



National Collaborating Centre
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Glossary of Terms: Antimicrobial Resistance

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Glossary of Terms - Antimicrobial Resistance (AMR)

Term	Definition	Source
Active Pharmaceutical Ingredients (API)	The biologically active ingredients in a pharmaceutical drug.	Government of Canada. (2018) Oversight on the quality of active pharmaceutical ingredients for veterinary use in Canada. https://www.canada.ca/en/public-health/services/antibiotic-antimicrobial-resistance/animals/oversight-quality-active-pharmaceutical-ingredients-veterinary-use.html
Alternative products	Strategies or products other than antimicrobials that could be used for either disease prevention or therapy. For example vaccines, phage therapy, lysines, antibodies, probiotics, immune stimulation, and peptides, as well as improved biosecurity practices and sanitation. In agriculture, this would also include improved best practices for management, housing, production systems, and husbandry.	O'Neill, J. (2016). Tackling Drug-Resistant Infections Globally: Final Report and Recommendations. Review on antimicrobial resistance to the Government of the United Kingdom. HM Government, London. https://amr-review.org/sites/default/files/160518_Final%20paper_with%20cover.pdf
Antibiogram	A laboratory resource used to determine the sensitivity of a bacterial strain to different antibiotics. A cumulative antibiogram provides a profile of antibacterial susceptibilities within an institution or aggregation of institutions over a given period time to monitor trends in antibacterial resistance and to guide empirical antibacterial therapy selection.	Institute of Medicine (2011). Antibiotic Resistance: Implications for Global Health and Novel Intervention Strategies: Workshop Summary. E. R. Choffnes, D. A. Relman, & A. Mack (Eds.). <i>The National Academies Press</i> . https://www.ncbi.nlm.nih.gov/books/NBK54255/ Truong, W. R., Hidayat, L., Bolaris, M. A., Nguyen, L., & Yamaki, J. (2021). The antibiogram: Key considerations for its development and utilization. <i>JAC-Antimicrobial Resistance</i> , 3(2), dlab060. https://doi.org/10.1093/jacamr/dlab060

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Antibiotic resistance	The genetically-acquired capacity for bacteria to withstand antibiotic treatment.	<p>Holmes, A.H., et al (2016). Understanding the mechanisms and drivers of antimicrobial resistance. <i>Lancet</i>, 387(10014). https://doi.org/10.1016/s0140-6736(15)00473-0</p> <p>World Health Organization (2020). Antibiotic Resistance Fact Sheet. https://www.who.int/news-room/fact-sheets/detail/antibiotic-resistance</p>
Antimicrobial agent	A general term for drugs, chemicals, or other substances that either kill or slow the growth of microbes. Different classes exist that are specific to the class of microbe, including: antibacterial drugs (antibiotics) that treat bacterial infections; antiviral agents that treat viral infections; antifungal agents that treat fungi; and antiparasitic agents that treat parasites.	<p>Holmes, A.H., et al (2016). Understanding the mechanisms and drivers of antimicrobial resistance. <i>Lancet</i>, 387(10014). https://doi.org/10.1016/s0140-6736(15)00473-0</p> <p>World Health Organization (2020). Antibiotic Resistance Fact Sheet. https://www.who.int/news-room/fact-sheets/detail/antibiotic-resistance</p>
Antimicrobial residue	<p>The parent compounds, metabolites, and impurities of veterinary drugs persistent in edible animal products and in the environment (maximum residue limits are implemented by the Food and Agricultural Organization for public health food safety).</p> <p>Although portions of antimicrobials are commonly metabolized, the release of non-metabolized drugs, or residues, may be excreted into the environment in animal waste, facilitating the selection and transfer of</p>	<p>Lundborg, C. S., & Tamhankar, A. J. (2017). Antibiotic residues in the environment of South East Asia. <i>BMJ</i>, 358, j2440. https://doi.org/10.1136/bmj.j2440</p> <p>Sanderson, H., et al. (2019). Chapter 7—Antimicrobial Resistant Genes and Organisms as Environmental Contaminants of Emerging Concern: Addressing Global Public Health Risks. In B. Roig, K. Weiss, & V. Thireau (Eds.), <i>Management of Emerging Public</i></p>

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	antibiotic resistance genes within the microbial community. For instance, residues of fluoroquinolones and sulphonamides, chemically stable antibiotics, are frequently detected in the environment and resistance to these drugs is often reported.	<i>Health Issues and Risks</i> (pp. 147–187). Academic Press. https://doi.org/10.1016/B978-0-12-813290-6.00007-X
Antimicrobial stewardship	Coordinated interventions designed to promote, improve, monitor, and evaluate the judicious use of antimicrobials so as to preserve their future effectiveness and to promote and protect human and animal health. Antimicrobial stewardship encompasses the 5Rs of AMU: responsibility, reduction, refinement, replacement, and review.	Public Health Agency of Canada. (2015). Tackling Antimicrobial Resistance and Antimicrobial Use: A Pan-Canadian Framework for Action. https://www.canada.ca/en/health-canada/services/publications/drugs-health-products/tackling-antimicrobial-resistance-use-pan-canadian-framework-action.html#a3.3 Page, S.W., and Gautier, P. (2012). Use of antimicrobial agents in livestock. <i>Rev. Sci. Tech. Off. Int. Epiz.</i> 31(1). https://doi.org/10.20506/rst.31.1.2106
Antimicrobial susceptibility tests	Used to determine to which specific antimicrobials a particular pathogen is sensitive.	Holmes, A.H., et al (2016). Understanding the mechanisms and drivers of antimicrobial resistance. <i>Lancet</i> , 387(10014). https://doi.org/10.1016/s0140-6736(15)00473-0
Antimicrobial use (AMU)	How antimicrobials are used, including treatment goal, treatment of populations versus targeted individuals, duration of use, route of administration, and species treated (i.e. human, animal, or plant).	Årdal, C., et al (2016). International cooperation to improve access to and sustain effectiveness of antimicrobials. <i>Lancet</i> , 387(10015). https://doi.org/10.1016/s0140-6736(15)00470-5

