THE EXTERNAL QUALITY ASSURANCE SYSTEM OF THE WHO GLOBAL FOODBORNE INFECTIONS NETWORK

YEAR 2016

Susanne Karlsøe Pedersen, Jens-Ole Frimann, Frank M. Aarestrup, Rene Hendriksen

1. edition, October 2018, revised January 2019
Copyright: National Food Institute, Technical University of Denmark
Photo: Mikkel Adsbøl
ISBN: 978-87-93565-37-1

The report is available at
www.food.dtu.dk
National Food Institute
Technical University of Denmark
Kemitorvet
Building 204
DK-2800 Kgs. Lyngby
Denmark
Tel: +45 35 88 70 00
Fax +45 35 88 70 01

Revision in January 2019 includes adjustments in the report to correctly reflect the data in the tables.
List of Abbreviations

AGISAR, WHO Advisory Group on Integrated Surveillance of Antimicrobial Resistance
AST, Antimicrobial Susceptibility Testing
ATCC, American Type Culture Collection
CAZ, Ceftazidime
CDC, Centers for Disease Control and Prevention
CRO, Ceftriaxone
CTX, Cefotaxime
DTU Food, Technical University of Denmark - National Food Institute
EQAS, External Quality Assurance System
ESBL, Extended Spectrum Beta-Lactamase
GEN, Gentamicin
IP, Institute Pasteur
MERO, Meropenem
MIC, Minimum Inhibitory Concentration
NSSC, National Salmonella and Shigella Center, Thailand
PHAC, Public Health Agency of Canada
QC, Quality Control
SMX, Sulfamethoxazole
TET, Tetracycline
WHO, World Health Organization
WHO GFN, WHO Global Foodborne Infections Network
1. Introduction

Since 2000, 15 WHO External Quality Assurance System (EQAS) reports have been issued with this report being the 16th. The WHO Global Foodborne Infections Network (WHO GFN) and the WHO Advisory Group on Integrated Surveillance of Antimicrobial Resistance (AGISAR) focus on enhancing World Health Organization (WHO) Member States’ capacity to detect and respond to foodborne disease outbreaks and the emerging of antimicrobial resistance (AMR) bacterial pathogens by conducting laboratory-based surveillance of *Salmonella* and other important foodborne pathogens. Thus, the WHO EQAS align with the 2015 WHO global action plan to target AMR worldwide, objective 2: Strengthen knowledge through surveillance and research, action 2, laboratory capacity.

Since its inception, the scope of WHO EQAS has expanded to include additional foodborne pathogens like *Shigella* and *Campylobacter*. *Salmonella, Campylobacter* and *Shigella* are among the most important foodborne pathogens worldwide and account for millions of cases of diarrheal disease and thousands of deaths per year impacting both developing and industrialized countries. Furthermore, the increased number of *Salmonella, Campylobacter* and *Shigella* isolates which are resistant to antimicrobials is of major concern since these isolates are associated with infections characterized by increased morbidity and mortality.

The WHO EQAS is organized annually by DTU Food in collaboration with World Health Organization (WHO) in Geneva, Switzerland; Centers for Disease Control and Prevention (CDC) in Atlanta, USA; Public Health Agency of Canada (PHAC) in Canada; National *Salmonella* and *Shigella* Center (NSSC), National Institute of Health, Department of Medical Science in Thailand and Institute Pasteur (IP) in Paris, France.

Individual laboratory data are confidential and only known by the participating laboratory, the EQAS Organizer (DTU Food) and possibly the respective WHO GFN regional centre/WHO AGISAR country representative. All summary conclusions are public. The goal set by WHO GFN/AGISAR aims towards having all national reference laboratories perform *Salmonella* serotyping with a maximum of one deviation out of eight strains tested (error rate of 13%) and performing antimicrobial susceptibility testing (AST) of *Salmonella* with a maximum error rate of 10% (either <5% very major / major errors and <5% minor errors, or <10% minor errors). Minor deviations are defined as classification of an intermediate strain as susceptible, resistant or vice versa (*i.e.* I ↔ S or I ↔ R). Major deviation is the classification of a susceptible strain as resistant (*i.e.* S → R). Very major deviation is the classification of a resistant strain as susceptible (*i.e.* R → S). In this report, the deviations of AST results are divided into two categories, *i.e.* critical deviations which include major and very major deviations, and total deviations which include also the minor deviations. In EQAS 2014, the regions were redefined for all countries worldwide for the analysis of data from the WHO GFN EQAS. This lead to some reorganization of countries into new regions compared to previous years, why interpretation of regional-based results from 2014 and onwards with results from before 2014 should be conducted with care. The countries belonging to each region is listed in Appendix 1.

Appendices 2-5 present additional background information in relation to the WHO EQAS 2016.
2. Summary

The summary report is divided into five sections; the *Salmonella* components, the *Shigella* components, reporting of ESBL *Salmonella* and *Shigella*, the *Campylobacter* components, and identification of the unknown strain. All results reported in the summary can be found in Appendix 1.

**Participation**

A total of 196 laboratories responded to the pre-notification and were enrolled in the WHO EQAS. When the deadline for submitting results was reached, 182 laboratories in 81 countries had uploaded data.

The following countries provided data for at least one of the EQAS components (Appendix 1): Argentina, Australia (3), Bahrain, Barbados, Belgium, Bolivia, Brazil (2), Brazil, Brunei Darussalam, Bulgaria, Cambodia, Cameroon, Canada (12), Chile (2), China (18), Colombia (3), Congo, Democratic Republic of the, Costa Rica (2), Croatia, Cyprus, Czech Republic (2), Ecuador (2), Egypt, El Salvador, Gambia (2), Germany (2), Greece (2), Guatemala (2), Honduras, Hungary, India (4), Iran, Islamic rep. Of (3), Iraq, Ireland, Israel, Italy (16), Ivory Coast, Jamaica, Japan, Kenya (3), Korea, Rep of (2), Kosovo, Lao PDR, Luxembourg (2), Madagascar, Malaysia (6), Malta (2), Mauritius, Mexico (2), Morocco (2), New Zealand, Nigeria, Norway, Oman, Panama (2), Paraguay, Peru, Philippines, Poland (4), Portugal, Senegal, Serbia (2), Singapore, Slovakia, Slovenia, South Africa, Spain, Sri Lanka (2), Suriname, Sweden, Taiwan, Thailand (15), Trinidad and Tobago, Turkey (2), Ukraine, United Kingdom, United States of America (5), Uruguay, Venezuela (2), Viet Nam (2), Zambia, Zimbabwe.

The level participation in the WHO EQAS 2016 was the same as at the WHO EQAS 2015.

**Salmonella** EQAS components

The acceptance threshold for the EQAS *Salmonella* serotyping component was met by 73% (n = 106) of the 146 participating laboratories (Table 1). In addition, 89% (n = 130) of the laboratories tested all eight strains with a total at 90% (n = 1,004) of all tests being correct, representing a slight increase compared to 2015 to one of the best performances observed since the initiation of the EQAS (Table 2). The ability to correctly serotype the internal control strain continued to decrease in 2016 to the lowest level since 2001 at 84%, most likely due to many new laboratories participating in 2016. In 2016, the participation in testing the internal control strain increased from 125 to the highest ever recorded, 159 (Table 3). On a region-based categorization of participating laboratories, the Caribbean and Africa both correctly serotyped between 60% and 62% of the test strains whereas Southeast Asia, Latin America, Central Asia & Middle East correctly serotyped between 79% and 88% of the test strains. The performance of correct serotyping in Europe, China, North America was between 93 and 99% but reached 100% correct serotyping of all eight strains in only Oceania.
In 2016, Russia was the only region not participating (Table 4). In all regions, either a marked or consistent improvement was observed and in line with the other data presented.

The main problem regarding the *Salmonella* serotyping appeared to be associated with all strains included the 2016 trial except for the internal control, WHO S-16.3 (Enteritidis; I 9,12:g,m:-).

WHO 2016 S-16.1 (Bovismorbificans / Hindmarsh, I 6,8:r:1,5), WHO 2016 S-16.2 (Infantis, I 6,7:r:1,5), WHO 2016 S-16.4 (Uganda, I 3,10:l,z13;1,5), WHO 2016 S-16.5 (Stanley, I 4,5,12:d;1,2), WHO 2016 S-16.6 (Heidelberg, I 4,12:r:1,2), WHO 2016 S-16.7 (Altendorf, I 4,12,27:c:1,7), and WHO 2016 S-16.8 (Plymouth, I 9,46:d:z6) revealed considerable levels of deviations, 17.9%, 28.0%, 25.5%, 15.7%, 17.6%, 21.0%, and 26.3%, respectively (Table 5). The level of deviation is surprising since the serovars included the 2016 should not pose major difficulties since the somatic O antigen all belong to the major serogroups such as O:4, O:3,10, O:7, O:8, O:9, O:9,46 and the flagella antigens to well known polyvalent antisera HMA, HMB, and HMD, respectively. It is a concern that many laboratories had difficulties at serotyping that many of the major serovars such as Infantis, Stanley, and Heidelberg which are all well-known often to be multidrug resistant.

Concerning the *Salmonella* AST component for the EQAS 2016, the performance slightly increased compared to the EQAS of 2015, with a low deviations of 2% minor, 2% major, and 1% very major deviations. Thus, the percentages of critical deviation was 3% (Table 6). Deviations categorized by the tested antimicrobials revealed that ciprofloxacin (CIP), gentamicin (GEN), meropenem (MERO), sulfamethoxazole (SMX) and tetracycline (TET) caused most of the difficulties observed with the following total percentage deviations: 10%, 6%, 6%, 8% and 6%, respectively (Table 7). The deviation to CIP is most likely due to the often observed double zone when performing disk diffusion and to SMX the bacteriostatic effect. TET, however, also often pose difficulties using disk diffusion whereas this is not reflected conducting MIC determination. For the four antimicrobials, CIP, MERO, SMX and TET the deviations resulted in that less than 90% of the laboratories submitted the correct and expected susceptibility interpretation. Thus, it is a concern that 27 laboratories of 106 incorrectly interpreted WHO 2016 S-16.2 (Infantis, I 6,7:r:1,5) as susceptible to MERO, a carbapenem (Table 8). On a region-based categorization of participating laboratories, Africa obtained the highest percentages of total deviations, 9.9 where as China, Southeast Asia, Latin America, Europe, Central Asia & Middle East, North America, and Oceania obtained a slightly lower percentage of total deviations between 0.9% to 6.5%. The performance of 100% correctly antimicrobial susceptibility testing all eight strains was observed in the Caribbean. Russia did not participate in the 2016 EQAS (Table 9).

For the 150 laboratories performing the *Salmonella* AST component (MIC (n = 30)/Disk diffusion (n = 76)), only 71% (106 laboratories) reported data for AST of the control strain *E. coli* ATCC 25922. This is a very alerting number and an almost 10 percentage-point decrease compared to 2015 (Table 10). It is of extreme importance to once again emphasize that this component represents the true indicator for the laboratory as to the performance of AST. It is noteworthy that the WHO EQAS organizers provide free of charge the control strain *E. coli* ATCC 25922 for all new participants in the AST component, why there should not be any excuses not to test this strain.
**Shigella EQAS components**

The *Shigella* components included in the WHO EQAS consist of serogrouping (i.e. the identification of the species), serotyping (i.e. the further typing of the species), and AST.

For the *Shigella* serogrouping component in EQAS 2016, the deviations observed ranged from 0.0% to 4.9%, for the four *Shigella* strains. This is an acceptable level as the 4.9% was related to one of the four strains whereas the remaining three isolates revealed a maximum deviation of 1.6% (Table 11).

The serotyping component was performed by a total of 77 laboratories for all of the four strains, WHO 2016 SH-16.1 (*S. flexneri*, 1b), WHO 2016 SH-16.2 (*S. boydii*, 4), WHO 2016 SH-16.3 (*S. flexneri*, 2b), and WHO 2016 SH-16.4 (*S. flexneri*, 3a) with deviating results observed between 36.9% and 43.1%, respectively (Table 11).

According to the geographical distribution of the participating laboratories the results, on a region-based categorization, ranged from 69.2% (Africa) to 93.3% correctly serotyped strains by the Oceania region. No participation from Russia and the Caribbean in this trial (Table 12).

For the results of the *Shigella* AST component, the number of participating laboratories was somehow at the same level as in previous years, with 112 participating laboratories in EQAS 2016. The results obtained were in 96% of the cases in agreement with the expected results and a slightly better than in previous years. Minor, major and very major deviations were observed in 1%, 1%, and 1% of the reported results, respectively (Table 13). Categorizing the tested antimicrobials according to the deviations revealed again as in 2015 that CIP (7.1%) and (CHL) (7.1%) but also SMX (4.1%) and GEN (4.2%) caused difficulties in the AST component (Table 14). The deviations to CIP and SMX was not surprising as the same explanation given for *Salmonella* also comply to *Shigella* (Table 14). For the four antimicrobials, CAZ, CIP, CHL, and SMX the deviations resulted in that less than 90% of the laboratories submitted the correct and expected susceptibility interpretation (Table 15).

A region-based categorization of the results revealed correct test results between 90.3% (Africa) and 98.7% (North America), with Central Asia & Middle East having most critical deviations (7.2%). No participation from Russian in this trial (Table 16).

**ESBL EQAS component**

A part of the EQAS is to detect and confirm ESBL production in the *Salmonella* and *Shigella* strains. If participating in this component of the EQAS, all strains showing reduced susceptibility to cefotaxime (CTX), ceftazidime (CAZ) ceftriaxone (CRO) and/or meropenem (MERO) should be tested for ESBL, AmpC and carbapenemase production.

For the EQAS 2016, three AmpC-, ESBL-, carbapenemase-producers were included with two *Salmonella* strains (WHO 2016 S-16.2, Infantis and WHO 2016 S-16.6, Heidelberg) and one *Shigella* isolate (WHO 2016 SH-16.3, *S. flexneri* serovar 2b). The *Salmonella* isolate, WHO 2016
S-16.2, Infantis was a carbapenemase-producer whereas WHO 2016 S-16.6, Heidelberg was an AmpC-phenotype. The Shigella strain included was an ESBL-producer (WHO 2016 SH-16.3, S. flexneri serovar 2b). For the two Salmonella strains, the genes accounting for the phenotypes were: bla_VIM-1 (WHO 2016 S-16.2) and bla_CMY-2 (WHO 2016 S-16.6) and the confirmatory tests (CAZ/Cl:CAZ and CTX/Cl:CTX) showed 32% and 24% of deviations in reporting correct results (based on assigned phenotype), respectively. For the Shigella strain; WHO 2016 SH-16.3 (bla_OXA-1 and bla_CTX-M14), deviations of the confirmatory test result as and ESBL-producer was observed to be 4%.

**Campylobacter EQAS components**

A total of 95 laboratories participated in the identification of the C. jejuni WHO 2016 C-16.1 and C. coli WHO 2016 C-16.2 strain with a result of 94% and 91% correct species identification, respectively (Table 18). On a region-based characterization, the accuracy in Campylobacter identification ranged from 79% (Southeast Asia) to 100% (Africa, Central Asia & Middle East, Caribbean, Oceania, and China regions). No participation from Russia (Table 19).

Concerning the Campylobacter AST component in the EQAS 2016, 49 laboratories participated. The overall performance of the AST showed 4.2% major deviations, and 4.0% very major deviations, summing up to a total of 8.2% critical deviations, a two percent-point decrease compared to 2015 (Table 20). From the categorization of the antimicrobials, the results showed problems when testing all of the antimicrobials with most critical deviations to streptomycin with a level of critical deviations at 17.2% (Table 21). For the three antimicrobials, CIP, NAL, and TET the deviations resulted in less than 90% of the laboratories submitting the correct and expected susceptibility interpretation (Table 22).

On a region-based characterization, the performance in Central Asia & Middle East and Caribbean were noteworthy, with a deviation level of 60.0% (n = 1) and 26.7% (n = 2) critical deviations, respectively. In contrast, the North America and Oceanic region perfectly performed the test without deviations. Latin America, China, Europe, and Southeast Asia reported deviations at 3.1 and 15.8%, respectively. In EQAS 2016, no laboratories in the Africa and the Russian region participated in the Campylobacter AST component (Table 23).

For the QC strain Campylobacter jejuni ATCC 33560 only 42 laboratories reported AST results. Again, we have to emphasize the importance of including this component as it represents the true indicator for the laboratory’s performance of AST. For gentamicin (GEN) which has previously shown to cause problems for the participants, the percentage of laboratories reporting a correct AST result for this compound increased once again from 86% to 93% compared to 2015 (Table 24).
Identification of unknown culture EQAS component

For this part of the EQAS, an unknown culture is provided for identification. In EQAS 2016, the unknown strain was the Gram positive *Listeria monocytogenes*.

A total of 137 laboratories participated in this component, with 86.1% identifying the strain correctly.
3. List of Appendices

Appendix 1: Figures and Tables
Appendix 2: Prenotification
Appendix 3: Expected results
Appendix 4: WHO EQAS 2016 Protocol
Appendix 5a: Subculture and Maintenance of Quality Control Strains
Appendix 5b: Instructions for Opening and Reviving Lyophilized Cultures
Figure 1. Countries participating* in the WHO EQAS 2016

*marked in green
## List of Countries in the 10 Regions

### Africa

<table>
<thead>
<tr>
<th>Region</th>
<th>Countries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Algeria</td>
<td>Gabon</td>
</tr>
<tr>
<td>Angola</td>
<td>Gambia</td>
</tr>
<tr>
<td>Benin</td>
<td>Ghana</td>
</tr>
<tr>
<td>Botswana</td>
<td>Guinea</td>
</tr>
<tr>
<td>Burkina Faso</td>
<td>Guinea-Bissau</td>
</tr>
<tr>
<td>Burundi</td>
<td>Kenya</td>
</tr>
<tr>
<td>Cameroon</td>
<td>Lesotho</td>
</tr>
<tr>
<td>Cameroun</td>
<td>Liberia</td>
</tr>
<tr>
<td>Cape Verde</td>
<td>Libyan Arab Jamahiriya</td>
</tr>
<tr>
<td>Central African Republic</td>
<td>Madagascar</td>
</tr>
<tr>
<td>Chad</td>
<td>Malawi</td>
</tr>
<tr>
<td>Comoros</td>
<td>Mali</td>
</tr>
<tr>
<td>Congo (Brazzaville)</td>
<td>Mauritania</td>
</tr>
<tr>
<td>Congo, Democratic Republic of the</td>
<td>Mauritius</td>
</tr>
<tr>
<td>Cote d'Ivoire (Ivory Coast)</td>
<td>Mayotte</td>
</tr>
<tr>
<td>Djibouti</td>
<td>Morroco</td>
</tr>
<tr>
<td>Egypt</td>
<td>Mozambique</td>
</tr>
<tr>
<td>Equatorial Guinea</td>
<td>Namibia</td>
</tr>
<tr>
<td>Eritrea</td>
<td>Niger</td>
</tr>
<tr>
<td>Ethiopia</td>
<td>Nigeria</td>
</tr>
</tbody>
</table>

### Caribbean

<table>
<thead>
<tr>
<th>Region</th>
<th>Countries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anguilla</td>
<td>Dominica</td>
</tr>
<tr>
<td>Antigua and Barbuda</td>
<td>Dominican Republic</td>
</tr>
<tr>
<td>Aruba</td>
<td>Grenada</td>
</tr>
<tr>
<td>Bahamas</td>
<td>Guadeloupe</td>
</tr>
<tr>
<td>Barbados</td>
<td>Haiti</td>
</tr>
<tr>
<td>Bonaire, Saint Eustatius and Saba</td>
<td>Jamaica</td>
</tr>
<tr>
<td>British Virgin Islands</td>
<td>Martinique</td>
</tr>
<tr>
<td>Cayman Islands</td>
<td>Monserrat</td>
</tr>
<tr>
<td>Cuba</td>
<td>Puerto Rico</td>
</tr>
<tr>
<td>Curaçao</td>
<td>Saint Lucia</td>
</tr>
</tbody>
</table>

### Central Asia & Middle East

<table>
<thead>
<tr>
<th>Region</th>
<th>Countries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Afghanistan</td>
<td>Israel</td>
</tr>
<tr>
<td>Armenia</td>
<td>Jordan</td>
</tr>
<tr>
<td>Azerbaijan</td>
<td>Kazakhstan</td>
</tr>
<tr>
<td>Bahrain</td>
<td>Kuwait</td>
</tr>
<tr>
<td>Bangladesh</td>
<td>Kyrgyzstan</td>
</tr>
<tr>
<td>Bhutan</td>
<td>Lebanon</td>
</tr>
<tr>
<td>Georgia</td>
<td>Macao</td>
</tr>
<tr>
<td>Hong Kong</td>
<td>Maldives</td>
</tr>
<tr>
<td>India</td>
<td>Mongolia</td>
</tr>
<tr>
<td>Indonesia</td>
<td>Myanmar (ex-Burma)</td>
</tr>
<tr>
<td>Iran, Islamic rep. Of</td>
<td>Nepal</td>
</tr>
<tr>
<td>Iraq</td>
<td>Oman</td>
</tr>
</tbody>
</table>

### China

<table>
<thead>
<tr>
<th>Region</th>
<th>Countries</th>
</tr>
</thead>
<tbody>
<tr>
<td>China</td>
<td>China</td>
</tr>
</tbody>
</table>

### Europe

<table>
<thead>
<tr>
<th>Region</th>
<th>Countries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Albania</td>
<td>Guerney and Alderney</td>
</tr>
<tr>
<td>Andorra</td>
<td>Hungary</td>
</tr>
<tr>
<td>Austria</td>
<td>Iceland</td>
</tr>
<tr>
<td>Group</td>
<td>Country 1</td>
</tr>
<tr>
<td>------------------------</td>
<td>-------------------------</td>
</tr>
<tr>
<td>Belarus</td>
<td>Ireland</td>
</tr>
<tr>
<td>Belgium</td>
<td>Italy</td>
</tr>
<tr>
<td>Bosnia</td>
<td>Jersey</td>
</tr>
<tr>
<td>Bulgaria</td>
<td>Kosovo</td>
</tr>
<tr>
<td>Croatia</td>
<td>Latvia</td>
</tr>
<tr>
<td>Cyprus</td>
<td>Liechtenstein</td>
</tr>
<tr>
<td>Czech Republic</td>
<td>Lithuania</td>
</tr>
<tr>
<td>Denmark</td>
<td>Luxembourg</td>
</tr>
<tr>
<td>Estonia</td>
<td>Macedonia</td>
</tr>
<tr>
<td>European Union</td>
<td>Malta</td>
</tr>
<tr>
<td>Faroe Islands</td>
<td>Man, Island of</td>
</tr>
<tr>
<td>Finland</td>
<td>Moldova</td>
</tr>
<tr>
<td>France</td>
<td>Monaco</td>
</tr>
<tr>
<td>Germany</td>
<td>Montenegro</td>
</tr>
<tr>
<td>Gibraltar</td>
<td>Netherland</td>
</tr>
<tr>
<td>Greece</td>
<td></td>
</tr>
<tr>
<td><strong>Latin America</strong></td>
<td></td>
</tr>
<tr>
<td>Argentina</td>
<td>El Salvador</td>
</tr>
<tr>
<td>Bolivia</td>
<td>Falkland Islands (Malvinas)</td>
</tr>
<tr>
<td>Brazil</td>
<td>French Guiana</td>
</tr>
<tr>
<td>Chile</td>
<td>Guatemala</td>
</tr>
<tr>
<td>Colombia</td>
<td>Guyana</td>
</tr>
<tr>
<td>Costa Rica</td>
<td>Honduras</td>
</tr>
<tr>
<td>Ecuador</td>
<td>Mexico</td>
</tr>
<tr>
<td><strong>North America</strong></td>
<td></td>
</tr>
<tr>
<td>Bermuda</td>
<td>Greenland</td>
</tr>
<tr>
<td>Canada</td>
<td>Saint Pierre and Miquelon</td>
</tr>
<tr>
<td><strong>Oceania</strong></td>
<td></td>
</tr>
<tr>
<td>Australia</td>
<td>Papua New Guinea</td>
</tr>
<tr>
<td>Kiribati</td>
<td>Tonga</td>
</tr>
<tr>
<td>New Zealand</td>
<td>French Polynesia</td>
</tr>
<tr>
<td>Solomon, Islands</td>
<td>Micronesia</td>
</tr>
<tr>
<td>Fiji</td>
<td>Samoa</td>
</tr>
<tr>
<td>Marshall Islands</td>
<td>Tuvalu</td>
</tr>
<tr>
<td><strong>Russia</strong></td>
<td></td>
</tr>
<tr>
<td>Russia</td>
<td></td>
</tr>
<tr>
<td><strong>Southeast Asia</strong></td>
<td></td>
</tr>
<tr>
<td>Brunei Darussalam</td>
<td>Lao PDR</td>
</tr>
<tr>
<td>Cambodia</td>
<td>Malaysia</td>
</tr>
<tr>
<td>Japan</td>
<td>Philippines</td>
</tr>
<tr>
<td>Korea, North</td>
<td>Singapore</td>
</tr>
<tr>
<td>Korea, Rep of</td>
<td>Sri Lanka</td>
</tr>
</tbody>
</table>
Table 1. Ability of EQAS participating laboratories to serotype the test *Salmonella* strains

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Participating laboratories</td>
<td>No.</td>
<td>%</td>
<td>No.</td>
<td>%</td>
<td>No.</td>
<td>%</td>
<td>No.</td>
</tr>
<tr>
<td>8</td>
<td>9</td>
<td>24</td>
<td>34</td>
<td>35</td>
<td>52</td>
<td>53</td>
<td>66</td>
<td>47</td>
</tr>
<tr>
<td>7</td>
<td>9</td>
<td>24</td>
<td>13</td>
<td>14</td>
<td>29</td>
<td>21</td>
<td>14</td>
<td>11</td>
</tr>
<tr>
<td>6</td>
<td>4</td>
<td>11</td>
<td>9</td>
<td>9</td>
<td>12</td>
<td>12</td>
<td>13</td>
<td>9</td>
</tr>
<tr>
<td>5</td>
<td>3</td>
<td>8</td>
<td>9</td>
<td>9</td>
<td>4</td>
<td>4</td>
<td>11</td>
<td>8</td>
</tr>
<tr>
<td>4</td>
<td>3</td>
<td>8</td>
<td>4</td>
<td>4</td>
<td>1</td>
<td>1</td>
<td>7</td>
<td>5</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
<td>11</td>
<td>8</td>
<td>8</td>
<td>4</td>
<td>4</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>5</td>
<td>3</td>
<td>3</td>
<td>5</td>
<td>5</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>1</td>
<td>1</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>3</td>
<td>11</td>
<td>11</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>In total</td>
<td></td>
<td>37</td>
<td>100</td>
<td>96</td>
<td>100</td>
<td>99</td>
<td>100</td>
<td>127</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No.</td>
<td>%</td>
<td>No.</td>
<td>%</td>
<td>No.</td>
<td>%</td>
<td>No.</td>
<td>%</td>
</tr>
<tr>
<td>8</td>
<td>50</td>
<td>33</td>
<td>76</td>
<td>50</td>
<td>91</td>
<td>61</td>
<td>82</td>
<td>67</td>
</tr>
<tr>
<td>7</td>
<td>36</td>
<td>24</td>
<td>29</td>
<td>19</td>
<td>16</td>
<td>11</td>
<td>17</td>
<td>14</td>
</tr>
<tr>
<td>6</td>
<td>11</td>
<td>7</td>
<td>7</td>
<td>5</td>
<td>12</td>
<td>8</td>
<td>10</td>
<td>8</td>
</tr>
<tr>
<td>5</td>
<td>14</td>
<td>9</td>
<td>13</td>
<td>8</td>
<td>9</td>
<td>6</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>12</td>
<td>8</td>
<td>5</td>
<td>3</td>
<td>6</td>
<td>5</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>9</td>
<td>6</td>
<td>7</td>
<td>5</td>
<td>2</td>
<td>1</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>8</td>
<td>6</td>
<td>5</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>9</td>
<td>6</td>
<td>6</td>
<td>4</td>
<td>7</td>
<td>5</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>0</td>
<td>2</td>
<td>1</td>
<td>5</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>In total</td>
<td>151</td>
<td>100</td>
<td>153</td>
<td>100</td>
<td>148</td>
<td>100</td>
<td>123</td>
<td>100</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Participating laboratories</th>
<th>EQAS 2015</th>
<th>EQAS 2016</th>
<th>Average EQAS 2000 - 2016</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No.</td>
<td>%</td>
<td>No.</td>
</tr>
<tr>
<td>8</td>
<td>65</td>
<td>43</td>
<td>84</td>
</tr>
<tr>
<td>7</td>
<td>25</td>
<td>17</td>
<td>22</td>
</tr>
<tr>
<td>6</td>
<td>17</td>
<td>11</td>
<td>18</td>
</tr>
<tr>
<td>5</td>
<td>22</td>
<td>15</td>
<td>5</td>
</tr>
<tr>
<td>4</td>
<td>5</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>3</td>
<td>2</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>2</td>
<td>4</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>1</td>
<td>7</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>0</td>
<td>4</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>In total</td>
<td>151</td>
<td>100</td>
<td>146</td>
</tr>
</tbody>
</table>
Table 2. EQAS participating laboratories’ performance of *Salmonella* serotyping

<table>
<thead>
<tr>
<th>EQAS iteration</th>
<th>Labs serotyping all provided strains</th>
<th>Correct test results</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No.</td>
<td>%</td>
</tr>
<tr>
<td>2000</td>
<td>34</td>
<td>92</td>
</tr>
<tr>
<td>2001</td>
<td>79</td>
<td>82</td>
</tr>
<tr>
<td>2002</td>
<td>80</td>
<td>81</td>
</tr>
<tr>
<td>2003</td>
<td>69</td>
<td>54</td>
</tr>
<tr>
<td>2004</td>
<td>78</td>
<td>61</td>
</tr>
<tr>
<td>2006</td>
<td>105</td>
<td>81</td>
</tr>
<tr>
<td>2007</td>
<td>109</td>
<td>78</td>
</tr>
<tr>
<td>2008</td>
<td>100</td>
<td>66</td>
</tr>
<tr>
<td>2009</td>
<td>119</td>
<td>83</td>
</tr>
<tr>
<td>2010</td>
<td>129</td>
<td>87</td>
</tr>
<tr>
<td>2011</td>
<td>109</td>
<td>89</td>
</tr>
<tr>
<td>2012</td>
<td>122</td>
<td>81</td>
</tr>
<tr>
<td>2013</td>
<td>74</td>
<td>59</td>
</tr>
<tr>
<td>2014</td>
<td>85</td>
<td>57</td>
</tr>
<tr>
<td>2015</td>
<td>104</td>
<td>69</td>
</tr>
<tr>
<td>2016</td>
<td>130</td>
<td>89</td>
</tr>
<tr>
<td>Average</td>
<td>99</td>
<td>76</td>
</tr>
</tbody>
</table>

Table 3. EQAS participating laboratories’ performance of internal quality control strain (WHO S-16.3, *Salmonella* Enteritidis) serotyping.

