National Institute for Public Health
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Seventeenth EURL-*Salmonella* interlaboratory comparison study (2012) on typing of *Salmonella* spp.

RIVM report 330604032/2013

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Colophon

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Rapport in het kort

Zeventiende EURL-*Salmonella* ringonderzoek (2012) voor de typering van *Salmonella* spp.

De 28 Nationale Referentie Laboratoria (NRL's) van de 27 Europese lidstaten en de NRL's van Kroatië, Noorwegen en Zwitserland scoorden in 2012 goed bij de kwaliteitscontrole op *Salmonella*-typering. Twee laboratoria hadden hiervoor een herkansing nodig. Uit de analyse van alle NRL's als groep bleek dat de laboratoria aan 96 procent van de geteste stammen de juiste naam konden geven.

Sinds 1992 zijn de NRL's van de Europese lidstaten verplicht om deel te nemen aan jaarlijkse kwaliteitstoetsen, die bestaan uit zogeheten ringonderzoeken voor *Salmonella*. Elke lidstaat wijst een laboratorium aan, het Nationale Referentie Laboratorium (NRL), dat binnen dat land verantwoordelijk is om *Salmonella* uit monsters van levensmiddelen of dieren aan te tonen en te typeren. Om te controleren of de laboratoria hun werk goed uitvoeren moeten zij onder andere 20 *Salmonella*-stammen op juiste wijze identificeren. Soms doen ook landen buiten de Europese Unie vrijwillig mee. In 2012 waren dat EU kandidaat-lidstaat Kroatië, en de EFTA landen (European Free Trade Association) Noorwegen en Zwitserland.

Van de NRL's zijn er zes laboratoria die, behalve de standaardtoets (serotypering) op *Salmonella*, preciezere typeringen uitvoeren, de zogeheten faagtypering. Voor deze kwaliteitstoets moeten zij 20 extra stammen met deze methode typeren. De laboratoria ontvingen hiervoor tien *Salmonella* Enteritidis-stammen en tien *Salmonella* Typhimurium-stammen. Deze NRL's typeerden 92 procent van de *S.* Typhimurium-stammen en 90 procent van de *S.* Enteritidis-stammen op de juiste wijze.

De organisatie van het typeringsringonderzoek is in handen van het Europese Unie Referentie Laboratorium (EURL) voor *Salmonella* (EURL-*Salmonella*). Het EURL-*Salmonella* is ondergebracht bij het Nationaal Instituut voor Volksgezondheid en Milieu (RIVM) in Bilthoven, Nederland. De organisatie van dit ringonderzoek is uitgevoerd in samenwerking met Public Health England (voorheen Health Protection Agency) in Londen, Engeland.

Trefwoorden: EURL-*Salmonella*, *Salmonella*, serotypering, faagtypering, vergelijkend laboratoriumonderzoek

Abstract

Seventeenth EURL-*Salmonella* interlaboratory comparison study (2012) on typing of *Salmonella* spp.

The National Reference Laboratories (NRLs) of all 27 European Union (EU) Member States, as well as the NRLs of Croatia, Norway, and Switzerland performed well on the 2012 quality control test on *Salmonella* typing. Two laboratories were found to require a follow-up study on their first test. Altogether, the EU-NRLs were able to assign the correct name to 96% of the strains tested.

Since 1992, the NRLs of the EU Member States have been required to participate in annual quality control tests, which consist of interlaboratory comparison studies on *Salmonella*. Each Member State designates a specific laboratory within their national boundaries to be responsible for the detection and identification of *Salmonella* strains from animals and/or food products. These laboratories are then referred to as the National Reference Laboratories. The performance of these NRLs on *Salmonella* typing is assessed annually, based on their capability to correctly identify 20 *Salmonella* strains. NRLs from countries outside the European Union occasionally participate in these tests on a voluntary basis. EU-candidate-country Croatia, and EFTA countries Norway and Switzerland took part in the 2012 test.

Six NRLs not only serotyped the 20 *Salmonella* strains of the quality control test, but also subtyped 20 additional strains by phage typing. For this, the laboratories received ten strains of *Salmonella* Enteritidis and ten strains of *Salmonella* Typhimurium. These NRLs typed 92% of the *S.* Typhimurium strains correctly. For *S.* Enteritidis, 90% of the strains were correctly phage typed.

The European Union Reference Laboratory for *Salmonella* (EURL-*Salmonella)* organises this annual interlaboratory comparison study on typing of *Salmonella* in cooperation with Public Health England (formerly Health Protection Agency) in London, UK. The EURL-*Salmonella* is situated at the National Institute for Public Health and the Environment (RIVM), Bilthoven, the Netherlands.

Keywords: EURL-*Salmonella*, *Salmonella*, serotyping, phage typing, interlaboratory comparison study

Contents

Summary

In November 2012, the 17th interlaboratory comparison study on typing of *Salmonella* was organised by the European Union Reference Laboratory for *Salmonella* (EURL-*Salmonella*, Bilthoven, the Netherlands) in collaboration with Public Health England (formerly: Health Protection Agency, London, United Kingdom). The main objective of the study was to evaluate whether typing of *Salmonella* strains by the National Reference Laboratories (NRLs-*Salmonella*) within the European Union was being carried out uniformly and whether comparable results were obtained.

A total of 28 NRLs-*Salmonella* of the 27 Member States of the European Union participated, supplemented by the NRL of EU-candidate-country Kroatia and the EFTA countries Norway and Switzerland.

All 31 laboratories performed serotyping. A total of 20 obligatory *Salmonella* strains plus 1 additional optional *Salmonella* strain were selected for serotyping by the EURL-*Salmonella*. The strains had to be typed with the method routinely used in each laboratory, following the White-Kauffman-Le Minor scheme. The laboratories were allowed to send strains for serotyping to another specialised laboratory in their country if this was part of their usual procedure.

Overall, 99% of the strains were typed correctly for the O-antigens, 98% of the strains were typed correctly for the H-antigens and 96% of the strains were correctly named by the participants.
At the EURL-*Salmonella* workshop in 2007, the EURL-*Salmonella* proposed a definition for good performance of the NRLs regarding the serotyping. Using this definition, 29 participants achieved good performance. The two laboratories that did not achieve the level of good performance were offered a follow-up study including ten additional strains for serotyping. This follow-up study is obligatory for EU-NRLs and the two EU-NRLs concerned obtained good scores in this follow-up study.

Six of the participating NRLs-*Salmonella* also performed phage typing of both *S.* Enteritidis and *S.* Typhimurium. Public Health England selected 20 strains for phage typing. Ten were of the serovar *Salmonella* Enteritidis and ten of the serovar *Salmonella* Typhimurium. The phage typing results of the participating laboratories were good.
These NRLs typed 92% of the *S*. Typhimurium strains correctly. For *S*. Enteritidis 90% of the strains were correctly phage typed.

1 Introduction

This report describes the 17th interlaboratory comparison study on the typing of *Salmonella* spp. organised by the European Union Reference Laboratory for *Salmonella* (EURL-*Salmonella*, Bilthoven, the Netherlands) in November 2012.

According to Regulation (EC) no 882/2004, it is one of the tasks of the EURL-*Salmonella* to organise interlaboratory comparison studies for the National Reference Laboratories for *Salmonella* (NRLs-*Salmonella*) of the European Union. The main objective is for typing of *Salmonella* strains in the Member States to be carried out uniformly and comparable results to be obtained. The organisation of the typing studies started in 1995.

A total of 31 laboratories participated in this study. These included 28 NRLs-*Salmonella* in the 27 EU Member States, 1 NRL of an EU-candidate country and 2 NRLs of EFTA countries. The main objective of this study was to check the performance of the NRLs for typing of *Salmonella* spp. and to compare the results of typing of *Salmonella* spp. among the NRLs-*Salmonella*. All NRLs performed serotyping of the 20 obligatory strains and all but 1 of the participants serotyped the optional 21st strain. NRLs of the EU member states which did not achieve the defined level of good performance for serotyping had to participate in a follow-up study in which 10 additional strains were serotyped.

Six of the NRLs-*Salmonella* performed phage typing on 10 *Salmonella* Enteritidis strains and on 10 *Salmonella* Typhimurium strains. The selection of the strains and interpretation of the results of the phage typing were performed in close cooperation with Public Health England (formerly: Health Protection Agency), London, UK.

2 Participants

Country	Institute/City
Austria	Austrian Agency for Health and Food Safety (AGES) NRC *Salmonella* Graz
Belgium	Veterinary and Agrochemical Research Centre (VAR-CODA-CERVA) Brussels
Bulgaria	National Reference Centre of Food Safety Sofia
Croatia	Croatian Veterinary Institute Zagreb
Cyprus	Laboratory for the Control of Foods of Animal Origin (LCFAO) Cyprus Veterinary Services Nicosia
Czech Republic	State Veterinary Institute Prague Department of Bacteriology Prague
Denmark	National Food Institute, DTU Division of Food Microbiology Søborg
Estonia	Estonian Veterinary and Food Laboratory Tartu
Finland	Finnish Food Safety Authority EVIRA Research Department, Veterinary Bacteriology Unit Kuopio
Finland	National Institute for Health and Welfare (THL) Helsinki
France	ANSES, Laboratoire de Sécurité des Aliments de Maisons-Alfort, Unité CEB Maisons-Alfort
Germany	Federal Institute for Risk Assessment (BFR) National Veterinary Salmonella Reference Laboratory Berlin
Greece	Veterinary Laboratory of Chalkis Chalkis
Hungary	National Food Chain Safety Office, Food and Feed Safety Directorate, Food Microbiology Reference Laboratory Budapest
Ireland	Central Veterinary Research Laboratory Dublin
Italy	Istituto Zooprofilattico Sperimentale delle Venezie Legnaro
Latvia	Institute of Food Safety, Animal Health and Environment 'BIOR' Animal Disease Diagnostic Laboratory Riga

Country	Institute/City
Lithuania	National Food and Veterinary Risk Assessment Institute Vilnius
Luxembourg	Laboratoire National de Santé Luxembourg
Malta	Public Health Laboratory Valletta
the Netherlands	National Institute for Public Health and the Environment Laboratory for Infectious Diseases and Perinatal Screening Bilthoven
Norway	Norwegian Veterinary Institute Section of Bacteriology Oslo
Poland	National Veterinary Research Institute Microbiological Department Pulawy
Portugal	Laboratório Nacional de Veterninária LNIV Lisboa
Romania	Institute of Diagnosis and Animal Health Bucharest
Slovak Republic	State Veterinary and Food Institute Reference laboratory for *Salmonella* Bratislava
Slovenia	National Veterinary Institute Veterinary Faculty Ljubljana
Spain	Laboratorio Central de Veterinaria Madrid
Sweden	National Veterinary Institute (SVA) Uppsala
Switzerland	Institute of Veterinary Bacteriology Centre for Zoonoses, Bacterial Animal Diseases and Antimicrobial Resistance (ZOBA) Bern
United Kingdom	Animal Health and Veterinary Laboratories Agency (AHVLA) Addlestone
United Kingdom	Agri-Food and Biosciences Institute (AFBI) Veterinary Sciences Division, Bacteriological Department Belfast

3 Materials and methods

3.1 *Salmonella* strains for serotyping

A total number of 20 *Salmonella* strains (coded S1 - S20) had to be serotyped by the participants. In some of the interlaboratory comparison typing studies the set of strains contains a strain in duplicate as an additional challenge. Strain S5 and strain S12 were duplicates of the *S*. Poona strain in this study.
As discussed at the 17th EURL-*Salmonella* Workshop in Chaldika (Mooijman, 2012), one additional strain from an uncommon source and subspecies (S21) was included in the study and serotyping of this strain was optional.
The *Salmonella* strains used for the study on serotyping originated from the collection of the National *Salmonella* Centre in the Netherlands. The strains were typed once again by this Centre before mailing. The complete antigenic formulas, according to the most recent White-Kauffmann-Le Minor scheme (Grimont&Weill, 2007), of the 21 serovars are shown in Table 1.

Table 1 Antigenic formulas of the 21 Salmonella *strains according to the White-Kauffmann-LeMinor scheme used in the 17th EURL-* Salmonella *typing study*

Strain code	O-antigens	H-antigens (phase 1)	H-antigens (phase 2)	Serovar
S-1	4,12	i	1,6	Agama
S-2	6,7,14	d	1,5	Isangi
S-3	6,7,14	r	1,5	Infantis
S-4	6,8	z_{10}	e,n,x	Hadar
S-5	1,13,22	z	1,6	Poona
S-6 [a)]	1,4,[5],12	i	-	1,4,[5],12:i:-
S-7	1,4,[5],12,27	d	1,2	Stanley
S-8	6,7	g,s,[t]	[1,6]	Menston
S-9	1,9,12	a	1,7	Saarbruecken
S-10	6,8	e,h	1,5	Kottbus
S-11	1,4,[5],12	r	1,2	Heidelberg
S-12	1,13,22	z	1,6	Poona
S-13	3,{10}{15}{15,34}	z_{10}	1,5 [z_{49}]	Lexington
S-14	1,4,[5],12	i	1,2	Typhimurium
S-15	6,7,14	k	1,2	Galiema
S-16	1,9,12	g,m	-	Enteritidis
S-17	6,7,14	r	1,2	Virchow
S-18	3,{10}{15}{15,34}	y	1,5	Orion
S-19	9,46	a	e,n,x	Baildon
S-20	6,7,14	y	1,5	Bareilly
S-21[b)]	1,44	z_4,z_{32}[c)]	-	44:z_4,z_{32}:-[c)]

[a)] Typhimurium, monophasic variant as determined by PCR (EFSA Journal, 2010; 8(10):1826).
[b)] *Salmonella enterica* subspecies *houtenae* (but due to contamination with a non-*Salmonella* strain, which only became apparent after pro-longed storage, biochemical identification of this strain may have been hampered).
[c)] A serum problem showed up for **z_{23}**, no z_{23} was found using serum from the regular manufacturer of the reference laboratory, but re-testing with serum from another manufacturer did show presence of z_{23}.

