This EFFAT internal briefing paper has been prepared by Mr. Peter Hurst.
The emergence of antimicrobial resistance in the agro-food sector and in the food chain threatens worker, consumer (food safety), and public/community health alike. But at the same time the growth of antimicrobial resistance also poses a challenge to workers in the agro-food sector, and the trade unions that organise them, as both can play key roles in combating this problem. In so doing, workers through their trade unions will not only protect their own health, but also the health of consumers by ensuring improved food safety, and the health of the public and communities.

I. The Problem of Antimicrobial Resistance

- A serious and global human health threat
- Transmission from farm animals to people through the food chain
- Workers at direct risk of infection and illness

Antimicrobial resistance is now widely recognised as one of the most serious and global human health threats. New forms of antimicrobial resistance and especially a main type, antibiotic resistance, can cross international boundaries and spread between continents with ease.¹

Antimicrobial resistance is on the rise globally with increasing numbers of deaths every year from microbial infectious diseases. Data on the exact scale of the antimicrobial resistance problem is often lacking or based only on estimations. The US Centre for Disease Control (CDC), for example, “estimates that in the United States, more than two million people are sickened every year with antibiotic-resistant infections - a main type of antimicrobial resistance - with at least 23,000 dying as a result. The estimates are based on conservative assumptions and are likely minimum estimates. They are the best approximations that can be derived from currently available data.” The CDC goes on to say that, “Infections from resistant bacteria are now too common, and some pathogens have even become resistant to multiple types or classes of antibiotics (antimicrobial drugs used to treat bacterial infections).²

Antimicrobial resistance is a long-standing issue in hospitals and clinics in the health sector, the emergence of antimicrobial resistance in the agro-food sector and contamination of the food chain is a more recent but rapidly developing phenomenon. The development and spread of antimicrobial resistance through the food chain links animal and human health and threatens worker, consumer (food safety), and public/community health alike.

The use of antibiotic drugs in intensive livestock production (and fish farming) where antibiotics are routinely added to farm animal water or feed to combat infections but also to act as growth promoters is seen by many sources as a main driver for antimicrobial resistance. Most contentious is the use of low levels of antibiotics in healthy animals to encourage them to grow faster.\(^3\) Veterinary and animal industries claim that they make and use antibiotic drugs responsibly, and that agriculture’s role in creating antimicrobial resistance is exaggerated.\(^4\) While many nations have sought to rein in antibiotic drug overuse in humans, administration of these drugs to livestock is largely unregulated, and is increasing along with global demand for meat, eggs and dairy.\(^5\)

Public health experts around the world, including the World Health Organization and the European Food Safety Authority, recognise that increasingly resistant microbes are being transmitted from farm animals to people through the food chain. Drug-resistant bacteria/microbes from farms are escaping via farmers and farmworkers or meat and poultry slaughter and food processing workers into food products and into the wider community.\(^6\)

### II. What exactly is antimicrobial resistance?

Antimicrobial resistance (AMR), including antibiotic resistance, is the **resistance of a microorganism (microbe) to an antimicrobial medication** that used to be effective in treating or preventing an infection caused by that microbe. Most microbial infections succumb to antibiotics, but varieties of **microorganisms (microbes) which have developed resistance to antibiotics can be difficult if not impossible to cure.** Livestock-associated Methicillin \(^7\) -resistant Staphylococcus aureus, MRSA CC 398, is used as to illustrate the problem of growing antibiotic resistance in the agriculture and food industries.\(^8\)

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7 In addition to methicillin which is a widely used antibiotic, MRSA is now resistant to other commonly used antibiotics such as amoxicillin, penicillin, and oxacillin.

8 Livestock-associated Methicillin-resistant Staphylococcus aureus, MRSA CC 398, a new variant of MRSA, is found in intensively farmed animals -primarily pigs, but also cows and chickens -from where it can be transmitted to humans. Pigs
Antimicrobial resistance occurs when disease-causing (pathogenic) microbes (microorganisms) evolve to become more, or fully, resistant to antimicrobial substances which were previously effective in treating them, and of which there are two main categories:

- **Antimicrobial drugs** such as antibiotics, antivirals, antifungals, and antimalarials/antiparasitics;

- **Antimicrobial chemicals** such as detergents, disinfectants, and food additives used as food preservatives.

Resistant microbes which include bacteria, fungi, viruses and parasites are able to withstand attack by antimicrobial drugs so that standard treatments become ineffective and infections persist, threatening the individual infected, and increasing the risk of spread to other persons.