<table>
<thead>
<tr>
<th>EQAS iteration</th>
<th>Labs serotyping <em>S. Enteritidis</em> correctly</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No.</td>
</tr>
<tr>
<td>2000</td>
<td>34</td>
</tr>
<tr>
<td>2001</td>
<td>64</td>
</tr>
<tr>
<td>2004</td>
<td>113</td>
</tr>
<tr>
<td>2006</td>
<td>116</td>
</tr>
<tr>
<td>2007</td>
<td>135</td>
</tr>
<tr>
<td>2008</td>
<td>139</td>
</tr>
<tr>
<td>2009</td>
<td>141</td>
</tr>
<tr>
<td>2010</td>
<td>138</td>
</tr>
<tr>
<td>2011</td>
<td>128</td>
</tr>
<tr>
<td>2012</td>
<td>139</td>
</tr>
<tr>
<td>2013</td>
<td>130</td>
</tr>
<tr>
<td>2014</td>
<td>145</td>
</tr>
<tr>
<td>2015</td>
<td>125</td>
</tr>
<tr>
<td>2016</td>
<td>159</td>
</tr>
<tr>
<td>Average</td>
<td>122</td>
</tr>
</tbody>
</table>
Table 4. Region-based categorization of EQAS participants’ performance of \textit{Salmonella} serotyping

<table>
<thead>
<tr>
<th>Region</th>
<th>EQAS iteration</th>
<th>No. of labs</th>
<th>No. of strains serotyped</th>
<th>% strains correctly serotyped</th>
<th>Countries participating in EQAS 2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>Africa</td>
<td>2001</td>
<td>6</td>
<td>37</td>
<td>73.0</td>
<td>Cameroun, Egypt, Madagascar, Mauritius, Morocco (2), South Africa, The Gambia</td>
</tr>
<tr>
<td></td>
<td>2002</td>
<td>9</td>
<td>62</td>
<td>87.1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2003</td>
<td>11</td>
<td>70</td>
<td>71.4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2004</td>
<td>9</td>
<td>51</td>
<td>62.7</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2006</td>
<td>16</td>
<td>95</td>
<td>71.6</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2007</td>
<td>11</td>
<td>73</td>
<td>80.8</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2008</td>
<td>10</td>
<td>71</td>
<td>49.3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2009</td>
<td>15</td>
<td>94</td>
<td>75.5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2010</td>
<td>13</td>
<td>83</td>
<td>67.5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2011</td>
<td>10</td>
<td>57</td>
<td>79.2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2012</td>
<td>10</td>
<td>65</td>
<td>60.0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2013</td>
<td>8</td>
<td>51</td>
<td>74.5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2014</td>
<td>11</td>
<td>63</td>
<td>76.2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2015</td>
<td>12</td>
<td>68</td>
<td>61.8</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2016</td>
<td>8</td>
<td>58</td>
<td>62.1</td>
<td></td>
</tr>
<tr>
<td>Central Asia &amp; Middle East</td>
<td>2001</td>
<td>10</td>
<td>60</td>
<td>50.0</td>
<td>Bahrain, India, Iraq, Israel, Oman</td>
</tr>
<tr>
<td></td>
<td>2002</td>
<td>5</td>
<td>30</td>
<td>83.3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2003</td>
<td>5</td>
<td>35</td>
<td>54.3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2004</td>
<td>5</td>
<td>33</td>
<td>54.5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2006</td>
<td>5</td>
<td>35</td>
<td>74.3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2007</td>
<td>5</td>
<td>40</td>
<td>55.0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2008</td>
<td>5</td>
<td>34</td>
<td>61.8</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2009</td>
<td>5</td>
<td>32</td>
<td>46.9</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2010</td>
<td>5</td>
<td>22</td>
<td>75.9</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2011</td>
<td>3</td>
<td>23</td>
<td>95.8</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2012</td>
<td>4</td>
<td>30</td>
<td>56.7</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2013</td>
<td>5</td>
<td>38</td>
<td>52.6</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2014</td>
<td>7</td>
<td>37</td>
<td>75.7</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2015</td>
<td>7</td>
<td>44</td>
<td>77.3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2016</td>
<td>5</td>
<td>38</td>
<td>78.9</td>
<td></td>
</tr>
<tr>
<td>Caribbean</td>
<td>2001</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>Barbados, Trinidad and Tobago</td>
</tr>
<tr>
<td></td>
<td>2002</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2003</td>
<td>3</td>
<td>18</td>
<td>61.1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2004</td>
<td>2</td>
<td>8</td>
<td>87.5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2006</td>
<td>3</td>
<td>14</td>
<td>78.6</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2007</td>
<td>2</td>
<td>9</td>
<td>77.8</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2008</td>
<td>3</td>
<td>12</td>
<td>78.6</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2009</td>
<td>3</td>
<td>12</td>
<td>83.3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2010</td>
<td>2</td>
<td>13</td>
<td>92.9</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2011</td>
<td>1</td>
<td>7</td>
<td>87.5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2012</td>
<td>2</td>
<td>16</td>
<td>62.5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2013</td>
<td>1</td>
<td>5</td>
<td>100.0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2014</td>
<td>3</td>
<td>15</td>
<td>60.0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2015</td>
<td>5</td>
<td>24</td>
<td>58.3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2016</td>
<td>2</td>
<td>16</td>
<td>60</td>
<td></td>
</tr>
<tr>
<td>Europe</td>
<td>2001</td>
<td>43</td>
<td>323</td>
<td>80.5</td>
<td>Belgium, Bulgaria, Croatia, Cyprus, Czech Republic (2), Germany (2), Greece (3), Hungary, Ireland, Italy (16), Luxembourg (2), Malta, Norway, Poland (3), Portugal, Serbia (2), Slovak Republic, Spain, Sweden, Turkey (2), Ukraine, United Kingdom</td>
</tr>
<tr>
<td></td>
<td>2002</td>
<td>50</td>
<td>384</td>
<td>90.0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2003</td>
<td>60</td>
<td>401</td>
<td>84.8</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2004</td>
<td>57</td>
<td>392</td>
<td>84.7</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2006</td>
<td>52</td>
<td>403</td>
<td>86.4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2007</td>
<td>54</td>
<td>415</td>
<td>89.4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2008</td>
<td>50</td>
<td>379</td>
<td>82.3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2009</td>
<td>47</td>
<td>362</td>
<td>93.1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2010</td>
<td>45</td>
<td>332</td>
<td>94.1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2011</td>
<td>42</td>
<td>314</td>
<td>94.6</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2012</td>
<td>47</td>
<td>368</td>
<td>92.9</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2013</td>
<td>42</td>
<td>309</td>
<td>94.5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2014</td>
<td>52</td>
<td>391</td>
<td>96.2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2015</td>
<td>48</td>
<td>371</td>
<td>93.8</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2016</td>
<td>46</td>
<td>362</td>
<td>93.4</td>
<td></td>
</tr>
</tbody>
</table>
Table 4 (continued). Region-based categorization of EQAS participants’ performance of *Salmonella* serotyping

<table>
<thead>
<tr>
<th>Region</th>
<th>EQAS iteration</th>
<th>No. of labs</th>
<th>No. of strains serotyped</th>
<th>% strains correctly serotyped</th>
<th>Countries participating in EQAS 2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>North America</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2001</td>
<td>4</td>
<td>32</td>
<td>87.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2002</td>
<td>2</td>
<td>16</td>
<td>100.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2003</td>
<td>6</td>
<td>41</td>
<td>95.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2004</td>
<td>8</td>
<td>55</td>
<td>81.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2006</td>
<td>10</td>
<td>80</td>
<td>96.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2007</td>
<td>12</td>
<td>94</td>
<td>97.9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2008</td>
<td>11</td>
<td>84</td>
<td>95.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2009</td>
<td>12</td>
<td>90</td>
<td>92.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2010</td>
<td>13</td>
<td>103</td>
<td>100.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2011</td>
<td>11</td>
<td>81</td>
<td>97.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2012</td>
<td>14</td>
<td>101</td>
<td>93.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2013</td>
<td>13</td>
<td>92</td>
<td>97.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2014</td>
<td>13</td>
<td>84</td>
<td>100.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2015</td>
<td>13</td>
<td>93</td>
<td>100.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2016</td>
<td>13</td>
<td>100</td>
<td>99.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oceania</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2001</td>
<td>4</td>
<td>30</td>
<td>100.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2002</td>
<td>6</td>
<td>43</td>
<td>93.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2003</td>
<td>6</td>
<td>46</td>
<td>93.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2004</td>
<td>5</td>
<td>38</td>
<td>97.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2006</td>
<td>5</td>
<td>37</td>
<td>94.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2007</td>
<td>4</td>
<td>32</td>
<td>100.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2008</td>
<td>4</td>
<td>30</td>
<td>93.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2009</td>
<td>4</td>
<td>32</td>
<td>96.9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2010</td>
<td>4</td>
<td>32</td>
<td>100.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2011</td>
<td>4</td>
<td>32</td>
<td>100.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2012</td>
<td>4</td>
<td>32</td>
<td>100.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2013</td>
<td>4</td>
<td>31</td>
<td>100.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2014</td>
<td>4</td>
<td>32</td>
<td>100.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2015</td>
<td>4</td>
<td>31</td>
<td>100.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2016</td>
<td>4</td>
<td>32</td>
<td>100.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Russia</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2001</td>
<td>1</td>
<td>8</td>
<td>12.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2002</td>
<td>1</td>
<td>8</td>
<td>62.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2003</td>
<td>1</td>
<td>7</td>
<td>14.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2004</td>
<td>4</td>
<td>26</td>
<td>69.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2006</td>
<td>5</td>
<td>40</td>
<td>80.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2007</td>
<td>8</td>
<td>51</td>
<td>80.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2008</td>
<td>6</td>
<td>40</td>
<td>90.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2009</td>
<td>7</td>
<td>49</td>
<td>91.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2010</td>
<td>8</td>
<td>54</td>
<td>87.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2011</td>
<td>7</td>
<td>48</td>
<td>87.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2012</td>
<td>6</td>
<td>48</td>
<td>87.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2013</td>
<td>2</td>
<td>16</td>
<td>75.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2014</td>
<td>4</td>
<td>30</td>
<td>93.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2015</td>
<td>3</td>
<td>24</td>
<td>100.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2016</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Latin America</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2001</td>
<td>11</td>
<td>78</td>
<td>57.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2002</td>
<td>11</td>
<td>82</td>
<td>87.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2003</td>
<td>13</td>
<td>83</td>
<td>75.9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2004</td>
<td>15</td>
<td>88</td>
<td>79.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2006</td>
<td>13</td>
<td>84</td>
<td>84.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2007</td>
<td>15</td>
<td>107</td>
<td>88.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2008</td>
<td>17</td>
<td>120</td>
<td>71.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2009</td>
<td>21</td>
<td>150</td>
<td>77.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2010</td>
<td>22</td>
<td>132</td>
<td>80.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2011</td>
<td>23</td>
<td>144</td>
<td>83.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2012</td>
<td>25</td>
<td>182</td>
<td>73.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2013</td>
<td>22</td>
<td>154</td>
<td>83.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2014</td>
<td>24</td>
<td>166</td>
<td>84.9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2015</td>
<td>20</td>
<td>133</td>
<td>84.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2016</td>
<td>23</td>
<td>165</td>
<td>87.9</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 4 (continued). Region-based categorization of EQAS participants’ performance of *Salmonella* serotyping

<table>
<thead>
<tr>
<th>EQAS iteration</th>
<th>Region</th>
<th>No. of labs</th>
<th>No. of strains serotyped</th>
<th>% strains correctly serotyped</th>
<th>Countries participating in EQAS 2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>Southeast Asia</td>
<td>15</td>
<td>113</td>
<td>54.0</td>
<td>Brunei Darussalam, Cambodia, Japan, Korea, Rep of (2), LAO PDR, Malaysia (5), Philippines, Singapore, Sri Lanka, Taiwan, Thailand (11), Viet Nam (2)</td>
</tr>
<tr>
<td>2002</td>
<td>Southeast Asia</td>
<td>12</td>
<td>90</td>
<td>92.2</td>
<td></td>
</tr>
<tr>
<td>2003</td>
<td>Southeast Asia</td>
<td>15</td>
<td>100</td>
<td>81.0</td>
<td></td>
</tr>
<tr>
<td>2004</td>
<td>Southeast Asia</td>
<td>17</td>
<td>130</td>
<td>81.5</td>
<td></td>
</tr>
<tr>
<td>2006</td>
<td>Southeast Asia</td>
<td>15</td>
<td>117</td>
<td>84.6</td>
<td></td>
</tr>
<tr>
<td>2007</td>
<td>Southeast Asia</td>
<td>19</td>
<td>140</td>
<td>91.4</td>
<td></td>
</tr>
<tr>
<td>2008</td>
<td>Southeast Asia</td>
<td>18</td>
<td>125</td>
<td>81.6</td>
<td></td>
</tr>
<tr>
<td>2009</td>
<td>Southeast Asia</td>
<td>23</td>
<td>180</td>
<td>81.1</td>
<td></td>
</tr>
<tr>
<td>2010</td>
<td>Southeast Asia</td>
<td>24</td>
<td>172</td>
<td>90.5</td>
<td></td>
</tr>
<tr>
<td>2011</td>
<td>Southeast Asia</td>
<td>23</td>
<td>180</td>
<td>98.4</td>
<td></td>
</tr>
<tr>
<td>2012</td>
<td>Southeast Asia</td>
<td>28</td>
<td>207</td>
<td>77.8</td>
<td></td>
</tr>
<tr>
<td>2013</td>
<td>Southeast Asia</td>
<td>22</td>
<td>163</td>
<td>89.6</td>
<td></td>
</tr>
<tr>
<td>2014</td>
<td>Southeast Asia</td>
<td>22</td>
<td>166</td>
<td>94.6</td>
<td></td>
</tr>
<tr>
<td>2015</td>
<td>Southeast Asia</td>
<td>24</td>
<td>179</td>
<td>88.3</td>
<td></td>
</tr>
<tr>
<td>2016</td>
<td>Southeast Asia</td>
<td>28</td>
<td>211</td>
<td>87.7</td>
<td></td>
</tr>
<tr>
<td>2001</td>
<td>China</td>
<td>4</td>
<td>32</td>
<td>96.9</td>
<td>China (17)</td>
</tr>
<tr>
<td>2002</td>
<td>China</td>
<td>3</td>
<td>24</td>
<td>100.0</td>
<td></td>
</tr>
<tr>
<td>2003</td>
<td>China</td>
<td>8</td>
<td>60</td>
<td>75.0</td>
<td></td>
</tr>
<tr>
<td>2004</td>
<td>China</td>
<td>7</td>
<td>46</td>
<td>78.3</td>
<td></td>
</tr>
<tr>
<td>2006</td>
<td>China</td>
<td>6</td>
<td>48</td>
<td>85.4</td>
<td></td>
</tr>
<tr>
<td>2007</td>
<td>China</td>
<td>10</td>
<td>80</td>
<td>91.3</td>
<td></td>
</tr>
<tr>
<td>2008</td>
<td>China</td>
<td>15</td>
<td>108</td>
<td>94.4</td>
<td></td>
</tr>
<tr>
<td>2009</td>
<td>China</td>
<td>16</td>
<td>126</td>
<td>95.2</td>
<td></td>
</tr>
<tr>
<td>2010</td>
<td>China</td>
<td>10</td>
<td>74</td>
<td>92.5</td>
<td></td>
</tr>
<tr>
<td>2012</td>
<td>China</td>
<td>10</td>
<td>78</td>
<td>80.8</td>
<td></td>
</tr>
<tr>
<td>2013</td>
<td>China</td>
<td>7</td>
<td>54</td>
<td>92.6</td>
<td></td>
</tr>
<tr>
<td>2014</td>
<td>China</td>
<td>9</td>
<td>71</td>
<td>93.0</td>
<td></td>
</tr>
<tr>
<td>2015</td>
<td>China</td>
<td>15</td>
<td>118</td>
<td>78.0</td>
<td></td>
</tr>
<tr>
<td>2016</td>
<td>China</td>
<td>17</td>
<td>136</td>
<td>95.6</td>
<td></td>
</tr>
<tr>
<td>Strain ID</td>
<td>Correct serotype</td>
<td>No. of labs reporting SG</td>
<td>% DSG</td>
<td>No. of labs reporting ST</td>
<td>% DST</td>
</tr>
<tr>
<td>----------</td>
<td>------------------</td>
<td>-------------------------</td>
<td>-------</td>
<td>------------------------</td>
<td>-------</td>
</tr>
<tr>
<td>WHO 2016 S-16.1</td>
<td>Bovismorbificans / Hindmarsh</td>
<td>1 6,8:r:1,5</td>
<td>156</td>
<td>5.8</td>
<td>156</td>
</tr>
<tr>
<td>WHO 2016 S-16.2</td>
<td>Infantis</td>
<td>1 6,7:r:1,5</td>
<td>157</td>
<td>1.9</td>
<td>157</td>
</tr>
<tr>
<td>WHO 2016 S-16.3</td>
<td>Enteritidis</td>
<td>1 9,12:g,m;/-</td>
<td>159</td>
<td>1.3</td>
<td>159</td>
</tr>
<tr>
<td>WHO 2016 S-16.4</td>
<td>Uganda</td>
<td>1 3,10:1,l13;1,5</td>
<td>157</td>
<td>5.1</td>
<td>157</td>
</tr>
<tr>
<td>WHO 2016 S-16.5</td>
<td>Stanley</td>
<td>1 4,5,12:d;1,2</td>
<td>159</td>
<td>0.6</td>
<td>159</td>
</tr>
<tr>
<td>WHO 2016 S-16.6</td>
<td>Heidelberg</td>
<td>1 4,12:r:1,2</td>
<td>159</td>
<td>0.0</td>
<td>159</td>
</tr>
<tr>
<td>WHO 2016 S-16.7</td>
<td>Altendorf</td>
<td>1 4,12,27:c:1,7</td>
<td>157</td>
<td>0.6</td>
<td>157</td>
</tr>
<tr>
<td>WHO 2016 S-16.8</td>
<td>Plymouth</td>
<td>1 9,46:d:z6</td>
<td>156</td>
<td>23.7</td>
<td>156</td>
</tr>
</tbody>
</table>

*number of participants reporting the specified deviating result
<table>
<thead>
<tr>
<th>EQAS iteration</th>
<th>No. of EQAS participating laboratories</th>
<th>% correct test results</th>
<th>% minor deviations (S ↔ I or I ↔ R)</th>
<th>% major deviations (S → R)</th>
<th>% very major deviations (R→ S)</th>
<th>% critical deviations (R→ S &amp; S → R)</th>
<th>% total deviations (S → R &amp; R → S &amp; S ↔ I or I ↔ R)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>44</td>
<td>92</td>
<td>4</td>
<td>4</td>
<td>0</td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>2001</td>
<td>108</td>
<td>91</td>
<td>6</td>
<td>2</td>
<td>1</td>
<td>3</td>
<td>9</td>
</tr>
<tr>
<td>2002</td>
<td>119</td>
<td>92</td>
<td>6</td>
<td>2</td>
<td>1</td>
<td>3</td>
<td>9</td>
</tr>
<tr>
<td>2003*</td>
<td>147</td>
<td>93</td>
<td>4</td>
<td>3</td>
<td>0</td>
<td>3</td>
<td>7</td>
</tr>
<tr>
<td>2004</td>
<td>152</td>
<td>93</td>
<td>4</td>
<td>2</td>
<td>1</td>
<td>3</td>
<td>7</td>
</tr>
<tr>
<td>2006</td>
<td>143</td>
<td>88</td>
<td>8</td>
<td>3</td>
<td>1</td>
<td>4</td>
<td>12</td>
</tr>
<tr>
<td>2007</td>
<td>143</td>
<td>93</td>
<td>4</td>
<td>2</td>
<td>1</td>
<td>3</td>
<td>7</td>
</tr>
<tr>
<td>2008</td>
<td>168</td>
<td>91</td>
<td>4</td>
<td>2</td>
<td>3</td>
<td>5</td>
<td>9</td>
</tr>
<tr>
<td>2009</td>
<td>153</td>
<td>94</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>2010</td>
<td>152</td>
<td>92</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>5</td>
<td>8</td>
</tr>
<tr>
<td>2011</td>
<td>127</td>
<td>91</td>
<td>4</td>
<td>2</td>
<td>3</td>
<td>5</td>
<td>9</td>
</tr>
<tr>
<td>2012</td>
<td>159</td>
<td>94</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>2013</td>
<td>145</td>
<td>95</td>
<td>3</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>2014</td>
<td>155</td>
<td>95</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>2015</td>
<td>155</td>
<td>92</td>
<td>4</td>
<td>2</td>
<td>1</td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>2016</td>
<td>150</td>
<td>95</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>Average*</td>
<td>139</td>
<td>93</td>
<td>4</td>
<td>2</td>
<td>1</td>
<td>3</td>
<td>7</td>
</tr>
</tbody>
</table>

*Data do not include one strain which may have lost resistance due to transport or storage stress
^S, susceptible; I, intermediate; R, resistant
Table 7. EQAS participants’ performance of *Salmonella* strains antimicrobial susceptibility testing categorized by antimicrobial

<table>
<thead>
<tr>
<th>EQAS iteration</th>
<th>No. of labs</th>
<th>Performance</th>
<th>Antimicrobial(^c)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>AMC AMP CAZ CHL CIP POD CRO CTX GEN KAN NAL SMX MER STR SXT TET TMP XNL OVERALL average</td>
<td></td>
</tr>
<tr>
<td>2000 44</td>
<td></td>
<td></td>
<td>No. of tests 44</td>
</tr>
<tr>
<td>2001 108</td>
<td></td>
<td></td>
<td>No. of tests 108</td>
</tr>
<tr>
<td>2002 119</td>
<td></td>
<td></td>
<td>No. of tests 119</td>
</tr>
<tr>
<td>2003 147*</td>
<td></td>
<td></td>
<td>No. of tests 147</td>
</tr>
<tr>
<td>2004 152</td>
<td></td>
<td></td>
<td>No. of tests 152</td>
</tr>
<tr>
<td>2006 143</td>
<td></td>
<td></td>
<td>No. of tests 143</td>
</tr>
<tr>
<td>2007 143</td>
<td></td>
<td></td>
<td>No. of tests 143</td>
</tr>
<tr>
<td>2008 168</td>
<td></td>
<td></td>
<td>No. of tests 168</td>
</tr>
<tr>
<td>2009 153</td>
<td></td>
<td></td>
<td>No. of tests 153</td>
</tr>
<tr>
<td>2010 152</td>
<td></td>
<td></td>
<td>No. of tests 152</td>
</tr>
</tbody>
</table>

\(^c\) Antimicrobial: AMC (Amoxicillin), AMP (Amoxicillin/Clavulanate), CAZ (Cefazolin), CHL (Chloramphenicol), CIP (Ciprofloxacin), POD (Piperacillin/Tazobactam), CRO (Ceftriaxone), CTX (Cefotaxime), GEN (Gentamicin), KAN (Kanamycin), NAL (Nalidixic Acid), SMX (Sulfamethoxazole), MER (Meroxyllin), STR (Streptomycin), SXT (Sulfamethoxazole/Trimethoprim), TET (Tetracycline), TMP (Trimethoprim), XNL (Xanthinol), OVERALL (Overall mean performance).
Table 7 (continued). EQAS participants’ performance of *Salmonella* strains antimicrobial susceptibility testing categorized by antimicrobial.

