WHO Global Salm-Surv

Progress Report

2000 ~ 2005

WHO Library Cataloguing-in-Publication Data

WHO Global Salm-Surv.
Progress report (2000-2005) : building capacity for laboratory-based foodborne disease surveillance and outbreak detection and response / WHO Global Salm-Surv.

1.WHO Global Salm-Surv. 2.Salmonella - epidemiology. 3.Food microbiology - education. 4. Food contamination. I.World Health Organization. II.Title: WHO Global Salm-Surv progress report (2000-2005).

ISBN 92 4 159409 8 (NLM classification: WC 268)
ISBN 978 92 4 159409 7

Printed by the WHO Document Production Services, Geneva, Switzerland

For further information:

Department of Food Safety, Zoonoses and Foodborne Diseases
World Health Organization
20, Avenue Appia
CH-1211 Geneva 27, Switzerland
Fax: +41 22 791 4807
Email: foodsafety@who.int
Web site: http://www.who.int/foodsafety

.

Table of Contents

Executive Summary

The Problem
Foodborne diseases are an important cause of morbidity and mortality worldwide. Travel, migration and distribution of food contribute to the global problem of foodborne diseases. The World Health Organization (WHO) estimates that over two million people die from diarrhoeal diseases each year. In response to the impact of foodborne and other infectious enteric diseases, WHO and other collaborators launched WHO Global Salm-Surv in 2000 (www.who.int/salmsurv).

WHO Global Salm-Surv is dedicated to improving laboratory-based foodborne disease surveillance and outbreak detection and response. WHO Global Salm-Surv activities are funded by in-kind support and external resources. The annual budget for WHO Global Salm-Surv was estimated at approximately US$ 1.7 million in 2004.

WHO Global Salm-Surv Steering Committee

- World Health Organization, Switzerland
- Centers for Disease Control and Prevention, United States of America
- Danish Institute for Food and Veterinary Research, Denmark
- Reseau International Des Instituts Pasteur, France
- Public Health Agency of Canada
- Food and Drug Administration, Center for Veterinary Medicine, United States of America
- Animal Sciences Group, Netherlands
- Enter-net, European Union
- OzFoodNet, Australia

Members
At the end of 2005, 888 individuals from National Reference Laboratories and other national and regional institutes in public health, veterinary and food-related disciplines in 142 countries were members of WHO Global Salm-Surv.

Vision
Foodborne and other infectious enteric diseases are a common cause of illness, disability and death worldwide. We believe they are preventable and, therefore, place an unnecessary burden on society. Our vision is that all countries will prevent and control these diseases.

Mission
To promote integrated, laboratory-based surveillance and foster intersectoral collaboration among human health, veterinary and food-related disciplines, thereby enhancing the capacity of countries to detect, respond to and prevent foodborne diseases.

Goals and Accomplishments, 2000-2005
There were five goals of WHO Global Salm-Surv from 2000 to 2005.

Goal I: Strengthen capacities of National Reference Laboratories and other national public health institutions to conduct laboratory-based foodborne disease surveillance and outbreak detection and response.

Key Accomplishments through 2005

WHO Global Salm-Surv International Training Courses

- Conducted 33 International Training Courses in English, Spanish, Portuguese, Chinese, Russian and Arabic for over 600 microbiologists and epidemiologists from over 90 countries.

External Quality Assurance System

- Conducted five cycles of the External Quality Assurance System with participants from over 225 laboratories from 97 countries.
- Increased correct *Salmonella* serotyping results from 76% in 2000 to 90% in 2002, and continued good results in subsequent years.
- Maintained correct *Salmonella* antimicrobial susceptibility testing results over 90% for five years.

Laboratory Support

- Developed standardized WHO Global Salm-Surv Laboratory Manuals in English, Spanish, Portuguese, Chinese, Russian and Arabic.
- Provided over 100 *Salmonella* serotyping kits to WHO Global Salm-Surv International Training Course participants.
- Performed reference testing for over 2300 *Salmonella*, *Campylobacter* and *Escherichia coli* O157 strains for verification and analysis.
- Served a number of international projects with reference testing services.

Goal II: Establish Centres of Excellence for specialized training and consultation in laboratory-based foodborne disease surveillance and outbreak detection and response.

Key Accomplishments through 2005

- Established five WHO Global Salm-Surv Regional Centres of Excellence.
- Conducted training in each of the six WHO Regions using 12 Training Sites.

Goal III: Foster collaboration among microbiologists and epidemiologists in national institutions working with foodborne diseases, including those in public health, veterinary and food-related disciplines.

Key Accomplishments through 2005

- Established surveillance and applied research projects among WHO Global Salm-Surv International Training Course participants including two regional projects, three burden of illness projects and two enhanced surveillance projects.

Goal IV: Enhance reporting of *Salmonella* serotype data through the use of a web-based country databank designed to collect and report annual data from Member Institutions.

Key Accomplishments through 2005

- WHO Global Salm-Surv has more than 880 members from 142 countries.
- The WHO Global Salm-Surv Country Databank contains data on over 1 million human *Salmonella* isolates and 100,000 non-human *Salmonella* isolates.
- One hundred laboratories, mainly national reference laboratories, in 75 countries contributed data on *Salmonella* serotypes isolated from human, animal, food and environmental sources, during 2000-2005.

- *Salmonella* Enteritidis and *Salmonella* Typhimurium were identified as the most common serotypes reported globally.

Goal V: Promote communication about surveillance of foodborne diseases, including antimicrobial resistance and other foodborne disease related issues, through a multitude of media including the worldwide web, print publications, meetings and conferences.

Key Accomplishments through 2005

- Disseminated over 170 messages to WHO Global Salm-Surv Members via the WHO Global Salm-Surv Electronic Discussion Group.
- Rapidly determined the global laboratory capabilities for *Bacillus anthracis* isolation and identification in response to the 2001 anthrax outbreak in the United States of America.

Overview

Introduction

Safe food is essential in maintaining a healthy and productive lifestyle. Foods can harbor harmful microorganisms that may cause serious human illnesses. WHO defines foodborne illnesses as "diseases, usually either infectious or toxic in nature, caused by agents that enter the body through the ingestion of food." Salmonellosis and other foodborne illnesses result in diarrhoea, bloody diarrhoea, vomiting and abdominal cramping. One of the most harmful types of foodborne bacteria, Shiga toxin-producing *Escherichia coli*, can result in hemolytic uremic syndrome, a condition that can lead to kidney failure. It is estimated that each year two million people die from diarrhoeal diseases, mostly attributed to contaminated food and drinking water.

Many nations are realizing the human health and monetary burden that foodborne diseases place on their communities. Each year in the United States of America for example, foodborne diseases result in an estimated 76 million illnesses, 325 000 hospitalizations and 5 000 deaths. The Economic Research Service of the United States Department of Agriculture estimates that foodborne diseases caused by *Campylobacter*, *Salmonella*, *Escherichia coli* O157 and *Listeria monocytogenes* cost almost US$ 7 billion each year in the United States of America. Other developed countries that have conducted burden of infectious enteric illness studies also report a major human health impact caused by foodborne diseases.

A WHO survey conducted in 1997 indicated a lack of basic infrastructure for laboratory-based *Salmonella* surveillance in up to one third of WHO member states (Herikstad H, *et. al. Epidemiology and Infection,* 2002). This survey served as the impetus for the creation of WHO Global Salm-Surv.

Food safety is a global public health goal. In developing countries, where diarrhoeal diseases are particularly prevalent, determining the proportion due to foodborne diseases can be difficult. Clinical laboratory and public health infrastructure to perform such assessments is not present in all nations. *Salmonella* is one of the most common causes of foodborne diseases. Over 2 500 *Salmonella* serotypes are described. While some information is available about the global impact of *Salmonella*, particularly in the developed world, additional research is needed to better define the global burden of these infections. Several countries have developed national interventions to prevent *Salmonella* infections. Multi-resistant Salmonellae have become common on several continents. Laboratory-based surveillance for *Salmonella*, including *Salmonella* serotyping, and monitoring of resistance, is an essential component of *Salmonella* prevention and control activities.

A WHO survey of WHO Member States in 1997 indicated a lack of basic infrastructure for laboratory-based surveillance for foodborne diseases. Although 73% (76) of the 104 countries who responded to the survey reported conducting public health surveillance for *Salmonella*, there was a need to enhance capacities for *Salmonella* serotyping. Up to one-third of WHO Members States indicated a lack of basic infrastructure for laboratory-based *Salmonella* surveillance. The survey also collected information on the number of countries conducting antimicrobial susceptibility testing on foodborne pathogens. Only 11% (11) of the 104 WHO Member States reported susceptibility testing of more than 1 000 *Salmonella* isolates a year.

Purpose

Recognizing the global public health importance of foodborne diseases including *Salmonella* and the need to enhance capacity for laboratory-based surveillance, WHO Global *Salmonella* Surveillance (WHO Global Salm-Surv) was launched in 2000.

WHO Global Salm-Surv Vision:
Foodborne and other infectious enteric diseases are a common cause of illness, disability and death worldwide. We believe they are preventable and therefore, place an unnecessary burden on society. Our vision is that all countries will prevent and control these diseases.

Founding members of WHO Global Salm-Surv included the World Health Organization, The Centers for Disease Control and Prevention (United States of America) and the Danish Institute for Food and Veterinary Research (Denmark).

WHO Global Salm-Surv Mission:
To promote integrated, laboratory-based surveillance and foster intersectoral collaboration among human health, veterinary and food-related disciplines, thereby enhancing the capacity of countries to detect, respond to and prevent foodborne diseases.

In 2001, representatives from Argentina, China, Kenya, Poland, Senegal, South Africa and Thailand joined WHO and its partners at the first Annual WHO Global Salm-Surv Strategic Planning Meeting in Copenhagen, Denmark and developed the WHO Global Salm-Surv Strategic Plan for 2001-2005. This plan guided the first years of the programme. Subsequent Annual WHO Global Salm-Surv Strategic Planning Meetings to review accomplishments and develop new or enhanced strategies to achieve the goals established in the WHO Strategic Plan were held in Atlanta, United States of America (2002 and 2004), Paris, France (2003) and Winnipeg, Canada (2005).

3rd Annual WHO Global Salm-Surv Strategy Planning Meeting in Paris, France

WHO Global Salm-Surv Steering Committee Members at the Annual WHO Global Salm-Surv Strategic Planning Meeting in Paris, France, 2003. Front Row Left to Right: Andrea Ellis (Canada), Suzanne Gelders (Switzerland), Beniamin Cherkasskiy (Russian Federation), Cameille Ali (Trinidad and Tobago), Lai-King Ng (Canada), Rene Hendriksen (Denmark). Middle Row: Patrick Grimont (France), Fred Angulo (United States of America), Tom Chiller (United States of America), Bala Swaminathan (United States of America), Marie-Christine Fonkoua (Cameroon), AnneMette Seyfarth (Denmark), Jocelyn Rocourt (Switzerland), Norma Binzstein (Argentina), Eleni Galanis (Denmark), Thongchai Chalermchaikit (Thailand), Anna Cieslak (Poland), Beth Imhoff (United States of America). Back Row: Francois Weill (France), Jaap Wagenaar (Netherlands), Henrik Wegener (Denmark), Pat McDermott (United States of America), Marcel Van Bergen (Netherlands), Danilo Lo Fo Wong (Denmark), Peter Gerner-Smidt (Denmark), Awa Aidara-Kane (Switzerland), Marc Jouan (France), Dale Morse (United States of America), Peter Braam (Switzerland).

Goals

There were five goals of WHO Global Salm-Surv from 2000 to 2005.

Goal I: Strengthen Capacities

Strengthen capacities of National Reference Laboratories and other national public health institutions to conduct laboratory-based foodborne disease surveillance and outbreak detection and response.

Goal II: Establish Centres of Excellence

Establish Centres of Excellence for specialized training and consultation in laboratory-based foodborne disease surveillance and outbreak detection and response.

Participants and Trainers from a Level II-Advanced Course for Microbiologists in Trinidad and Tobago in 2004.

Goal III: Foster Collaboration

Foster collaboration among microbiologists and epidemiologists in national institutions working with foodborne diseases, including those in public health, veterinary and food-related disciplines.

Goal IV: Enhance Reporting

Enhance reporting of *Salmonella* serotype data through the use of a web-based country databank designed to collect and report annual data from Member Institutions.

Goal V: Promote Communication

Promote communication about surveillance of foodborne diseases, including antimicrobial resistance and other foodborne related issues through a multitude of media including the worldwide web, print publications, meetings and conferences.

A participant at a Level I-Basic Course for Microbiologists in Cameroon in 2002 discusses his points with other participants.

Structure

WHO Global Salm-Surv Steering Committee

The WHO Global Salm-Surv Steering Committee sets the strategic direction of WHO Global Salm-Surv, mentors Training Sites and Regional Centres of Excellence, and provides assistance for activities at the national and regional level. The WHO Global Salm-Surv Steering Committee reviews activities of a Training Site, usually after completion of two successful training courses, to determine whether the Training Site meets the terms of reference for a Regional Centre of Excellence.

WHO Global Salm-Surv Steering Committee Members are representatives from government and private institutions or public health surveillance networks that focus on foodborne diseases. In 2005, WHO Global Salm-Surv Steering Committee Members include the World Health Organization, Centers for Disease Control and Prevention (United States of America), Danish Institute for Food and Veterinary Research (Denmark), Reseau International des Instituts Pasteur (France), Public Health Agency of Canada, Animal Sciences Group (Netherlands), Food and Drug Administration (United States of America), Enter-net (European Union) and OzFoodNet (Australia).