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Antimicrobial use patterns	A classification system to describe how antimicrobials are used in either veterinary or human medical systems. For example, in animals, four AMU patterns are described: growth promotion, prophylaxis, metaphylaxis, and treatment of clinical disease. Each classification is defined based on the target for treatment (e.g. individual or group administration); the typical duration of use, including long duration (e.g. growth promotion), intermediate duration (e.g. prophylaxis), and short duration (e.g. metaphylaxis or treatment); and route of administration (e.g. injection, individual oral administration or group oral administration through feed or water).	Page, S.W., and Gautier, P. (2012). Use of antimicrobial agents in livestock. <i>Rev. Sci. Tech. Off. Int. Epiz.</i> 31(1). https://doi.org/10.20506/rst.31.1.2106
Appropriate use	AMU that maximizes therapeutic impact while minimizing toxicity and the development of resistance. This should not be interpreted simply as reduced use.	Bell, D.M., (2001). Promoting appropriate antimicrobial drug use: perspectives from the Centers for Disease Control and Prevention. <i>Clinical Infectious Diseases</i> , 33(3). https://doi.org/10.1086/321857
Acquired resistance	When a particular microorganism obtains the ability to resist a particular antimicrobial agent to which it was previously susceptible.	Page, S.W., and Gautier, P. (2012). Use of antimicrobial agents in livestock. <i>Rev. Sci. Tech. Off. Int. Epiz.</i> 31(1). https://doi.org/10.20506/rst.31.1.2106
Benchmarking AMU	Organizing multiple hospitals into networks to allow for inter-hospital comparison of antimicrobial use. Comparison of antimicrobial use by farm or of prescription history by veterinarian. This is considered a valuable national and farm-level management tool in	Ibrahim, O.M. and Polk, R.E. (2012). Benchmarking antimicrobial drug use in hospitals. <i>Expert Review of Anti-infective Therapy</i> , 4. https://doi.org/10.1586/eri.12.18

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	promoting antimicrobial stewardship and reducing AMU.	Marian, E.H., et al (2015). Antimicrobial prescription patterns of veterinarians: introduction of a benchmarking approach. <i>Journal of Antimicrobial Chemotherapy</i> . 70(8):2423-5. https://doi.org/10.1093/jac/dkv104
Broad-spectrum antibiotic	Antibiotics that work against a wide range of Gram-positive and Gram-negative bacteria.	Page, S.W., and Gautier, P. (2012). Use of antimicrobial agents in livestock. <i>Rev. Sci. Tech. Off. Int. Epiz.</i> 31(1). https://doi.org/10.20506/rst.31.1.2106
Carbapenemase-producing organisms (CPO)	Certain strains of bacteria that are naturally found in the gastrointestinal tract, such as Klebsiella, Escherichia coli, Acinetobacter, and Pseudomonas, that have acquired resistance to a group of broad-spectrum antibiotics, known as carbapenems, by producing an enzyme (carbapenemase) that breaks down the structure of the antibiotic. Carbapenems are considered a reliable antimicrobial treatment of last resort, thus this type of antimicrobial resistance may significantly limit treatment options.	Meletis G. (2016). Carbapenem resistance: overview of the problem and future perspectives. <i>Therapeutic advances in infectious disease</i> , 3(1), 15–21. https://doi.org/10.1177/2049936115621709 Provincial Infection Control Network of British Columbia. (2022). <i>Carbapenemase-producing Organisms (CPOs)</i> . https://www.picnet.ca/surveillance/cpo/
Combination therapy	Treatment involving more than one drug. A rationale for use of combination therapy has been the lesser likelihood that a pathogen develops resistance to multiple drugs	Holmes, A.H., et al (2016). Understanding the mechanisms and drivers of antimicrobial resistance. <i>Lancet</i> , 387(10014). https://doi.org/10.1016/s0140-6736(15)00473-0
Community-acquired infection	Infection acquired in the community by someone who has not been recently hospitalized nor had a recent medical procedure.	World Health Organization (2014). Antimicrobial Resistance: Global Report on Surveillance. https://apps.who.int/iris/handle/10665/112642

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Community-setting	Refers to where antimicrobials are used or prescribed outside of a hospital or emergency-room setting; for example, a private medical or veterinary clinic, pharmacies, or public health centres.	<p>Hansen, M.P., et al (2015). Antibiotic resistance: What are the opportunities for primary care in alleviating the crisis? <i>Frontiers in Public Health</i>, 3(35). https://doi.org/10.3389%2Fpubh.2015.00035</p> <p>Australian Commission on Safety and Quality in Health Care (2022). Community antimicrobial resistance. https://www.safetyandquality.gov.au/our-work/antimicrobial-resistance/antimicrobial-use-and-resistance-australia-surveillance-system-aura/community-antimicrobial-resistance</p>
Computer-based decision support	Support programs to provide real-time recommendations on antimicrobial choice that links national or local antimicrobial formularies to computerized systems.	<p>Guardabassi, L. and Prescott, J.F. (2015). Antimicrobial stewardship in small animal veterinary practice: from theory to practice. <i>Vet. Clin. North Am. Small Anim</i>, 45. https://doi.org/10.1016/j.cvsm.2014.11.005</p>
Critically important antimicrobials	<p>A classification system described by the World Health Organization (WHO) and the World Organization for Animal Health (OIE) for medical and veterinary antimicrobials, respectively, that defines the two criteria used to classify antimicrobials by their level of importance.</p> <p>For veterinary antimicrobials, Criterion 1 is that the importance of the antimicrobial class is widely recognized, and; Criterion 2 is that the antimicrobial agents in this class are widely identified as essential for the treatment of serious animal disease and few alternatives are available.</p>	<p>World Health Organization (2018). Critically Important Antimicrobials for Human Medicine, 6th revision. https://apps.who.int/iris/bitstream/handle/10665/312266/9789241515528-eng.pdf</p> <p>World Organization for Animal Health. (2021). OIE list of antimicrobial agents of veterinary importance. OIE International Committee. Vol. 33, pp. 1–9 https://www.woah.org/app/uploads/2021/06/a-oie-list-antimicrobials-june2021.pdf</p>

