

12. Antimicrobial resistance in zoonotic agents

15 countries provided information on the occurrence of antimicrobial resistance in *Salmonella*. In 2002, for the first time, data on antimicrobial resistance in *Campylobacter* were collected and 5 countries provided this information.

Quantitative data, that is the minimal inhibitory concentrations (MIC) measured by using dilution methods, were reported from 6 countries for *Salmonella* and from 2 countries for *Campylobacter*. This type of information allows a more detailed analysis of changes in the resistance patterns.

12.1. Salmonella

Source of information

In Finland, Sweden and Norway a very limited number of animal derived isolates of *Salmonella* were available for testing, a fact which is attributed to the favourable situation in the country. In Spain, Greece, Ireland and Portugal less than 200 *Salmonella* isolates were tested. In the other countries more than 1000 isolates of *Salmonella* were investigated.

Strains were collected by different approaches. Typically, isolates were selected out of those available at the National Reference Laboratory (NRL) or all the isolates were tested (Austria, Belgium, Finland, Germany, Norway). These strains included the positives from monitoring programmes (Denmark, Finland, Sweden, Norway, England and Wales) and those from clinical cases (Denmark, Sweden, United Kingdom, Norway) in animals and humans. In Sweden, Denmark, Norway and United Kingdom it is ensured, that only the first isolate from a particular premises within a set period of time is included in the monitoring for antimicrobial resistance. This is done to avoid bias in the figures where large numbers of (similar) isolates are recovered from a single premises because of the intensity of sampling. It is assumed that all isolates are taken from animals at the level of primary production. In Belgium, this is not the case. In France, data are derived from a network of laboratories involved in the testing for antimicrobial resistance.

Comments to the Tables:

- Some countries provided different data sets. The same species could be investigated by different laboratories in the frame of a monitoring program or due to other reasons. In this case, separate data sets are given in the tables for the country.
- Some countries reported on all *Salmonella* isolates tested together, others on specific serovars only. To enable some comparison, in Tables SA 5 to SA 9, data are given in two lines. In the row for *Salmonella*, the overall results are given as reported, and in the line *Salmonella #* results reported on the individual *Salmonella* serovars are summarised.
- The column investigated present the number of bacteria investigated for antimicrobial resistance. If different numbers of isolates were tested for resistance to the single antimicrobials, the highest number of isolates tested is given in the table.

Methods applied

In most countries usually standard methods and breakpoints published by the National Committee for Clinical Laboratory Standards, USA (NCCLS) are used for testing (Table AB 1). In France, United Kingdom and partly in Austria, other standards are used. For florfenicol, streptomycin and neomycin, no NCCLS standard is established. Table AB 2 summarises the breakpoints used for these antimicrobials. In Table AB 3 those countries are

listed which reported deviations from the published NCCLS standard.^{1,2} It is obvious that countries do not always apply the recommended breakpoints. In Table AB 4, the countries using other methods and their breakpoints are listed.

Results were requested as percentage resistant strains for a defined panel of antimicrobials: tetracycline (TET), chloramphenicol (CHL), florfenicol (FLR), ampicillin (AMP), 3rd generation cephalosporins (CE), ciprofloxacin (CIP), enrofloxacin (ENR), nalidixic acid (NAL), trimethoprim/sulfonamide (SXT), streptomycin (STR), gentamicin (GEN), neomycin (NEO), kanamycin (KAN). Testing and reporting on trimethoprim (TMP) and sulfonamide (SU) was optional. Tetracycline, chloramphenicol or florfenicol are the antimicrobials, which were tested in all the 13 countries which provided detailed data. Furthermore, β lactams, ciprofloxacin or enrofloxacin, were tested in 12 countries. In Ireland, a very reduced panel of antimicrobials is tested only, excluding cephalosporins, ampicillin, nalidixic acid and streptomycin. Germany provided only the qualitative statement, whether the strains are resistant to one or more antimicrobials.

Results

Data were requested from the main animal species (cattle, pigs and poultry) and for the five major *Salmonella* serovars. The Member States mainly followed this guideline. In contrast, Spain provided mainly information related to pigs. Denmark included information on food isolates. Two countries gave details on human *Salmonella* isolates.

In 14 countries, at least data for *S. Typhimurium* were presented. Data for *S. Enteritidis* were given from 12 countries. 5 countries provided data from the five most common serovars in the country. As in 2001, Germany did not include data on the serovars. Information on the phagetypes involved is limited; therefore data are not presented separately. Figures on all *Salmonella* isolates together are not available from all countries.

Data are presented in Table AB 5 for *Salmonella* in animals. Data are broken down for the main animal species and humans in Tables AB 6 to 9. Details on *S. Enteritidis*, *S. Typhimurium* separately and the other serovars together broken down by the main animal species are given in Tables AB 10 to 12. Details on the other serovars are given in Table AB 12. In case isolates are collected in a monitoring programme, this detail is given in the tables. No distinction is made by the breakpoints applied.

Quantitative data, that is the minimal inhibitory concentrations (MIC) measured by using dilution methods, are presented for each of the antimicrobials requested separately in Tables AB 14 to 26. These tables include information on the breakpoint applied in the individual country, the dilutions tested, the share of resistant isolates and the percentage of isolates showing the individual MIC-values. As most information was provided for all animals together only, detailed analysis by the source of origin was not made.

Animals

Results reported for *Salmonella* isolates from animals are presented in Table AB 5. There, information is included from all countries, which gave data on resistance testing of *Salmonella* isolates. In addition to the reported overall rates for *Salmonella*, summarising rates were calculated from the reported serovars. It has to be taken into account that for countries, where the information provided did not cover all *Salmonella* isolates or serovars, these tables do not necessarily reflect the whole resistance situation.

¹ Performance Standards for Antimicrobial Disk and Dilution Susceptibility Tests for Bacteria Isolated from Animals; Approved Standard [ISBN 1-56238-377-9] M31-A

² NCCLS. Performance Standards for Antimicrobial Susceptibility Testing: Eleventh Informational Supplement. NCCLS document M100-S11 [ISBN 1-56238-426-0]. NCCLS, 940 West Valley Road, Suite 1400, Wayne, Pennsylvania 19087-1898 USA, 2001.

In general, resistance to tetracycline seems to be common in *Salmonella* strains isolated in the European Union. Also resistance to streptomycin, sulfonamide and ampicillin was often detected. However, quite large differences exist in the resistance rates and patterns between the Member States.

Low resistance rates to ciprofloxacin or enrofloxacin were reported by 7 Member States. No resistance to these antimicrobials was identified in Austria, Finland, Sweden and Norway. Resistance to nalidixic acid, which is an indicator of developing resistance to fluoroquinolones, was reported by most Member States.

In Belgium, in 2002, a total of 1277 susceptibility tests against 12 antimicrobials were performed on *Salmonella*. Most resistance was found against ampicillin (27,6%), streptomycin (22,6%), tetracycline (22,5%), sulfonamide (26,4%), sulfonamide / trimethoprim (17,4%) and nalidixic acid (20,7%) and to a lesser extent against chloramphenicol (11,6%) and florfenicol (8,5%). No resistance was found against enrofloxacin, and only a few isolates were found resistant against ceftiofur and neomycin (both n=7) and gentamicin (n=5).

Of the 3425 *Salmonella* isolates from animals and their environment tested in England and Wales in 2002, 61,1% were sensitive to all of the antimicrobials tested similar to the figure of 65,5% recorded in 2001. Levels of resistance to tetracycline in these isolates decreased from 33,3% in 1999 to 21,2% in 2002. This probably reflects both the proportionate decrease in salmonella isolates of all serotypes from pigs and the relative decline in frequency of isolation of *S. Typhimurium* DT 104. The level of resistance to neomycin in all salmonella serotypes was 3,9 % in 2002, an increase on the figure of 1,2 % recorded in 2001. No resistance was detected to ceftazidime.

In Sweden, a total of 51 isolates were included in the testing for antimicrobial resistance. Of these, 31 were *S. Typhimurium*, four *S. Dublin* and 16 isolates were other serovars. The majority of isolates (46%) emanated from major food producing animals and the remainder from pets and horses (30%) and wild animals (25%). Only three isolates (6%) were classified as resistant to any of the antimicrobials tested. One of these, *S. Typhimurium* DT 40 isolated from a cat, was resistant to nalidixic acid. The other two resistant isolates, *S. Schleissheim* from a wild bird and *S. Agona* from a dog, were resistant to streptomycin and to streptomycin and sulfonamide, respectively. The latter was the only isolate resistant to more than one antimicrobial. The overall situation of antimicrobial resistance in *Salmonella* is most favourable. There is no evident spread of multiresistant clones among food-producing animals within the country, probably as a result of the strategies in the Swedish *Salmonella* control programme. Nor is there among the notified incidents in wild animals any indication of spread of such clones as only one of the 70 *Salmonella enterica* isolates tested since 1997 was multiresistant.

Cattle

Results reported for *Salmonella* isolates from cattle are presented in Table AB 6. There are different trends for the different antimicrobials in the countries from 2001 to 2002. In Denmark and The Netherlands a decrease in antimicrobial resistance is obvious. A comparison in the other countries is difficult, because the sample size or the source of the samples changed.

In cattle, as in previous years, the highest resistance rates are reported for tetracycline, chloramphenicol, florfenicol, ampicillin, sulfonamide, and streptomycin. In contrast, for cephalosporins low rates are prevalent. High resistance rates to florfenicol, ampicillin and streptomycin are reported in France for the antimicrobials tested. Antimicrobials with elevated rates are in principle the same in all countries, mainly resistance to streptomycin and tetracycline are found. However, comparison of these data is difficult. French data were provided by a passive surveillance system based on a network of laboratories. Strains were mainly isolated from clinical cases and therefore, in many cases, recently exposed to an

antibiotic treatment administered to the animal. Actually, these data are not issued from a monitoring programme on healthy animals.

In Belgium, France, Italy, the Netherlands, Portugal, and United Kingdom resistance to nalidixic acid was reported in *Salmonella* isolates from cattle. In France, resistance to enrofloxacin was reported since 3 years. Also in Ireland resistance to fluoroquinolone was found. In Austria and Denmark resistance to nalidixic acid was not found since 2000 in *Salmonella* isolates from cattle.

Pigs

Results reported for *Salmonella* isolates from pigs are presented in Table AB 7. There are different trends in the countries for the single antimicrobials. The good situation in Finland, Sweden and Norway remained, no resistance was found in any antimicrobial tested. In the Netherlands a slight decrease in the resistance to 4 antimicrobials is seen. A statement for the other countries could not be done, because the sample size or the source of the samples changed.

In pigs, the resistance to tetracycline, chloramphenicol, sulfonamide and streptomycin are common. The resistance patterns from pigs differ from the patterns seen in cattle isolates by the high resistance rate to sulfonamide/ trimethoprim and trimethoprim and more isolates with a chloramphenicol resistance.

In Austria, Belgium, Denmark, France, Italy, Spain, The Netherlands, Portugal, and United Kingdom resistance to nalidixic acid was detected in *Salmonella* strains isolated from pigs. Resistance to fluoroquinolone was investigated in 10 countries, only in the United Kingdom and Spain resistance to the antimicrobial was found.

Poultry

Results reported for *Salmonella* isolates from poultry are presented in Table AB 8.

Besides Finland and Sweden, where the favourable situation remained and no resistance found, there is no general trend. In Austria, Belgium, Denmark and the Netherlands the resistance to Nalidixic acid increased in comparison to the last year.

Resistance to tetracycline, ampicillin, nalidixic acid, sulfonamide and streptomycin are dominating in poultry isolates. The reported nalidixic acid resistance was highest in poultry isolates. Nalidixic acid resistance was found in isolates tested in all Member States. 9 Member States investigated fluoroquinolone, 5 of them found resistance to that antimicrobial.

In Denmark, no significant changes in resistance among *S. Enteritidis* isolates from poultry were observed, except for resistance to nalidixic acid, which increased from 0% in 2001 to 23% in 2002. Usage of fluoroquinolones in food animals decreased markedly in 2002 and the increase in resistance was most likely a result of clonal spread caused by trade with day-old chickens carrying nalidixic acid resistant *S. Enteritidis*. A similar event occurred in 1999, where 8 farms were infected with trade contacts to an infected hatchery. These are examples of how the association between usage of antimicrobials and occurrence of resistance may be confounded by other factors, such as transmission of resistant bacterial strains between premises.

Humans

Results reported for human *Salmonella* isolates are presented in Table AB 9.

Information is available from Belgium and Denmark. The resistance pattern in humans is similar to the pattern in cattle, pigs and poultry.