WHO GLOBAL SALM-SURV STEERING COMMITTEE, 2005

INSTITUT PASTEUR

International Networks of Institut Pasteur (France)

ozfoodnet

OzFoodNet (Australia)

Danish Institute for Food and Veterinary Research (Denmark)

CDC

Centers for Disease Control and Prevention (United States of America)

World Health Organization

World Health Organization

Food and Drug Administration (United States of America)

PUBLIC HEALTH AGENCY of CANADA
AGENCE DE SANTÉ PUBLIQUE du CANADA

Public Health Agency of Canada (Canada)

ANIMAL SCIENCES GROUP
WAGENINGEN UR

Animal Sciences Group (Netherlands)

ENTER-NET

Enter-net (European Union)

WHO Global Salm-Surv Affiliated Member

A WHO Global Salm-Surv Affiliated Member collaborates with WHO Global Salm-Surv on projects aimed at strengthening the regional and national foodborne disease surveillance systems worldwide. Affiliated Members provide invaluable partnerships aimed at achieving WHO Global Salm-Surv goals. Training Programs in Epidemiology and Public Health Interventions Network (TEPHINET) and PulseNet International are currently WHO Global Salm-Surv Affiliated Members.

Training Programs in Epidemiology Interventions and Public Health Network (TEPHINET)

PulseNet International

WHO Global Salm-Surv Organizational Structure

From 2000 to 2005, there were five subcommittees within WHO Global Salm-Surv:

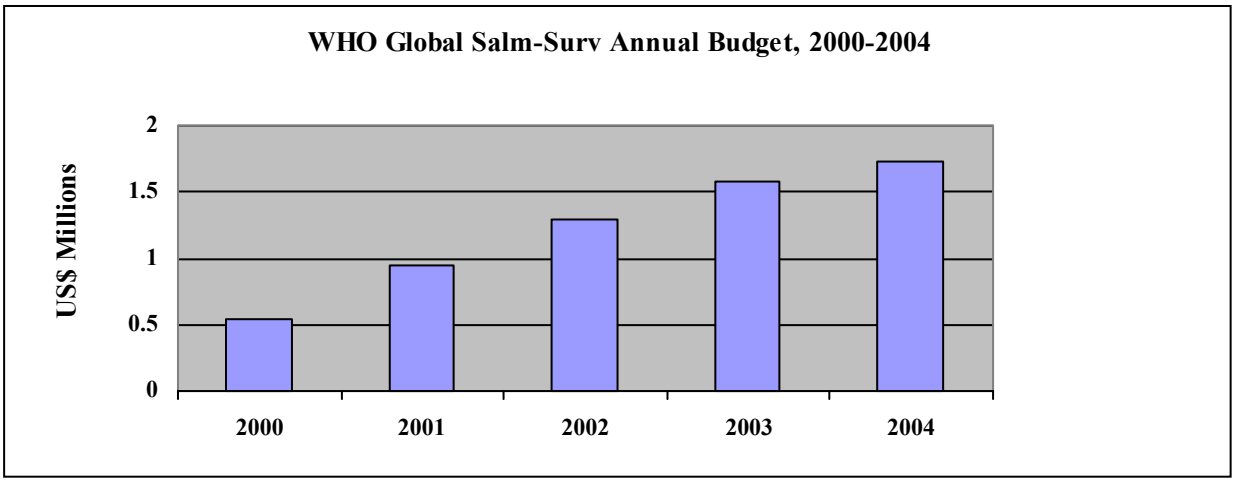
The **Epidemiology Subcommittee** focused on the development, preparation and evaluation of WHO Global Salm-Surv epidemiologic training course materials and curricula. The **Laboratory Subcommittee** addressed the microbiologic component of training courses including the development of standardized laboratory protocols, provision of *Salmonella* antisera, the WHO Global Salm-Surv External Quality Assurance System and reference testing. The **Funding Subcommittee** assessed funding requirements for upcoming training courses and other WHO Global Salm-Surv programme activities. The **Evaluation Subcommittee** focused on methods to assess the impact of the WHO Global Salm-Surv Programme, including the training provided at WHO Global Salm-Surv International Training Courses. Last, the **Archiving Subcommittee** maintained all International Training Course materials and other WHO Global Salm-Surv documents.

Participants work together on microbiological methods at a Level II-Advanced Course for Microbiologists in Argentina in 2001.

Support

WHO Global Salm-Surv Annual Budget

Since 2000, the WHO Global Salm-Surv annual budget has more than tripled from US$ 540 000 to over US$ 1.7 million. The budget includes expenditures for WHO Global Salm-Surv International Training Courses (which include participant and trainer costs and *Salmonella* antisera) and other WHO Global Salm-Surv programme activities. The number of International Training Courses per year is determined primarily by the amount of funding available. WHO Global Salm-Surv increased the annual number of International Training Courses from two courses in 2000 to six courses in 2005. The budget includes in-kind additional support provided by WHO Global Salm-Surv Steering Committee Members, Regional Centres of Excellence and Training Sites.



WHO Global Salm-Surv in 2005

At the end of 2005, there were 888 WHO Global Salm-Surv members from 142 countries.

Since its inception in 2000, WHO Global Salm-Surv has grown from a network into a mature programme resulting in the addition of Steering Committee Members, identification of 12 WHO Global Salm-Surv Training Sites including five Regional Centres of Excellence and the launching of regional and national projects. During this time, WHO Global Salm-Surv also provided *Salmonella* antisera to International Training Course participants, formally evaluated the overall programme and enhanced the International Training Course curricula. In September 2005, training materials to enhance both laboratory and epidemiological skills on specific foodborne pathogens were added to the curricula. Participation in the External Quality Assurance System and the web-based Country Databank has increased, as has advocacy for building capacity for the surveillance of and response to foodborne diseases.

Participants study lecture materials at a Level II- Advanced Course for Microbiologists in St. Petersburg, Russian Federation in 2005.

Microbiologists work on laboratory techniques at a Level I- Basic Course for Microbiologists in Brazil in 2005.

Participants work together during a level III- Integrated Surveillance Course for Epidemiologists and Microbiologists in Trinidad and Tobago 2005.

Goals and Key Accomplishments, 2000-2005

Goal I: Strengthen Capacities

Key Accomplishments Through 2005

WHO Global Salm-Surv International Training Courses

- Conducted 33 International Training Courses in English, Spanish, Portuguese, Chinese, Russian and Arabic for over 600 microbiologists and epidemiologists from over 90 countries.

External Quality Assurance System

- Conducted five cycles of the External Quality Assurance System with participants from over 225 laboratories from 97 countries.
- Increased *Salmonella* correct serotyping results from 76% in 2000 to 90% in 2004.
- Maintained *Salmonella* correct antimicrobial susceptibility testing results over 90% for five years.

Laboratory Support

- Developed standardized WHO Global Salm-Surv Laboratory Manuals in Arabic, Chinese, English, French, Portuguese, Russian and Spanish.
- Provided over 100 *Salmonella* serotyping kits to WHO Global Salm-Surv International Training Course participants
- Performed reference testing for over 2300 *Salmonella*, *Campylobacter* and *Escherichia coli* O157 strains for verification, analysis and project support.

The capacity of National Reference Laboratories and other national public health institutions to conduct laboratory-based foodborne disease surveillance and outbreak detection and response are directly strengthened through three WHO Global Salm-Surv activities:

Activity One: International Training Courses
Activity Two: External Quality Assurance System
Activity Three: Laboratory Support

<u>Activity One: International Training Courses</u>

WHO Global Salm-Surv International Training Courses equip microbiologists and epidemiologists at the national public health, veterinary and food institutions with practical skills needed to strengthen laboratory-based foodborne disease surveillance and outbreak detection and response. WHO Global Salm-Surv has conducted 33 week-long International Training Courses at 12 Training Sites in the six WHO Regions.

A WHO Global Salm-Surv International Training Course cycle consists of four courses for microbiologists and three courses for epidemiologists. The four courses for microbiologists include a Level I-Basic Course for Microbiologists, Level II-Advanced Course for Microbiologists, Level III-Integrated Surveillance Course for Epidemiologists and Microbiologists and Level IV-Advanced Workshop for Epidemiologists and Microbiologists. For epidemiologists, the courses are a Level I-Basic Course for Epidemiologists, Level III-Integrated Surveillance Course for Epidemiologists and Microbiologists and Level IV-Advanced Workshop for Epidemiologists and Microbiologists.

Level I - Basic Course for Microbiologists

A Level I-Basic Course for Microbiologists brings together public health, veterinary and food microbiologists from 10 to 15 nations, totalling approximately 20-35 persons in each course. A Level I-Basic Course for Microbiologists includes:

Microbiologists work in the laboratory during a Level I-Basc Course for Microbiologists in Poland in 2002.

- Lecture and benchtop training for isolation, identification, serotyping and antimicrobial susceptibility testing of *Salmonella*.
- Lectures on epidemiological surveillance and foodborne disease outbreak detection and response techniques, including a presentation of *Salmonella* laboratory data.
- Training on WHO-Net, a Windows®-based database software, to assist laboratories with data analysis of antimicrobial susceptibility test results.
- Creation of an integrated country plan of action by the public health, veterinary and food microbiologists from each nation. The purpose of the country plan of action is to allow country participants to work together to create a plan to implement the techniques and skills learned at the WHO Global Salm-Surv International Training Course.

Level I-Basic Course for Epidemiologists

The Level I-Basic Course for Epidemiologists brings together epidemiologists from 10-15 nations with approximately 20-35 present in each course.
A Level I-Basic Course for Epidemiologists includes:

A discussion on epidemiological techniques at a Level I-Basic Course for Epidemiologists in Brazil in 2005.

- Training on evaluating laboratory-based surveillance systems.
- Training, including practical group exercises, on foodborne disease outbreak detection and investigation.

Level II- Advanced Course for Microbiologists

As in the Level I-Basic Course for Microbiologists, the Level II-Advanced Course for Microbiologists brings together public health, veterinary and food microbiologists from 10 to 15 nations with approximately 20-35 persons in each course. Microbiologists attending the course are the same who have attended the Level I-Basic Course for Microbiologists. A Level II-Advanced Course for Microbiologists includes:

A Level II-Advanced Course for Microbiologists in Thailand in 2001.

- Lectures and benchtop review of serotyping and antimicrobial resistance testing of *Salmonella*.
- Lectures and benchtop training on isolation, identification and antimicrobial susceptibility testing of *Campylobacter*.
- A presentation of the progress made on the country plan of action created during the Level I- Basic Course for Microbiologists.
- A presentation by course participants on their national surveillance system, particularly *Salmonella* serotyping data produced as a result of training from the Level I-Basic Course for Microbiologists.

Level III- Integrated Surveillance Course for Microbiologists and Epidemiologists

The Level III-Integrated Surveillance Course for Microbiologists and Epidemiologists brings together microbiologists (from public health, veterinary and food laboratories), epidemiologists who have attended the previous WHO Global Salm-Surv International Training Courses within the country or region and in some instances institution managers and environmental health officers, from 10 to 15 nations with approximately 40-50 persons in each training course. The course includes:

A microbiologist studies in the laboratory at the Level III-Integrated Surveillance Course for Microbiologists and Epidemiologists in Cameroon in 2004.

For microbiologists:

- A review of laboratory techniques taught at both the Level I-Basic Course for Microbiologists and Level II-Advanced Course for Microbiologists.

For epidemiologists:

- A review for epidemiologists of epidemiological techniques taught at the Level I-Basic Course for Epidemiologists.
- Training on additional pathogens specific to a region.

For microbiologists and epidemiologists:

- Collaboration between microbiologists and epidemiologists through combined exercises on surveillance and outbreaks.

- Microbiologists, epidemiologists and institution managers work as a team to update country plans of action for the following year that focus on national surveillance initiatives for foodborne diseases.

- The importance of advocacy for the political support of laboratory-based surveillance.

Level IV- Advanced Workshop for Microbiologists and Epidemiologists

As in the Level III-Integrated Surveillance Course for Microbiologists and Epidemiologists, the Level IV-Advanced Workshop for Microbiologists and Epidemiologists brings together microbiologists (from public health, veterinary and food laboratories) and epidemiologists from 10 to 15 nations with approximately 40-50 persons in each workshop. The workshop builds on skills acquired at previous WHO Global Salm-Surv International Training Courses and are tailored to meet the specific needs of the region or country where the training is held. A Level IV-Advanced Workshop for Microbiologists and Epidemiologists includes:

Participants receive a lecture on the production of plates for agar dilution of *Salmonella* and *Campylobacter* during a WHO Global Salm-Surv International Training Course in Thailand in 2001.

- Training on advanced microbiological and epidemiological methods that include computer-based epidemiologic training, protocol design instruction and microbiologic training on *E. coli* O157.