3.2 Laboratory codes

The NRLs-Salmonella were assigned a laboratory code 1-31, which differed from the previous typing studies.

3.3 Protocol and test report

Two weeks before the start of the study, the NRLs received the protocol by email. This study was the first EURL-*Salmonella* interlaboratory comparison study using a web based test report. Instructions for the use of this new type of test report and the password to enter it were sent to the NRLs in week 45. The protocol and test report can be found on the EURL-*Salmonella* website: http://www.eurlsalmonella.eu/Proficiency_testing/Typing_studies (visited 4-2-2013).

3.4 Transport

All samples were packed and transported as Biological Substance Category B (UN 3373) and transported by door-to-door courier service. The parcels containing the strains for serotyping and phage typing were sent by the EURL-*Salmonella* in week 45, 2012.

3.5 Guidelines for evaluation

The evaluation of the various serotyping results as mentioned in this report is described in Table 4.

Table 4 Evaluation of serotyping results

Results	Evaluation	Abbreviation
Auto-agglutination or Incomplete set of antisera (outside range of antisera)	Not typable	NT
Partly typable due to incomplete set of antisera or Part of the formula (for the name of the serovar) or No name serovar	Partly correct	+/-
Wrong serovar or Mixed sera formula	Incorrect	-

At the EURL-*Salmonella* workshop in Bilthoven in May 2007 (Mooijman, 2007), the EURL-*Salmonella* made a proposal for the level of 'good performance' that the NRLs need to achieve during an interlaboratory comparison study on serotyping. Penalty points are given for strains that are typed incorrectly. A distinction is made between the five most important *Salmonella* serovars (as indicated in EU legislation) and all other strains:

- **4 penalty points:** Incorrect typing of *S.* Enteritidis, *S.* Typhimurium (including the monophasic variant), *S.* Hadar, *S.* Infantis or *S.* Virchow **or** assigning the name of one of these five serovars to another strain.
- **1 penalty point:** Incorrect typing of all other *Salmonella* serovars.

For each NRL-*Salmonella* the total number of penalty points is determined. The NRL meets the criterion of 'good performance' if it has less than four penalty points.

A follow-up study is organised for NRLs with four penalty points or more. All NRLs of the EU Member States not meeting the criterion of 'good performance' have to participate in this follow-up study.

3.6 Follow-up study serotyping

The follow-up study for serotyping consisted of typing an additional set of 10 *Salmonella* strains. The strains for the follow-up study are shown in Table 5. All EU-NRLs with four penalty points or more had to participate in this follow-up study.

Table 5 Antigenic formulas of the ten Salmonella *strains according to the White-Kauffmann-Le Minor scheme used in the follow-up part of the 17th EURL-*Salmonella *typing study*

Strain code	O-antigens	H-antigens (phase 1)	H-antigens (phase 2)	Serovar
SF1	1,4,12,27	i	l,w	Gloucester
SF2	1,9,12	g,m	-	Enteritidis
SF3[a)]	1,4,[5],12	i	-	1,4,[5],12:i:-
SF4	6,7,14	r	1,5	Infantis
SF5	6,8	d	1,2	Muenchen
SF6	6,8	z_{10}	e,n,x	Hadar
SF7	1,4,[5],12	i	1,2	Typhimurium
SF8	6,7,14	r	1,2	Virchow
SF9	21	b	e,n,x	Minnesota
SF10	8,20	z_4,z_{24}	-	Albany

[a)] Typhimurium, monophasic variant as determined by PCR (EFSA Journal, 2010; 8(10):1826)

3.7 *Salmonella* strains for phage typing

The *Salmonella* strains for phage typing were obtained from the collection of the Gastrointestinal Bacteria Reference Unit (*Salmonella* Reference Service), Public Health England, (PHE, formerly: Health Protection Agency, HPA), London, UK. Ten strains of *Salmonella* Enteritidis and 10 strains of *Salmonella* Typhimurium were selected.

The explanation of the various notations in Tables 2 and 3 are as follows:

CL	Confluent (complete) lysis		
OL	Opaque lysis (confluent lysis with a heavy central opacity due to secondary (lysogenised) growth)		
<CL	Intermediate degrees of confluent lysis		
<OL	Intermediate degrees of opaque lysis		
SCL	Semi-confluent lysis		
<SCL	Intermediate degrees of semi-confluent lysis		
+++	Over 100 plaques,	<u>+++</u>	81 – 100 plaques
++	61 – 80 plaques,	<u>++</u>	41 – 60 plaques
+	21 – 40 plaques,	<u>+</u>	6 – 20 plaques
1 – 5	1 – 5 plaques,	-	No plaques

Table 2 Phage reactions of the Salmonella Enteritidis strains used in the 17th EURL- Salmonella typing study

		Phage reactions at Routine Test Dilution (*S.* Enteritidis)																
Strain number	Phage type	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
E1	22	CL	-	-	SCL	-	SCL	-	OL	< OL	OL	-	-	-	CL	-	-	SCL
E2	1	CL	SCL	CL	OL	CL	SCL	CL	OL	OL	OL	CL	CL	CL	< CL	-	-	OL
E3	8	-	-	CL	SCL	CL	SCL	< CL	OL	< OL	OL	< CL	OL	-	-	-	-	SCL
E4	11	-	-	CL	-	CL	-	+	OL	-	OL	SCL	CL	-	-	-	< CL	-
E5	1b	< OL	SCL	CL	< OL	CL	SCL	CL	OL	OL	< OL	CL	CL	CL	< CL	CL	CL	< OL
E6	13	-	-	-	SCL	-	++	-	-	< OL	-	-	-	-	-	-	-	SCL
E7	63	-	SCL	-	< OL	-	SCL	++	OL	< OL	OL	++	-	-	-	-	-	< OL
E8	4	-	SCL	CL	< OL	CL	SCL	CL	OL	OL	OL	CL	CL	CL	-	-	-	OL
E9	13a	-	-	-	SCL	-	SCL	-	OL	< OL	SCL	-	-	-	-	-	-	< OL
E10	29	-	-	-	-	-	-	-	-	-	-	-	CL	-	-	-	-	-

Table 3 Phage reactions of the Salmonella Typhimurium strains used in the 17th EURL- Salmonella typing study

		Phage reactions at Routine Test Dilution (*S.* Typhimurium)																	
Strain number	Phage type	1	2	3	4	5	6	7	8	10	11	12	13	14	15	16	17	18	19
T1	41	CL	OL	CL	OL	CL	CL	SCL	-	< CL	OL	-	-	CL	CL	CL	CL	CL	< CL
T2	193	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
T3	104	-	-	-	-	-	-	-	-	-	-	SCL	SCL	-	-	-	-	SCL	-
T4	36	OL	OL	OL	OL	OL	OL	SCL	< CL	SCL	OL	OL	OL	CL	OL	OL	OL	CL	OL
T5	12	-	-	-	-	-	-	-	-	-	-	CL	CL	-	-	-	-	-	-
T6	2	-	OL	CL	OL	CL	CL	-	-	< CL	CL	OL	OL	CL	OL	CL	CL	-	CL
T7	22	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
T8	80	-	-	-	-	-	-	-	-	-	OL	-	-	-	-	-	SCL	CL	< OL
T9	141	-	-	-	++	++	-	-	-	++	++	++	+	-	+++	SCL	-	-	+++
T10	U302	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

		Phage reactions at Routine Test Dilution (*S*. Typhimurium)												**Additional phages**						
Strain number	Phage type	20	21	22	23	24	25	26	27	28	29	32	35	1	2	3	10	10 var 2	10 var 3	18
T1	41	OL	OL	OL	< CL	OL	CL	< CL	CL	-	CL	CL	OL	+	+	+++	< OL	OL	OL	CL
T2	193	-	-	-	-	-	-	-	-	-	-	-	-	+++	+++	+++	-	-	-	-
T3	104	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	< OL	< OL	< OL	-
T4	36	< OL	OL	OL	OL	OL	OL	SCL	CL	OL	CL	CL	OL	+++	++	SCL	< OL	OL	OL	CL
T5	12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	< OL	OL	OL	-
T6	2	< CL	OL	OL	CL	CL	CL	CL	CL	-	CL	CL	OL	+	+	+++	< OL	OL	OL	CL
T7	22	-	-	SCL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
T8	80	SCL	-	SCL	-	-	-	-	-	-	-	CL	-	+	+	+++	< OL	OL	OL	CL
T9	141	SCL	-	< OL	++	-	±	±	CL	-	CL	CL	OL	+++	++	SCL	< OL	OL	OL	-
T10	U302	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	< OL	OL	OL	-

4 Questionnaire

4.1 General

A questionnaire was incorporated in the test report of the interlaboratory comparison study. The questions and a summary of the answers are listed below.

4.2 General questions

Question 2: Was your parcel damaged on arrival?

All packages but one were received in good condition. One parcel was wet upon arrival. However, this has not shown any influence on the results.

Question 3: What was the date of receipt of the parcel at the laboratory?

All but one NRL received their package in the same week as it was sent (week 45 of 2012). The remaining NRL received its package eight days after shipment of the parcels on 5 November 2012.

Question 4: What kind of medium was used for sub-culturing the strains?

The NRLs used a variety of media from various manufacturers for the sub-culturing of the *Salmonella* strains. Non-selective nutrient agar was most commonly used.

4.3 Questions regarding serotyping

Question 5: What was the frequency of serotyping of *Salmonella* at your laboratory in 2011?

Question 6: How many *Salmonella* strains (approximately) did your laboratory serotype in 2011?

Replies to questions 5 and 6 are summarised in Table 6.

Table 6 Frequency and number of strains serotyped in 2011 (for all 31 NRLs)

Laboratory code	Typing frequency	Number of strains serotyped in 2011	Laboratory code	Typing frequency	Number of strains serotyped in 2011
22	Once a week	~ 70	17	Daily	850
13	Twice a week	100	3	Daily	900
26	Daily	122	21	Daily	1037
6	Daily	130	23	Daily	1200
28	Daily	150	5	Daily	1500
20	Weekly	~ 200	27	Daily	1600
25	Daily	200	19	Daily	1900
10	Thrice a week	217	2	Daily	2377
1	Daily	230	30	Once a week	3500
8	Thrice a week	260	11	Daily	3500
18	Weekly	264	9	Daily	> 4600
4	Daily	400	16	Daily	~ 4700
29	Daily	500	7	Daily	5300
14	Daily	550	24	Daily	5450
15	Daily	552	31	Daily	6000
12	Once a week	800			

Question 7: What kind of sera do you use (commercially available or prepared in own laboratory)?

The replies to question 7 are summarised in Table 7 and Table 8.

Table 7 Number of laboratories using sera from one or more manufacturers and/or in-house prepared sera

Number of manufacturers from which sera are obtained	Number of NRLs (n=31)
From 1 manufacturer	8
From 2 manufacturers	7
From 3 manufacturers	9
From 4 manufacturers	4
From 5 manufacturers or more	2

Table 8 Number of laboratories using sera from different manufacturers

Manufacturer	Number of NRLs (n=31)
BD-Difco	1
Biomed	1
Biorad	14
Bul-Bio	1
Denka Seiken	3
Immunolab	1
Mast	2
Own preparation	5
Pro-Lab	5
Reagensia	3
Remel	2
Sifin	19
Statens Serum Institute (SSI)	25

Question 8: Were the strains in this study typed in your own laboratory?

Two NRLs-*Salmonella* (laboratory codes 20 and 21) sent the additional strain S21 to another laboratory for further serotyping or confirmation. All other laboratories tested all strains in their own laboratory.

4.4 Questions regarding phage typing

Questions 17/18: Does your laboratory perform phage typing of *S*. Enteritidis, *S*. Typhimurium and/or other strains?

Six NRLs performed phage typing of *S*. Typhimurium and *S*. Enteritidis strains. For routine purposes, one NRL also phage typed other strains, including *S*. Hadar, *S.* Virchow, *S*. Paratyphi B and *S*. Typhi.

Questions 19/20: Which typing system is used for *S.* Enteritidis and *S.* Typhimurium?

All phage typing laboratories use the HPA (nowadays PHE)/Colindale system.

Question 21: How many strains did your laboratory phage type in 2011?

Replies to question 21 are summarised in Table 9.

Table 9 Number of strains phage typed in 2011

Laboratory code	Number of strains phage typed in 2011
24	200
19	860
11	1000
21	1100
7	1150
16	~2.700

4.5 Questions regarding the use of PCR

Question 9: Did you use PCR for confirmation of any of the serotyped strains S1-S21?

