



AMU denominator: the OIE Animal Biomass

Methodology presentation

Presented by **Dr Morgan Jeannin**

OIE Sub-Regional Workshop on the database on antimicrobial agents
intended for use in animals in **Eastern and Southern Africa**

Mombasa, Kenya, 29-31 Oct. 2019

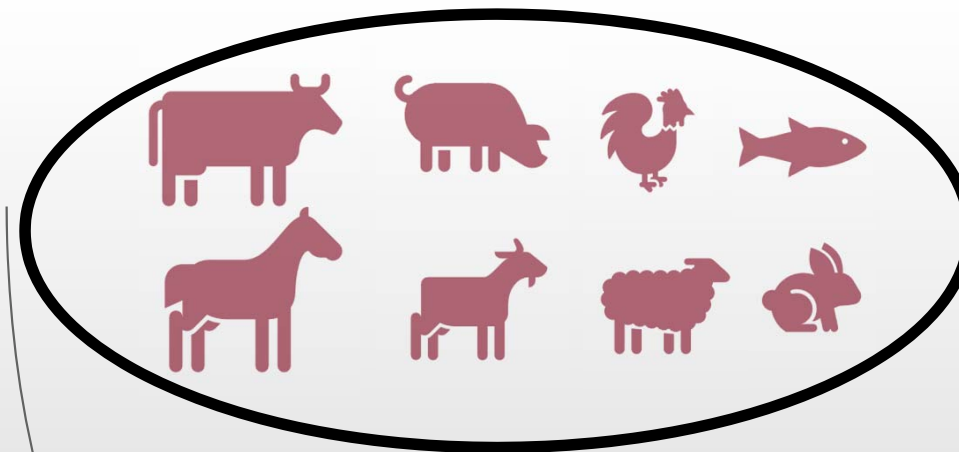
Antimicrobial agents (mg)



=



Animal biomass (kg)



As reported by the country to the OIE data collection for the target year

Total weight of food-producing animals in the target year



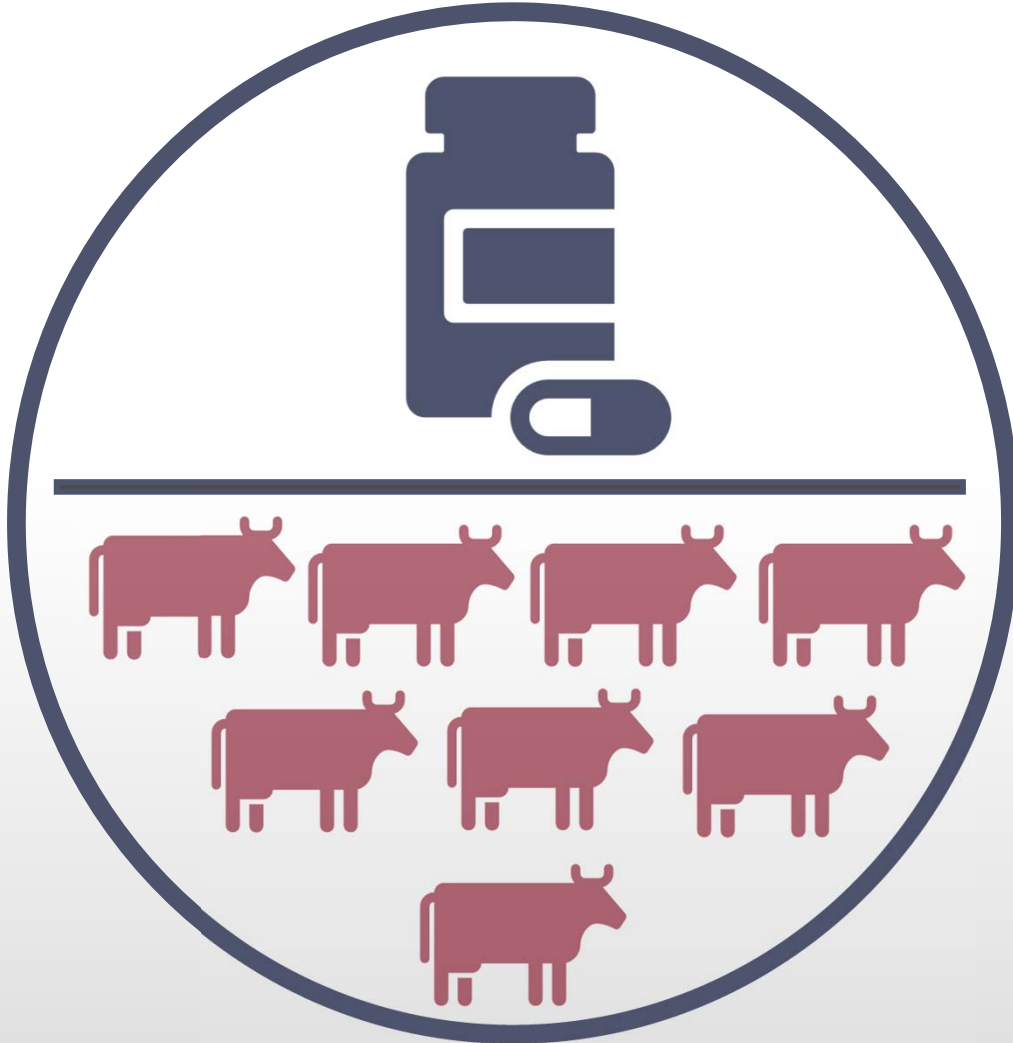
Calculated Animal Biomass of a country for the target year

