

Appendix 1

Table S1: Characteristics of individual studies

Study	Country	Population sampled	Bacteria studied	Description of intervention or intervention group	Outcomes measured
Complete restriction					
Aarestrup (1995)	Denmark	Broilers	<i>Enterococcus faecium</i>	Ecological farms with no antibiotic use in feed or for therapeutic purposes	Resistance to glycopeptide antibiotics
Abdalrahman (2015)	USA	Broilers, turkeys	<i>Staphylococcus aureus</i>	Organic retail meat	Prevalence of <i>Staphylococcus aureus</i> and methicillin resistant <i>Staphylococcus aureus</i> Characterization of resistance to antibiotics (including beta-lactams, tetracyclines, macrolides, aminoglycosides, fluoroquinolones, lincosamides, amphenicols, glycopeptides, rifamycines, sulfonamides) and presence of toxin genes
Agga (2015)	USA	Beef cows	<i>Escherichia coli</i> <i>Salmonella enterica</i> <i>Enterococcus spp.</i>	Pasture-raised non-antimicrobial treated beef cows, which were co-mingled with ceftiofur treated cows	Resistance to antibiotics (including cephalosporins, tetracyclines, sulfonamides, macrolides) Prevalence of <i>Salmonella</i> spp. in fecal and farm samples
Alali (2010)	USA	Broilers	<i>Salmonella</i> spp.	Organic farms (USDA certified)	Characterization of resistance to antibiotics (including penicillins, aminoglycosides, cephalosporins, amphenicols, quinolones, sulfonamides, tetracyclines)
Bailey (2019)	USA	Broilers	<i>Campylobacter</i> spp.	Organic broilers which were raised without antibiotics, processed using "organic methods" at a processing plant (USDA certification standards cited)	Prevalence and antimicrobial resistance of <i>Campylobacter</i> spp. (including aminoglycosides, amphenicols, tetracyclines, macrolides, quinolones, lincosamides, ketolides)
Bombyk (2007)	USA	Dairy cows	<i>Staphylococcus</i> spp.	Organic dairy farms (USDA certified for a at least 1 year)	Resistance to tetracycline
Bunner (2007)	USA	Pigs	<i>Escherichia coli</i>	Antimicrobial free swine farms, with no use of any antimicrobial agents in production for 1 year minimum	Level and pattern of antimicrobial resistance (including penicillins, aminoglycosides, cephalosporins, amphenicols, quinolones, sulfonamides, tetracyclines)
Cho (2007)	USA	Dairy cows	<i>Escherichia coli</i>	Organic dairy farms (USDA certified)	Characterization of resistance to antibiotics (including penicillins, aminoglycosides, cephalosporins, amphenicols, quinolones, sulfonamides, tetracyclines, aminocyclitols)
Cicconi-Hogan (2014)	USA	Dairy cows	Coagulase-negative staphylococci <i>Staphylococcus aureus</i>	Organic dairy farms	Prevalence of methicillin resistant bacteria

Study	Country	Population sampled	Bacteria studied	Description of intervention or intervention group	Outcomes measured
Cui (2004)	USA	Broilers	<i>Salmonella</i> spp.	Organic retail carcasses	Prevalence of <i>Salmonella</i> spp. Characterization of resistance to antibiotics (including penicillins, aminoglycosides, cephalosporins, amphenicols, quinolones, sulfonamides, tetracyclines)
Cui (2005)	USA	Broilers	<i>Salmonella</i> spp. <i>Campylobacter</i> spp.	Organic retail carcasses	Prevalence of <i>Salmonella</i> spp. and <i>Campylobacter</i> spp. Characterization of resistance to antibiotics (including penicillins, aminoglycosides, cephalosporins, amphenicols, quinolones, sulfonamides, tetracyclines, macrolides)
Cuny (2012)	Germany	Pigs	<i>Staphylococcus aureus</i>	Alternative "Neuland" farms, characterized by their smaller size, environmental features, no administration of antimicrobials to pigs of a certain size (body mass greater than 25kg), and no imports from conventional farms	Prevalence of methicillin-resistant <i>Staphylococcus aureus</i>
Gebreyes (2006)	USA	Pigs	<i>Salmonella</i> spp.	Antimicrobial-free production systems (samples collected in farms and slaughterhouses), where no antimicrobials were used for any reason post-weaning	Prevalence and antimicrobial resistance of <i>Salmonella</i> spp. (including penicillins, aminoglycosides, cephalosporins, amphenicols, sulfonamides, tetracyclines) Presence of multi-drug resistant strains and phenotypic diversity at the production and processing stages
Gellin (1989)	USA	Pigs	Gram negative enteric bacteria	Herd with no antimicrobial exposure for 154 months	Resistance to antibiotics (including penicillins, aminoglycosides, cephalosporins, amphenicols, quinolones, sulfonamides, tetracyclines)
Halbert (2006a)	USA	Dairy cows	<i>Campylobacter</i> spp.	Organic farms certified by an organic certification agency and having had no use of antibiotics for at least three years in cattle over the age of 1	Prevalence and antimicrobial susceptibility of <i>Campylobacter</i> spp. (including penicillins, aminoglycosides, cephalosporins, amphenicols, quinolones, sulfonamides, tetracyclines, macrolides, lincosamides)
Halbert (2006b)	USA	Dairy cows	<i>Campylobacter</i> spp.	Organic dairy farms	Resistance to antibiotics (including amphenicols, aminoglycosides, quinolones, macrolides, tetracyclines, lincosamides), and mechanism of tetracycline resistance
Han (2009)	USA	Broilers	<i>Campylobacter</i> spp.	Organic retail carcasses	Prevalence and antimicrobial resistance profiles of <i>Campylobacter</i> spp. (including aminoglycosides, quinolones, tetracyclines, macrolides)
Joseph (2007)	USA	Poultry	<i>Enterococcus</i> spp.	Organic / antibiotic-free farms	Resistance to antibiotics (including bacitracin, macrolides, lincosamides, aminoglycosides, streptogramins, nitrofurans, tetracyclines, penicillins)