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	<p>For human medical antimicrobials, Criterion 1 is that the antimicrobial agent is used as the sole therapy or one of few alternatives to treat serious human disease, and; Criterion 2 is that the antimicrobial agent is used to treat diseases caused by either a) bacteria that may be transmitted via non-human sources or b) bacteria that may acquire resistance genes from non-human sources.</p> <p>Both veterinary and human medical antimicrobial agents are thus classified based on whether they meet their respective criteria, i.e. they are classified as: 'critically important' if they meet Criteria 1 and 2, 'highly important' if they meet Criteria 1 or 2, and 'important' if they meet neither Criterion 1 nor 2.</p>	<p>Scott HM, et al. (2019). Critically important antibiotics: criteria and approaches for measuring and reducing their use in food animal agriculture. <i>Ann N Y Acad Sci.</i> 2019 Apr;1441(1):8-16. https://doi.org/10.1111%2Fnyas.14058 .</p>
Defined Daily Dose (DDD)	Assumed average maintenance dose per day for a drug used for its main indication in its target species.	World Health Organization (2022). Defined Daily Dose. https://www.who.int/tools/atc-ddd-toolkit/about-ddd
Disease prevention	Activities designed to protect patients (or other members of the public or animals) from actual or potential health threats and their harmful consequences.	Page, S.W., and Gautier, P. (2012). Use of antimicrobial agents in livestock. <i>Rev. Sci. Tech. Off. Int. Epiz.</i> 31(1). https://doi.org/10.20506/rst.31.1.2106
Dose optimization	The time course of drugs in the body with reference to their absorption, distribution, metabolism, and elimination.	Holmes, A.H., et al (2016). Understanding the mechanisms and drivers of antimicrobial resistance. <i>Lancet</i> , 387(10014). https://doi.org/10.1016/s0140-6736(15)00473-0

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		Page, S.W., and Gautier, P. (2012). Use of antimicrobial agents in livestock. <i>Rev. Sci. Tech. Off. Int. Epiz.</i> 31(1). https://doi.org/10.20506/rst.31.1.2106
Drivers of antimicrobial resistance (AMR)	Increased and continued transmission of antimicrobial resistance mechanisms to other microbes by standards of infection control, sanitation, access to clean water, access to assured quality antimicrobials and diagnostics, travel, and migration. Although emergence of antimicrobial resistance in microorganisms is a natural phenomenon, antimicrobial resistance selection can be expedited by antimicrobial exposure in healthcare, agriculture, and the environment.	Holmes, A.H., et al (2016). Understanding the mechanisms and drivers of antimicrobial resistance. <i>Lancet</i> , 387(10014). https://doi.org/10.1016/s0140-6736(15)00473-0
Efflux pump	A resistance mechanism that allows bacteria to pump out any antibiotics that penetrate them.	Holmes, A.H., et al (2016). Understanding the mechanisms and drivers of antimicrobial resistance. <i>Lancet</i> , 387(10014). https://doi.org/10.1016/s0140-6736(15)00473-0
Empirical diagnosis and/or treatment	A diagnosis or treatment on the basis of a clinical educated guess in the absence of complete or perfect information. Clinicians use their expertise, intuition and professional judgement to ‘guess’ whether an infection is present and what is likely to be causing it, and thus the most appropriate treatment.	O'Neill, J. (2015). Rapid Diagnostics: Stopping Unnecessary Use of Antibiotics. Review on antimicrobial resistance to the Government of the United Kingdom. HM Government, London. https://amr-review.org/sites/default/files/160518_Final%20paper_with%20cover.pdf

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Extended spectrum Beta-lactamase	A bacterial enzyme that inactivates some antibiotics, such as penicillin.	Holmes, A.H., et al (2016). Understanding the mechanisms and drivers of antimicrobial resistance. <i>Lancet</i> , 387(10014). https://doi.org/10.1016/s0140-6736(15)00473-0
Extra-label drug use (ELDU)	A process by which Canadian veterinarians are able to prescribe the use of a drug in a way other than the approved uses listed on the label, i.e. to treat a different species or use an alternate dose or route of administration. The veterinarian is responsible for the safety to the animal and end food product, and efficacy of the treatment. The veterinarian must also obtain informed consent from the animal's owner when prescribing ELDU and adhere to Health Canada regulations and guidelines on drugs prohibited for use in food producing animals or other situations. Commonly referred to as "Off-Label" drug use, e.g., "I am using this drug off-label to treat this goat".	Canadian Veterinary Medical Association. (2021) Extra-label drug use (ELDU) in Veterinary Medicine. https://wilmotveterinaryclinic.com/wp-content/uploads/2022/05/Extra-Label-Drug-Use-ELDU-in-Veterinary-Medicine--Canadian-Veterinary-Medical-Association.pdf
Feed additives	Antimicrobials added to animal feed for growth promotion or disease prevention purposes.	Page, S.W., and Gautier, P. (2012). Use of antimicrobial agents in livestock. <i>Rev. Sci. Tech. Off. Int. Epiz.</i> 31(1). https://doi.org/10.20506/rst.31.1.2106
First choice, restricted, and reserve drugs	First choice drugs are classified as antimicrobials that can be prescribed without restriction by any authority; Restricted drugs can be prescribed for a specific indication as defined by a policy or with expert consultation; Reserve drugs can be prescribed only after permission from expert consultation or national expert committee.	Guardabassi, L. and Prescott, J.F. (2015). Antimicrobial stewardship in small animal veterinary practice: from theory to practice. <i>Vet. Clin. Small North Am. Anim</i> , 45. https://doi.org/10.1016/j.cvsm.2014.11.005