Animal Biomass (denominator) what for?



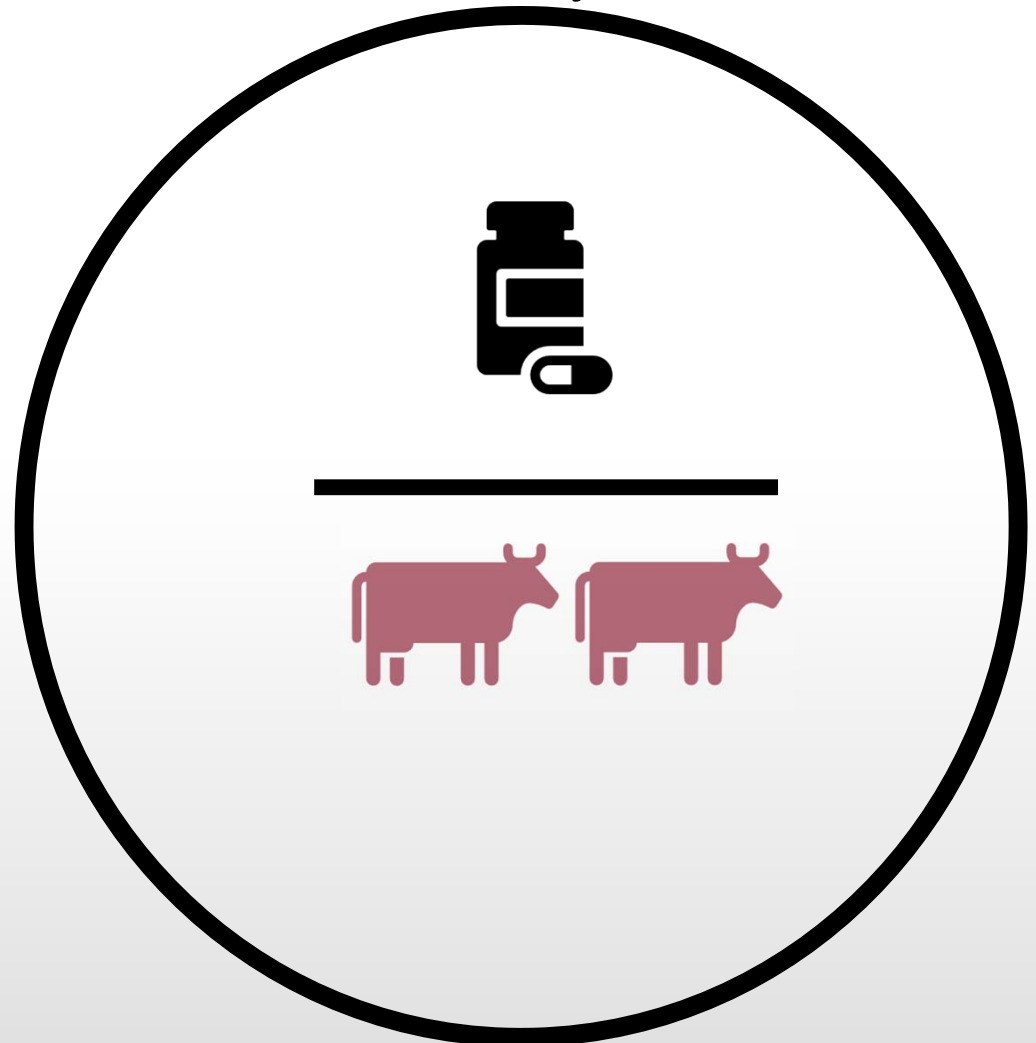
- As acknowledged by the OIE *ad hoc* Group on AMR each country will have variability of their animals' population numbers, cycle factors and average weights.
- *Terrestrial Animal Health Code Chapter 6.9 & Aquatic Animal Health Code Chapter 6.3 – « When comparing AMU data over time, changes in **size** and **composition** of **animal populations** should also be taken into account. »*
- Adjusting the quantity of AM by the biomass improves the possibilities of,
 - **following AMU over time**, taking into account the changes in animal population
 - **Comparing AMU between different regions**, with different species of food-producing animals and different farming systems.