Study	Country	Population sampled	Bacteria studied	Description of intervention or intervention group	Outcomes measured
Joseph (2008)	USA	Broilers	<i>Salmonella</i> spp.	Organic / antibiotic-free farms	Resistance to antibiotics (including penicillins, cephalosporins, amphenicols, aminoglycosides, tetracyclines, sulfonamides)
Kassem (2017)	USA	Laying hens	<i>Campylobacter</i> spp.	Organic layer farms (USDA certified)	Prevalence of antibiotic resistant organisms (including resistance to quinolones, tetracyclines, macrolides, aminocyclitols)
Keelara (2013)	USA	Pigs	<i>Salmonella</i> spp.	Antibiotic free farms, where no antimicrobials were used for any purpose. Other features included: outdoor housing, access to ambient environment, feed was non-pelleted	Prevalence and serotypes of <i>Salmonella</i> at farm and at slaughter Antimicrobial resistance profiles (including penicillins, aminoglycosides, cephalosporins, amphenicols, quinolones, sulfonamides, tetracyclines) and genotypic profiles of bacterial isolates along the swine production chain
Kieke (2006)	USA	Poultry (chicken and turkey)	<i>Enterococcus faecium</i>	Antibiotic-free retail poultry, confirmed per product label or based on information obtained through direct contact with manufacturer or distributor of the product	Susceptibility to streptogramins (quinupristin-dalfopristin) in isolates from humans and retail poultry susceptibility
Langlois (1983)	USA	Pigs	Lactose-positive enteric bacteria	Discontinuation of both therapeutic and non-therapeutic uses of antimicrobials in a closed swine herd	Resistance to antibiotics (including penicillins, aminoglycosides, cephalosporins, amphenicols, quinolones, sulfonamides, tetracyclines, polymyxins, nitrofurans)
Langlois (1986)	USA	Pigs	Lactose-positive enteric bacteria	Discontinuation of all antibiotics (including for subtherapeutic, prophylactic, and therapeutic indications) in a closed swine herd	Contributors to levels, persistence, and transfer of antibiotic resistance (including penicillins, aminoglycosides, cephalosporins, amphenicols, quinolones, sulfonamides, tetracyclines, polymyxins, nitrofurans)
Lestari (2009)	USA	Broilers	<i>Salmonella</i> spp.	Organic retail carcasses	Prevalence of <i>Salmonella</i> spp., characterization of genotypes, and characterization of antimicrobial susceptibilities (including penicillins, aminoglycosides, cephalosporins, amphenicols, quinolones, sulfonamides, tetracyclines)
Lou (1995)	USA	Pigs	Fecal coliforms	Discontinuation of all antibiotics (including for subtherapeutic, prophylactic, and therapeutic indications) in a closed swine herd	Prevalence of fecal coliforms and their resistance to antibiotics (including penicillins, aminoglycosides, cephalosporins, amphenicols, quinolones, sulfonamides, tetracyclines) and genetic determinants of resistance to tetracycline
Luangtongkum (2006)	USA	Poultry (broilers and turkey)	<i>Campylobacter</i> spp.	Certified organic farms	Prevalence of <i>Campylobacter</i> spp. and their resistance to antibiotics (including penicillins, aminoglycosides, quinolones, tetracyclines, macrolides, lincosamides)
Nulsen (2008)	New Zealand	Pigs	<i>Escherichia coli</i> <i>Enterococcus</i> spp.	Organic farm that used no antimicrobials	Resistance to antibiotics (including penicillins, aminoglycosides, quinolones, sulfonamides, tetracyclines, macrolides, glycopeptides, streptogramins)

Study	Country	Population sampled	Bacteria studied	Description of intervention or intervention group	Outcomes measured
Peng (2016)	USA	Broilers, cattle, goats, laying hens, pigs	<i>Salmonella</i> spp.	Organic mixed crop livestock farms	Prevalence of <i>Salmonella</i> spp., serovar prevalence, and resistance to antibiotics (including cephalosporins, amphenicols, aminoglycosides, tetracyclines, sulfonamides, quinolones)
Petty (2008)	USA	Pigs	<i>Lactobacillus</i> spp.	Closed swine herd with no use of antibiotics growth promotion, prophylaxis, or therapy	Characteristics of antibiotic resistance (including resistance to penicillins, aminoglycosides, amphenicols, sulfonamides, macrolides, tetracyclines, lincosamides, glycopeptides) and distribution of tetracycline resistance genes
Pol (2007)	USA	Dairy cows	Coagulase-negative staphylococci <i>Staphylococcus aureus</i> <i>Streptococcus</i> spp.	Organic dairy farm (certified organic for a minimum of 3 years)	Resistance to antibiotics (including penicillins, cephalosporins, sulfonamides, tetracyclines, macrolides, lincosamides, aminocoumarins [novobiocin])
Price (2005)	USA	Broilers	<i>Campylobacter</i> spp.	Retail meat from two producers claiming to not use any antibiotics	Resistance to fluoroquinolone antibiotics
Price (2007)	USA	Broilers	<i>Campylobacter</i> spp.	Retail meat from three producers claiming to not use any antibiotics	Resistance to fluoroquinolone antibiotics (Primary outcome – temporal changes to resistance after cessation of fluoroquinolone use in conventional producers Secondary outcome – comparison of resistance in conventional vs antibiotic-free producers)
Ray (2006)	USA	Dairy cows	<i>Salmonella</i> spp.	Organic dairy farms (certified organic for a minimum of 3 years)	Prevalence of <i>Salmonella</i> spp. and their resistance to antibiotics (including penicillins, aminoglycosides, cephalosporins, amphenicols, quinolones, sulfonamides, tetracyclines)
Rollo (2010)	USA	Pigs	<i>Campylobacter</i> spp.	Antibiotic-free farms that have not used any antimicrobials for a minimum of 1 year	Prevalence of <i>Campylobacter</i> spp. and their patterns of antibiotic resistance (including to macrolides, quinolones, aminoglycosides, tetracyclines)
Rossa (2013)	Brazil	Broilers	Enterobacteriaceae	Organic retail carcasses (certified by a recognized institution)	Prevalence of pathogenic and indicator bacteria, and the antimicrobial resistance profiles of Enterobacteriaceae (including resistance to penicillins, aminoglycosides, cephalosporins, amphenicols, quinolones, sulfonamides, tetracyclines)
Salaheen (2016)	USA	Broilers, cattle, goats, laying hens, pigs	<i>Campylobacter</i> spp.	Mixed crop livestock farm, where no antimicrobials are used	Prevalence of <i>Campylobacter</i> spp., their resistance to antibiotics (including penicillins, amphenicols, aminoglycosides, tetracyclines, macrolides, quinolones), and survival of isolates on surfaces of produce
Sanchez (2015)	USA	Broilers	<i>Escherichia coli</i>	Organic retail meat (certified by a third party) and non-organic retail meat labelled “no antibiotics”	Resistance to antibiotics (including penicillins, aminoglycosides, cephalosporins, quinolones, tetracyclines)
Sapkota (2010)	USA	Poultry	<i>Salmonella</i> spp.	Organic farms	Prevalence of <i>Salmonella</i> spp. and their patterns of antibiotic resistance (included individual antibiotics tested not reported)