In Belgium, a total of 681 human *Salmonella* isolates were randomly collected in 2002. Resistance was mostly found against tetracycline (33,7%), ampicillin (26,9%), streptomycin (26,6%), sulfonamide (22%), and to a lesser extent against nalidixic acid (12,9%)

chloramphenicol (12,6%) and amoxicillin/ clavulanic acid (12,2%). Only one full resistance against ciprofloxacin was found in a *S. Typhimurium* isolate displaying 10 additional resistance s, and only a few isolates were resistant against cefotaxim (n=3). However, all nalidixic resistant isolates of *S. Hadar* (n=43) and *S. Virchow* (n=38) displayed a low level resistance to ciprofloxacin and this reduced susceptibility could be sufficient to jeopardise treatment with this antibiotic. The highest incidences of antibiotic resistance were observed for *S. Hadar*. All *S. Hadar* isolates (n=44) were resistant to at least one antibiotic. Resistance to tetracycline, ampicillin, nalidixic acid and streptomycin reached values from 80,4 % up to 97,8 %. Simultaneous resistance to these four antibiotics was observed in 77% of these isolates. However, isolates from this serotype remained fully sensitive to cefotaxim, ciprofloxacin, chloramphenicol, gentamicin, and sulfonamide/ trimethoprim. *S. Typhimurium* also showed a high prevalence of antibiotic resistance with 28,8% of isolates resistant to four or more antimicrobial agents (defined as multiresistance). Twenty five percent of the isolates were shown resistant to ampicillin, chloramphenicol, streptomycin, sulfonamide and tetracycline (R-type ACSSuT with or without additional resistance s), of which 82% were of DT 104. Multiresistance was also common in *S. Virchow* (27,6% of the isolates). The highest incidence was observed for nalidixic acid (80,9%). All these nalidixic acid resistant isolates displayed a low level resistance to ciprofloxacin (MIC 0.125µg/ml). Ampicillin resistance incidence doubled since 2001 (40% in 2002). The vast majority of *S. Enteritidis* (97%), *S. Brandenburg* (88,2%) and *S. Derby* (82,4%) isolates remained sensitive to all tested antibiotics. In *S. Enteritidis*, resistance to more than one antibiotic was rare (only 1% of the isolates). Highest resistance percentage was found against ampicillin (1,5%). Nalidixic acid resistance was limited to 2 strains. Antibiotic resistance was slightly more common in *S. Brandenburg* and *S. Derby*. These two serotypes also displayed a very high incidence of intermediate resistance to streptomycin, 97,1 % and 82,4 % in *S. Brandenburg* and *S. Derby*, respectively. Resistance patterns and percentages in 2002 were generally the same as those in 2001, except for the serotype *S. Virchow* for which a significant increase of resistance against ampicillin, nalidixic acid, tetracycline, sulfonamide, trimethoprim, and sulfonamide/ trimethoprim was observed.

In Denmark, the occurrence of resistance was generally low in domestically acquired isolates as well as in those acquired abroad. In 2002, there were no significant changes in resistance levels in domestically acquired isolates compared with 2001. In contrast, among isolates acquired abroad, the percentage of nalidixic acid resistant isolates was significantly higher than in the previous year, with a more than threefold increase from 8% (95% CI, 3,3%-16,1%) in 2001 to 28% (95% CI, 17,9%-39,6%) in 2002. As observed in previous years, resistance to ampicillin and sulfonamide in *S. Typhimurium* continued to increase in isolates from domestically acquired infections with a significant increase in 2002 as compared to 2001. However, resistance to trimethoprim decreased significantly. The proportion of DT104 and related phagetypes (DT104b and U302) among the *S. Typhimurium* isolates was similar in 2002 and 2001, 16% and 14% respectively. For several antimicrobials resistance was significantly higher in isolates from infections acquired abroad compared to isolates from domestically acquired infections. No significant changes were observed in levels of resistance among *S. Typhimurium* isolates acquired abroad.

S. Enteritidis

Data on antimicrobial resistance in *S. Enteritidis* are presented in Table AB 10.

Only few isolates were available for resistance testing derived from cattle and pigs. Most isolates were from poultry.

In principle, very low resistance rates were reported in the 12 countries, which provided data on *S. Enteritidis* isolates from poultry. Resistance to nalidixic acid was reported in Austria, Belgium, France, Greece, The Netherlands, Portugal and the United Kingdom. There, the resistance rates ranged between 5 % (Austria) and 61 % (Portugal). No poultry *S. Enteritidis* isolates with resistance to nalidixic acid were reported in Finland, Italy and Sweden.

The monitoring of resistance against nalidixic acid is of special public health relevance as it is indicating an increase in resistance to fluoroquinolones. 7 countries investigated both, nalidixic acid and fluoroquinolones. 4 countries found resistance to nalidixic acid, 2 countries resistance to fluoroquinolones, but only Portugal found resistance to both antimicrobials.

Data on *S. Enteritidis* isolates from food were only reported from Denmark.

Data on human *S. Enteritidis* isolates show a low resistance level too. In Belgium, only resistance to ampicillin (2%) and nalidixic acid (1%) was found. In Denmark the highest resistance rate was found for nalidixic acid (7%); the rate of resistance to ampicillin, tetracycline, trimethoprim and sulfonamide is 2% and 1%.

In England and Wales, out of the 53 cultures of *S. Enteritidis*, 19 were *S. Enteritidis* DT 4. 90% of these *S. Enteritidis* DT 4 isolates were sensitive to all of the antimicrobials used in the test panel.

S. Typhimurium

Data on antimicrobial resistance in *S. Typhimurium* are given in Table AB 11.

As in the previous year, high resistance rates (up to 100 %) are obvious for those antimicrobials where resistance occurs. This reflects the large contribution of *S. Typhimurium* to the overall situation as regards resistance in *Salmonella*.

Resistance to cephalosporins in *S. Typhimurium* from cattle was reported in France and Italy, but not in the other 7 countries which investigated this group of antimicrobials.

In Belgium, in total 304 *S. Typhimurium* strains (181 Classic type O5+ and 123 Copenhagen type O5-) were tested for their susceptibility. About 36,8% of the *S. Typhimurium* isolates were found sensitive. More than 40% of strains were found resistant against ampicillin, streptomycin, tetracycline or sulfonamide, and about 30% were resistant against chloramphenicol or florfenicol. The Copenhagen variant is statistically more resistant against ampicillin, streptomycin, chloramphenicol and florfenicol as compared to the classic variant. On the contrary, O5+ variants were significantly more frequently found resistant against sulfonamide/ trimethoprim. Twenty-eight percent of *S. Typhimurium* isolates showed the multiple resistance against ampicillin, sulfonamide/ trimethoprim, tetracycline, sulfonamide and chloramphenicol. Like former years, this profile is more abundant among Copenhagen type O5- isolates (40,0%) than among Classic type O5+ strains (20,0%).

In England and Wales the number of cultures examined was 533 of which 44,8% were definitive type (DT) 104, DT104B or U302. 14,5% of the cultures were sensitive to all the antimicrobials tested, a decline from the figure for 2001, when 20,6% of *S. Typhimurium* cultures were fully sensitive. The generally high level of resistance of *S. Typhimurium* isolates is partly a reflection of the numbers of DT104 and its variants DT 104B and U302, only 0,8% of which were sensitive to all the antimicrobials tested in 2002. Most *S. Typhimurium* DT104 isolates recovered from cattle had the typical pentaresistance pattern ampicillin, chloramphenicol, streptomycin, sulfonamide, tetracycline, this was also the commonest pattern observed in isolates of DT104 from pigs. The commonest pattern for isolates from poultry was ampicillin, chloramphenicol, streptomycin, sulfonamide, tetracycline, cefoperazone and this was the second most common pattern in isolates from cattle and pigs. There were no *S. Typhimurium* isolates resistant to ceftazidime and cefuroxime recovered in 2002. 6,3% of DT104 and 104B isolates were resistant to nalidixic acid and 20,5% resistant to sulfonamide/ trimethoprim in 2002.

In Denmark, among *S. Typhimurium* isolates from cattle, belonging to phagetypes other than DT104/104a/104b and U302, resistance to sulfonamide and streptomycin decreased significantly. In isolates from pigs resistance to ampicillin and streptomycin increased significantly. Among isolates from poultry no significant changes were observed from 2001 to 2002.

Other *Salmonella* serovars

Data for other serovars are given in Tables AB 12 and 13. As in 2001, for most serovars, only a few isolates were available for testing. In cattle, mainly *S. Dublin* was tested and only very low resistance rates were reported. In poultry, several other serovars were reported in higher numbers, mainly from Austria and France.

High resistance rates were observed for tetracycline, nalidixic acid and streptomycin in *S. Hadar* (Belgium), *S. Heidelberg* (Austria), *S. Infantis* (Austria), *S. Kottbus* (France), *S. Virchow* (Belgium) and *S. Senftenberg* (Austria). High resistance rates to ampicillin occurred additionally in some of these serovars.

Resistance to nalidixic acid was seen in Austria, Belgium and United Kingdom. This resistance was high especially in *S. Hadar*, *S. Infantis*, *S. Virchow* and *S. Kottbus*. These isolates were from humans and poultry.

In Belgium, only 10% of 136 *S. Virchow* isolates tested were sensitive against all antimicrobials. Almost 90% of the strains were resistant against nalidixic acid, and about 20% of the strains were resistant against ampicillin, tetracycline, sulfonamide or sulfonamide/trimethoprim. A total of 63 *S. Agona* isolates were tested, and 46,0% were found sensitive. Surprising is the pentaresistance ampicillin, streptomycin, tetracycline, sulfonamide and chloramphenicol in about 30% of the isolates. Most (85,4%) of the 48 *S. Hadar* strains tested had the resistance profile ampicillin, streptomycin, tetracycline and nalidixic acid, whereas only 1 strain was totally susceptible.

In Finland, one poultry isolate out of the two tested domestic *S. Montevideo* isolates was resistant to ampicillin and one bovine isolate out of the three tested domestic *S. Tennessee* isolates was resistant to streptomycin. All the other tested domestic isolates (n=34) were sensitive to all the drugs tested.

Of the 687 *S. Dublin* cultures tested in England and Wales, 97,5% were susceptible to all 16 antimicrobial. This has been the situation since surveillance began in 1971 and is of interest because most isolates come from cattle. Resistance to ampicillin was not recorded in 2001 or 2002. Conversely, resistance to furazolidone and neomycin, which had not been detected for several years in *S. Dublin*, was observed for the first time in recent years in 2002. 0,9% of the *S. Dublin* isolates were resistant to sulfonamide/trimethoprim in 2002, higher than the figure for 2001, when only 0,2% of isolates were resistant.

12.2. *Campylobacter*

Source of information and methods applied

Data from *Campylobacter* were provided by 5 countries. Austria and Norway investigated isolates from human and poultry, Sweden exclusively from poultry.

Results were requested as percentage resistant strains for a defined panel of antimicrobials: tetracycline (TET), ampicillin (AMP), ciprofloxacin (CIP) or enrofloxacin (ENR), nalidixic acid (NAL) and gentamicin (GEN). Fluoroquinolones, tetracycline and nalidixic acid were investigated by all countries. The number of *Campylobacter* isolates, tested for antimicrobial resistance, ranged from 61 to 251.

Besides Austria all countries used a dilution method to determine the breakpoints (Table AB 26). For most antimicrobials, the breakpoints applied in the countries differ by one dilution step only. Resistance to erythromycin is defined different, the lowest value is 2 µg/ml, the highest value 16 µg/ml (Table AB 27).

Results

Animals

In animals resistance to tetracycline, nalidixic acid and fluoroquinolone was mainly found in Austria and The Netherlands. In addition, in The Netherlands a high level of erythromycin was found (Table AB 28). The results from the investigations of the *Campylobacter* isolates, separately given for the individual animal species, are summarised in Table AB 29.

Quantitative data, that is the minimal inhibitory concentrations (MIC) measured by using dilution methods, are presented for each of the antimicrobials requested separately in Tables AB 31 to 39. These tables include information on the breakpoint applied in the individual country, the dilutions tested, the share of resistant isolates and the percentage of isolates showing the individual MIC-values. As most information was provided for all animals together only, detailed analysis by the source of origin was not made.

Cattle

In comparison to pigs and poultry, isolates from cattle had a low resistance level in Denmark. 11% of the isolates were resistant to fluoroquinolones and nalidixic acid, and 6% to tetracycline (Table AB 29).

Pigs

Resistance to erythromycin is common in Denmark and The Netherlands in *Campylobacter* isolates from pigs. In addition, the isolates showed high resistance levels to streptomycin in Denmark and to tetracycline in the Netherlands (Table AB 29).

In Denmark, erythromycin resistance was substantially reduced among *C. coli* from pigs after withdrawal of the antimicrobial growth promoter tylosin. However as macrolides are widely used for treatment of infections in pigs erythromycin resistance has remained above 30%.

Poultry

Low levels of resistance in *Campylobacter* from poultry is seen in Denmark, Sweden and Norway. Austria and The Netherlands found resistance to tetracycline, nalidixic acid and fluoroquinolone. In The Netherlands some isolates were additionally resistant to erythromycin (Table AB 29).

In Denmark, an increase in resistance to nalidixic acid was observed among *C. jejuni* from broilers from 0% in 1996 to 8% in 2001. However, no nalidixic acid resistant *C. jejuni* were detected in 2002. In 2002, the consumption of fluoroquinolone decreased, following

restrictions imposed by the Danish Veterinary and Food Administration to reduce fluoroquinolone consumption.

In Sweden, the majority of isolates were identified as *C. jejuni* (84%) and only 16% were classified as hippurate-negative thermophilic *Campylobacter* spp. Overall, antimicrobial resistance among *C. jejuni* was low. No isolate was resistant to more than one antimicrobial tested. Resistance to ampicillin (10%) was the most prevalent trait. One isolate was resistant to tetracycline. In the year 2002, no isolate was resistant to nalidixic acid.

The occurrence of antimicrobial resistance in *Campylobacter* spp. from Norwegian broilers is low.

Humans

The resistance pattern in human isolates is uniform in Austria, Denmark and Norway. A high level of resistance to nalidixic acid and fluoroquinolone and a low level of tetracycline resistance were found (Table AB 29).

In Sweden, among 1040 clinical isolates of *C. jejuni* from humans in one county of Sweden in the years 1991-2000 resistance to ciprofloxacin and tetracycline occurred in 31 % and 24 % of the isolates, respectively. Both these resistance traits were rare among isolates from chickens. The majority of the human isolates however were of foreign origin.

In Denmark, susceptibility testing and serotyping was performed for 120 human isolates. 93% of the isolates were *C. jejuni*. Due to the low number of *C. coli* isolates, resistance data from this species was not presented. A significant decrease in tetracycline, erythromycin and streptomycin resistance was observed in 2002, as compared to 2001. As previously reported in DANMAP, resistance in *C. jejuni* was generally higher in isolates from infections associated with travel than from infections acquired in Denmark. In 2002, resistance to ciprofloxacin and nalidixic acid were significantly higher in *C. jejuni* from infections associated with travel and a similar, although non-significant, trend was observed for tetracycline resistance.