Resistant microbes are increasingly difficult to treat, requiring alternative medications or higher doses—which may be more costly or more toxic. Microbes resistant to multiple antimicrobial drugs are called **multidrug resistant** (MDR); or sometimes **superbugs**. Most infections succumb to antibiotic drugs, but varieties of microbial infections which have developed resistance to antibiotics\(^9\) can be difficult if not impossible to cure.

### INFOBOX: Facts and figures on antibiotic use in livestock production

- **Globally**, livestock consumed 63,000 tons of antibiotics in 2010, and their use is expected to grow by two-thirds by 2030, said the chief of animal health at the United Nations’ Food and Agriculture Organization.\(^10\)

- The European Medicines Agency quantified the overall sales of veterinary antimicrobial agents in 26 European countries to **8,122 tons** in 2013.\(^11\) In Europe antimicrobial resistance in general causes **23,000 deaths** every year, **15,000 alone in Germany**.\(^12\)

- A full 80% of antibiotic use in the **USA** is for growth promotion and disease prevention in farm animals.\(^13\) Although farm owners do not always reveal the quantities or types of

\(^9\) Sometimes the term “**antibiotic**” is mistakenly used to refer to any substance used against microbes, synonymous to “**antimicrobial**”, leading to the widespread but incorrect belief that antibiotics can be used against viral infections such as colds, flu, most coughs and bronchitis, and sore throats (unless caused by streptococcus microorganisms). Antibiotics are mainly used to treat bacterial infections.


antibiotics they use as an analysis of US Federal Department of Agriculture data by researchers at the Johns Hopkins Center for a Livable Future found that in 2009, some 13.1 million kilograms — 80% of the antibiotics sold in the USA — were used on farms for disease prevention and growth promotion.\(^{14}\)

- In the USA, the major problem in determining the degree of antibiotic resistance associated with intensive livestock production has been lack of data. Many farmers are reluctant to allow scientists access to their facilities, and farm workers — many of whom, in the United States, are undocumented immigrants — are wary of anyone who might want to sample them.\(^{15}\)
- According to a 2016 investigation by the Bureau of Investigative Journalism, fluoroquinolones, a type of antibiotics that was banned on US chicken farms a decade ago over links to the spread of potentially deadly bacteria in humans are being used in significantly increased quantities by the UK poultry industry.\(^{16}\)
- Almost half of all antibiotics used in the UK are administered to farm animals.\(^{17}\)

### III. Who is at risk?

- Workers
- Consumers
- Wider Public at large

Antimicrobial resistance can occur in humans and animals. Antimicrobial resistance can pass from humans to humans through direct skin contact, touching infected surfaces or equipment, or through breathing in infected microbes. Human infection can occur through contact with infected animals, animal carcasses, raw meat and poultry products, or eating infected animals products - meat, poultry, eggs, or milk.\(^{18}\) The foodborne route is the major transmission pathway for resistant bacteria and resistance genes from food animals to humans in most infections, for example, with enteric bacterial pathogens such as *Salmonella enteric*, *Campylobacter coli/jejuni*, and *Yersinia enterocolitica* in industrialised

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\(^{16}\) Poultry farmers ‘using more antibiotics linked to resistant food poisoning bugs’ Fluoroquinolones are becoming less effective in treating human infections, and critics say their excessive use on chickens is to blame. Andrew Wasley, Victoria Parsons. Independent newspaper UK, 08.02.2016; [http://www.independent.co.uk/life-style/health-and-families/health-news/poultry-farmers-using-more-antibiotics-linked-to-resistant-food-poisoning-bugs-a6859436.html](http://www.independent.co.uk/life-style/health-and-families/health-news/poultry-farmers-using-more-antibiotics-linked-to-resistant-food-poisoning-bugs-a6859436.html)


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countries. Whereas, for other resistant pathogens, direct contact between animal and humans, or handling infected animal carcasses and animal food products, may be the major route of transmission as, for example, with Livestock associated Methicillin-resistant Staphylococcus aureus (MRSA) 398.

As already stated, the emergence of antimicrobial resistance in the agro-food sector and in the food chain links animal and human health, and poses health threats to workers, consumers, and the public and communities.