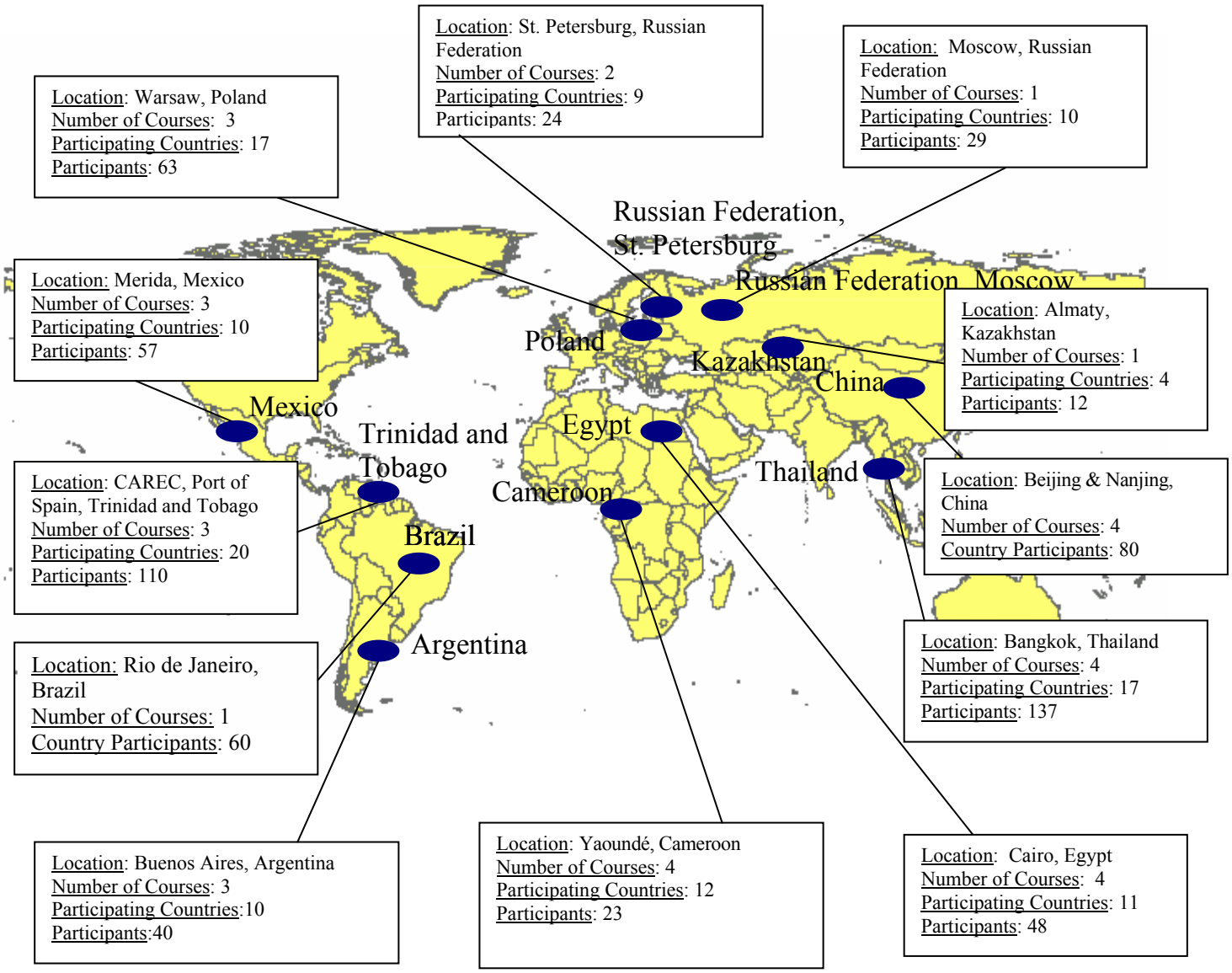
- Provincial Workshops for enhanced foodborne disease surveillance.

- Subregional training on surveillance and laboratory techniques on specific foodborne pathogens such as *E .coli* O157 and *Shigella*.

Evaluation of Training Courses

An evaluation framework is used in WHO Global Salm-Surv International Training Courses to generate feedback from participants before, during and after the courses. The first tool, a daily evaluation, assesses whether each day's teaching has been effective and is used to redirect training during a course. Information gathered has also been used to improve the course curriculum and organization. A second set of evaluation tools, a pre-test and post-test, are administered at each course. Questions are based upon content covered during the course and a comparison of the results gathered is used to assess the impact of training. A third evaluation tool, a final course evaluation, is used to assess participant opinion regarding all components of the course. WHO Global Salm-Surv values evaluation as a necessary component of instruction to determine whether the courses and subsequent activities have made a lasting impact on programme participants.

WHO Global Salm-Surv International Training Courses, 2000-2005



Trainers at a Level III-Integrated Surveillance Course for Microbiologists and Epidemiologists in Egypt in 2004.

Microbiologists watch foodborne disease laboratory techniques at a Level I-Basic Course for Microbiologists in Cameroon in 2002.

Epidemiologists and microbiologists work on a training exercise during a Level III-Integrated Surveillance Course for Microbiologists and Epidemiologists in Argentina in 2003.

Activity Two: External Quality Assurance System

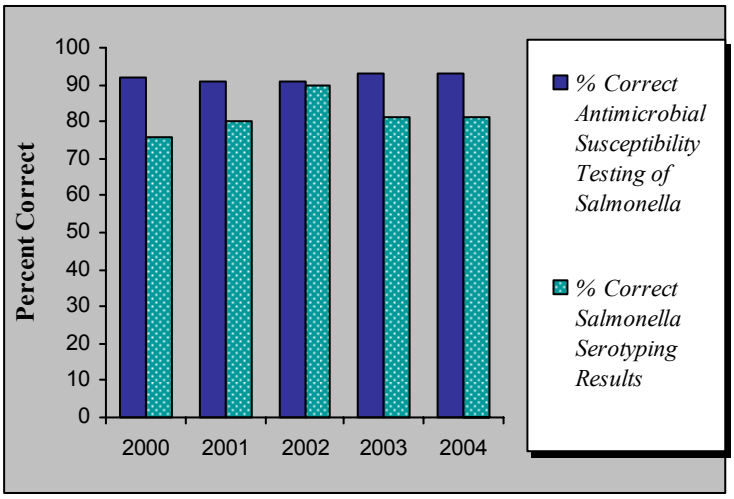
The WHO Global Salm-Surv External Quality Assurance System was established in 2000. Its objective is to assess the accuracy of serotyping and antimicrobial susceptibility testing of foodborne pathogens at participating national and regional laboratories, particularly National Reference Laboratories trained at WHO Global Salm-Surv International Training Courses.

The importance of performing accurate antimicrobial susceptibility testing

Multidrug-resistant *Salmonella* Typhimurium DT 104

Multidrug-resistant *Salmonella* Typhimurium Definitive Type 104 (DT104) was first identified in the United Kingdom in 1984. By 1990, multidrug-resistant *Salmonella* Typhimurium DT104 was prevalent among *Salmonella* isolates in humans in England and Wales and is now detected worldwide in both animals and people. Multidrug-resistant S. Typhimurium DT104 is typically resistant to ampicillin, chloramphenicol, streptomycin, sulfonamides and tetracycline (ACSSuT). A global comparison of DT104 isolates suggests limited variation, suggesting that the evolution of the pathogen was fairly recent and that spread internationally took little time. In June 2005, Helms and Molbak reported results from a survey disseminated to various institutions including WHO Global Salm-Surv Members (Helms M, *Emerging Infectious Diseases* 2005). Results from the survey illustrated an overall increase in the incidence of multidrug-resistant *Salmonella* Typhimurium DT104 in 29 European and North American countries from 1992-2001. The spread of this resistant pathogen stresses the importance of having strong surveillance and control programmes worldwide.

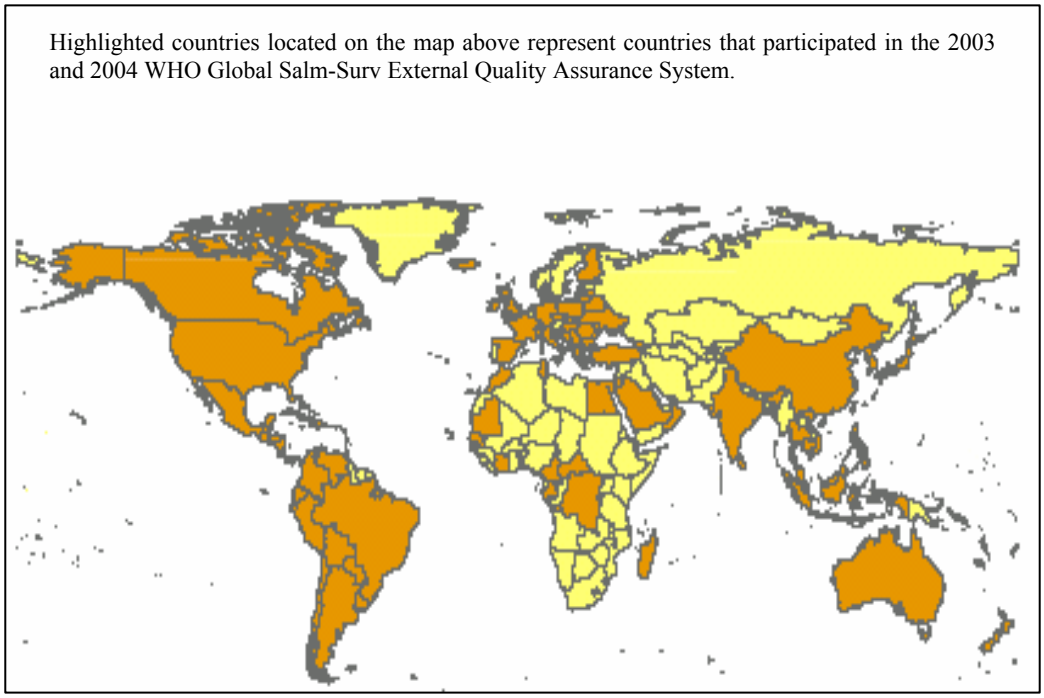
External Quality Assurance System results from 2000 to 2004



The WHO Global Salm-Surv External Quality Assurance System is coordinated by the Danish Institute for Food and Veterinary Research, in collaboration with WHO Global Salm-Surv Training Sites and Regional Centers of Excellence. The External Quality Assurance System tests the skills of training course participants and other national and regional laboratories on serotyping and antimicrobial susceptibility testing of *Salmonella* isolates and allows participating laboratories to utilize and enhance their skills. Each participating laboratory received a parcel containing eight *Salmonella* strains and one reference strain (*Escherichia coli* ATCC 25922) for quality control testing according to standard procedures published by the Clinical and Laboratory Standards Institute (CLSI). In 2003, identification of two thermophilic *Campylobacter* isolates and one "blank" bacterial isolate were also included in the WHO Global Salm-Surv External Quality Assurance System. After identifying strains, results were entered into a database via the web with immediate feedback provided to the participant.

Over 220 laboratories from 96 countries have taken part in the WHO Global Salm-Surv External Quality Assurance System. Forty-four laboratories in 35 countries participated in the first External Quality Assurance System in 2000. In 2001, the number of participants increased to 103 laboratories in 60 countries and in 2002, to 117 laboratories in 67 countries. In 2003 and 2004, 150 public health, food safety and animal health laboratories in more than 80 countries took part in the External Quality Assurance System. The performance of antimicrobial susceptibility testing, for both quality control and testing *Salmonella* strains has improved from 2000 to 2004. An increase in *Salmonella* serotyping performance was seen from 2000 to 2003. In 2003, the

level of difficulty increased and caused the observed decrease in the performance. The same performance results observed for *Salmonella* serotyping in 2003 were also seen in 2004.



Highlighted countries located on the map above represent countries that participated in the 2003 and 2004 WHO Global Salm-Surv External Quality Assurance System.

Activity Three: Laboratory Support

To build capacity for laboratory-based surveillance at the National Reference Laboratories, WHO Global Salm-Surv provides basic resources to assist with application of techniques learned in the International Training Courses. These resources include laboratory manuals, *Salmonella* antisera to conduct *Salmonella* serotyping and reference testing.

Laboratory Manuals

WHO Global Salm-Surv Laboratory Manuals are available in English, Spanish, French, Russian and Chinese. Laboratory Manuals are provided to National Reference Laboratories at WHO Global Salm-Surv International Training Courses. These manuals contain standardized techniques for isolation, identification and antimicrobial susceptibility testing of *Salmonella*, *Campylobacte*r and *Escherichia coli* O157, serotyping following the Kaufmann-White scheme, pulsed-field gel electrophoresis of *Salmonella* according to PulseNet International polymerase chain reaction testing of *Campylobacter* and *Escherichia coli* O157.

Salmonella Antisera

National Reference Laboratories attending WHO Global Salm-Surv International Training Courses are provided a set of *Salmonella* serotyping reagents, free of charge. The *Salmonella* antisera sets are quality controlled by Institut Pasteur, Public Health Agency of Canada and the Danish Institute for Food and Veterinary Research. WHO Global Salm-Surv conducted a global survey on the availability of quality antisera to help direct National Reference Laboratories to reasonably priced, reliable sources of high quality *Salmonella* antisera once the sets are depleted.

Reference Testing

Reference Testing is provided free of charge to National Reference Laboratories to facilitate surveillance and research that might not otherwise be performed at host institutions due to a lack of testing capabilities or materials. Reference testing services include:

- Serotyping and phage typing of *Salmonella*
- Antimicrobial susceptibility testing of *Salmonella* and other foodborne bacteria (e.g, *Campylobacter*)
- PFGE of *Salmonella* and other foodborne pathogens
- Genetic characterization of antibiotic resistance genes in foodborne pathogens

Reference testing is also available to validate the testing results within the host institution, and personnel are available to answer questions regarding guidelines in laboratory manuals on serotyping and direct inquiries to the correct source for assistance on specific technical laboratory issues.

The Danish Institute for Food and Veterinary Research has served a number of international projects with reference testing services. National and regional projects, presentations and manuscripts have come to fruition because of reference testing services given to laboratories worldwide. Through 2005, over 2 300 isolates were received for reference testing. As a result of this service, national and regional projects have gained beneficial data and insight into *Salmonella* serotypes within their regions. Examples of these projects include:

The Salmonella Weltevreden project:
As a result of presentations and discussions of *Salmonella* serotypes at the Level II-Advanced Course for Microbiologists in Thailand in 2001, *Salmonella* Weltevreden was identified as a regional serotype of concern and interest. Consequently, a regional project was launched among countries from the course to further investigate this serotype. A total of 413 isolates from South-East Asia and Western Pacific regions were collected and investigated. A Pulsed-field gel electrophoresis database was created and susceptibility testing results were published in: Antimicrobial susceptibility and occurrence of resistance genes among *Salmonella* enterica serovar Weltevreden from different countries. *Journal of Antimicrobial Chemotherapy*. 2003;52(4):715-8.

The Thai phage typing project:
In 2002, the WHO National *Salmonella* and *Shigella* Centre, Department of Medical Science in Thailand, requested the Danish Institute for Food and Veterinary Research to phage type 79 *Salmonella* Typhimurium strains of human and animal origin during 2000-2001. Phage typing was performed to gain a better understanding of the prevalence of the different phage types of Typhimurium present in Thailand.

The Salmonella Schwarzengrund project:
Serotype Schwarzengrund was noted as an emergent serotype in Asia, as well as some Western nations, in the WHO Global Salm-Surv publication: *Salmonella* serovars from humans and other sources in Thailand, 1993-2002. *Emerging Infectious Diseases*. 2004 Jan;10(1):131-6. From 2004 to 2005, 314 isolates from Asia, Europe and North America were collected and investigated at the Danish Institute for Food and Veterinary Research. Investigation into *Salmonella* Schwarzengrund suggested that trade and foreign travel were related to its emergence. The manuscript describing results from the investigation, "Molecular characterization of *Salmonella*

Schwarzengrund from animals and humans in Thailand, Denmark and the US", will be submitted to an international journal.