<table>
<thead>
<tr>
<th>EQAS iteration</th>
<th>No. of labs</th>
<th>Performance</th>
<th>Antimicrobial&lt;sup&gt;+&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>AMC</td>
</tr>
<tr>
<td>2011</td>
<td>127</td>
<td>No. of tests</td>
<td>- 1099</td>
</tr>
<tr>
<td></td>
<td></td>
<td>% critical deviations&lt;sup&gt;*&lt;/sup&gt;</td>
<td>- 5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>% total deviations&lt;sup&gt;^&lt;/sup&gt;</td>
<td>- 6</td>
</tr>
<tr>
<td>2012</td>
<td>159</td>
<td>No. of tests</td>
<td>- 1228</td>
</tr>
<tr>
<td></td>
<td></td>
<td>% critical deviations&lt;sup&gt;*&lt;/sup&gt;</td>
<td>- 3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>% total deviations&lt;sup&gt;^&lt;/sup&gt;</td>
<td>- 5</td>
</tr>
<tr>
<td>2013</td>
<td>145</td>
<td>No. of tests</td>
<td>- 1121</td>
</tr>
<tr>
<td></td>
<td></td>
<td>% critical deviations&lt;sup&gt;*&lt;/sup&gt;</td>
<td>- 2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>% total deviations&lt;sup&gt;^&lt;/sup&gt;</td>
<td>- 3</td>
</tr>
<tr>
<td>2014</td>
<td>155</td>
<td>No. of tests</td>
<td>- 1176</td>
</tr>
<tr>
<td></td>
<td></td>
<td>% critical deviations&lt;sup&gt;*&lt;/sup&gt;</td>
<td>- 3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>% total deviations&lt;sup&gt;^&lt;/sup&gt;</td>
<td>- 4</td>
</tr>
<tr>
<td>2015</td>
<td>155</td>
<td>No. of tests</td>
<td>- 1176</td>
</tr>
<tr>
<td></td>
<td></td>
<td>% critical deviations&lt;sup&gt;*&lt;/sup&gt;</td>
<td>- 3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>% total deviations&lt;sup&gt;^&lt;/sup&gt;</td>
<td>- 5</td>
</tr>
<tr>
<td>2016</td>
<td>150</td>
<td>No. of tests</td>
<td>- 1133</td>
</tr>
<tr>
<td></td>
<td></td>
<td>% critical deviations&lt;sup&gt;*&lt;/sup&gt;</td>
<td>- 4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>% total deviations&lt;sup&gt;^&lt;/sup&gt;</td>
<td>- 5</td>
</tr>
<tr>
<td>Average*</td>
<td>139</td>
<td>No. of tests</td>
<td>944</td>
</tr>
<tr>
<td></td>
<td></td>
<td>% critical deviations&lt;sup&gt;*&lt;/sup&gt;</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>% total deviations&lt;sup&gt;^&lt;/sup&gt;</td>
<td>17</td>
</tr>
</tbody>
</table>

<sup>*</sup>For antimicrobial abbreviations: see List of Abbreviations page 1

<sup>+</sup>R→ S & S→ R (R, resistant; S, susceptible)

<sup>^</sup>S→R & R→S & S→I or I→R (I, intermediate)

* Data do not include one strain which may have lost resistance due to transport or storage stress

-, not determined
Table 8. Antimicrobial susceptibility test results (number of R/I/S) for the EQAS 2016 *Salmonella* strains*

<table>
<thead>
<tr>
<th>Strain</th>
<th>Antimicrobial^</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>AMP</td>
</tr>
<tr>
<td>WHO S-16.1</td>
<td></td>
</tr>
<tr>
<td>WHO S-16.2</td>
<td></td>
</tr>
<tr>
<td>WHO S-16.3</td>
<td></td>
</tr>
<tr>
<td>WHO S-16.4</td>
<td></td>
</tr>
<tr>
<td>WHO S-16.5</td>
<td></td>
</tr>
<tr>
<td>WHO S-16.6</td>
<td></td>
</tr>
<tr>
<td>WHO S-16.7</td>
<td></td>
</tr>
<tr>
<td>WHO S-16.8</td>
<td></td>
</tr>
</tbody>
</table>

^For antimicrobial abbreviations: see List of Abbreviations page 1

Table 9. Region-based categorization of EQAS participants’ performance of *Salmonella* AST

<table>
<thead>
<tr>
<th>Region</th>
<th>EQAS iteration</th>
<th>No. of labs</th>
<th>% correct test result</th>
<th>% minor deviations (S ↔ I or I ↔ R)</th>
<th>% major deviations (S ↔ R)</th>
<th>% very major deviations (R → S)</th>
<th>% critical deviations (S → R &amp; R → S)</th>
<th>% total deviations (S→R &amp; R→S &amp; S↔I or I→R)</th>
<th>Countries participating in the 2016 iteration</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Africa</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2001</td>
<td>7</td>
<td>80.1</td>
<td>9.6</td>
<td>7.7</td>
<td>2.5</td>
<td>10.2</td>
<td>19.8</td>
<td></td>
<td>Cameroun, Congo, Democratic Republic of the, Egypt, Ivory Coast, Kenya (3), Madagascar, Mauritius, Morocco (2), Nigeria, Senegal, South Africa, The Gambia (2), Zambia, Zimbabwe</td>
</tr>
<tr>
<td>2002</td>
<td>10</td>
<td>94.3</td>
<td>4.1</td>
<td>1.0</td>
<td>0.6</td>
<td>1.6</td>
<td>5.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2003</td>
<td>13</td>
<td>86.9</td>
<td>6.6</td>
<td>2.8</td>
<td>3.7</td>
<td>6.5</td>
<td>13.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2004</td>
<td>11</td>
<td>85.7</td>
<td>7.2</td>
<td>5.2</td>
<td>1.9</td>
<td>7.1</td>
<td>14.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2006</td>
<td>20</td>
<td>85.8</td>
<td>7.5</td>
<td>4.1</td>
<td>2.7</td>
<td>6.8</td>
<td>14.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2007</td>
<td>16</td>
<td>90.7</td>
<td>4.4</td>
<td>4.0</td>
<td>0.9</td>
<td>4.9</td>
<td>9.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2008</td>
<td>19</td>
<td>83.8</td>
<td>6.5</td>
<td>5.5</td>
<td>4.2</td>
<td>9.7</td>
<td>16.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2009</td>
<td>22</td>
<td>90.1</td>
<td>4.5</td>
<td>3.6</td>
<td>1.8</td>
<td>5.4</td>
<td>9.9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2010</td>
<td>22</td>
<td>84.7</td>
<td>6.0</td>
<td>6.5</td>
<td>2.8</td>
<td>9.3</td>
<td>15.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2011</td>
<td>17</td>
<td>87.0</td>
<td>5.0</td>
<td>4.7</td>
<td>3.3</td>
<td>8.0</td>
<td>13.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2012</td>
<td>18</td>
<td>89.4</td>
<td>5.3</td>
<td>3.5</td>
<td>1.9</td>
<td>5.4</td>
<td>10.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2013</td>
<td>16</td>
<td>92.0</td>
<td>3.2</td>
<td>4.0</td>
<td>0.9</td>
<td>4.9</td>
<td>8.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2014</td>
<td>20</td>
<td>92.5</td>
<td>3.8</td>
<td>2.0</td>
<td>1.7</td>
<td>3.7</td>
<td>7.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2015</td>
<td>22</td>
<td>86.7</td>
<td>7.3</td>
<td>4.1</td>
<td>1.9</td>
<td>6.0</td>
<td>13.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>2016</strong></td>
<td><strong>18</strong></td>
<td><strong>90.1</strong></td>
<td><strong>4.6</strong></td>
<td><strong>4.2</strong></td>
<td><strong>1.1</strong></td>
<td><strong>5.3</strong></td>
<td><strong>9.9</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Central Asia &amp; Middle East</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2001</td>
<td>10</td>
<td>87.7</td>
<td>6.3</td>
<td>5.2</td>
<td>0.8</td>
<td>6.0</td>
<td>12.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2002</td>
<td>6</td>
<td>83.4</td>
<td>9.8</td>
<td>6.6</td>
<td>0.2</td>
<td>6.8</td>
<td>16.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2003</td>
<td>8</td>
<td>89.9</td>
<td>4.5</td>
<td>4.0</td>
<td>1.6</td>
<td>5.6</td>
<td>10.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2004</td>
<td>10</td>
<td>87.5</td>
<td>6.7</td>
<td>5.5</td>
<td>0.3</td>
<td>5.8</td>
<td>12.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2006</td>
<td>7</td>
<td>79.2</td>
<td>10.5</td>
<td>9.8</td>
<td>0.5</td>
<td>10.3</td>
<td>20.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2007</td>
<td>7</td>
<td>87.8</td>
<td>5.0</td>
<td>6.2</td>
<td>1.1</td>
<td>7.3</td>
<td>12.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2008</td>
<td>12</td>
<td>86.1</td>
<td>6.5</td>
<td>4.0</td>
<td>3.4</td>
<td>7.4</td>
<td>13.9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2009</td>
<td>6</td>
<td>93.7</td>
<td>4.3</td>
<td>0.9</td>
<td>1.1</td>
<td>2.0</td>
<td>6.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2010</td>
<td>7</td>
<td>95.8</td>
<td>2.6</td>
<td>0.2</td>
<td>1.4</td>
<td>1.6</td>
<td>4.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2011</td>
<td>4</td>
<td>91.8</td>
<td>4.1</td>
<td>1.8</td>
<td>2.3</td>
<td>4.1</td>
<td>8.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2012</td>
<td>8</td>
<td>92.8</td>
<td>4.4</td>
<td>1.6</td>
<td>0.7</td>
<td>2.3</td>
<td>6.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2013</td>
<td>8</td>
<td>93.6</td>
<td>5.2</td>
<td>1.0</td>
<td>0.1</td>
<td>1.2</td>
<td>6.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2014</td>
<td>17</td>
<td>91.0</td>
<td>4.2</td>
<td>2.9</td>
<td>2.0</td>
<td>4.9</td>
<td>9.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2015</td>
<td>14</td>
<td>91.4</td>
<td>4.3</td>
<td>2.3</td>
<td>2.1</td>
<td>4.4</td>
<td>8.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>2016</strong></td>
<td><strong>11</strong></td>
<td><strong>95.5</strong></td>
<td><strong>0.9</strong></td>
<td><strong>1.8</strong></td>
<td><strong>1.8</strong></td>
<td><strong>3.6</strong></td>
<td><strong>4.5</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Caribbean</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2001</td>
<td>2</td>
<td>83.5</td>
<td>9.5</td>
<td>7.0</td>
<td>0.0</td>
<td>7.0</td>
<td>16.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2002</td>
<td>1</td>
<td>95.8</td>
<td>4.2</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>4.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2003</td>
<td>8</td>
<td>91.7</td>
<td>6.4</td>
<td>1.5</td>
<td>0.5</td>
<td>2.0</td>
<td>8.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2004</td>
<td>8</td>
<td>94.1</td>
<td>3.1</td>
<td>1.9</td>
<td>0.9</td>
<td>2.8</td>
<td>5.9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2006</td>
<td>5</td>
<td>92.1</td>
<td>5.4</td>
<td>1.6</td>
<td>1.0</td>
<td>2.6</td>
<td>8.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2007</td>
<td>4</td>
<td>95.0</td>
<td>3.1</td>
<td>0.9</td>
<td>0.9</td>
<td>1.8</td>
<td>5.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2008</td>
<td>5</td>
<td>90.7</td>
<td>5.5</td>
<td>0.9</td>
<td>2.9</td>
<td>3.8</td>
<td>9.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2009</td>
<td>4</td>
<td>93.2</td>
<td>1.8</td>
<td>3.2</td>
<td>1.8</td>
<td>5.0</td>
<td>6.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2010</td>
<td>4</td>
<td>90.9</td>
<td>5.4</td>
<td>2.7</td>
<td>0.7</td>
<td>3.4</td>
<td>8.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2011</td>
<td>2</td>
<td>96.5</td>
<td>1.4</td>
<td>0.0</td>
<td>2.1</td>
<td>2.1</td>
<td>3.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2012</td>
<td>4</td>
<td>91.1</td>
<td>1.5</td>
<td>6.7</td>
<td>0.7</td>
<td>7.4</td>
<td>8.9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2013</td>
<td>3</td>
<td>90.2</td>
<td>2.6</td>
<td>7.3</td>
<td>0.0</td>
<td>7.3</td>
<td>9.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2014</td>
<td>4</td>
<td>78.3</td>
<td>4.7</td>
<td>9.4</td>
<td>7.6</td>
<td>17.0</td>
<td>21.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2015</td>
<td>4</td>
<td>87.5</td>
<td>6.6</td>
<td>3.7</td>
<td>2.2</td>
<td>5.9</td>
<td>12.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>2016</strong></td>
<td><strong>2</strong></td>
<td><strong>100.0</strong></td>
<td><strong>0.0</strong></td>
<td><strong>0.0</strong></td>
<td><strong>0.0</strong></td>
<td><strong>0.0</strong></td>
<td><strong>0.0</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 9 (continued). Region-based categorization of EQAS participants’ performance of *Salmonella* antimicrobial susceptibility testing

<table>
<thead>
<tr>
<th>Region</th>
<th>EQAS iteration</th>
<th>No. of labs</th>
<th>% correct test result</th>
<th>% minor deviations (S ↔ I or I ↔ R)</th>
<th>% major deviations (S ↔ R)</th>
<th>% very major deviations (R → S)</th>
<th>% critical deviations (S → R &amp; R → S)</th>
<th>% total deviations (S→R &amp; R→S &amp; S↔I or I→R)</th>
<th>Countries participating in the 2016 iteration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Europe</td>
<td>2001</td>
<td>47</td>
<td>91.3</td>
<td>5.7</td>
<td>2.7</td>
<td>0.3</td>
<td>3.0</td>
<td>8.7</td>
<td>Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Greece (3), Hungary, Ireland, Italy (9), Kosovo, Luxembourg (2), Malta (2), Norway, Poland (2), Portugal, Serbia (2), Slovak Republic, Spain, Turkey (2), Ukraine, United Kingdom</td>
</tr>
<tr>
<td></td>
<td>2002</td>
<td>57</td>
<td>92.7</td>
<td>5.2</td>
<td>2.1</td>
<td>0.9</td>
<td>2.1</td>
<td>7.3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2003</td>
<td>64</td>
<td>92.9</td>
<td>3.8</td>
<td>1.0</td>
<td>2.3</td>
<td>3.3</td>
<td>7.1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2004</td>
<td>58</td>
<td>93.5</td>
<td>4.3</td>
<td>1.4</td>
<td>0.8</td>
<td>2.2</td>
<td>6.5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2006</td>
<td>54</td>
<td>88.7</td>
<td>7.0</td>
<td>3.8</td>
<td>0.6</td>
<td>4.4</td>
<td>11.3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2007</td>
<td>49</td>
<td>94.2</td>
<td>3.7</td>
<td>1.6</td>
<td>0.4</td>
<td>2.0</td>
<td>5.7</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2008</td>
<td>51</td>
<td>91.2</td>
<td>4.4</td>
<td>2.5</td>
<td>1.9</td>
<td>4.4</td>
<td>8.8</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2009</td>
<td>40</td>
<td>95.1</td>
<td>2.6</td>
<td>1.3</td>
<td>0.9</td>
<td>2.2</td>
<td>4.8</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2010</td>
<td>39</td>
<td>92.4</td>
<td>4.1</td>
<td>1.2</td>
<td>2.3</td>
<td>3.5</td>
<td>7.6</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2011</td>
<td>36</td>
<td>92.5</td>
<td>4.5</td>
<td>1.7</td>
<td>1.3</td>
<td>3.0</td>
<td>7.5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2012</td>
<td>40</td>
<td>95.5</td>
<td>2.8</td>
<td>1.2</td>
<td>0.4</td>
<td>1.7</td>
<td>4.5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2013</td>
<td>37</td>
<td>95.7</td>
<td>2.5</td>
<td>1.4</td>
<td>0.3</td>
<td>1.7</td>
<td>4.2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2014</td>
<td>40</td>
<td>96.6</td>
<td>2.1</td>
<td>0.8</td>
<td>0.5</td>
<td>1.3</td>
<td>3.4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2015</td>
<td>38</td>
<td>93.4</td>
<td>4.1</td>
<td>1.3</td>
<td>1.2</td>
<td>2.5</td>
<td>6.6</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>2016 36</strong></td>
<td><strong>96.9</strong></td>
<td><strong>1.5</strong></td>
<td><strong>1.2</strong></td>
<td><strong>0.5</strong></td>
<td><strong>1.6</strong></td>
<td><strong>3.1</strong></td>
<td><strong>Europe</strong></td>
<td></td>
</tr>
<tr>
<td>North America</td>
<td>2001</td>
<td>4</td>
<td>95.8</td>
<td>3.8</td>
<td>0.0</td>
<td>0.4</td>
<td>0.4</td>
<td>4.2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2002</td>
<td>3</td>
<td>90.5</td>
<td>6.9</td>
<td>0.6</td>
<td>2.0</td>
<td>2.6</td>
<td>9.5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2003</td>
<td>7</td>
<td>93.4</td>
<td>5.2</td>
<td>0.0</td>
<td>1.4</td>
<td>1.4</td>
<td>6.6</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2004</td>
<td>9</td>
<td>94.2</td>
<td>4.2</td>
<td>1.8</td>
<td>0.0</td>
<td>1.8</td>
<td>6.0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2006</td>
<td>8</td>
<td>94.8</td>
<td>2.9</td>
<td>1.0</td>
<td>1.3</td>
<td>2.3</td>
<td>5.2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2007</td>
<td>10</td>
<td>95.4</td>
<td>2.9</td>
<td>0.8</td>
<td>0.8</td>
<td>1.6</td>
<td>4.6</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2008</td>
<td>14</td>
<td>96.4</td>
<td>0.6</td>
<td>0.4</td>
<td>2.6</td>
<td>3.0</td>
<td>3.6</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2009</td>
<td>10</td>
<td>98.7</td>
<td>0.0</td>
<td>0.4</td>
<td>0.9</td>
<td>1.3</td>
<td>1.3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2010</td>
<td>11</td>
<td>94.8</td>
<td>2.6</td>
<td>0.2</td>
<td>2.4</td>
<td>2.6</td>
<td>5.2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2011</td>
<td>9</td>
<td>92.1</td>
<td>2.6</td>
<td>1.5</td>
<td>3.8</td>
<td>5.3</td>
<td>7.9</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2012</td>
<td>10</td>
<td>96.0</td>
<td>2.1</td>
<td>1.0</td>
<td>0.9</td>
<td>1.9</td>
<td>4.0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2013</td>
<td>7</td>
<td>98.4</td>
<td>1.3</td>
<td>0.0</td>
<td>0.2</td>
<td>0.2</td>
<td>1.6</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2014</td>
<td>8</td>
<td>96.9</td>
<td>2.2</td>
<td>0.4</td>
<td>0.6</td>
<td>0.9</td>
<td>3.1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2015</td>
<td>8</td>
<td>94.5</td>
<td>2.0</td>
<td>0.8</td>
<td>2.8</td>
<td>3.6</td>
<td>5.5</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>2016 8</strong></td>
<td><strong>99.1</strong></td>
<td><strong>0.2</strong></td>
<td><strong>0.0</strong></td>
<td><strong>0.7</strong></td>
<td><strong>0.7</strong></td>
<td><strong>0.9</strong></td>
<td><strong>North America</strong></td>
<td></td>
</tr>
<tr>
<td>Oceania</td>
<td>2001</td>
<td>6</td>
<td>91.8</td>
<td>4.7</td>
<td>2.7</td>
<td>0.9</td>
<td>3.6</td>
<td>8.2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2002</td>
<td>7</td>
<td>91.7</td>
<td>6.2</td>
<td>0.0</td>
<td>2.0</td>
<td>2.0</td>
<td>8.3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2003</td>
<td>9</td>
<td>94.3</td>
<td>2.5</td>
<td>1.2</td>
<td>2.0</td>
<td>3.2</td>
<td>5.7</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2004</td>
<td>11</td>
<td>97.1</td>
<td>2.5</td>
<td>0.3</td>
<td>0.1</td>
<td>0.4</td>
<td>2.9</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2006</td>
<td>7</td>
<td>93.4</td>
<td>4.6</td>
<td>0.9</td>
<td>1.1</td>
<td>2.0</td>
<td>6.6</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2007</td>
<td>1</td>
<td>98.9</td>
<td>1.1</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>1.1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2008</td>
<td>4</td>
<td>93.9</td>
<td>3.8</td>
<td>0.0</td>
<td>2.3</td>
<td>2.3</td>
<td>6.1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2009</td>
<td>4</td>
<td>95.9</td>
<td>3.2</td>
<td>0.3</td>
<td>0.6</td>
<td>0.9</td>
<td>4.1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2010</td>
<td>4</td>
<td>92.5</td>
<td>4.6</td>
<td>0.6</td>
<td>2.3</td>
<td>2.9</td>
<td>7.5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2011</td>
<td>4</td>
<td>93.8</td>
<td>5.6</td>
<td>0.6</td>
<td>0.0</td>
<td>0.6</td>
<td>6.2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2012</td>
<td>4</td>
<td>95.5</td>
<td>3.1</td>
<td>0.6</td>
<td>0.9</td>
<td>1.4</td>
<td>4.5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2013</td>
<td>4</td>
<td>96.8</td>
<td>2.9</td>
<td>0.0</td>
<td>0.3</td>
<td>0.3</td>
<td>3.2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2014</td>
<td>5</td>
<td>97.4</td>
<td>2.0</td>
<td>0.0</td>
<td>0.6</td>
<td>0.6</td>
<td>2.6</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2015</td>
<td>5</td>
<td>95.3</td>
<td>3.8</td>
<td>0.5</td>
<td>0.5</td>
<td>1.0</td>
<td>4.8</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>2016 3</strong></td>
<td><strong>98.1</strong></td>
<td><strong>0.0</strong></td>
<td><strong>0.5</strong></td>
<td><strong>1.4</strong></td>
<td><strong>1.9</strong></td>
<td><strong>1.9</strong></td>
<td><strong>Oceania</strong></td>
<td></td>
</tr>
</tbody>
</table>
Table 9 (continued). Region-based categorization of EQAS participants’ performance of *Salmonella* antimicrobial susceptibility testing.

| Region       | EQAS iteration | No. of labs | % correct test result | % minor deviations (S → R) \(\times\) | % major deviations (S → R) \(\times\) | % very major deviations (R → S) \(\times\) | % critical deviations (S → R & R → S) \(\times\) | % total deviations (S → R & R → S & I→R) \(\times\) | Countries participating in the 2016 iteration |
|--------------|----------------|-------------|------------------------|--------------------------------------|--------------------------------------|----------------------------------------|-----------------------------------------------|-----------------------------------------------|
| Russia       | 2001           | 1           | 81.9                   | 15.3                                 | 2.8                                  | 0.0                                    | 2.8                                           | 18.1                                          | - none -                                      |
|              | 2002           | 1           | 84.5                   | 9.9                                  | 5.6                                  | 0.0                                    | 5.6                                           | 15.5                                          |                                               |
|              | 2003           | 1           | 100.0                  | 0.0                                  | 0.0                                  | 0.0                                    | 0.0                                           | 0.0                                           |                                               |
|              | 2004           | 4           | 91.2                   | 6.6                                  | 1.5                                  | 0.7                                    | 2.2                                           | 8.8                                           |                                               |
|              | 2006           | 5           | 87.4                   | 8.2                                  | 2.7                                  | 1.7                                    | 4.4                                           | 12.6                                          |                                               |
|              | 2007           | 8           | 88.9                   | 5.8                                  | 4.8                                  | 0.4                                    | 5.2                                           | 11.0                                          |                                               |
|              | 2008           | 6           | 92.2                   | 4.7                                  | 1.4                                  | 1.7                                    | 3.1                                           | 7.8                                           |                                               |
|              | 2009           | 6           | 93.8                   | 2.1                                  | 3.3                                  | 0.8                                    | 4.1                                           | 6.2                                           |                                               |
|              | 2010           | 8           | 94.3                   | 3.3                                  | 1.3                                  | 1.1                                    | 2.4                                           | 5.7                                           |                                               |
|              | 2011           | 7           | 90.0                   | 4.8                                  | 3.2                                  | 2.0                                    | 5.2                                           | 10.0                                          |                                               |
|              | 2012           | 6           | 97.4                   | 2.0                                  | 0.0                                  | 0.6                                    | 0.6                                           | 2.6                                           |                                               |
|              | 2013           | 2           | 98.2                   | 1.8                                  | 0.0                                  | 0.0                                    | 0.0                                           | 1.8                                           |                                               |
|              | 2014           | 4           | 98.2                   | 0.3                                  | 0.9                                  | 0.6                                    | 1.5                                           | 1.8                                           |                                               |
|              | 2015           | 4           | 98.7                   | 1.0                                  | 0.0                                  | 0.3                                    | 0.3                                           | 1.3                                           |                                               |
|              | 2016           | -           | -                      | -                                    | -                                    | -                                      | -                                             | -                                             |                                               |
| Latin America| 2001           | 11          | 90.8                   | 6.9                                  | 1.4                                  | 1.0                                    | 2.4                                           | 9.2                                           |                                               |
|              | 2002           | 13          | 93.7                   | 4.6                                  | 0.7                                  | 1.0                                    | 1.7                                           | 6.3                                           |                                               |
|              | 2003           | 12          | 90.8                   | 4.2                                  | 2.0                                  | 3.0                                    | 5.0                                           | 9.2                                           |                                               |
|              | 2004           | 17          | 94.4                   | 4.7                                  | 0.8                                  | 0.1                                    | 0.9                                           | 5.6                                           |                                               |
|              | 2006           | 16          | 88.7                   | 6.3                                  | 4.5                                  | 0.6                                    | 5.1                                           | 11.3                                          |                                               |
|              | 2007           | 17          | 94.9                   | 1.8                                  | 1.9                                  | 1.4                                    | 3.3                                           | 5.0                                           |                                               |
|              | 2008           | 20          | 93.0                   | 3.4                                  | 1.5                                  | 2.1                                    | 3.6                                           | 7.0                                           |                                               |
|              | 2009           | 20          | 95.6                   | 2.1                                  | 1.1                                  | 1.2                                    | 2.3                                           | 4.4                                           |                                               |
|              | 2010           | 23          | 90.8                   | 2.1                                  | 5.6                                  | 1.4                                    | 7.1                                           | 9.2                                           |                                               |
|              | 2011           | 22          | 90.8                   | 2.8                                  | 3.1                                  | 3.3                                    | 6.4                                           | 9.2                                           |                                               |
|              | 2012           | 25          | 94.4                   | 1.6                                  | 3.0                                  | 1.0                                    | 4.0                                           | 5.6                                           |                                               |
|              | 2013           | 25          | 95.5                   | 2.6                                  | 1.2                                  | 0.3                                    | 1.5                                           | 4.2                                           |                                               |
|              | 2014           | 24          | 96.5                   | 1.9                                  | 1.1                                  | 0.6                                    | 1.7                                           | 3.5                                           |                                               |
|              | 2015           | 20          | 94.9                   | 3.8                                  | 0.6                                  | 0.7                                    | 1.3                                           | 5.1                                           |                                               |
|              | 2016           | 24          | 95.6                   | 2.5                                  | 1.4                                  | 0.5                                    | 1.9                                           | 4.4                                           |                                               |
| China        | 2001           | 4           | 98.9                   | 0.8                                  | 0.0                                  | 0.3                                    | 0.3                                           | 1.1                                           |                                               |
|              | 2002           | 3           | 96.0                   | 4.0                                  | 0.0                                  | 0.0                                    | 0.0                                           | 4.0                                           |                                               |
|              | 2003           | 8           | 90.1                   | 3.6                                  | 2.8                                  | 3.6                                    | 6.4                                           | 10.0                                          |                                               |
|              | 2004           | 8           | 96.0                   | 3.2                                  | 0.7                                  | 0.1                                    | 0.8                                           | 4.0                                           |                                               |
|              | 2006           | 6           | 89.6                   | 7.0                                  | 2.9                                  | 0.5                                    | 3.4                                           | 10.4                                          |                                               |
|              | 2007           | 10          | 98.3                   | 1.1                                  | 0.3                                  | 0.2                                    | 0.5                                           | 1.6                                           |                                               |
|              | 2008           | 18          | 92.8                   | 3.7                                  | 0.8                                  | 2.7                                    | 3.5                                           | 7.2                                           |                                               |
|              | 2009           | 14          | 94.8                   | 2.2                                  | 2.1                                  | 0.8                                    | 2.9                                           | 5.1                                           |                                               |
|              | 2010           | 9           | 92.1                   | 4.5                                  | 1.6                                  | 1.8                                    | 3.4                                           | 7.9                                           |                                               |
|              | 2012           | 9           | 95.3                   | 3.0                                  | 0.5                                  | 1.2                                    | 1.6                                           | 4.7                                           |                                               |
|              | 2013           | 8           | 96.9                   | 2.0                                  | 0.5                                  | 0.5                                    | 1.0                                           | 3.1                                           |                                               |
|              | 2014           | 8           | 97.0                   | 1.2                                  | 0.1                                  | 1.6                                    | 1.8                                           | 3.0                                           |                                               |
|              | 2015           | 15          | 92.8                   | 2.0                                  | 4.0                                  | 1.1                                    | 5.1                                           | 7.2                                           |                                               |
|              | 2016           | 16          | 96.7                   | 0.4                                  | 1.8                                  | 1.1                                    | 2.9                                           | 3.3                                           |                                               |

\(^{\text{S. susceptible; I. intermediate; R. resistant}}\)
Table 9 (continued). Region-based categorization of EQAS participants’ performance of *Salmonella* antimicrobial susceptibility testing.