Worker Health: Workers in commercial livestock raising, slaughter, and meat and poultry processing and manufacture can be at risk of catching an infectious microbial disease exposure due to working with infected farm animals, handling infected carcasses, and handling infected raw meat products in the course of food processing and manufacturing. Injury and microbial infectious disease are often linked as many of the disease-causing microbes (microorganisms) can only enter the body through skin lacerations, cuts, or wounds.

In addition to the direct risks to themselves, these groups of workers may unknowingly act as “carriers” of infectious microbial diseases with the risk of passing on infectious diseases to others. These carriers do not fall ill or show symptoms of the microbial diseases themselves, but can accidentally contaminate the food products they handle in the course of their work with the infectious disease that they are carrying, posing risks to others.

In terms of “others at risk”, first in line can be workers further up the food chain who come into contact with and handle infected meat and poultry products in the course of their work. For example, supermarket/shop workers filling fridges and shelves with poultry and meat products may be at risk of catching a microbial disease from the food packaging which as accidentally contaminated by “carrier” workers packaging the food in the processing plant/factory. Another example of other workers directly at risk are food handlers and preparers who come into contact with and handle infected raw meat or poultry products when preparing them for customers in restaurants and food outlets. In addition, food handlers and preparers may then also accidentally infect the food they are preparing for customers. Finally, all these groups of other workers may also unknowingly act as “carriers, capable of passing infections on to third persons through skin and/or respiratory contact.

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Next at risk are consumers who unknowingly buy meat and poultry products infected with harmful microbes. They may catch a microbial disease when preparing raw meat and poultry for cooking, and when they eat infected food which has not adequately cooked to kill off harmful microbes. So, combating antimicrobial resistance is a major element in ensuring Food Safety.

Next are risks to Public Health (Community) from workers unknowingly acting as carriers of microbial infection. Workers in commercial livestock raising, slaughter, food processing and manufacturing, supermarkets, food handlers and preparers and so on who are “carriers” may pass on the infectious microbial disease to members of the public in the wider community through respiratory and/or skin contact, e.g., shaking hands.

**The Example of Livestock-associated Methicillin-resistant Staphylococcus aureus (MRSA)**

Livestock associated Methicillin-resistant Staphylococcus aureus (MRSA) 398 is used to illustrate the issue of antimicrobial resistance in the agro-food sector and in the food chain as the major route of transmission for this infection is direct contact between animal and humans, or handling infected animal carcasses and animal food products, and poses risks to the health of workers, consumers, the public and communities.

Staphylococcus aureus, often referred to simply as “staph,” is a type of bacteria commonly peacefully carried on the skin or in the nose of healthy people. The bacteria are carried by about 2% of the population (2 in 100 people), although most of them aren't infected. Sometimes, staph can cause an infection. Staph bacteria are one of the most common causes of skin infections, for example, in the USA. Most of these skin infections are minor such as pustules and boils and can be treated without antibiotics. However, staph bacteria also can cause serious, even life-threatening, infections such as skin and soft tissue wound infections, bloodstream infections, and pneumonia.

Staphylococcus aureus is spread by contact. So you could get it by touching another person who has it on the skin or by touching objects or meat and food products that have the bacteria on them. Infections occur when skin is broken.

Some staph bacteria have developed a resistance to the antibiotic, Methicillin, which previously was very effectively used to treat most staph infections. Resistant bacteria are called methicillin-resistant staphylococcus aureus or MRSA. MRSA is often resistant to other antibiotics, as well (amoxicillin, penicillin, oxacillin, and many other common antibiotics). Because it's hard to treat, MRSA is sometimes called a “super bug.”

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21 MRSA. Canadian Center for Occupational Health & Safety, February 2014; [https://www.ccohs.ca/oshanswers/biol_hazards/methicillin.html](https://www.ccohs.ca/oshanswers/biol_hazards/methicillin.html)


Most *Methicillin-resistant Staphylococcus aureus (MRSA)* is human-associated and is best known for causing hospital-acquired infections – and many deaths. There has been little human to human transmission of the MRSA in the community, but it is particularly dangerous in hospitals because it can colonise wounds easily, especially where patients’ immunity is low. MRSA is the leading infectious cause of disease and death in US with at least 2 million illnesses and 23,000 deaths per year.\(^{24}\)

MRSA can be difficult if not impossible to cure. There are 270,000 strains, each potentially harmful.\(^{25}\) In the European Union, more than 150,000 people are estimated to contract MRSA each year.\(^{26}\)