Question 10: For which strains did you use this PCR?

A total of 13 laboratories reported to have used PCR for confirmation of strains. Three laboratories used PCR to confirm all strains. Ten laboratories used PCR to confirm strain S6, the monophasic variant of *S*. Typhimurium 1,4,[5],12:i:-, and three of these also used PCR to confirm strain S14, *S*. Typhimurium. A few laboratories also confirmed some other strains, S8, S15, S21, by PCR.

Question 11: Is the PCR used commercially available, details and manufacturer?

Only one laboratory used a commercially available PCR: Check & Trace *Salmonella* by Check points.

Question 12: Details of the PCR and literature references?

Respectively six and two laboratories mentioned the following references:
- EFSA Journal, 2010; 8(10):1826;
- Presentation of Lisa Barco at the XVIth Workhop (Mooijman, 2011).

Other references mentioned were
- Lee et al., 2009;
- Tennant et al., 2010;
- O'Regan et al., 2008 + Munoz et al., 2010;
- Echeita et al., 1998 + Vanegas et al., 1995;
- Fitzgerald et al., 2007 + McQuiston et al., 2011;
- Herrera-León et al., 2007 + Herrera-León et al., 2004 + Echeita and Usera 2002 + Tennant et al., 2010.

Question 13: Do you use this PCR routinely?

Ten of the laboratories use this PCR routinely.

Question 14: How many samples did you test for *Salmonella* using this PCR in 2011?

The replies to question 14 are summarised in Table 10.

Table 10 Number of samples routinely tested by PCR in 2011

Laboratory code	Number of strains tested by PCR in 2011
26	5
8	7
20	8
30	13
18	36
12	113
5	251
2	500
19	600
15	Routinely started on January 2012

5 Results

5.1 Serotyping results

5.1.1 General comments on this year's evaluation

As decided at the 17th EURL-*Salmonella* Workshop (Mooijman, 2012), Strain S21 was an additional strain to the study. Testing of this strain was optional and results were not included in the evaluation.

5.1.2 Serotyping results per laboratory

The evaluation of the detection of O- and H-antigens and identification of the strains per laboratory are shown in Figures 2, 3 and 4 and the percentages of correct results in Figure 1.

The O-antigens were typed correctly by 24 of the 31 participants (77%). This corresponds to 99% of the total number of strains. The H-antigens were typed correctly by 19 of the 31 participants (61%), corresponding to 98% of the total number of strains. A total of 17 participants (55%) gave the correct serovar names, corresponding to 96% of all strains evaluated.

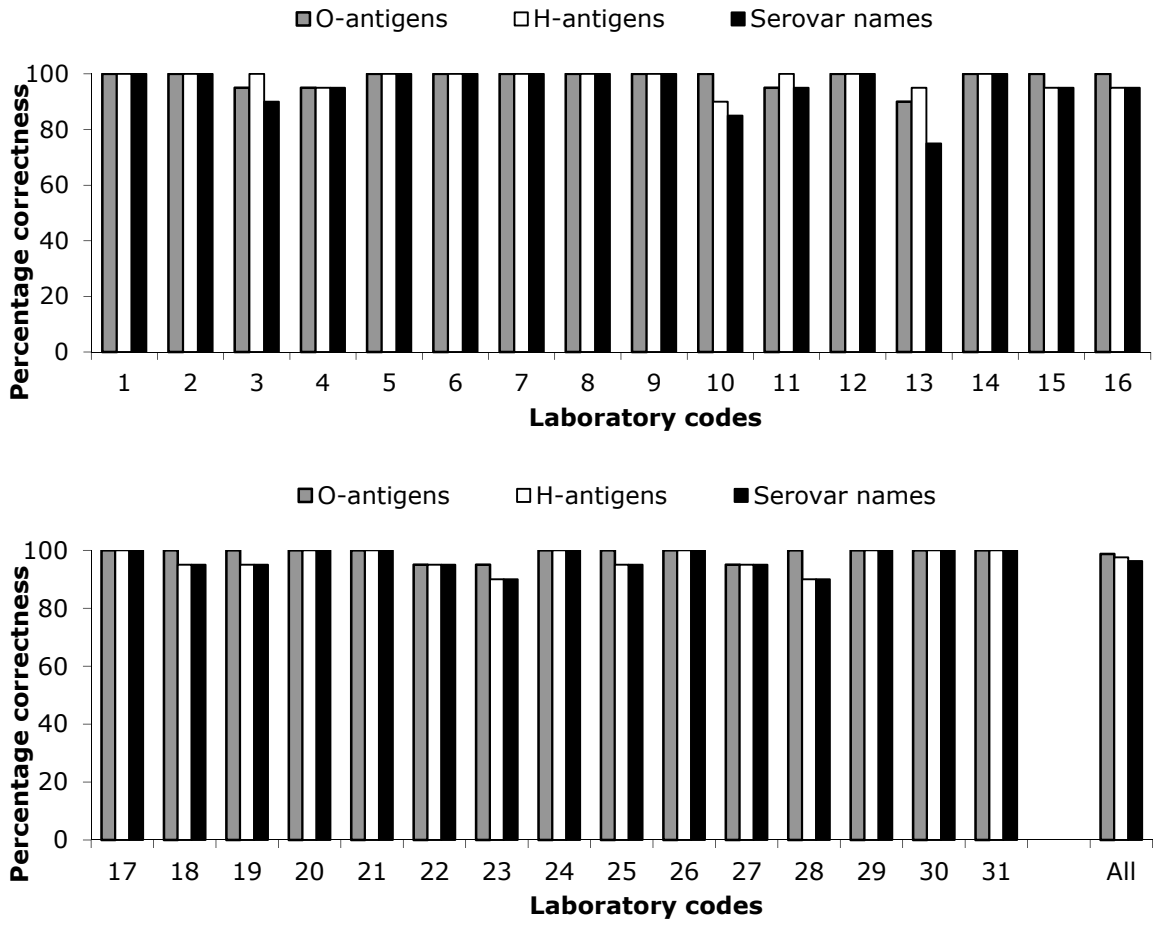

Figure 1 Percentage correctness of serotyping

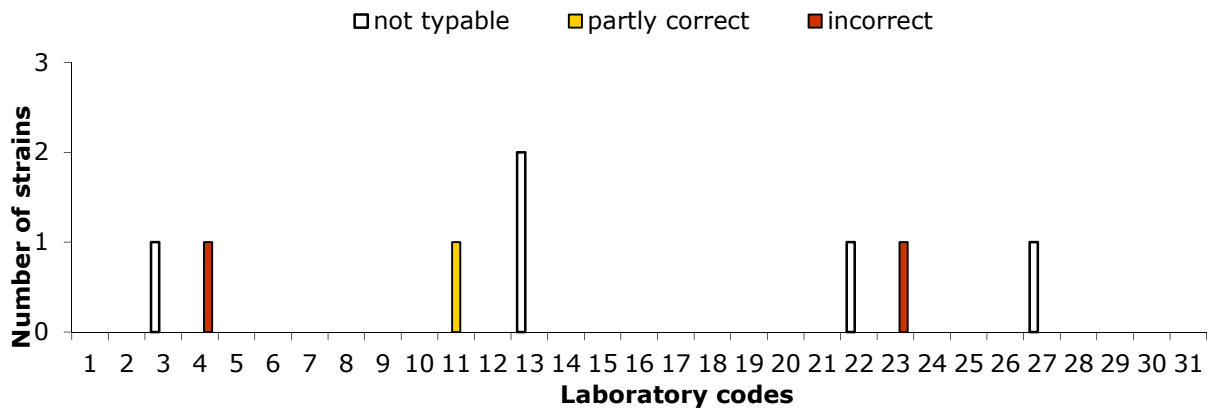

Figure 2 Evaluation of serotyping of O-antigens per NRL

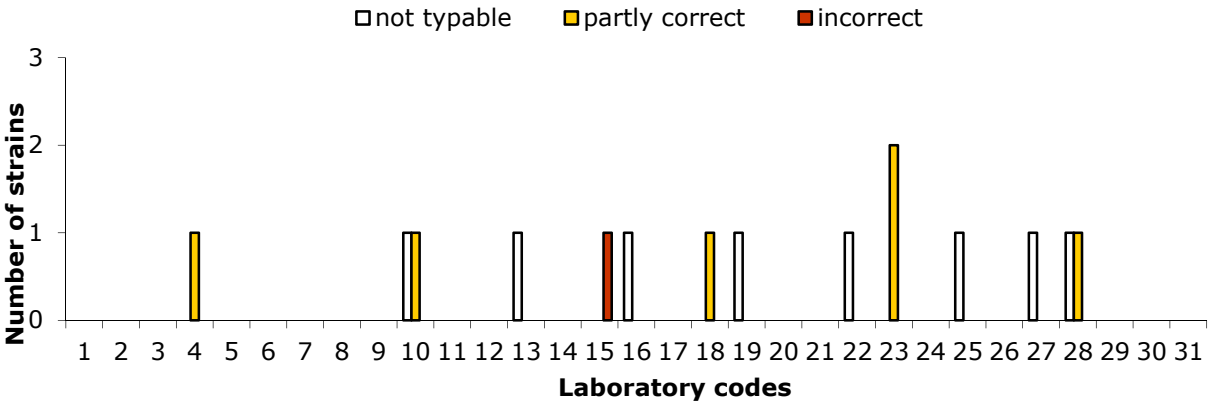

Figure 3 Evaluation of serotyping of H-antigens per NRL

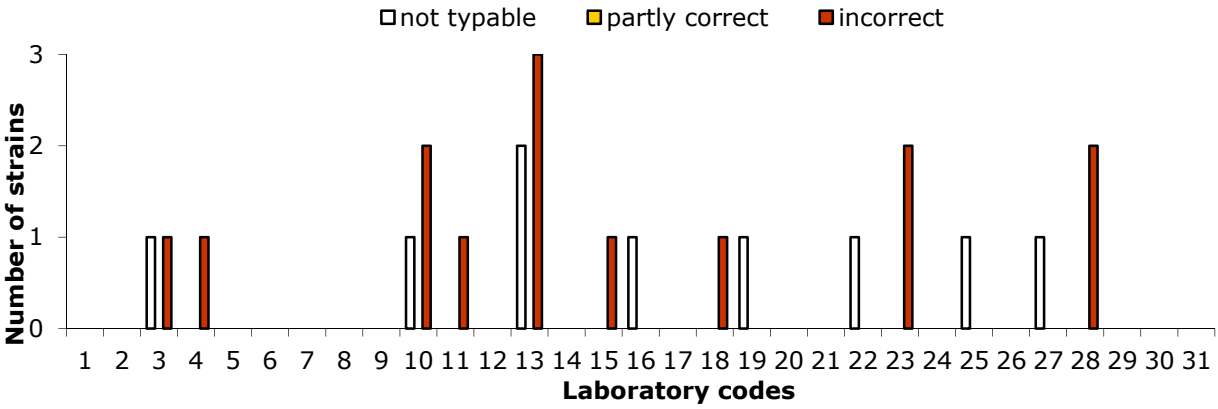

Figure 4 Evaluation of the correct serovar names per NRL

For each NRL the amount of penalty points was determined using the guidelines in section 3.5. Table 11 shows the amount of penalty points for each NRL, in the second column it is reported whether the level of good performance was achieved. Two NRLs did not meet the level of Good Performance at this stage of the study and for these laboratories a follow-up study was be organised.

Table 11 Evaluation of serotyping results per NRL

Lab code	Penalty points	Good performance	Lab code	Penalty points	Good performance
1	0	yes	17	0	yes
2	0	yes	18	1	yes
3	**4**	**no**	19	0	yes
4	1	yes	20	0	yes
5	0	yes	21	0	yes
6	0	yes	22	0	yes
7	0	yes	23	2	yes
8	0	yes	24	0	yes
9	0	yes	25	0	yes
10	2	yes	26	0	yes
11	1	yes	27	0	yes
12	0	yes	28	2	yes
13	**6**	**no**	29	0	yes
14	0	yes	30	0	yes
15	1	yes	31	0	yes
16	0	yes			

5.1.3 Serotyping results per strain

Results found per strain and per laboratory are given in Annex 1, except for the more complicated strains S6 and S21, which are summarised in Annex 2.
A completely correct identification by all participants was obtained for ten strains: *S*. Agama (S1), *S*. Infantis (S3), *S*. Poona (S5 and S12), *S*. Heidelberg (S11), *S*. Lexington (S13), *S*. Typhimurium (S14), *S*. Enteritidis (S16), *S*. Virchow (S17), and *S*. Orion (S18).
The characterisations of strains that caused problems in serotyping are shown in Annex 3.
Most problems occurred with the serovar *S*. Galiema (S15). Seven laboratories had difficulties correctly assigning the correct serovar name to this strain, though this sometimes was caused by the (partly) non-typable nature of the strain.
The results for strain S7 (*S*. Stanley) gave reason to the reference laboratory to do some additional testing and ask the participants with deviating results for specific information on their reagents. The additional testing indicated a serum problem, which was confirmed by the information from several participants. OMA serum from three different manufacturers was tested, and strain S7 only reacted in one of these three brands.