<table>
<thead>
<tr>
<th>Region</th>
<th>EQAS iteration</th>
<th>No. of labs</th>
<th>% correct test result</th>
<th>% minor deviations (S ↔ I or I ↔ R)</th>
<th>% major deviations (S → R)</th>
<th>% very major deviations (R → S)</th>
<th>% critical deviations (S → R &amp; R → S)</th>
<th>% total deviations (S→R &amp; R→S &amp; S↔I or I→R)</th>
<th>Countries participating in the 2015 iteration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Southeast Asia</td>
<td>2001</td>
<td>16</td>
<td>88.1</td>
<td>7.7</td>
<td>2.3</td>
<td>1.9</td>
<td>4.2</td>
<td>11.9</td>
<td>Cambodia, Japan, Korea, Rep of (2), LAO PDR, Malaysia (5), Philippines, Sri Lanka (2), Taiwan, Thailand (10), Viet Nam</td>
</tr>
<tr>
<td></td>
<td>2002</td>
<td>18</td>
<td>89.0</td>
<td>8.1</td>
<td>1.4</td>
<td>1.6</td>
<td>3.0</td>
<td>11.0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2003</td>
<td>17</td>
<td>87.4</td>
<td>5.2</td>
<td>4.7</td>
<td>2.7</td>
<td>7.4</td>
<td>12.6</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2004</td>
<td>16</td>
<td>92.8</td>
<td>4.4</td>
<td>2.3</td>
<td>0.5</td>
<td>2.8</td>
<td>7.2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2006</td>
<td>15</td>
<td>90.0</td>
<td>8.1</td>
<td>1.2</td>
<td>0.8</td>
<td>2.0</td>
<td>10.0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2007</td>
<td>20</td>
<td>93.9</td>
<td>4.0</td>
<td>1.4</td>
<td>0.7</td>
<td>2.1</td>
<td>6.1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2008</td>
<td>19</td>
<td>90.5</td>
<td>4.7</td>
<td>2.2</td>
<td>2.6</td>
<td>4.8</td>
<td>9.5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2009</td>
<td>27</td>
<td>91.8</td>
<td>4.1</td>
<td>3.0</td>
<td>1.2</td>
<td>4.2</td>
<td>8.3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2010</td>
<td>25</td>
<td>92.8</td>
<td>3.8</td>
<td>1.5</td>
<td>1.9</td>
<td>3.4</td>
<td>7.2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2011</td>
<td>26</td>
<td>90.5</td>
<td>3.5</td>
<td>2.4</td>
<td>3.5</td>
<td>5.9</td>
<td>9.5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2012</td>
<td>35</td>
<td>91.7</td>
<td>3.9</td>
<td>3.5</td>
<td>0.9</td>
<td>4.4</td>
<td>8.3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2013</td>
<td>35</td>
<td>93.4</td>
<td>3.2</td>
<td>2.5</td>
<td>0.7</td>
<td>3.2</td>
<td>6.4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2014</td>
<td>8</td>
<td>97.0</td>
<td>1.2</td>
<td>0.1</td>
<td>1.6</td>
<td>1.8</td>
<td>3.0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2015</td>
<td>25</td>
<td>89.9</td>
<td>6.0</td>
<td>2.6</td>
<td>1.5</td>
<td>4.1</td>
<td>10.1</td>
<td></td>
</tr>
<tr>
<td>2016</td>
<td>30</td>
<td>93.5</td>
<td>2.2</td>
<td>3.5</td>
<td>0.8</td>
<td>4.3</td>
<td>6.5</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*S. susceptible; I. intermediate; R. resistant*
Table 10. EQAS participants’ performance of antimicrobial susceptibility testing of quality control strain *Escherichia coli* ATCC 25922

| EQAS iteration | Method | Performance | MIC (μg/ml) | Amp | CAZ | CHL | CIP | CRO | CTX | FIS (SMX)² | FOX | GEN | MER | NAL | STR | SXT | TET | TMP |
|----------------|--------|-------------|-------------|-----|-----|-----|-----|-----|-----|-----------|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 2000 (44)      | MIC & Disk | No.⁴ | 37 | 38 | 35 | - | - | 19 | - | - | 39 | - | 23 | - | - | - | - | 42 | 31 |
|                |        | Disk (102) | 128 | 100 | 121 | 124 | 88 | 107 | 63 | 123 | 128 | 124 | 120 | 97 | 107 | 117 | 67 |
| 2001 (107)     | MIC & Disk | No.⁴ | 97 | 97 | 97 | - | - | 19 | - | - | 39 | - | 23 | - | - | - | - | 42 | 31 |
|                |        | Disk (89) | 111 | 97 | 98 | 98 | 68 | 87 | 49 | 98 | 99 | 97 | 98 | 97 | 92 | 95 | 55 |
| 2002 (114)     | MIC & Disk | No.⁴ | 9 | 15 | 14 | - | - | 33 | - | - | 33 | - | 13 | - | - | - | - | 42 | 31 |
|                |        | Disk (89) | 111 | 97 | 98 | 98 | 68 | 87 | 49 | 98 | 99 | 97 | 98 | 97 | 92 | 95 | 55 |
| 2003 (144)     | MIC & Disk | No.⁴ | 14 | 22 | 9 | - | - | 33 | - | - | 33 | - | 13 | - | - | - | - | 42 | 31 |
|                |        | Disk (89) | 111 | 97 | 98 | 98 | 68 | 87 | 49 | 98 | 99 | 97 | 98 | 97 | 92 | 95 | 55 |
| 2004 (140)     | MIC & Disk | No.⁴ | 10 | 15 | 8 | - | - | 19 | - | - | 39 | - | 23 | - | - | - | - | 42 | 31 |
|                |        | Disk (89) | 111 | 97 | 98 | 98 | 68 | 87 | 49 | 98 | 99 | 97 | 98 | 97 | 92 | 95 | 55 |
| 2005 (137)     | MIC & Disk | No.⁴ | 133 | 96 | 126 | 127 | - | 115 | 74 | - | 131 | - | 122 | 106 | 122 | 125 | 74 |
|                |        | Disk (89) | 111 | 97 | 98 | 98 | 68 | 87 | 49 | 98 | 99 | 97 | 98 | 97 | 92 | 95 | 55 |
| 2006 (122)     | MIC & Disk | No.⁴ | 14 | 22 | 9 | - | - | 33 | - | - | 33 | - | 13 | - | - | - | - | 42 | 31 |
|                |        | Disk (89) | 111 | 97 | 98 | 98 | 68 | 87 | 49 | 98 | 99 | 97 | 98 | 97 | 92 | 95 | 55 |
| 2007 (129)     | MIC & Disk | No.⁴ | 14 | 22 | 9 | - | - | 33 | - | - | 33 | - | 13 | - | - | - | - | 42 | 31 |
|                |        | Disk (89) | 111 | 97 | 98 | 98 | 68 | 87 | 49 | 98 | 99 | 97 | 98 | 97 | 92 | 95 | 55 |
| 2008 (147)     | MIC & Disk | No.⁴ | 14 | 22 | 9 | - | - | 33 | - | - | 33 | - | 13 | - | - | - | - | 42 | 31 |
|                |        | Disk (89) | 111 | 97 | 98 | 98 | 68 | 87 | 49 | 98 | 99 | 97 | 98 | 97 | 92 | 95 | 55 |
| 2009 (129)     | MIC & Disk | No.⁴ | 14 | 22 | 9 | - | - | 33 | - | - | 33 | - | 13 | - | - | - | - | 42 | 31 |
|                |        | Disk (89) | 111 | 97 | 98 | 98 | 68 | 87 | 49 | 98 | 99 | 97 | 98 | 97 | 92 | 95 | 55 |
| 2010 (116)     | MIC & Disk | No.⁴ | 14 | 22 | 9 | - | - | 33 | - | - | 33 | - | 13 | - | - | - | - | 42 | 31 |
|                |        | Disk (89) | 111 | 97 | 98 | 98 | 68 | 87 | 49 | 98 | 99 | 97 | 98 | 97 | 92 | 95 | 55 |
| 2011 (112)     | MIC & Disk | No.⁴ | 14 | 22 | 9 | - | - | 33 | - | - | 33 | - | 13 | - | - | - | - | 42 | 31 |
|                |        | Disk (89) | 111 | 97 | 98 | 98 | 68 | 87 | 49 | 98 | 99 | 97 | 98 | 97 | 92 | 95 | 55 |

Appendix 1 – Figure and Tables, page 18 of 38
<table>
<thead>
<tr>
<th>Method</th>
<th>MIC (µg/ml)</th>
<th>Amp</th>
<th>CAZ</th>
<th>CHL</th>
<th>CIP</th>
<th>CRO</th>
<th>CTX</th>
<th>FIS</th>
<th>FOX</th>
<th>GEN</th>
<th>MER</th>
<th>NAL</th>
<th>STR</th>
<th>SXT</th>
<th>TET</th>
<th>TMP</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>AMP</td>
<td>CAZ</td>
<td>CHL</td>
<td>SMX</td>
<td>FIS</td>
<td>FIS</td>
<td>FIS</td>
<td>FIS</td>
<td>FIS</td>
<td>FIS</td>
<td>FIS</td>
<td>FIS</td>
<td>FIS</td>
<td>FIS</td>
<td>FIS</td>
</tr>
<tr>
<td>2012 (155)</td>
<td></td>
<td>&amp; Disk</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2013</td>
<td></td>
<td>134</td>
<td>111</td>
<td>121</td>
<td>131</td>
<td>90</td>
<td>115</td>
<td>53</td>
<td>-</td>
<td>127</td>
<td>-</td>
<td>121</td>
<td>89</td>
<td>112</td>
<td>129</td>
<td>66</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2014</td>
<td></td>
<td>107</td>
<td>112</td>
<td>119</td>
<td>82</td>
<td>107</td>
<td>44</td>
<td>-</td>
<td>113</td>
<td>-</td>
<td>113</td>
<td>-</td>
<td>101</td>
<td>114</td>
<td>59</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2015</td>
<td></td>
<td>86</td>
<td>75</td>
<td>84</td>
<td>87</td>
<td>63</td>
<td>80</td>
<td>27</td>
<td>-</td>
<td>81</td>
<td>-</td>
<td>85</td>
<td>-</td>
<td>79</td>
<td>82</td>
<td>37</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2016 (106)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 11. *Shigella* serotypes (ST) and deviations (D). WHO EQAS 2016

<table>
<thead>
<tr>
<th>Strain</th>
<th>Correct serotype</th>
<th>No. of labs reporting correct identification</th>
<th>D (%)</th>
<th>Deviating results</th>
<th>No. of labs reporting correct ST</th>
<th>D (%)</th>
<th>Deviating results (*)</th>
</tr>
</thead>
<tbody>
<tr>
<td>WHO 2016 SH-16.1</td>
<td><em>S. flexneri</em> 1b</td>
<td>120</td>
<td>1.6</td>
<td>2</td>
<td>77</td>
<td>36.9</td>
<td>6</td>
</tr>
<tr>
<td>WHO 2016 SH-16.2</td>
<td><em>S. boydii</em> 4</td>
<td>117</td>
<td>4.9</td>
<td>6</td>
<td>70</td>
<td>43.1</td>
<td>1(2), 2, 9</td>
</tr>
<tr>
<td>WHO 2016 SH-16.3</td>
<td><em>S. flexneri</em> 2b</td>
<td>121</td>
<td>1.6</td>
<td>2</td>
<td>75</td>
<td>39.0</td>
<td></td>
</tr>
<tr>
<td>WHO 2016 SH-16.4</td>
<td><em>S. flexneri</em> 3a</td>
<td>123</td>
<td>0.0</td>
<td>0</td>
<td>71</td>
<td>42.3</td>
<td>6(2)</td>
</tr>
</tbody>
</table>

*number of participants reporting deviating result
Table 12. Region-based categorization of laboratories performing *Shigella* serotyping in 2016

<table>
<thead>
<tr>
<th>Region</th>
<th>Year</th>
<th>No. of laboratories</th>
<th>No. of strains serotyped</th>
<th>Strains serotyped correctly (%)</th>
<th>Countries participating in the 2016 iteration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Africa</td>
<td>2009</td>
<td>8</td>
<td>18</td>
<td>72.2</td>
<td>Ivory Coast, Kenya, Mauritius, Senegal, South Africa, Zimbabwe</td>
</tr>
<tr>
<td></td>
<td>2010</td>
<td>7</td>
<td>16</td>
<td>62.5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2011</td>
<td>4</td>
<td>10</td>
<td>100.0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2012</td>
<td>5</td>
<td>18</td>
<td>90.0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2013</td>
<td>5</td>
<td>8</td>
<td>62.5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2014</td>
<td>6</td>
<td>9</td>
<td>55.6</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2015</td>
<td>8</td>
<td>22</td>
<td>68.2</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>2016</strong></td>
<td><strong>6</strong></td>
<td><strong>13</strong></td>
<td><strong>69.2</strong></td>
<td></td>
</tr>
<tr>
<td>Central Asia &amp; Middle East</td>
<td>2009</td>
<td>3</td>
<td>5</td>
<td>100.0</td>
<td>Bahrain, India (2), Iraq, Israel, Oman</td>
</tr>
<tr>
<td></td>
<td>2010</td>
<td>3</td>
<td>6</td>
<td>83.3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2011</td>
<td>2</td>
<td>6</td>
<td>100.0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2012</td>
<td>3</td>
<td>9</td>
<td>81.8</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2013</td>
<td>4</td>
<td>8</td>
<td>100.0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2014</td>
<td>5</td>
<td>10</td>
<td>80.0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2015</td>
<td>6</td>
<td>24</td>
<td>100.0</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>2016</strong></td>
<td><strong>6</strong></td>
<td><strong>22</strong></td>
<td><strong>90.9</strong></td>
<td></td>
</tr>
<tr>
<td>China</td>
<td>2009</td>
<td>13</td>
<td>35</td>
<td>100.0</td>
<td>China (17)</td>
</tr>
<tr>
<td></td>
<td>2010</td>
<td>9</td>
<td>23</td>
<td>91.3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2011</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2012</td>
<td>8</td>
<td>29</td>
<td>90.6</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2013</td>
<td>6</td>
<td>11</td>
<td>100.0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2014</td>
<td>9</td>
<td>18</td>
<td>94.4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2015</td>
<td>14</td>
<td>55</td>
<td>87.3</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>2016</strong></td>
<td><strong>17</strong></td>
<td><strong>68</strong></td>
<td><strong>91.2</strong></td>
<td></td>
</tr>
<tr>
<td>Caribbean</td>
<td>2009</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>- none -</td>
</tr>
<tr>
<td></td>
<td>2010</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2011</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2012</td>
<td>1</td>
<td>1</td>
<td>33.3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2013</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2014</td>
<td>1</td>
<td>1</td>
<td>0.0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2015</td>
<td>1</td>
<td>3</td>
<td>100.0</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>2016</strong></td>
<td><strong>1</strong></td>
<td><strong>3</strong></td>
<td><strong>0.0</strong></td>
<td></td>
</tr>
<tr>
<td>Europe</td>
<td>2009</td>
<td>15</td>
<td>40</td>
<td>92.5</td>
<td>Belgium, Bulgaria, Czech Republic, Germany (2), Greece, Ireland, Luxembourg, Malta, Norway, Portugal, Serbia (2), Slovenia, Spain, Sweden, Turkey, Ukraine, United Kingdom</td>
</tr>
<tr>
<td></td>
<td>2010</td>
<td>15</td>
<td>35</td>
<td>85.7</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2011</td>
<td>16</td>
<td>42</td>
<td>92.9</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2012</td>
<td>19</td>
<td>63</td>
<td>86.3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2013</td>
<td>18</td>
<td>31</td>
<td>96.8</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2014</td>
<td>20</td>
<td>36</td>
<td>86.1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2015</td>
<td>21</td>
<td>74</td>
<td>93.2</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>2016</strong></td>
<td><strong>19</strong></td>
<td><strong>73</strong></td>
<td><strong>91.8</strong></td>
<td></td>
</tr>
</tbody>
</table>
Table 12 (continued). Region-based categorization of laboratories performing *Shigella* serotyping in 2016

<table>
<thead>
<tr>
<th>Region</th>
<th>Year</th>
<th>No. of laboratories</th>
<th>No. of strains serotyped</th>
<th>Strains serotyped correctly (%)</th>
<th>Countries participating in the 2016 iteration</th>
</tr>
</thead>
<tbody>
<tr>
<td>North America</td>
<td>2009</td>
<td>7</td>
<td>18</td>
<td>100.0</td>
<td>Canada (5), United States of America (2)</td>
</tr>
<tr>
<td></td>
<td>2010</td>
<td>7</td>
<td>20</td>
<td>100.0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2011</td>
<td>6</td>
<td>16</td>
<td>100.0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2012</td>
<td>8</td>
<td>25</td>
<td>80.6</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2013</td>
<td>8</td>
<td>14</td>
<td>100.0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2014</td>
<td>6</td>
<td>11</td>
<td>100.0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2015</td>
<td>7</td>
<td>26</td>
<td>100.0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2016</td>
<td>7</td>
<td>25</td>
<td>92.0</td>
<td></td>
</tr>
<tr>
<td>Oceania</td>
<td>2009</td>
<td>3</td>
<td>8</td>
<td>100.0</td>
<td>Australia (3), New Zealand</td>
</tr>
<tr>
<td></td>
<td>2010</td>
<td>3</td>
<td>8</td>
<td>100.0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2011</td>
<td>3</td>
<td>8</td>
<td>100.0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2012</td>
<td>3</td>
<td>12</td>
<td>100.0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2013</td>
<td>4</td>
<td>10</td>
<td>100.0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2014</td>
<td>4</td>
<td>7</td>
<td>100.0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2015</td>
<td>4</td>
<td>15</td>
<td>86.7</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2016</td>
<td>4</td>
<td>15</td>
<td>93.3</td>
<td></td>
</tr>
<tr>
<td>Russia</td>
<td>2009</td>
<td>6</td>
<td>18</td>
<td>83.3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2010</td>
<td>7</td>
<td>20</td>
<td>75.0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2011</td>
<td>6</td>
<td>18</td>
<td>88.9</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2012</td>
<td>5</td>
<td>16</td>
<td>80.0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2013</td>
<td>2</td>
<td>4</td>
<td>100.0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2014</td>
<td>3</td>
<td>6</td>
<td>100.0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2015</td>
<td>3</td>
<td>12</td>
<td>100.0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2016</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Latin America</td>
<td>2009</td>
<td>16</td>
<td>40</td>
<td>97.5</td>
<td>Argentina, Brazil (2), Chile (2), Costa Rica, Ecuador (2), Guatemala, Honduras, Mexico (2), Paraguay, Peru, Uruguay, Venezuela (2)</td>
</tr>
<tr>
<td></td>
<td>2010</td>
<td>13</td>
<td>33</td>
<td>78.8</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2011</td>
<td>15</td>
<td>37</td>
<td>94.6</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2012</td>
<td>19</td>
<td>58</td>
<td>89.4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2013</td>
<td>16</td>
<td>30</td>
<td>93.3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2014</td>
<td>17</td>
<td>29</td>
<td>86.2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2015</td>
<td>13</td>
<td>45</td>
<td>88.9</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2016</td>
<td>17</td>
<td>62</td>
<td>83.9</td>
<td></td>
</tr>
<tr>
<td>Southeast Asia</td>
<td>2009</td>
<td>11</td>
<td>30</td>
<td>90.0</td>
<td>Japan, Korea, Rep of, LAO PDR, Malaysia (2), Philippines, Sri Lanka, Taiwan, Thailand (5), Viet Nam</td>
</tr>
<tr>
<td></td>
<td>2010</td>
<td>14</td>
<td>32</td>
<td>87.5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2011</td>
<td>13</td>
<td>33</td>
<td>84.8</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2012</td>
<td>14</td>
<td>47</td>
<td>90.4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2013</td>
<td>9</td>
<td>17</td>
<td>100.0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2014</td>
<td>12</td>
<td>22</td>
<td>95.5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2015</td>
<td>14</td>
<td>49</td>
<td>91.8</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2016</td>
<td>14</td>
<td>54</td>
<td>85.2</td>
<td></td>
</tr>
</tbody>
</table>
Table 13. EQAS participating laboratories’ performance of *Shigella* strains antimicrobial susceptibility testing

<table>
<thead>
<tr>
<th>EQAS iteration</th>
<th>No. of participating laboratories</th>
<th>% correct test results</th>
<th>% minor deviations (S ↔ I or I ↔ R)&lt;sup&gt;^&lt;/sup&gt;</th>
<th>% major deviations (S → R)&lt;sup&gt;^&lt;/sup&gt;</th>
<th>% very major deviations (R → S)&lt;sup&gt;^&lt;/sup&gt;</th>
<th>% critical deviations (S → R &amp; R → S)&lt;sup&gt;^&lt;/sup&gt;</th>
<th>% total deviations (S → R &amp; R → S &amp; S ↔ I or I ↔ R)&lt;sup&gt;^&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008</td>
<td>15</td>
<td>95</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>2009</td>
<td>111</td>
<td>96</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>2010</td>
<td>114</td>
<td>91</td>
<td>2</td>
<td>1</td>
<td>6</td>
<td>7</td>
<td>9</td>
</tr>
<tr>
<td>2011</td>
<td>107</td>
<td>92</td>
<td>2</td>
<td>1</td>
<td>4</td>
<td>5</td>
<td>7</td>
</tr>
<tr>
<td>2012</td>
<td>120</td>
<td>91</td>
<td>3</td>
<td>1</td>
<td>5</td>
<td>6</td>
<td>9</td>
</tr>
<tr>
<td>2013</td>
<td>99</td>
<td>91</td>
<td>2</td>
<td>2</td>
<td>4</td>
<td>4</td>
<td>10</td>
</tr>
<tr>
<td>2014</td>
<td>116</td>
<td>92</td>
<td>4</td>
<td>1</td>
<td>3</td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>2015</td>
<td>116</td>
<td>93</td>
<td>4</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>7</td>
</tr>
<tr>
<td>2016</td>
<td>112</td>
<td>96</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>

<sup>^</sup>S. susceptible; I. intermediate; R. resistant
### Table 14. EQAS laboratories’ performance of *Shigella* strains antimicrobial susceptibility testing categorized by antimicrobial

