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Antimicrobials in farm animals: impact on the environment and consequent antimicrobial resistance dissemination.

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Abstract

In intensive animal farming, antimicrobial drugs (AMD) are used for individual therapy, but also for mass medication involving use of large amounts of drugs. Some of the AMDs are eliminated as such and others as metabolites. Manure is commonly used for the fertilization of agricultural soils potentially resulting in an environmental load of drug residues. The environmental consequences from the soil fertilization with drug-contaminated manure represent a topic of increasing interest. The evaluation of the environmental risks deriving from the use of veterinary medicinal products is mandatory for all the new marketing authorizations in the EU. For the already authorized veterinary drugs this requirement does not exist. Thus, the real scenario of environmental exposure to AMDs remains incomplete. Besides soil and water contamination with undesirable substances, the persistence of veterinary AMDs in the environment may represent a toxicological risk for non-target species (e.g. fishes, plants, aquatic and terrestrial organisms). Additionally, an emerging concern is the occurrence and spread of antimicrobial resistance (AMR) in the environment. Along with its impact on the soil and water resistome, the distribution of drug-contaminated manure can affect the composition and functional properties of microbial communities or microbiome. The reservoir of resistance in the environment is a mix of naturally occurring resistance genes and those added via animal and human waste. Moreover, the selective effects of antimicrobials may have potential serious ecological and public health implications. Indeed, there is an increasing concern that environmental resistance may be transferred to humans. A research project has been granted by the Italian Ministry of School Education, University and Research (PRIN 2015KA3XFH) to evaluate the role of intensive animal farming (poultry, cattle and swine located in two Italian regions), as potential source of environmental antimicrobial contamination and resistance and as potential cause of toxic effects on non-target organisms. Analyses are carried out in order to generate data on antimicrobial concentrations, antimicrobial resistance genes (ARGs) and microbial community composition of animal manure and soil before and after the application of manure. The toxic effects on non-target organisms of the soil and freshwater compartments will be also investigated