Country A



$\frac{\text{mg}}{\text{kg}}$

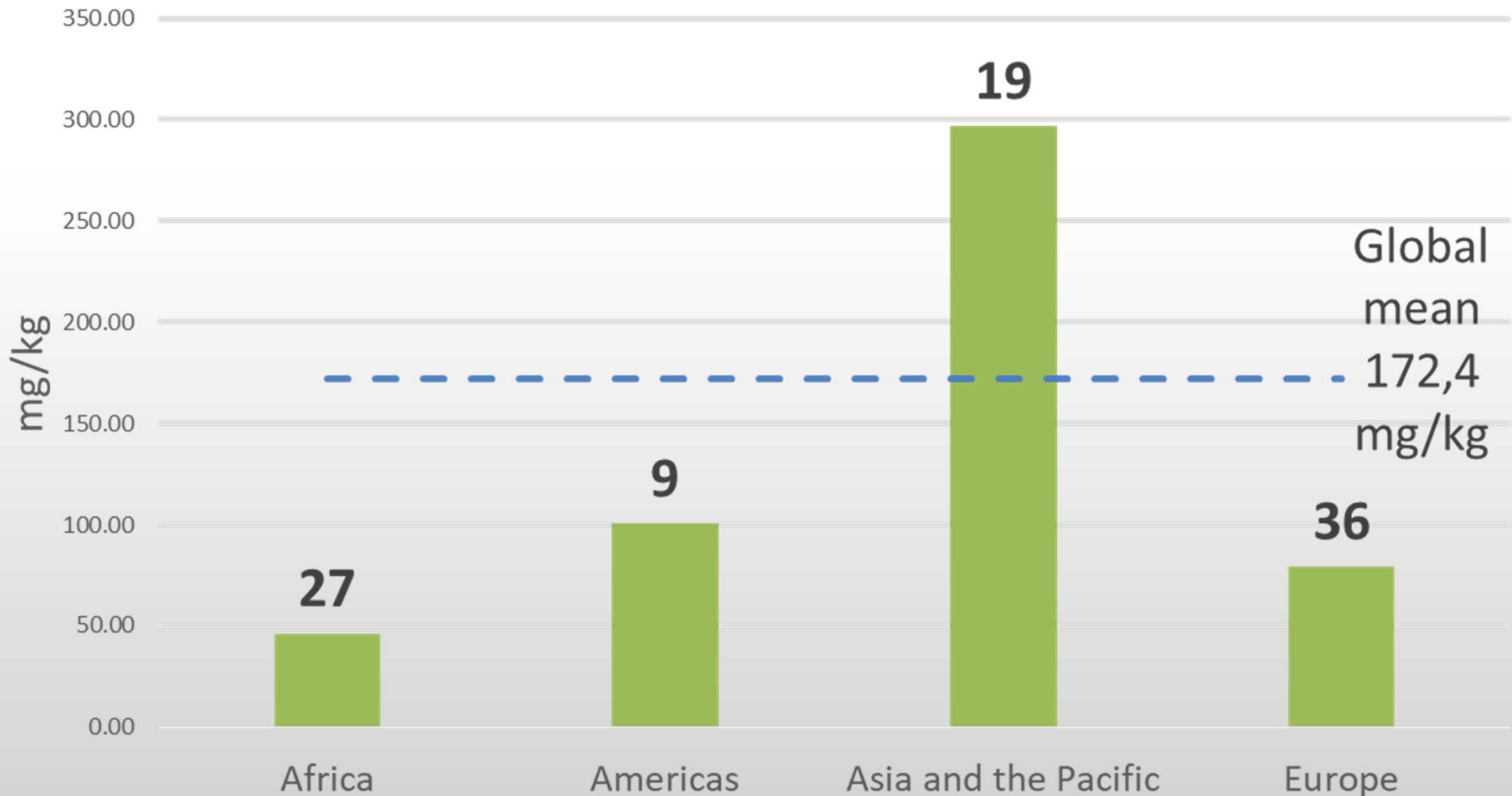
Country B



$\frac{\text{mg}}{\text{kg}}$

<<

Approach taken by OIE to determine the Antimicrobial agents (mg) for 2015? Animal biomass (kg)



Why use a 'biomass' denominator ?

- Antimicrobial use data vary from one country to another and from one year to another.
- Possible variations of AMU data include:
 - **Change in the animal population** (increase, decrease, import, export)
 - Occurrence of diseases in the year
 - Availability
 - Effect of national management measures
 - ...
- Animal Biomass = Calculated animal population of a country in a year