The same tendency was reported in Norway. Resistance was significantly more widespread among the *C. jejuni* isolates derived from patients infected abroad than patients infected in Norway.

Food

In Denmark, ninety-nine *C. jejuni* isolates obtained from poultry meat samples collected at retail outlets were subjected to susceptibility testing. Resistance to tetracycline, nalidixic acid and ciprofloxacin was detected (Table AB 29) The occurrence of resistance to tetracycline was significantly higher in isolates from imported broiler meat than in broiler meat of Danish origin.

Table AB 1. Test methods used for antibiotic resistance testing of Salmonella spp. 2002

Standard used for testing	Test method	Country	used for	further remarks	Is the testing procedure subject of quality control
Salmonella					
NCCLS	Agar diffusion	Austria	Animal and food		yes
		Denmark	² Humans	Used until 31 August 2002	yes
		Finland	Animal and food		yes
		Greece	Animal and food		yes
		Italy	Animal and food		yes
		Portugal	Animal and food		yes
		Spain	¹ Pigs		yes
		Spain	² Poultry (Gallus gallus)		
NCCLS	Broth dilution	Denmark	³ Humans	since 1 September 2002	yes
		Denmark	¹ Animal and food		yes
		Spain	³ Other animals		
		The Netherlands	Animal and food		yes
CASFM	Agar diffusion	France	² Cattle	RESSAB and RESAPATH	yes
		France	¹ Animal and food		yes
Microbiological Breakpoints	Broth dilution	Norway	Animal and food		yes
		Sweden	Animal and food		yes
n.a.	Agar diffusion	Luxembourg	Animal and food		no
Provider	Agar diffusion	Belgium	Animal and food	Rosco,Neo Sensitet	yes
VLA	Agar diffusion	England and Wales	Animal and food	adapted from BSAC 1991	yes

Note: If a country is listed more than once, further specification is found under the subsequent columns
Indices are given for the explanation of Table 2,3 and 4

Table AB 2. Breakpoints used for those antimicrobials where no NCCLS breakpoint is fixed 200:

Standard used	Country	Breakpoints (µg/ml)		Disk content (µg)	Zone diameter (mm)			
		susceptible ≤	resistant >		susceptible ≥	intermediate	resistant ≤	
Salmonella								
Florfenicol	Spain	¹	16	16				
	The Netherlands			16				
	Belgium			30	-		-	
	Denmark	¹		16				
	France	²				14	18	
	Sweden		8	16				
	Norway			16				
Streptomycin	Spain	¹		10	15		11	
	Belgium			100	26		22	
	Denmark	²					20	
	Denmark	¹		16				
	France	¹		10U.I.	15		12	
	France	²			15		12	
	Sweden		16	32				
	Norway			32				
	England and Wales				25	13	13	
Neomycin	Spain	¹	8	16				
	Spain	²			120	26	25-20	20
	Italy				30	17	13-16	12
	The Netherlands			16				
	Portugal				30	15	13-14	12
	Belgium				120	25		20
	Denmark	¹		8				
	Sweden		4	8				
	Norway			8				
	England and Wales				10	13		13

Note: Indices are explained in Table AB 1

Table AB 3. Breakpoints used for antibiotic resistance testing of *Salmonella* spp. - deviations from NCCLS-Standards 2002

Antimicrobial	Country	Breakpoints (µg/ml)		Disk content (µg)	Zone diameter (mm)		
		susceptible <=	resistant >		susceptible >=	intermediate	resistant <=
Salmonella							
Tetracyclin	Spain	²		80	28	27-23	23
	Spain	¹	4	8			
	Italy			30	19	15-18	13
Doxycycline	The Netherlands						4
Chloramphenicol	Spain	¹	8	16			
	The Netherlands						16
Ampicillin	Spain	²		33	28	27-18	18
3rd gen. Cephalosporin	Spain	²		30	21	20-18	17
	Spain	³	4	32			
Ceftazidime	Spain	¹		30	18	15-17	14
Cephalotin	Italy			30	18	15-17	14
Cefuroxime	The Netherlands						16
Cefotaxim	The Netherlands						1
Ciprofloxacin	Spain	³	0,5	2			
	Spain	¹	1	2			
	The Netherlands						2
Enrofloxacin	Spain	²		10	24	23-18	18
	Italy			5	23	22-17	16
	Portugal			5	20	17-19	16
Nalidixic acid	Spain	³	16	16			
	Spain	¹	16	16			
Flumequine	The Netherlands						4
Sulfonamide/Trime thoprim	Spain	²		240/5,2	32	31-26	26
	Spain	³	10	16			
	The Netherlands						8/152
Trimethoprim	Spain	¹		5	16		10
	The Netherlands						8
Sulfonamide	Spain	¹		300	17	13-16	12
Gentamycin	Spain	²		40	26	25-20	20
	Spain	³	0,5	8			
	Spain	¹	4	8			
	The Netherlands						8
Kanamycin	Portugal			30	15	13-18	12
Amoxicillin	Spain	¹	8	16			
	The Netherlands						16

Indices are explained in Table AB 01

Table AB 4.
Breakpoints used for antibiotic resistance testing of Salmonella spp. other than NCCLS 2002

Antimicrobial	Standard used	Country	Disk content (µg)	Zone diameter (mm)	
				susceptible >=	resistant <=
Salmonella					
Tetracyclin	CASFM	France	30 U.I.	19	16
	VLA	England and Wales	10	13	13
Chloramphenicol	CASFM	France	30	23	18
	VLA	England and Wales	10	13	13
Ampicillin	CASFM	France	10	19	13
Cephalotin	CASFM	France	30	18	11
Ceftazidime	CASFM	France	30	21	14
Cefotaxim	CASFM	France	30	21	14
Cefoperazone	VLA	England and Wales	30	13	13
Ceftazidime	VLA	England and Wales	30	13	13
Enrofloxacin	CASFM	France	5	22	16
Nalidixic acid	CASFM	France	30	20	14
Sulfonamide/Trimethoprim	CASFM	France	23,75+1,25	16	9
	VLA	England and Wales	25	13	13
Sulfonamide	CASFM	France	200	17	11
	VLA	England and Wales	300	13	13
Streptomycin	CASFM	France	10U.I.	15	12
	VLA	England and Wales	25	13	13
Gentamycin	CASFM	France	15	16	13
	VLA	England and Wales	10	13	13
Neomycin	VLA	England and Wales	10	13	13
Kanamycin	CASFM	France	30U.I.	17	14

Table AB 5. Antibiotic resistance testing of Salmonella spp.- Percentage of resistant isolates 2002

Monitoring	Country	Invest.	TET	CHL	FLR	AMP	NAL	FQ	SXT	TMP	SU	CE	CEP	CTX	CAZ	GFP	TIO	CXM	CQN	CRO	STR	GEN	NEO	KAN
Animals																								
Salmonella	NO	A	1042	19	5	13	21	0	7	14				0							21	3		14
Salmonella#	NO	A	699	10	3	7	13	0	5	15				0							13	3		3
Salmonella	NO	B	119	41	26	20	30	12	18	42											33	0		1
Salmonella	YES	B	214	20	9	7	35	33	23	27	1										25	0		0
Salmonella#	NO	B	92	52	36	32	45	1	21	54											42	1		6
Salmonella#	YES	B	43	44	49	39	12	24	24	62	0										65			
Salmonella	-	D	3937																					
Salmonella#	-	DK	806	31	7	18	2	2	7	30				0							31	1		
Salmonella	YES	E	49	96	31	6	6	0	31	55				2							49	6		8
Salmonella#	NO	E	38	20		22	20	5	13													3		3
Salmonella#	YES	E	24	95	38	14	0	16	8	81				9							67	8		12
Salmonella	YES	FIN	36	0	0	3	0	0	0	0				0							3			
Salmonella#	-	FIN	1	0	0	0	0	0	0	0				0							0			
Salmonella#	YES	FIN	28	0	0	0	0	0	0	0				0							4			
Salmonella	NO	F	1604	31	12	65	20	10	1	7	2	16		1	0	0		3			43	1		0
Salmonella#	-	F	363	45	30	30	19	1	3	28				0	0	0					46	1		0
Salmonella#	NO	F	233	16	20	71	33	6	0	3	0	2		0	0	0	2				3	0		0
Salmonella	NO	EL	5	80	50	20	20	0	20	0	40										60	20		0
Salmonella	YES	EL	38	21	34	13	11	0	5	0	0										11	24		4

Note: The figures given in the line Salmonella represent the overall number of isolates tested as reported by the country, the figures given in the line Salmonella # represent the calculated sum of those Salmonella serotypes tested which were reported by the country. Thus, not all Salmonella strains tested might be included in this figure.
 Data from Denmark are taken from DANMAP 2002. Data from Norway are taken from the NORM/NORM-VET-report.
 YES - Isolates collected within a monitoring programme; NO - Isolates collected not within a monitoring programme; - no information on the source of the isolates available
 Tetracycline (TET), Chloramphenicol (CHL), Florfenicol (FLR), Ampicillin (AMP), Nalidixic acid or other quinolone (NAL), Fluoroquinolone (Ciprofloxacin or Enrofloxacin) (FQ), Sulfonamide/Trimethoprim (SXT), Trimethoprim (TMP), Sulfonamides (SU), Cephalosporin not further specified (CE), Cephalotin (CEP), Cefotaxim (CTX), Cefazidime (CAZ), Cefoperazone (GFP), Ceftiofur (TIO), Cefuroxime (CXM), Ceftiofur (TIO), Cefuroxime (CXM), Ceftiofur (TIO), Streptomycin (STR), Gentamicin (GEN), Neomycin (NEO), Kanamycin (KAN)

Table AB 5. Antibiotic resistance testing of Salmonella spp.- Percentage of resistant isolates 2002

Monitoring	Country	Invest.	TET	CHL	FLR	AMP	NAL	FQ	SXT	TMP	SU	CE	CEP	CTX	CAZ	GFP	TIO	CXM	CQN	CRO	STR	GEN	NEO	KAN
Salmonella#	YES	EL	21	14	14	5	33	0	0	0	0										14	0	5	
Salmonella#	NO	EL	5	75	50	25	25	20	20	0	25										50	25	0	
Salmonella	NO	IRL	13	67	17			33															17	
Salmonella#	NO	IRL	189	82	49			5	100														55	
Salmonella	NO	I	3897	59	25	44	33	1	25	58	8	1									47	2	15	15
Salmonella#	NO	I	4028	53	12	39	27	1	12	60	6	1									41	7	9	10
Salmonella	YES	NL	605	23	13	11	12		20	21		2						3				1	1	1
Salmonella	NO	NL	3	40			20																	
Salmonella#	YES	NL	381	39	26	22	10		15	16		2						6				1	0	0
Salmonella#	-	NL	214	13	4	0	17		29	30		3						4				1	5	5
Salmonella#	NO	P	50	34	26	38	56	14	6	16		0									28	2	0	2
Salmonella	YES	S	36	0	0	0	3	0	0	0	3										0	0	0	0
Salmonella#	YES	S	42	0	0	0	5	0	0	0	0										0	0	0	0
Salmonella	-	UK	3209	22	16	16	3		20	29											18	4	4	4
Salmonella#	YES	UK	687	1	0				1	1											0	0	0	0
Salmonella#	-	UK	2700	27	19	19	3		24	35											21	5	5	5
Salmonella#	NO	N	24	8	4	4	8	0	0	0	8										8	0	0	0
Salmonella#	YES	N	5	0	0	0	0	0	0	0	0										0	0	0	0
Salmonella	YES	UK(E+W)	2760	21	17	16	2		21	30											17	1	4	4
Salmonella#	YES	UK(E+W)	1157	35	27	30	4		20	34											28	2	2	2

Note: The figures given in the line Salmonella represent the overall number of isolates tested as reported by the country, the figures given in the line Salmonella # represent the calculated sum of those Salmonella serotypes tested which were reported by the country. Thus, not all Salmonella strains tested might be included in this figure.

Data from Denmark are taken from DANMAP 2002. Data from Norway are taken from the NORM/NORM-VET-report.

YES - Isolates collected within a monitoring programme; NO - Isolates collected not within a monitoring programme; - no information on the source of the isolates available
Tetracycline (TET), Chloramphenicol (CHL), Florfenicol (FLR), Ampicillin (AMP), Nalidixic acid or other quinolone (NAL), Fluoroquinolone (Ciprofloxacin or Enrofloxacin) (FQ), Sulfonamide/Trimethoprim (SXT), Trimethoprim (TMP), Sulfonamides (SU), Cephalosporin not further specified (CE), Cephalotin (CEP), Cefotaxim (CTX), Cefazidime (CAZ), Cefoperazone (GFP), Ceftiofur (TIO), Cefuroxime (CXM), Ceftiofur (TIO), Cefuroxime (CXM), Ceftiofur (TIO), Gentamicin (STR), Streptomycin (STR), Neomycin (NEO), Kanamycin (KAN)

Table AB 5. Antibiotic resistance testing of Salmonella spp.- Percentage of resistant isolates 2002

Monitoring	Country	Invest.	TET	CHL	FLR	AMP	NAL	FQ	SXT	TMP	SU	CE	CEP	CTX	CAZ	CFP	TIO	CXM	CQN	CRO	STR	GEN	NEO	KAN
Salmonella	NO	UK(NIRL)	523	32	14	16	2	0	15	28											27	0		1
Salmonella#	NO	UK(NIRL)	523	32	14	17	2	0	15	28											27	0		1

Note: The figures given in the line Salmonella represent the overall number of isolates tested as reported by the country, the figures given in the line Salmonella # represent the calculated sum of those Salmonella serotypes tested which were reported by the country. Thus, not all Salmonella strains tested might be included in this figure. Data from Denmark are taken from DANMAP 2002. Data from Norway are taken from the NORM/NORM-VET-report.