The Salmonella Corvallis project:
Hospital infections, extended-spectrum beta-lactamase- producing strains containing the gene *SHV* 2 and its rank as the third most reported serotype among humans in Bulgaria for a number of years made *Salmonella* Corvallis a pathogen of interest for reference testing at the Danish Institute for Food and Veterinary Research in 2004. A comparison between 243 Corvallis strains collected from Bulgaria, Thailand and Denmark was conducted. The poster "Molecular characterization and occurrence of extended-spectrum beta-lactamase resistance genes among *Salmonella* enterica serovar Corvallis from Thailand, Bulgaria and Denmark" was presented at the Agriculture's Role in Managing Antimicrobial Resistance Conference in Toronto, 2005. A manuscript will also be submitted to an international journal.

The Belarus project:
A high incidence of salmonellosis in young children from the region of Gomel, Belarus was reported to the Danish Institute for Food and Veterinary Research in 2004. After investigating 35 strains, results suggested a spread of closely related clones based on pulsed-field gel electrophoresis and multilocus variable-number tandem-repeat analysis (MLVA) typing. These strains were highly resistant and contained the *CTX*-M15 gene. Results were presented at the Republican Conference on Infectious Diseases in May 2005 in Gomel, Belarus. A manuscript will be submitted for publication in an international journal.

The Thai Campylobacter project:
In 2004, assistance to determine the minimum inhibitory concentration (MIC) in 50 isolates of *Campylobacte*r was requested by a WHO Global Salm-Surv member from the Armed Forces Research Institute of Medical Sciences (AFRIMS) in Thailand. Strains were tested using agar dilution against chloramphenicol, streptomycin, gentamicin, tetracycline, azithromycin, erythromycin, nalidixic acid and ciprofloxacin. All isolates were resistant against streptomycin, tetracycline, azithromycin, erythromycin, nalidixic acid and ciprofloxacin.

The Colombia project:
From 2004 to 2005, fifty-five isolates were serotyped for the School of Veterinary Medicine and Animal Husbandry at the University of Antioquia in Medellín, Colombia. Serotypes were intended to assist in producing important epidemiological information as part of the study entitled "Prevalence, biotype and serotype of *Salmonella* spp. in flocks and commercials layers in the Antioquia region".

Democratic Republic of the Congo:
Salmonella serotyping and antimicrobial susceptibility testing were performed on 28 isolates sent to the Danish Institute for Food and Veterinary Research in 2002. A poster presentation of the project was submitted and accepted at the 15th European Congress of Clinical Microbiology and Infectious Diseases in Copenhagen, Denmark in 2005. A manuscript entitled "Antimicrobial Susceptibility of Bacterial Enteric Pathogens Isolated in Humans from 2002 to 2004 in the Province of South–Kivu, Democratic Republic of the Congo," has also been developed.

Nepal Project:
In 2005, *Salmonella* serotyping was performed on 65 isolates from drinking water and clinical samples from Kathmandu, Nepal. Twenty-nine of the 65 strains were found to be Typhi; eight of the 65 strains were identified as Paratyphi A. An abstract on the project was presented at the WHO Sixth International Conference of Typhoid Fever and other Salmonellosis in China.

The Sudanese Project:
In 2005, *Salmonella* serotyping was conducted on 40 isolates from Sudan. Data will be used for the thesis, "Genetic Analysis of *Salmonella* spp. isolated from Humans and other sources in Sudan".

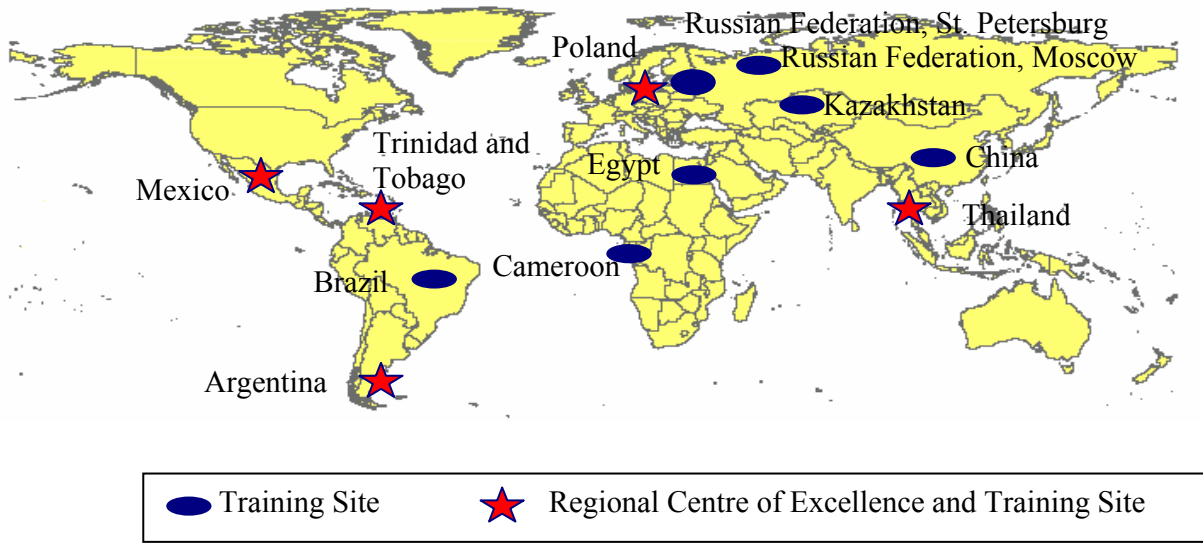
The Salmonella Krefeld Project:
In 2005, assistance on minimum inhibitory concentration (MIC) determinations and pulsed-field gel electrophoresis on 11 isolates of *S*. Krefeld was provided for the *Salmonella* Reference Laboratory at the Institute of Public Health of Serbia and Montenegro. The project analyzes the first isolates of *S*. Krefeld from human and food origin in Serbia and Montenegro. A paper entitled "*Salmonella* Krefeld Isolates of Human Origin in Serbia" will be published.

Goal II: Establish Centres of Excellence

Key Accomplishments Through 2005

- Established five WHO Global Salm-Surv Regional Centres of Excellence.
- Conducted training in each of the six WHO Regions using 12 different Training Sites.

See Appendix One for a description of the regional activities during 2000-2005.



Through 2005, WHO Global Salm-Surv has established 12 Training Sites. Five Training Sites have been recognized as Regional Centres of Excellence. Each WHO Global Salm-Surv Regional Centre of Excellence has conducted several WHO Global Salm-Surv International Training Courses and provided leadership for laboratory-based foodborne disease surveillance and outbreak detection and response in their region.

In 2005, a Strategic Planning Meeting for WHO Global Salm-Surv Regional Centre of Excellence and Training Sites was held in Copenhagen, Denmark. During this meeting, Steering Committee Members partnered with representatives from each Regional Centre of Excellence and Training Site to develop regional plans of action, identify regional projects and discuss future regional training cycles. Additional responsibilities of WHO Global Salm-Surv Regional Centres of Excellence were also discussed and later created through Terms of Reference.

Terms of Reference for WHO Global Salm-Surv Regional Centres of Excellence

- Lead regional communications about laboratory-based foodborne surveillance, including activities related to WHO Global Salm-Surv and promote communication between microbiologists and epidemiologists in human health, veterinary and food safety discipline.
- Develop a regional strategy to provide high-quality *Salmonella* antisera for National Reference Laboratories.
- Serve as a regional reference centre for National Reference Laboratories for *Salmonella*.
- Lead regional research projects.
- Develop strategies and methods for national laboratory-based foodborne disease surveillance.
- Provide training for national foodborne disease microbiologists and epidemiologists, including individual fellowships and at least one WHO Global Salm-Surv International Training Course per year.

Goal III: Foster Collaboration

Key Accomplishments Through 2005

- Established numerous surveillance and applied research projects developed from partnerships strengthened between WHO Global Salm-Surv International Training Course participants. These surveillance and applied research projects included two Regional Projects, three Burden of Illness Projects and two Enhanced Surveillance Projects.
- Created a global *Salmonella* Weltevreden database on over 4 000 human infections and over 900 non-human *Salmonella* isolates. Four hundred eighty-nine isolates from seven countries were subtyped using pulsed-field gel electrophoresis; 339 distinct PFGE patterns were found.
- Conducted the Jordan Burden of Illness Study including a national population survey, laboratory survey and validation survey. Data from the study estimated that over 16 000 shigellosis, nearly 7 000 brucellosis and over 6 600 salmonellosis cases occur each year in Jordan.
- Strengthened partnerships among the Philippines Department of Health, National Epidemiology Centre, Research Institute for Tropical Medicine and Bureau of Food and Drug by facilitating the enhanced *Salmonella* Surveillance Project in the Philippines.
- Forged partnerships between the Fiji Ministry of Health, Fiji School of Medicine, the Centers for Disease Control and Prevention and WHO with the *Salmonella* Surveillance Project in Fiji.

WHO Global Salm-Surv recognizes the need to foster collaboration with international partners to gain support for foodborne disease surveillance worldwide. As WHO Global Salm-Surv advocated for support, projects were also encouraged to build stronger partnerships between epidemiologists and microbiologists within the same country or region. WHO Global Salm-Surv Regional and National projects promoted continued development and application of techniques learned at WHO Global Salm-Surv International Training Courses and provided opportunities for sustainable relationships. Two types of projects helped facilitate this goal: Regional Projects and National Projects.

Regional Projects promote collaboration among foodborne disease microbiologists and epidemiologists within a region. Many of those microbiologists and epidemiologists have also participated in WHO Global Salm-Surv International Training Courses and are given the opportunity to apply the skills learned on foodborne disease projects focused on a specific pathogen in their region. Two National Projects, Burden of Illness Studies and Enhanced Surveillance Projects, also give trained course participants the chance to apply acquired skills. Burden of Illness Studies estimate the morbidity and mortality caused by foodborne disease in the community and Enhanced *Salmonella* Surveillance Projects improve the surveillance capacity for laboratory-based surveillance within a country.

Regional Projects

The *Salmonella* Weltevreden Regional Project and the *Salmonella* Hadar Regional Project are examples of Regional Projects conducted by WHO Global Salm-Surv International Training Course participants. Established by fourteen countries following the WHO Global Salm-Surv Level II-Advanced Course for Microbiologists in Thailand in June 2001, the *Salmonella* Weltevreden Regional Project created a global library of Weltevreden strains and gave further insight into possible causes of infection and areas of possible intervention and research for

Weltevreden. The *Salmonella* Hadar Regional Project was a collaborative study launched by participants following the Level II-Advanced Course for Microbiologists in Cameroon in 2004. This project focused on gathering microbiologic and epidemiologic data about *S*. Hadar from non-human and human sources in French-speaking Western Africa.

National Projects

Burden of Illness Studies

The Burden of Illness studies include the Jordan Sentinel Foodborne Illness Study, the Slovenia Burden of Illness National Project and the Caribbean Burden of Illness Study. The Jordan Sentinel Foodborne Illness Study was launched in 2003 to estimate the burden of infection caused by *Salmonella* (non-typhoidal and typhoidal), *Shigella* and *Brucella* in Jordan. The Slovenia Burden of Illness National Project was a direct consequence of the Level III-Integrated Surveillance Course for Microbiologists and Epidemiologists in Poland in 2004. The project aimed to determine the economic burden of salmonellosis and campylobacteriosis in Slovenia. As with the burden study in Jordan, this study consisted of a national population survey, a physician study and a laboratory survey. Finally, the Caribbean Burden of Illness Study, an integral part of the Level III-Integrated Surveillance Course for Microbiologists and Epidemiologists in Trinidad and Tobago in 2005, was developed to determine the burden of gastroenteritis, acute respiratory illness and fever in the Caribbean through studies in the Bahamas, Saint Lucia, Suriname and Barbados. The study components include a population survey, physician study, laboratory practices survey, microbiological study and tourists survey.

Enhanced Surveillance Projects

Through partnerships forged at WHO Global Salm-Surv International Training Courses, an enhanced *Salmonella* Surveillance Project was designed for the Philippines and Fiji. The enhanced *Salmonella* Surveillance Project in the Philippines was a product of the Level III-Integrated Surveillance Course for Microbiologists and Epidemiologists in Thailand in 2000. The *Salmonella* Surveillance Project in Fiji, launched in October 2003, was a collaborative effort with the objective of creating a non-typhoidal *Salmonella* Surveillance System, while gaining partner support within Fiji and equipping microbiologists with benchtop skills for *Salmonella*.

Advocacy for Support

As part of its efforts to foster collaboration in foodborne diseases, WHO Global Salm-Surv created strategic partnerships worldwide. These partnerships include: the Fogarty International Center (part of the National Institutes of Health of the United States Department of Health and Human Services) and the Field Epidemiology Training Programmes of TEPHINET. The Fogarty International Center partnered with WHO Global Salm-Surv as a sponsor for both the Level I-Basic Course for Microbiologists and Level II- Advanced Course for Microbiologists in Poland in 2002 and 2003 and served as trainers for the microbiologists at both courses. Partnering with the Field Epidemiology Training Programmes have brought national epidemiology partners into WHO Global Salm-Surv and, in turn, provided training for a number of Field Epidemiology Training Programme trainees. This training has allowed epidemiologists to gain field epidemiology experience, as well as network with other public health professionals on the national and regional levels.

Goal IV: Enhance Reporting

Key Accomplishments Through 2005

- WHO Global Salm-Surv has more than 880 members from 142 countries.
- The WHO Global Salm-Surv Country Databank contains data on over 1 million human *Salmonella* isolates and 100 000 non-human *Salmonella* isolates.
- One hundred laboratories, mainly national reference laboratories, in 75 countries contributed data on *Salmonella* serotypes isolated from human, animal, food and environmental sources, during 2000-2005.
- *Salmonella* Enteritidis and *Salmonella* Typhimurium were identified as the most common serotypes reported globally.