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Gram stain	A laboratory staining technique used to distinguish between two groups of bacteria, Gram-positive and Gram-negative that differ in their cell wall structure	Holmes, A.H., et al (2016). Understanding the mechanisms and drivers of antimicrobial resistance. <i>Lancet</i> , 387(10014). https://doi.org/10.1016/s0140-6736(15)00473-0
Growth promotion	Administration of an antimicrobial, usually as a feed additive, over a period of time to growing animals that is thought to result in improved physiological performance (i.e. weight gain, feed conversion). Pattern characteristics: long duration of use, group administration in feed. Veterinary example: antibiotics in feed for cattle, pigs, and poultry. No human medical equivalent.	Page, S.W., and Gautier, P. (2012). Use of antimicrobial agents in livestock. <i>Rev. Sci. Tech. Off. Int. Epiz.</i> 31(1). https://doi.org/10.20506/rst.31.1.2106
Healthcare associated infection (HAI)	See 'nosocomial infection'	
Highly important antimicrobials	See 'critically important antimicrobials'	
Horizontal gene transfer	The process in which an organism (donor) transfers genetic material to another organism (recipient) by a mechanism other than descent, or without the recipient organism being the offspring of the donor organism. This process allows bacteria to exchange antibiotic resistance genes among a variety of species.	Maganha de Almeida Kumlien, A. C., Borrego, C. M., & Balcázar, J. L. (2021). Antimicrobial Resistance and Bacteriophages: An Overlooked Intersection in Water Disinfection. <i>Trends in Microbiology</i> , 29(6), 517–527. https://doi.org/10.1016/j.tim.2020.12.011 Sun, D., Jeannot, K., Xiao, Y., & Knapp, C. W. (2019). Editorial: Horizontal Gene Transfer Mediated Bacterial Antibiotic Resistance. <i>Frontiers in</i>

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Term	Definition	Source
		<i>Microbiology</i> , 10. https://www.frontiersin.org/articles/10.3389/fmicb.2019.01933
Hospital-acquired infection	See 'nosocomial infection'	
Husbandry	The art, science, and tradition that encompass responsible livestock production, which includes providing appropriate facilities that provide for animal comfort, adequate space, proper flooring, ventilation, heating, and access to clean water.	National Farmed Animal Health and Welfare Council, (NFAHWC)2016. Antimicrobial Stewardship in Food Animals in Canada. Page, S.W., and Gautier, P. (2012). Use of antimicrobial agents in livestock. <i>Rev. Sci. Tech. Off. Int. Epiz.31(1)</i> . https://doi.org/10.20506/rst.31.1.2106
Important antimicrobials	See 'critically important antimicrobials'	
Inappropriate antimicrobial use	When antimicrobials are used unnecessarily or for non-therapeutic reasons, such as over prescribing or as feed additives in agriculture.	Holmes, A.H., et al (2016). Understanding the mechanisms and drivers of antimicrobial resistance. <i>Lancet</i> , 387(10014). https://doi.org/10.1016/s0140-6736(15)00473-0 Page, S.W., and Gautier, P. (2012). Use of antimicrobial agents in livestock. <i>Rev. Sci. Tech. Off. Int. Epiz.31(1)</i> . https://doi.org/10.20506/rst.31.1.2106
Inappropriate disposal	When active antimicrobials are disposed of in such a way that they potentially contaminate the environment, i.e. share their resistance mechanisms with the 'normal' bacterial living in that environment.	Page, S.W., and Gautier, P. (2012). Use of antimicrobial agents in livestock. <i>Rev. Sci. Tech. Off. Int. Epiz.31(1)</i> . https://doi.org/10.20506/rst.31.1.2106

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	One example would be flushing antimicrobials down a toilet.	
Infection prevention and control interventions (IPCI)	Interventions intended to minimize the spread of pathogens (including those that are resistant), decrease the likelihood of infection in health-care settings, and reduce the overall need for antimicrobials. The WHO has proposed 4 core areas for health-care facilities, including hand hygiene, environmental cleaning, disinfection and sterilization, and education of staff.	<p>Årdal, C., et al (2016). International cooperation to improve access to and sustain effectiveness of antimicrobials. <i>Lancet</i>, 387(10015). https://doi.org/10.1016/s0140-6736(15)00470-5</p> <p>Dar, O.A, et al (2016). Exploring the evidence base for national and regional policy interventions to combat resistance. <i>Lancet</i>, 387 16;387(10015):285-95. https://doi.org/10.1016/s0140-6736(15)00520-6</p>
Innovation	Creating new solutions to counteract loss in antimicrobial effectiveness through research and development. For example, developing new and/or improved rapid diagnostic tests or alternatives to antimicrobials, such as probiotics or vaccinations.	Dar, O.A, et al (2016). Exploring the evidence base for national and regional policy interventions to combat resistance. <i>Lancet</i> , 387 16;387(10015):285-95. https://doi.org/10.1016/s0140-6736(15)00520-6
Intrinsic resistance	See 'natural resistance'	
Judicial use	See 'responsible use'	
Mechanisms of antimicrobial resistance	<p>The way that a microbe becomes resistant to an antimicrobial drug, e.g. acquisition of resistance genes.</p> <p>Three fundamental mechanisms of antimicrobial resistance are (1) enzymatic degradation of antibacterial drugs, (2) alteration of bacterial proteins that are antimicrobial targets, and (3) changes in membrane permeability to antibiotics. However, there</p>	<p>Holmes, A.H., et al (2016). Understanding the mechanisms and drivers of antimicrobial resistance. <i>Lancet</i>, 387(10014). https://doi.org/10.1016/s0140-6736(15)00473-0</p> <p>Page, S.W., and Gautier, P. (2012). Use of antimicrobial agents in livestock. <i>Rev. Sci. Tech. Off. Int. Epiz.</i>31(1). https://doi.org/10.20506/rst.31.1.2106</p>