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Sapkota (2011)	USA	Broilers	<i>Enterococcus</i> spp.	Organic farms (with newly received certification)	Prevalence of antibiotic resistant <i>Enterococcus</i> spp. (including to aminoglycosides, amphenicols, quinolones, sulfonamides, tetracyclines, macrolides, cyclic lipopeptides, streptogramins, glycopeptides, lincosamides, flavophospholipol, nitrofurans, oxazolidinones [linezolid], glycylycylcline [tigecycline])
Sapkota (2014)	USA	Broilers	<i>Salmonella</i> spp.	Organic farms (with newly received certification by a United States National Organic Program – accredited agency)	Prevalence of antibiotic resistant <i>Salmonella</i> spp. (including penicillins, aminoglycosides, cephalosporins, amphenicols, quinolones, sulfonamides, tetracyclines)
Sato (2004)	Denmark, USA	Dairy cows	<i>Staphylococcus aureus</i>	Organic farms in US where no antimicrobials are allowed (with certification by an approved agency for a minimum of 3 years)	Prevalence of <i>Staphylococcus aureus</i> and their patterns of antibiotic resistance (including penicillins, aminoglycosides, cephalosporins, amphenicols, quinolones, macrolides, tetracyclines, bacitracin, sulfonamides, glycopeptides, streptogramins [quinupristin-dalfopristin])
Sato (2005)	USA	Dairy cows	<i>Escherichia coli</i>	Organic farms (with certification by a USDA-accredited agency for a minimum of 3 years)	Resistance to antibiotics (including penicillins, aminoglycosides, cephalosporins, quinolones, sulfonamides, tetracyclines)
Siemon (2007)	USA	Broilers	<i>Salmonella</i> spp.	Pasture farms, where no antimicrobials are used	Prevalence of <i>Salmonella</i> spp., their resistance to antibiotics (including penicillins, amphenicols, cephalosporins, aminoglycosides, tetracyclines, sulfonamides)
Smith (2013)	USA	Pigs	<i>Staphylococcus aureus</i>	Farms raising pigs without the use of antibiotics	Prevalence of methicillin-resistant <i>Staphylococcus aureus</i>
Thakur (2005)	USA	Pigs	<i>Campylobacter</i> spp.	Antibiotic-free farms, where no antibiotics were used after weaning (3 weeks of age)	Prevalence of <i>Campylobacter</i> spp. and their patterns of antibiotic resistance (including to amphenicols, macrolides, quinolones, aminoglycosides, tetracyclines)
Tikofsky (2003)	USA	Dairy cows	<i>Staphylococcus aureus</i>	Organic farms (USDA- certified)	Resistance to antibiotics (including penicillins, cephalosporins, macrolides, lincosamides, tetracyclines, glycopeptides, aminocoumarins [novobiocin])
Vikram (2017)	USA	Beef cattle	<i>Escherichia coli</i> <i>Salmonella</i> spp. <i>Enterococcus</i> spp.	Raised without antibiotic production, where no antimicrobials were used for any reason (including for prophylaxis, therapy, or production purposes)	Prevalence of antibiotic resistant bacteria (including resistance to macrolides, tetracyclines, sulfonamides, quinolone), their molecular and phylogenetic profiles and characteristics
Wanninger (2016)	Switzerland	Pigs	<i>Chlamydia suis</i>	Farms that do not use any antibiotics	Resistance to tetracycline
Zhang (2005)	USA	Broilers	<i>Listeria monocytogenes</i>	Organic retail meat	Serotypes and molecular subtypes of <i>Listeria monocytogenes</i> , and their antibiotic resistance profiles (including penicillins, quinolones, aminoglycosides, sulfonamides, tetracyclines) and determinants of antibiotic resistance