<table>
<thead>
<tr>
<th>EQAS iteration</th>
<th>No. of labs</th>
<th>Lab performance</th>
<th>AMP</th>
<th>CAZ</th>
<th>CHL</th>
<th>CIP</th>
<th>CTX</th>
<th>GEN</th>
<th>MER</th>
<th>NAL</th>
<th>SMX</th>
<th>STR</th>
<th>SXT</th>
<th>TET</th>
<th>TMP</th>
<th>CRO</th>
<th>OVERALL average</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008</td>
<td>15</td>
<td>No. of tests</td>
<td>52</td>
<td>44</td>
<td>51</td>
<td>48</td>
<td>48</td>
<td>50</td>
<td>-</td>
<td>-</td>
<td>52</td>
<td>7</td>
<td>27</td>
<td>52</td>
<td>4</td>
<td>42</td>
<td>529</td>
</tr>
<tr>
<td></td>
<td></td>
<td>% critical deviations*</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>-</td>
<td>2</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>4</td>
<td>2</td>
<td>4</td>
<td>-</td>
<td>2</td>
<td>1.5</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>% total deviations^</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>-</td>
<td>2</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>9</td>
<td>2</td>
<td>8</td>
<td>-</td>
<td>2</td>
<td>2.2</td>
<td></td>
</tr>
<tr>
<td>2009</td>
<td>111</td>
<td>No. of tests</td>
<td>423</td>
<td>358</td>
<td>388</td>
<td>426</td>
<td>372</td>
<td>396</td>
<td>-</td>
<td>388</td>
<td>211</td>
<td>293</td>
<td>388</td>
<td>386</td>
<td>218</td>
<td>301</td>
<td>4548</td>
</tr>
<tr>
<td></td>
<td></td>
<td>% critical deviations*</td>
<td>2.4</td>
<td>0.3</td>
<td>2.1</td>
<td>0.2</td>
<td>1.1</td>
<td>2.5</td>
<td>-</td>
<td>0.5</td>
<td>3.8</td>
<td>5.8</td>
<td>2.3</td>
<td>2.8</td>
<td>1.8</td>
<td>0.3</td>
<td>1.9</td>
</tr>
<tr>
<td></td>
<td></td>
<td>% total deviations^</td>
<td>3.8</td>
<td>0.3</td>
<td>4.6</td>
<td>0.9</td>
<td>1.1</td>
<td>3.5</td>
<td>-</td>
<td>1.5</td>
<td>3.8</td>
<td>18.1</td>
<td>3.6</td>
<td>7.5</td>
<td>1.8</td>
<td>0.6</td>
<td>3.8</td>
</tr>
<tr>
<td>2010</td>
<td>114</td>
<td>No. of tests</td>
<td>424</td>
<td>344</td>
<td>402</td>
<td>434</td>
<td>377</td>
<td>403</td>
<td>-</td>
<td>382</td>
<td>194</td>
<td>275</td>
<td>363</td>
<td>410</td>
<td>218</td>
<td>291</td>
<td>4517</td>
</tr>
<tr>
<td></td>
<td></td>
<td>% critical deviations*</td>
<td>1.7</td>
<td>0.6</td>
<td>3.5</td>
<td>40.8</td>
<td>2.4</td>
<td>3.5</td>
<td>-</td>
<td>2.1</td>
<td>4.6</td>
<td>8.0</td>
<td>8.3</td>
<td>4.4</td>
<td>3.7</td>
<td>0.0</td>
<td>6.4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>% total deviations^</td>
<td>1.9</td>
<td>1.2</td>
<td>9.2</td>
<td>77.9</td>
<td>3.0</td>
<td>5.5</td>
<td>-</td>
<td>3.0</td>
<td>6.0</td>
<td>14.6</td>
<td>13.8</td>
<td>5.9</td>
<td>3.8</td>
<td>0.0</td>
<td>11.2</td>
</tr>
<tr>
<td>2011</td>
<td>107</td>
<td>No. of tests</td>
<td>403</td>
<td>322</td>
<td>353</td>
<td>396</td>
<td>343</td>
<td>359</td>
<td>-</td>
<td>369</td>
<td>179</td>
<td>246</td>
<td>371</td>
<td>376</td>
<td>178</td>
<td>289</td>
<td>4.184</td>
</tr>
<tr>
<td></td>
<td></td>
<td>% critical deviations*</td>
<td>5.5</td>
<td>5.2</td>
<td>2.2</td>
<td>38.9</td>
<td>2.7</td>
<td>3.3</td>
<td>-</td>
<td>4.0</td>
<td>1.7</td>
<td>3.6</td>
<td>3.2</td>
<td>2.7</td>
<td>2.2</td>
<td>2.0</td>
<td>5.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>% total deviations^</td>
<td>7.7</td>
<td>1.0</td>
<td>4.2</td>
<td>40.7</td>
<td>2.7</td>
<td>4.4</td>
<td>-</td>
<td>11.0</td>
<td>1.7</td>
<td>10.5</td>
<td>3.2</td>
<td>3.5</td>
<td>2.2</td>
<td>2.0</td>
<td>7.7</td>
</tr>
<tr>
<td>2012</td>
<td>120</td>
<td>No. of tests</td>
<td>462</td>
<td>376</td>
<td>427</td>
<td>464</td>
<td>400</td>
<td>430</td>
<td>-</td>
<td>442</td>
<td>196</td>
<td>291</td>
<td>396</td>
<td>426</td>
<td>215</td>
<td>337</td>
<td>4862</td>
</tr>
<tr>
<td></td>
<td></td>
<td>% critical deviations*</td>
<td>2.6</td>
<td>0.8</td>
<td>5.6</td>
<td>35.3</td>
<td>2.0</td>
<td>4.9</td>
<td>-</td>
<td>1.6</td>
<td>1.5</td>
<td>9.3</td>
<td>6.3</td>
<td>5.4</td>
<td>1.9</td>
<td>0.9</td>
<td>6.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>% total deviations^</td>
<td>3.9</td>
<td>0.8</td>
<td>11.5</td>
<td>38.6</td>
<td>3.8</td>
<td>6.3</td>
<td>-</td>
<td>3.2</td>
<td>2.0</td>
<td>27.1</td>
<td>8.1</td>
<td>7.5</td>
<td>4.2</td>
<td>2.1</td>
<td>9.2</td>
</tr>
<tr>
<td>2013</td>
<td>99</td>
<td>No. of tests</td>
<td>-</td>
<td>351</td>
<td>379</td>
<td>420</td>
<td>384</td>
<td>392</td>
<td>-</td>
<td>393</td>
<td>164</td>
<td>-</td>
<td>346</td>
<td>392</td>
<td>193</td>
<td>309</td>
<td>3723</td>
</tr>
<tr>
<td></td>
<td></td>
<td>% critical deviations*</td>
<td>-</td>
<td>1.1</td>
<td>2.1</td>
<td>8.3</td>
<td>3.4</td>
<td>2.3</td>
<td>-</td>
<td>3.3</td>
<td>1.8</td>
<td>-</td>
<td>5.8</td>
<td>2.8</td>
<td>3.1</td>
<td>1.0</td>
<td>3.4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>% total deviations^</td>
<td>-</td>
<td>0.3</td>
<td>0.6</td>
<td>2.0</td>
<td>0.9</td>
<td>0.6</td>
<td>-</td>
<td>0.8</td>
<td>1.1</td>
<td>-</td>
<td>1.7</td>
<td>0.7</td>
<td>1.6</td>
<td>0.3</td>
<td>9.5</td>
</tr>
<tr>
<td>2014</td>
<td>116</td>
<td>No. of tests</td>
<td>441</td>
<td>390</td>
<td>386</td>
<td>441</td>
<td>389</td>
<td>424</td>
<td>-</td>
<td>405</td>
<td>188</td>
<td>-</td>
<td>413</td>
<td>398</td>
<td>189</td>
<td>331</td>
<td>4395</td>
</tr>
<tr>
<td></td>
<td></td>
<td>% critical deviations*</td>
<td>2.5</td>
<td>9.7</td>
<td>2.1</td>
<td>7.9</td>
<td>1.3</td>
<td>4.0</td>
<td>-</td>
<td>2.5</td>
<td>4.8</td>
<td>-</td>
<td>3.9</td>
<td>3.5</td>
<td>5.3</td>
<td>2.1</td>
<td>4.1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>% total deviations^</td>
<td>2.9</td>
<td>14.1</td>
<td>3.9</td>
<td>34.2</td>
<td>1.5</td>
<td>5.4</td>
<td>-</td>
<td>5.2</td>
<td>4.8</td>
<td>-</td>
<td>4.1</td>
<td>6.5</td>
<td>6.3</td>
<td>3.9</td>
<td>8.1</td>
</tr>
<tr>
<td>2015</td>
<td>116</td>
<td>No. of tests</td>
<td>441</td>
<td>405</td>
<td>400</td>
<td>448</td>
<td>397</td>
<td>434</td>
<td>296</td>
<td>388</td>
<td>202</td>
<td>-</td>
<td>399</td>
<td>410</td>
<td>222</td>
<td>331</td>
<td>4773</td>
</tr>
<tr>
<td></td>
<td></td>
<td>% critical deviations*</td>
<td>2.0</td>
<td>5.7</td>
<td>4.0</td>
<td>4.5</td>
<td>1.8</td>
<td>0.0</td>
<td>2.3</td>
<td>0.5</td>
<td>-</td>
<td>1.3</td>
<td>3.7</td>
<td>0.5</td>
<td>3.9</td>
<td>2.4</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>% total deviations^</td>
<td>2.7</td>
<td>8.4</td>
<td>10.3</td>
<td>26.6</td>
<td>5.0</td>
<td>3.0</td>
<td>6.4</td>
<td>1.0</td>
<td>-</td>
<td>1.3</td>
<td>6.6</td>
<td>0.5</td>
<td>4.5</td>
<td>5.9</td>
<td>-</td>
</tr>
<tr>
<td>2016</td>
<td>112</td>
<td>No. of tests</td>
<td>418</td>
<td>391</td>
<td>380</td>
<td>310</td>
<td>377</td>
<td>409</td>
<td>340</td>
<td>361</td>
<td>195</td>
<td>-</td>
<td>374</td>
<td>390</td>
<td>224</td>
<td>339</td>
<td>4508</td>
</tr>
<tr>
<td></td>
<td></td>
<td>% critical deviations*</td>
<td>2.6</td>
<td>7.2</td>
<td>2.6</td>
<td>1.0</td>
<td>2.7</td>
<td>2.9</td>
<td>0.3</td>
<td>1.9</td>
<td>4.1</td>
<td>-</td>
<td>1.9</td>
<td>2.3</td>
<td>3.1</td>
<td>2.4</td>
<td>2.7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>% total deviations^</td>
<td>2.9</td>
<td>7.4</td>
<td>7.1</td>
<td>7.1</td>
<td>2.9</td>
<td>4.2</td>
<td>0.3</td>
<td>3.0</td>
<td>4.1</td>
<td>-</td>
<td>2.1</td>
<td>3.3</td>
<td>3.1</td>
<td>2.4</td>
<td>3.9</td>
</tr>
</tbody>
</table>

*For antimicrobial abbreviations: see List of Abbreviations page 1
*R → S & S → R (R. resistant; S. susceptible)
^S→R & R→S & S↔I or I↔R (I. intermediate)
- not determined
Table 15. Antimicrobial susceptibility test results (number of R/I/S) for the EQAS 2016 *Shigella* strains*

| Strain          | AMP  | CTX  | CAZ  | CRO  | CHL  | CIP  | GEN  | MER  | NAL  | SMX  | TET  | SXT  | TMP  |
|-----------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| WHO 2016 SH-16.1 | 98/0/4 | 2/0/90 | 2/0/93 | 1/0/81 | 1/1/91 | 3/1/95 | 0/0/82 | 0/1/86 | 44/0/5 | 92/1/2 | 87/0/3 | 53/0/2 |
| WHO 2016 SH-16.2 | 104/0/2 | 2/0/93 | 4/0/95 | 2/0/84 | 87/7/2 | 0/6/99 | 2/1/100 | 1/0/85 | 2/0/90 | 49/0/0 | 94/1/3 | 93/0/2 | 55/0/2 |
| WHO 2016 SH-16.3 | 102/0/3 | 93/1/1 | 18/0/80 | 84/0/2 | 90/2/4 | * | 3/2/99 | 0/0/87 | 88/1/3 | 48/0/1 | 94/2/3 | 93/1/1 | 53/0/3 |
| WHO 2016 SH-16.4 | 102/1/2 | 5/0/90 | 4/1/94 | 3/0/82 | 85/7/3 | 2/12/90 | 4/1/98 | 0/0/85 | 2/2/86 | 46/0/2 | 96/1/1 | 93/0/1 | 56/0/0 |

*For antimicrobial abbreviations: see List of Abbreviations page 1

In bold: expected interpretation. Grey cell: <90% of laboratories did correct interpretation. R. resistant; I. intermediate; S. susceptible.

* The results obtained from the combination of SH-16.3 and ciprofloxacin, i.e. the obtained interpretation has been disregarded. In the preparatory work for WHO SH-16.3, three independent tests towards ciprofloxacin showed an MIC-value at 1 mg/L and one test showed an MIC-value at 0.5 mg/L, therefore the expected result was set at 1 mg/L interpreted as ‘resistant’. As the results were submitted and approved by the participants, it became clear that the MIC-values reported were lower than expected (consequently, the DD-zones were higher than expected). Following this observation, and 1) knowing that the differences in the obtained MIC-/DD-results could likely be due to expected method variability and 2) as the obtained MIC-/DD-results were found to vary closely around the interpretative criteria, the EQAS organizers have decided to disregard the results obtained from the combination of SH-16.3 and ciprofloxacin, i.e. the obtained interpretation will not be evaluated in neither the individual nor the overall report.
### Table 16. Region-based categorization of EQAS participating laboratories’ performance of antimicrobial susceptibility tests for *Shigella* strains

<table>
<thead>
<tr>
<th>Region</th>
<th>Year</th>
<th>No. of labs</th>
<th>% correct test result</th>
<th>% minor deviations (S↔I or I↔R)^</th>
<th>% major deviations (S→R)^</th>
<th>% very major deviations (R→S)^</th>
<th>% critical deviations (R→S &amp; S→R)^</th>
<th>% total deviations (S→R &amp; R→S &amp; S↔I or I↔R)^</th>
<th>Countries participating in the 2016 iteration</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Africa</strong></td>
<td>2009</td>
<td>17</td>
<td>93.3</td>
<td>2.4</td>
<td>3.5</td>
<td>0.8</td>
<td>4.3</td>
<td>6.8</td>
<td>Cameroun, Congo, Democratic Republic of the, Ivory Coast, Kenya (3), Madagascar, Mauritius, Morocco, Nigeria, Senegal, South Africa, The Gambia (2), Zambia, Zimbabwe</td>
</tr>
<tr>
<td></td>
<td>2010</td>
<td>16</td>
<td>84.8</td>
<td>2.5</td>
<td>2.7</td>
<td>10.0</td>
<td>12.7</td>
<td>15.2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2011</td>
<td>16</td>
<td>86.0</td>
<td>1.8</td>
<td>3.6</td>
<td>8.3</td>
<td>11.9</td>
<td>13.7</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2012</td>
<td>17</td>
<td>82.6</td>
<td>4.2</td>
<td>2.5</td>
<td>10.7</td>
<td>13.2</td>
<td>17.4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2013</td>
<td>14</td>
<td>87.6</td>
<td>7.2</td>
<td>2.5</td>
<td>2.7</td>
<td>5.2</td>
<td>12.4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2014</td>
<td>18</td>
<td>85.3</td>
<td>6.1</td>
<td>2.3</td>
<td>6.4</td>
<td>8.7</td>
<td>14.7</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2015</td>
<td>20</td>
<td>91.7</td>
<td>4.9</td>
<td>1.5</td>
<td>1.9</td>
<td>3.4</td>
<td>8.3</td>
<td></td>
</tr>
<tr>
<td><strong>2016</strong></td>
<td>16</td>
<td>90.3</td>
<td>3.5</td>
<td>1.1</td>
<td>5.1</td>
<td>6.2</td>
<td>9.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Central Asia &amp; Middle East</strong></td>
<td>2009</td>
<td>5</td>
<td>94.8</td>
<td>0.9</td>
<td>3.0</td>
<td>1.3</td>
<td>4.4</td>
<td>5.2</td>
<td>Bahrain, India (4), Iran, Islamic rep. Of (3), Iraq, Israel, Oman</td>
</tr>
<tr>
<td></td>
<td>2010</td>
<td>6</td>
<td>90.6</td>
<td>1.2</td>
<td>1.6</td>
<td>6.7</td>
<td>8.3</td>
<td>9.4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2011</td>
<td>4</td>
<td>92.9</td>
<td>1.6</td>
<td>0.5</td>
<td>4.9</td>
<td>5.4</td>
<td>7.1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2012</td>
<td>6</td>
<td>92.3</td>
<td>4.0</td>
<td>2.0</td>
<td>1.3</td>
<td>3.4</td>
<td>7.4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2013</td>
<td>6</td>
<td>86.9</td>
<td>8.5</td>
<td>3.9</td>
<td>0.8</td>
<td>4.6</td>
<td>13.1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2014</td>
<td>16</td>
<td>85.6</td>
<td>6.7</td>
<td>1.7</td>
<td>6.0</td>
<td>7.7</td>
<td>14.4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2015</td>
<td>13</td>
<td>91.7</td>
<td>5.2</td>
<td>1.6</td>
<td>1.6</td>
<td>3.1</td>
<td>8.3</td>
<td></td>
</tr>
<tr>
<td><strong>2016</strong></td>
<td>11</td>
<td>91.3</td>
<td>1.5</td>
<td>5.1</td>
<td>2.1</td>
<td>7.2</td>
<td>8.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Caribbean</strong></td>
<td>2009</td>
<td>4</td>
<td>95.6</td>
<td>1.5</td>
<td>0.7</td>
<td>2.2</td>
<td>2.9</td>
<td>4.4</td>
<td>Barbados, Jamaica</td>
</tr>
<tr>
<td></td>
<td>2010</td>
<td>4</td>
<td>88.5</td>
<td>1.5</td>
<td>3.8</td>
<td>6.2</td>
<td>10.0</td>
<td>11.5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2011</td>
<td>1</td>
<td>97.7</td>
<td>2.3</td>
<td>0.0</td>
<td>0.0</td>
<td>2.3</td>
<td>2.3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2012</td>
<td>3</td>
<td>84.6</td>
<td>1.9</td>
<td>7.7</td>
<td>5.8</td>
<td>13.5</td>
<td>15.4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2013</td>
<td>2</td>
<td>87.5</td>
<td>9.4</td>
<td>0.0</td>
<td>3.1</td>
<td>3.1</td>
<td>12.5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2014</td>
<td>3</td>
<td>76.5</td>
<td>5.1</td>
<td>7.1</td>
<td>11.2</td>
<td>18.4</td>
<td>23.5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2015</td>
<td>4</td>
<td>90.7</td>
<td>6.4</td>
<td>2.9</td>
<td>0.0</td>
<td>2.9</td>
<td>9.3</td>
<td></td>
</tr>
<tr>
<td><strong>2016</strong></td>
<td>2</td>
<td>98.4</td>
<td>0.0</td>
<td>1.6</td>
<td>0.0</td>
<td>1.6</td>
<td>1.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Europe</strong></td>
<td>2009</td>
<td>22</td>
<td>98.1</td>
<td>1.1</td>
<td>0.7</td>
<td>0.1</td>
<td>0.8</td>
<td>1.9</td>
<td>Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Greece (2), Ireland, Italy (4), Luxembourg, Malta, Norway, Poland, Portugal, Serbia (2), Spain, Turkey, Ukraine, United Kingdom</td>
</tr>
<tr>
<td></td>
<td>2010</td>
<td>27</td>
<td>93.6</td>
<td>1.5</td>
<td>0.9</td>
<td>3.9</td>
<td>4.8</td>
<td>6.4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2011</td>
<td>24</td>
<td>94.8</td>
<td>2.2</td>
<td>0.5</td>
<td>2.5</td>
<td>3.0</td>
<td>5.1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2012</td>
<td>24</td>
<td>96.6</td>
<td>1.7</td>
<td>0.4</td>
<td>1.4</td>
<td>1.7</td>
<td>3.4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2013</td>
<td>23</td>
<td>93.6</td>
<td>4.8</td>
<td>1.2</td>
<td>0.3</td>
<td>1.5</td>
<td>6.4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2014</td>
<td>26</td>
<td>96.0</td>
<td>3.2</td>
<td>0.1</td>
<td>0.7</td>
<td>0.8</td>
<td>4.0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2015</td>
<td>25</td>
<td>95.2</td>
<td>3.7</td>
<td>0.4</td>
<td>0.8</td>
<td>1.1</td>
<td>4.8</td>
<td></td>
</tr>
<tr>
<td><strong>2016</strong></td>
<td>23</td>
<td>98.2</td>
<td>0.8</td>
<td>0.6</td>
<td>0.5</td>
<td>1.0</td>
<td>1.8</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Table 16 (continued) Region-based categorization of EQAS participating laboratories’ performance of antimicrobial susceptibility tests for *Shigella* strains

| Region       | Year | No. of labs | % correct test result | % minor deviations (S↔I or I↔R)^ | % major deviations (S→R)^ | % very major deviations (R→ S & S → R)^ | % critical deviations (R→ S & S → I or I↔R)^ | % total deviations (S→R & R→S & S↔I or I↔R)^ | Countries participating in the 2016 iteration |
|--------------|------|-------------|-----------------------|---------------------------------|---------------------------|------------------------------------------|-----------------------------------------------|---------------------------------------------|
| North America | 2009 | 6           | 100.0                 | 0.0                             | 0.0                       | 0.0                                      | 0.0                                           | 0.0                                         |
|              | 2010 | 7           | 95.0                  | 0.0                             | 0.0                       | 5.0                                      | 5.0                                           | 5.0                                         |
|              | 2011 | 4           | 90.1                  | 0.7                             | 3.3                       | 5.9                                      | 9.2                                           | 9.9                                         |
|              | 2012 | 6           | 89.5                  | 0.0                             | 2.1                       | 8.4                                      | 10.5                                          | 10.5                                        |
|              | 2013 | 4           | 95.2                  | 3.2                             | 0.0                       | 1.6                                      | 1.6                                           | 4.8                                         |
|              | 2014 | 3           | 95.4                  | 2.8                             | 0.0                       | 1.9                                      | 1.9                                           | 4.6                                         |
|              | 2015 | 4           | 96.2                  | 3.8                             | 0.0                       | 0.0                                      | 0.0                                           | 3.8                                         |
|              | 2016 | 4           | **98.7**              | **0.7**                         | **0.7**                   | **0.0**                                  | **0.7**                                       | **1.3**                                     |
| Oceania      | 2009 | -           | -                     | -                               | -                         | -                                        | -                                             | -                                           |
|              | 2010 | 1           | 90.0                  | 10.0                            | 0.0                       | 0.0                                      | 0.0                                           | 10.0                                        |
|              | 2011 | 1           | 92.5                  | 5.0                             | 0.0                       | 2.5                                      | 2.5                                           | 7.5                                         |
|              | 2012 | 1           | 90.0                  | 7.5                             | 0.0                       | 2.5                                      | 2.5                                           | 10.0                                        |
|              | 2013 | 1           | 95.5                  | 4.5                             | 0.0                       | 0.0                                      | 0.0                                           | 4.5                                         |
|              | 2014 | 2           | 96.2                  | 3.8                             | 0.0                       | 0.0                                      | 0.0                                           | 3.8                                         |
|              | 2015 | 2           | 95.7                  | 2.9                             | 1.4                       | 0.0                                      | 1.4                                           | 4.3                                         |
|              | 2016 | 2           | **98.6**              | **0.0**                         | **1.4**                   | **0.0**                                  | **1.4**                                       | **1.4**                                     |
| Russia       | 2009 | 6           | 95.5                  | 1.6                             | 1.6                       | 1.3                                      | 2.9                                           | 4.6                                         |
|              | 2010 | 7           | 92.1                  | 2.9                             | 1.5                       | 3.5                                      | 5.0                                           | 7.9                                         |
|              | 2011 | 6           | 94.4                  | 3.6                             | 0.0                       | 2.0                                      | 2.0                                           | 5.6                                         |
|              | 2012 | 5           | 96.8                  | 1.4                             | 0.5                       | 1.4                                      | 1.8                                           | 3.2                                         |
|              | 2013 | 2           | 95.2                  | 4.8                             | 0.0                       | 0.0                                      | 0.0                                           | 4.8                                         |
|              | 2014 | 3           | 98.4                  | 0.8                             | 0.0                       | 0.8                                      | 0.8                                           | 1.6                                         |
|              | 2015 | 3           | 100.0                 | 0.0                             | 0.0                       | 0.0                                      | 0.0                                           | 0.0                                         |
|              | 2016 | -           | -                     | -                               | -                         | -                                        | -                                             | -                                           |
| Latin America| 2009 | 20          | 98.3                  | 1.1                             | 0.4                       | 0.3                                      | 0.7                                           | 1.7                                         |
|              | 2010 | 22          | 92.1                  | 1.3                             | 2.1                       | 4.5                                      | 6.6                                           | 7.9                                         |
|              | 2011 | 20          | 94.0                  | 1.5                             | 1.3                       | 3.2                                      | 4.5                                           | 6.0                                         |
|              | 2012 | 24          | 91.7                  | 1.3                             | 0.6                       | 6.5                                      | 7.1                                           | 8.3                                         |
|              | 2013 | 23          | 94.1                  | 3.9                             | 1.2                       | 0.8                                      | 2.0                                           | 5.9                                         |
|              | 2014 | 23          | 94.4                  | 3.3                             | 0.5                       | 1.9                                      | 2.3                                           | 5.6                                         |
|              | 2015 | 17          | 93.0                  | 3.5                             | 1.3                       | 2.2                                      | 3.5                                           | 7.0                                         |
|              | 2016 | 21          | **98.2**              | **0.4**                         | **0.2**                   | **1.2**                                  | **1.4**                                       | **1.8**                                     |

^S. susceptible; I. intermediate; R. resistant.
Table 16 (continued) Region-based categorization of EQAS participating laboratories’ performance of antimicrobial susceptibility tests for *Shigella* strains

<table>
<thead>
<tr>
<th>Region</th>
<th>Year</th>
<th>No. of labs</th>
<th>% correct test result</th>
<th>% minor deviations (S→I or I↔R)^</th>
<th>% major deviations (S→R)^</th>
<th>% very major deviations (R→S)^</th>
<th>% critical deviations (R→S &amp; S→R)^</th>
<th>% total deviations (S→R &amp; R→S &amp; S↔I or I↔R)^</th>
<th>Countries participating in the 2016 iteration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Southeast Asia</td>
<td>2009</td>
<td>18</td>
<td>94.1</td>
<td>3.9</td>
<td>0.3</td>
<td>1.7</td>
<td>2.0</td>
<td>5.9</td>
<td>Cambodia, Japan, Korea, Rep of, LAO PDR, Malaysia (2), Philippines, Sri Lanka (2), Taiwan, Thailand (5), Viet Nam</td>
</tr>
<tr>
<td></td>
<td>2010</td>
<td>16</td>
<td>90.5</td>
<td>2.4</td>
<td>0.7</td>
<td>6.4</td>
<td>7.1</td>
<td>9.5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2011</td>
<td>19</td>
<td>90.0</td>
<td>2.1</td>
<td>0.8</td>
<td>6.1</td>
<td>6.9</td>
<td>9.0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2012</td>
<td>27</td>
<td>87.1</td>
<td>5.1</td>
<td>1.9</td>
<td>5.6</td>
<td>7.6</td>
<td>12.7</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2013</td>
<td>19</td>
<td>86.2</td>
<td>7.5</td>
<td>2.9</td>
<td>3.1</td>
<td>6.0</td>
<td>13.5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2014</td>
<td>13</td>
<td>92.5</td>
<td>4.0</td>
<td>1.1</td>
<td>2.4</td>
<td>3.5</td>
<td>7.5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2015</td>
<td>15</td>
<td>93.1</td>
<td>4.8</td>
<td>0.8</td>
<td>1.3</td>
<td>2.0</td>
<td>6.9</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>2016</strong></td>
<td><strong>16</strong></td>
<td><strong>96.8</strong></td>
<td><strong>1.5</strong></td>
<td><strong>0.7</strong></td>
<td><strong>1.0</strong></td>
<td><strong>1.8</strong></td>
<td><strong>3.2</strong></td>
<td></td>
</tr>
<tr>
<td>China</td>
<td>2009</td>
<td>12</td>
<td>96.3</td>
<td>2.2</td>
<td>1.0</td>
<td>0.5</td>
<td>1.5</td>
<td>3.7</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2010</td>
<td>8</td>
<td>92.7</td>
<td>1.2</td>
<td>0.6</td>
<td>5.5</td>
<td>6.1</td>
<td>7.3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2011</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2012</td>
<td>7</td>
<td>90.3</td>
<td>2.9</td>
<td>0.0</td>
<td>6.8</td>
<td>6.8</td>
<td>9.7</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2013</td>
<td>5</td>
<td>92.7</td>
<td>3.4</td>
<td>0.4</td>
<td>3.4</td>
<td>3.9</td>
<td>7.3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2014</td>
<td>8</td>
<td>94.6</td>
<td>2.2</td>
<td>0.3</td>
<td>3.0</td>
<td>3.2</td>
<td>5.4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2015</td>
<td>13</td>
<td>92.9</td>
<td>2.2</td>
<td>2.3</td>
<td>2.6</td>
<td>5.0</td>
<td>7.1</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>2016</strong></td>
<td><strong>16</strong></td>
<td><strong>97.1</strong></td>
<td><strong>0.8</strong></td>
<td><strong>1.5</strong></td>
<td><strong>0.6</strong></td>
<td><strong>2.1</strong></td>
<td><strong>2.9</strong></td>
<td></td>
</tr>
</tbody>
</table>

^S. susceptible; I. intermediate; R. resistant.
Table 17. Proportion of laboratories that obtained the expected result. Number (n/N) and percentages of laboratories which correctly detected and confirmed the ESBL-producing *Salmonella* and *Shigella* strains.