The WHO Global Salm-Surv Country Databank is a web-based databank maintained by the Danish Institute for Food and Veterinary Research. WHO Global Salm-Surv Institution Representatives enter their top 15 *Salmonella* serotypes annually. Analysis of this data provides a better understanding of regional and global serotypes.

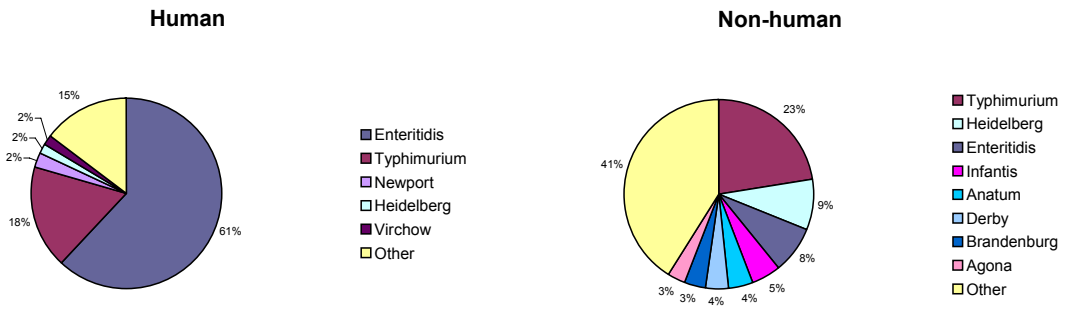
WHO Global Salm-Surv Country Databank:

- Country Databank Institution Representatives enter the top 15 *Salmonella* serotypes isolated in their country through a secure connection by using a password.
- Country Databank users are able to view national summaries of *Salmonella* serotypes reported from WHO Global Salm-Surv Institution Representatives by year, geographic region and individual serotype

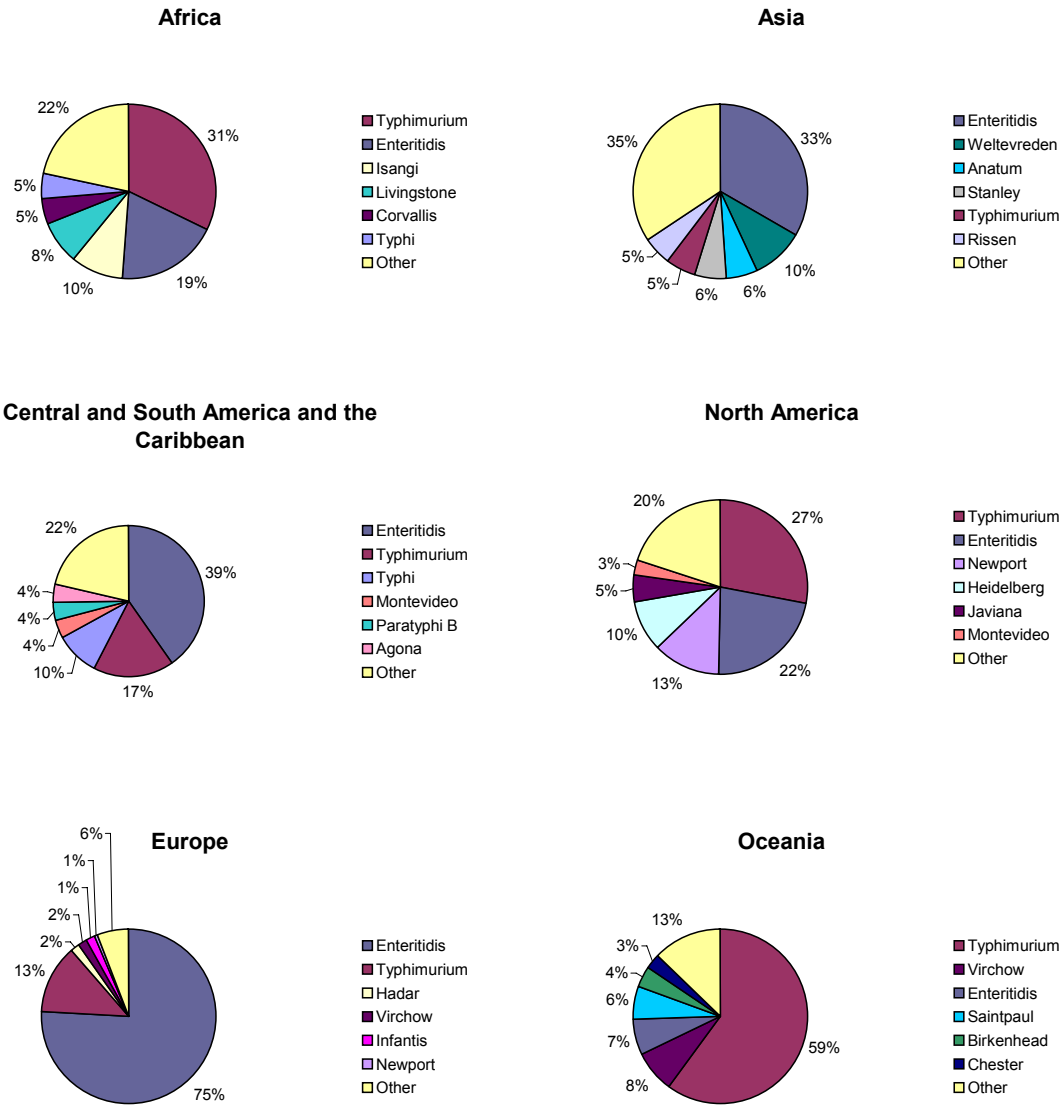
What data is in the databank?

Salmonella serotype data of isolates from human, animal, food, feed and environmental sources from countries in Africa, Asia, Europe, the Americas and Oceania are represented in the databank. Through 2005, the WHO Global Salm-Surv Country Databank has over 500 national datasets from 66 countries and membership information for over 880 members from 142 countries.

Distribution of *Salmonella* serotypes reported to the Country Databank, 2000-2004



Distribution of human *Salmonella* serotypes by region, 2000-2004



A manuscript describing the 2000 to 2002 data in the Country Databank from 49 countries was written in 2005 (Galanis E, *Emerging Infectious Disease* [in press]). *Salmonella* Enteritidis was the most common serotype worldwide followed by *Salmonella* Typhimurium.

The information in the WHO Global Salm-Surv Country Databank allows countries to follow trends of specific *Salmonella* serotypes both regionally and worldwide. Understanding the epidemiology of *Salmonella* is the first important step in strengthening foodborne surveillance systems.

The absence of data from every country is a limiting factor of the database. Countries that lack the infrastructure to perform proper isolation and identification of specific serotypes are not able to report on the most common *Salmonella* serotypes in their country. Addressing this limitation is a fundamental objective of WHO Global Salm-Surv.

Goal V: Promote Communication

Key Accomplishments Through 2005

- Disseminated over 170 messages to WHO Global Salm-Surv Members via the WHO Global Salm-Surv Electronic Discussion Group.
- Rapidly determined the global laboratory capabilities for *Bacillus anthracis* isolation and identification in response to the 2001 anthrax outbreak in the United States of America.

Sharing information on foodborne diseases issues is a crucial step in building sustainable foodborne disease surveillance and outbreak detection and response systems. The WHO Global Salm-Surv Electronic Discussion Group is a moderated electronic listserv that links WHO Global Salm-Surv members globally. The listserv messages provide members with training materials, articles on foodborne diseases and programmatic information (see Appendix Two). Occasionally, the listserv is used to solicit information during outbreaks or other public health emergencies. Messages are in four languages: English, Spanish, French and Arabic. All messages are archived at the WHO Global Salm-Surv website (www.who.int/salmsurv).

WHO Global Salm-Surv also encourages presenting scientific findings and programmatic issues related to foodborne diseases at international conferences and meetings. WHO Global Salm-Surv Steering Committee Members, representatives from Regional Centres of Excellence and Member Institutions have presented at conferences highlighting both the efforts of WHO Global Salm-Surv and the results of recent foodborne disease surveillance projects related to WHO Global Salm-Surv.

Training Materials & Recent Publications

WHO Global Salm-Surv equips its members with training materials and articles on foodborne disease issues via the Electronic Discussion Group. Training materials include case studies, learning modules, manuals and articles focused on foodborne disease topics such as *Salmonella*, botulism and norovirus. Circulation of materials helps keep members informed on laboratory and epidemiology techniques and information.

WHO Global Salm-Surv Presentations

From 2000 to 2005, WHO Global Salm-Surv Steering Committee members have provided 20 presentations on WHO Global Salm-Surv at international meetings around the world. Meetings have included: Enter-net Meetings, International Conference on Emerging Infectious Diseases, Global Training Programmes in Epidemiology and Public Health Interventions Network (TEPHINET) Meetings, World Veterinary Congress and the International Symposium on *Salmonella* and Salmonellosis (IS3 Symposium).

Seeking Information

Occasionally, the WHO Global Salm-Surv Electronic Discussion Group is used to solicit information in support of an outbreak investigation or other public health emergency. In response to the anthrax bioterrorism attacks in the United States of America, a request was made by WHO to WHO Global Salm-Surv in October 2001 for a rapid assessment of laboratories willing and able to test environmental specimens for the presence of *Bacillus anthracis*, the causative agent of anthrax. An Electronic Discussion Group message requested information on the following: laboratory capacity to isolate *B. anthracis*, methods used to test for *B. anthracis*, whether the laboratory was a national reference laboratory for *B. anthracis* and whether the laboratory was willing to test samples from countries that do not have the capacity to test for *B. anthracis*. Responses were received within one week from 55 WHO Global Salm-Surv members from 42 countries.

The Future of WHO Global Salm-Surv

Trainers at a Level III-Integrated Surveillance Course for Microbiologists and Epidemiologists in Egypt in 2004.

WHO Global Salm-Surv saw much growth and development from 2000 to 2005 and evolved from a training network into a mature training programme. To evaluate this growth, in 2005 WHO Global Salm-Surv launched a full programme evaluation, in conjunction with the Division of International Health, Office of Global Health at the Centers for Disease Control and Prevention of the United States of America. The programme evaluation consisted of three parts: a survey of all training course participants, a survey of Training Sites and a survey of the nine Steering Committee members. This programme evaluation will assess impact of training, routine regional activities and involvement in the programme. Preliminary results from the survey administered to training course participants were presented at the Annual WHO Global Salm-Surv Strategic Planning Meeting in 2005.

WHO Global Salm-Surv, 2006-2010

The WHO Global Salm-Surv mission was expanded at the Annual WHO Global Salm-Surv Strategic Meeting in Winnipeg, Canada in 2005 from a focus on foodborne disease to include a focus on foodborne disease and other infectious enteric diseases. Furthermore, the Strategic Plan for WHO Global Salm-Surv from 2006-2010 was charted.

The new WHO Global Salm-Surv goals for 2006-2010 are the following:

- Continue to establish and strengthen Regional Centres of Excellence.
- Expand intersectoral partnerships.
- Measure and describe the impact of WHO Global Salm-Surv activities.
- Strengthen national capacities of foodborne and other infectious enteric disease detection and response.
- Promote interventions that reduce foodborne and other enteric diseases.

A Steering Committee Member presents strategic plans for Regional Centres of Excellence and Training Sites at the WHO Global Salm-Surv Strategic Planning Meeting, 2006-2010 in Winnipeg Canada in 2005.

To continue establishing and strengthening Regional Centres of Excellence, WHO Global Salm-Surv will continue to identify new training areas, recognize National Reference Laboratories and Epidemiological Surveillance Programmes as active WHO Global Salm-Surv Member Institutions and evaluate Regional Centres of Excellence and Training Sites against the Terms of Reference to help foster their leadership, communication, networking and mentoring role of National Reference Laboratories and Epidemiological Surveillance Programmes within their region.

WHO Global Salm-Surv also recognizes the importance of creating new partnerships and relationships. By expanding intersectoral partnerships, WHO Global Salm-Surv will seek support, including in-kind opportunities and increase WHO Global Salm-Surv's exposure, visibility and involvement with new, potential partners.

WHO Global Salm-Surv will also increase its focus on measuring and describing the impact of WHO Global Salm-Surv programme activities worldwide. WHO Global Salm-Surv will focus on country or regional specific techniques developed to measure the programme's impact on response time to foodborne and other infectious enteric disease outbreaks, the cost and benefit of WHO Global Salm-Surv International Training Courses and the overall reduction of foodborne diseases.

To strengthen national capacities for foodborne and other infectious enteric disease detection and response systems, WHO Global Salm-Surv looks forward to identifying country-specific projects that address relevant country or regional issues. This will help enhance skills training participants acquired from previous WHO Global Salm-Surv International Training Courses. Specific Regional and National Projects will also be designed to incorporate applied research into WHO Global Salm-Surv International Training Courses.

To promote interventions that reduce foodborne and other infectious enteric diseases, WHO Global Salm-Surv will assist Regional Centres of Excellence in identifying appropriate evidence-based interventions, develop plans for countries to use for control of foodborne diseases and assist countries in translating public health surveillance data into practical information for use by policymakers and other stakeholders.

Laboratory-based surveillance assists in identifying public health priorities based on analysis of burden of disease by a serotype to determine risk factors for a serotype specific disease. WHO Global Salm-Surv programme activities will continue to enhance laboratory-based surveillance of foodborne diseases and result in improved outbreak detection and response globally, thereby reducing the global burden of foodborne diseases.

Epidemiologists and microbiologists discuss *Campylobacter* data during a Level II-Integrated Surveillance Course for Microbiologists and Epidemiologists in Mexico in 2004.

A microbiologist receives training during a Level I-Basic Course for Microbiologists in Poland in 2004.

Training at a Level III-Integrated Surveillance Course for Microbiologists and Epidemiologists in Cameroon in 2004.