 - *proxy* to measure the **population exposed** to AM during the **year** of data collection

Which data are available?



Data needed

The **number of animal** present in the country for each **age category** of each **species** and their **mean body weight**.

Data available globally

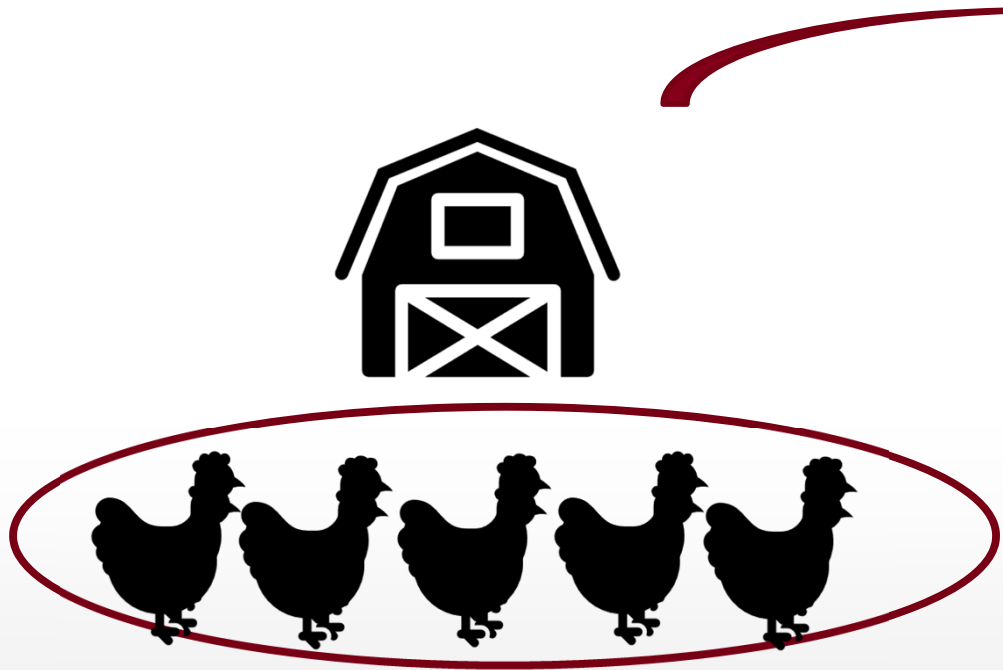
- **WAHIS** census data → number of live animals per species at one *time* of the year (+/- age categories)
- **FAOSTAT** → Production data: Number of animals slaughtered, for each species, in a whole year + mass of animal slaughtered
- Published reviews, countries' annual reports...