The reported serovar name for strain S6 still showed a large variation of 'Typhimurium-like' names. Therefore the reported serovar names are summarised separately in Annex 2.
Also the details on the additional and optional strain S21 are given in Annex 2.

All but one participant actually did serotype this additional strain S21, being a *Salmonella enterica* subspecies *houtenae* 44:z4,z32:-. However, the biochemical identification of the strain was disturbed by the presence of a non-*Salmonella* strain, which only became apparent after pro-longed storage. Moreover, a serum problem showed up for this strain, as many participants reported the presence of z_{23}. No z_{23} was found by the reference laboratory using serum from their regular manufacturer, but re-testing with serum from another manufacturer indeed did show presence of z_{23}.

5.1.4 *Follow-up*

Two NRLs did not achieve the level of good performance (Table 11; Lab codes 3 and 13) and were offered a follow-up study. This follow-up study is obligatory for laboratories from EU Member States and the two laboratories received ten additional strains for serotyping in week 17, 2013.
The evaluation of the detection of O- and H-antigens and identification of the strains per laboratory of the follow-up study are shown in Figure 5.

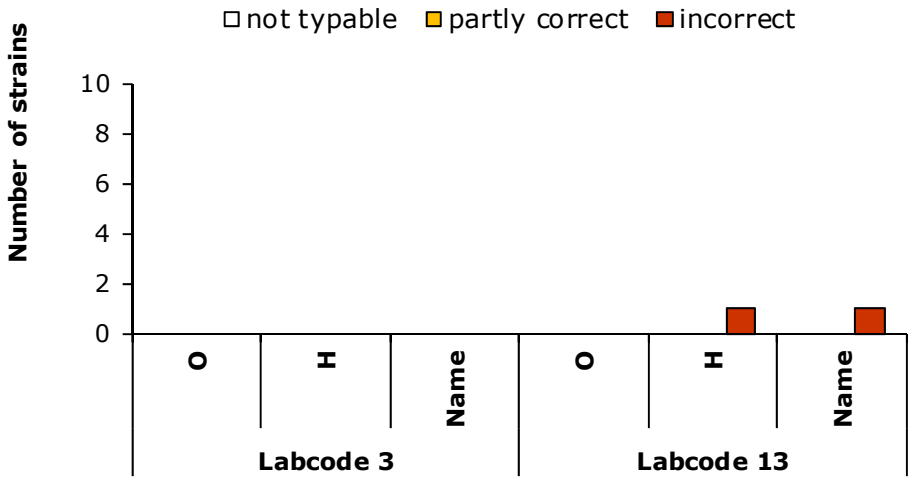

Figure 5 Evaluation of serotyping O- and H-antigens and of the serovar names by the NRLs during the follow-up study

Results found per serovar and per laboratory are given in Table 12. For each participant the number of penalty points was determined using the guidelines in section 3.5. Table 13 shows the number of penalty points for each participant and whether or not the level of good performance was achieved. The two EU-NRLs achieved the level of good performance in this follow-up study.

Table 12 Serotyping results per Salmonella *strain and per NRL, in the follow-up study*

Lab	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10
REF	**Gloucester**	**Enteritidis**	**1,4,[5],12:i:-**	**Infantis**	**Muenchen**	**Hadar**	**Typhimurium**	**Virchow**	**Minnesota**	**Albany**
3	Gloucester	Enteritidis	1,4,[5],12:i:-	Infantis	Muenchen	Hadar	Typhimurium	Virchow	Minnesota	Albany
13	Gloucester	Enteritidis	1,4,[5],12:i:-	Infantis	Muenchen	Hadar	Typhimurium	Virchow	Minnesota	Bovismorbificans
X	0	0	0	0	0	0	0	0	0	1

X = number of deviating laboratories per strain, grey = deviating results of any kind.

Table 13 Evaluation of serotyping results per NRL in the follow-up study

Lab code	Penalty points	Good performance
3	0	yes
13	1	yes

5.2 Phage typing results

Six NRLs participated in the phage typing study of both *S*. Enteritidis and *S*. Typhimurium. The results for phage typing *S*. Enteritidis and *S*. Typhimurium are shown in Table 13. The percentages of strains correctly phage typed for each laboratory for both *S*. Enteritidis and *S*. Typhimurium are shown in Figure 6.
Separate notations per phage type and per laboratory are given in Annex 4 and Annex 5.

Three laboratories correctly phage typed all ten strains of *S*. Enteritidis. The laboratory with lab code 24 assigned the incorrect phage type to one of the strains (E4). Laboratory 7 incorrectly phage typed two of the strains, E7 and E10, and laboratory 11 incorrectly phage typed three of the ten strains, E4, E7 and E10.
Two laboratories correctly phage typed all ten strains of *S*. Typhimurium. Three laboratories (7, 11 and 19) assigned the correct phage type to nine of the ten strains. They all incorrectly phage typed strain T9. Laboratory 24 incorrectly phage typed two of the strains, T6 and T9.
Overall, 90% of the *S*. Enteritidis strains and 92% of the *S*. Typhimurium strains were correctly phage typed.

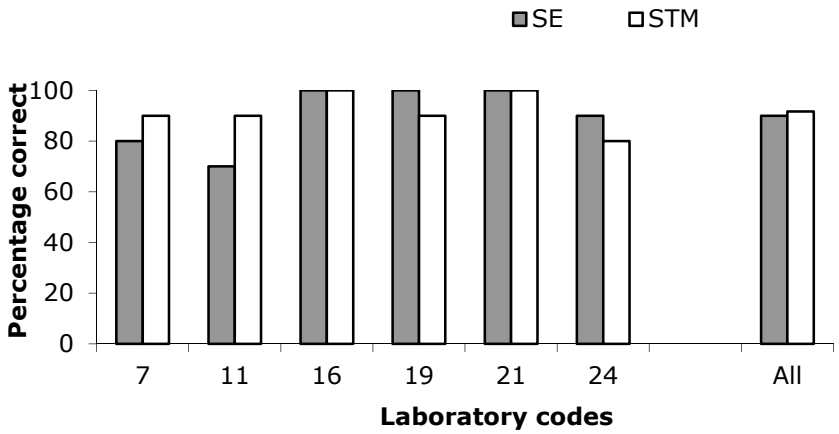

Figure 6 Percentage of strains correctly phage typed for each participating laboratory

Table 13 Results of Salmonella *Enteritidis and* Salmonella *Typhimurium phage typing*

S. Enteritidis strain numbers

Lab code	E1	E2	E3	E4	E5	E6	E7	E8	E9	E10	Y
HPA	**22**	**1**	**8**	**11**	**1b**	**13**	**63**	**4**	**13a**	**29**	
7	22	1	8	11	1b	13	6	4	13a	29a	2
11	22	1	8	11 (or 9a)	1b	13	rdnc (or 63)	4	13a	11b (or 9b)	3
16	22	1	8	11	1b	13	63	4	13a	29	0
19	22	1	8	11	1b	13	RDNC (scheme 2012 - PT63)	4	13a	29	0
21	22	1	8	11	1B	13	63	4	13A	29	0
24	22	1	8	9a	1b	13	63	4	13a	29	1
X	0	0	0	2	0	0	2	0	0	2	6

S. Typhimurium strain numbers

Lab code	T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	Y
HPA	**41**	**193**	**104**	**36**	**12**	**2**	**22**	**80**	**141**	**U302**	
7	41	193	104	36	12	2	22	80	4	302	1
11	41	193	104	36	12 (or 104a)	2	22	80	rdnc (or 141)	U302	1
16	41	193	104L	36	12	2	22	80	141	U302	0
19	41	193	104L	36	12	2	22	80	68	U302	1
21	41	193	104	36	12	2	22	80	141	U302	0
24	41	193	104	36	12	2a	22	80	68	U302	2
X	0	0	0	0	0	1	0	0	4	0	5

HPA = reference results X = number of deviating laboratories per strain Y = number of deviating strains per laboratory

incorrect result

incorrect result with remark

Strain E4, lab 11 the phage reactions obtained were not correct for 11
Strain E7, lab 11 the phage reactions obtained were not correct for 63
Strain T9, lab 11 the phage reactions obtained were not correct for 141

correct result with remark

Strain E7, lab 19 the phage reactions obtained were correct for 63
Strain T5, lab 11 the phage reactions obtained were correct for 12
Strain T10, lab 7 the phage reactions obtained were correct for U302 (typing error)

6 Discussion

6.1 Serotyping

A total of 31 laboratories participated in this study. These included 28 National Reference Laboratories for *Salmonella* (NRLs-*Salmonella*) in the 27 EU Member States, 1 NRL of an EU-candidate country, and 2 NRLs of EFTA countries.
A total of 20 *Salmonella* strains were sent to the participants in November 2012 for serotyping by all participants, the 21st strain was optional and not included in the evaluation.
Overall, 99% of the strains were typed correctly for the O-antigens, 98% of the strains were typed correctly for the H-antigens and 96% of the strains were correctly named by the participants.

At the EURL-*Salmonella* workshop in 2007, the EURL-*Salmonella* proposed a definition for good performance of the NRLs regarding the serotyping. Using this definition, 29 laboratories achieved good performance. The two NRLs that did not achieve the defined level of good performance were offered a follow-up study including ten additional strains for serotyping. This follow-up study is obligatory for EU-NRLs and the two EU-NRLs concerned achieved good performance in this follow-up study. Therefore, in the end all 31 participants achieved good performance in the 2012 typing studies.

When evaluating the results of the participants, mistakes in typing five designated *Salmonella* serovars (Enteritidis, Typhimurium, Hadar, Infantis and Virchow) are more severely judged than the other *Salmonella* serovars. This '*Salmonella* top 5' is indicated in European legislation and it is most important that the laboratories are able to type these serovars correctly. In the 2012 study, none of the NRLs had problems with correctly serotyping *S.* Enteritidis, *S*. Infantis, *S*. Virchow or *S. T*yphimurium. One mistake was made with typing *S*. Hadar and one with typing the monophasic variant of *S*. Typhimurium 1,4,[5],12:i:-.
Table 13 and Table 14 show an overview of the details obtained for the typing studies starting from 2007, when the system of penalty points was used for the first time. Table 13 shows results for EU-NRLs only and Table 14 shows results for all participants per study. The relatively large number of 56 penalty points in 2009 (Table 14) was mainly due to the results of one non-EU NRL, participating for the first time.
The percentages of correctly typed strains remain quite stable over the years, with usually a slightly better performance for the O-antigens than for the H-antigens.
Compared to the 2011 study, less typing mistakes were made overall but these mistakes were more spread among the laboratories and thus resulting in a lower percentage of laboratories achieving completely correct results for O-antigens, H-antigens or serovar names.

*Table 13 Historical overview of the EURL-*Salmonella *interlaboratory comparison studies on serotyping of* Salmonella*, for EU-NRLs only*

Study/Year	XII 2007	XIII 2008	XIV 2009	XV 2010	XVI 2011	XVII 2012
N participants	25	27	28	30	28	28
N strains evaluated	20	20	20	19	19	20
O-antigens correct/strains	98%	98%	98%	98%	99%	99%
H-antigens correct/strains	95%	98%	95%	95%	97%	98%
Names correct/strains	95%	97%	95%	95%	97%	96%
O-antigens correct/labs	68%	70%	75%	93%	93%	82%
H-antigens correct/labs	56%	67%	43%	73%	71%	64%
Names correct/labs	52%	52%	46%	67%	75%	57%
N penalty points	35	30	36	16	22	20
N labs with non-good performance	6	3	4	2	2	2
N labs with non-good performance after follow-up	0	0	0	0	0	0

*Table 14 Historical overview of the EURL-*Salmonella *interlaboratory comparison studies on serotyping of* Salmonella*, for all participants*

Study/Year	XII 2007	XIII 2008	XIV 2009	XV 2010	XVI 2011	XVII 2012
N participants	26	29	31	33	36	31
N strains evaluated	20	20	20	19	19	20
O-antigens correct/strains	98%	98%	97%	98%	98%	99%
H-antigens correct/strains	96%	98%	94%	95%	96%	98%
Names correct/strains	95%	97%	93%	95%	96%	96%
O-antigens correct/labs	69%	76%	74%	88%	86%	77%
H-antigens correct/labs	58%	72%	45%	67%	69%	61%
Names correct/labs	54%	59%	48%	61%	69%	55%
N penalty points	36	34	56	37	41	20
N labs with non-good performance	6	4	5	4	4	2
N labs with non-good performance after follow-up	0	0	0	0 (n=3)	1 (n=3)	0

6.2 Phage typing

Ten strains of *S*. Enteritidis and ten strains of *S*. Typhimurium were selected by the *Salmonella* Reference Service of Public Health England (formerly Health Protection Agency), London, UK.
All ten of the *S*. Entertidis strains were correctly phage typed by three of the six NRLs. One NRL incorrectly phage typed one of the *S*. Enteritidis strains. One NRL incorrectly phage typed two of the strains and one NRL incorrectly phage typed three of the ten strains.
Two laboratories incorrectly phage typed strain E4 (PT 11). One laboratory typed it as PT 9a and the other as PT 11 or PT 9a. Both of these laboratories obtained a high reading with phage 13; PT 11 should not react with this phage. This suggests the titre of this phage was too high.