YES - Isolates collected within a monitoring programme; NO - Isolates collected not within a monitoring programme; - no information on the source of the isolates available

Tetracycline (TET), Chloramphenicol (CHL), Florfenicol (FLR), Ampicillin (AMP), Nalidixic acid or other quinolone (NAL), Fluoroquinolone (Ciprofloxacin or Enrofloxacin) (FQ), Sulfonamide/Trimethoprim (SXT), Trimethoprim (TMP), Sulfonamides (SU), Cephalosporin not further specified (CE), Cephalotin (CEP), Cefotaxim (CTX), Ceftazidime (CAZ), Cefoperazone (CFP), Cefitiofur (TIO), Cefuroxime (CXM), Ceftiofur (CXM), Cefturoxime (CXM), Streptomycin (STR), Gentamicin (GEN), Neomycin (NEO), Kanamycin (KAN)

Table AB 6. Antibiotic resistance testing of Salmonella spp. in cattle - Percentage of resistant isolates 2002

Monitoring	Country	Invest.	TET	CHL	FLR	AMP	NAL	FQ	SXT	TMP	SU	CE	CEP	CTX	CAZ	GFP	TIO	CXM	CQN	CRO	STR	GEN	NEO	KAN	
Cattle																									
Salmonella	NO	A	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Salmonella#	NO	A	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Salmonella	NO	B	29	21	32	13	22	18	7	40	40										38		1		
Salmonella#	NO	B	14	48	52	39	61		17	57	57										57		4		
Salmonella	-	D	538																						
Salmonella#	-	DK	31	23	10	19	0	0	0	19	0	0	0	0	0	0	0	0	0	0	23	0	0	0	0
Salmonella	YES	FIN	13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8				
Salmonella#	YES	FIN	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9				
Salmonella	NO	F	472	29	20	65	32	5	1	3	2	19	1	0	0	0	0	0	3	3	58	2	0	0	1
Salmonella#	NO	F	124	37	58	71	65	11	1	5	0	0	1	0	0	0	2	2	2	2	5	0	0	0	0
Salmonella#	-	F	92	59	49	48	4	0	1	52	52	0	0	0	0	0	0	0	0	0	62	2	0	0	0
Salmonella	NO	EL	3	100	66	33	0	0	0	0	33										67	33			
Salmonella#	NO	EL	3	100	67	33	0	0	0	0	33										67	33			
Salmonella#	NO	IRL	176	77	36	36	5																		9
Salmonella	NO	I	268	63	27	43	24	0	9	73	73	3	0	0	0	0	0	0	0	0	48	1	10	11	
Salmonella#	NO	I	268	63	27	44	24	0	8	74	74	3	0	0	0	0	0	0	0	0	49	1	9	11	
Salmonella	YES	NL	14	45	36	29	3	16	16	16	16														3
Salmonella#	YES	NL	13	62	48	43		19	19	19	19														
Salmonella#	-	NL	7	10	10	10	10	10	10	10	10														10

Note: The figures given in the line Salmonella represent the overall number of isolates tested as reported by the country, the figures given in the line Salmonella # represent the calculated sum of those Salmonella serotypes tested which were reported by the country. Thus, not all Salmonella strains tested might be included in this figure. Data from Denmark are taken from DANMAP 2002. Data from Norway are taken from the NORM/NORM-VET-report.

YES - Isolates collected within a monitoring programme; NO - Isolates collected not within a monitoring programme; - no information on the source of the isolates available
 Tetracycline (TET), Chloramphenicol (CHL), Florfenicol (FLR), Ampicillin (AMP), Nalidixic acid or other quinolone (NAL), Fluoroquinolone (Ciprofloxacin or Entrofloxacin) (FQ), Sulfonamide/Trimethoprim (SXT), Trimethoprim (TMP), Sulfonamides (SU), Cephalosporin not further specified (CE), Cephalotin (CEP), Cefotaxim (CTX), Ceftazidime (CAZ), Cefoperazone (CFP), Ceftiofur (TIO), Cefuroxime (CXM), Ceftriaxone (CRO), Streptomycin (STR), Gentamicin (GEN), Neomycin (NEO), Kanamycin (KAN)

Table AB 6. Antibiotic resistance testing of Salmonella spp. in cattle - Percentage of resistant isolates 2002

Salmonella#	Monitoring	Country	Invest.	TET	CHL	FLR	AMP	NAL	FQ	SXT	TMP	SU	CE	CEP	CTX	CAZ	CFP	TIO	CXM	CQN	CRO	STR	GEN	NEO	KAN
Salmonella	YES	S	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Salmonella#	YES	S	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Salmonella	-	UK	862	13	10	10	11	1	1	4	4	12											9	0	0
Salmonella#	YES	N	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Salmonella	YES	UK(E+W)	862	13	10	10	11	1	1	4	4	12				0	4						9	1	1
Salmonella#	YES	UK(E+W)	765	14	12	12	12	2	2	5	5	13				0	5					13	1	1	
Salmonella	NO	UK(NIRL)	269	5	4	4	3	2	0	3	3	7										18	0	0	
Salmonella#	NO	UK(NIRL)	269	6	4	4	5	2	0	3	7											17	0	0	

Note: The figures given in the line Salmonella represent the overall number of isolates tested as reported by the country, the figures given in the line Salmonella # represent the calculated sum of those Salmonella serotypes tested which were reported by the country. Thus, not all Salmonella strains tested might be included in this figure. Data from Denmark are taken from DANMAP 2002. Data from Norway are taken from the NORM/NORM-VET-report.

YES - Isolates collected within a monitoring programme; NO - Isolates collected not within a monitoring programme; - no information on the source of the isolates available
Tetracycline (TET), Chloramphenicol (CHL), Florfenicol (FLR), Ampicillin (AMP), Nalidixic acid or other quinolone (NAL), Fluoroquinolone (Ciprofloxacin or Enrofloxacin) (FQ)
Sulfonamide/Trimethoprim (SXT), Trimethoprim (TMP), Sulfonamides (SU), Cephalosporin not further specified (CE), Cephalotin (CEP), Cefotaxim (CTX), Ceftazidime (CAZ), Cefoperazone (CFP), Ceftiofur (TIO), Cefuroxime (CXM), Ceftriaxone (CRO), Streptomycin (STR), Gentamicin (GEN), Neomycin (NEO), Kanamycin (KAN)

Table AB 7. Antibiotic resistance testing of Salmonella spp. in pigs - Percentage of resistant isolates 2002

Monitoring		Country	Invest.	TET	CHL	FLR	AMP	NAL	FQ	SXT	TMP	SU	CE	CEP	CTX	CAZ	CFP	TIO	CXM	CQN	CRO	STR	GEN	NEO	KAN		
Pigs																											
Salmonella	NO	A	40	50	40	50	3	0	40	50	0	0	0	0	0	0	0	0	0	0	0	0	50	30	30	30	
Salmonella#	NO	A	27	85	60	63	4	0	48	63	0	0	0	0	0	0	0	0	0	0	0	60	44	44	44		
Salmonella	NO	B	92	44	24	21	32	5	19	43	0	0	0	0	0	0	0	0	0	0	0	31	0	0	0		
Salmonella#	NO	B	79	53	32	30	41	1	22	53	0	0	0	0	0	0	0	0	0	0	0	39	1	6	6		
Salmonella	-	D	258																								
Salmonella#	-	DK	736	33	7	18	1	8	32	0	0	0	0	0	0	0	0	0	0	0	0	33	1	1	1		
Salmonella	YES	E	49	96	31	6	6	0	31	55	0	0	0	0	0	2	0	0	0	0	0	49	6	8	8		
Salmonella#	YES	E	21	95	38	14	9	9	28	81	0	0	0	0	0	9	0	0	0	0	0	67	9	9	12		
Salmonella	YES	FIN	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Salmonella#	YES	FIN	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Salmonella	NO	F	50	68	30	30	2	0	10	44	0	0	0	0	0	0	0	0	0	0	0	52	2	2	0		
Salmonella#	-	F	19	89	63	68	0	0	11	79	0	0	0	0	0	0	0	0	0	0	0	79	5	5	0		
Salmonella	NO	EL	1	100	0	0	0	0	100	100	0	0	0	0	0	0	0	0	0	0	0	100	0	0	0		
Salmonella	NO	IRL	3	100				33																			
Salmonella#	NO	IRL	3	100				100																			
Salmonella	NO	I	1471	71	19	43	7	0	18	68	3	0	0	0	0	0	0	0	0	0	0	50	2	7	8		
Salmonella#	NO	I	1471	66	19	43	27	0	18	68	3	0	0	0	0	0	0	0	0	0	0	51	7	7	8		
Salmonella	YES	NL	92	35	11	8	3	18	18																		

Note: The figures given in the line Salmonella represent the overall number of isolates tested as reported by the country, the figures given in the line Salmonella # represent the calculated sum of those Salmonella serotypes tested which were reported by the country. Thus, not all Salmonella strains tested might be included in this figure.
Data from Denmark are taken from DANMAP 2002. Data from Norway are taken from the NORM/NORM-VET-report.

YES - Isolates collected within a monitoring programme; NO - Isolates collected not within a monitoring programme; - no information on the source of the isolates available
Tetracycline (TET), Chloramphenicol (CHL), Florfenicol (FLR), Ampicillin (AMP), Nalidixic acid or other quinolone (NAL), Fluoroquinolone (Ciprofloxacin or Enrofloxacin) (FQ), Sulfonamide/Trimethoprim (SXT), Trimethoprim (TMP), Sulfonamides (SU), Cephalosporin not further specified (CE), Cephalotin (CEP), Cefotaxim (CTX), Ceftazidime (CAZ), Cefoperazone (CFP), Ceftiofur (TIO), Cefuroxime (CXM), Ceftriaxone (CRO), Streptomycin (STR), Gentamicin (GEN), Neomycin (NEO), Kanamycin (KAN)

Table AB 7. Antibiotic resistance testing of Salmonella spp. in pigs - Percentage of resistant isolates 2002

Monitoring Salmonella#	Country	Invest.	TET	CHL	FLR	AMP	NAL	FQ	SXT	TMP	SU	CE	CEP	CTX	CAZ	CFP	TIO	CXM	CQN	CRO	STR	GEN	NEO	KAN
Salmonella#	NL	46	51	21	14	3	14	14	14	14														
Salmonella#	NL	58	16			3	22	22																
Salmonella#	NO	7	100	100	100	85	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	0	0	14
Salmonella	YES	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Salmonella#	YES	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Salmonella	-	309	84	50	61	6	63	79													55		7	
Salmonella#	YES	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Salmonella	YES	309	84	50	61	6	63	79							0	7					55	4	7	
Salmonella#	YES	234	90	64	76	8	72	89							0	8					67	4	6	
Salmonella	NO	202	73	30	38	2	0	34	61												43	1	2	
Salmonella#	NO	202	73	30	38	2	0	33	61												43	1	2	

Note: The figures given in the line Salmonella represent the overall number of isolates tested as reported by the country, the figures given in the line Salmonella # represent the calculated sum of those Salmonella serotypes tested which were reported by the country. Thus, not all Salmonella strains tested might be included in this figure. Data from Denmark are taken from DANMAP 2002. Data from Norway are taken from the NORM/NORM-VET-report.

YES - Isolates collected within a monitoring programme; NO - Isolates collected not within a monitoring programme; - no information on the source of the isolates available
Tetracycline (TET), Chloramphenicol (CHL), Florfenicol (FLR), Ampicillin (AMP), Nalidixic acid or other quinolone (NAL), Fluoroquinolone (Ciprofloxacin or Enrofloxacin) (FQ)
Sulfonamide/Trimethoprim (SXT), Trimethoprim (TMP), Sulfonamides (SU), Cephalosporin not further specified (CE), Cephalotin (CEP), Cefotaxim (CTX), Ceftazidime (CAZ), Cefoperazone (CFP), Ceftiofur (TIO), Cefuroxime (CXM), Ceftriaxone (CRO), Streptomycin (STR), Gentamicin (GEN), Neomycin (NEO), Kanamycin (KAN)

Table AB 8. Antibiotic resistance testing of Salmonella spp. in poultry - Percentage of resistant isolates 2002

Monitoring	Country	Invest.	TET	CHL	FLR	AMP	NAL	FQ	SXT	TMP	SU	CE	CEP	CTX	CAZ	CFP	TIO	CXM	CQN	CRO	STR	GEN	NEO	KAN	
Poultry																									
Salmonella	NO	A	996	17	4	11	22	0	5	12	0	0	0	0	0	0	0	0	0	0	20	1	1	11	0
Salmonella#	NO	A	669	7	1	5	13	0	3	13	0	0	0	0	0	0	0	0	0	0	11	1	1	0	0
Salmonella	YES	B	214	20	9	7	35	33	23	27	1	1	0	0	0	0	0	0	0	0	25	0	0	0	0
Salmonella#	YES	B	43	44	49	39	12	24	24	62	0	0	0	0	0	0	0	0	0	0	65	0	0	0	0
Salmonella	-	D	869																						
Salmonella#	-	DK	39	5	3	8	15		3	5							0			0	5	0			0
Salmonella#	NO	E	38	20		22	20	5	13													3			3
Salmonella	YES	FIN	16	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Salmonella#	YES	FIN	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Salmonella#	-	FIN	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Salmonella	NO	F	1082	30	8	15	11	0	9	14	2	2	0	0	0	0	0	0	0	0	37	1	1	1	1
Salmonella#	-	F	252	36	20	20	25	1	3	15	0	0	0	0	0	0	0	0	0	0	38	0	0	0	0
Salmonella#	NO	F	109	8	0	5	3	0	2	2	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0
Salmonella	NO	EL	1	0	1	0	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Salmonella	YES	EL	38	21	34	13	11	0	5	0	0	0	0	0	0	0	0	0	0	0	11	24	24	4	4
Salmonella#	YES	EL	21	14	14	5	33	0	0	0	0	0	0	0	0	0	0	0	0	0	14	0	0	5	5
Salmonella#	NO	EL	2	0	0	0	100	50	50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Salmonella	NO	IRL	3																						

Note: The figures given in the line Salmonella represent the overall number of isolates tested as reported by the country, the figures given in the line Salmonella # represent the calculated sum of those Salmonella serotypes tested which were reported by the country. Thus, not all Salmonella strains tested might be included in this figure.