Study	Country	Population sampled	Bacteria studied	Description of intervention or intervention group	Outcomes measured
Zwonitzer (2016)	USA	Pigs	<i>Escherichia coli</i>	Organic farms	Prevalence of <i>Escherichia coli</i> and their resistance to antibiotics (including penicillins, amphenicols, aminoglycosides, quinolones, macrolides, tetracyclines, sulfonamides), and relationship between antibiotic resistance and attachment
Single antibiotic-class restriction					
Agersø (2013)	Denmark	Pigs	<i>Escherichia coli</i>	Voluntary cephalosporin ban in pig production	Prevalence of extended-spectrum cephalosporinase-producing <i>Escherichia coli</i>
Gallay (2007)	France	Broilers Pigs	<i>Campylobacter</i> spp.	Recommendation by the European Union to limit fluoroquinolone use in poultry	Resistance to antibiotics (including penicillins, quinolones, tetracyclines, aminoglycosides, macrolides)
Nannapaneni (2009)	USA	Broilers	<i>Campylobacter</i> spp.	Ban (withdrawal of approval by the FDA) of fluoroquinolone use in poultry	Resistance to fluoroquinolones (ciprofloxacin)
Single antibiotic restriction					
Agunos (2018)	Canada	Broilers	<i>Salmonella</i> spp. <i>Escherichia coli</i> <i>Campylobacter</i> spp.	Elimination of ceftiofur use from hatcheries	Resistance to antibiotics (including penicillins, aminoglycosides, cephalosporins, amphenicols, quinolones, macrolides, sulfonamides, tetracyclines)
Bauer-Garland (2006)	USA	Broilers	<i>Salmonella enterica</i>	No treatment with chlortetracycline in a non-randomized controlled trial	Transmission of both multi-drug resistant and sensitive strains of <i>Salmonella enterica</i>
Dutil (2010)	Canada	Broilers	<i>Salmonella enterica</i> <i>Escherichia coli</i>	Voluntary cessation of the use of in-ovo ceftiofur	Primary- Incidence of infections with ceftiofur-resistant <i>Salmonella enterica</i> in humans Secondary –Resistance to ceftiofur in <i>Salmonella enterica</i> and <i>Escherichia coli</i> in animals and humans
Hiki (2015)	Japan	Broilers	<i>Escherichia coli</i>	Voluntary cessation of the use of in-ovo ceftiofur	Prevalence of broad-spectrum cephalosporin-resistant <i>Escherichia coli</i> , type of B-lactamase genes present, and replicon types of broad-spectrum cephalosporin-resistant <i>Escherichia coli</i> Antibiotic resistance profiles for <i>Escherichia coli</i> (not necessarily broad-spectrum cephalosporin resistant organisms; antibiotic classes studied included penicillins, aminoglycosides, cephalosporins, amphenicols, quinolones, sulfonamides, tetracyclines, polymyxins)
Patchanee (2008)	USA	Pigs	<i>Salmonella enterica</i>	Farms with no history of ceftiofur use	Resistance to antibiotics (including penicillins, aminoglycosides, cephalosporins, amphenicols, quinolones, sulfonamides, tetracyclines) Primary - Resistance to ceftriaxone
Tragesser (2006)	USA	Dairy cows	<i>Escherichia coli</i>	Farms with policies describing no ceftiofur use	Also reported resistance to other antibiotics (including penicillins, aminoglycosides, cephalosporins, amphenicols, quinolones, sulfonamides, tetracyclines)

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Verrette (2019)	Canada	Broilers	<i>Escherichia coli</i>	Cessation of ceftiofur use from hatcheries	Prevalence of <i>Escherichia coli</i> with extended-spectrum-B-lactamase / AmpC resistance genes, and their antibiotic resistance profiles (including resistance to penicillins, cephalosporins, aminoglycosides, quinolones, macrolides, sulfonamides, amphenicols, tetracyclines, aminocyclitols)
All non-therapeutic use restriction					
Álvarez-Fernández (2012)	Spain	Poultry (Broilers, quail)	<i>Escherichia coli</i>	Organic housing systems (European Union Council Regulation on organic production cited)	Resistance to antibiotics (including penicillins, aminoglycosides, cephalosporins, amphenicols, quinolones, sulfonamides, tetracyclines, nitrofurans, fosfomycin)
Álvarez-Fernández (2013)	Spain	Poultry (Broilers, quail, turkey)	<i>Escherichia coli</i>	Organic retail carcasses	Microbiologic quality of retail meat samples and antibiotic resistance profiles of <i>Escherichia coli</i> strains isolated from retail meat samples (including resistance to penicillins, aminoglycosides, cephalosporins, amphenicols, quinolones, sulfonamides, tetracyclines, nitrofurans, fosfomycin)
Bennedsgaard (2006)	Denmark	Dairy cows	<i>Staphylococcus aureus</i>	Organic herds (organic production for at least five years)	Resistance to penicillin
Boutet (2005)	Belgium	Dairy cows	<i>Staphylococcus aureus</i> <i>Streptococcus</i> spp.	Organic farms	Prevalence and antibiotic resistance of intramammary bacterial isolates (including resistance to penicillins, aminoglycosides, cephalosporins, amphenicols, quinolones, sulfonamides, tetracyclines, macrolides, lincosamides, aminocoumarins [novobiocin])
Cohen Stuart (2012)	The Netherlands	Broilers	Extended Spectrum Beta-Lactamase micro-organisms (including <i>Escherichia</i> spp. and <i>Klebsiella pneumoniae</i>)	Organic retail meat (which allows for one course of antibiotics used for therapeutic indications) certified by the national body [Stichting EKO keurmerk controle]]	Prevalence of Extended Spectrum Beta-Lactamase organisms and load of Extended Spectrum Beta-Lactamase isolates
El-Shibiny (2005)	UK	Broilers	<i>Campylobacter</i> spp.	Organic farm “reared to ... standards”	Prevalence and “diversity” (including antibiotic resistance to penicillins, aminoglycosides, glycopeptides, amphenicols, quinolones, macrolides, tetracyclines, bacitracin) of <i>Campylobacter</i> spp. and bacteriophages.
Fraqueza (2014)	Portugal	Broilers	<i>Campylobacter</i> spp.	Organic flocks, carcasses sampled at slaughter (European Union legal requirements for organic production cited)	Prevalence and antibiotic resistance of <i>Campylobacter</i> spp. (including resistance to penicillins, aminoglycosides, sulfonamides, amphenicols, quinolones, macrolides, tetracyclines,