Two laboratories phage typed strain E7 (PT 63) incorrectly. One laboratory phage typed it as PT 6 because they failed to obtain any phage reactions with phages 7 and 11. This was probably caused by the titre of these two phages being low. The second laboratory typed it as RDNC or PT 63, but the phage reactions were incorrect for PT 63. This laboratory had a high reaction with phage 12 and this phage does not react with PT 63. The titre of this phage was probably too high.
Strain E10 (PT 29) was also incorrectly phage typed by two laboratories. One laboratory typed it as PT 29a and the other laboratory typed it as PT 11b or PT 9b. Both laboratories obtained phage reactions with several phages that do not react with PT 29, suggesting that the inoculum of the broth culture used for the phage typing was not correct.
Two of the six NRLs correctly phage typed the ten strains of *S*. Typhimurium. Three of the NRLs correctly phage typed nine of the *S*. Typhimurium strains and one NRL correctly typed eight of the ten strains.
Strain T6 (DT 2) was incorrectly phage typed by one laboratory as DT 2a. This was due to them obtaining low phage reactions with phages 12 and 13, suggesting the titre of these two phages was too low.
Four of the NRLs incorrectly phage typed strain T9 (DT 141) incorrectly. One of the NRLs typed it as DT 4 because they obtained phage reactions with phages 6 and 21 and DT 141 does not react with these phages. This suggests the titre of these two phages was too high. Two of the NRLs phaged typed this strain as DT 68 and they both failed to get phage reactions with several phages that react with DT 141. This was probably due to the inoculum of the broth culture being incorrect. The fourth NRL typed this strain as RDNC as they obtain low or no reaction with several of the phages and this was probably due to the inoculum of the broth culture used being incorrect. *S*. Typhimurium requires a light growth in the broth whereas *S*. Enteritidis requires a heavier growth.

7 Conclusions

7.1 Serotyping

- 99% of the strains were typed correctly for the O-antigens.
- 98% of the strains were typed correctly for the H-antigens.
- 96% of the strains were correctly named.
- Serotyping of *S.* Galiema caused most problems in this study.
- All participants correctly serotyped the 'top 5' strains *S.* Enteritidis, *S*. Infantis, *S*. Virchow and *S. T*yphimurium. Only one mistake was made with typing *S.* Hadar and one with typing the monophasic variant of *S*. Typhimurium: 1,4,[5],12:i:-.
- Two NRLs had to participate in the follow-up study, typing an additional set of ten strains.
- In the end, all 31 participants achieved the defined level of good performance.

7.2 Phage typing

- The performance of the laboratories participating in this study showed an improvement for *S*. Enteritidis compared to the study of 2011. In 2011, 87% of the *S*. Enteritidis strains were correctly phage typed and in this study of 2012, 90% of the strains were correctly typed.
- The performance in the phage typing of the *S*. Typhimurium strains was good in this study but there were more incorrect results when compared to the study of 2011. In 2011, 98% of the *S*. Typhimurium strains were correctly phage typed and in this study of 2012, 92% of the strains were correctly typed.
- Seven of the *S*. Enteritidis strains and eight of the *S*. Typhimurium strains were correctly phage typed by all of the participating laboratories.
- Three of the *S*. Enteritidis strains were incorrectly phage typed. Strain E4 (PT 11), strain E7 (PT 63) and strain E10 (PT 29) were all incorrectly phage typed by two laboratories each.
- Two strains of *S*. Typhimurium were incorrectly phage typed. Strain T6 (DT 2) was incorrectly phage typed by one laboratory and strain T9 (DT 141) was incorrectly typed by four of the participating laboratories.

List of abbreviations

CRL-*Salmonella*	Community Reference Laboratory for *Salmonella* (nowadays EURL-*Salmonella*)
DT	Definitive type
EFTA	European Free Trade Association
EU	European Union
EURL-*Salmonella*	European Union Reference Laboratory for *Salmonella*
HPA	Health Protection Agency (nowadays Public Health England)
LGP	Laboratory of Gastrointestinal Pathogens
N	Total number
NL	The Netherlands
NRLs-*Salmonella*	National Reference Laboratories for *Salmonella*
Nt	Not typable
PHE	Public Health England (formerly Health Protection Agency)
PT	Phage Type
REF	Reference
RIVM	National Institute for Public Health and the Environment
RNDC	Reacts with the phages but does not confirm to a recognised pattern
SE	*Salmonella* Enteritidis
STM	*Salmonella* Typhimurium
UK	United Kingdom

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Annex 1 Serotyping results per strain and laboratory

Lab REF	S1 Agama	S2 Isangi	S3 Infantis	S4 Hadar	S5 Poona	S7 Stanley	S8 Menston	S9 Saarbruecken	S10 Kottbus
1	Agama	Isangi	Infantis	Hadar	Poona	Stanley	Menston	Saarbruecken	Kottbus
2	Agama	Isangi	Infantis	Hadar	Poona	Stanley	Menston	Saarbruecken	Kottbus
3	S. Agama	S. Isangi	S. Infantis	S. Hadar	S. Poona	S.I=-:d:1,2	S. Menston	S. Saarbruecken	S. Kottbus
4	Agama	Isangi	Infantis	Hadar	Poona	Salmonella sp. serovar 61:d:1,2	Menston	Saarbruecken	Kottbus
5	S. Agama	S. Isangi	S. Infantis	S. Hadar	S. Poona	S. Stanley	S. Menston	S. Saarbruecken	S. Kottbus
6	Salmonella Agama	Salmonella Isangi	Salmonella Infantis	Salmonella Hadar	Salmonella Poona	Salmonella Stanley	Salmonella Menston	Salmonella Saarbruecken	Salmonella Kottbus
7	S Agama	S Isangi	S Infantis	S Hadar	S Poona	S Stanley	S Menston	S Saarbruecken	S Kottbus
8	Agama	Isangi	Infantis	Hadar	Poona	Stanley	Menston	Saarbruecken	Kottbus
9	S. Agama	S. Isangi	S. Infantis	S. Hadar	S. Poona	S. Stanley	S. Menston	S. Saarbruecken	S. Kottbus
10	Agama	Isangi	Infantis	Hadar	Poona	Stanley	Montevideo	Saarbruecken	Bovismorbificans
11	Agama	Isangi	Infantis	Hadar	Poona	Stanley	Menston	Saarbruecken	Kottbus
12	s.agama	s.isangi	s.infantis	s.hadar	s.poona	s.stanley	s.menston	s.saarbruecken	s.kottbus
13	S. Agama	S. Isangi	S. Infantis	Salmonella spp.	S. Poona	Salmonella spp.	Salmonella spp.	S. Saarbruecken	Salmonella spp.
14	Salmonella Agama	Salmonella Isangi	Salmonella Infantis	Salmonella Hadar	Salmonella Poona	Salmonella Stanley	Salmonella Menston	Salmonella Saarbruecken	Salmonella Kottbus
15	Agama	Isangi	Infantis	Hadar	Poona	Stanley	Menston	Saarbruecken	Kottbus
16	S.Agama	S.Isangi	S.Infantis	S.Hadar	S.Poona	S.Stanley	S.Menston	S.Saarbruecken	S.Kottbus
17	Salmonella Agama	Salmonella Isangi	Salmonella Infantis	Salmonella Hadar	Salmonella Poona	Salmonella Stanley	Salmonella Menston	Salmonella Saarbruecken	Salmonella Kottbus
18	S.Agama	S.Isangi	S.Infantis	S.Hadar	S.Poona	S.Stanley	S.Menston	S.Saarbruecken	S.Kottbus
19	S. Agama	S. Isangi	S. Infantis	S. Hadar	S. Poona	S. Stanley	S. Menston	S. Saarbruecken	S. Kottbus
20	Agama	Isangi	Infantis	Hadar	Poona	Stanley	Menston	Saarbruecken	Kottbus
21	Agama	Isangi	Infantis	Hadar	Poona	Stanley	Menston	Saarbruecken	Kottbus
22	Salmonella Agama	Salmonella Isangi	Salmonella Infantis	Salmonella Hadar	Salmonella Poona	Lab comments	Salmonella Menston	Salmonella Saarbruecken	Salmonella Kottbus
23	Salmonella Agama	Salmonella Wil	Salmonella Infantis	Salmonella Hadar	Salmonella Poona	Salmonella Chingola	Salmonella Menston	Salmonella Saarbruecken	Salmonella Kottbus
24	Salmonella Agama	Salmonella Isangi	Salmonella Infantis	Salmonella Hadar	Salmonella Poona	Salmonella Stanley	Salmonella Menston	Salmonella Saarbruecken	Salmonella Kottbus
25	S. Agama	S. Isangi	S. Infantis	S. Hadar	S. Poona	S. Stanley	S. Menston	S. Saarbruecken	S. Kottbus
26	Agama	Isangi	Infantis	Hadar	Poona	Stanley	Menston	Saarbruecken	Kottbus
27	S. Agama	S. Isangi	S. Infantis	S.Hadar	S. Poona	Salmonella spp.	S. Menston	S. Saarbruecken	S. Kottbus
28	S. Agama	S. Isangi	S. Infantis	S. Hadar	S. Poona	S. Stanley	S. Menston	S. Gallinarum	S. Kottbus
29	Salmonella Agama	Salmonella Isangi	Salmonella Infantis	Salmonella Hadar	Salmonella Poona	Salmonella Stanley	Salmonella Menston	Salmonella Saarbruecken	Salmonella Kottbus
30	Agama	Isangi	Infantis	Hadar	Poona	Stanley	Menston	Saarbruecken	Kottbus
31	Agama	Isangi	Infantis	Hadar	Poona	Stanley	Menston	Saarbruecken	Kottbus
X	0	1	0	1	0	6	2	1	2

S11 Heidelberg	S12 Poona	S13 Lexington	S14 Typhimurium	S15 Galiema	S16 Enteritidis	S17 Virchow	S18 Orion	S19 Baildon	S20 Bareilly	Lab REF
Heidelberg	Poona	Lexington	Typhimurium	Galiema	Enteritidis	Virchow	Orion	Baildon	Bareilly	**1**
Heidelberg	Poona	Lexington	Typhimurium	Galiema	Enteritidis	Virchow	Orion	Baildon	Bareilly	**2**
S. Heidelberg	S. Poona	S. Lexington	S. Typhimurium	S. Galiema	S. Enteritidis	S. Virchov	S. Orion	S. Baildon	S. Bareilly	**3**
Heidelberg	Poona	Lexington	Typhimurium	Galiema	Enteritidis	Virchow	Orion	Baildon	Bareilly	**4**
S. Heidelberg	S. Poona	S. Lexington	S. Typhimurium	S. Galiema	S. Enteritidis	S. Virchow	S. Orion	S. Baildon	S. Bareilly	**5**
Salmonella Heidelberg	Salmonella Poona	Salmonella Lexington	Salmonella Typhimurium	Salmonella Galiema	Salmonella Enteritidis	Salmonella Virchow	Salmonella Orion	Salmonella Baildon	Salmonella Bareilly	**6**
S Heidelberg	S Poona	S Lexington (15,34+ variant)	S Typhimurium	S Galiema	S Enteritidis	S Virchow	S Orion (15,34+ variant)	S Baildon	S Bareilly	**7**
Heidelberg	Poona	Lexington	Typhimurium	Galiema	Enteritidis	Virchow	Orion	Baildon	Bareilly	**8**
S. Heidelberg	S. Poona	S. Lexington	S. Typhimurium	S. Galiema	S. Enteritidis	S. Virchow	S. Orion	S. Baildon	S. Bareilly	**9**
Heidelberg	Poona	Lexington	Typhimurium	6,7 (auto-agglutination)	Enteritidis	Virchow	Orion	Baildon	Bareilly	**10**
Heidelberg	Poona	Lexington var 34	Typhimurium	Galiema	Enteritidis	Virchow	Orion var 43	Lomalinda	Bareilly	**11**
s.heidelberg	s.poona	s.lexington	s.typhimurium	s.galiema	s.enteritidis	s.virchow	s.orion	s.baildon	s.bareilly	**12**
S. Heidelberg	S. Poona	S. Lexington	S. Typhimurium	lab comment	S. Enteritidis	S. Virchow	S. Orion	S. Baildon	S. Bareilly	**13**
Salmonella Heidelberg	Salmonella Poona	Salmonella Lexington	Salmonella Typhimurium	Salmonella Galiema	Salmonella Enteritidis	Salmonella Virchow	Salmonella Orion	Salmonella Baildon	Salmonella Bareilly	**14**
Heidelberg	Poona	Lexington	Typhimurium	Lille	Enteritidis	Virchow	Orion	Baildon	Bareilly	**15**
S.Heidelberg	S.Poona	S.Lexington	S.Typhimurium	S.Galiema	S.Enteritidis	S.Virchow	S.Orion	S.Baildon	monophasic strain group C1	**16**
Salmonella Heidelberg	Salmonella Poona	Salmonella Lexington	Salmonella Typhimurium	Salmonella Galiema	Salmonella Enteritidis	Salmonella Virchow	Salmonella Orion	Salmonella Baildon	Salmonella Bareilly	**17**
S.Heidelberg	S.Poona	S.Lexington	S.Typhimurium	S. Singapore	S.Enteritidis	S.Virchow	S.Orion	S.Baildon	S.Bareilly	**18**
S. Heidelberg	S. Poona	S. Lexington	S. Typhimurium	S.enterica subsp. enterica 6,7:k:-	S. Enteritidis	S. Virchow	S. Orion	S. Baildon	S. Bareilly	**19**
Heidelberg	Poona	Lexington	Typhimurium	Galiema	Enteritidis	Virchow	Orion	Baildon	Bareilly	**20**
Heidelberg	Poona	Lexington	Typhimurium	Galiema	Enteritidis	Virchow	Orion	Baildon	Bareilly	**21**
Salmonella Heidelberg	Salmonella Poona	Salmonella Lexington	Salmonella Typhimurium	Salmonella Galiema	Salmonella Enteritidis	Salmonella Virchow	Salmonella Orion	Salmonella Baildon	Salmonella Bareilly	**22**
Salmonella Heidelberg	Salmonella Poona	Salmonella Lexington	Salmonella Typhimurium	Salmonella Galiema	Salmonella Enteritidis	Salmonella Virchow	Salmonella Orion	Salmonella Baildon	Salmonella Bareilly	**23**
Salmonella Heidelberg	Salmonella Poona	Salmonella Lexington	Salmonella Typhimurium	Salmonella Galiema	Salmonella Enteritidis	Salmonella Virchow	Salmonella Orion	Salmonella Baildon	Salmonella Bareilly	**24**
S. Heidelberg	S. Poona	S. Lexington	S. Typhimurium	S. enterica subsp. enterica 6,7:k:-	S. Enteritidis	S. Virchow	S. Orion	S. Baildon	S. Bareilly	**25**
Heidelberg	Poona	Lexington	Typhimurium	Galiema	Enteritidis	Virchow	Orion	Baildon	Bareilly	**26**
S. Heidelberg	S. Poona	S. Lexington	S. Typhimurium	S. Galiema	S. Enteritidis	S.Virchow	S. Orion	S. Baildon	S. Bareilly	**27**
S. Heidelberg	S. Poona	S. Lexington	S. Typhimurium	S. Thompson	S. Enteritidis	S. Virchow	S. Orion	S. Baildon	S. Bareilly	**28**
Salmonella Heidelberg	Salmonella Poona	Salmonella Lexington	Salmonella Typhimurium	Salmonella Galiema	Salmonella Enteritidis	Salmonella Virchow	Salmonella Orion	Salmonella Baildon	Salmonella Bareilly	**29**
Heidelberg	Poona	Lexington	Typhimurium	Galiema	Enteritidis	Virchow	Orion	Baildon	Bareilly	**30**
Heidelberg	Poona	Lexington	Typhimurium	Galiema	Enteritidis	Virchow	Orion	Baildon	Bareilly	**31**
0	0	0	0	7	0	0	0	1	1	**X**