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	are many mechanisms and the science is continually updated.	Dever, L.A., Dermody, T.S. (1991). Mechanisms of bacterial resistance to antibiotics. <i>Arch Intern Med.</i> 1991;151(5):886-895. doi:10.1001/archinte.1991.00400050040010
Medically important antimicrobials	Antimicrobials that are considered important to treat either human or animal disease. See also 'critically important antimicrobials'	Page, S.W., and Gautier, P. (2012). Use of antimicrobial agents in livestock. <i>Rev. Sci. Tech. Off. Int. Epiz.31(1)</i> . https://doi.org/10.20506/rst.31.1.2106
Medically important pathogens	Microbes that cause important clinical or economic disease in either animals or humans or both. See also 'priority microbes'.	Page, S.W., and Gautier, P. (2012). Use of antimicrobial agents in livestock. <i>Rev. Sci. Tech. Off. Int. Epiz.31(1)</i> . https://doi.org/10.20506/rst.31.1.2106
Metaphylaxis	Mass treatment of populations currently experiencing any level of disease before the onset of clinical illness. Pattern characteristics: short duration of use, group administration through injection, feed, or water. Veterinary example: control of bovine respiratory disease (BRD) in feedlot cattle through injection of animals with antimicrobials on arrival at the feedlot. Human medical example: risk management for those potentially exposed to a specific pathogen, e.g. <i>Streptococcus pneumonia</i> or highly pathogenic H5N1 avian influenza virus.	Page, S.W., and Gautier, P. (2012). Use of antimicrobial agents in livestock. <i>Rev. Sci. Tech. Off. Int. Epiz.31(1)</i> . https://doi.org/10.20506/rst.31.1.2106
Methicillin-resistant	A type of <i>Staphylococcus aureus</i> bacterium resistant to methicillin and other beta-lactam antibiotics. No	Turner NA, Sharma-Kuinkel BK, Maskarinec SA, Eichenberger EM, Shah PP, Carugati M, Holland TL, Fowler VG Jr. (2019) Methicillin-resistant

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<i>Staphylococcus aureus</i> (MRSA)	longer confined to hospitals, MRSA has caused infectious outbreaks in community groups.	<p>Staphylococcus aureus: an overview of basic and clinical research. <i>Nat Rev Microbiol.</i> 2019 Apr;17(4):203-218 https://doi.org/10.1038/s41579-018-0147-4</p> <p>World Health Organization. 2021. Antimicrobial resistance. https://www.who.int/news-room/fact-sheets/detail/antimicrobial-resistance</p>
Multi-drug resistant organism	A microbe that is resistant to the effect of more than one antimicrobial drug, i.e. multiple distinct drugs do not kill the microbe.	Holmes, A.H., et al (2016). Understanding the mechanisms and drivers of antimicrobial resistance. <i>Lancet</i> , 387(10014). https://doi.org/10.1016/s0140-6736(15)00473-0
Multiple-drug resistance	A phenomenon when one or more micro-organism is resistant to the effects of more than one antimicrobial drug (i.e. the drug no longer works to kill the microbe).	Holmes, A.H., et al (2016). Understanding the mechanisms and drivers of antimicrobial resistance. <i>Lancet</i> , 387(10014). https://doi.org/10.1016/s0140-6736(15)00473-0
Natural resistance	Innate ability of a bacterial species to resist activity of a particular antimicrobial agent through its inherent structural or functional characteristics, which allow tolerance of a particular antimicrobial drug or class.	Holmes, A.H., et al (2016). Understanding the mechanisms and drivers of antimicrobial resistance. <i>Lancet</i> , 387(10014). https://doi.org/10.1016/s0140-6736(15)00473-0
Non-therapeutic use of antimicrobials	When antimicrobials are used without providing a health benefit to those being treated, e.g. feeding antimicrobials to animals for growth-promotion purposes, a practice that is well-documented to be associated with the emergence of antimicrobial resistance in the animals treated.	<p>Holmes, A.H., et al (2016). Understanding the mechanisms and drivers of antimicrobial resistance. <i>Lancet</i>, 387(10014). https://doi.org/10.1016/s0140-6736(15)00473-0</p> <p>Page, S.W., and Gautier, P. (2012). Use of antimicrobial agents in livestock. <i>Rev. Sci. Tech. Off. Int. Epiz.</i>31(1).</p>

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		https://doi.org/10.20506/rst.31.1.2106
Nosocomial infection	An infection acquired in the hospital, excluding infections incubating at time of admission.	Public Health Agency of Canada. 2013 The Chief Public Health Officer's Report on the State of Public Health in Canada 2013 – Healthcare-associated infections – Due diligence. https://www.canada.ca/en/public-health/corporate/publications/chief-public-health-officer-reports-state-public-health-canada/chief-public-health-officer-report-on-state-public-health-canada-2013-infectious-disease-never-ending-threat/healthcare-associated-infections-due-diligence.html
Off-label drug use	See "Extra-label Drug Use"	
'One Health' approach	A method of determining policies that bridge human, animal, and environmental health, and accounts for factors relevant to each of these sectors.	Dar, O.A, et al (2016). Exploring the evidence base for national and regional policy interventions to combat resistance. <i>Lancet</i> , 387 16;387(10015):285-95. https://doi.org/10.1016/s0140-6736(15)00520-6
Optimal duration treatment	The ideal length of time for treatment with antimicrobials to prevent disease relapse and antimicrobial resistance, and also to ensure patient safety and cost-effectiveness.	Holmes, A.H., et al (2016). Understanding the mechanisms and drivers of antimicrobial resistance. <i>Lancet</i> , 387(10014). https://doi.org/10.1016/s0140-6736(15)00473-0
Own Use Importations (OUI)	A Canadian regulation on veterinary drugs for food-producing animals or animals intended to be consumed as food (including horses). A drug that is not authorized for sale in Canada can only be imported for personal use if it is on List B: List of Certain	Government of Canada. Personal Importation of certain drugs for food-producing animals. (2021). https://www.canada.ca/en/public-health/services/antibiotic-antimicrobial-