Participation from the Countries



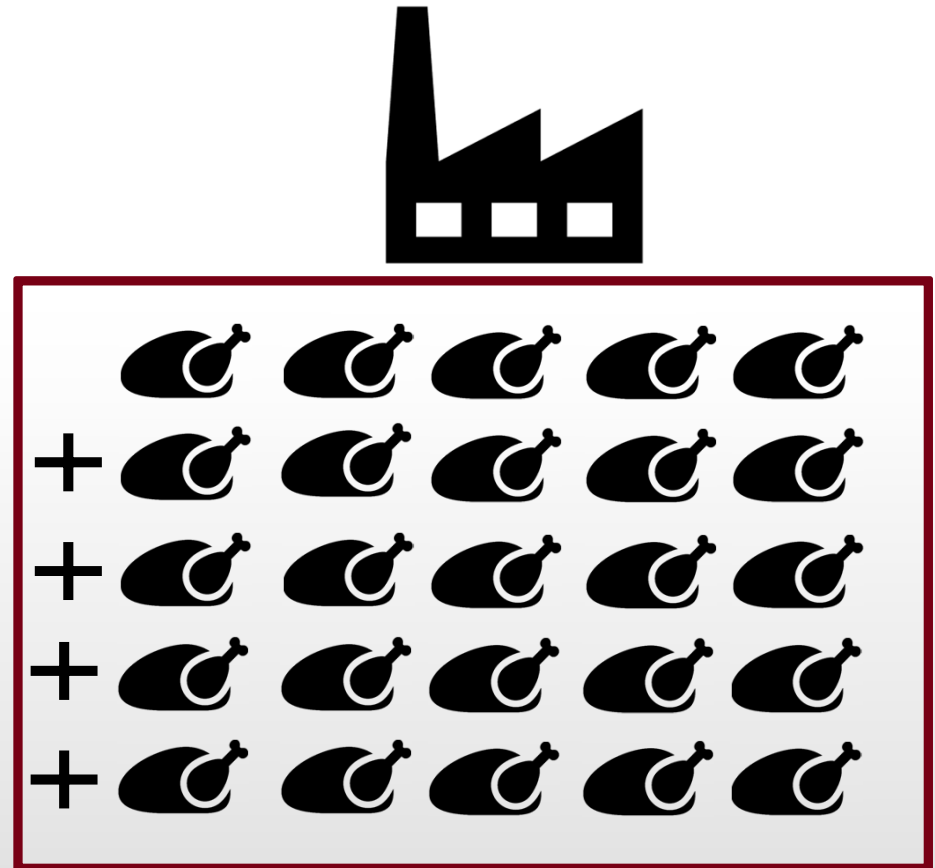
We need help from Member Countries with validation of average species weights and cycle factors

Census or Production data?