X= number of deviating laboratories per strain, grey = deviating results of any kind. Results for strains S6 and S21 are given in Annex 2.

Annex 2 Details on serotyping strains S6 and S21

Strain	O-antigens	H-antigens phase 1	H-antigens phase 2	Serovar	Labcode
S6	**1,4,[5],12**	**i**	**-**	**1,4,[5],12:i:-**	**REF**
S6	4,12	i	-	4,12:i:-	1
S6	4	i	-	Monophasic strain of S. Typhimurium	2
S6	4	i	l,w	S. Gloucester	3
S6	4,12	i	-	Salmonella enterica subsp. enterica serovar 4,12:i:-	4
S6	4,12	i	-	Monophasic S. Typhimurium	5
S6	4,12	i	-	Salmonella enterica subsp. enterica serotype 4,5,12:i:-	6
S6	O4,12	i	-	O4,12:i:-	7
S6	1,4,[5],12	i	-	1,4,[5],12:i:-	8
S6	4,12	i	-	S. Typhimurium, monophasic	9
S6	4,12	i	-	4,12:i:-	10
S6	4	i	-	4,12.i:-	11
S6	4,12	i	-	monophasic s.typhimurium	12
S6	4,12	i	-	Salmonella spp.	13
S6	4,12	i	-	Monophasic Salmonella Typhimurium	14
S6	4,12	i	-	4,12:i:- or Typhimurium-like	15
S6	4	i	-	monophasic strain group B (monophasic S. Typhimurium)	16
S6	4,[5],12	i	-	Salmonella enterica subsp. enterica I 4,[5],12:i:-	17
S6	1, 4, 5, 12	i	-	S.enerica subsp. enterica	18
S6	4	i	-	Monophasic variant of S. Typhimurium	19
S6	4	i	-	Typhimurium monophasic variant	20
S6	4	i	-	monophasic Typhimurium	21
S6	4, 12	i	-	Monophasic Salmonella Typhimurium	22
S6	1,4,[5],12	i	-	1,4,[5],12:i:- S. Typhimurium, monophasic variant	23
S6	4,12	i	-	4,12:i:- (monophasic S. Typhimurium)	24
S6	4,12	i	-	S. enterica subsp. enterica 4,12:i:-	25
S6	4,12	i	-	Typhimurium monophasic	26
S6	4,12	i		monophasic S. Typhimurium	27
S6	1,4,5,12	i	-	1,4,5,12:i:-	28
S6	4,12	i	-	Salmonella species	29
S6	4,12	i	-	4,12:i:-	30
S6	4,12	i	-	S. 4,12:i:-	31

Grey = deviating results of any kind.

Strain	O-antigens	H-antigens phase 1	H-antigens phase 2	Serovar	Labcode
S21	**1,44**	**z4,z32*)**	**-**	**1,44:z4,z32:-*)**	**REF**
S21	44	z4,z32	-	44:z4,z32:-	1
S21	44	z4,z23,z32	-	S. enterica subsp. arizonae O:44; z4,z23,z32; -	2
S21	44	z4,z23	-	S. Kua	3
S21	44	z4z32	-	Salmonella enterica subsp. arizonae serovar 44:z4z32:-	4
S21	44	z4,z23,z32	-	IIIa (arizonae)	5
S21	44	z4,z23,z32	-	Salmonella enterica subsp. arizonae (IIIa)	6
S21	O44	z4,z23,z32	-	SG IIIa O44:z4,z23,z32:-	7
S21	44	z4,z23	-	IIIa 44:z4,z23:-	8
S21	44	z4,z32	-	S. IIIa 44:z4,z32:-	9
S21	44	z10	e,n,x	44:z10:e,n,x	10
S21	44	z4,z32	-	44:z4,z32:- (see remarks)	11
S21	44	z4,z23,z32	-	S. enterica subsp arizonae	12
S21	44	z4,z23,z32	-	Salmonella spp.	13
S21	44	z4,z23,z32	-	Salmonella Ploufragan IIIA	14
S21	44	z4,z32	-	44:z4,z32:-	15
S21	44	z23	-	S.IIIa	16
S21	44	z4,z23	-	Salmonella enterica subsp. arizonae IIIa 44:z4,z23:-	17
S21	44	Z4	-	S. enterica subsp. arizonae	18
S21	44	z4,z32	-	S. enterica subsp. arizonae	19
S21	44	z4,z23,z32	-	enterica subsp. arizonae	20
S21	53	z32	-	Salmonella ssp. IIIa	21
S21					22
S21	44	z4,z32	-	44:z4,z32:- S. enterica subsp. Arizonae	23
S21	44	z4,z23	-	Salmonella enterica subsp. arizonae (III.a) z4,z23:-	24
S21	44	z4,z23,z32	-	S. enterica subsp. arizonae 44:z4,z23,z32:-	25
S21	44	z4,z23	-	IIIa (44:z4,z23:-)	26
S21	OME			Salmonella spp. OME +	27
S21	44	z4,z23,z32	-	44:z4,z23,z32:-	28
S21	-	z4,z32	-	Untypable	29
S21	44	z4,z32	-	44:z4,z32	30
S21	1,44	z4,z32	-	S.IV 1,44:z4,z32:-	31

Grey = deviating results of any kind

*) A serum problem showed up for **z_{23}**; no z_{23} was found using serum from the regular manufacturer of the reference laboratory, but re-testing with serum from another manufacturer did show presence of z_{23}.

Annex 3 Identifications per strain that caused problems in serotyping

Strain	O-antigens	H-antigens phase 1	H-antigens phase 2	Serovar	Labcode
S2	**6,7,14**	**d**	**1,5**	**Isangi**	**REF**
S2	6,7	d	l,z13,z28	Salmonella Wil	23
S4	**6,8**	**z_{10}**	**e,n,x**	**Hadar**	**REF**
S4	8	z10	e,n,x	Salmonella spp.	13
S7	**1,4,[5],12,27**	**d**	**1,2**	**Stanley**	**REF**
S7	-	d	1,2	S.I=-:d:1,2	3
S7	61	d	1,2	Salmonella sp. serovar 61:d:1,2	4
S7	-	d	1,2	Salmonella spp.	13
S7	neg for omniO, OMA, OMB, and OMD			lab remark	22
S7	11	e,h	1,2	Salmonella Chingola	23
S7	negative for OMA, OMB, OMC, OMD and OME			Salmonella spp.	27
S8	**6,7**	**g,s,[t]**	**[1,6]**	**Menston**	**REF**
S8	6,7	g,s,t	-	Montevideo	10
S8	7	g,t,s	-	Salmonella spp.	13
S9	**1,9,12**	**a**	**1,7**	**Saarbruecken**	**REF**
S9	1,9,12	-	-	S. Gallinarum	28
S10	**6,8**	**e,h**	**1,5**	**Kottbus**	**REF**
S10	6,8	r	1,5	Bovismorbificans	10
S10	8	e,h	1,5	Salmonella spp.	13
S15	**6,7,14**	**k**	**1,2**	**Galiema**	**REF**
S15	6,7	NT	NT	6,7 (auto-agglutination)	10
S15	lab remark	lab remark	lab remark	lab remark	13
S15	7	z38	-	Lille	15
S15	6, 7	k	e, n, x	S. Singapore	18
S15	6,7	k	-	S. enterica subsp. enterica 6,7:k:-	19
S15	6,7	k	-	S. enterica subsp. enterica 6,7:k:-	25
S15	6,7,14	k	1,5	S. Thompson	28
S17	**9,46**	**a**	**e,n,x**	**Baildon**	**REF**
S17	9	a	e,n,x	Lomalinda	11
S20	**6,7,14**	**y**	**1,5**	**Bareilly**	**REF**
S20	7	y	-	monophasic strain group C1	16

Grey = deviating results of any kind.

Annex 4 Phage typing results per *S.* Enteritidis strain for all participating laboratories

Strain E1		Phages reactions at Routine Test Dilution (*S.* Enteritidis)																
Lab code	**Phage type**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**
HPA	**22**	**CL**	**-**	**-**	**SCL**	**-**	**SCL**	**-**	**OL**	**< OL**	**OL**	**-**	**-**	**-**	**CL**	**-**	**-**	**SCL**
7	22	OL	-	-	SCL	-	++	-	OL	++	SCL	-	-	-	SCL	-	-	SCL
11	22	OL	-	-	< OL	-	< OL	-	OL	< OL	OL	-	-	-	CL		-	SCL
16	22	OL	-	-	< OL	-	< OL	-	OL	< OL	SCL	-	-	-	CL	-	-	SCL
19	22	OL	-	-	+++	-	SCL	-	OL	< OL	OL	-	-	-	SCL	-	-	OL
21	22	CL	-	-	+++	-	SCL	-	OL	+++	OL	-	-	-	CL	-	-	+++
24	22	OL	-	-	SCL	-	<SCL	-	OL	OL	OL	-	-	-	SCL	-	-	OL

Strain E2		Phages reactions at Routine Test Dilution (*S.* Enteritidis)																
Lab code	**Phage type**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**
HPA	**1**	**CL**	**SCL**	**CL**	**OL**	**CL**	**SCL**	**CL**	**OL**	**OL**	**OL**	**CL**	**CL**	**CL**	**< CL**	**-**	**-**	**OL**
7	1	CL	SCL	CL	CL	CL	CL	SCL	CL	++	SCL	CL	CL	SCL	CL	-	-	SCL
11	1	OL	< CL	CL	< OL	CL	< OL	CL	OL	< OL	OL	CL	CL	CL	CL		-	< OL
16	1	OL	SCL	CL	OL	CL	SCL	CL	OL	< OL	< OL	CL	CL	CL	CL	-	-	SCL
19	1	OL	SCL	CL	OL	CL	SCL	CL	OL	OL	OL	CL	CL	CL	SCL	-	-	OL
21	1	OL	CL	CL	<SCL	CL	SCL	SCL	OL	OL	OL	SCL	CL	CL	CL	+	-	+++
24	1	OL	SCL	CL	OL	CL	<SCL	CL	OL	OL	OL	CL	CL	CL	CL	-	-	OL