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Term	Definition	Source
	<u>Veterinary Drugs Which May Be Imported But Not Sold</u> . Health Canada considers that drugs on List B do not compromise public health or food safety.	<u>resistance/animals/personal-importation-certain-drugs-food-producing-animals.html</u> .
Priority microbes	Micro-organisms considered most important in the spread of antimicrobial resistance, including those important for clinical disease impact, spectrum of resistance, appearing in novel environments or geographical regions, and/or economic consequences. See also 'medically important pathogens'.	Page, S.W., and Gautier, P. (2012). Use of antimicrobial agents in livestock. <i>Rev. Sci. Tech. Off. Int. Epiz.31(1)</i> . <u>https://doi.org/10.20506/rst.31.1.2106</u>
Prophylaxis	Administration of an antimicrobial to exposed healthy animals considered to be at risk for developing a disease, but prior to the onset of the disease symptoms and for which no etiologic agent has yet been confirmed by culture or other detection methods. Pattern characteristics: intermediate duration of use, group administration of the antimicrobial through injection, feed, or water. Veterinary example: medicated milk replacer fed to calves to prevent diarrhea; human medical example: antimicrobials given through injection or by oral administration before surgical procedures (pre-operative prophylaxis).	Page, S.W., and Gautier, P. (2012). Use of antimicrobial agents in livestock. <i>Rev. Sci. Tech. Off. Int. Epiz.31(1)</i> . <u>https://doi.org/10.20506/rst.31.1.2106</u>
Prudent use	See 'responsible use'.	
Rapid diagnostic tools	A quick and easy-to-perform test for a specific microbe that formerly only laboratory tests could measure; they are intended to provide point of care and same day results to reduce unnecessary antimicrobial use.	Holmes, A.H., et al (2016). Understanding the mechanisms and drivers of antimicrobial resistance. <i>Lancet</i> , 387(10014). <u>https://doi.org/10.1016/s0140-6736(15)00473-0</u>

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Rational antimicrobial use	See 'responsible use'.	
Regulatory maximum discharge	A proposed limit to the amount of active pharmaceutical ingredient (API) that may be discharged from a facility, such as a hospital or farm operation.	O'Neill, J. (2016). Tackling Drug-Resistant Infections Globally: Final Report and Recommendations. Review on antimicrobial resistance to the Government of the United Kingdom. HM Government, London. https://amr-review.org/sites/default/files/160518_Final%20paper_with%20cover.pdf
Reservoir of antimicrobial resistance (reservoir hypothesis)	A potential concern about the use of antibiotics in animal husbandry is that as antibiotic resistant bacteria move from the farm into the human food supply, they may pass antibiotic resistance genes to the bacteria that normally reside in the human intestinal tract and from there, to bacteria that cause human disease.	Salyers, A. and Shoemaker, N.B. (2006). Reservoirs of antibiotic resistance genes. <i>Animal Biotechnology</i> , 17(2). 137-46 https://doi.org/10.1080/10495390600957076
Resistance prevalence	The number of cases of a disease caused by antimicrobial resistance that are present in a particular population at a given time.	Holmes, A.H., et al (2016). Understanding the mechanisms and drivers of antimicrobial resistance. <i>Lancet</i> , 387(10014). https://doi.org/10.1016/s0140-6736(15)00473-0
Resistant (microbe)	A microbe that is unaffected by an antimicrobial, i.e. that is able to withstand treatment with antimicrobials.	Holmes, A.H., et al (2016). Understanding the mechanisms and drivers of antimicrobial resistance. <i>Lancet</i> , 387(10014). https://doi.org/10.1016/s0140-6736(15)00473-0
Resistome	The reservoir of all types of antibiotic resistance genes (acquired or intrinsic), their precursors, and potential resistance mechanisms that directly or indirectly result in resistance.	Institute of Medicine (2011). Antibiotic Resistance: Implications for Global Health and Novel Intervention Strategies: Workshop Summary. E. R. Choffnes, D. A. Relman, & A. Mack (Eds.). <i>The National Academies</i>

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Term	Definition	Source
		<p><i>Press.</i> https://www.ncbi.nlm.nih.gov/books/NBK54255/</p> <p>Kim, D.-W., & Cha, C.-J. (2021). Antibiotic resistance from the One-Health perspective: Understanding and controlling antimicrobial resistance transmission. <i>Experimental & Molecular Medicine</i>, 53(3), 301–309. https://doi.org/10.1038/s12276-021-00569-z</p>
Responsible use (sometimes called “prudent use”)	This term implies that activities and capabilities of human and animal health systems are aligned to ensure that patients receive the right treatment at the right time, use these drugs appropriately, and benefit from them.	Dar, O.A, et al (2016). Exploring the evidence base for national and regional policy interventions to combat resistance. <i>Lancet</i> , 387 387(10015):285-95 https://doi.org/10.1016/s0140-6736(15)00520-6
Reversibility of resistance	The observed fitness cost of resistance genes and/or mutations to a resistant microbe is a prerequisite for the reversal of antibiotic resistance by reduced antibiotic use.	Holmes, A.H., et al (2016). Understanding the mechanisms and drivers of antimicrobial resistance. <i>Lancet</i> , 387(10014). https://doi.org/10.1016/s0140-6736(15)00473-0
Ribosomal protection	A resistance mechanism that allows bacteria to interfere with an antibiotic's ability to prevent the bacteria to make proteins necessary for their survival.	Holmes, A.H., et al (2016). Understanding the mechanisms and drivers of antimicrobial resistance. <i>Lancet</i> , 387(10014). https://doi.org/10.1016/s0140-6736(15)00473-0
Selective pressure	A driving force of evolution and natural selection, selective pressure is any phenomena which alters the reproductive behavior and fitness of living organisms within their environment. Antimicrobial- use creates a strong selective pressure as microbes that are able to survive despite antimicrobial treatment can proliferate	Institute of Medicine (2011). Antibiotic Resistance: Implications for Global Health and Novel Intervention Strategies: Workshop Summary. E. R. Choffnes, D. A. Relman, & A. Mack (Eds.). <i>The National Academies Press.</i> https://www.ncbi.nlm.nih.gov/books/NBK54255/