Data from Denmark are taken from DANMAP 2002. Data from Norway are taken from the NORM/NORM-VET-report.

YES - Isolates collected within a monitoring programme; NO - Isolates collected not within a monitoring programme; - no information on the source of the isolates available
Tetracycline (TET), Chloramphenicol (CHL), Florfenicol (FLR), Ampicillin (AMP), Nalidixic acid or other quinolone (NAL), Fluoroquinolone (Ciprofloxacin or Enrofloxacin) (FQ), Sulfonamide/Trimethoprim (SXT), Trimethoprim (TMP), Sulfonamides (SU), Cephalosporin not further specified (CE), Cephalotin (CEP), Cefotaxim (CTX), Ceftazidime (CAZ), Cefoperazone (CFP), Ceftiofur (TIO), Cefuroxime (CXM), Cefquinome (CQN), Streptomycin (STR), Gentamicin (GEN), Neomycin (NEO), Kanamycin (KAN)

Table AB 8. Antibiotic resistance testing of Salmonella spp. in poultry - Percentage of resistant isolates 2002

Monitoring Salmonella#	Country	Invest.	TET	CHL	FLR	AMP	NAL	FQ	SXT	TMP	SU	CE	CEP	CTX	CAZ	CFP	TIO	CXM	CQN	CRO	STR	GEN	NEO	KAN
NO	IRL	3																						
Salmonella	NO	I	2158	51	29	45	52	2	32	28	50	12	1	1							44	2	20	20
Salmonella#	NO	I	2289	43	7	36	28	1	9	53	53	8	1	1							33	7	10	10
Salmonella	NO	NL	3	40			20																	
Salmonella	YES	NL	165	12	2	1	15		27	28			3					4				1	0	0
Salmonella#	-	NL	134	12	1	0	18		30	32			3					4				1	0	0
Salmonella#	YES	NL	32	43	21	14			11	11								7						
Salmonella#	NO	P	36	22	14	28	53	18	0	16	16		0								14	0	0	0
Salmonella	YES	S	7	0	0	0	0	0	0	0	0										0	0	0	0
Salmonella#	YES	S	2	0	0	0	0	0	0	0	0										0	0	0	0
Salmonella	-	UK	1580	16	13	10	2	24	24	31	31										16			7
Salmonella	YES	UK(E+W)	1407	14	15	11	2	25	25	33	33				0	2					14	1	5	5
Salmonella#	YES	UK(E+W)	112	62	63	63	5	18	18	65	65				0	38					56	0	2	2
Salmonella	NO	UK(NIRL)	52	8	0	2	0	0	4	10	10										10	0	0	6
Salmonella#	NO	UK(NIRL)	52	8	0	2	0	0	4	10	10										10	0	0	6

Note: The figures given in the line Salmonella represent the overall number of isolates tested as reported by the country, the figures given in the line Salmonella # represent the calculated sum of those Salmonella serotypes tested which were reported by the country. Thus, not all Salmonella strains tested might be included in this figure.

Data from Denmark are taken from DANMAP 2002. Data from Norway are taken from the NORM/NORM-VET-report.

YES - Isolates collected within a monitoring programme; NO - Isolates collected not within a monitoring programme; - no information on the source of the isolates available
Tetracycline (TET), Chloramphenicol (CHL), Florfenicol (FLR), Ampicillin (AMP), Nalidixic acid or other quinolone (NAL), Fluoroquinolone (Ciprofloxacin or Enrofloxacin) (FQ), Sulfonamide/Trimethoprim (SXT), Trimethoprim (TMP), Sulfonamides (SU), Cephalosporin not further specified (CE), Cephalotin (CEP), Cefotaxim (CTX), Ceftazidime (CAZ), Cefoperazone (CFP), Ceftiofur (TIO), Cefuroxime (CXM), Cefquinome (CQN), Streptomycin (STR), Gentamicin (GEN), Neomycin (NEO), Kanamycin (KAN)

Table AB 9. Antibiotic resistance testing of Salmonella spp. in humans - Percentage of resistant isolates 2002

Monitoring	Country	Invest.	TET	CHL	FLR	AMP	NAL	FQ	SXT	TMP	SU	CE	CEP	CTX	CAZ	CFP	TIO	CXM	CQN	CRO	STR	GEN	NEO	KAN
Salmonella#	-	B	681	33	13	27	13	0	6	7	22			0							26	0	0	0
Salmonella#	-	DK	901	19	8	17	5		4	20				0						0	17	1		

Humans

Note: The figures given in the line Salmonella represent the overall number of isolates tested as reported by the country, the figures given in the line Salmonella # represent the calculated sum of those Salmonella serotypes tested which were reported by the country. Thus, not all Salmonella strains tested might be included in this figure.

Data from Denmark are taken from DANMAP 2002. Data from Norway are taken from the NORM/NORM-VET-report.

YES - Isolates collected within a monitoring programme: NO - Isolates collected not within a monitoring programme: - no information on the source of the isolates available
Tetracycline (TET), Chloramphenicol (CHL), Florfenicol (FLR), Ampicillin (AMP), Nalidixic acid or other quinolone (NAL), Fluoroquinolone (Ciprofloxacin or Enrofloxacin) (FQ)
Sulfonamide/Trimethoprim (SXT), Trimethoprim (TMP), Sulfonamides (SU), Cephalosporin not further specified (CE), Cephalotin (CEP), Cefotaxim (CTX), Ceftazidime (CAZ),
Cefoperazone (CFP), Ceftiofur (TIO), Cefuroxime (CXM), Streptomyacin (STR), Gentamicin (GEN), Neomycin (NEO), Kanamycin (KAN)

Table AB 10. Antibiotic resistance testing of Salmonella Enteritidis - Percentage of resistant isolates 2002

Monitoring	Country	Invest.	TET	CHL	FLR	AMP	NAL	FQ	SXT	TMP	SU	CE	CEP	CTX	CAZ	CFP	TIO	CXM	CQN	CRO	STR	GEN	NEO	KAN	
S. Enteritidis																									
Cattle																									
NO	A	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NO	F	29	20	0	0	0	0	0	0	0	0	0	0	0	0	0	11	0	0	0	9	0	0	0	0
NO	I	8	0	0	0	0	0	0	0	0	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0
YES	S	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
YES	UK(E+W)	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pigs																									
NO	A	2	0	0	0	0	50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
YES	FIN	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NO	I	8	0	0	0	0	0	0	0	0	50	0	0	0	0	0	0	0	0	0	0	0	0	0	0
YES	S	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
YES	UK(E+W)	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Note: The figures given in the line Salmonella represent the overall number of isolates tested as reported by the country, the figures given in the line Salmonella # represent the calculated sum of those Salmonella serotypes tested which were reported by the country. Thus, not all Salmonella strains tested might be included in this figure. Data from Denmark are taken from DANMAP 2002. Data from Norway are taken from the NORM/NORM-VET-report. YES - Isolates collected within a monitoring programme; NO - Isolates collected not within a monitoring programme; - no information on the source of the isolates available. Tetracycline (TET), Chloramphenicol (CHL), Florfenicol (FLR), Ampicillin (AMP), Nalidixic acid or other quinolone (NAL), Fluoroquinolone (Ciprofloxacin or Enrofloxacin) (FQ), Sulfonamide/Trimethoprim (SXT), Trimethoprim (TMP), Sulfonamides (SU), Cephalosporin not further specified (CE), Cephalotin (CEP), Cefotaxim (CTX), Ceftazidime (CAZ), Cefoperazone (CFP), Ceftiofur (TIO), Cefuroxime (CXM), Cefquinome (CQN), Streptomycin (STR), Gentamicin (GEN), Neomycin (NEO), Kanamycin (KAN)

Table AB 10. Antibiotic resistance testing of Salmonella Enteritidis - Percentage of resistant isolates 2002

Monitoring	Country	Invest.	TET	CHL	FLR	AMP	NAL	FQ	SXT	TMP	SU	CE	CEP	CTX	CAZ	CFP	TIO	CXM	CQN	CRO	STR	GEN	NEO	KAN		
Poultry																										
NO	A	325	2	0	2	5	0	0	1	1	1	0	0	0	0	0	0	0	0	0	2	0	0	0	0	
YES	B	6																								
-	DK	26	0	0	4	23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
NO	E	38	20	22	20	5	13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	3	3	3	
YES	FIN	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
NO	F	109	8	0	5	3	0	2	2	2	2	0	0	0	0	0	0	0	0	0	2	0	0	0	0	
NO	EL	1	0	0	0	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
YES	EL	17	0	0	6	41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	
NO	I	162	0	0	4	0	1	0	0	32	6	0	0	0	0	0	0	0	0	0	20	2	0	0	4	
YES	NL	29						3	3																	
NO	P	26	20	8	27	61	13	0	0	16	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	
YES	S	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
YES	UK(E+W)	13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Other animals																										
-	NL	15				6																				
NO	P	2	0	0	0	50	0	50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
YES	S	11	0	0	0	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Humans																										
-	B	203	0	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-	DK	521	1	0	2	7	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Food																										
-	DK	19	0	0	0	16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11	5	0	0	0	

Note: The figures given in the line Salmonella represent the overall number of isolates tested as reported by the country, the figures given in the line Salmonella # represent the calculated sum of those Salmonella serotypes tested which were reported by the country. Thus, not all Salmonella strains tested might be included in this figure. Data from Denmark are taken from DANMAP 2002. Data from Norway are taken from the NORM/NORM-VET-report. YES - Isolates collected within a monitoring programme; NO - Isolates collected not within a monitoring programme; - no information on the source of the isolates available. Tetracycline (TET), Chloramphenicol (CHL), Florfenicol (FLR), Ampicillin (AMP), Nalidixic acid or other quinolone (NAL), Fluoroquinolone (Ciprofloxacin or Enrofloxacin) (FQ), Sulfonamide/Trimethoprim (SXT), Trimethoprim (TMP), Sulfonamides (SU), Cephalosporin not further specified (CE), Cephalotin (CEP), Cefotaxim (CTX), Ceftazidime (CAZ), Cefoperazone (CFP), Ceftiofur (TIO), Cefuroxime (CXM), Cefquinome (CQN), Streptomycin (STR), Gentamicin (GEN), Neomycin (NEO), Kanamycin (KAN)

Table AB 11. Antibiotic resistance testing of Salmonella Typhimurium - Percentage of resistant isolates 2002

Monitoring	Country	Invest.	TET	CHL	FLR	AMP	NAL	FQ	SXT	TMP	SU	CE	CEP	CTX	CAZ	GFP	TIO	CXM	CQN	CRO	STR	GEN	NEO	KAN	
-	UK	533	80	62	71	7	44	78													61			3	
S. Typhimurium																									
Animals																									
Cattle																									
NO	A	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NO	B	14	48	52	39	61	17	57													57			4	
-	DK	31	23	10		19	0	19									0				23			0	
YES	FIN	9	0	0		0	0	0													0				
-	F	67	72	66		66	6	70													75			3	0
NO	F	95	63	85	80	87	14	1	6			1					1				4			0	
NO	EL	3	100	67		33	0	0	0	0	33										67			33	
NO	IRL	17	77		36			5																9	
NO	I	115	86	59		84	36	1	7		85		5	0							74			2	4
YES	NL	13	62	48	43			19	19																5
NO	P	1	100	0		100	100	0	0												100			0	0
YES	S	4	0	0	0	0	0	0	0	0	0										0			0	0
YES	UK(E+W)	125	83	66		74	7	24			76					0	28				74			2	1
NO	UK(NIRL)	12	83	67		67	0	0	50	100											67			0	0

Note: The figures given in the line Salmonella represent the overall number of isolates tested as reported by the country, the figures given in the line Salmonella # represent the calculated sum of those Salmonella serotypes tested which were reported by the country. Thus, not all Salmonella strains tested might be included in this figure. Data from Denmark are taken from DANMAP 2002. Data from Norway are taken from the NORM/NORM-VET-report.