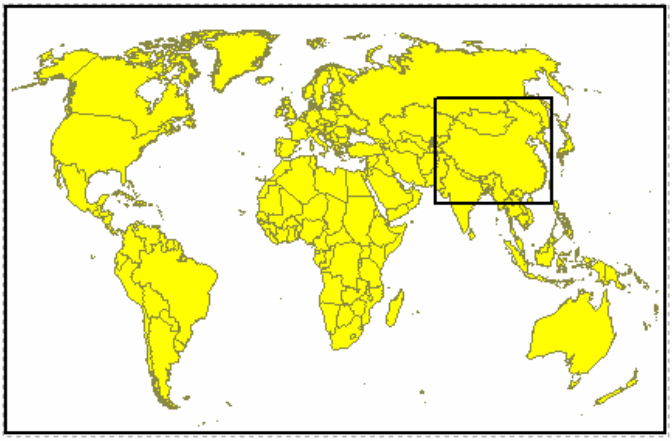
Appendices-Selected Activities, 2000-2005

Appendix One: Description of Regional Activities, 2000-2005

WHO WESTERN PACIFIC REGION (WPR)

Through 2005, WHO Global Salm-Surv International Training Courses have been conducted in the WHO Western Pacific Region (WPR) in China. WPR member countries have also participated in International Training Courses in the South-East Asia Region (SEAR).

WHO Global Salm-Surv Training Site:
The People's Republic of China
National Institute for Nutrition and Food Safety, the Centres for Disease Control and Prevention, Beijing, People's Republic of China



Participants:
Beijing, Henan, Jilin, Hubei, Guangdong, Shandong, Sichuan, Jiangsu, Nantong, Zhejiang, Fujian, Shaanxi, Shanghai, Guangxi, Hebei, Neimenggu, Yunnan.

Training: Four courses have been conducted
in Chinese and English.

- Level I-Basic Course for Microbiologists: April 2001, 25 participants from 12 provinces
  Location: Beijing

- Level II-Advanced Course for Microbiologists:
  November 2002, 27 participants from 16 provinces
  Location: Beijing

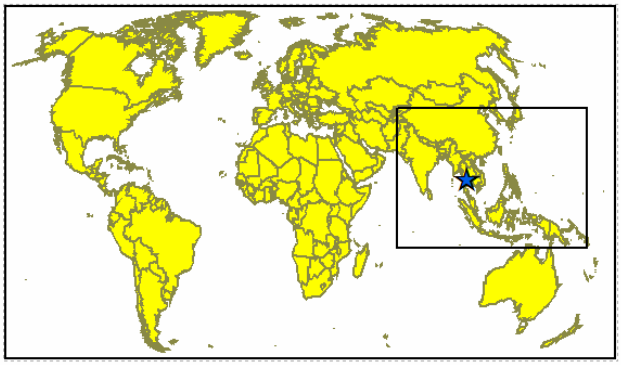
- Level III-Integrated Surveillance Course for Microbiologists and Epidemiologists:
  May 2004, 55 participants from 17 provinces
  Location: Nanjing

- Level IV-Advanced Workshop for Microbiologists and Epidemiologists:
  December 2005, 90 participants from 3 provinces
  Locations: Henan, Shanghai and Fujian Provinces

WHO SOUTH-EAST ASIA REGION (SEAR)

Through 2005, WHO Global Salm-Surv International Training Courses have been conducted in the South-East Asia Region (SEAR) in Thailand for SEAR and WPR Member countries.

WHO Global Salm-Surv Regional Centre of Excellence: South-East Asia and Western Pacific
Faculty of Veterinary Science of the Chulalongkorn University, Bangkok, Thailand



Participants:
Cambodia, China, India, Indonesia, Lao People's Democratic Republic, Malaysia, Myanmar, Nepal, Papua New Guinea, Philippines, Republic of Korea, Singapore, Sri Lanka, Thailand, Viet Nam.

Training: Four courses have been conducted in English.

- Level I-Basic Course for Microbiologists: January 2001, 22 participants from 10 countries Location: Bangkok

- Level II-Advanced Course for Microbiologists: June 2001, 19 participants from 9 countries Location: Bangkok

- Level III-Integrated Surveillance Course for Microbiologists and Epidemiologists: January 2002, 53 participants from 12 countries, Location: Bangkok

- Level IV-Advanced Workshop for Microbiologists and Epidemiologists: August 2003, 55 participants from 13 countries, Location: Bangkok

Regional & National Projects:

- WHO Global Salm-Surv *Salmonella* Weltevreden Research Project: A 2001 study that created a library of global Weltevreden PFGE patterns; identified seafood as a potential source of human infection of S. Weltevreden. The project was presented at the International Conference of Emerging Infectious Diseases in 2004, Atlanta, United States of America.
- Enhanced *Salmonella* Surveillance Project in the Philippines-National Project: A project begun in 2002 to enhance *Salmonella* surveillance in collaboration with the Philippines Department of Health, National Epidemiology Centre and Research Institute for Tropical Medicine.

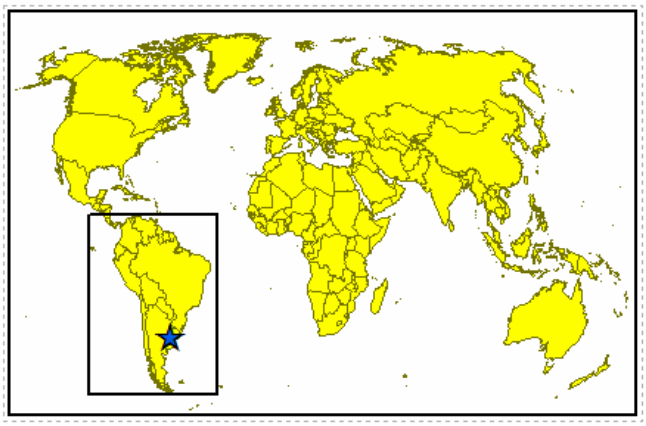
Regional Centres of Excellence Highlight:

- Presentation of the abstract entitled "*Salmonella* Weltevreden in South-East Asia and the Western Pacific – A WHO Global Salm-Surv Research Regional Project" at the March 2004 International Conference of Emerging Infectious Disease in 2004, Atlanta, United States of America.

WHO AMERICAS REGION (AMR)

Through 2005, WHO Global Salm-Surv International Training Courses have been conducted in the Americas Region (AMR) in four Training Sites.

WHO Global Salm-Surv Regional Centre of Excellence: Latin America
Instituto Nacional de Enfermedades Infecciosas- ANLIS "Carlos G. Malbrán", Buenos Aires, Argentina
Website:
http://www.panalimentos.org/salmsurv/



Participants:
Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, Paraguay, Peru, Uruguay, Venezuela.

Training: Three courses have been conducted in Spanish.

- Level I-Basic Course for Microbiologists: June 2000, 22 participants from 9 countries
  Location: Buenos Aires

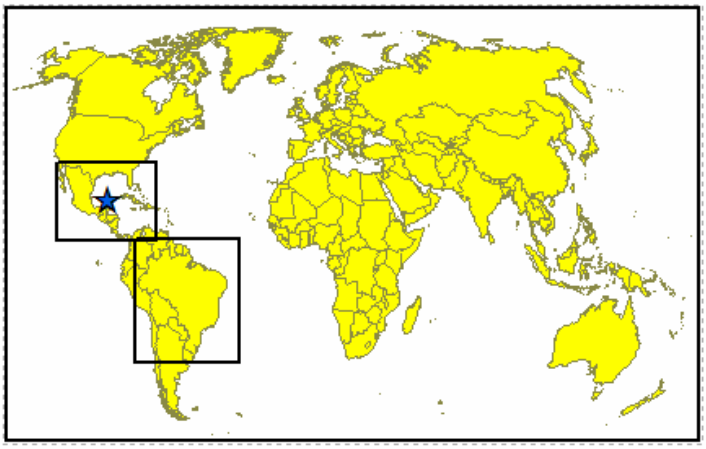
- Level II-Advanced Course for Microbiologists: September 2001, 25 participants from 10 countries
  Location: Buenos Aires

- Level III-Integrated Surveillance Course for Microbiologists and Epidemiologists:
  May 2003, 40 participants from 10 countries
  Location: Buenos Aires

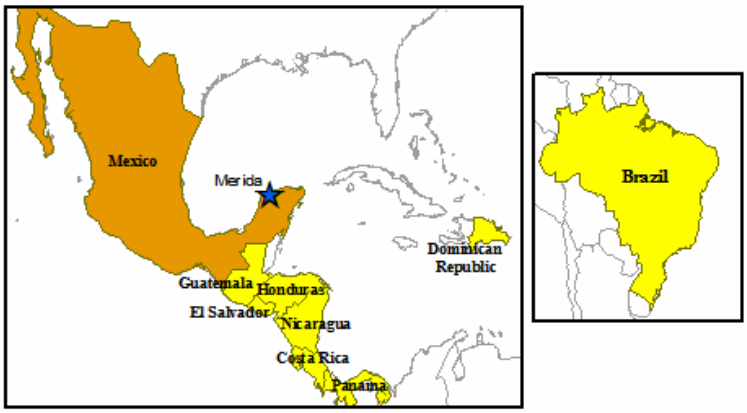
Regional Centres of Excellence Highlights:

- Level III-Integrated Surveillance Course for Microbiologists and Epidemiologists included manager's component.
- Equipped the South American region with high quality *Salmonella* antisera.
- Presented posters on South American Regional serotypes and antimicrobial susceptibility testing results at the 2002 & 2004 International Conference of Emerging Infectious Diseases, Atlanta, United States of America.
- Distributed manuals on *Salmonella* diagnosis, serotyping and antimicrobial resistance, Campylobacter diagnosis and shipment of strains.

WHO Global Salm-Surv Regional Centre of Excellence: Central America
Universidad Autónoma de Yucatán, Mérida, Mexico



Participants:
Brazil, Costa Rica, Dominican Republic,
El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama.



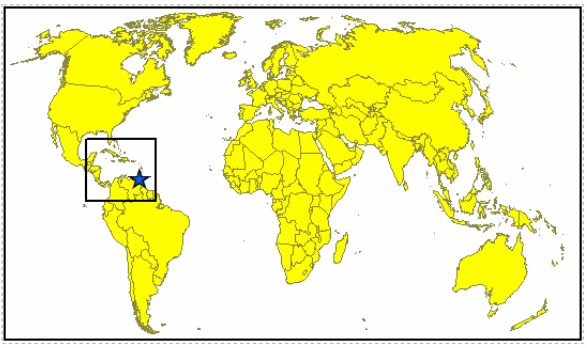
Training: Three courses have been conducted in Spanish.

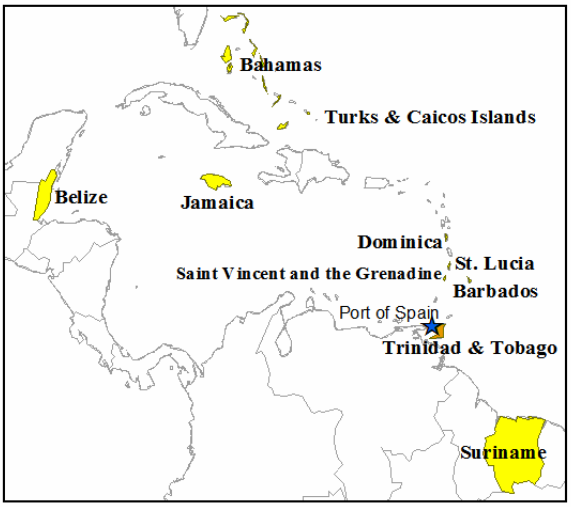
- Level I-Basic Course for Microbiologists: July 2001, 21 participants from 10 countries
  Location: Mérida

- Level II-Advanced Course for Microbiologists: March 2003, 28 participants from 9 countries
  Location: Mérida

- Level III-Integrated Surveillance Course for Microbiologists and Epidemiologists: September 2004, 34 participants from 9 countries
  Location: Mérida

WHO Global Salm-Surv Regional Centre of Excellence: The Caribbean
Caribbean Epidemiology Centre, Port of Spain, Trinidad and Tobago





Participants:
Barbados, Belize, Jamaica, Saint Lucia, Suriname, Trinidad and Tobago, Saint Vincent and the Grenadine, Turks and Caicos Islands, Bahamas, Dominica.

Training: Four courses have been conducted in English.

- Level I-Basic Course for Epidemiologists: September 2001, 19 participants from 8 countries Location: Port of Spain

- Level I-Basic Course for Microbiologists: September 2002, 19 participants from 8 countries Location: Port of Spain

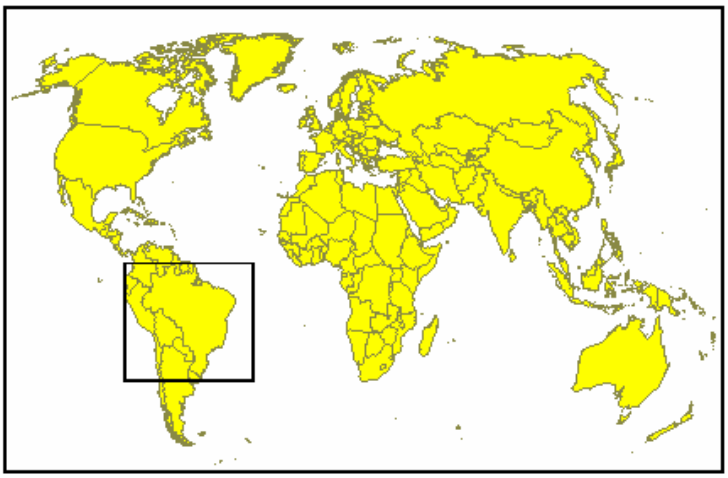
- Level II-Advanced Course for Microbiologists: March 2004, 24 participants from 9 countries Location: Port of Spain

- Level III-Integrated Surveillance Course for Microbiologists and Epidemiologists: May 2005, 47 participants from 10 countries, Location: Port of Spain

Regional Centres of Excellence Highlights:

- Established a listserv for laboratory personnel from clinical, food, veterinary and university labs from six countries (Barbados, Trinidad and Tobago, Belize, Suriname, Saint Lucia and Jamaica) for improved communications, data sharing and promoting integrated laboratory surveillance.
- Conducted workshop on "Writing Effective Standard Operating Procedures" for laboratory personnel.
- Established WHO Global Salm-Surv coordinators in Barbados, Trinidad and Tobago, Belize, Suriname, Saint Lucia and Jamaica.
- Presented the Caribbean Epidemiology Centre Level-II Advance Course for Microbiologists WHO Global Salm-Surv Trainer's Report on country needs and plans of actions at the 6th Meeting of the National Epidemiologists and Laboratory Directors for the Caribbean in June 2004. The report addressed the needs in designing country protocols for integrated foodborne disease at the Foodborne disease interagency meeting for the Caribbean Epidemiology Centre the same month.
- Conducted follow-up in-country training: *Salmonella* serotyping and *Campylobacter* isolation training in Belize and meeting to promote integrated Foodborne disease surveillance in Barbados.