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	and extend their reproductive advantage within the microbial community. Also see ‘Squeezing the balloon’.	Michael, C. A., Dominey-Howes, D., & Labbate, M. (2014). The Antimicrobial Resistance Crisis: Causes, Consequences, and Management. <i>Frontiers in Public Health</i> , 2. https://www.frontiersin.org/articles/10.3389/fpubh.2014.00145
Selective toxicity	A drug's ability to target pathogens such as bacteria or viruses without damaging the host organism.	Holmes, A.H., et al (2016). Understanding the mechanisms and drivers of antimicrobial resistance. <i>Lancet</i> , 387(10014). https://doi.org/10.1016/s0140-6736(15)00473-0
Societal drugs	Drugs whose use and misuse have societal consequences well beyond the individual who is taking them. (E.g. Antimicrobials are considered societal drugs because once they become ineffective, they are ineffective for everyone, not just the person taking them.	Levy, S.B. (1998). The challenge of antibiotic resistance. <i>Scientific American</i> , March. 1998 Mar;278(3):46-53. https://doi.org/10.1038/scientificamerican0398-46 Levy, S.B. (2002). Factors impacting on the problem of antibiotic resistance. <i>Journal of Antimicrobial Chemotherapy</i> , 49. olume 49, Issue 1, January 2002, Pages 25–30, https://doi.org/10.1093/jac/49.1.25
Spectrum of activity	The range of an antimicrobial's effectiveness, i.e. able to kill multiple types of microbes or specialized to target one type of organism. See ‘broad-spectrum antibiotic’	Holmes, A.H., et al (2016). Understanding the mechanisms and drivers of antimicrobial resistance. <i>Lancet</i> , 387(10014). https://doi.org/10.1016/s0140-6736(15)00473-0
Squeezing the balloon	An analogy used when describing how selection pressure would simply shift to a new antimicrobial without addressing issues of inappropriate use. The	Bell, D.M., (2001). Promoting appropriate antimicrobial drug use: perspectives from the centers

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Term	Definition	Source
	uncertainty of whether reducing the rates of resistance to drug X, if accomplished by a switch to the use of drug Y, would result in increased rates of resistance in drug Y.	for disease control and prevention. <i>Clinical Infectious Disease</i> , 33(3). https://doi.org/10.1086/321857 Peterson, L.R.,(2005). Squeezing the antibiotic balloon: the impact of antimicrobial classes on emerging resistance. <i>Clin. Micro.Infect.</i> 11(Supp 5):4-16. https://doi.org/10.1111/j.1469-0691.2005.01238.x
Static activity	An antibiotic's ability to disarm bacteria without killing the bacteria.	Holmes, A.H., et al (2016). Understanding the mechanisms and drivers of antimicrobial resistance. <i>Lancet</i> , 387(10014). https://doi.org/10.1016/s0140-6736(15)00473-0
Stewardship	Conserving the effectiveness of existing treatments through infection prevention and control guidelines, education and awareness, regulations, and oversight. The multi-faceted and dynamic approaches required to sustain the clinical efficacy of antimicrobials by optimizing drug use, choice, dosing, duration, and route of administration while minimizing the emergence of resistance and other adverse effects.	Public Health Agency of Canada. (2017). Tackling Antimicrobial Resistance and Antimicrobial Use: A Pan-Canadian Framework for Action https://www.canada.ca/en/health-canada/services/publications/drugs-health-products/tackling-antimicrobial-resistance-use-pan-canadian-framework-action.html
Sub-therapeutic	Involving or relating to drug dosages administered at too low a level to produce a therapeutic effect, i.e. below the level necessary to treat disease, but the presence of the antimicrobial even at low levels can promote resistance in the microbe population being treated; antimicrobials administered at a level not powerful enough to have a therapeutic effect.	Holmes, A.H., et al (2016). Understanding the mechanisms and drivers of antimicrobial resistance. <i>Lancet</i> , 387(10014). https://doi.org/10.1016/s0140-6736(15)00473-0 Page, S.W., and Gautier, P. (2012). Use of antimicrobial agents in livestock. <i>Rev. Sci. Tech. Off. Int. Epiz.</i> 31(1). https://doi.org/10.20506/rst.31.1.2106

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Term	Definition	Source
Superbugs	Bacteria with resistance to several commonly used antibiotics.	World Health Organization (2021). Antimicrobial resistance. https://www.who.int/news-room/fact-sheets/detail/antimicrobial-resistance
Surveillance	Detecting and monitoring trends and threats in order to inform strategies to reduce the risks and impacts of antimicrobial resistance (AMR).	Public Health Agency of Canada. (2017). Tackling Antimicrobial Resistance and Antimicrobial Use: A Pan-Canadian Framework for Action https://www.canada.ca/en/health-canada/services/publications/drugs-health-products/tackling-antimicrobial-resistance-use-pan-canadian-framework-action.html
Susceptible (microbes)	Microbes that are vulnerable to the therapeutic effect of antimicrobials, i.e. they are destroyed by antimicrobials.	Holmes, A.H., et al (2016). Understanding the mechanisms and drivers of antimicrobial resistance. <i>Lancet</i> , 387(10014). https://doi.org/10.1016/s0140-6736(15)00473-0
Therapeutic	Antimicrobials administered at a level capable of treating disease.	Page, S.W., and Gautier, P. (2012). Use of antimicrobial agents in livestock. <i>Rev. Sci. Tech. Off. Int. Epiz.</i> 31(1). https://doi.org/10.20506/rst.31.1.2106
Treatment	Administration of an antimicrobial to an animal or person that exhibits frank clinical disease. Pattern characteristics: short duration of use and targeted administration to an individual by injection or orally. Veterinary example: antibiotic injection to treat a cow	Holmes, A.H., et al (2016). Understanding the mechanisms and drivers of antimicrobial resistance. <i>Lancet</i> , 387(10014). https://doi.org/10.1016/s0140-6736(15)00473-0