YES - Isolates collected within a monitoring programme; NO - Isolates collected not within a monitoring programme; - no information on the source of the isolates available
 Tetracycline (TET), Chloramphenicol (CHL), Florfenicol (FLR), Ampicillin (AMP), Nalidixic acid or other quinolone (NAL), Fluoroquinolone (Ciprofloxacin or Entrofloxacin) (FQ)
 Sulfonamide/Trimethoprim (SXT), Trimethoprim (TMP), Sulfonamides (SU), Cephalosporin not further specified (CE), Cephalosporin (CEP), Cefotaxim (CTX), Ceftazidime (CAZ),
 Cefoperazone (CFP), Cefitofur (TIO), Cefuroxime (CXM), Ceftriaxone (CRO), Streptomycin (STR), Gentamicin (GEN), Neomycin (NEO), Kanamycin (KAN)

Table AB 11. Antibiotic resistance testing of Salmonella Typhimurium - Percentage of resistant isolates 2002

Monitoring	Country	Invest.	TET	CHL	FLR	AMP	NAL	FQ	SXT	TMP	SU	CE	CEP	CTX	CAZ	CFP	TIO	CXM	CQN	CRO	STR	GEN	NEO	KAN	
	Pigs																								
NO	A	24	96	67	71	0	0	0	54	71	0	0	0	0	0	0	0	0	0	0	67	50	50	50	
NO	B	79	53	32	30	41	1	22	53	53	0	0	0	0	0	0	0	0	0	0	39	1	6	6	
-	DK	736	33	7	18	1	1	8	32	32	0	0	0	0	0	0	0	0	0	0	33	1	1	1	
YES	E	9	100	78	22	11	11	22	100	100	11	11	11	11	11	11	11	11	11	11	100	11	11	11	
YES	FIN	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
-	F	18	94	67	72	0	0	11	83	83	0	0	0	0	0	0	0	0	0	0	83	6	6	0	
NO	IRL	2	100																						
NO	I	655	87	37	74	9	1	20	80	80	3	1	1	1	1	1	1	1	1	1	68	2	1	2	
YES	NL	46	51	21	14	3	14	14	14	14	0	0	0	0	0	0	0	0	0	0	100	0	0	0	
NO	P	6	100	100	100	83	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	0	0	0	
YES	S	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
YES	N	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
YES	UK(E+W)	227	93	66	78	8	8	74	92	92	0	0	0	0	0	8	8	8	8	8	69	4	6	6	
NO	UK(NIRL)	108	86	54	69	3	0	45	80	80	0	0	0	0	0	0	0	0	0	0	59	0	2	2	

Note: The figures given in the line Salmonella represent the overall number of isolates tested as reported by the country, the figures given in the line Salmonella # represent the calculated sum of those Salmonella serotypes tested which were reported by the country. Thus, not all Salmonella strains tested might be included in this figure. Data from Denmark are taken from DANMAP 2002. Data from Norway are taken from the NORM/NORM-VET-report.

YES - Isolates collected within a monitoring programme; NO - Isolates collected not within a monitoring programme; - no information on the source of the isolates available
Tetracycline (TET), Chloramphenicol (CHL), Florfenicol (FLR), Ampicillin (AMP), Nalidixic acid or other quinolone (NAL), Fluoroquinolone (Ciprofloxacin or Enrofloxacin) (FQ), Sulfonamide/Trimethoprim (SXT), Trimethoprim (TMP), Sulfonamides (SU), Cephalosporin not further specified (CE), Cephalotin (CEP), Cefotaxim (CTX), Ceftazidime (CAZ), Cefoperazone (CFP), Ceftiofur (TIO), Cefuroxime (CXM), Ceftriaxone (CRO), Streptomycin (STR), Gentamicin (GEN), Neomycin (NEO), Kanamycin (KAN)

Table AB 11. Antibiotic resistance testing of Salmonella Typhimurium - Percentage of resistant isolates 2002

Monitoring	Country	Invest.	TET	CHL	FLR	AMP	NAL	FQ	SXT	TMP	SU	CE	CEP	CTX	CAZ	GFP	TIO	CXM	CQN	CRO	STR	GEN	NEO	KAN	
Poultry																									
NO	A	74	12	7	11	4	0	0	4	18	0	0	0	0	0	0	0	0	0	0	18	3	0	0	
YES	B	39	49	49	39	12	28	68													65				
-	DK	13	15	8	15	0	8	15	0	0	0	0	0	0	0	0	0	0	0	0	15	0	0	0	
-	F	64	66	44	58	9	2	6	52	0	0	0	0	0	0	0	0	0	0	0	66	2	2	2	
YES	EL	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
NO	EL	1					100	100																	
NO	IRL	2																							
NO	I	207	58	46	67	28	0	7	79	1	0	0	0	0	0	0	0	0	0	58	4	20	22		
YES	NL	10	43	21	14	14	14	14	7																
NO	P	10	30	30	30	30	30	0	0	0	0	0	0	0	0	0	0	0	0	40	0	0	0		
YES	S	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
YES	UK(E+W)	92	76	77	77	6	22	79	0	47	0	0	0	0	0	0	0	0	0	68	0	3	3		
Other animals																									
YES	E	2			0	50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
NO	IRL	2	100		100																			100	
YES	NL	35	23	19	18	2	4	4	4	4	4	4	4	4	4	4	4	4	4	4	25	25	0	0	
NO	P	4	25	25	25	25	0	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
YES	S	11	0	0	0	0	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
NO	N	3	67	33	33	67	0	0	0	67	0	0	0	0	0	0	0	0	0	67	0	0	0	0	
YES	UK(E+W)	11	91	73	82	27	18	82	0	45	0	0	0	0	0	0	0	0	0	73	0	0	0	0	

Note: The figures given in the line Salmonella represent the overall number of isolates tested as reported by the country, the figures given in the line Salmonella # represent the calculated sum of those Salmonella serotypes tested which were reported by the country. Thus, not all Salmonella strains tested might be included in this figure. Data from Denmark are taken from DANMAP 2002. Data from Norway are taken from the NORM/NORM-VET-report.

YES - Isolates collected within a monitoring programme; NO - Isolates collected not within a monitoring programme; - no information on the source of the isolates available
Tetracycline (TET), Chloramphenicol (CHL), Florfenicol (FLR), Ampicillin (AMP), Nalidixic acid or other quinolone (NAL), Fluoroquinolone (Ciprofloxacin or Enrofloxacin) (FQ), Sulfonamide/Trimethoprim (SXT), Trimethoprim (TMP), Sulfonamides (SU), Cephalosporin not further specified (CE), Cephalotin (CEP), Cefotaxim (CTX), Ceftazidime (CAZ), Cefoperazone (CFP), Ceftiofur (TIO), Cefuroxime (CXM), Ceftriaxone (CRO), Streptomycin (STR), Gentamicin (GEN), Neomycin (NEO), Kanamycin (KAN)

Table AB 11. Antibiotic resistance testing of Salmonella Typhimurium - Percentage of resistant isolates 2002

Monitoring	Country	Invest.	TET	CHL	FLR	AMP	NAL	FQ	SXT	TMP	SU	CE	CEP	CTX	CAZ	CFP	TIO	CXM	CQN	CRO	STR	GEN	NEO	KAN
Humans																								
-	B	319	52	26	39	2	0	9	9	9	41			0			0				39	1	1	1
-	DK	380	44	18	37	2	2	8	8	47							0				40	2	2	
Food																								
-	DK	54	53	35	45	6	6	13	58								0				52	6	6	

Note: The figures given in the line Salmonella represent the overall number of isolates tested as reported by the country, the figures given in the line Salmonella # represent the calculated sum of those Salmonella serotypes tested which were reported by the country. Thus, not all Salmonella strains tested might be included in this figure. Data from Denmark are taken from DANMAP 2002. Data from Norway are taken from the NORM/NORM-VET-report.

YES - Isolates collected within a monitoring programme; NO - Isolates collected not within a monitoring programme; - no information on the source of the isolates available
 Tetracycline (TET), Chloramphenicol (CHL), Florfenicol (FLR), Ampicillin (AMP), Nalidixic acid or other quinolone (NAL), Fluoroquinolone (Ciprofloxacin or Enrofloxacin) (FQ)
 Sulfonamide/Trimethoprim (SXT), Trimethoprim (TMP), Sulfonamides (SU), Cephalosporin not further specified (CE), Cephalotin (CEP), Cefotaxim (CTX), Ceftazidime (CAZ),
 Cefoperazone (CFP), Ceftiofur (TIO), Cefuroxime (CXM), Ceftriaxone (CRO), Streptomycin (STR), Gentamicin (GEN), Neomycin (NEO), Kanamycin (KAN)

Table AB 12. Antibiotic resistance testing of other Salmonella spp. - Percentage of resistant isolates 2002

	Invest.	TET	CHL	FLR	AMP	NAL	FQ	SXT	TMP	SU	CE	CEP	CTX	CAZ	CFP	TIO	CXM	CRO	STR	GEN	NEO	KAN	
S. Blockley	Poultry	EL	3	100	100	0	0	0	0	0	0	0	0	0	0	0	0	0	100	0	0	0	0
S. Brandenburg	Humans	B	34	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0
S. Derby	Pigs	IRL	1	100	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Humans	B	34	3	3	0	0	0	3	3	3	0	0	0	0	0	0	0	18	0	0	0	0
S. Diarizonae	Other animals	N	21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S. Dublin	Animals	UK	687	1	0	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	Cattle	UK(E+W)	637	1	1	0	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1	1
	Pigs	UK(E+W)	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Poultry	UK(E+W)	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Other animals	UK(E+W)	35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S. Hadar	Humans	B	44	98	0	80	94	0	0	2	2	0	0	0	0	0	0	0	96	0	0	0	2
S. Heidelberg	Poultry	A	120	4	0	10	28	0	6	15	0	0	0	0	0	0	0	0	14	6	0	0	0
S. Indiana	Cattle	F	21	26	4	0	0	0	0	0	0	0	0	0	0	0	0	0	30	0	0	0	0
	Poultry	F	35	21	15	3	0	0	0	0	0	0	0	0	0	0	0	0	38	0	0	0	0
S. Infantis	Cattle	FIN	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Pigs	A	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Poultry	A	117	25	0	5	26	0	5	43	0	0	0	0	0	0	0	0	33	0	0	0	0
	Poultry	FIN	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S. Javiana	Cattle	N	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Note: The figures given in the line Salmonella represent the overall number of isolates tested as reported by the country, the figures given in the line Salmonella # represent the calculated sum of those Salmonella serotypes tested which were reported by the country. Thus, not all Salmonella strains tested might be included in this figure.

Data from Denmark are taken from DANMAP 2002. Data from Norway are taken from the NORM/NORM-VET-report.

YES - Isolates collected within a monitoring programme: NO - Isolates collected not within a monitoring programme: - no information on the source of the isolates available
Tetracycline (TET), Chloramphenicol (CHL), Florfenicol (FLR), Ampicillin (AMP), Nalidixic acid or other quinolone (NAL), Fluoroquinolone (Ciprofloxacin or Enrofloxacin) (FQ)
Sulfonamide/Trimethoprim (SXT), Trimethoprim (TMP), Sulfonamides (SU), Cephalosporin not further specified (CE), Cephalotin (CEP), Cefotaxim (CTX), Ceftazidime (CAZ),
Cefoperazone (CFP), Ceftiofur (TIO), Cefuroxime (CXM), Streptomycin (STR), Gentamicin (GEN), Neomycin (NEO), Kanamycin (KAN)

Table AB 12. Antibiotic resistance testing of other Salmonella spp. - Percentage of resistant isolates 2002

		Invest.	TET	CHL	FLR	AMP	NAL	FQ	SXT	TMP	SU	CE	CEP	CTX	CAZ	CFP	TIO	CXM	CRO	STR	GEN	NEO	KAN
S. Kottbus	Cattle	F	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Poultry	F	28	43	0	36	82	0	7	14	14	0	0	0	0	0	0	0	0	21	0	0	0
S. Livingstone	Poultry	FIN	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S. Senftenberg	Cattle	F	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Pigs	F	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Poultry	A	33	0	0	0	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Poultry	F	125	24	13	2	27	2	1	2	2	0	0	0	0	0	0	0	0	28	0	0	0
S. Tennessee	Cattle	FIN	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	0	0	0
	Pigs	FIN	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Poultry	FIN	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S. Virchow	Humans	B	47	26	2	40	81	0	30	32	34	6	6	6	6	6	6	6	6	11	0	0	0
Salmonella 4,5:i:-	Pigs	P	1	100	100	100	100	0	0	0	0	0	0	0	0	0	0	0	0	100	0	0	100
Salmonella, not S.Dublin, S. Typhimurium	Animals	UK	2167	14	8	6	2	2	20	24	24	24	24	24	24	24	24	24	24	11	5	5	5

Note: The figures given in the line Salmonella represent the overall number of isolates tested as reported by the country, the figures given in the line Salmonella # represent the calculated sum of those Salmonella serotypes tested which were reported by the country. Thus, not all Salmonella strains tested might be included in this figure.

Data from Denmark are taken from DANMAP 2002. Data from Norway are taken from the NORM/NORM-VET-report.

YES - Isolates collected within a monitoring programme: NO - Isolates collected not within a monitoring programme: - no information on the source of the isolates available
Tetracycline (TET), Chloramphenicol (CHL), Florfenicol (FLR), Ampicillin (AMP), Nalidixic acid or other quinolone (NAL), Fluoroquinolone (Ciprofloxacin or Enrofloxacin) (FQ)
Sulfonamide/Trimethoprim (SXT), Trimethoprim (TMP), Sulfonamides (SU), Cephalosporin not further specified (CE), Cephalotin (CEP), Cefotaxim (CTX), Ceftazidime (CAZ),
Cefoperazone (CFP), Ceftiofur (TIO), Cefuroxime (CXM), Ceftriaxone (CRO), Streptomycin (STR), Gentamicin (GEN), Neomycin (NEO), Kanamycin (KAN)

Table AB 13. Antimicrobial resistance in *Salmonella* spp. - Distribution (%) of MIC-values, 2002 - Tetracycline

Country	Species	Number	% Resistant	Distribution (%) of MICs																				
				<=0,003	0,007	0,015	0,03	0,06	0,12	0,25	0,5	1	2	4	8	16	32	64	128	256	>=512	1024	2048	>2048
<i>Salmonella</i> spp.																								
Finland	Animals, production	34																						
Spain	Pigs	49	97,96																					
Sweden	Animals	36	0	2,8																				
<i>S. Enteritidis</i>																								
Denmark	Poultry	26	0																					
Finland	Animals, production	2																						
<i>S. Typhimurium</i>																								
Denmark	Cattle	31	22,60																					
	Pigs	736	33,40																					
	Pork	57																						
	Poultry	13	15,40																					
	Animals, production	12																						
Finland	Animals	7	28,57																					
Norway	Animals	7	28,57																					
Spain	Pigs	9	100,00																					
Sweden	Animals	31	0	3,2																				
Other serotypes																								
Finland	Animals, production	9																						
	Poultry (gallus gallus)	4																						
Norway	Animals, production	22	0																					
Spain	Pigs	12	100,00																					

Bold vertical lines denote breakpoints for resistance. White fields denote range of dilutions tested for each antimicrobial.