Study	Country	Population sampled	Bacteria studied	Description of intervention or intervention group	Outcomes measured
Garmo (2010)	Norway	Dairy cows	Mastitis bacteria including: <i>Streptococcus</i> spp. <i>Escherichia coli</i> Enterobacteriaceae <i>Staphylococcus</i> spp. <i>Enterococcus</i> spp.	Organic herds, with organic production for a minimum of 4 years. Authors cite and state national regulations for organic production (which includes prohibition of the use of prophylactic antibiotics and a maximum of three courses of antibiotics for therapeutic indications annually)	Dairy cow reproductive performance and their udder health Resistance to penicillin in bacterial isolates
Gellin (1989)	USA	Pigs	Gram negative enteric bacteria	“Therapeutic herd”, where animals are given antimicrobials for therapeutic indications, but where no subtherapeutic antibiotics are administered	Resistance to antibiotics (including penicillins, aminoglycosides, cephalosporins, amphenicols, quinolones, sulfonamides, tetracyclines)
Guarddon (2014)	Spain	Beef cattle, broilers, pigs	Mesophilic aerobic bacteria Enterobacteriaceae	Organic retail meat (European Union Commission Regulation for organic production cited)	Counts of tetracycline-resistant bacteria and presence of <i>tet(A)</i> and <i>tet(B)</i> genes
Huijbers (2015)	The Netherlands	Broilers	<i>Staphylococcus aureus</i> <i>Escherichia coli</i>	Certified organic farms	Prevalence of methicillin resistant <i>Staphylococcus aureus</i> and extended-spectrum and AmpC B-lactamase-producing <i>Escherichia coli</i> , and their molecular characteristics
Kempf (2017)	France, Sweden	Pigs	<i>Campylobacter</i> spp.	Organic farms (European Union Commission Regulation for organic production cited)	Prevalence of <i>Campylobacter</i> spp. and their resistance to antibiotics (aminoglycosides, quinolones, tetracyclines, macrolides) Presence of resistance gene <i>erm(B)</i> in macrolide-resistance isolates
Kerouanton (2014)	France	Pigs	<i>Escherichia coli</i>	Organic herds	Prevalence of <i>Escherichia coli</i> , their resistance to tetracycline, and their genetic diversity
Kim (2018)	South Korea	Broilers	<i>Enterococcus</i> spp.	Organic retail carcasses; antimicrobials are used only to treat diseases, and are not used for any other indications	Prevalence of <i>Enterococcus</i> spp., their resistance to antibiotics (including aminoglycosides, quinolones, tetracyclines, macrolides, glycopeptides, oxazolidinones [linezolid], streptogramins, nitrofurans, rifampin, glycylicline [tigecycline]) and rates of multi-drug resistance
Larsen (1975)	Denmark	Pigs	<i>Escherichia coli</i>	Discontinuation of use of antibiotics for routine and preventative use, and as feed additives	Resistance to antibiotics (including penicillins, aminoglycosides, amphenicols, quinolones, sulfonamides, tetracyclines, nitrofurans)
Malissiova (2017)	Greece	Sheep, goats	<i>Escherichia coli</i> <i>Staphylococcus aureus</i>	Organic farms (European Union Commission Regulation for organic production cited)	Microbiologic load of milk, resistance to antibiotics of bacterial pathogens (including resistance to penicillins, aminoglycosides, cephalosporins, amphenicols, quinolones, sulfonamides, tetracyclines, nitrofurans, polymyxin, aminocyclitols, macrolides, glycopeptides, lincosamides, rifampin)
Meemken (2009)	Germany	Pigs	<i>Staphylococcus aureus</i>	Organic herds	Prevalence of methicillin resistant <i>Staphylococcus aureus</i>

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Miranda (2007)	Spain	Broilers	<i>Enterococcus</i> spp.	Organic retail meat	Prevalence of <i>Enterococcus</i> spp. and their resistance to antibiotics (including penicillins, amphenicols, tetracyclines, quinolones, macrolides, aminoglycosides, nitrofurans, glycopeptides)
Miranda (2008a)	Spain	Poultry (chicken, turkey)	Enterobacteriaceae	Organic retail meat	Prevalence of Enterobacteriaceae and their resistance to antibiotics (including penicillins, aminoglycosides, cephalosporins, amphenicols, quinolones, sulfonamides, tetracyclines, nitrofurans)
Miranda (2008b)	Spain	Pigs	<i>Escherichia coli</i>	Organic retail meat	Prevalence of <i>Escherichia coli</i> and their resistance to antibiotics (including penicillins, aminoglycosides, cephalosporins, amphenicols, quinolones, sulfonamides, tetracyclines, nitrofurans)
Miranda (2008c)	Spain	Broilers	<i>Listeria monocytogenes</i> <i>Escherichia coli</i> <i>Staphylococcus aureus</i>	Organic retail meat	Resistance to antibiotics (including penicillins, aminoglycosides, cephalosporins, amphenicols, quinolones, sulfonamides, tetracyclines, nitrofurans, Fosfomycin, lincosamides, macrolides, glycopeptides)
Miranda (2009a)	Spain	Beef cattle	<i>Listeria monocytogenes</i> <i>Escherichia coli</i> <i>Staphylococcus aureus</i> <i>Salmonella</i> spp.	Organic retail meat from farms certified to be organic for a minimum of two years	Primary- Contamination of retail meat samples with <i>Listeria monocytogenes</i> , <i>Escherichia coli</i> , <i>Staphylococcus aureus</i> , and <i>Salmonella</i> spp. Secondary- Resistance to antibiotics (including penicillins, aminoglycosides, cephalosporins, monobactams [aztreonam], amphenicols, quinolones, sulfonamides, tetracyclines, nitrofurans, fosfomycin, lincosamides, macrolides, glycopeptides, rifampin)
Miranda (2009b)	Spain	Dairy cows	<i>Escherichia coli</i> <i>Staphylococcus aureus</i>	Certified organic retail cheese samples	Microbiologic quality of retail cheese samples, and antibiotic resistance of <i>Escherichia coli</i> and <i>Staphylococcus aureus</i> isolates (including resistance to penicillins, aminoglycosides, cephalosporins, monobactams [aztreonam], amphenicols, quinolones, sulfonamides, tetracyclines, nitrofurans, fosfomycin, lincosamides, macrolides, rifampin)
Morley (2011)	USA	Beef cattle	<i>Escherichia coli</i>	“Natural” production, with no exposure to hormones, anti-helminthics, or antimicrobials prior to arriving or during their time at the feedlot, with the exception of parenteral uses of antibiotics for bacterial infections.	Resistance to antibiotics (including penicillins, aminoglycosides, cephalosporins, amphenicols, quinolones, sulfonamides, tetracyclines)