<table>
<thead>
<tr>
<th>Isolate no.</th>
<th>Expected interpretation</th>
<th>Confirmatory tests</th>
</tr>
</thead>
<tbody>
<tr>
<td>WHO 2016 S-16.1</td>
<td>No ESBL, AmpC or carbapenemase</td>
<td>-</td>
</tr>
<tr>
<td>WHO 2016 S-16.2</td>
<td>Carbapenemase-phenotype</td>
<td>56/82 (68%)</td>
</tr>
<tr>
<td>WHO 2016 S-16.3</td>
<td>No ESBL, AmpC or carbapenemase</td>
<td>-</td>
</tr>
<tr>
<td>WHO 2016 S-16.4</td>
<td>No ESBL, AmpC or carbapenemase</td>
<td>-</td>
</tr>
<tr>
<td>WHO 2016 S-16.5</td>
<td>No ESBL, AmpC or carbapenemase</td>
<td>-</td>
</tr>
<tr>
<td>WHO 2016 S-16.6</td>
<td>AmpC-phenotype</td>
<td>61/80 (76%)</td>
</tr>
<tr>
<td>WHO 2016 S-16.7</td>
<td>No ESBL, AmpC or carbapenemase</td>
<td>-</td>
</tr>
<tr>
<td>WHO 2016 S-16.8</td>
<td>No ESBL, AmpC or carbapenemase</td>
<td>-</td>
</tr>
<tr>
<td>WHO 2016 SH-16.1</td>
<td>No ESBL, AmpC or carbapenemase</td>
<td>-</td>
</tr>
<tr>
<td>WHO 2016 SH-16.2</td>
<td>No ESBL, AmpC or carbapenemase</td>
<td>-</td>
</tr>
<tr>
<td>WHO 2016 SH-16.3</td>
<td>ESBL-phenotype</td>
<td>72/75 (96%)</td>
</tr>
<tr>
<td>WHO 2016 SH-16.4</td>
<td>No ESBL, AmpC or carbapenemase</td>
<td>-</td>
</tr>
</tbody>
</table>
Table 18. EQAS participating laboratories’ performance of *Campylobacter* strains identification

<table>
<thead>
<tr>
<th>EQAS iteration</th>
<th>No. of labs</th>
<th>Correct species</th>
<th>Strain no.</th>
<th>No. of results submitted</th>
<th>% correct identification</th>
<th>Deviating results (*)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003</td>
<td>97</td>
<td><em>C. jejuni</em></td>
<td># 1</td>
<td>93</td>
<td>88%</td>
<td><em>C. coli</em> (9)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><em>C. lari</em> (3)</td>
</tr>
<tr>
<td></td>
<td>97</td>
<td><em>C. coli</em></td>
<td># 2</td>
<td>93</td>
<td>84%</td>
<td><em>C. jejuni</em> (7)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><em>C. lari</em> (4)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><em>C. upsaliensis</em> (4)</td>
</tr>
<tr>
<td>2004</td>
<td>109</td>
<td><em>C. lari</em></td>
<td># 1</td>
<td>97</td>
<td>79%</td>
<td><em>C. coli</em> (11)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><em>C. jejuni</em> (8)</td>
</tr>
<tr>
<td></td>
<td>109</td>
<td><em>C. jejuni</em></td>
<td># 2</td>
<td>109</td>
<td>87%</td>
<td><em>C. coli</em> (8)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><em>C. lari</em> (4)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><em>C. upsaliensis</em> (2)</td>
</tr>
<tr>
<td>2006</td>
<td>99</td>
<td><em>C. jejuni</em></td>
<td># 1</td>
<td>87</td>
<td>90%</td>
<td><em>C. lari</em> (3)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><em>C. coli</em> (3)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><em>C. upsaliensis</em> (3)</td>
</tr>
<tr>
<td></td>
<td>99</td>
<td><em>C. coli</em></td>
<td># 2</td>
<td>95</td>
<td>65%</td>
<td><em>C. jejuni</em> (19)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><em>C. jejuni</em> (11)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><em>C. upsaliensis</em> (2)</td>
</tr>
<tr>
<td>2007</td>
<td>142</td>
<td><em>C. lari</em></td>
<td># 1</td>
<td>98</td>
<td>74%</td>
<td><em>C. jejuni</em> (10)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><em>C. coli</em> (9)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><em>C. upsaliensis</em> (7)</td>
</tr>
<tr>
<td></td>
<td>142</td>
<td><em>C. coli</em></td>
<td># 2</td>
<td>102</td>
<td>76%</td>
<td><em>C. lari</em> (3)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><em>C. jejuni</em> (20)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><em>C. upsaliensis</em> (2)</td>
</tr>
<tr>
<td>2008</td>
<td>154</td>
<td><em>C. lari</em></td>
<td># 1</td>
<td>109</td>
<td>62%</td>
<td><em>C. coli</em> (14)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><em>C. jejuni</em> (18)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><em>C. upsaliensis</em> (7)</td>
</tr>
<tr>
<td></td>
<td>154</td>
<td><em>C. lari</em></td>
<td># 2</td>
<td>109</td>
<td>62%</td>
<td><em>C. coli</em> (10)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><em>C. jejuni</em> (19)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><em>C. upsaliensis</em> (13)</td>
</tr>
<tr>
<td>2009</td>
<td>131</td>
<td><em>C. coli</em></td>
<td># 1</td>
<td>87</td>
<td>77%</td>
<td><em>C. upsaliensis</em> (10)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><em>C. jejuni</em> (9)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><em>C. lari</em> (1)</td>
</tr>
<tr>
<td></td>
<td>131</td>
<td><em>C. jejuni</em></td>
<td># 2</td>
<td>87</td>
<td>95%</td>
<td><em>C. upsaliensis</em> (3)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><em>C. lari</em> (1)</td>
</tr>
<tr>
<td>2010</td>
<td>130</td>
<td><em>C. jejuni</em></td>
<td># 1</td>
<td>88</td>
<td>92%</td>
<td><em>C. coli</em> (4)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><em>C. lari</em> (3)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><em>C. upsaliensis</em> (1)</td>
</tr>
<tr>
<td></td>
<td>130</td>
<td><em>C. coli</em></td>
<td># 2</td>
<td>84</td>
<td>85%</td>
<td><em>C. jejuni</em> (11)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><em>C. lari</em> (2)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><em>C. upsaliensis</em> (2)</td>
</tr>
<tr>
<td>2011</td>
<td>132</td>
<td><em>C. coli</em></td>
<td># 1</td>
<td>81</td>
<td>59%</td>
<td><em>C. jejuni</em> (19)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><em>C. lari</em> (13)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><em>C. upsaliensis</em> (1)</td>
</tr>
<tr>
<td></td>
<td>132</td>
<td><em>C. coli</em></td>
<td># 2</td>
<td>79</td>
<td>70%</td>
<td><em>C. jejuni</em> (17)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><em>C. lari</em> (5)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><em>C. upsaliensis</em> (2)</td>
</tr>
<tr>
<td>2012</td>
<td>135</td>
<td><em>C. jejuni</em></td>
<td># 1</td>
<td>112</td>
<td>96%</td>
<td><em>C. coli</em> (4)</td>
</tr>
<tr>
<td></td>
<td>135</td>
<td><em>C. jejuni</em></td>
<td># 2</td>
<td>103</td>
<td>85%</td>
<td><em>C. coli</em> (10)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><em>C. lari</em> (5)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><em>C. upsaliensis</em> (1)</td>
</tr>
<tr>
<td>2013</td>
<td>123</td>
<td><em>C. coli</em></td>
<td># 1</td>
<td>95</td>
<td>82%</td>
<td><em>C. jejuni</em> (13)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><em>C. lari</em> (3)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><em>C. upsaliensis</em> (1)</td>
</tr>
<tr>
<td></td>
<td>123</td>
<td><em>C. coli</em></td>
<td># 2</td>
<td>92</td>
<td>84%</td>
<td><em>C. jejuni</em> (9)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><em>C. lari</em> (4)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><em>C. upsaliensis</em> (2)</td>
</tr>
<tr>
<td>2014</td>
<td>101</td>
<td><em>C. coli</em></td>
<td># 2</td>
<td>101</td>
<td>85 %</td>
<td><em>C. jejuni</em> (8)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><em>C. lari</em> (6)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><em>C. upsaliensis</em> (1)</td>
</tr>
<tr>
<td>2015</td>
<td>114</td>
<td><em>C. jejuni</em></td>
<td>#1</td>
<td>112</td>
<td>93 %</td>
<td><em>C. coli</em> (6)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><em>C. lari</em></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><em>C. upsaliensis</em></td>
</tr>
<tr>
<td></td>
<td>114</td>
<td><em>C. coli</em></td>
<td>#2</td>
<td>110</td>
<td>89 %</td>
<td><em>C. jejuni</em> (8)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><em>C. lari</em> (4)</td>
</tr>
<tr>
<td>2016</td>
<td>95</td>
<td><em>C. jejuni</em></td>
<td>#1</td>
<td>94</td>
<td>94 %</td>
<td><em>C. coli</em> (5)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><em>C. lari</em></td>
</tr>
<tr>
<td></td>
<td>95</td>
<td><em>C. coli</em></td>
<td>#2</td>
<td>93</td>
<td>91 %</td>
<td><em>C. jejuni</em> (6)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><em>C. upsaliensis</em> (2)</td>
</tr>
</tbody>
</table>

*number of participants reporting the specified deviating result
Table 19. Region-based categorization of EQAS 2016 participating laboratories’ performance of *Campylobacter* strains identification

<table>
<thead>
<tr>
<th>Region</th>
<th>Year</th>
<th>No. of labs</th>
<th>No. of strains identified</th>
<th>% strains correctly identified</th>
<th>Countries participating in the 2016 iteration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Africa</td>
<td>2009</td>
<td>9</td>
<td>15</td>
<td>53</td>
<td>Egypt, Kenya (2), Mauritius, Senegal, South Africa</td>
</tr>
<tr>
<td></td>
<td>2010</td>
<td>7</td>
<td>13</td>
<td>77</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2011</td>
<td>10</td>
<td>19</td>
<td>32</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2012</td>
<td>9</td>
<td>17</td>
<td>82</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2013</td>
<td>9</td>
<td>17</td>
<td>41</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2014</td>
<td>9</td>
<td>9</td>
<td>67</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2015</td>
<td>12</td>
<td>24</td>
<td>88</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2016</td>
<td>6</td>
<td>12</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>Central Asia &amp; Middle East</td>
<td>2009</td>
<td>14</td>
<td>27</td>
<td>85</td>
<td>Bahrain, Iran, Islamic rep. of, Oman</td>
</tr>
<tr>
<td></td>
<td>2010</td>
<td>13</td>
<td>26</td>
<td>89</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2011</td>
<td>2</td>
<td>4</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2012</td>
<td>11</td>
<td>22</td>
<td>96</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2013</td>
<td>1</td>
<td>8</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2014</td>
<td>7</td>
<td>7</td>
<td>57</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2015</td>
<td>6</td>
<td>12</td>
<td>67</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2016</td>
<td>3</td>
<td>6</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>Caribbean</td>
<td>2009</td>
<td>2</td>
<td>4</td>
<td>100</td>
<td>Barbados</td>
</tr>
<tr>
<td></td>
<td>2010</td>
<td>3</td>
<td>6</td>
<td>67</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2011</td>
<td>1</td>
<td>2</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2012</td>
<td>4</td>
<td>7</td>
<td>57</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2013</td>
<td>2</td>
<td>4</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2014</td>
<td>2</td>
<td>2</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2015</td>
<td>3</td>
<td>6</td>
<td>67</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2016</td>
<td>1</td>
<td>2</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>Europe</td>
<td>2009</td>
<td>29</td>
<td>55</td>
<td>89</td>
<td>Bulgaria, Croatia, Cyprus, Czech Republic (2), Germany, Greece (2), Italy (8), Luxembourg (2), Malta, Poland (2), Portugal, Serbia (2), Slovenia, Spain, Turkey (2)</td>
</tr>
<tr>
<td></td>
<td>2010</td>
<td>29</td>
<td>57</td>
<td>97</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2011</td>
<td>25</td>
<td>48</td>
<td>85</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2012</td>
<td>29</td>
<td>56</td>
<td>95</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2013</td>
<td>26</td>
<td>51</td>
<td>88</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2014</td>
<td>26</td>
<td>26</td>
<td>89</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2015</td>
<td>30</td>
<td>60</td>
<td>93</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2016</td>
<td>28</td>
<td>56</td>
<td>96</td>
<td></td>
</tr>
<tr>
<td>North America</td>
<td>2009</td>
<td>10</td>
<td>19</td>
<td>90</td>
<td>Canada (7), United States of America (3)</td>
</tr>
<tr>
<td></td>
<td>2010</td>
<td>11</td>
<td>22</td>
<td>86</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2011</td>
<td>9</td>
<td>18</td>
<td>78</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2012</td>
<td>13</td>
<td>26</td>
<td>96</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2013</td>
<td>10</td>
<td>18</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2014</td>
<td>10</td>
<td>10</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2015</td>
<td>13</td>
<td>26</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2016</td>
<td>10</td>
<td>20</td>
<td>90</td>
<td></td>
</tr>
<tr>
<td>Oceania</td>
<td>2009</td>
<td>2</td>
<td>4</td>
<td>100</td>
<td>Australia, New Zealand</td>
</tr>
<tr>
<td></td>
<td>2010</td>
<td>2</td>
<td>3</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2011</td>
<td>2</td>
<td>4</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2012</td>
<td>2</td>
<td>4</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2013</td>
<td>2</td>
<td>4</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2014</td>
<td>1</td>
<td>1</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2015</td>
<td>2</td>
<td>4</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2016</td>
<td>2</td>
<td>4</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>
Table 19 (continued). Region-based categorization of EQAS 2016 participating laboratories’ performance of *Campylobacter* strains identification

<table>
<thead>
<tr>
<th>Region</th>
<th>Year</th>
<th>No. of labs</th>
<th>No. of strains identified</th>
<th>% strains correctly identified</th>
<th>Countries participating in the 2016 iteration</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Russia</strong></td>
<td>2009</td>
<td>2</td>
<td>4</td>
<td>100</td>
<td>- none -</td>
</tr>
<tr>
<td></td>
<td>2010</td>
<td>2</td>
<td>4</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2011</td>
<td>2</td>
<td>4</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2012</td>
<td>5</td>
<td>10</td>
<td>80</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2013</td>
<td>1</td>
<td>2</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2014</td>
<td>3</td>
<td>3</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2015</td>
<td>3</td>
<td>6</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2016</td>
<td>0</td>
<td>0</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td><strong>Latin America</strong></td>
<td>2009</td>
<td>14</td>
<td>26</td>
<td>89</td>
<td>Brazil (2), Colombia (2), Costa Rica, Mexico, Panama, Paraguay</td>
</tr>
<tr>
<td></td>
<td>2010</td>
<td>19</td>
<td>37</td>
<td>78</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2011</td>
<td>19</td>
<td>37</td>
<td>49</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2012</td>
<td>22</td>
<td>40</td>
<td>95</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2013</td>
<td>20</td>
<td>36</td>
<td>83</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2014</td>
<td>22</td>
<td>22</td>
<td>86</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2015</td>
<td>15</td>
<td>28</td>
<td>89</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2016</td>
<td>8</td>
<td>13</td>
<td>85</td>
<td></td>
</tr>
<tr>
<td><strong>Southeast Asia</strong></td>
<td>2009</td>
<td>10</td>
<td>20</td>
<td>90</td>
<td>Brunei Darussalam, Cambodia, Japan, Korea, Rep of, LAO PDR, Malaysia (2), Philippines, Sri Lanka, Taiwan, Thailand (7), Viet Nam (2)</td>
</tr>
<tr>
<td></td>
<td>2010</td>
<td>14</td>
<td>27</td>
<td>93</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2011</td>
<td>12</td>
<td>24</td>
<td>67</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2012</td>
<td>17</td>
<td>33</td>
<td>85</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2013</td>
<td>15</td>
<td>28</td>
<td>89</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2014</td>
<td>13</td>
<td>13</td>
<td>92</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2015</td>
<td>16</td>
<td>28</td>
<td>93</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2016</td>
<td>19</td>
<td>38</td>
<td>79</td>
<td></td>
</tr>
<tr>
<td><strong>China</strong></td>
<td>2009</td>
<td>12</td>
<td>24</td>
<td>92</td>
<td>China (18)</td>
</tr>
<tr>
<td></td>
<td>2010</td>
<td>10</td>
<td>20</td>
<td>85</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2011</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2012</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2013</td>
<td>5</td>
<td>10</td>
<td>90</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2014</td>
<td>8</td>
<td>8</td>
<td>75</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2015</td>
<td>14</td>
<td>28</td>
<td>93</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2016</td>
<td>18</td>
<td>36</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

Table 20. EQAS participants’ performance of *Campylobacter* strains antimicrobial susceptibility testing

<table>
<thead>
<tr>
<th>EQAS iteration</th>
<th>No. of labs</th>
<th>% correct test results</th>
<th>% major deviations (S → R)^</th>
<th>% very major deviations (R → S)^</th>
<th>% critical deviations (R → S &amp; S → R)^</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td>25</td>
<td>91.4</td>
<td>4.5</td>
<td>4.1</td>
<td>8.6</td>
</tr>
<tr>
<td>2010</td>
<td>37</td>
<td>91.3</td>
<td>4.2</td>
<td>4.5</td>
<td>8.7</td>
</tr>
<tr>
<td>2011</td>
<td>38</td>
<td>93.8</td>
<td>2.8</td>
<td>3.4</td>
<td>6.2</td>
</tr>
<tr>
<td>2012</td>
<td>47</td>
<td>93.6</td>
<td>5.0</td>
<td>1.5</td>
<td>6.4</td>
</tr>
<tr>
<td>2013</td>
<td>47</td>
<td>92.4</td>
<td>5.0</td>
<td>2.6</td>
<td>7.6</td>
</tr>
<tr>
<td>2014</td>
<td>50</td>
<td>91.2</td>
<td>1.6</td>
<td>7.2</td>
<td>8.8</td>
</tr>
<tr>
<td>2015</td>
<td>56</td>
<td>89.5</td>
<td>5.2</td>
<td>5.2</td>
<td>10.5</td>
</tr>
<tr>
<td>2016</td>
<td>49</td>
<td>91.8</td>
<td>4.2</td>
<td>4.0</td>
<td>8.2</td>
</tr>
</tbody>
</table>

^S. susceptible; R. resistant
Table 21. EQAS participants’ performance of *Campylobacter* antimicrobial susceptibility testing categorized by antimicrobial

<table>
<thead>
<tr>
<th>EQAS iteration</th>
<th>No. of labs</th>
<th>Lab performance</th>
<th>Antimicrobial</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>% critical deviations*</td>
<td>CHL</td>
</tr>
<tr>
<td>2009</td>
<td>25</td>
<td>No. of tests</td>
<td>37</td>
</tr>
<tr>
<td></td>
<td></td>
<td>% critical deviations*</td>
<td>8.1</td>
</tr>
<tr>
<td>2010</td>
<td>37</td>
<td>No. of tests</td>
<td>44</td>
</tr>
<tr>
<td></td>
<td></td>
<td>% critical deviations*</td>
<td>4.5</td>
</tr>
<tr>
<td>2011</td>
<td>38</td>
<td>No. of tests</td>
<td>41</td>
</tr>
<tr>
<td></td>
<td></td>
<td>% critical deviations*</td>
<td>0.0</td>
</tr>
<tr>
<td>2012</td>
<td>47</td>
<td>No. of tests</td>
<td>70</td>
</tr>
<tr>
<td></td>
<td></td>
<td>% critical deviations*</td>
<td>4.3</td>
</tr>
<tr>
<td>2013</td>
<td>47</td>
<td>No. of tests</td>
<td>71</td>
</tr>
<tr>
<td></td>
<td></td>
<td>% critical deviations*</td>
<td>5.6</td>
</tr>
<tr>
<td>2014</td>
<td>50</td>
<td>No. of tests</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>% critical deviations*</td>
<td>-</td>
</tr>
<tr>
<td>2015</td>
<td>56</td>
<td>No. of tests</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>% critical deviations*</td>
<td>-</td>
</tr>
<tr>
<td>2016</td>
<td>49</td>
<td>No. of tests</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>% critical deviations*</td>
<td>-</td>
</tr>
</tbody>
</table>

*^For antimicrobial abbreviations. See List of Abbreviations page 1
*R→ S & S → R (R. resistant; S. susceptible)

Table 22. Antimicrobial susceptibility test results (number of R/S) for the EQAS 2016 *Campylobacter* strains*

<table>
<thead>
<tr>
<th>Strain</th>
<th>CIP</th>
<th>ERY</th>
<th>GEN</th>
<th>NAL</th>
<th>STR</th>
<th>TET</th>
</tr>
</thead>
<tbody>
<tr>
<td>WHO 2016 C-16.1</td>
<td>42/0/4</td>
<td>43/0/3</td>
<td>39/0/2</td>
<td>36/0/4</td>
<td>26/0/6</td>
<td>45/0/1</td>
</tr>
<tr>
<td>WHO 2016 C-16.2</td>
<td>5/0/42</td>
<td>2/0/45</td>
<td>2/0/38</td>
<td>3/0/35</td>
<td>5/0/27</td>
<td>4/0/43</td>
</tr>
</tbody>
</table>

*^For antimicrobial abbreviations. see List of Abbreviations page 1
*In bold: expected interpretation. Grey cell: <90% of laboratories did correct interpretation. R. resistant; S. susceptible
Table 23. Region-based categorization of EQAS 2016 participants’ performance of antimicrobial susceptibility testing of *Campylobacter* strains

<table>
<thead>
<tr>
<th>Region</th>
<th>Year</th>
<th>No. of labs</th>
<th>% correct test result</th>
<th>% major deviations (S → R)^()</th>
<th>% very major deviations (S → R)^()</th>
<th>% critical deviations (R→S &amp; S→R)^()</th>
<th>Countries participating in the 2016 iteration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Africa</td>
<td>2009</td>
<td>2</td>
<td>75.0</td>
<td>10.7</td>
<td>14.3</td>
<td>25.0</td>
<td>- none -</td>
</tr>
<tr>
<td></td>
<td>2010</td>
<td>2</td>
<td>95.2</td>
<td>0.0</td>
<td>4.8</td>
<td>4.8</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2011</td>
<td>7</td>
<td>85.0</td>
<td>3.3</td>
<td>11.7</td>
<td>15.0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2012</td>
<td>4</td>
<td>94.3</td>
<td>0.0</td>
<td>5.7</td>
<td>5.7</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2013</td>
<td>5</td>
<td>90.9</td>
<td>5.5</td>
<td>3.6</td>
<td>9.1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2014</td>
<td>7</td>
<td>51.5</td>
<td>39.4</td>
<td>9.1</td>
<td>48.5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2015</td>
<td>6</td>
<td>71.9</td>
<td>12.5</td>
<td>15.6</td>
<td>28.1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2016</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Central Asia &amp; Middle East</td>
<td>2009</td>
<td>0</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>Iran, Islamic rep. of</td>
</tr>
<tr>
<td></td>
<td>2010</td>
<td>0</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2011</td>
<td>1</td>
<td>75.0</td>
<td>0.0</td>
<td>25.0</td>
<td>25.0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2012</td>
<td>2</td>
<td>93.8</td>
<td>6.3</td>
<td>0.0</td>
<td>6.3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2013</td>
<td>3</td>
<td>93.3</td>
<td>3.3</td>
<td>3.3</td>
<td>6.7</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2014</td>
<td>3</td>
<td>100.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2015</td>
<td>3</td>
<td>97.1</td>
<td>2.9</td>
<td>0.0</td>
<td>2.9</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2016</td>
<td>1</td>
<td>40.0</td>
<td>40.0</td>
<td>20.0</td>
<td>60.0</td>
<td></td>
</tr>
<tr>
<td>China</td>
<td>2009</td>
<td>2</td>
<td>95.2</td>
<td>4.8</td>
<td>0.0</td>
<td>4.8</td>
<td>China (16)</td>
</tr>
<tr>
<td></td>
<td>2010</td>
<td>1</td>
<td>100.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2011</td>
<td>0</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2012</td>
<td>2</td>
<td>88.5</td>
<td>7.7</td>
<td>3.8</td>
<td>11.5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2013</td>
<td>3</td>
<td>95.2</td>
<td>2.4</td>
<td>2.4</td>
<td>4.8</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2014</td>
<td>6</td>
<td>100.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2015</td>
<td>8</td>
<td>86.5</td>
<td>5.2</td>
<td>8.3</td>
<td>13.5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2016</td>
<td>16</td>
<td>88.5</td>
<td>5.2</td>
<td>6.3</td>
<td>11.5</td>
<td></td>
</tr>
<tr>
<td>Caribbean</td>
<td>2009</td>
<td>0</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>Cuba, Jamaica</td>
</tr>
<tr>
<td></td>
<td>2010</td>
<td>0</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2011</td>
<td>0</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2012</td>
<td>1</td>
<td>75.0</td>
<td>25.0</td>
<td>0.0</td>
<td>25.0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2013</td>
<td>1</td>
<td>100.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2014</td>
<td>2</td>
<td>100.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2015</td>
<td>2</td>
<td>73.3</td>
<td>20.0</td>
<td>6.7</td>
<td>26.7</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2016</td>
<td>2</td>
<td>73.3</td>
<td>20.0</td>
<td>6.7</td>
<td>26.7</td>
<td></td>
</tr>
<tr>
<td>Europe</td>
<td>2009</td>
<td>10</td>
<td>94.8</td>
<td>3.0</td>
<td>2.2</td>
<td>5.2</td>
<td>Czech Republic, Greece (2), Italy (3), Luxembourg (2), Malta, Poland, Serbia, Spain, Turkey</td>
</tr>
<tr>
<td></td>
<td>2010</td>
<td>13</td>
<td>100.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2011</td>
<td>11</td>
<td>100.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2012</td>
<td>16</td>
<td>97.3</td>
<td>1.6</td>
<td>1.1</td>
<td>2.7</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2013</td>
<td>16</td>
<td>94.9</td>
<td>3.5</td>
<td>1.5</td>
<td>5.1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2014</td>
<td>16</td>
<td>97.4</td>
<td>1.3</td>
<td>1.3</td>
<td>2.6</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2015</td>
<td>15</td>
<td>97.5</td>
<td>2.5</td>
<td>0.0</td>
<td>2.5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2016</td>
<td>13</td>
<td>94.1</td>
<td>5.0</td>
<td>0.8</td>
<td>5.9</td>
<td></td>
</tr>
<tr>
<td>North America</td>
<td>2009</td>
<td>2</td>
<td>100.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>Canada (3), United States of America (3)</td>
</tr>
<tr>
<td></td>
<td>2010</td>
<td>5</td>
<td>93.8</td>
<td>6.3</td>
<td>0.0</td>
<td>6.3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2011</td>
<td>5</td>
<td>100.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2012</td>
<td>5</td>
<td>100.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2013</td>
<td>3</td>
<td>100.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2014</td>
<td>4</td>
<td>100.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2015</td>
<td>5</td>
<td>97.9</td>
<td>2.1</td>
<td>0.0</td>
<td>2.1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2016</td>
<td>6</td>
<td>100.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td></td>
</tr>
</tbody>
</table>