Table AB 14. Antimicrobial resistance in *Salmonella* spp. - Distribution (%) of MIC-values, 2002 - Chloramphenicol

Country	Species	Number	% Resistant	Distribution (%) of MICs																				
				<=0,003	0,007	0,015	0,03	0,06	0,12	0,25	0,5	1	2	4	8	16	32	64	128	256	>=512	1024	2048	>2048
Salmonella spp.																								
Finland	Animals, production	34																						
Spain	Pigs	49	30,61																					
Sweden	Animals	36	0																					
Netherlands	All sources	694	6,92																					
S. Enteritidis																								
Denmark	Poultry	26	0																					
Finland	Animals, production	2																						
Netherlands	All sources	59	0																					
S. Typhimurium																								
Denmark	Cattle	31	9,70																					
	Pigs	736	7,10																					
	Poultry	13	7,70																					
Finland	Animals, production	12																						
Norway	Animals	7	14,29																					
Spain	Pigs	9	77,78																					
Sweden	Animals	31	0																					
Netherlands	All sources	182	23,63																					
Other serotypes																								
Finland	Animals, production	9																						
	Poultry (<i>gallus gallus</i>)	4																						
Norway	Animals, production	22	0																					
Spain	Pigs	12	0																					
Netherlands	Poultry	124	0																					

White vertical lines denote breakpoints for resistance. White fields denote range of dilutions tested for each antimicrobial.

Table AB 15. Antimicrobial resistance in *Salmonella* spp. - Distribution (%) of MIC-values, 2002 - Florfenicol

Country	Species	Number	% Resistant	Distribution (%) of MICs																				
				<=0,003	0,007	0,015	0,03	0,06	0,12	0,25	0,5	1	2	4	8	16	32	64	128	256	>=512	1024	2048	>2048
Salmonella spp.																								
Finland	Animals, production	34																						
Spain	Pigs	49	6,12																					
Sweden	Animals	36	0																					
Netherlands	All sources	694	5,19																					
S. Enteritidis/Florfenicol/2002																								
Denmark	Poultry	26	0																					
Finland	Animals, production	2																						
The Netherlands	All sources	59	0																					
S. Typhimurium																								
Denmark	Cattle	31	9,70																					
	Pigs	736	3,40																					
	Pork	57																						
	Poultry	13	7,70																					
Finland	Animals, production	12																						
Norway	Animals	7	14,29																					
Spain	Pigs	9	44,44																					
Sweden	Animals	31	0																					
Netherlands	All sources	182	18,68																					
Other serotypes																								
Finland	Animals, production	9																						
	Poultry (gallus gallus)	4																						
Norway	Animals, production	22	0																					
Spain	Pigs	12	0																					
Netherlands	Poultry	124	0																					

Bold vertical lines denote breakpoints for resistance. White fields denote range of dilutions tested for each antimicrobial.

Table AB 17. Antimicrobial resistance in *Salmonella* spp. - Distribution (%) of MIC-values, 2002 - Nalidixic acid

Country	Species	Number	% Resistant																										
			<=0,003	0,003	0,007	0,015	0,03	0,06	0,12	0,25	0,5	1	2	4	8	16	32	64	128	256	>=512	1024	2048	>2048					
Salmonella spp.																													
Finland	Animals, production	34																											
Spain	Other animals	2																											
	Pigs	49																											
Sweden	Animals	36																											
S. Enteritidis																													
Denmark	Poultry	26																											
Finland	Animals, production	2																											
S. Typhimurium																													
Denmark	Cattle	31																											
	Pigs	736																											
	Pork	57																											
	Poultry	13																											
Finland	Animals, production	12																											
Norway	Animals	7																											
Spain	Pigs	9																											
Sweden	Animals	31																											
Other serotypes																													
Finland	Animals, production	9																											
	Poultry (gallus gallus)	4																											
Norway	Animals, production	22																											
Spain	Animals	1																											
	Pigs	12																											

White fields denote breakpoints for resistance. White fields denote range of dilutions tested for each antimicrobial.

Table AB 18. Antimicrobial resistance in *Salmonella* spp. - Distribution (%) of MIC-values, 2002 - Fluoroquinolones

Country	Species	Number	% Resistant	Distribution (%) of MICs																				
				<=0,003	0,007	0,015	0,03	0,06	0,12	0,25	0,5	1	2	4	8	16	32	64	128	256	>=512	1024	2048	>2048
Salmonella spp.																								
Finland	Animals, production	34						26,5	70,6	2,9														
Spain	Other animals	2	0								50,0	50,0												
Spain	Pigs (Cipro)	49	0					93,9	4,1	2,0														
Spain	Pigs (Enro)	49																						
Spain	Other animals	2	0																					
Sweden	Animals	36	0					22,2	77,8															
Netherlands	All sources	694	0				75,8	48,0	2,7	7,1	4,0	1,3												
S. Enteritidis																								
Denmark	Poultry	26	0				73,1	3,8		7,7	7,7	7,7												
Finland	Animals, production	2						50,0	50,0															
Netherlands	All sources	59	0				47,5	50,8		1,7														
S. Typhimurium																								
Denmark	Cattle	31	0				100,0																	
	Pigs	736	0				94,4	4,9	0,3	0,4														
	Pork	57					93,0	1,8		3,5														
	Poultry	13	0				100,0																	
Finland	Animals, production	12						8,3	83,3	8,3														
Norway	Animals	7	0					100,0																
Spain	Pigs	9	0																					
Sweden	Animals	31	0					29,0	71,0															
Netherlands	All sources	182	0				64,3	33,5	0,5	1,1	0,5													
Other serotypes																								
Finland	Animals, production	9						33,3	66,7															
	Poultry (gallus gallus)	4						25,0	75,0															
Norway	Animals, production	22	0					4,5	86,4	9,1														
Spain	Animals	1									100,0													
	Pigs	12	0					91,7	8,3															
Netherlands	Poultry	124	0				33,1	26,6	4,0	13,7	17,7	4,8												

Bold vertical lines denote breakpoints for resistance. White fields denote range of dilutions tested for each antimicrobial.

Table AB 19. Antimicrobial resistance in Salmonella spp. - Distribution (%) of MIC-values, 2002 - Sulfonamide / Trimethoprim

Country	Species	Number	% Resistant	Distribution (%) of MICs																				
				<=0,003	0,007	0,015	0,03	0,06	0,12	0,25	0,5	1	2	4	8	16	32	64	128	256	>=512	1024	2048	>2048
Salmonella spp.																								
Spain	Other animals	2	0																					
Netherlands	All sources	694								108,6	2,4	0,4	0,4	0,6	0,7	0,4	0,3	0,1				25,2		
S. Enteritidis																								
Netherlands	All sources	59								98,3												1,7		
S. Typhimurium																								
Netherlands	All sources	182								84,1	3,8	0,5										11,5		
Other serotypes																								
Spain	Animals	1																				100,0		
Netherlands	Poultry	124								0,8			0,8	1,6	3,2	2,4	0,8	0,8				89,5		

Bold vertical lines denote breakpoints for resistance. White fields denote range of dilutions tested for each antimicrobial.

Table AB 21. Antimicrobial resistance in *Salmonella* spp. - Distribution (%) of MIC-values, 2002 - Sulfonamides

Country	Species	Number	% Resistant	Distribution (%) of MICs																				
				<=0,003	0,007	0,015	0,03	0,06	0,12	0,25	0,5	1	2	4	8	16	32	64	128	256	>=512	1024	2048	>2048
Salmonella spp.																								
Finland	Animals, production	34																						
Sweden	Animals	36	2,78																					
S. Enteritidis																								
Denmark	Poultry	26	0																					
Finland	Animals, production	2																						
S. Typhimurium																								
Denmark	Cattle	31	19,40																					
	Pigs	736	32,50																					
	Pork	57																						
	Poultry	13	15,40																					
Finland	Animals, production	12																						
Norway	Animals	7	28,57																					
Sweden	Animals	31																						
Other serotypes																								
Finland	Animals, production	9																						
	Poultry (<i>gallus gallus</i>)	4																						
Norway	Animals, production	22	0																					

White vertical lines denote breakpoints for resistance. White fields denote range of dilutions tested for each antimicrobial.

Table AB 22. Antimicrobial resistance in *Salmonella* spp. - Distribution (%) of MIC-values, 2002 - Cephalosporins

Country	Species	Number	% Resistant	Distribution (%) of MICs																					
				<=0,003	0,007	0,015	0,03	0,06	0,12	0,25	0,5	1	2	4	8	16	32	64	128	256	>=512	1024	2048	>2048	
Salmonella spp.																									
Netherlands	CTX	694	1,73																						
Finland	TIO	34				124,8	10,7	1,7				0,3	0,1	1,3											
Netherlands	CXM	694	2,45					58,8	35,3	5,9															
Spain	CE	2	0																						
Sweden	TIO	36	0									100,0													
S. Enteritidis																									
Denmark	CEP	26	0									61,5	23,1	15,4											
Denmark	TIO	26	0					69,2	23,1	7,7															
Finland	TIO	2						100,0																	
Netherlands	CTX	59	0																						
Netherlands	CXM	59	0					94,9	3,4	1,7												100,0			
S. Typhimurium																									
Denmark	CEP	31	0									79,3	20,7												
Denmark	CEP	736	0,80									61,7	24,0	10,7	2,7	0,7	0,1								
Denmark	CEP	13	0									69,2	30,8												
Denmark	TIO	31	0																						
Denmark	TIO	736	0					96,8	3,2																
Denmark	TIO	57	0					77,2	20,5	2,3															
Denmark	TIO	57	0					80,7	17,5	1,8															
Denmark	TIO	13	0					76,9	23,1																
Finland	TIO	12	0					66,7	25,0	8,3															
Norway	TIO	7	0					57,1	42,9																
Netherlands	CTX	182	1,10					92,9	4,9	1,1															
Netherlands	CXM	182	1,65																						
Sweden	TIO	31	0					25,8	64,5	9,7															
Other serotypes																									
Finland	TIO	9						44,4	55,6																
Netherlands	CTX	124	2,42					25,0	75,0																
Netherlands	CXM	124	4,84					77,4	16,1	4,0															
Norway	TIO	22	0																						
Spain	CE	1						90,9	9,1																

White vertical lines denote breakpoints for resistance. White fields denote range of dilutions tested for each antimicrobial.
CE = Cephalosporin; CTX = Cefotaxim; TIO = Ceftiofur; CXM = Cefuroxime; CEP = Cephalotin

Table AB 23. Antimicrobial resistance in *Salmonella* spp. - Distribution (%) of MIC-values, 2002 - Streptomycin

Country	Species	Number	% Resistant	Distribution (%) of MICs																				
				<=0,003	0,007	0,015	0,03	0,06	0,12	0,25	0,5	1	2	4	8	16	32	64	128	256	>=512	1024	2048	>2048
Salmonella spp.																								
Finland	Animals, production	27																						
Sweden	Animals	36	2,78																					
S. Enteritidis																								
Denmark	Poultry	26	0																					
Finland	Animals, production	1																						
S. Typhimurium																								
Denmark	Cattle	31	22,60																					
	Pigs	736	32,60																					
	Pork	57																						
	Poultry	13	15,40																					
Finland	Animals, production	10																						
Norway	Animals	7	28,57																					
Sweden	Animals	31	0																					
Other serotypes																								
Finland	Animals, production	8																						
	Poultry (gallus gallus)	2																						
Norway	Animals, production	22	0																					

Bold vertical lines denote breakpoints for resistance. White fields denote range of dilutions tested for each antimicrobial.

Table AB 24. Antimicrobial resistance in *Salmonella* spp. - Distribution (%) of MIC-values 2002 - Gentamicin

Country	Species	Number	% Resistant	Distribution (%) of MICs																					
				<=0,003	0,007	0,015	0,03	0,06	0,12	0,25	0,5	1	2	4	8	16	32	64	128	256	>=512	1024	2048	>2048	
Salmonella spp.																									
Finland	Animals, production	34	0							58,8	38,2	2,9													
Spain	Other animals	2	0							100,0															
	Pigs	49	6,12						4,1	28,6	53,1	8,2			2,0						2,0		2,0		
Sweden	Animals	36	0						2,8	69,4	22,2	5,6													
Netherlands	All sources	694	0,72						57,8	66,4	12,4	1,3			0,4						0,1		0,1		
S. Enteritidis																									
Denmark	Poultry	26	0							100,0															
Finland	Animals, production	2	0							100,0															
Netherlands	All sources	59	0						64,4	33,9	1,7														
S. Typhimurium																									
Denmark	Cattle	31	0							100,0															
	Pigs	736	1,10								98,8														
	Pork	57	0							94,7															
	Poultry	13	0							100,0															
Finland	Animals, production	12	0							50,0	50,0														
Norway	Animals	7	0							42,9	57,1														
Spain	Pigs	9	11,11						11,1	11,1	44,4	22,2													11,1
Sweden	Animals	31	0							3,2	61,3	35,5													
Netherlands	All sources	182	0						26,4	61,0	12,6														
Other serotypes																									
Finland	Animals, production	9	0							66,7	22,2	11,1													
	Poultry (gallus gallus)	4	0							50,0	50,0														
Norway	Animals, production	22	0							9,1	90,9														
Spain	Animals	1	0							100,0															
	Pigs	12	0																						
Netherlands	Poultry	124	1,61						88,7	9,7															1,6

Bold vertical lines denote breakpoints for resistance. White fields denote range of dilutions tested for each antimicrobial.