Census data

= Head-count at one time in the year



Production data

= Head-count & total weight of slaughtered animals for a WHOLE year

How is the biomass calculated?

General principles

- Animals with a life duration of less than one year → Use yearly **production data**
- Animals with a life duration of more than one year → Use **census data**, combined with estimates of average weights by sub-region/country.
- **Privilege census data** when possible → Production data might not reflect backyard slaughter practices

General Methodology

- Animal biomass is calculated using country-level animal population data by species, data-derived estimates of their average weights by sub-region and country, and average reproductive rates of short-lived species (cycle factors).
 - **kilograms animal biomass** used as a *denominator* in analysis of antimicrobial use data (mg/kg)

Calculation of average animal weights

- **From production data → carcass weight**

$$\text{carcass weight (kg)} = \frac{\text{weight of species slaughtered (kg)}}{\text{number of species slaughtered (heads)}}$$

- **From carcass weight → live weight at time of slaughter**

$$\text{live weight at slaughter (kg)} = \frac{\text{carcass weight (kg)}}{\text{conversion coefficient (k)}}$$

- Different AMU surveillance programs → Different weight calculation methodologies
 - Canada, ESVAC, Thailand: weight at time of treatment
 - USA, Japan: average weight by production category

Animal biomass methodology: Poultry

Poultry	FAOSTAT 2016																BIOMASS
Country	Slaughtered Head	Slaughtered Tonnes	carcass Kg	Weight live	Slaughtered Head	Slaughtered Tonnes	carcass Kg	Weight live	Slaughtered Head	Slaughtered Tonnes	carcass Kg	Weight live	Slaughtered Head	Slaughtered Tonnes	carcass Kg	Weight live	Calculation with species specific weights
	CHICKEN	CHICKEN	CHICKEN	CHICKEN	TURKEY	TURKEY	TURKEY	TURKEY	GEESE + GUINEA FOWL	GEESE + GUINEA FOWL	GEESE + GUINEA FOWL	GEESE + GUINEA FOWL	DUCK	DUCK	DUCK	DUCK	kg
Country 1	88 200 000	125 500	1,42	2,03	1 900 000	20 700	10,89	15,56	106 000	350	3,30	4,72	49 000	120	2,45	3,50	209 528 571
Country 2	114 406 000	151 693	1,33	1,89	143 000	1 420	9,93	14,19	97 000	460	4,74	6,77	3 657 000	7 183	1,96	2,81	229 651 429
Country 3	435 539 000	536 210	1,23	1,76	13 787 000	99 149	7,19	10,27	997 000	3 301	3,31	4,73	1 706 000	2 218	1,30	1,86	915 540 000

Biomass Poultry

= Biomass Chicken + Biomass Turkey + Biomass Geese + Biomass Duck

Poultry		FAOSTAT 2016		
Country	Slaughtered Head	Slaughtered Tonnes	carcass Kg	Weight live
	CHICKEN	CHICKEN	CHICKEN	CHICKEN
Country 1	88,200,000	125,500	1.42	2.03
Country 2	114,406,000	151,693	1.33	1.89
Country 3	435,539,000	536,210	1.23	1.76

1000 x Tonnes / Heads Carcass weight / 0,7

Biomass Chicken = Number Slaughtered Chickens * Mean live weight at slaughter for chickens

