



## The use of antimicrobials in global pig production: A systematic review of methods for quantification



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### ABSTRACT

**Background:** Overuse of antimicrobials in both humans and animals is recognized as one of the main drivers of Antimicrobial Resistance (AMR); and the optimisation of their use has been advocated as a key strategy for dealing with AMR. The measurement of antimicrobial use is vital for the design, monitoring and evaluation of such strategies. This systematic review describes and compares methods and measurements used to quantify antimicrobial use in pigs in order to inform efforts to standardize measurement.

**Methods:** The peer-reviewed literature was systematically searched using four online databases: MEDLINE, ScienceDirect, Scopus and Web of Science. Eligibility criteria for inclusion in the review included: articles published in English, involving pigs of any age and types of production, providing quantitative data on antimicrobial use, containing a clear description of the methodology, and having moderate to high rank in the quality assessment.

**Results:** Of 2,362 abstracts reviewed, a total of 25 studies were included based on the eligibility criteria. All studies were published between 2001 and 2017. Twenty of the studies were conducted in eight European countries. Twelve studies estimated antimicrobial use and eight studies were primarily methodological papers comparing different methods or variables, or developing new methods. The two main sources of antimicrobial use data were farm surveys and national sales data.

A large variety of units of measurement was found. In this review, the ten measurements identified were categorized into four groups: 1) antimicrobials use measured by milligrams of active substance per animal weight; 2) antimicrobials use measured by daily dose per weight at treatment; 3) antimicrobial use measured by daily dose per treatment period; and 4) antimicrobials use measured by daily dose per period at risk of treatment.

**Conclusion:** There is no global standardized measurement of antimicrobial use in pigs. Given the importance of monitoring the use antimicrobials, we recommend that at a minimum, all countries should develop macro-level monitoring using national sales data and report use by milligram of active ingredients per Population Correcting Unit. Monitoring in specific animal species requires the development of systems to capture prescription at national or farm level. Findings from monitoring antimicrobial use may help to guide effective interventions for optimising use of antimicrobials, as recommended by the WHO Global Action Plan on AMR.

### 1. Background

Antimicrobial Resistance (AMR) is an increasingly serious threat to global public health. Overuse of antimicrobials can accelerate the

emergence of antimicrobial resistance (World Health Organization, 2015b). In livestock industries, large amounts of antimicrobials are used for both therapeutic and non-therapeutic purposes including growth promotion (Aarestrup, 2005). In response to global concerns

**Abbreviations:** ADD, animal daily dose; ADDD, animal defined daily dose; AMR, antimicrobial resistance; CASP, critical appraisal skills programme; DADD, defined animal daily dosage; DDD, defined daily dose; DDDA, daily doses animal; DDDvet, defined daily dose; DCDvet, defined course dose; DPD, daily product dose; EMA, european medicines agency; ESVAC, european surveillance of veterinary antimicrobial consumption; FAO, food and agriculture organization; nDDay, daily dose per animal year; OIE, organization for animal health; PCU, population correction unit; PDD, prescribed daily dose; PrDD, product-related daily doses; TI, treatment incidence; UDD, used daily dose; WHO, world health organisation

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<https://doi.org/10.1016/j.prevetmed.2018.09.016>

Received 17 March 2018; Received in revised form 27 August 2018; Accepted 16 September 2018

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