WHO Global Salm-Surv Training Site: Brazil
Ministry of Health and Ministry of Agriculture, Rio de Janeiro, Brazil



Participants:
Alagoas, Mato Grosso do Sul, Sergipe, Amazonas, Ceará, Goiás, Mato Grosso, Paraná, Rio Grande do Sul, Rio de Janeiro, Santa Catarina, São Paulo, Distrito Federal, Pará.

Training: Courses have been conducted in Portuguese and Spanish.

- Level I-Basic Course for Microbiologists: September 2005, 60 participants from 10 provinces
  Location of course: Rio de Janeiro

- Level I-Basic course for Epidemiology: September 2005, 60 participants from 10 provinces
  Location of course: Rio de Janeiro

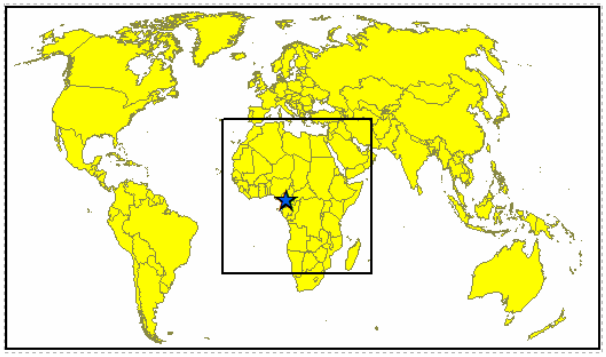
Training Site Highlights:

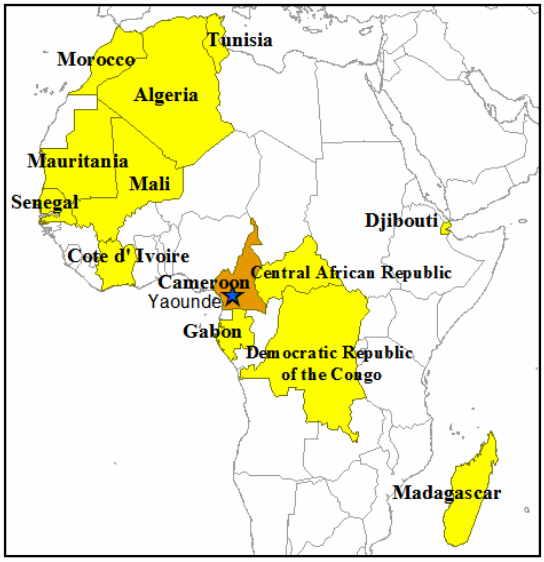
- Developed and implemented parallel and overlapping Level I-Basic Course for Microbiologists and Level I-Basic Course for Epidemiologists on non-typhoidal *Salmonella* and *Salmonella* Typhi laboratory techniques and epidemiological methods.

WHO AFRICAN REGION (AFR)

Through 2005, WHO Global Salm-Surv International Training Courses have been conducted in the Africa Region (AFR) in Cameroon.

WHO Global Salm-Surv Training Site: West Africa
Centre Pasteur, Cameroon (Yaoundé)





Participants:
Algeria, Cameroon, Central African Republic, Côte d'Ivoire, Democratic Republic of the Congo, Djibouti, Gabon, Madagascar, Mali, Mauritania, Morocco, Senegal, Tunisia.

Training: Four courses have been conducted in French.

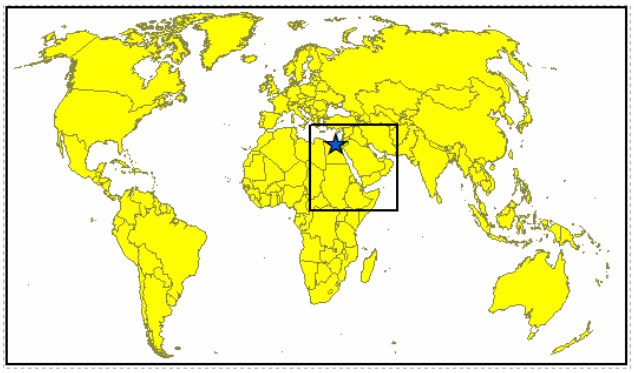
- Level I-Basic Course for Microbiologists: November 2002, 23 participants from 12 countries Location: Yaoundé
- Level II-Advanced Course for Microbiologists: December 2003, 22 participants from 12 countries Location: Yaoundé
- Level III-Integrated Surveillance Course for Microbiologists and Epidemiologists: December 2004, 23 participants from 12 countries, Location: Yaoundé
- Level IV-Advanced Workshop for Microbiologists and Epidemiologists: December 2005, 24 participants from 12 countries, Location: Yaoundé

Training Site Highlight:

- *Salmonella* Hadar project: focus on antibiotic resistant *Salmonella* Hadar in Francophone Africa.

WHO EASTERN MEDITERRANEAN REGION (EMR)

Through 2005, WHO Global Salm-Surv International Training Courses have been conducted in the Eastern Mediterranean Region (EMR) in three Training Sites.



WHO Global Salm-Surv Training Site: Eastern Mediterranean and Middle East
Eastern Mediterranean Regional Office & NAMRU-3, Cairo, Egypt

Participants: Egypt, Jordan, Kuwait, Lebanon, Syrian Arab Republic, Saudi Arabia, Oman, Yemen, Sudan, West Bank and Gaza Strip.

Training: Four courses have been conducted in English.

- Level I-Basic Course for Microbiologists: July 2000, 23 participants from 10 countries

  Location: Crete

- Level II-Advanced Course for Microbiologists: June 2002, 22 participants from 10 countries
  Location: Irbid

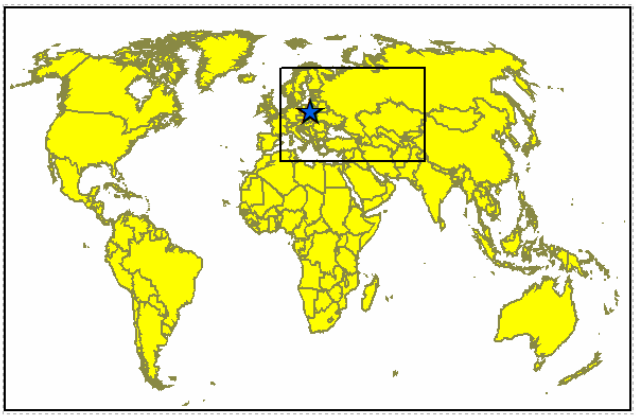
- Level III-Integrated Surveillance Course for Microbiologists and Epidemiologists: February 2004, 12 participants from 10 countries, Location: Cairo

- Level IV-Advanced Workshop for Microbiologists and Epidemiologists: February 2004, 26 participants from 10 countries, Location: Cairo

WHO EUROPEAN REGION (EUR)

Through 2005, WHO Global Salm-Surv International Training Courses have been conducted in the European Region (EUR) in four Training Sites.

WHO Global Salm-Surv Regional Centre of Excellence: Europe



National Institute of Hygiene, Warsaw, Poland

Participants:
Albania, Bulgaria, Croatia, Cyprus, Czech Republic, Estonia, Greece, Hungary, Latvia, Lithuania, The Former Yugoslav Republic of Macedonia, Republic of Moldova, Poland, Romania, Russian Federation, Slovakia, Slovenia, Turkey.

Training: Three courses have been conducted in English.

- Level I-Basic Course for Microbiologists: April 2002, 23 participants from 13 countries Location: Warsaw
- Level II-Advanced Course for Microbiologists: June 2003, 26 participants from 16 countries Location: Warsaw
- Level III- Integrated Surveillance Course for Microbiologists and Epidemiologists: April 2004, 42 participants from 17 countries Location: Warsaw

Regional & National Projects:
Slovenia Burden of Illness Project 2004-06: A study to determine the burden and economic impact of salmonellosis and campylobacteriosis in Slovenia. The study involves a population survey, laboratory survey and physician study.

WHO Global Salm-Surv Training Site: Europe and Central Asia
Laboratory of Zoonosis, Moscow, Russian Federation, Central Research Institute of Epidemiology

Participants:
Armenia, Azerbaijan, Belarus, Georgia, Kazakhstan, Kyrgyzstan, Republic of Moldova, Russian Federation, Uzbekistan, Ukraine

Training: One course has been conducted in English with Russian translation.

- Level I-Basic Course for Microbiologists: May 2003,
  29 participants from 10 countries
  Location: Moscow

WHO Global Salm-Surv Training Site: Europe and Central Asia
Institut Pasteur-St. Petersburg, Russian Federation

Participants:
Armenia, Azerbaijan, Belarus, Georgia, Kazakhstan, Kyrgyzstan, Russian Federation, Uzbekistan, Ukraine

Training: Two courses have been conducted in English and French with Russian Translation.

- Level I-Basic Course for Microbiologists: October 2004,
  24 participants from 9 countries
  Location: St. Petersburg

- Level II-Advanced Course for Microbiologists: June 2005,
  24 participants from 9 countries
  Location: St. Petersburg

WHO Global Salm-Surv Training Site: Central Asia
Kazakhstan School of Public Health, Almaty, Kazakhstan

Participants:
Kazakhstan, Kyrgyzstan, Tajikistan, Uzbekistan.

Training: One course has been conducted in English with Russian translation.

- Level I-Basic Course for Microbiologists: July 2003, 12 participants from 4 countries Location: Almaty

Training Site Highlight:

- Course conducted under the leadership and support from the WHO European Region.

Appendix Two: Electronic Discussion Group Messages, 2000-2005

In 2000, forty-three messages were sent. Selected topics included:

- *Salmonella* serotype Enteritidis infection and eggs in the United States of America
- Deadly household outbreak of *Salmonella* serotype Enteritidis in Denmark
- Nosocomial outbreaks of fluoroquinolone-resistant *Salmonella* in the United States of America
- Fluoroquinolone-resistant *Salmonella*: WHO Global Salm-Surv Member Responses
- *Salmonella* serotype Newport outbreak from mangoes, United States of America
- Human salmonellosis associated with chicks, ducklings and other young fowl
- Reference services from the Danish Veterinary Laboratory to participants
- Ceftriaxone-resistant *Salmonella* in the United States of America
- Reptile-associated salmonellosis in Sweden

In 2001, Thirty-nine messages were sent. Selected topics included:

- *Salmonella* serotype Mbandaka outbreak in Australia
- External Quality Assurance System (EQAS) 2001 - Call for participants
- *Salmonella* Enteritidis PT34 in Denmark: request for information
- Fluoroquinolone-resistant *Salmonella* update
- Travel-associated salmonellosis in Norway
- Increase in *Salmonella* serotype Bovismorbificans from humans in Denmark
- Regional Project: *Salmonella* Weltevreden in the South-East Asian and Western Pacific
- Manual of laboratory protocols for WHO Global Salm-Surv Level-I Training Courses
- Outbreak of *Salmonella* Typhimurium DT104 in Sweden and Australia

In 2002, twenty-seven messages were sent. Selected topics included:

- *Salmonella* Oranienburg Outbreak
- External Quality Assurance System (EQAS) 2002 - call for participants
- Antibiotic-resistant *Salmonella* meeting announcement
- Training materials available online: case study of botulism in Argentina
- Questionnaire about WHO Global Salm-Surv's External Quality Assurance System
- Human campylobacteriosis in developing countries
- Upcoming WHO Global Salm-Surv training course (Amman, Jordan)
- *Salmonella* serotype Enteritidis outbreak in Yaoundé, Cameroon
- *Salmonella* serotype Stanley in peanuts - Australia and Canada

In 2003, sixteen messages were sent. Selected topics included:

- WHO Global Salm-Surv Training Course in Trinidad and Tobago
- WHO Global Salm-Surv Training Course in China
- Estimating the incidence of Typhoid Fever and other febrile illnesses
- *Salmonella* serotype Enteritidis and shell eggs
- WHO Global Salm-Surv Training Course in Mexico
- Ceftriaxone-resistant *Salmonella* isolates in Taiwan, China
- Three abstracts describing *Salmonella* outbreaks in Georgia
- Updating contact information, membership level and data in the Country Databank
- *Salmonella* Typhimurium DT 170a: request for information
- WHO Global Salm-Surv Training Course in Cameroon

In 2004, twenty-one messages were sent. Selected topics included:

- EQAS 2002 results posted on the WHO Global Salm-Surv Website
- ICEID 2004 and WHO Global Salm-Surv Strategic Planning Meeting 2004
- Food Safety Newsletter from the WHO/Europe Food Safety Team
- Global burden of typhoid fever
- Release of computer-based *E. coli* O157:H7 epidemiology case study
- Manual for the laboratory identification and antimicrobial susceptibility testing
- Botulism in the Georgia and botulism in the United States of America
- *Salmonella* serovars from humans and other sources in Thailand, 1993-2002
- Global TEPHINET Meeting, Beijing, China
- Completion of a successful WHO Global Salm-Surv Training Course for Central America
- Second FAO/WHO Global Forum of Food Safety Regulators

In 2005, twenty-two messages were sent. Selected topics included:

- Completion of a successful WHO Global Salm-Surv Training Course for Russian Federation
- Highlight a WHO Global Salm-Surv Training Site: Argentina
- Change in SE phage types in Western Europe
- Outbreak training material – cyclospora
- Highlighting a WHO Global Salm-Surv Training Course: Thailand
- International epidemiology training opportunity
- Newsletter of interest-"LINK"-South Africa
- Updating data in the WHO Global Salm-Surv Country Databank
- WHO Global Salm-Surv training course in the Caribbean
- *Salmonella* and pocket-pets
- Sixth International Conference on Typhoid Fever and Other Salmonellosis

Appendix Three: Publications and Presentations, 2000-2005

WHO GLOBAL SALM-SURV PUBLICATIONS

Aarestrup F M, Lertworapreecha M, Evans MC, Bangtrakulnonth A, Chalermchaikit T, Hendriksen RS, Wegener HC. Antimicrobial susceptibility and occurrence of resistance genes among *Salmonella* enterica serovar Weltevreden from different countries, *Journal of Antimicrobial Chemotherapy.* 2003;52(4):715-8.