**Livestock-associated Methicillin-resistant Staphylococcus aureus, MRSA CC 398**, a new variant of MRSA, is found in intensively farmed animals - primarily pigs, but also cows and chickens - from where it can be transmitted to humans.\(^{27}\) Although the bacteria doesn’t make it through the cooking process, meat can still be what scientists call a “vector,” or a mode of transmission, when we handle it. This livestock-associated strain of Staphylococcus aureus are multi-drug-resistant and can go from person-to-person. It can leave the farm, and if it leaves the farm, it goes everywhere. It doesn’t stop because you live in the city or just because you don’t eat meat.\(^{28}\) Its appearance on farms in the USA and Europe signalled the expansion of what many believe is a dangerous source of human infection.\(^{29}\) It was discovered from at least 1995 onwards to have spread from farm animals to humans. Pigs carrying methicillin-resistant *Staphylococcus aureus* (MRSA) were found on US farms for the first time in 2007.\(^{30}\)

According to an investigative report by the Guardian newspaper UK, the threat of MRSA in hospitals has generated an urgent response, but an MRSA variant, CC 398, is spreading from farm livestock to supermarket meat unchecked.\(^{31}\)

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IV. What needs to be done?

Recommendations for Prevention and Protection against Antimicrobial Resistance

These include, inter alia:

1. The EU and its Member States should:
   - Ban the use of routine, preventive low-level therapeutic treatment with antibiotics of farm animals, for instance by adding antibiotics routinely to animal feed and water.
   - Raise a public awareness campaign on the problem
   - Set targets and harmonise systems of monitoring and reporting – as well as more detailed data collection – of the extent of antibiotics usage in animal production all across the EU.
   - Establish arrangements for carrying out relevant health surveillance of workers.
   - Review Annex III of Directive 2000/54/EC to ensure that appropriate measures are implemented.

2. Agribusiness – Agricultural producers and their producer associations should:
   - Develop policies and programs to drastically reduce the use of antibiotics in farm animal production.
   - Agro-food companies, commodity buyers, food processors and food retailers should develop policies and programs to reduce and eliminate the purchase of meat, poultry and dairy products treated with antibiotics.
   - Implement regular health monitoring programs for workers at risk, including migrant workers.

3. Employers should:
   - Develop measures to protect their workers against antimicrobial disorders and diseases by, inter alia:
     - Providing training for workers on the prevention and reduction of antimicrobial disorders and diseases, including measures to help protect consumer health (food safety), and the health of the communities and the public at large.
     - Provide personal protective equipment and clean laundry.
     - Provide facilities for regular hand washing.
     - Implement more rigorous cleaning routines.

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32 Without prejudice to DIRECTIVE 2000/54/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 18 September 2000 on the protection of workers from risks related to exposure to biological agents at work (seventh individual directive within the meaning of Article 16(1) of Directive 89/391/EEC)
Provide **health monitoring** for employees by competent persons and keep a list of workers exposed to biological agents, including MRSA.

4. **Trade Unions should:**

- Campaign about the growing risks to worker health, consumer health (food safety), and community/public health from antimicrobial resistance, and the contamination of the food chain, and the importance of developing EU-wide policies and measures to tackle this growing problem.
- Campaign about the importance of supporting and aiding the efforts of food chain workers and their trade unions to help combat the growth of antimicrobial disorders and diseases in order not only to protect worker health but the health of consumers (food safety), and communities and the public alike.
- Demand protection and monitoring on the issue of antimicrobial resistance for workers in collective bargaining agreements.
- Campaign against precarious work as casual workers who are not subject to health checks and training are more at risk to themselves, their families and their communities. It is therefore important that unions campaign to convert precarious work to permanent direct hire work and assist casual workers obtain permanent employment and regular checks and training.
Annex

Examples of MRSA CC 398 and worker infection

Denmark

The superbug CC398 is a variant of the more commonly known MRSA found in hospitals and is endemic in pig farms in some European countries, particularly Denmark. Two-thirds of Denmark’s pig farms are currently infected with CC398, where it is spreading rapidly: 648 people were infected with CC398 in 2013; in 2014, 1,271 people contracted the bug. Of those infected two people died as a result of the infection, and many suffered serious blood poisoning.33