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Term	Definition	Source
	with foot rot. Human medical example: oral antibiotics to treat a urinary tract infection.	Page, S.W., and Gautier, P. (2012). Use of antimicrobial agents in livestock. <i>Rev. Sci. Tech. Off. Int. Epiz.31(1)</i> . https://doi.org/10.20506/rst.31.1.2106
Un-metabolized antibiotics	Antibiotics that are excreted in an active form from animals/humans that enter the environment, including water and sewage systems.	O'Neill, J. (2016). Tackling Drug-Resistant Infections Globally: Final Report and Recommendations. Review on antimicrobial resistance to the Government of the United Kingdom. HM Government, London. https://amr-review.org/sites/default/files/160518_Final%20paper_with%20cover.pdf
Unnecessary use	See 'inappropriate use'	
Vancomycin-resistant Enterococcus (VRE)	Gram-positive bacteria from the genus <i>Enterococcus</i> spp. that have developed resistance to the antibiotic vancomycin. Commonly commensal organisms inhabiting the gastrointestinal tract of healthy humans and animals, <i>Enterococcus</i> spp. can cause a variety of infections and can be particularly dangerous to immunocompromised individuals. While VRE have been found in both community and hospital settings, they are typically acquired in health care or hospital environments.	Institute of Medicine (2011). Antibiotic Resistance: Implications for Global Health and Novel Intervention Strategies: Workshop Summary. E. R. Choffnes, D. A. Relman, & A. Mack, (Eds.). <i>The National Academies Press</i> . https://www.ncbi.nlm.nih.gov/books/NBK54255/ O'Driscoll, T., & Crank, C. W. (2015). Vancomycin-resistant enterococcal infections: epidemiology, clinical manifestations, and optimal management. <i>Infection and drug resistance</i> , 8, 217–230. https://doi.org/10.2147/IDR.S54125

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Term	Definition	Source
<p>Veterinary Client Patient Relationship (VCPR)</p>	<p>A pre-requisite to establish medical need and consequently to prescribe or dispense antimicrobials, a VCPR is an on-going working relationship (not a contractual agreement) between the veterinarian, client, and specific animal patient(s) established on trust. The exact definition is defined by provincial legislation, however Canadian Veterinary Medical Association Antimicrobial Prudent Use Guidelines (2008) considers the following conditions consistent with provincial legislation:</p> <ol style="list-style-type: none"> 1. The veterinarian has assumed the responsibility for making clinical judgments regarding the health of the animal(s) and the need for medical treatment, and the client has agreed to follow the veterinarian's instructions. 2. The veterinarian has sufficient knowledge of the animal(s) to initiate at least a general or preliminary diagnosis of the medical condition of the animal(s). This means that the veterinarian has recently seen and is personally acquainted with the keeping and care of the animal(s) by virtue of an examination of the animal(s) or by medically appropriate and timely visits to the premises where the animal(s) are kept. 3. The veterinarian is readily available for follow-up evaluation, or has arranged for emergency coverage, in the event of adverse reactions or failure of the treatment regimen. 	<p>Farmed Animal Antimicrobial Stewardship Initiative. (2022) Veterinarian-Client-Patient Relationship (VCPR) in Ontario. https://www.amstewardship.ca/factsheet/veterinarians/veterinarian-client-patient-relationship-vcpr-in-ontario/</p> <p>College of Veterinarians of British Columbia. 2018 Professional Practice Standard: the Veterinarian-Client-Patient Relationship (VCPR). https://www.cvbc.ca/wp-content/uploads/2020/03/Standard.pdf</p>
<p>Veterinary critically important antimicrobials</p>	<p>See 'critically important antimicrobials'</p>	

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Term	Definition	Source
Veterinary Drugs Directive	Located in Ottawa, the Veterinary Drugs Directorate (VDD) is part of the Health Products and Food Branch of Health Canada. To protect human and animal health and the safety of Canada's food supply, the Veterinary Drugs Directorate (VDD) evaluates and monitors the safety, quality and effectiveness, sets standards, and promotes the prudent use of veterinary drugs administered to food-producing and companion animals.	http://www.hc-sc.gc.ca/ahc-asc/branch-dirgen/hpfb-dgpsa/vdd-dmv/index-eng.php
Veterinary Feed Directive	<p>In the US, a written statement that authorizes the owner or caretaker of animals to obtain and use animal feed containing VFD (veterinary feed directive)-specific drugs to treat their animals in accordance with FDA-approved directions for use.</p> <p>A VFD drug is intended for use in animal feeds, and such use of the VFD drug is permitted only under the professional supervision of a licensed veterinarian.</p>	<p>Lewis, C.A. (2016). Veterinary Drugs, Antimicrobial Resistance and Food Safety: FDA CVM's Antimicrobial Resistance Policy.</p> <p>http://www.fda.gov/AnimalVeterinary/DevelopmentApprovalProcess/ucm071807.htm</p>
Veterinary highly important antimicrobials	See 'critically important antimicrobials'	
Veterinary oversight	The professional involvement of licensed veterinarians in providing guidance or direction for appropriate use of antimicrobials in animals with the objective of ensuring prudent use and minimizing the emergence or spread of antimicrobial resistance	<p>Canadian Veterinary Medical Association (2017). . . Veterinary Oversight of Antimicrobial Use – a Pan-Canadian Framework of Professional standards for Veterinarians.</p> <p>https://www.canadianveterinarians.net/veterinary-resources/antimicrobial-stewardship-resources/cvma-guidelines-for-veterinary-antimicrobial-use/</p>

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Withdrawal times	The specific period of time from when the last antimicrobial was administered to an animal until the time that it may enter the human food chain. The specific time varies with antimicrobial drug administered, route of administration, and animal species treated.	Page, S.W., and Gautier, P. (2012). Use of antimicrobial agents in livestock. <i>Rev. Sci. Tech. Off. Int. Epiz.</i> 31(1). https://doi.org/10.20506/rst.31.1.2106