Study	Country	Population sampled	Bacteria studied	Description of intervention or intervention group	Outcomes measured
O'Neill (2010)	UK	Dairy cows	Methicillin-resistant staphylococci	Organic dairy farms, which prevents use of antibiotics for prophylaxis; antibiotics may be used for therapeutic indications if infections are not responsive to non-antibiotic therapies	Prevalence and diversity of methicillin-resistant coagulase negative staphylococci, and their antibiotic resistance profiles (including to aminoglycosides, tetracyclines, quinolones, sulfonamides, lincosamides, macrolides, glycopeptides, oxazolidinones, fusidic acid, mupirocin, rifampin) Molecular characteristics of <i>Staphylococcus epidermidis</i> and <i>Staphylococcus aureus</i> Virulence toxin carriage by bacterial isolates
Österberg (2016)	Denmark, France, Italy, Sweden	Pigs	<i>Escherichia coli</i>	Organic herds (European Union Commission Regulation for organic production cited)	Resistance to antibiotics
Roesch (2006)	Switzerland	Dairy cows	<i>Staphylococcus</i> spp. <i>Streptococcus</i> spp.	Organic dairy farms, where use of antibiotics for prophylaxis but are permitted for use to treat infections if prescribed by a veterinarian	Resistance to antibiotics (including resistance to penicillins, aminoglycosides, cephalosporins, amphenicols, quinolones, tetracyclines, lincosamides, macrolides, glycopeptides, streptogramins [quinupristin-dalfopristin])
Sato (2004)	Denmark, USA	Dairy cows	<i>Staphylococcus aureus</i>	Organic farms in Denmark, having converted to organic production for a minimum of 5 years; information on antibiotic use in dairy cows were available to authors from Danish Cattle Database	Prevalence of <i>Staphylococcus aureus</i> and their patterns of antibiotic resistance (including penicillins, aminoglycosides, cephalosporins, amphenicols, quinolones, macrolides, tetracyclines, bacitracin, sulfonamides, glycopeptides, streptogramins [quinupristin-dalfopristin])
Schwaiger (2008)	Germany	Laying hens	<i>Salmonella</i> spp. Coliforms <i>Campylobacter</i> spp.	Organic farms (European Union Commission Regulation for organic production cited)	Prevalence of bacterial pathogens and zoonotic bacteria and their resistance to antibiotics (including penicillins, carbapenems, aminoglycosides, cephalosporins, amphenicols, quinolones, sulfonamides, tetracyclines, lincosamides, macrolides, polymyxins, oxazolidinones [linezolid])
Schwaiger (2010)	Germany	Laying hens	<i>Listeria</i> spp. <i>Enterococcus</i> spp.	Organic farms with no permitted use of prophylactic antibiotics or antibiotic growth promoters (European Union Commission Regulation for organic production cited)	Prevalence of / contamination with gram positive zoonotic and commensal bacteria, and their resistance to antibiotics (including penicillins, carbapenems, aminoglycosides, amphenicols, quinolones, sulfonamides, tetracyclines, nitrofurans, fosfomycin, lincosamides, macrolides, polymyxins, oxazolidinones [linezolid], rifampin, streptogramins [quinupristin-dalfopristin], glycopeptides, fosfomycin)

Study	Country	Population sampled	Bacteria studied	Description of intervention or intervention group	Outcomes measured
Suriyasathaporn (2010)	Thailand	Dairy cows	Mastitis pathogens, including: <i>Staphylococcus</i> spp. <i>Streptococcus</i> spp. <i>Escherichia coli</i> <i>Arcanobacterium pyogenes</i> <i>Corynebacterium bovis</i>	Conversion of a conventional dairy farm to organic farm, with no antimicrobials (or any other drug) except as indicated for illness	Patterns of antibiotic resistance (including to penicillins, cephalosporins, aminoglycosides, and sulfonamides)
Tamang (2015)	South Korea	Pigs	<i>Salmonella</i> spp.	Organic farms, where antimicrobials were used only for treatment of disease when prescribed by a veterinarian	Prevalence <i>Salmonella</i> spp. and their resistance to antibiotics (including penicillins, aminoglycosides, cephalosporins, amphenicols, quinolones, sulfonamides, tetracyclines, polymyxins) Phenotypic and genotypic characteristics and diversity of isolates resistant to cephalosporins or quinolones
Tenhagen (2018)	Germany	Dairy cows	<i>Staphylococcus aureus</i>	Organic farms (European Union Commission Regulation for organic production cited)	Prevalence of methicillin-resistant <i>Staphylococcus aureus</i> , and their resistance to antimicrobials (including penicillins, aminoglycosides, cephalosporins, amphenicols, quinolones, macrolides, tetracyclines, lincosamides, mupirocin, sulfonamides, rifampin, oxazolidinones [linezolid], fusidic acid, glycopeptides, streptogramins [quinupristin-dalfopristin], tiamulin)
Growth promoter restriction					
Aarestrup (2000a)	Denmark	Broilers	<i>Enterococcus faecium</i>	Decrease in the use of antibiotic growth promoters starting in 1995, leading to a decision in 1998 by food animal producers to voluntarily stop the use of all antibiotic growth promoters by 1999	Resistance to avilamycin
Aarestrup (2000b)	Denmark, Norway, Finland	Broilers, pigs	<i>Enterococcus faecium</i>	Restricted use of antibiotic growth promoters in Norway and Finland (compared to Denmark); for example: prohibited use of avoparcin from 1995, virginiamycin from 1998, and tylosin/avilamycin/spiramycin have never been used	Resistance to antibiotics used as growth promoters (avilamycin, avoparcin, bacitracin, flavomycin, momensin, salinomycin, tylosin, virginiamycin) Presence of genes encoding resistance to vancomycin, macrolides, streptogramins) in resistant isolates
Aarestrup (2001)	Denmark	Broilers, pigs	<i>Enterococcus</i> spp.	Antibiotic growth promoter bans (avoparcin in 1995, virginiamycin 1998), and voluntary cessation of use of all antibiotic growth promoters in 1999	Resistance to antibiotics (including glycopeptides, macrolides, orthosomycins, streptogramins)
Aarestrup (2002)	Denmark, Spain, Sweden	Pigs	<i>Enterococcus</i> spp.	No use of antibiotic growth promoters in Sweden since 1985	Resistance to antibiotics (including avilamycin, glycopeptides macrolides, amphenicols, aminoglycosides, tetracyclines, penicillins, bacitracin, streptogramins) and presence of resistance genes