^S. susceptible; R. resistant
Table 23 (continued). Region-based categorization of EQAS 2016 participants’ performance of antimicrobial susceptibility testing of *Campylobacter* strains

<table>
<thead>
<tr>
<th>Region</th>
<th>Year</th>
<th>No. of labs</th>
<th>% correct test result</th>
<th>% major deviations (S → R)^</th>
<th>% very major deviations (S → R)^</th>
<th>% critical deviations (R→S &amp; S→R)^</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oceania</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2009</td>
<td>0</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>2010</td>
<td>0</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>2011</td>
<td>1</td>
<td>100.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td></td>
<td>2012</td>
<td>0</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>2013</td>
<td>0</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>2014</td>
<td>0</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>2015</td>
<td>1</td>
<td>100.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td></td>
<td>2016</td>
<td>1</td>
<td>100.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Russia</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2009</td>
<td>0</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>2010</td>
<td>1</td>
<td>78.6</td>
<td>7.1</td>
<td>14.3</td>
<td>21.4</td>
</tr>
<tr>
<td></td>
<td>2011</td>
<td>1</td>
<td>100.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td></td>
<td>2012</td>
<td>0</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>2013</td>
<td>0</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>2014</td>
<td>0</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>2015</td>
<td>0</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>2016</td>
<td>0</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Latin America</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2009</td>
<td>5</td>
<td>93.2</td>
<td>6.8</td>
<td>0.0</td>
<td>6.8</td>
</tr>
<tr>
<td></td>
<td>2010</td>
<td>8</td>
<td>89.6</td>
<td>6.0</td>
<td>4.5</td>
<td>10.4</td>
</tr>
<tr>
<td></td>
<td>2011</td>
<td>7</td>
<td>96.8</td>
<td>0.0</td>
<td>3.2</td>
<td>3.2</td>
</tr>
<tr>
<td></td>
<td>2012</td>
<td>7</td>
<td>95.2</td>
<td>3.2</td>
<td>1.6</td>
<td>4.8</td>
</tr>
<tr>
<td></td>
<td>2013</td>
<td>7</td>
<td>92.4</td>
<td>4.5</td>
<td>3.0</td>
<td>7.6</td>
</tr>
<tr>
<td></td>
<td>2014</td>
<td>6</td>
<td>100.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td></td>
<td>2015</td>
<td>8</td>
<td>93.1</td>
<td>4.2</td>
<td>2.8</td>
<td>6.9</td>
</tr>
<tr>
<td></td>
<td>2016</td>
<td>3</td>
<td>84.2</td>
<td>0.0</td>
<td>15.8</td>
<td>15.8</td>
</tr>
<tr>
<td>Southeast Asia</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2009</td>
<td>4</td>
<td>84.4</td>
<td>4.4</td>
<td>11.1</td>
<td>15.6</td>
</tr>
<tr>
<td></td>
<td>2010</td>
<td>7</td>
<td>77.2</td>
<td>9.8</td>
<td>13.0</td>
<td>22.9</td>
</tr>
<tr>
<td></td>
<td>2011</td>
<td>5</td>
<td>85.1</td>
<td>9.0</td>
<td>6.0</td>
<td>14.0</td>
</tr>
<tr>
<td></td>
<td>2012</td>
<td>10</td>
<td>85.8</td>
<td>13.3</td>
<td>0.9</td>
<td>14.2</td>
</tr>
<tr>
<td></td>
<td>2013</td>
<td>9</td>
<td>84.8</td>
<td>10.7</td>
<td>4.5</td>
<td>15.2</td>
</tr>
<tr>
<td></td>
<td>2014</td>
<td>6</td>
<td>87.5</td>
<td>12.5</td>
<td>0.0</td>
<td>12.5</td>
</tr>
<tr>
<td></td>
<td>2015</td>
<td>8</td>
<td>82.9</td>
<td>6.1</td>
<td>11.0</td>
<td>17.1</td>
</tr>
<tr>
<td></td>
<td>2016</td>
<td>9</td>
<td>96.9</td>
<td>0.0</td>
<td>3.1</td>
<td>3.1</td>
</tr>
</tbody>
</table>

^S. susceptible; R. resistant
Table 24. EQAS participants’ performance of antimicrobial susceptibility testing of *Campylobacter jejuni* ATCC 33560

<table>
<thead>
<tr>
<th>Method used</th>
<th>Incubation conditions</th>
<th>Labs’ performance&lt;sup&gt;1,2&lt;/sup&gt;</th>
<th>Antimicrobial&lt;sup&gt;3&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>No.&lt;sup&gt;1&lt;/sup&gt;</td>
<td>CHL</td>
</tr>
<tr>
<td>EQAS 2010</td>
<td>Microdilution</td>
<td>42°C / 24h</td>
<td>3</td>
</tr>
<tr>
<td>(N=20)</td>
<td></td>
<td>%&lt;sup&gt;2&lt;/sup&gt;</td>
<td>67</td>
</tr>
<tr>
<td></td>
<td></td>
<td>36-37°C / 48h</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>%&lt;sup&gt;2&lt;/sup&gt;</td>
<td>80</td>
</tr>
<tr>
<td>EQAS 2011</td>
<td>Agardilution</td>
<td>42°C / 24h</td>
<td>-</td>
</tr>
<tr>
<td>(N=26)</td>
<td></td>
<td>%&lt;sup&gt;2&lt;/sup&gt;</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>36-37°C / 48h</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>%&lt;sup&gt;2&lt;/sup&gt;</td>
<td>-</td>
</tr>
<tr>
<td>Overall</td>
<td></td>
<td>No.&lt;sup&gt;1&lt;/sup&gt;</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td></td>
<td>%&lt;sup&gt;2&lt;/sup&gt;</td>
<td>75</td>
</tr>
<tr>
<td>EQAS 2012</td>
<td>Microdilution</td>
<td>42°C / 24h</td>
<td>4</td>
</tr>
<tr>
<td>(N=34)</td>
<td></td>
<td>%&lt;sup&gt;2&lt;/sup&gt;</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td></td>
<td>36-37°C / 48h</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>%&lt;sup&gt;2&lt;/sup&gt;</td>
<td>83</td>
</tr>
<tr>
<td>EQAS 2012</td>
<td>Agardilution</td>
<td>42°C / 24h</td>
<td>-</td>
</tr>
<tr>
<td>(N=34)</td>
<td></td>
<td>%&lt;sup&gt;2&lt;/sup&gt;</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>36-37°C / 48h</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>%&lt;sup&gt;2&lt;/sup&gt;</td>
<td>-</td>
</tr>
<tr>
<td>Overall</td>
<td></td>
<td>No.&lt;sup&gt;1&lt;/sup&gt;</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td></td>
<td>%&lt;sup&gt;2&lt;/sup&gt;</td>
<td>90</td>
</tr>
<tr>
<td></td>
<td>Microdilution</td>
<td>42°C / 24h</td>
<td>9</td>
</tr>
<tr>
<td>EQAS 2012</td>
<td></td>
<td>%&lt;sup&gt;2&lt;/sup&gt;</td>
<td>67</td>
</tr>
<tr>
<td>(N=34)</td>
<td></td>
<td>36-37°C / 48h</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>%&lt;sup&gt;2&lt;/sup&gt;</td>
<td>100</td>
</tr>
<tr>
<td>EQAS 2012</td>
<td>Agardilution</td>
<td>42°C / 24h</td>
<td>-</td>
</tr>
<tr>
<td>(N=34)</td>
<td></td>
<td>%&lt;sup&gt;2&lt;/sup&gt;</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>36-37°C / 48h</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>%&lt;sup&gt;2&lt;/sup&gt;</td>
<td>-</td>
</tr>
<tr>
<td>Overall</td>
<td></td>
<td>No.&lt;sup&gt;1&lt;/sup&gt;</td>
<td>34</td>
</tr>
<tr>
<td></td>
<td></td>
<td>%&lt;sup&gt;2&lt;/sup&gt;</td>
<td>82</td>
</tr>
</tbody>
</table>

<sup>1</sup>No., number of labs performing the analysis, <sup>2</sup>%, percentage of labs reporting correct results, <sup>3</sup>For antimicrobial abbreviations: see List of Abbreviations page 1, - not determined
Table 24 (continued). EQAS participants’ performance of antimicrobial susceptibility testing of *Campylobacter jejuni* ATCC 33560

<table>
<thead>
<tr>
<th>Method used</th>
<th>Incubation conditions</th>
<th>Labs’ performance&lt;sup&gt;1, 2&lt;/sup&gt;</th>
<th>Antimicrobial&lt;sup&gt;3&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>No.</td>
<td>CHL</td>
</tr>
<tr>
<td>EQAS 2013 (N=47)</td>
<td>Microdilution</td>
<td>42°C / 24h</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>%&lt;sup&gt;2&lt;/sup&gt;</td>
<td>83</td>
</tr>
<tr>
<td></td>
<td>Agardilution</td>
<td>42°C / 24h</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td></td>
<td>%&lt;sup&gt;2&lt;/sup&gt;</td>
<td>88</td>
</tr>
<tr>
<td></td>
<td></td>
<td>No.</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>%&lt;sup&gt;2&lt;/sup&gt;</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>No.</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td></td>
<td>%&lt;sup&gt;2&lt;/sup&gt;</td>
<td>86</td>
</tr>
<tr>
<td>Overall</td>
<td>Microdilution</td>
<td>42°C / 24h</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Agardilution</td>
<td>42°C / 24h</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>%&lt;sup&gt;2&lt;/sup&gt;</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>No.</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>%&lt;sup&gt;2&lt;/sup&gt;</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>No.</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>%&lt;sup&gt;2&lt;/sup&gt;</td>
<td>-</td>
</tr>
<tr>
<td>Overall</td>
<td>Microdilution</td>
<td>42°C / 24h</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Agardilution</td>
<td>42°C / 24h</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>%&lt;sup&gt;2&lt;/sup&gt;</td>
<td>-</td>
</tr>
<tr>
<td>EQAS 2015 (N=32)</td>
<td>Microdilution</td>
<td>42°C / 24h</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>%&lt;sup&gt;2&lt;/sup&gt;</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>No.</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>%&lt;sup&gt;2&lt;/sup&gt;</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>No.</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>%&lt;sup&gt;2&lt;/sup&gt;</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>No.</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>%&lt;sup&gt;2&lt;/sup&gt;</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>No.</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>%&lt;sup&gt;2&lt;/sup&gt;</td>
<td>-</td>
</tr>
<tr>
<td>Overall</td>
<td>Microdilution</td>
<td>42°C / 24h</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>%&lt;sup&gt;2&lt;/sup&gt;</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>No.</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>%&lt;sup&gt;2&lt;/sup&gt;</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>No.</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>%&lt;sup&gt;2&lt;/sup&gt;</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>No.</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>%&lt;sup&gt;2&lt;/sup&gt;</td>
<td>-</td>
</tr>
<tr>
<td>Overall</td>
<td>Microdilution</td>
<td>42°C / 24h</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>%&lt;sup&gt;2&lt;/sup&gt;</td>
<td>-</td>
</tr>
</tbody>
</table>

<sup>1</sup>No., number of labs performing the analysis, <sup>2</sup>%, percentage of labs reporting correct results, <sup>3</sup>For antimicrobial abbreviations: see List of Abbreviations page 1, - , not determined
<table>
<thead>
<tr>
<th>EQAS iteration</th>
<th>Strain ID</th>
<th>No. of participating labs</th>
<th>Percentage (%) of labs performing correct identification</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003</td>
<td><em>E. coli</em> O157</td>
<td>115</td>
<td>99</td>
</tr>
<tr>
<td>2004</td>
<td><em>Shigella flexneri</em></td>
<td>121</td>
<td>94 (Shigella); 74 (S. flexneri)</td>
</tr>
<tr>
<td>2006</td>
<td><em>Yersinia enterocolitica</em> O3</td>
<td>134</td>
<td>93 (Yersinia); 89 (Y. enterocolitica); 66 (Y. enterocolitica O3)</td>
</tr>
<tr>
<td>2007</td>
<td><em>Vibrio parahaemolyticus</em></td>
<td>86</td>
<td>83</td>
</tr>
<tr>
<td>2008</td>
<td><em>Enterobacter sakasakii</em></td>
<td>128</td>
<td>92</td>
</tr>
<tr>
<td>2009</td>
<td><em>Vibrio mimicus</em></td>
<td>56</td>
<td>48</td>
</tr>
<tr>
<td>2010</td>
<td><em>Citrobacter spp.</em></td>
<td>115</td>
<td>90</td>
</tr>
<tr>
<td>2011</td>
<td><em>Aeromonas hydrophila</em></td>
<td>106</td>
<td>83</td>
</tr>
<tr>
<td>2012</td>
<td><em>Salmonella Paratyphi B var. Java</em></td>
<td>134</td>
<td>23% (Salmonella spp) 7% (Salmonella O:B) 24% (Salmonella Paratyphi B var. java) In total 54% Deviations: Citrobacter freundii (1), Edwardsiella sp (1), Escherichia fergusonii (1), Proteus mirabilis (1), Salmonella serovar X* (24), Salmonella serovar Paratyphi B (34) * incorrect serovar</td>
</tr>
<tr>
<td>2014</td>
<td><em>Yersinia pseudotuberculosis</em></td>
<td>117</td>
<td>75% correct, including: YERSINIA SPECIES Yersinia pseudotuberculosis Yersinia pseudotuberculosis I / O1 / O:1b / API 20 E [1014100] Deviations: Acinetobacter baumannii, Burkholderia sp., Citrobacter freundii, corynebacterium species, Sphingomonas paucimobilis, HELICOBACTER, Pasteurella maimi, Pasteurella sp., Pseudomonas luteola, Rhizobium radiobacter (6), Salmonella typhi, Shigella flexneri, Sphingomonas paucimobilis (4), unknown, Vibrio metschnikovii, Yersinia enterocolitica (4), Yersinia similis, Yestina pestis</td>
</tr>
<tr>
<td>2015</td>
<td><em>Hafnia alvei</em></td>
<td>142</td>
<td>87.3% correct, including: Hafnia alvei (116), Hafnia alvei 1(8) Deviations: Aeromonas spp., Aeromonas veronii, Serratia marcescens, Enterobacter, Enterobacter cloacae, Escherichia coli (3), Eschericia fergussonii, Bacillus, Hafnia alvei ATCC 13337, Plesiomonas shigelloides, Shigella flexneri, Shigella sonnei, Shigella spp, (2), Vibrio parahaemolyticus, Yokenella regensburgei</td>
</tr>
<tr>
<td>2016</td>
<td><em>Listeria monocytogenes</em></td>
<td>137</td>
<td>86.1% correct, including: Listeria monocytogenes (101), Listeria monocytogenes 1/2 a (8), Listeria monocytogenes 2a, Listeria monocytogenes Ilu, Listeria monocytogenes O:1, Listeria monocytogenes O1/2, Listeria monocytogenes Serotype 1, Listeria monocytogenes Type 1, Listeria spp (3). Deviations: Actinomyces pyogenes, Aeromonas, Chromobacterium violaceum, Corynebacterium spp., Enterobacter agglomerans, Ewingella americana, Listeria ivanovii, Listeria monocytogenes/innocua, Listeria grayi (2), non-fermenter spp, Pantoae spp 3, Salmonella Dublin (9,12;gp), Salmonella enterica spp enterica, Sphingomonas paucimobilis (2), Staphylococcus xylosus, Vibrio parahaemolyticus, Yersinia enterocolitica.</td>
</tr>
</tbody>
</table>
SIGN-UP FOR EQAS 2016
Greetings to the WHO Global Foodborne Infections Network (WHO GFN) Members:

WHO GFN strives to increase the quality of laboratory-based surveillance of *Salmonella* and other foodborne pathogens by encouraging national and regional reference laboratories that attended WHO GFN training courses to participate in the External Quality Assurance System (EQAS). We are pleased to announce the launch of the 2016 EQAS cycle.

WHY PARTICIPATE IN EQAS?
EQAS provides the opportunity for proficiency testing which is considered an important tool for the production of reliable laboratory results of consistently good quality.

WHAT IS OFFERED IN EQAS?
This year, WHO EQAS offers the following components:
- Serogrouping, serotyping and antimicrobial susceptibility testing of eight *Salmonella* isolates;
- Serotyping and antimicrobial susceptibility testing of four *Shigella* isolates;
- Species identification and antimicrobial susceptibility testing of two *Campylobacter* isolates. Note that in relation to the antimicrobial susceptibility testing of *Campylobacter*, results obtained by broth micro dilution or agar dilution, only, are accepted;
- Identification of one unknown bacterial isolate.

WHO SHOULD PARTICIPATE IN EQAS 2016?
All national and regional reference laboratories which perform analysis on *Salmonella*, *Shigella* and/or *Campylobacter* and are interested in participating in an external quality assurance program are invited to participate. We expect that all national and regional reference laboratories that attended WHO GFN Training Courses will participate in EQAS.

The WHO GFN Regional Centers in cooperation with the EQAS Coordinator will evaluate the list of laboratories that sign up for EQAS 2016. Laboratories which signed up and received bacterial isolates in year 2015 but did not submit any result should provide a consistent explanation for this if they want to participate in 2016.

COST FOR PARTICIPATING IN EQAS
There is no participation fee. Laboratories should, however, cover the expenses for parcel shipment if they can afford it. If FedEx has ‘Dangerous Goods-service’ in your country or if you have a DHL-account no, please provide your FedEx or DHL import account number (for import of UN3373 Biological Substance Category B) in the sign-up form or, alternatively, to the EQAS Coordinator (please find contact information below). We need this information at this stage to save time and resources. Participating laboratories are responsible for paying any expenses related to taxes or custom fees applied by their country.
HOW TO SIGN-UP FOR EQAS 2016
This link will open a sign-up webpage: http://eqas.food.dtu.dk/who/signup
In this webpage, you will be asked to provide the following information:

- Name of institute, department, laboratory, and contact person
- Complete mailing address for shipment of bacterial isolates (no post-office box number)
- Telephone and fax number, e-mail address
- FedEx or DHL import account number (if available)
- Approximate number of *Salmonella* isolates annually serogrouped/serotyped
- Approximate number of *Salmonella* isolates annually tested for antimicrobial susceptibility
- Availability of ATCC reference strains
- Components of EQAS 2016 you plan to participate in
- Level of reference function in your country

If you experience any problem in the sign-up webpage, please try again a few days later. If problems persist after several attempts, please contact the EQAS Coordinator Susanne Karlsmose Pedersen: E-mail suska@food.dtu.dk; fax +45 3588 6341.

TIMELINE FOR SHIPMENT OF ISOLATES AND AVAILABILITY OF PROTOCOLS
Due to increased number of participants in WHO EQAS, a number of different institutions will ship the bacterial isolates, and you will receive information concerning the institution shipping your parcel. The bacterial isolates will be shipped in August/September 2016.

In order to minimize delays, please send a valid import permit to the EQAS coordinator. Please apply for a permit to receive the following (according to your level of participation): “UN3373, Biological Substance Category B”: eight *Salmonella* strains, four *Shigella* strains, two *Campylobacter*, one *Campylobacter* reference strain (for new participants performing antimicrobial susceptibility testing on *Campylobacter*), one *Escherichia coli* reference strain (for new participants performing antimicrobial susceptibility testing on *Salmonella* and/or *Shigella*) and an unknown isolate (enteric bacteria) in August/September 2016.

Protocols and all relevant information will be available for download from the website http://www.antimicrobialresistance.dk/233-169-215-eqas.htm.

DEADLINE FOR SUBMITTING RESULTS TO THE NATIONAL FOOD INSTITUTE
Results must be submitted to the National Food Institute (DTU Food) by 31st December 2016 through the password-protected website. An evaluation report will be generated upon submission of results. Full anonymity is ensured, and only DTU Food and the WHO GFN Regional Centre in your region will have access to your results.

 Deadline for sign-up for EQAS 2016 is 27th May 2016
| WHO 2016 S-16.1 | Salmonella Bovismorbificans/S. Hindmarsh | 6:8 r:1,5 | - | +64 RESIST <=0.25 SUSC <=0.5 SUSC | 0.064 SUSC <=8.0 SUSC | 0.03 SUSC <=0.5 SUSC | <=0.03 SUSC | 0.03 SUSC <=4 SUSC | 1024 RESIST >64 RESIST >32 RESIST >32 RESIST |
| WHO 2016 S-16.2 | Salmonella Infantis | 5:7 r:1,5 | ciprofloxacin | +64 RESIST no synergy | +64 RESIST >128 RESIST no synergy | 64 RESIST >128 RESIST >0.03 SUSC | 1 SUSC 0.23 RESIST <=4 SUSC 1024 RESIST 4 SUSC >32 RESIST >32 RESIST |
| WHO 2016 S-16.3 | Salmonella Enteritidis | 9:12 g,m,- | 4 | SUSC 0.5 SUSC | 1 | SUSC 0.25 SUSC <=8.0 SUSC | 0.06 SUSC <=32 RESIST 0.06 SUSC <=4 SUSC 1024 RESIST 4 SUSC >0.25 SUSC 0.125 SUSC |
| WHO 2016 S-16.4 | Salmonella Uganda | 3:10,13:1,5 | <=1 SUSC <=0.25 SUSC | <=0.5 SUSC | 0.064 SUSC <=8.0 SUSC | 0.03 SUSC <=0.5 SUSC | <=0.03 SUSC | 1 SUSC 0.25 RESIST <=4 SUSC >1024 RESIST >64 RESIST >32 RESIST |
| WHO 2016 S-16.5 | Salmonella Stanley | 4:5,12 d:1,2 | 2 | SUSC <=0.25 SUSC | <=0.5 SUSC | 0.022 SUSC 128 RESIST 0.03 SUSC <=0.5 SUSC | <=0.03 SUSC | 4 SUSC <=0.25 SUSC 0.06 SUSC |
| WHO 2016 S-16.6 | Salmonella Heidelberg | 4:12 r:1,2 AmpC | +64 RESIST 8 RESIST no synergy | 32 RESIST 16 RESIST no synergy | 32 RESIST >128 RESIST 0.03 SUSC <=0.5 SUSC | <=0.03 SUSC | 4 SUSC >0.25 SUSC 0.25 SUSC |
| WHO 2016 S-16.7 | Salmonella Allendorf | 4:12,27 c:1,7 | 2 | SUSC <=0.25 SUSC | <=0.5 SUSC | 0.064 SUSC <=8.0 SUSC | 0.03 SUSC <=0.5 SUSC | <=0.03 SUSC | 4 SUSC <=0.25 SUSC 0.06 SUSC |
| WHO 2016 S-16.8 | Salmonella Plymouth | 5:46 d:6,7 | 2 | SUSC <=0.25 SUSC | <=0.5 SUSC | 0.064 SUSC <=8.0 SUSC | 0.03 SUSC <=0.5 SUSC | <=0.03 SUSC | 4 SUSC <=0.25 SUSC 0.06 SUSC |
| WHO 2016 SH-16.1 | Shigella flexneri 1b | - | +64 RESIST <=0.25 SUSC | <=0.5 SUSC | 0.064 SUSC <=8.0 SUSC | <=0.10 SUSC | 1 SUSC <=0.03 SUSC | <=4 SUSC 1024 RESIST >64 RESIST >32 RESIST >32 RESIST |
| WHO 2016 SH-16.2 | Shigella boydii 4 | - | +64 RESIST <=0.25 SUSC | <=0.5 SUSC | 0.022 SUSC 84 RESIST <=0.10 SUSC | 1 SUSC <=0.03 SUSC | <=4 SUSC 1024 RESIST >64 RESIST >32 RESIST >32 RESIST |
| WHO 2016 SH-16.3 | Shigella flexneri 2b ESBL | - | +64 RESIST >32 RESIST no synergy | 6 SUSC 0.5 SUSC no synergy | 32 RESIST >128 RESIST 1 RESIST 1 SUSC <=0.03 SUSC | >128 RESIST 1024 RESIST >64 RESIST >32 RESIST >32 RESIST |
| WHO 2016 SH-16.4 | Shigella flexneri 3a | - | +64 RESIST <=0.25 SUSC | <=0.5 SUSC | 0.022 SUSC 128 RESIST 0.03 SUSC <=0.5 SUSC | <=0.03 SUSC | 2 SUSC <=0.03 SUSC | <=4 SUSC 1024 RESIST >64 RESIST >32 RESIST >32 RESIST |

**Appendix 3, page 1 of 1**

| WHO 2016 C-16.1 | C. jejuni | 32 RESIST <=0.06 RESIST <=32 RESIST <=0.06 RESIST <=0.06 RESIST <=0.06 RESIST |
| WHO 2016 C-16.2 | C. coli | 0.06 SUSC 1 SUSC 1 SUSC <=4 SUSC <=4 SUSC 0.5 SUSC |
PROTOCOL for
- serotyping and antimicrobial susceptibility testing of Salmonella
- serotyping and antimicrobial susceptibility testing of Shigella
- identification and antimicrobial susceptibility testing of Campylobacter
- identification of an unknown enteric pathogen

1 INTRODUCTION .................................................................1
2 OBJECTIVES ........................................................................2
3 OUTLINE OF THE EQAS 2016 ..................................................2
  3.1 Shipping, receipt and storage of strains ................................2
  3.2 Serotyping of Salmonella .....................................................4
  3.3 Antimicrobial susceptibility testing of Salmonella, Shigella and Escherichia coli ATCC 25922 ........................................4
  3.4 Handling the Campylobacter strains ....................................7
  3.5 Identification of Campylobacter ...........................................8
  3.6 Antimicrobial susceptibility testing of Campylobacter and Campylobacter jejuni ATCC 33560 ........................................8
  3.7 Identification of the unknown enteric pathogen ......................9
4 REPORTING OF RESULTS AND EVALUATION .......................9
5 HOW TO ENTER RESULTS IN THE INTERACTIVE DATABASE ........10

HISTORY OF CHANGES; protocol version 2
Interpretative criteria for meropenem adjusted in Table 1 (changes from protocol version 1 indicated with bold and italics)

1 INTRODUCTION

In 2000, the Global Foodborne Infections Network (formerly known as WHO Global Salm-Surv) launched an External Quality Assurance System (EQAS). The EQAS is organized by the National Food Institute, Technical University of Denmark (DTU Food), in collaboration with partners and Regional Sites in WHO GFN.
Various aspects of the proficiency test scheme may from time to time be subcontracted. When subcontracting occurs, it is placed with a competent subcontractor and the National Food Institute is responsible for the subcontractor’s work.

