
- Date of report
- Region
- Phage type
- **Antibiogram**
- Age
- Travel associated
- Food Implicated





# Antimicrobials surveilled

- **Aminoglycosides**
  - ◆ **Streptomycin, gentamicin, kanamycin**
  
- **$\beta$ -lactams**
  - ◆ **Ampicillin, cefotaxime**
  
- **tetrahydrofolate inhibitors**
  - ◆ **Sulphonamides, trimethoprim**
  
- **Quinolones**
  - ◆ **Nalidixic acid, ciprofloxacin**
  
- **Other antimicrobials**
  - ◆ **Chloramphenicol, tetracyclines**



# Antimicrobial resistance standardisation

## The questions?

Which standards to use?

**NCCLS**

**BSAC**

**EUCAST**

Which method?

**MIC**

**Disk diffusion**

**Breakpoint**



## An alternative view

---

**The questions?**

**Which standards to use?**

**NCCLS**

**BSAC**

**EUCAST**

**Which method?**

**MIC**

**Disk diffusion**

**Breakpoint**



# Harmonisation study

## Methods

**Panel of 48 strains sent to 18 NRLs**

**30 different sero/phage-types**

**Ranging from fully sensitive to multi-resistant**

**Tested using own techniques**

## Results

**Qualitative results (R, I, S)**

**Method used (DD, BP, MIC)**

**Transmitted electronically to Enter-net hub**



# Concordance of resistance results

## Calculation of results

### Resistance to antimicrobial “X”

N° of strains resistant	20
N° of labs testing	15/18
N° of tests for resistance	300
Results showing resistance - actual	260
Percentage “concordance”	87% (260/300)



## Results – I

### Data returned

**Eight laboratories**

**Five laboratories**

**Three laboratories**

**One laboratory**

**One laboratory**

**11 antimicrobials**

**10 antimicrobials**

**9 antimicrobials**

**8 antimicrobials**

**5 antimicrobials**

**Total number of tests**

**8,688 (9,504, 91.4%)**



## Results – II (concordance)

<b>Resistant strains</b>	<b>%</b>		<b>%</b>
<b>Streptomycin</b>	<b>99.8</b>	<b>Gentamicin</b>	<b>100</b>
<b>Kanamycin</b>	<b>99.6</b>	<b>Ampicillin</b>	<b>99.6</b>
<b>Cefotaxime</b>	<b>100</b>	<b>Sulphonamides</b>	<b>99.7</b>
<b>Trimethoprim</b>	<b>99.1</b>	<b>Chloramphenicol</b>	<b>100</b>
<b>Tetracyclines</b>	<b>99.4</b>	<b>Nalidixic acid</b>	<b>99.3</b>
<b>Ciprofloxacin (BP 1.0)</b>	<b>100</b>	<b>Ciprofloxacin (BP 0.125)</b>	<b>56.2</b>



## **Study conclusions – I**

### **For routine surveillance of resistant and sensitive strains**

- **mean difference for concordance of resistant strains**
  - ◆ **99.7% (range 99.1-100)**
- **mean difference for non-concordance of sensitive strains**
  - ◆ **0.7% (range 0.0-2.0)**
- **∴ we can be confident that the results are comparable**





## Study conclusions – II

### For routine surveillance of resistant and sensitive strains

- International data of harmonised antimicrobial resistance patterns are being exchanged
- Incorporated into the international surveillance database that had already been created.
- **Integrity is maintained by an annual QA scheme**



## Data outputs

Antibiotic-resistant *Salmonella* infections are a problem of increasing significance in the United States.

In the last 3 years, public health surveillance activities at the Centers for Disease Control and Prevention and in the U.S. have detected the emergence of a **multidrug-resistant strain of *Salmonella* serotype Newport**, the third most common *Salmonella* serotype in the United States. This multidrug-resistant strain is commonly resistant to **ampicillin, amoxicillin/clavulanic acid, cephalothin, cefoxitin, ceftiotur, ceftriaxone, chloramphenicol, tetracycline, streptomycin, and sulfamethoxazole**. Several isolates are also resistant to **kanamycin**. Clusters of human infection have recently been recognized in the United States and dairy cows have been identified as a major reservoir for this multidrug-resistant pathogen.



## Results

	2000	2001*
<b>N° of strains of S. Newport</b>	<b>659</b>	<b>748</b>
<b>N° including antibiogram</b>	<b>242</b>	<b>214</b>
<b>N° sensitive</b>	<b>197 (81.4%)</b>	<b>177 (82.7%)</b>
<b>N° resistant to &lt;5 antimicrobials</b>	<b>30 (12.4%)</b>	<b>24 (11.2%)</b>
<b>N° resistant to <math>\geq 5</math> antimicrobials</b>	<b>15 (6.2%)</b>	<b>13 (6.1%)</b>

\* Provisional



## Results – 2000

<b>R-type</b>	<b>Nº</b>	<b>%</b>
<b>ACSuTTm (K, Nx)</b>	<b>4</b>	<b>1.7</b>
<b>ACSSuT (Tm, K, Tm/G/K/Nx)</b>	<b>3</b>	<b>1.2</b>
<b>ASSuTK</b>	<b>3</b>	<b>1.2</b>
<b>ASSuTTm</b>	<b>1</b>	<b>0.4</b>
<b>SSuTTmG</b>	<b>1</b>	<b>0.4</b>
<b>SuTmKNxCp</b>	<b>1</b>	<b>0.4</b>



## Results – 2001

<b>R-type</b>	<b>Nº</b>	<b>%</b>
<b>ACSSuTTm (K, 3 x G/K/Nx)</b>	<b>5</b>	<b>2.4</b>
<b>ACSSuTTmKNxCp</b>	<b>2</b>	<b>0.9</b>
<b>ACSuTTm (Cp/G)</b>	<b>2</b>	<b>0.9</b>
<b>ACSSuT</b>	<b>2</b>	<b>0.9</b>
<b>ACSuTTmKNx</b>	<b>1</b>	<b>0.5</b>
<b>ASSuTTmG</b>	<b>1</b>	<b>0.5</b>
<b>SuTTmGK</b>	<b>1</b>	<b>0.5</b>
<b>CSSuTTmK</b>	<b>1</b>	<b>0.5</b>



## Conclusions

- **Isolates of multiple resistant *S. Newport* have been recognised by the Enter-net surveillance network,**
- **The incidence is very low at the moment,**
- **Vigilance is required to monitor any emergence of this virulent strain,**
- **A mechanism exists to rapidly identify any international distribution of this strain.**



# Acknowledgements

- **The 18 NRLs that performed this study**
- **All Enter-net participants for supporting the network**
- **The European Commission (DG SANCO) for funding the network.**
- **John Threlfall, for his invaluable analysis of the results**



## References

- **Fisher IST (on behalf of the Enter-net participants)  
The Enter-net international surveillance network – how it works. Eurosurv 1999 4: 52-55.**
- **EJ Threlfall, IST Fisher, LR Ward, H Tschäpe, P Gerner-Smidt. Harmonisation of antibiotic susceptibility testing for *Salmonella*: results of a study by 18 National Reference Laboratories within the European Union-funded Enter-net group. Microb. Drug Resist. 1999 5: 195-200.**





**The International network for the surveillance of Enteric Infections - Salmonella and VTEC O157**

**Funded by the European Commission, DG Health and Consumer Protection (SANCO)  
(previously by DG 12 under Framework 4)**