Strain E3		Phages reactions at Routine Test Dilution (*S.* Enteritidis)																
Lab code	**Phage type**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**
HPA	**8**	**-**	**-**	**CL**	**SCL**	**CL**	**SCL**	**< CL**	**OL**	**< OL**	**OL**	**< CL**	**OL**	**-**	**-**	**-**	**-**	**SCL**
7	8	-	-	++	++	CL	SCL	SCL	CL	SCL	SCL	++	CL	-	-	-	-	SCL
11	8	-	-	< CL	< OL	CL	< OL	SCL	OL	< OL	OL	SCL	OL	-	-		-	< OL
16	8	-	-	SCL	< OL	CL	SCL	< CL	OL	OL	< OL	CL	CL	-	-	-	-	< OL
19	8	-	-	+++	SCL	SCL	SCL	SCL	OL	< OL	OL	SCL	CL	-	-	-	-	< OL
21	8	-	-	SCL	+++	CL	<SCL	SCL	OL	+++	OL	SCL	CL	-	-	-	-	+++
24	8	-	-	SCL	SCL	SCL	<SCL	< CL	OL	OL	OL	SCL	SCL	-	-	-	-	OL

Strain E4		Phages reactions at Routine Test Dilution (*S.* Enteritidis)																
Lab code	**Phage type**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**
HPA	**11**	**-**	**-**	**CL**	**-**	**CL**	**-**	**+**	**OL**	**-**	**OL**	**SCL**	**CL**	**-**	**-**	**-**	**< CL**	**-**
7	11	-	-	SCL	-	CL	-	±	CL	-	SCL	SCL	OL	-	-	-	CL	-
11	11 (or 9a)	±	-	CL	-	CL	-	+	OL	-	OL	+++	CL	+++	±		< OL	-
16	11	-	-	< OL	-	CL	-	++	OL	-	++	++	CL	-	-	-	CL	-
19	11	-	-	±±±	-	CL	-	+	OL	-	< OL	±±	CL	-	-	-	±±	-
21	11	-	-	+++	-	CL	-	+	OL	-	< OL	1 - 5	CL	±	-	-	+++	-
24	9a	-	-	CL	-	CL	-	SCL	OL	-	OL	< CL	CL	< CL	-	+	CL	-

Strain E5		Phages reactions at Routine Test Dilution (*S.* Enteritidis)																
Lab code	**Phage type**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**
HPA	**1b**	**< OL**	**SCL**	**CL**	**< OL**	**CL**	**SCL**	**CL**	**OL**	**OL**	**< OL**	**CL**	**CL**	**CL**	**< CL**	**CL**	**CL**	**< OL**
7	1b	++	++	CL	-	CL	SCL	SCL	CL	++	++	CL	CL	++	CL	CL	CL	++
11	1b	OL	< OL	< CL	< OL	CL	OL	CL	OL	< OL	OL	CL	CL	CL	CL		CL	< OL
16	1b	OL	SCL	CL	OL	CL	SCL	CL	OL	< OL	< OL	CL	CL	CL	CL	OL	CL	SCL
19	1b	< OL	±±±	< CL	< OL	CL	SCL	SCL	OL	< OL	< OL	CL	CL	CL	+++	+++	+++	< OL
21	1B	+++	SCL	CL	+++	CL	SCL	SCL	OL	+++	+++	SCL	CL	CL	CL	SCL	<SCL	+++
24	1b	OL	SCL	CL	OL	CL	<SCL	CL	OL	OL	OL	CL	CL	CL	CL	SCL	CL	OL

Strain E6		Phages reactions at Routine Test Dilution (*S.* Enteritidis)																
Lab code	**Phage type**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**
HPA	**13**	**-**	**-**	**-**	**SCL**	**-**	**++**	**-**	**-**	**< OL**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**SCL**
7	13	-	-	-	CL	-	SCL	-	-	++	-	-	-	-	-	-	-	SCL
11	13	-	-	-	< OL	-	< OL	-	-	< OL	-	-	-	-	-		-	< OL
16	13	-	-	-	< OL	-	<SCL	-	-	< OL	-	-	-	-	-	-	-	+++
19	13	-	-	-	+++	-	SCL	-	-	< OL	-	-	-	-	-	-	-	< OL
21	13	-	-	-	+++	-	SCL	-	-	< OL	-	-	-	-	-	-	-	+++
24	13	-	-	-	SCL	-	<SCL	-	-	OL	-	-	-	-	-	-	-	< OL

Strain E7		Phages reactions at Routine Test Dilution (*S.* Enteritidis)																
Lab code	**Phage type**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**
HPA	**63**	**-**	**SCL**	**-**	**< OL**	**-**	**SCL**	**++**	**OL**	**< OL**	**OL**	**++**	**-**	**-**	**-**	**-**	**-**	**< OL**
7	6	-	++	-	++	-	SCL	-	CL	SCL	SCL	-	-	-	-	-	-	SCL
11	rdnc (or 63)	±	< CL	-	< OL	-	< OL	+	OL	< OL	OL	++	< OL	-	1 - 5		-	< OL
16	63	-	SCL	1 - 5	OL	-	SCL	++	OL	< OL	< OL	++	-	-	-	-	-	<SCL
19	RDNC (scheme 2012 - PT63)	-	+++	-	SCL	-	SCL	±±±	OL	OL	< OL	±±	-	-	-	-	-	< OL
21	63	±	SCL	-	SCL	-	SCL	++	OL	OL	OL	+++	-	-	1 - 5	-	+	+++
24	63	-	SCL	-	SCL	-	SCL	+++	OL	OL	OL	+++	-	-	-	-	-	SCL

Strain E8		Phages reactions at Routine Test Dilution (*S.* Enteritidis)																
Lab code	**Phage type**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**
HPA	**4**	**-**	**SCL**	**CL**	**< OL**	**CL**	**SCL**	**CL**	**OL**	**OL**	**OL**	**CL**	**CL**	**CL**	**-**	**-**	**-**	**OL**
7	4	-	++	SCL	CL	CL	++	SCL	CL	SCL	SCL	CL	CL	++	-	-	-	SCL
11	4	1 - 5	< CL	CL	< OL	CL	< OL	CL	OL	< OL	OL	CL	CL	CL	-		-	< OL
16	4	-	< OL	CL	OL	CL	SCL	CL	OL	OL	< OL	CL	CL	CL	-	-	-	< OL
19	4	-	+++	SCL	SCL	OL	SCL	SCL	< OL	< OL	< OL	CL	CL	CL	-	-	-	< OL
21	4	1 - 5	SCL	< CL	<SCL	CL	SCL	SCL	OL	< OL	OL	SCL	CL	CL	-	-	-	+++
24	4	-	SCL	CL	OL	CL	SCL	CL	OL	OL	OL	CL	CL	CL	-	-	-	< OL

Strain E9		Phages reactions at Routine Test Dilution (*S.* Enteritidis)																
Lab code	**Phage type**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**
HPA	**13a**	**-**	**-**	**-**	**SCL**	**-**	**SCL**	**-**	**OL**	**< OL**	**SCL**	**-**	**-**	**-**	**-**	**-**	**-**	**< OL**
7	13a	-	-	-	CL	-	SCL	-	CL	SCL	SCL	-	-	-	-	-	-	SCL
11	13a	-	-	-	< OL	-	OL	-	OL	< OL	OL	-	-	-	-		-	< OL
16	13a	-	-	-	< OL	-	< OL	-	OL	< OL	< OL	-	-	-	-	-	-	< OL
19	13a	-	-	-	+++	-	SCL	-	OL	< OL	OL	-	-	-	-	-	-	< OL
21	13A	-	-	-	+++	-	SCL	-	OL	+++	OL	-	-	-	-	-	-	+++
24	13a	-	-	-	SCL	-	SCL	-	OL	OL	OL	-	-	-	-	-	-	< OL

Strain E10		Phages reactions at Routine Test Dilution (*S.* Enteritidis)																
Lab code	**Phage type**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**
HPA	**29**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**CL**	**-**	**-**	**-**	**-**	**-**
7	29a	-	-	±	-	+	-	±	-	-	+	-	OL	±	-	-	-	SCL
11	11b (or 9b)	-	-	< CL	-	< CL	-	-	-	-	-	±	CL	1 - 5	+		-	-
16	29	-	-	-	-	-	-	-	-	-	-	-	CL	-	-	-	-	-
19	29	-	-	-	-	-	-	-	-	-	-	-	CL	-	-	-	-	-
21	29	-	-	-	-	-	-	-	-	-	-	-	CL	-	-	-	-	< CL
24	29	-	-	-	-	-	-	-	-	-	-	-	CL	-	-	-	±	-

Annex 5 Phage typing results per *S*. Typhimurium strain for all participating laboratories

Strain T1		Phages reactions at Routine Test Dilution (*S.* Typhimurium)																	
Lab code	**Phage type**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**
HPA	**41**	**CL**	**OL**	**CL**	**OL**	**CL**	**CL**	**SCL**	**-**	**< CL**	**OL**	**-**	**-**	**CL**	**CL**	**CL**	**CL**	**CL**	**< CL**
7	41	SCL	SCL	CL	CL	CL	CL	SCL	-	SCL	SCL	-	-	CL	CL	CL	CL	CL	CL
11	41	< CL	CL	CL	OL	CL	CL	< CL	-	< CL	OL	-	-	OL	CL	CL	CL	CL	CL
16	41	OL	CL	CL	OL	CL	CL	CL	-	CL	CL	-	-	CL	CL	CL	CL	CL	CL
19	41	SCL	SCL	CL	OL	CL	SCL	SCL	-	SCL	CL	-	-	CL	CL	CL	SCL	SCL	SCL
21	41	SCL	+++	CL	SCL	SCL	+++	SCL	-	+++	< CL	-	-	CL	CL	CL	CL	CL	CL
24	41	CL	< CL	CL	CL	< CL	CL	SCL	-	CL	CL	-	-	CL	CL	CL	CL	CL	CL

Strain T1		Phages reactions at Routine Test Dilution (S.Typhimurium)												Additional phages						
Lab code	**Phage type**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**32**	**35**	**1**	**2**	**3**	**10**	**10 var 2**	**10 var 3**	**18**
HPA	**41**	**OL**	**OL**	**OL**	**< CL**	**OL**	**CL**	**< CL**	**CL**	**-**	**CL**	**CL**	**OL**	**+**	**+**	**+++**	**< OL**	**OL**	**OL**	**CL**
7	41	SCL	SCL	SCL	SCL	CL	CL	SCL	SCL	-	SCL	CL	SCL	±	±	±	CL	CL	CL	SCL
11	41	++	< CL	< CL	SCL	< CL	CL	< CL	< CL	-	CL	< CL	OL	++	1 - 5	+++	< OL	< OL	< OL	OL
16	41	CL	CL	CL	CL	CL	CL	CL	CL	-	CL	CL	OL	-	+	++	< OL	OL	OL	CL
19	41	SCL	SCL	+++	SCL	SCL	SCL	SCL	SCL	-	SCL	SCL	<SCL	-	-	-	SCL	SCL	SCL	OL
21	41	+++	CL	SCL	SCL	SCL	+++	SCL	CL	-	CL	CL	SCL	-	-	+++	OL	OL	OL	OL
24	41	CL	CL	CL	CL	CL	< CL	< CL	CL	-	CL	< CL	CL	-	-	-	OL	OL	< OL	CL

Strain T2		Phages reactions at Routine Test Dilution (*S.* Typhimurium)																	
Lab code	**Phage type**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**
HPA	**193**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
7	193	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11	193	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
16	193	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
19	193	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
21	193	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
24	193	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Strain T2		Phages reactions at Routine Test Dilution (S.Typhimurium)												Additional phages						
Lab code	**Phage type**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**32**	**35**	**1**	**2**	**3**	**10**	**10 var 2**	**10 var 3**	**18**
HPA	**193**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**+++**	**+++**	**+++**	**-**	**-**	**-**	**-**
7	193	-	-	-	-	-	-	-	-	-	-	-	-	+	+	+	-	-	-	-
11	193	-	-	-	-	-	-	-	-	-	-	-	-	SCL	++	< CL	-	-	-	-
16	193	-	-	-	-	-	-	-	-	-	-	-	-	++	+++	+++	-	-	-	-
19	193	-	-	-	-	-	-	-	-	-	-	-	-	±±±	±±±	±±±	-	-	-	-
21	193	-	-	-	-	-	-	-	-	-	-	-	-	++	±±±	SCL	< OL	-	-	-
24	193	-	-	-	-	-	-	-	-	-	-	-	-	++	++	++	OL	OL	< OL	-

Strain T3		Phages reactions at Routine Test Dilution (*S.* Typhimurium)																	
Lab code	**Phage type**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**
HPA	**104**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**SCL**	**SCL**	**-**	**-**	**-**	**-**	**SCL**	**-**
7	104	-	-	-	-	-	-	-	-	-	-	OL	OL	-	-	-	-	+	-
11	104	-	-	-	-	-	-	-	-	-	-	±	SCL	-	-	-	-	++	-
16	104L	-	-	-	-	-	-	-	-	-	-	< OL	< OL	-	-	-	-	+	-
19	104L	-	-	-	-	-	-	-	-	-	-	+++	+++	-	-	-	-	±±±	-
21	104	-	-	-	-	-	-	-	-	-	-	+++	SCL	-	-	-	-	SCL	-
24	104	-	-	-	-	-	-	-	-	-	-	<SCL	<SCL	-	-	-	-	++	-