The WHO EQAS 2016 includes
- serotyping and antimicrobial susceptibility testing of eight Salmonella strains,
- serotyping and antimicrobial susceptibility testing of four Shigella strains,
- antimicrobial susceptibility testing of the Escherichia coli ATCC 25922 (NCIMB 12210) reference strain for quality control (QC),
- identification and antimicrobial susceptibility testing of two thermophilic Campylobacter isolates,
- antimicrobial susceptibility testing of Campylobacter jejuni ATCC 33560 (NCTC 11351) reference strain for QC,
- identification of one ‘unknown’ bacterial isolate.

All participants will receive the strains according to the information they reported in the sign-up form.

The above-mentioned QC reference strains are included in the parcel only for new participants of the EQAS who did not receive them previously. The QC reference strains are original CERTIFIED cultures provided free of charge, and should be used for future internal quality control for antimicrobial susceptibility testing in your laboratory. The QC reference strains will not be included in the years to come. Therefore, please take proper care of these strains. Handle and maintain them as suggested in the manual ‘Subculture and Maintenance of QC Strains’ available on the WHO Collaborating Centre website (see www.antimicrobialresistance.dk).

2 OBJECTIVES

The main objective of this EQAS is to support laboratories to assess and if necessary improve the quality of serotyping and antimicrobial susceptibility testing of enteric human pathogens, especially Salmonella. A further objective is to assess and improve the comparability of surveillance data on Salmonella serotypes and antimicrobial susceptibility reported by different laboratories. Therefore, the laboratory work for this EQAS should be done by using the methods routinely used in your laboratory.

3 OUTLINE OF THE EQAS 2016

3.1 Shipping, receipt and storage of strains

In September 2016 around 200 laboratories located worldwide will receive a parcel containing eight Salmonella strains, four Shigella strains, two Campylobacter strains and one ‘unknown’ bacterial
isolate (according to information reported in the sign-up form). An *E. coli* ATCC 25922 reference strain and a *C. jejuni* ATCC 33560 reference strain will be included for participants who signed up to perform antimicrobial susceptibility testing (AST) and did not receive them previously. All provided strains belong to UN3373, Biological substance category B. AmpC-, Extended-Spectrum Beta-Lactamase (ESBL)-, and carbapenemase-producing strains could be included in the selected material.

**Please confirm receipt of the parcel through the confirmation form enclosed in the shipment**

The *Salmonella* and *Shigella* strains, and the ‘unknown’ bacterial isolate are shipped as agar stab cultures whereas the reference strains for QC and the *Campylobacter* strains are shipped lyophilised (LYFO DISK®). See section 3.1.1 below for additional info on handling and reconstitution of the lyophilised cultures.

On arrival, the bacterial cultures must be stored in a dark place at 2°C to 8°C until handling in the laboratory.

The agar stab cultures must be subcultured and prepared for storage in your strain collection (e.g. in a -80°C freezer). This set of cultures should serve as reference if discrepancies are detected during the testing (e.g. they can be used to detect errors such as mis-labelling or contamination).

### 3.1.1 Instructions related to handling of LYFO DISK®

The microorganisms supplied as LYFO DISK® are packaged in re-sealable vials that contain a lyophilized pellet and a desiccant to prevent adverse accumulations of moisture.

The following instructions can be downloaded from the manufacturer’s website ([http://microbiologics.com/Support-Center/KWIK-STIK-trade](http://microbiologics.com/Support-Center/KWIK-STIK-trade)):

1. Remove the unopened LYFO DISK® vial from 2°C to 8°C storage and allow the unopened vial to equilibrate to room temperature.
2. Aseptically remove the pellet with sterile forceps from the vial. Do not remove desiccant.
3. Place the pellet in 0.5 mL of sterile fluid (water, saline, TSB, or BHIB).
4. Crush the pellet with a sterile swab until the suspension is homogenous. Immediately heavily saturate the same swab with the hydrated material and transfer to agar medium.
5. Inoculate the primary culture plate(s) by gently rolling the swab over one-third of the plate.
6. Using a sterile loop, streak to facilitate colony isolation.
7. Using proper biohazard disposal, discard the remaining hydrated material.
8. Immediately incubate the inoculated media at temperature and conditions appropriate to the microorganism.
Materials required but not provided:
- Microorganisms require sterile tubes and 0.5 ml of sterile liquid such as, Tryptic Soy Broth, Brain Heart Infusion Broth, saline, or deionized water to hydrate the lyophilized preparation.
- Sterile swabs or inoculating loops are needed to transfer the hydrated preparation to an agar plate.
- Non-selective, nutrient or enriched agar media and specific incubation times and conditions to optimize growth and recovery.

3.2 Serotyping of Salmonella

The eight Salmonella strains should be serotyped by using the method routinely used in the laboratory. If you do not have all the necessary antisera please go as far as you can in the identification and report the serogroup, since also serogroup results will be evaluated. Serogroups should be reported using terms according to Kauffmann-White-Le Minor (Grimont and Weill, 2007. 9th ed. Antigenic formulae of the Salmonella serovars. WHO Collaborating Centre for Reference and Research on Salmonella).

Please fill in information concerning the brand of antisera used for typing in the fields available in the database for entering results. In addition, we kindly ask you to report which antisera you think are required to complete the serotyping, if relevant.

3.3 Antimicrobial susceptibility testing of Salmonella, Shigella and Escherichia coli ATCC 25922

The Salmonella and Shigella strains as well as the E. coli ATCC 25922 QC reference strain should be tested for susceptibility towards as many as possible of the antimicrobials mentioned in the test form. Please use the methods routinely used in your laboratory.

For reconstitution of the E. coli QC reference strain (NCIMB 12210) which is supplied in the form of a LYFO DISK®, see instructions in section 3.1.1 above.

Testing of gentamicin susceptibility may be valuable for monitoring purposes. Therefore we kindly ask you to disregard, for the purpose of this proficiency trial, that the Clinical and Laboratory Standards Institute (CLSI) guidelines state that Salmonella and Shigella should not be reported as susceptible to aminoglycosides.

The breakpoints used in this EQAS for interpreting MIC results are in accordance with CLSI values (Table 1). Consequently, interpretation of MIC results will lead to categorization of strains into three categories: resistant (R), intermediate (I) and susceptible (S). In the evaluation report you
receive upon result submission, you can find that obtained interpretations in accordance with the expected interpretation will be defined as ‘correct’, whereas deviations from the expected interpretation will be defined as ‘minor’ (I ↔ S or I ↔ R), ‘major’ (S interpreted as R) or ‘very major’ (R interpreted as S).

Please report the breakpoints that you routinely use in your laboratory for interpretation of antimicrobial susceptibility test results in the fields available in the database (or in the test forms).

Table 1. Interpretive breakpoint for *Salmonella* and *Shigella* antimicrobial susceptibility testing

<table>
<thead>
<tr>
<th>Antimicrobials</th>
<th>Reference value, MIC (µg/mL)</th>
<th>Reference value, Disk diffusion (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Sensitive</td>
<td>Intermediate</td>
</tr>
<tr>
<td>Ampicillin, AMP</td>
<td>≤8</td>
<td>16</td>
</tr>
<tr>
<td>Cefotaxime, CTX*</td>
<td>≤1</td>
<td>-</td>
</tr>
<tr>
<td>Cefoxitin, FOX</td>
<td>≤8</td>
<td>16</td>
</tr>
<tr>
<td>Ceftazidime, CAZ*</td>
<td>≤1</td>
<td>-</td>
</tr>
<tr>
<td>Ceftriaxone, CRO*</td>
<td>≤1</td>
<td>-</td>
</tr>
<tr>
<td>Chloramphenicol, CHL</td>
<td>≤8</td>
<td>16</td>
</tr>
<tr>
<td>Ciprofloxacin, CIP</td>
<td>≤0.06**</td>
<td>0.12-0.5**</td>
</tr>
<tr>
<td>Gentamicin, GEN</td>
<td>≤4</td>
<td>8</td>
</tr>
<tr>
<td>Meropenem, MER*</td>
<td>≤0.12</td>
<td>-</td>
</tr>
<tr>
<td>Nalidixic acid, NAL</td>
<td>≤16</td>
<td>-</td>
</tr>
<tr>
<td>Sulfonamides, SMX</td>
<td>≤256</td>
<td>-</td>
</tr>
<tr>
<td>Tetracycline, TET</td>
<td>≤4</td>
<td>8</td>
</tr>
<tr>
<td>Trimethoprim, TMP</td>
<td>≤8</td>
<td>-</td>
</tr>
<tr>
<td>Trimethoprim + sulfamethoxazole, TMP+SMX, SXT</td>
<td>≤2/38</td>
<td>-</td>
</tr>
</tbody>
</table>

Reference values used in this EQAS are according to CLSI (M100-S25), with the following exceptions:
* For the cephalosporins and meropenem, the application of the interpretative criteria is intended to indicate if the microorganism is a presumptive ESBL- or carbapenemase-producer. Reference values for the cephalosporins are according to CLSI M100-S25 Table 3A. These interpretative criteria are also applied for *Salmonella* and *Shigella* test strains for interpretation of AST results in this EQAS. *Reference values for meropenem are based on epidemiological cut off values from [www.eucast.org](http://www.eucast.org).*

** These breakpoints should also be applied for *Shigella* test strains for interpretation of AST results in this EQAS

*** The publication by Cavaco LM and Aarestrup FM (J. Clin. Microbiol. 2009. Sep;47(9):2751-8) provides the background for these interpretative criteria in the WHO GFN EQAS. These interpretative criteria are also applied for *Shigella* test strains for interpretation of AST results in this EQAS.
Concerning ciprofloxacin susceptibility tests, please note that for results obtained in this proficiency test, the breakpoints for *Salmonella* are applied for *Shigella* also. These breakpoints for ciprofloxacin take into consideration mechanisms of resistance due to plasmid-mediated quinolone resistance genes (e.g. *qnr*-genes) and one-point-mutation in the gyrase gene.

**Important notes: beta-lactam resistance**
The following tests for detection of ESBL-, AmpC-, and carbapenemase-producing phenotypes are optional in relation to the current WHO GFN EQAS.

If choosing to participate in this component of the EQAS, all strains displaying reduced susceptibility to cefotaxime (CTX), ceftazidime (CAZ), and/or ceftriaxone (CRO) should be tested for ESBL-, AmpC, or carbapenemase-production by confirmatory tests. Reduced susceptibility to any of the above-mentioned antimicrobials indicates that the bacterial strain is an ESBL-, AmpC, or carbapenemase-producing phenotype.

Confirmatory test for ESBL production requires the use of both cefotaxime (CTX) and ceftazidime (CAZ) alone, and in combination with a β-lactamase inhibitor (clavulanic acid). Synergy is defined either as i) by microbroth dilution methods or E-test; a ≥ 3 twofold concentration decrease in an MIC for either antimicrobial agent tested in combination with clavulanic acid vs. its MIC when tested alone (E-test 3 dilution steps difference; MIC CTX : CTX/Cl or CAZ : CAZ/Cl ratio ≥ 8) or ii) by disk diffusion; a ≥ 5 mm increase in a zone diameter for either antimicrobial agent tested in combination with clavulanic acid vs. its zone when tested alone (CLSI M100 Table 2A; Enterobacteriaceae). The presence of synergy indicates ESBL production.

Detection of AmpC-type beta-lactamases can be performed by testing the bacterial culture for susceptibility to cefoxitin (FOX). Resistance to FOX indicates the presence of an AmpC-type beta-lactamase.

Confirmatory test for carbapenemase production requires the testing of meropenem (MER). Reduced susceptibility to MER indicates that the bacterial strain is a carbapenemase-producer.

The classification of the phenotypic results should be based on the most recent EFSA (European Food Safety Agency) recommendations (EURL-AR Workshop 2016, [http://www.crl-ar.eu/data/images/ws_april-2016/f11_efsacriteria.pdf](http://www.crl-ar.eu/data/images/ws_april-2016/f11_efsacriteria.pdf)). The following summary of these recommendations indicate how the phenotypes should be categorized:
ESBL-phenotype:
- CTX or CAZ > 1 mg/L AND
- MER ≤ 0.12 mg/L AND
- FOX ≤ 8 mg/L AND
- Synergy for CTX : CTX/Cl and/or CAZ : CAZ/Cl

ESBL+AmpC-phenotype:
- CTX or CAZ > 1 mg/L AND
- MER ≤ 0.12 mg/L AND
- FOX > 8 mg/L AND
- Synergy for CTX : CTX/Cl and/or CAZ : CAZ/Cl

AmpC-phenotype:
- CTX or CAZ > 1 mg/L AND
- MER ≤ 0.12 mg/L AND
- FOX > 8 mg/L AND
- No synergy for CTX : CTX/Cl nor CAZ : CAZ/Cl
  (note, presence of ESBLs is not excluded)

Carbapenemase-phenotype:
- MER > 0.12 mg/L
  (note, presence of ESBLs or AmpCs is not excluded)

Other-phenotype:
- Not covered by any of the above categories AND
- CTX, CAZ, FOX, or MER > interpretative criteria as susceptible in Table 1 (i.e. exhibits reduced susceptibility)

No ESBL-, AmpC-, or carbapenemase:
- CTX, CAZ, FOX, and MER ≤ interpretative criteria as susceptible in Table 1 (i.e. exhibits susceptibility)

The genotype obtained by PCR and/or sequencing may be necessary to correctly categorize a bacterial test strain as either of the categories, ESBL-, AmpC, and/or carbapenemase-producer, but is not requested as part of this WHO GFN EQAS.

3.4 Handling the Campylobacter strains

The Campylobacter test strains as well as the C. jejuni reference strain (NCTC 11351) are supplied in the form of LYFO DISK®. To revive the strains, see instructions in section 3.1.1 above.
3.5 Identification of *Campylobacter*

The two thermophilic *Campylobacter* isolates should be identified to species level.

3.6 Antimicrobial susceptibility testing of *Campylobacter* and *Campylobacter jejuni* ATCC 33560

The *Campylobacter* test strains and the *C. jejuni* reference strain ATCC33560 should be tested for susceptibility to as many antimicrobials as possible among the ones mentioned in the test form. It should be noted that only MIC methods (i.e. broth or agar dilution methods) are recommendable for AST of *Campylobacter*. Neither the use of disk diffusion nor E-test is recommendable for AST of *Campylobacter*.

In this EQAS, the breakpoints used for interpretation of MIC results for *Campylobacter* are epidemiological cut-off values according to EUCAST (European Committee on Antimicrobial Susceptibility Testing; [www.eucast.org](http://www.eucast.org); Table 2). Consequently, only two categories of characterisation (resistant, R or susceptible, S) are allowed. In the evaluation report that you receive upon result submission, you can find that obtained interpretations in agreement with the expected interpretation, will be categorised as ‘correct’, whereas deviations from the expected interpretation will be categorizes as ‘incorrect’.

Please report the breakpoints that you routinely use in your laboratory for interpretation of antimicrobial susceptibility test results, in the fields available in the database (or in the test form).

Note that the interpretation of antimicrobial susceptibility test results for *Campylobacter* requires knowledge of the *Campylobacter* species. If you did not sign-up for *Campylobacter* identification, but perform AST on *Campylobacter*, you are welcome to contact the EQAS Coordinator to obtain information regarding the identity of the *Campylobacter* test strains.

<table>
<thead>
<tr>
<th>Antimicrobials for <em>Campylobacter</em></th>
<th>MIC (µg/mL)</th>
<th>MIC (µg/mL)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>R is &gt;</td>
<td>R is &gt;</td>
</tr>
<tr>
<td></td>
<td><em>C. jejuni</em></td>
<td><em>C. coli</em></td>
</tr>
<tr>
<td>Ciprofloxacin, CIP</td>
<td>0.5</td>
<td>0.5</td>
</tr>
<tr>
<td>Erythromycin, ERY</td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>Gentamicin, GEN</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Nalidixic acid, NAL</td>
<td>16</td>
<td>16</td>
</tr>
<tr>
<td>Streptomycin, STR</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Tetracycline, TET</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

Reference values for interpretation of *Campylobacter* AST results according to EUCAST
The sub-cultured *Campylobacter* strains should be used for MIC-testing after incubation at 36-37°C for 48 hours or at 42°C for 24 hours. Likely, two subcultures are needed prior to MIC-testing to ensure optimal growth.

### 3.7 Identification of the unknown enteric pathogen

The ‘unknown’ isolate should be identified to species level and further typed if relevant.

### 4 REPORTING OF RESULTS AND EVALUATION

We recommend that you write your results in the enclosed test forms and that you read carefully the description in paragraph 5 before entering your results in the web database. For entering your results via the web, you will be guided through all steps on the screen and you will immediately be able to view and print a report evaluating your results. Results in agreement with the expected interpretation are categorised as ‘correct’, while results deviating from the expected interpretation are categorised as ‘incorrect’.

**Results must be submitted no later than 31 December 2016.**

Results must be submitted directly via the Internet based database. Should you not be able to access the Internet, you may return the completed test forms scanned by e-mail to the National Food Institute, Denmark.

All results will be summarized in a report which will be publicly available. Individual results will be anonymous and will only be forwarded to the official GFN Regional Centre in your region.

We are looking forward to receiving your results.

**If you have any questions or concerns, please do not hesitate to contact the WHO GFN EQAS Coordinator:**

Susanne Karlsmose Pedersen  
National Food Institute, Technical University of Denmark  
Søltofts Plads, Building 221, DK-2800 Kgs. Lyngby - DENMARK  
Tel: +45 3588 6601  
E-mail: suska@food.dtu.dk
6 HOW TO ENTER RESULTS IN THE INTERACTIVE DATABASE

Please carefully read these instructions before entering the web page. Remember that you need by your side the completed test forms and the breakpoint values you used.

In general, you can browse back and forth in the pages of the database. Always remember to save your input before leaving a page.

1) Enter the WHO Collaborating Centre website (from http://www.antimicrobialresistance.dk), then
   a. Click on ‘EQAS’
   b. Click on the link for the interactive database (http://eqas.food.dtu.dk/who)
   c. Write your username and password in lower-case letters and click on ‘Login’.
      You can find your username and password in the letter following your strains.
      Your username and password will remain unchanged in future trials. Do not hesitate to contact us if you experience problems with the login.

2) Click on ‘Materials and methods’
   a. Fill in the fields relative to brand of antisera (very important because we would like to compare results obtained with different brands of antisera)
   b. Fill in the fields relative to the method used for antimicrobial susceptibility testing
   c. Enter the brand of materials, e.g. Oxoid
   d. Fill in the field asking whether your institute serves as a national reference laboratory
   e. In the comment field, report which antisera you think is required to complete your serotyping, if relevant
   f. Click on ‘Save and go to next page’ – ALWAYS remember to save each page before leaving it!

3) In the data entry page ‘Routinely used breakpoints’
   a. Fill in the fields relative to the breakpoints used routinely in your laboratory to determine the antimicrobial susceptibility category. Remember to use the operator keys in order to show – equal to (=), less than (<), less or equal to(≤), greater than (>) or greater than or equal to (≥).

4) In the data entry pages ‘Salmonella strains 1-8’,
   a. SELECT the serogroup (O-group) from the drop-down list, DO NOT WRITE – Wait a few seconds – the page will automatically reload, so that the drop-down list in the field “Serotype” only contains serotypes belonging to the chosen serogroup.
   b. SELECT the serotype from the drop-down list – DO NOT WRITE – wait a few seconds and you can enter the antigenic formula (e.g. 1,4,5,12:i:1,2)
c. Enter the zone diameters in mm or MIC values in µg/ml. Remember to use the operator keys to show e.g. equal to (=), etc.
d. Enter the interpretation as R (resistant), I (intermediate) or S (susceptible)
e. If you performed confirmatory tests for ESBL production, select the appropriate result.
f. If relevant, fill in the field related to comments (e.g. which antisera you miss for complete serotyping)
g. Click on ‘Save and go to next page’

If you did not perform these tests, please leave the fields empty

5) In the data entry page ‘E. coli reference strain’:
a. Enter the zone diameters in mm or MIC values in µg/ml. Remember to use the operator keys to show e.g. equal to (=), etc.
b. Click on ‘Save and go to next page’

6) In the page ‘Identification of Campylobacter and unknown sample’:
a. Choose the correct Campylobacter species from the pick list
b. Fill in the field concerning species and type of the unknown bacterial isolate, and report the method used for identification
c. Click on ‘Save and go to next page’

If you did not perform these tests, please leave the fields empty

7) The next page is a menu that allows you to review the input pages and approve your input and finally see and print the evaluated results
a. Browse through the input pages and make corrections if necessary. Remember to click on ‘save and go to next page’ if you make any corrections.
b. Approve your input. Be sure that you have filled in all the results before approval, as YOU CAN ONLY APPROVE ONCE! The approval blocks your data entry into the interactive database, but allows you to see the evaluated results.
c. As soon as you have approved your input, an evaluation report will appear.

8) After browsing all pages in the report, you will find a new menu. You can choose ‘EQAS 2016 start page’, ‘Review evaluated results’ (a printer friendly version of the evaluation report is also available) or ‘Go to WHO GFN homepage’.

End of entering your data – thank you very much!
SUBCULTURE AND MAINTENANCE OF QUALITY CONTROL STRAINS

1.1 Purpose

Improper storage and repeated subculturing of bacteria can produce alterations in antimicrobial susceptibility test results. The Clinical and Laboratory Standards Institute (CLSI, formerly NCCLS) has published a guideline for Quality Control (QC) stock culture maintenance to ensure consistent antimicrobial susceptibility test results.

1.2 References

M100-S24, January 2014 (Performance Standards for Antimicrobial Susceptibility Testing)
M7-A9, January 2012 (Methods for Dilution Antimicrobial Susceptibility Test for Bacteria That Grow Aerobically; Approved Standard)

1.3 Definition of Terms

Reference Culture: A reference culture is a microorganism preparation that is acquired from a culture type collection.

Reference Stock Culture: A reference stock culture is a microorganism preparation that is derived from a reference culture. Guidelines and standards outline how reference stock cultures must be processed and stored.

Working Stock Cultures: A working stock culture is growth derived from a reference stock culture. Guidelines and standards outline how working stock cultures must be processed and how often they can be subcultured.

Subcultures (Passages): A subculture is simply the transfer of established microorganism growth on media to fresh media. The subsequent growth on the fresh media constitutes a subculture or passage. Growing a reference culture or reference stock culture from its preserved status (frozen or lyophilized) is not a subculture. The preserved microorganism is not in a stage of established growth until it is thawed or hydrated and grown for the first time.

1.4 Important Considerations

- Do not use disc diffusion strains for MIC determination.
- Obtain QC strains from a reliable source such as ATCC.
- CLSI requires that QC be performed either on the same day or weekly (only after 30 day QC validation).
- Any changes in materials or procedure must be validated with QC before implemented.
- For example: Agar and broth methods may give different QC ranges for drugs such as glycopeptides, aminoglycosides and macrolides.
- Periodically perform colony counts to check the inoculum preparation procedure.
WHO Collaborating Centre
External Quality Assurance System (EQAS)

1.5 Storage of Reference Strains

Preparation of stock cultures

- Use a suitable stabilizer such as 50% fetal calf serum in broth, 10-15% glycerol in tryptic soy broth, defibrinated sheep blood or skim milk to prepare multiple aliquots.
- Store at -20°C, -70°C or liquid nitrogen. (Alternatively, freeze dry.)
- Before using rejuvenated strains for QC, subculture to check for purity and viability.

Working cultures

- Set up on agar slants with appropriate medium, store at 4-8°C and subculture weekly.
- Replace the working strain with a stock culture at least monthly.
- If a change in the organisms inherent susceptibility occurs, obtain a fresh stock culture or a new strain from a reference culture collection e.g. ATCC.

1.6 Frequency of Testing

Weekly vs. daily testing

Weekly testing is possible if the lab can demonstrate satisfactory performance with daily testing as follows:

- Documentation showing reference strain results from 30 consecutive test days were within the acceptable range.
- For each antimicrobial/organism combination, no more than 3 out of 30 MIC values may be outside the acceptable range.

When the above are fulfilled, each quality control strain may be tested once a week and whenever any reagent component is changed.

Corrective Actions

If an MIC is outside the range in weekly testing, corrective action is required as follows:

- Repeat the test if there is an obvious error e.g. wrong strain or incubation conditions used
- If there is no obvious error, return to daily control testing

The problem is considered resolved only after the reference strain is tested for 5 consecutive days and each drug/organism result is within specification on each day.

If the problem cannot be resolved, continue daily testing until the errors are identified.

Repeat the 30 days validation before resuming weekly testing.
DAILY MIC QC CHART

Appendix A. Quality Control Protocol Flow Charts

Quality Control (QC) Protocol: Daily Testing

QC each test day (Section 16.7.1)

≤3 out of 30 results out of range

QC each test day. (For conversion to weekly testing, see Section 16.7.2.)

Error identified and corrected

Retest

Results in range – continue QC each test day

All results in range

Continue QC each test day

>3 out of 30 results out of range

Corrective Action (Section 16.9)

No error identified

Immediate Corrective Action (Section 16.9.2.1)

Retest and monitor for five consecutive test days

Any results out of range

Additional Corrective Action (Section 16.9.2.2)

Investigate possible source of errors

Reference: CLSI M7-A9, page 46
Appendix A. (Continued)

QC Protocol: Weekly Testing

Demonstrate Satisfactory Performance (Section 16.7.2.1)

≤ 1 out of 20 or ≤ 3 out of 30 results out of range

Implement weekly QC testing (Section 16.7.2.2)

Any result out of range

Corrective Action (Section 16.9)

Error identified and corrected

Retest

Results in range

Return to weekly QC testing

Results out of range

Immediate Corrective Action (Section 16.9.2.1)

Retest and monitor for five consecutive test days

All results in range

Any results out of range

Additional Corrective Action (Section 16.9.2.2)

Return to weekly QC testing

Investigate possible source of errors

Reference: CLSI M7-A9, page 47
INSTRUCTIONS FOR OPENING AND REVIVING LYOPHILISED CULTURES

Instructions adjusted from Czech Collection of Microorganisms (CCM) document 'Instructions for Opening and Reviving of Freeze-Dried Bacteria and Fungi' available on http://www.sci.muni.cz.

Lyophilised cultures are supplied in vacuum-sealed ampoules. Care should be taken in opening the ampoule. All instructions given below should be followed closely to ensure the safety of the person who opens the ampoule and to prevent contamination of the culture.

a. Check the number of the culture on the label inside the ampoule
b. Make a file cut on the ampoule near the middle of the plug (see Figure 1)
c. Disinfect the ampoule with alcohol-dampened gauze or alcohol-dampened cotton wool from just below the plug to the pointed end
d. Apply a red-hot glass rod to the file cut to crack the glass and allow air to enter slowly into the ampoule
e. Remove the pointed end of the ampoule into disinfectant
f. Add about 0.3 ml appropriate broth to the dried suspension using a sterile Pasteur pipette and mix carefully to avoid creating aerosols. Transfer the contents to one or more suitable solid and/or liquid media
g. Incubate the inoculated medium at appropriate conditions for several days
h. Autoclave or disinfect effectively the used Pasteur pipette, the plug and all the remains of the original ampoule before discarding

Notes:
- Cultures should be grown on media and under conditions as recommended in the CCM catalogue (see http://www.sci.muni.cz)
- Cultures may need at least one subculturing before they can be optimally used in experiments
- Unopened ampoules should be kept in a dark and cool place!