Archambault M, Petrov P, Hendriksen RS, Asseva G, Bangtrakulnonth A, Aarestrup FM. Molecular characterization and occurrence of extended-spectrum beta-lactamase resistance genes among *Salmonella* enterica serovar Corvallis from Thailand, Bulgaria and Denmark.[in press, abstract available from WHO].

Bangtrakulnonth A, Pornreongwong S, Pulsrikarn C, Sawanpanyalert P, Hendriksen RS, Lo Fo Wong DM, Aarestrup FM. *Salmonella* serovars from humans and other sources in Thailand, 1993-2002. *Emerging Infectious Disease*. 2004;10(1):131-6.

Flint JA, Duynhoven YT, Angulo FJ, DeLong SM, Braun P, Kirk M, Scallan E, Fitzgerald M, Adak GK, Sockett P, Ellis A, Hall G, Gargouri N, Walke H, Braam P. Estimating the burden of acute gastroenteritis, foodborne disease, and pathogens commonly transmitted by food: an international review. *Clinical Infectious Disease*. 2005;41(5):698-704.

Galanis E, Lo Fo Wong DMA, Patrick M, Ellis A, Binsztein N, Chalermchaikit T, Aidara-Kane A, Cieslik A, Angulo FJ. Global distribution of *Salmonella* serotypes in humans and non-human sources, 2000-02. *Emerging Infectious Diseases.*[in press, abstract available from WHO].

Galic N, Grego E, Hendriksen RS, Aarestrup FM, Grujic D. *Salmonella* Krefeld isolates of human origin in Serbia and Montenegro. [in press, abstract available from WHO].

Herikstad H, Motarjemi Y, Tauxe RV. *Salmonella* Surveillance: a global survey of public health serotyping. Epidemiology and Infection. 2002;129(1):1-8.

Petersen A, Aarestrup FM, Angulo FJ, Wong S, Stohr K and Wegener HC. WHO Global Salm-Surv External Quality Assurance System (EQAS): An important step towards improving the quality of *Salmonella* serotyping and antimicrobial susceptibility testing worldwide. *Microbial Drug Resistance.* 2002;8(4):345-353.

Wagenaar J, Fernandez H, van Bergen M, Hendriksen RS, Price L, Wegener HC. WHO Activities to strengthen Campylobacter surveillance in resource poor countries (WHO Global Salm-Surv). *International Journal of Medical Microbiology*, vol. 293 Suppl. 35:95.

Wegener H, Petersen A, Evans M., Hendriksen R, Lo Fo Wong D, Aarestrup, F. WHO Global Salm-Surv [in Danish]. *Alimenta*. 2002;(2): 10-15.

World Health Organization. Global Salm-Surv on Internet. *Weekly Epidemiological Record*. 2000;75(29):236-7.

Zono N, Vandenberg O, Mitangala P, Donnen P, Wouafo M, Butzler JP. Antimicrobial susceptibility of bacterial enteric pathogens isolated in humans from 2002 to 2004 in the Province of South-Kivu, Democratic Republic of the Congo.[in press, abstract available from WHO].

WHO GLOBAL SALM-SURV PRESENTATIONS

Aidara-Kane A, DeLong SM, Chiller TM, Wagenaar JA, Wegener HC, Ng LK, Jouan M, Angulo FJ, and WHO Global Salm-Surv. World Health Organization Global Salm-Surv: Working to reduce foodborne diseases globally. 11th International Congress on Infectious Diseases. Cancun, Mexico. March, 2004.

Aidara-Kane A, Imhoff BC, Braam P, Wegener HC, Jouan M, Wagenaar JA, Ellis A, Lo Fo Wong D, Angulo FJ, and WHO Global Salm-Surv. WHO Global Salm-Surv: reducing the global burden of foodborne disease by strengthening laboratory-based surveillance. American Society for Microbiology Conference on *Salmonella*: Pathogenesis, Epidemiology, and Vaccine Development. Alghero, Sardinia, Italy. September, 2003.

Binsztein N and WHO Global Salm-Surv Programme. Pan American Health Organization Meeting on antimicrobial resistance. Santa Cruz, Bolivia. April, 2002.

Braam P, Imhoff BC, Wegener HC, Evans MC, Petersen A, Jouan M, Angulo FJ and WHO Global Salm-Surv.WHO Global Salm-Surv: Strengthening Laboratory-Based Surveillance to Reduce the Global Burden of Foodborne Diseases. Second International Conference on Emerging Infectious Diseases. Atlanta, United States of America. March, 2002.

Braam P and WHO Global Salm-Surv. 27th World Veterinary Congress. Tunis, Tunisia. September, 2002.

Carlos C and WHO Global Salm-Surv. Changing antimicrobial resistance patterns among enteric pathogens in the Philippines. Third International Conference on Emerging Infectious Diseases. Atlanta, United States of America. March, 2004.

Chalermchaikit T, Bangtrakulnonth A, Lertworapreecha M and WHO Global Salm-Surv. Activities of the WHO Global Salm-Surv Asian Regional Centre. Third International Conference on Emerging Infectious Diseases. Atlanta, United States of America. March, 2004.

Chalermchaikit T, Chongthaleoung A, Kanarat S and WHO Global Salm-Surv. WHO Global Salm-Surv: Asian Regional Centre. Second International Conference on Emerging Infectious Diseases. Atlanta, United States of America. March, 2002.

Chiller, TM. Update on WHO Global Salm-Surv Activities: establishing training in the Pacific. Pacific Public Health Surveillance Network Coordinating Body Annual Meeting. August, 2003.

DeLong SM, Chiller TM, Jouan M, Wegener HC, Wagenaar J, Braam P, Ng LK, Angulo FJ and WHO Global Salm-Surv. World Health Organization Global Salm-Surv: Fostering global collaboration in laboratory-based foodborne disease surveillance and outbreak detection and response. Third International Conference on Emerging Infectious Diseases. Atlanta, United States of America. March, 2004.

DeLong SM, Chiller TM, Angulo FJ and WHO Global Salm-Surv. World Health Organization Global Salm-Surv (WHO-GSS): Fostering global collaboration in foodborne disease surveillance. South-East Asian and Western Pacific Training Programmes in Epidemiology and Public Health Interventions Network (TEPHINET) Conference. Boracay Islands, Philippines. November, 2003.

Ellis A, WHO Global Programme on Foodborne Disease Surveillance. Third International Conference on Emerging Infectious Diseases. Atlanta, United States of America. March, 2004.

Galanis E, Lo Fo Wong DMA, Patrick ME, Wegener HC and the WHO Global Salm-Surv Steering Committee and Members, Characterizing the worldwide distribution of *Salmonella* serotypes: The role of WHO Global Salm-Surv. Third International Conference on Emerging Infectious Diseases. Atlanta, United States of America. March, 2004.

GSS South American Working Group. WHO Global Salm-Surv (WHO-GSS) in South America 2000-2002: Surveillance of *Salmonella* serovars and antibiotic resistance. Third International Conference on Emerging Infectious Diseases. Atlanta, United States of America. March, 2004.

Imhoff BC, Mintz ED, Jouan M, Braam P, Wegener HC, Angulo FJ and WHO Global Salm-Surv. Rapid International Assessment of Laboratory Capacity to Test for Bacillus anthracis via WHO Global Salm-Surv, 2001. Second International Conference on Emerging Infectious Diseases. Atlanta, United States of America. March, 2002.

Lu R, Wang MQ and WHO Global Salm-Surv. The National Foodborne Pathogens Reference Laboratory in China: Making strides to reduce foodborne disease in China. Third International Conference on Emerging Infectious Diseases. Atlanta, United States of America. March, 2004.

Musto J, Lo Fo Wong DMA, Wegener HC and WHO Global Salm-Surv. WHO Global Salm-Surv - Worldwide *Salmonella* Surveillance. 10th European Programme for Intervention Epidemiology Training (EPIET) Scientific Conference. Menorca, Spain. October, 2005.

Patrick ME, Hendriksen RS, Lertworapreecha M, Aarestrup FM, Chalermchaikit T, Wegener HC, Lo Fo Wong DMA and WHO Global Salm-Surv partners in the South-East Asian Region (SEAR) and Western Pacific Region (WPR). Epidemiology of *Salmonella* Weltevreden in South-East Asia and the Western Pacific: A WHO Global Salm-Surv Regional Research Project. Third International Conference on Emerging Infectious Diseases. Atlanta, United States of America. March, 2004.

Petersen A, Aarestrup FM, Jensen AB, Lo Fo Wong D, Evans MC, Angulo FJ, Imhoff BC, Wegener HC and WHO Global Salm-Surv. External Quality Assurance System (EQAS) demonstrates continued need for improvement in *Salmonella* serotyping and susceptibility testing: WHO Global Salm-Surv, 2000 and 2001. Second International Conference on Emerging Infectious Diseases. Atlanta, United States of America. March, 2002.

Petersen A, Aarestrup FM, Jensen AB, Wong S, Angulo FJ, Stohr K, Wegener HC. WHO Global Salm-Surv External Quality Assurance System (EQAS): An important step towards improving the quality of *Salmonella* serotyping and antimicrobial susceptibility testing worldwide. Interscience Conference on Antimicrobial Agents and Chemotherapy. Chicago, Illinois. December, 2001.

Seyfarth A.M, Galanis E, Hendriksen RS, Wegener HC, Jensen AB, Lo Fo Wong DMA, DeLong SM, Angulo FJ, Aarestrup FM and WHO Global Salm-Surv. Assessing the quality of *Salmonella* serotyping and antimicrobial susceptibility testing in national laboratories worldwide: Experiences from four years of WHO Global Salm-Surv EQAS. Third International Conference on Emerging Infectious Diseases. Atlanta, United States of America. March, 2004.

Varma J, Imhoff B, Jouan M, Braam P, Wegener H, Angulo F. WHO Global Salm-Surv: Strengthening laboratory-based surveillance and laboratory-epidemiology partnerships to reduce the burden of foodborne diseases. Global Training Programmes in Epidemiology and Public Health Interventions Network (TEPHINET) Conference. Barcelona, Spain. February, 2002.

Wang M Q, Ran L Xu J, Li YH, Wu SY, Yao JH, Li ZG, Fing P, Yang BL and WHO Global Salm-Surv. WHO Global Salm-Surv: National active surveillance for *Salmonella* in China: 2000-2002. Third International Conference on Emerging Infectious Diseases. Atlanta, United States of America. March, 2004.

Wagenaar J, Aidara-Kane A, Braam P, and WHO Global Salm-Surv. Zoonoses and Public Health. World's Poultrty Science Association (Spanish Branch) Scientific Symposium. Barcelona, Spain. November, 2004.

Wagenaar J, Fernandez H, van Bergen M, Hendriksen RS, Price L, Wegener HC. WHO Activities to strengthen Campylobacter surveillance in resource poor countries (WHO Global Salm-Surv). 12th International Workshop on *Campylobacter*, *Helicobacter* and related organisms. Aarhus, Denmark, September, 2003.

Wagenaar, J, Gohstadt E, Aidara-Kane A, Lo Fo Wong D, Jouan M, Ng LK, and WHO Global Salm-Surv. WHO Global Salm-Surv and Applied Epidemiology Training Programs: Beneficial Partnerships. 9th European Programme for Intervention Epidemiology Training Scientific Seminar. Menorca, Spain. October, 2004.

Wagenaar J, Seyfarth AM, Hendriksen R, van Bergen M, Lo Fo Wong D, Wegener H, and WHO-Global Salm Surv. WHO Global Salm-Surv EQAS: results of the External Quality Assurance System for *Campylobacter* speciation, 2003-2004. 13th International Workshop on *Campylobacter*, *Helicobacter* and related organisms. Queensland, Australia. September, 2005.

Wagenaar, J, Lo Fo Wong D, Hendriksen R, van Bergen M, Wegener HC, Braam P, Angulo F. World Health Organization Global Salm-Surv: A capacity-building network for laboratory-based surveillance for foodborne diseases. Symposium "*Salmonella* and Salmonellosis''. Saint-Malo, France. May, 2006.

Wagenaar, J, Lo Fo Wong D, Musto J, McDermott P, Angulo F, Ng LK, Aidara-Kane A, Wegener H, and WHO Global Salm-Surv. WHO Global Salm-Surv Interdisciplinary collaboration in lab-based foodborne disease surveillance and outbreak detection and response. MedVetNet General Scientific Meeting. Winchester, United Kingdom. June-July, 2005.

Wegener HC, Angulo FJ, Braam P, Jouan M, Imhoff B, Evans M, Petersen A and Aarstrup F. The WHO Global *Salmonella* surveillance programme. International Symposium on *Salmonella* and Salmonellosis. St. Brieuc, France. May, 2002.

WHO Global Salm-Surv South America Working Group and WHO Global Salm-Surv. A WHO Global Salm-Surv retrospective study examining *Salmonella* serotypes in South America, 2000: Dominance of *Salmonella* Serotype Enteritidis. Second International Conference on Emerging Infectious Diseases. Atlanta, United States of America. March, 2002.

Zono N, Vandenberg O, Mitangala P, Donnen P, Wouafo M, Aidara-Kane A, Butzler JP. Antimicrobial Susceptibility of Bacterial Enteric Pathogens Isolated in Humans from 2002 to 2004 in the Province of South-Kivu, Democratic Republic of Congo. 15th European Congress of Clinical Microbiology and Infectious Diseases. Copenhagen, Denmark, April, 2005.