A Guardian UK newspaper investigation claimed that the spread of Livestock-associated MRSA CC398 in Denmark is being fuelled by the sector’s reliance on a large number of casual workers who unknowingly contract the infection and then pass it on to others in the wider community. A group of Romanian workers in Denmark who were interviewed as part of the Guardian’s investigation say they knew nothing about MRSA until after they started working at farms. One former farm worker infected with the bug said: “I was three months on the farm, [and] I got some spots on my scalp, also on my chest and I thought first it’s from the dust and the conditions.” “[Eight months later] I was in Romania on holiday and I visited the doctor and they took some examples from my skin and they said I have MRSA.”34

According to Danish trade union leaders, workers receive little or no training relating to MRSA. The Danish government has pledged to tackle spiralling CC398 rates by reducing the amount of antibiotics used in pig production by 15% by 2018, and to improve biosecurity by strengthening hygiene training of pig-farm workers.35

An investigation by Guardian UK newspaper’s, into pork sold by several leading UK supermarkets which were found to be contaminated with MRSA CC398, established that the spread of CC398 in Denmark was being fuelled by the sector’s reliance on a large number of casual workers who unknowingly contracted the superbug and then passed it on to others in the wider community.

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Germany

A German multicenter study proved that especially in rural areas in northwestern Germany with a high density of livestock farming the share of MRSA CC 398 to all MRSA rises with the concentration of intensive livestock farming. The study proved that between 2008 and 2012 the concentration of MRSA CC 398 in hospitals was at 23% on an average. The national Surveillance-System in the Netherlands proved that exceedingly few human infections (4.4%) with MRSA CC 983 can be traced back to direct contacts with pigs or veal, but to human-to-human transmission.36

USA

A group of US scientists swabbed the noses of two distinct groups of North Carolina hog farm workers looking for antibiotic-resistant Staphylococcus aureus. One group worked in a conventional industrial hog farm; the other in an antibiotic-free operation. What’d they find? According to the new study just over 40 percent of both groups carried staph bacteria—but several of those who worked in the conventional industrial pig farm also carried something called ST398, also known as pig MRSA.37

A US study of the prevalence, antibiotic susceptibility, and molecular characteristics of S. aureus among industrial livestock operation and antibiotic-free livestock operation workers and household members in North Carolina was published in 2013. Among 99 industrial livestock operation and 105 antibiotic-free livestock operation participants, S. aureus nasal carriage prevalence was 41% and 40%, respectively. Among industrial livestock operation and antibiotic-free livestock operation S. aureus carriers, MRSA was detected in 7% (3/41) and 7% (3/42), respectively. Thirty seven percent of 41 industrial livestock operation versus 19% of 42 antibiotic-free livestock operation S. aureus-positive participants carried MDRSA. S. aureus clonal complex (CC) 398 was observed only among workers and predominated among industrial livestock operation (13/34) compared with antibiotic-free livestock operation (1/35) S. aureus-positive workers. Only industrial livestock operation workers carried scn-negative MRSA CC398 (2/34) and scn-negative MDRSA CC398 (6/34), and all of these isolates were tetracycline resistant.38

37 Persistence of livestock-associated antibiotic-resistant Staphylococcus aureus among industrial hog operation workers in North Carolina over 14 days. Occupational & Environmental Medicine, published 8 September 2014, http://oem.bmj.com/content/early/2014/09/05/oemed-2014-102095.full
Despite similar *S. aureus* and MRSA prevalence among industrial livestock operation and antibiotic-free livestock operation workers and household members in **North Carolina**, livestock-associated MRSA and MDRSA (tetracycline-resistant, CC398, *scn*-negative) were only present among industrial livestock operation exposed individuals. These findings support growing concern about antibiotics use and confinement in livestock production, raising questions about the potential for occupational exposure to an opportunistic and drug-resistant pathogen, which in other settings including hospitals and the community is of broad public health importance.\(^3^9\)

Antibiotic use on a broad scale leads to resistant microbes. In a **1976 study**, Stuart Levy, a microbiologist at Tufts University School of Medicine in Boston, Massachusetts, found that when farmers started using tetracycline, the numbers of tetracycline-resistant bacteria on the farms spiked within months, resistance had spread to microbes in farm workers' intestinal tracts.\(^4^0\)

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\(^3^9\) MRSA is currently included in risk group 2 of Annex III of Directive 2000/54/EC. Group 2 biological agent means one that can cause human disease and might be a hazard to workers; it is unlikely to spread to the community; there is usually effective prophylaxis or treatment available. According to Article 11 of Directive 2000/54/EC, employers shall only keep a list of workers exposed to group 3 and/or group 4 biological agents which may present a risk of spreading to the community.