Study	Country	Population sampled	Bacteria studied	Description of intervention or intervention group	Outcomes measured
Avrain (2003)	France	Broilers	<i>Campylobacter</i> spp.	Free-range production, with no use of antibiotic growth promoters, confirmed by documents accompanying the animals to slaughterhouse	Prevalence of <i>Campylobacter</i> spp. and their resistance to antibiotics (including penicillins, aminoglycosides, quinolones, tetracyclines, macrolides)
Boerlin (2001)	Switzerland	Pigs	<i>Enterococcus</i> spp.	Ban of all antibiotics for growth promotion	Resistance to antibiotics (including penicillins, amphenicols, aminoglycosides, tetracyclines, macrolides, glycopeptides, lincosamides)
Borgen (2000)	Norway	Poultry (broiler and layer chickens, turkeys)	<i>Enterococcus</i> spp.	Ban of avoparcin (which was used as a feed additive for growth promotion)	Prevalence of vancomycin-resistant enterococci, and their molecular characteristics
Borgen (2001)	Norway	Poultry (broiler and layer chickens, turkeys)	<i>Enterococcus</i> spp.	Ban of avoparcin (which was used as a feed additive for growth promotion)	Prevalence of <i>vanA</i> vancomycin-resistant enterococci
Del Grosso (2000)	Italy	Poultry (broilers, turkey), pigs	<i>Enterococcus</i> spp.	Ban of avoparcin (which was used as a feed additive for growth promotion)	Prevalence of vancomycin-resistant enterococci, and their molecular characteristics
Desmonts (2004)	France	Broilers	<i>Campylobacter</i> spp.	Ban of avoparcin, virginiamycin, tylosin, spiramycin, bacitracin	Resistance to antibiotics (including penicillins, aminoglycosides, quinolones, tetracyclines, macrolides)
Heuer (2002)	Denmark	Broilers	<i>Enterococcus</i> spp.	Ban of avoparcin (which was used as a feed additive for growth promotion)	Prevalence of vancomycin-resistant enterococci
Kruse (1999)	Norway	Poultry (broilers, turkey), pigs	<i>Enterococcus</i> spp.	Ban of avoparcin (which was used as a feed additive for growth promotion)	Prevalence of vancomycin-resistant enterococci
Kühn (2005)	Spain, Sweden, UK	Beef cattle, broilers, pigs	<i>Enterococcus</i> spp.	No use of antibiotic growth promoters in Sweden since 1985	Prevalence of vancomycin-resistant enterococci Relationships between vancomycin-resistant enterococci isolates along the food-chain
Lauderdale (2007)	Taiwan	Broilers	<i>Enterococcus</i> spp.	Ban of avoparcin (which was used as a feed additive for growth promotion)	Resistance to antibiotics (including penicillins, aminoglycosides, amphenicols, quinolones, tetracyclines, macrolides, streptogramins) Resistance to colistin
Li (2018)	China	Pigs	<i>Escherichia coli</i>	Ban of colistin (used as an antibiotic growth promoter)	Though not stated as a study objective, resistance to other antibiotics also reported (including penicillins, amphenicols, cephalosporins, carbapenems, aminoglycosides, quinolones, tetracyclines, sulfonamides, fosfomycin)
Nwankwo (2014)	Nigeria	Broilers	<i>Escherichia coli</i>	Farm with no antibiotic feed additives	Cloacal fecal carriage and antibiotic resistance of <i>Escherichia coli</i> isolates (including resistance to penicillins, amphenicols, cephalosporins, aminoglycosides, quinolones, sulfonamides, tetracyclines)

Study	Country	Population sampled	Bacteria studied	Description of intervention or intervention group	Outcomes measured
Smith (1981)	UK	Broilers, pigs	<i>Escherichia coli</i>	Ban of tetracycline in feed	Resistance to antibiotics (including penicillins, quinolones, tetracyclines, aminoglycosides, sulfonamides, amphenicols, nitrofurans, aminocyclitols, polymyxins, rifampin)
Sørnum (2004)	Norway	Poultry (broilers, turkey)	<i>Enterococcus</i> spp.	Ban of avoparcin (which was used as a feed additive for growth promotion)	Prevalence of vancomycin-resistant enterococci, presence of <i>vanA</i> gene, susceptibility of isolates to narasin
van den Bogaard (2000)	The Netherlands	Broilers, pigs	<i>Enterococcus</i> spp.	Ban of avoparcin (which was used as a feed additive for growth promotion)	Prevalence of vancomycin-resistant enterococci, and resistance to other antibiotics (including glycopeptides, macrolides, streptogramins)
Other/Undetermined					
Agunos (2019)	Canada	Poultry (broilers, turkey)	<i>Escherichia coli</i> <i>Campylobacter</i> spp. <i>Salmonella</i> spp.	National antimicrobial use reduction strategy, including rolling implementation of eliminating preventative use of antibiotics of very high, high, and medium importance to human medicine, based on the Health Canada's Veterinary Drugs Directorate categories	Trends in antimicrobial use and resistance among poultry species, and over time (including resistance to penicillins, cephalosporins, macrolides, aminoglycosides, quinolones, tetracyclines, sulfonamides, ketolides) Comparison of antimicrobial use and antimicrobial resistance indicators
Cohen Stuart (2012)	The Netherlands	Broilers	Extended Spectrum Beta-Lactamase micro-organisms (including <i>Escherichia</i> spp. and <i>Klebsiella pneumoniae</i>)	Free-range retail meat (antibiotic use policy not described or specified)	Prevalence of Extended Spectrum Beta-Lactamase organisms and load of Extended Spectrum Beta-Lactamase isolates
Desmonts (2004)	France	Broilers	<i>Campylobacter</i> spp.	Free-range production, where no antibiotic growth promoters are used and where antibiotic treatments (for therapeutic indications) are "limited"	Resistance to antibiotics (including penicillins, aminoglycosides, quinolones, tetracyclines, macrolides)
Dorado-García (2015)	The Netherlands	Veal	<i>Staphylococcus aureus</i>	Reductions of overall antimicrobial use by: -Focusing on individual treatments -Only one antibiotic can be used at a time (i.e. no combination antibiotics) -Limiting group treatments where criteria must be met before any group treatment can be initiated -Guidance from veterinarians (with audits) to help implement a protocol to reduce antimicrobial use	Prevalence of methicillin-resistant <i>Staphylococcus aureus</i> , risk factors associated with presence of methicillin-resistant <i>Staphylococcus aureus</i> , effects of restrictions of antibiotic use on technical and production measures
Harper (2009)	USA	Pigs	<i>Staphylococcus aureus</i>	"Organic/antibiotic-free" farms with no further description of antibiotic use	Prevalence of methicillin-resistant <i>Staphylococcus aureus</i>
Haskell (2018)	USA	Beef cattle, pigs, poultry (broilers, turkey)	<i>Staphylococcus aureus</i>	Antibiotic-free retail meat	Prevalence of <i>Staphylococcus aureus</i> and methicillin-resistant <i>Staphylococcus aureus</i> , and their antibiotic resistance profiles