Strain T3		Phages reactions at Routine Test Dilution (S.Typhimurium)												Additional phages						
Lab code	**Phage type**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**32**	**35**	**1**	**2**	**3**	**10**	**10 var 2**	**10 var 3**	**18**
HPA	**104**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**< OL**	**< OL**	**< OL**	**-**
7	104	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	OL	OL	SCL
11	104	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	< OL	OL	< OL	-
16	104L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	< OL	OL	OL	-
19	104L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	OL	OL	OL	-
21	104	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	OL	OL	OL	-
24	104	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	OL	OL	< OL	-

Strain T4		Phages reactions at Routine Test Dilution (*S.* Typhimurium)																	
Lab code	**Phage type**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**
HPA	**36**	**OL**	**OL**	**OL**	**OL**	**OL**	**OL**	**SCL**	**< CL**	**SCL**	**OL**	**OL**	**OL**	**CL**	**OL**	**OL**	**OL**	**CL**	**OL**
7	36	CL	CL	CL	CL	CL	CL	CL	CL	CL	CL	CL	CL	CL	CL	CL	CL	CL	CL
11	36	< OL	< OL	OL	OL	OL	OL	< OL	SCL	< OL	OL	< OL	OL	OL	OL	OL	< OL	CL	OL
16	36	CL	CL	CL	CL	CL	CL	CL	CL	CL	CL	CL	CL	CL	CL	CL	CL	CL	CL
19	36	SCL	SCL	CL	OL	CL	SCL	SCL	SCL	SCL	CL	CL	CL	CL	CL	CL	CL	CL	SCL
21	36	SCL	<SCL	CL	SCL	SCL	+++	SCL	+++	SCL	CL	CL	SCL	SCL	CL	CL	CL	CL	CL
24	36	CL	< CL	CL	CL	< CL	CL	< CL	CL	< CL	CL	< CL	CL	CL	CL	CL	< CL	CL	CL

Strain T4		Phages reactions at Routine Test Dilution (S.Typhimurium)												Additional phages						
Lab code	**Phage type**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**32**	**35**	**1**	**2**	**3**	**10**	**10 var 2**	**10 var 3**	**18**
HPA	**36**	**< OL**	**OL**	**OL**	**OL**	**OL**	**OL**	**SCL**	**CL**	**OL**	**CL**	**CL**	**OL**	**+++**	**++**	**SCL**	**< OL**	**OL**	**OL**	**CL**
7	36	CL	CL	CL	CL	CL	CL	CL	CL	CL	CL	CL	CL	+	+	+	OL	OL	OL	SCL
11	36	++	< OL	< OL	< OL	OL	OL	OL	< OL	OL	OL	OL	OL	+++	+	+++	< OL	OL	< OL	OL
16	36	CL	CL	CL	CL	CL	CL	CL	CL	CL	CL	CL	CL	+	++	++	< OL	OL	OL	CL
19	36	SCL	SCL	SCL	SCL	SCL	SCL	SCL	CL	CL	CL	<SCL	OL	-	-	-	SCL	SCL	SCL	OL
21	36	+++	CL	SCL	SCL	< CL	+++	CL	CL	OL	CL	CL	SCL	++	+++	SCL	OL	OL	OL	OL
24	36	CL	CL	CL	< CL	CL	< CL	CL	CL	CL	CL	CL	CL	±	±	±	OL	OL	< OL	CL

Strain T5		Phages reactions at Routine Test Dilution (*S.* Typhimurium)																	
Lab code	**Phage type**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**
HPA	**12**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**CL**	**CL**	**-**	**-**	**-**	**-**	**-**	**-**
7	12	-	-	-	-	-	-	-	-	-	-	CL	CL	-	-	-	-	-	-
11	12 (or 104a)	-	-	-	-	-	-	-	-	-	-	SCL	CL	-	-	-	-	-	-
16	12	-	-	-	-	-	-	-	-	-	-	SCL	CL	-	-	-	-	-	-
19	12	-	-	-	-	-	-	-	-	-	-	CL	CL	-	-	-	-	-	-
21	12	-	-	-	-	-	-	-	-	-	-	+++	<SCL	-	-	-	-	-	-
24	12	-	-	-	-	-	-	-	-	-	-	< CL	< CL	-	-	-	-	-	-

Strain T5		Phages reactions at Routine Test Dilution (S.Typhimurium)												Additional phages						
Lab code	**Phage type**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**32**	**35**	**1**	**2**	**3**	**10**	**10 var 2**	**10 var 3**	**18**
HPA	**12**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**< OL**	**OL**	**OL**	**-**
7	12	±	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	OL	OL	SCL
11	12 (or 104a)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	OL	OL	< OL	-
16	12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	< OL	OL	OL	-
19	12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	OL	OL	OL	-
21	12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	OL	OL	OL	-
24	12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	OL	OL	< OL	-

Strain T6		Phages reactions at Routine Test Dilution (*S.* Typhimurium)																	
Lab code	**Phage type**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**
HPA	**2**	**-**	**OL**	**CL**	**OL**	**CL**	**CL**	**-**	**-**	**< CL**	**CL**	**OL**	**OL**	**CL**	**OL**	**CL**	**CL**	**-**	**CL**
7	2	-	SCL	CL	CL	CL	SCL	-	-	SCL	SCL	CL	OL	CL	CL	CL	CL	-	CL
11	2	-	CL	CL	OL	CL	CL	-	-	CL	OL	SCL	CL	CL	CL	CL	CL	-	CL
16	2	-	CL	CL	CL	CL	CL	-	-	CL	CL	CL	CL	CL	CL	CL	CL	-	CL
19	2	-	SCL	CL	OL	CL	CL	-	-	SCL	CL	CL	CL	CL	CL	CL	SCL	-	SCL
21	2	-	+++	CL	<SCL	<SCL	+++	-	-	SCL	< CL	<SCL	SCL	CL	CL	CL	CL	-	SCL
24	2a	-	< CL	CL	CL	< CL	CL	-	-	< CL	CL	++	++	CL	CL	CL	CL	-	CL

Strain T6		Phages reactions at Routine Test Dilution (S.Typhimurium)												Additional phages						
Lab code	**Phage type**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**32**	**35**	**1**	**2**	**3**	**10**	**10 var 2**	**10 var 3**	**18**
HPA	**2**	**< CL**	**OL**	**OL**	**CL**	**CL**	**CL**	**CL**	**CL**	**-**	**CL**	**CL**	**OL**	**+**	**+**	**+++**	**< OL**	**OL**	**OL**	**CL**
7	2	SCL	SCL	SCL	CL	CL	CL	CL	CL	-	CL	CL	CL	±	±	±	CL	CL	CL	SCL
11	2	++	< OL	SCL	SCL	CL	CL	< OL	< OL	-	OL	OL	OL	+	1 - 5	++	OL	OL	< OL	OL
16	2	CL	CL	CL	CL	CL	CL	CL	CL	-	CL	CL	CL	-	+	++	< OL	CL	OL	CL
19	2	SCL	SCL	SCL	SCL	SCL	SCL	SCL	SCL	-	SCL	SCL	OL	-	-	-	OL	OL	OL	OL
21	2	+++	CL	±±±	CL	CL	+++	+++	CL	-	CL	CL	<SCL	-	-	+++	OL	OL	OL	OL
24	2a	CL	CL	< CL	< CL	CL	< CL	CL	CL	±	CL	CL	CL	±	±	±	OL	OL	< OL	CL

Strain T7		Phages reactions at Routine Test Dilution (*S.* Typhimurium)																	
Lab code	**Phage type**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**
HPA	**22**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
7	22	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11	22	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
16	22	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
19	22	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
21	22	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
24	22	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Strain T7		Phages reactions at Routine Test Dilution (S.Typhimurium)												Additional phages						
Lab code	**Phage type**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**32**	**35**	**1**	**2**	**3**	**10**	**10 var 2**	**10 var 3**	**18**
HPA	**22**	**-**	**-**	**SCL**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
7	22	-	±	SCL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11	22	-	±	++	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
16	22	-	-	< OL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
19	22	-	±	±±±	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
21	22	-	-	++	-	-	-	-	-	-	-	-	-	-	-	-	1 - 5	-	-	-
24	22	-	-	SCL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Strain T8		Phages reactions at Routine Test Dilution (*S.* Typhimurium)																	
Lab code	**Phage type**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**
HPA	**80**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**OL**	**-**	**-**	**-**	**-**	**-**	**SCL**	**CL**	**< OL**
7	80	-	-	-	-	-	-	-	-	-	OL	-	-	-	-	-	SCL	SCL	SCL
11	80	-	-	-	-	-	-	-	-	-	OL	-	-	-	-	-	< CL	< CL	< OL
16	80	-	-	-	-	-	-	-	-	-	CL	-	-	-	-	-	< OL	SCL	OL
19	80	-	-	-	-	-	-	-	-	-	CL	-	-	-	-	-	±±±	SCL	+++
21	80	-	-	-	-	-	-	-	-	-	CL	-	-	-	-	-	SCL	CL	+++
24	80	-	-	-	-	-	-	-	-	-	SCL	-	-	-	-	-	+++	SCL	SCL

Strain T8		Phages reactions at Routine Test Dilution (S.Typhimurium)												Additional phages						
Lab code	**Phage type**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**32**	**35**	**1**	**2**	**3**	**10**	**10 var 2**	**10 var 3**	**18**
HPA	**80**	**SCL**	**-**	**SCL**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**CL**	**-**	**+**	**+**	**+++**	**< OL**	**OL**	**OL**	**CL**
7	80	SCL	-	SCL	-	-	-	-	-	-	-	SCL	-	±	±	±	CL	CL	CL	SCL
11	80	++	-	< CL	-	-	-	-	-	-	-	< CL	-	+	1 - 5	++	OL	OL	< OL	OL
16	80	OL	-	< OL	-	-	-	-	-	-	-	OL	-	-	+	++	< OL	CL	OL	CL
19	80	+++	-	+++	-	-	-	-	-	-	-	++	-	-	-	-	OL	OL	OL	OL
21	80	+++	-	+++	-	-	-	-	-	-	-	CL	-	-	-	+++	OL	OL	OL	OL
24	80	SCL	-	SCL	-	-	-	-	-	-	-	SCL	-	±	±	±	OL	OL	< OL	CL

Strain T9		Phages reactions at Routine Test Dilution (*S.* Typhimurium)																	
Lab code	**Phage type**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**
HPA	**141**	**-**	**-**	**-**	**++**	**++**	**-**	**-**	**-**	**++**	**++**	**++**	**+**	**-**	**+++**	**SCL**	**-**	**-**	**+++**
7	4	-	-	-	SCL	++	++	-	-	SCL	++	+	+	-	++	SCL	-	-	++
11	rdnc (or 141)	-	-	-	+++	±	-	-	-	< CL	±	-	-	-	++	+	-	-	±
16	141	-	-	-	+++	++	-	-	-	<SCL	++	+	+	-	++	<SCL	-	-	+++
19	68	-	-	-	-	-	-	-	-	+++	-	-	-	-	-	±±±	-	-	-
21	141	-	-	-	+++	++	-	-	-	CL	+++	+	-	-	+++	SCL	-	-	+++
24	68	-	-	-	-	-	-	-	-	OL	-	-	-	-	-	SCL	-	-	-

Strain T9		Phages reactions at Routine Test Dilution (S.Typhimurium)												Additional phages						
Lab code	**Phage type**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**32**	**35**	**1**	**2**	**3**	**10**	**10 var 2**	**10 var 3**	**18**
HPA	**141**	**SCL**	**-**	**< OL**	**++**	**-**	**±**	**±**	**CL**	**-**	**CL**	**CL**	**OL**	**+++**	**++**	**SCL**	**< OL**	**OL**	**OL**	**-**
7	4	++	+	SCL	SCL	-	+	+	SCL	-	SCL	SCL	SCL	±	±	±	-	OL	SCL	SCL
11	rdnc (or 141)	++	-	+++	SCL	-	+	±	< OL	1 - 5	< OL	SCL	< OL	SCL	++	< CL	< OL	< OL	< OL	-
16	141	<SCL	-	< OL	<SCL	-	++	+	< OL	1 - 5	CL	< CL	CL	++	+++	+++	< OL	OL	OL	-
19	68	+	-	±±	±±	-	-	-	+++	-	SCL	<SCL	< OL	±	±	±	< OL	< OL	< OL	±
21	141	+++	-	+++	SCL	-	+	SCL	CL	±±	CL	SCL	+++	+	++	SCL	OL	OL	OL	-
24	68	SCL	+	SCL	SCL	-	-	±	< CL	-	CL	< CL	CL	±	±	±	OL	OL	< OL	-

Strain T10		Phages reactions at Routine Test Dilution (*S.* Typhimurium)																	
Lab code	**Phage type**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**
HPA	**U302**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
7	302	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11	U302	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
16	U302	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
19	U302	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
21	U302	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
24	U302	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Strain T10		Phages reactions at Routine Test Dilution (S.Typhimurium)												Additional phages						
Lab code	**Phage type**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**32**	**35**	**1**	**2**	**3**	**10**	**10 var 2**	**10 var 3**	**18**
HPA	**U302**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**< OL**	**OL**	**OL**	**-**
7	302	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	OL	OL	SCL
11	U302	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	OL	OL	< OL	-
16	U302	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	< OL	OL	OL	-
19	U302	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	< OL	OL	OL	-
21	U302	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	OL	OL	OL	-
24	U302	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	OL	OL	< OL	-

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