Table AB 25. Antimicrobial resistance in *Salmonella* spp. - Distribution (%) of MIC-values, 2002 - Neomycin

Country	Species	Number	% Resistant	Distribution (%) of MICs																					
				<=0,003	0,007	0,015	0,03	0,06	0,12	0,25	0,5	1	2	4	8	16	32	64	128	256	>=512	1024	2048	>2048	
Salmonella spp.																									
Finland	Animals, production	34																							
	Pigs	49	8,16																						
Spain	Animals	36	0																						
	All sources	694	0,43																						
Netherlands	All sources																							0,1	
S. Enteritidis																									
Denmark	Poultry	26	0																						
Finland	Animals, production	2																							
Netherlands	All sources	59	0																						
S. Typhimurium																									
Denmark	Cattle	31	0																						
	Pigs	736	7,30																						
	Pork	57																							
	Poultry	13	0																						
	Animals, production	12																							
Finland	Animals	7	0																						
Norway	Animals	7	0																						
Spain	Pigs	9	0																						
	All sources	31	0																						
Sweden	Animals	31	0																						
Netherlands	All sources	182	0																						
Other serotypes																									
Finland	Animals, production	9																							
	Poultry (gallus gallus)	4																							
Norway	Animals, production	22	0																						
Spain	Pigs	12	0																						
Netherlands	Poultry	124	0																						

Bold vertical lines denote breakpoints for resistance. White fields denote range of dilutions tested for each antimicrobial.

Table AB 26.
Test methods used for antibiotic resistance testing of *Campylobacter* spp. 2002

Standard used for testing	Test method	Country		used for	further remarks	Is the testing procedure subject of quality control
Campylobacter						
NCCLS						
	Agar diffusion	Austria		Animal and food		no
AFA						
	Broth dilution	Norway	²	Humans		yes
Microbiological Breakpoints						
	Broth dilution	Norway	¹	Poultry	testet for <i>C.jejuni</i>	yes
		Sweden		Animal and food		yes
n.a.						
	Agar diffusion	Denmark	²	Humans		yes
	Agar dilution	Denmark	¹	Animals		yes
	Broth dilution	The Netherlands		Animal and food		

Note: If a country is listed more than once, further specification is found under the subsequent columns
Indices are given for the explanation of Table 28

Table AB 27.
Breakpoints used for antibiotic resistance testing of *Campylobacter* spp. - 2002

Antimicrobial	Country	Breakpoints (µg/ml)		Disk content (µg)	Zone diameter (mm)		
		susceptible <=	resistant >		susceptible >=	intermediate	resistant <=
Campylobacter							
Erythromycin	Austria			15	23	14-22	13
	Denmark	1	16				
	Denmark	2					26
	The Netherlands		4				
	Norway	2	2				
	Sweden		8	16			
	Norway	1		16			
Tetracyclin	Austria			30	19	15-18	14
	Denmark	1	8				
	Denmark	2					31
Doxycycline	The Netherlands		4				
	Norway	2	2				
Tetracyclin	Sweden		4	8			
	Norway	1		8			
Ampicillin	Denmark	1	16				
	The Netherlands		16				
	Norway	2	16				
	Sweden		8	16			
	Norway	1		16			
Ciprofloxacin	Austria			5	21	16-20	15
	Denmark	1	2				
	Denmark	2					26
	The Netherlands		2				
	Norway	2	2				
Enrofloxacin	Sweden		0,5	1			
	Norway	1		1			
Nalidixic acid	Austria			30	19	14-18	13
	Denmark	2					26
	Denmark	1	32				
	The Netherlands		16				
	Norway	2	16				
	Sweden		8	16			
	Norway	1		16			
Gentamycin	Denmark	1	8				
	Denmark	2					29
	The Netherlands		8				
	Norway	2	4				
	Sweden		4	8			
	Norway	1		8			

Note: Indices are explained in Table 27

**Table AB 28. Antibiotic resistance testing of *Campylobacter* spp.
-Percentage of resistant isolates 2002**

Monitoring	Country	Invest.	TET	AMP	NAL	FQ	SU	STR	GEN	NEO	ERY
Animals											
-	A	78	33		64	64					0
-	DK	198	3	1	7	7	8	25	0	1	20
YES	NL	61	61		40	32					47
YES	S	84	1	10	0	0			0		0
YES	N	161	0	3	2	1			0		1

Note: Data from Denmark are taken from DANMAP 2002. Data from Norway are taken from the NORM/NORM-VET-report.
 YES - Isolates collected within a monitoring programme; NO - Isolates collected not within a monitoring programme;
 - no information on the source of the isolates available
 Tetracycline (TET), Ampicillin (AMP), Nalidixic acid or other quinolone (NAL), Fluoroquinolone (Ciprofloxacin or Enrofloxacin) (FQ), Sulfonamides (SU), Streptomycin (STR), Gentamicin (GEN), Neomycin (NEO), Kanamycin (KAN), Erythromycin (ERY)

**Table AB 29. Antibiotic resistance testing of *Campylobacter* spp.
-Percentage of resistant isolates 2002**

Monitoring	Country	Invest.	TET	AMP	NAL	FQ	SU	STR	GEN	NEO	ERY
Cattle											
-	DK	53	6		11	11		2	0		0
Pigs											
-	DK	92	1	1	8	8	8	52	0	1	32
YES	NL	42	69			12					53
Poultry											
-	A	78	33		64	64					0
-	DK	53	2		0	0		0	0		
YES	NL	19	42		40	40					11
YES	S	84	1	10	0	0			0		0
YES	N	161	0	3	2	1			0		1
Humans											
-	A	528	18		40	37					2
-	DK	112	20		28	28		1	0		1
YES	N	147	41		56	54			1		5
Food											
-	D	175	29	24	45	43			0		2
-	DK	99	7		6	6		0	0		0

Note: Data from Denmark are taken from DANMAP 2002. Data from Norway are taken from the NORM/NORM-VET-report.
 YES - Isolates collected within a monitoring programme; NO - Isolates collected not within a monitoring programme;
 - no information on the source of the isolates available
 Tetracycline (TET), Ampicillin (AMP), Nalidixic acid or other quinolone (NAL), Fluoroquinolone (Ciprofloxacin or Enrofloxacin) (FQ), Sulfonamides (SU), Streptomycin (STR), Gentamicin (GEN), Neomycin (NEO), Kanamycin (KAN), Erythromycin (ERY)

Table AB 30. Antimicrobial resistance in *Campylobacter* spp. - Distribution (%) of MIC-values, 2002 - Tetracyclin

Country	Species	Number	% Resistant	Distribution (%) of MICs																					
				<=0,003	0,007	0,015	0,03	0,06	0,12	0,25	0,5	1	2	4	8	16	32	64	128	256	>=512	1024	2048	>2048	
<i>Campylobacter</i> species																									
Sweden	Broilers	84	1,19							96,4	2,4													1,2	
<i>Campylobacter jejuni</i>																									
Denmark	Broiler meat	97								69,1	14,4	5,2	2,1	2,1	1,0									6,2	
	Broilers	53	1,90							98,1														1,9	
	Cattle	53	5,70							94,3					1,9									3,8	
Norway	Poultry (<i>gallus gallus</i>)	161	0							93,8	4,3	1,9													
<i>Campylobacter coli</i>																									
Denmark	Pigs	92	1,10							82,6	13,0	2,2	1,1											1,1	

Bold vertical lines denote breakpoints for resistance. White fields denote range of dilutions tested for each antimicrobial.

Table AB 31. Antimicrobial resistance in *Campylobacter* spp. - Distribution (%) of MIC-values, 2002 - Ampicillin

Country	Species	Number	% Resistant	Distribution (%) of MICs																					
				<=0,003	0,007	0,015	0,03	0,06	0,12	0,25	0,5	1	2	4	8	16	32	64	128	256	>=512	1024	2048	>2048	
Campylobacter species																									
Sweden	Broilers	84	9,52																						
Campylobacter jejuni																									
Denmark	Broilers	53	7,60																						
	Cattle	53	11,30																						
Norway	Poultry (gallus gallus)	161	3,10																						
Campylobacter coli																									
Denmark	Pigs	92	1,10																						

Bold vertical lines denote breakpoints for resistance. White fields denote range of dilutions tested for each antimicrobial.

Table AB 32. Antimicrobial resistance in *Campylobacter* spp. - Distribution (%) of MIC-values, 2002 - Nalidixic acid

Country	Species	Number	% Resistant	Distribution (%) of MICs																				
				<=0,003	0,007	0,015	0,03	0,06	0,12	0,25	0,5	1	2	4	8	16	32	64	128	256	>=512	1024	2048	>2048
Campylobacter species																								
Sweden	Broilers	84	0																					
Campylobacter jejuni																								
Denmark	Broiler meat	99																						
	Broilers	53	0																					
	Cattle	53	11,40																					
Campylobacter jejuni																								
Norway	Poultry (gallus gallus)	161	1,90																					
Campylobacter coli																								
Denmark	Pigs	92	7,60																					

White fields denote breakpoints for resistance. White fields denote range of dilutions tested for each antimicrobial.

Table AB 33. Antimicrobial resistance in *Campylobacter* spp. - Distribution (%) of MIC-values, 2002 - Fluoroquinolones

Country	Species	Number	% Resistant	Distribution (%) of MICs																				
				<=0,003	0,007	0,015	0,03	0,06	0,12	0,25	0,5	1	2	4	8	16	32	64	128	256	>=512	1024	2048	>2048
Campylobacter species																								
Sweden	Broilers	84	0					27,4	61,9	8,3	2,4													
Campylobacter jejuni																								
Denmark	Broiler meat	99	0	2,0	6,1	52,5	20,2	9,1	2,0	2,0														
	Broilers	53	0	1,9	9,4	54,7	34,0																	
	Cattle	53	11,30					13,2	45,3	30,2														
Norway	Poultry (gallus gallus)	161	0,60	4,3	28,0	59,0	5,6	1,2	1,2															
Campylobacter coli																								
Denmark	Pigs	92	7,60					1,1	30,4	40,2	18,5	2,2												

White vertical lines denote breakpoints for resistance. White fields denote range of dilutions tested for each antimicrobial.

Table AB 34. Antimicrobial resistance in *Campylobacter* spp. - Distribution (%) of MIC-values, 2002 - Sulfonamides

Country	Species	Number	% Resistant	Distribution (%) of MICs																					
				<=0,003	0,007	0,015	0,03	0,06	0,12	0,25	0,5	1	2	4	8	16	32	64	128	256	>=512	1024	2048	>2048	
<i>Campylobacter jejuni</i>																									
Denmark	Broilers	53	0																						
	Cattle	53	0																						
<i>Campylobacter coli</i>																									
Denmark	Pigs	92	7,60																						

Bold vertical lines denote breakpoints for resistance. White fields denote range of dilutions tested for each antimicrobial.

Table AB 36. Antimicrobial resistance in *Campylobacter* spp. - Distribution (%) of MIC-values, 2002 - Gentamicin

Country	Species	Number	% Resistant	Distribution (%) of MICs																					
				<=0,003	0,007	0,015	0,03	0,06	0,12	0,25	0,5	1	2	4	8	16	32	64	128	256	>=512	1024	2048	>2048	
Campylobacter species																									
Sweden	Broilers	84	0						29,8	52,4	17,9														
Campylobacter jejuni																									
Denmark	Broiler meat	99									100,0														
	Broilers	53	0								54,7	43,4	1,9												
	Cattle	53	0								54,7	35,8	9,4												
Norway	Poultry (gallus gallus)	161	0								10,6	37,3	41,6	10,6											
Campylobacter coli																									
Denmark	Pigs	92	0								8,7	58,7	31,5	1,1											

Bold vertical lines denote breakpoints for resistance. White fields denote range of dilutions tested for each antimicrobial.

Table AB 37. Antimicrobial resistance in *Campylobacter* spp. - Distribution (%) of MIC-values, 2002 - Neomycin

Country	Species	Number	% Resistant	Distribution (%) of MICs																						
				<=0,003	0,007	0,015	0,03	0,06	0,12	0,25	0,5	1	2	4	8	16	32	64	128	256	>=512	1024	2048	>2048		
<i>Campylobacter jejuni</i>																										
Denmark	Broilers	53	0																							
	Cattle	53	1,90																							1,9
<i>Campylobacter coli</i>																										
Denmark	Pigs	92	1,10																							1,1

Bold vertical lines denote breakpoints for resistance. White fields denote range of dilutions tested for each antimicrobial.

Table AB 38. Antimicrobial resistance in *Campylobacter* spp. - Distribution (%) of MIC-values, 2002 - Erythromycin

Country	Species	Number	% Resistant	Distribution (%) of MICs																					
				<=0,003	0,007	0,015	0,03	0,06	0,12	0,25	0,5	1	2	4	8	16	32	64	128	256	>=512	1024	2048	>2048	
Campylobacter species																									
Sweden	Broilers	84	0						6,0	26,2	47,6	17,9	2,4												
Campylobacter jejuni																									
Denmark	Broiler meat	99								10,3	45,4	35,1	9,3												
	Broilers	53	0							5,7	41,5	49,1	3,8												
	Cattle	53	0							13,2	43,4	30,2	13,2												
Norway	Poultry (gallus gallus)	161	1,20							2,5	5,0	36,2	46,2	8,8											
Campylobacter coli																									
Denmark	Pigs	92	31,50							1,1	7,6	2,2	21,7	31,5	4,3										
													1,1	30,4											

White fields denote range of dilutions tested for each antimicrobial.