Study	Country	Population sampled	Bacteria studied	Description of intervention or intervention group	Outcomes measured
Hässig (2014)	Switzerland	Beef cattle	Bacterial isolates from calves with pneumonia or diarrhea	Ban of antibiotic growth promoters and implementation of other regulations such as the need to document antibiotic use	Resistance to antibiotics (including penicillins, aminoglycosides, cephalosporins, amphenicols, quinolones, macrolides, tetracyclines, bacitracin, sulfonamides, glycopeptides, lincosamides, rifampin, polymyxins, fusidic acid, nitroimidazoles, nitrofurans, aminocyclitols)
Joseph (2007)	USA	Poultry	<i>Enterococcus</i> spp.	Antibiotic-free farms (no description provided)	Resistance to antibiotics (including bacitracin, macrolides, lincosamides, aminoglycosides, streptogramins, nitrofurans, tetracyclines, penicillins)
Joseph (2008)	USA	Broilers	<i>Salmonella</i> spp.	Antibiotic-free farms (no description provided)	Resistance to antibiotics (including penicillins, cephalosporins, amphenicols, aminoglycosides, tetracyclines, sulfonamides)
Kilonzo-Nthenge (2015)	USA	Broilers	<i>Enterococcus</i> spp.	Retail meat with labels “antibiotics free”, “no antibiotics”, or “organic” (these were not differentiated)	Prevalence and antibiotic resistance profile of <i>Enterococcus</i> spp. (including penicillins, aminoglycosides, cephalosporins, amphenicols, tetracyclines, macrolides)
Lejeune (2004)	USA	Beef cattle	<i>Escherichia coli</i> <i>Salmonella</i> spp.	Antibiotic-free retail meat, or labels with similar meaning	Prevalence of coliforms and bacterial pathogens, and their resistance to antibiotics (including penicillins, cephalosporins, amphenicols, aminoglycosides, tetracyclines, sulfonamides)
Lenart-Boron (2016)	Poland	Broilers	<i>Escherichia coli</i>	Organic farm (no description of antibiotic use and restrictions)	Resistance to antibiotics (including penicillins, cephalosporins, aminoglycosides, quinolones), and molecular mechanisms of resistance to fluoroquinolone antibiotics
O’Brien (2012)	USA	Pigs	<i>Staphylococcus aureus</i>	“Alternative” retail meats (including labels such “raised without antibiotics” and “raised without antibiotic growth promoters”)	Prevalence of <i>Staphylococcus aureus</i> and methicillin-resistance <i>Staphylococcus aureus</i>
Obeng (2012)	Australia	Broilers and layer chickens	<i>Escherichia coli</i>	Free-range samples (antibiotic use policy not described or specified)	Resistance to antibiotics (including penicillins, cephalosporins, amphenicols, aminoglycosides, tetracyclines, sulfonamides, aminocyclitols) and genetic resistance profiles of the isolates
Tadesse (2009)	USA	Pigs	<i>Campylobacter</i> spp.	Antibiotic-free farms; description provided includes that antibiotics are not used after the weaning stage, and where animals that require antibiotics to treat infections are moved to a separate barn in the farm	Prevalence of <i>Campylobacter</i> spp., their resistance to antibiotics (including amphenicols, aminoglycosides, tetracyclines, macrolides, quinolones)
Teramoto (2016)	USA	Broilers	<i>Staphylococcus aureus</i>	Retail carcasses from farmer’s markets and organic supermarkets	Prevalence of <i>Staphylococcus aureus</i> and their resistance to antibiotics (including penicillins, aminoglycosides, quinolones, macrolides, tetracyclines, and glycopeptides)

Study	Country	Population sampled	Bacteria studied	Description of intervention or intervention group	Outcomes measured
Thapaliya (2017)	USA	Beef, poultry (broilers, turkey), fish	<i>Staphylococcus aureus</i>	Antibiotic-free retail meat	Prevalence of <i>Staphylococcus aureus</i> and methicillin-resistant <i>Staphylococcus aureus</i> , their resistance to antibiotics (including penicillins, aminoglycosides, quinolones, macrolides, tetracyclines, and glycopeptides), and molecular characteristics
van den Bogaard (2001)	The Netherlands	Poultry (broilers, laying hens, turkey)	<i>Escherichia coli</i>	Layer farms (which have “relatively low antibiotic use”), compared to broiler and turkey farms (which have “relatively high antibiotic use”)	Prevalence of <i>Escherichia coli</i> and their resistance to antibiotics, genetic characteristics and profiles of ciprofloxacin-resistant isolates
Vikram (2018)	USA	Beef cattle	<i>Escherichia coli</i> <i>Enterococcus</i> spp. <i>Salmonella</i> spp. <i>Staphylococcus aureus</i>	“Raised without antibiotics” retail meat	Prevalence of antibiotic resistant bacteria (including to tetracycline, third generation cephalosporin, nalidixic acid, erythromycin, and presence of methicillin-resistant <i>Staphylococcus aureus</i>), prevalence of antibiotic resistance genes, phylogenetic profiles of isolates
Wanninger (2016)	Switzerland	Pigs	<i>Chlamydia suis</i>	Farm that prophylactically treated animals with trimethoprim, sulfadimidine and sulfathiazole, but not tetracyclines (compared to farms that treated with chlortetracycline)	Resistance to tetracycline
Zhang (2011)	USA	Broilers	<i>Escherichia coli</i> <i>Enterococcus</i> spp. <i>Salmonella</i> spp.	Retail meat with the label “no antibiotics added”	Prevalence of bacterial contamination and patterns of antibiotic resistance (including penicillins, aminoglycosides, cephalosporins, amphenicols, quinolones, sulfonamides, tetracyclines, macrolides, cyclic lipopeptides [daptomycin], glycopeptides, nitrofurans, oxazolidinones [linezolid], glycylycine [tigecycline])

Abbreviations: USA- United States of America, USDA – United States Department of Agriculture, FDA- United States Food and Drug Administration, UK – United Kingdom