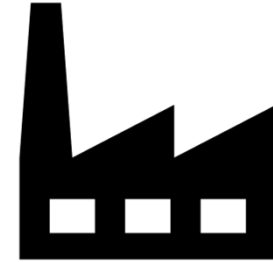
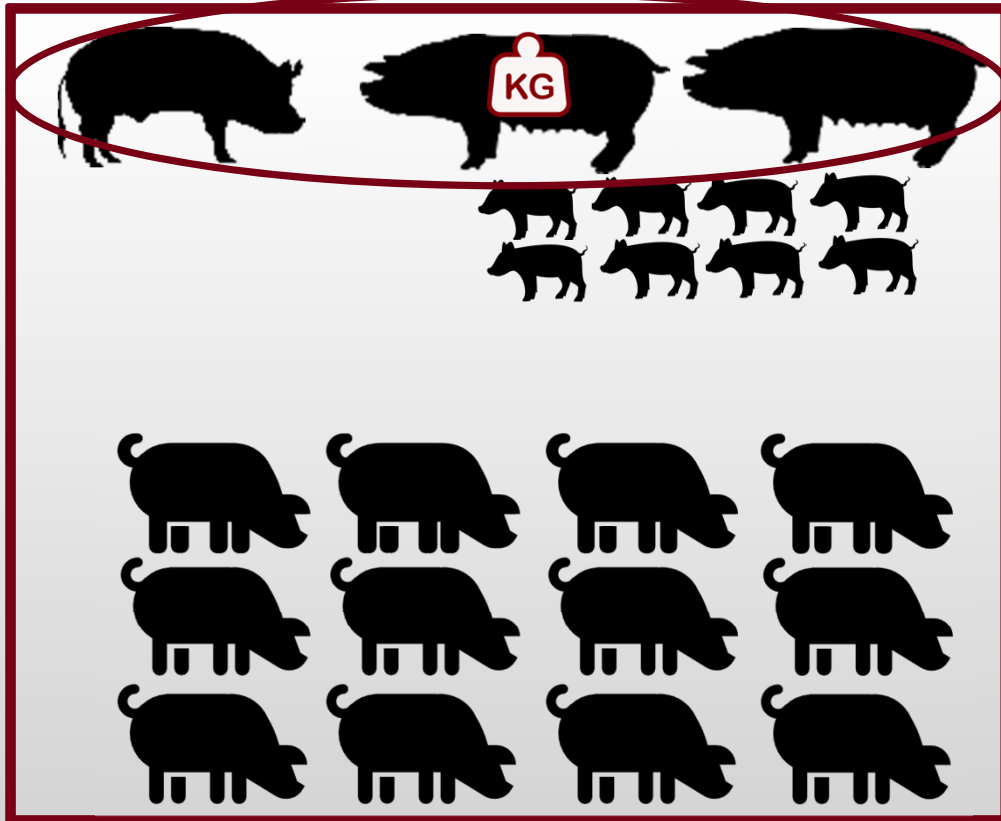
Swine biomass calculation

Using FIXED
Population ratios

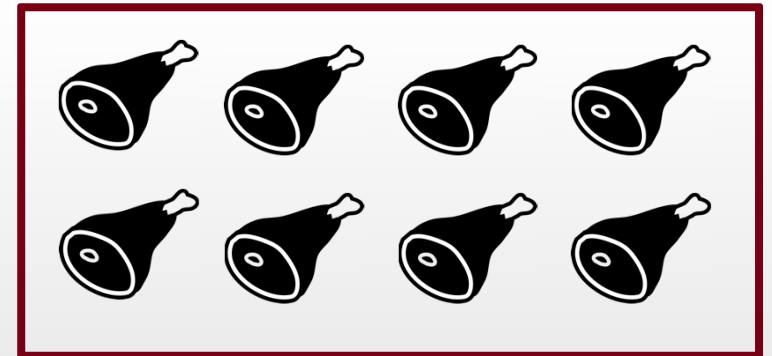


Using a standard
Adult Live Weight

Census data



Production data



Animal biomass methodology: Swine

1000 x Tonnes
Heads

Carcass weight
0,78

Swine		WAHIS Census data	FAOSTAT Slaughter data 2016				BIOMASS Swine 2016	
Country	OIE Subregion	Live heads 2016	Slaughtered Head	Slaughtered tonnes	Mean weight carcass kg (calculated)	Mean Weight live animal at slaughter (calculated)	Slaughtered Biomass	Slaughtered Biomass + Sow correction factor (WAHIS census data)
		Swine	pig meat 2016	pig meat 2016	kg	kg	FAOstat production data	FAOstat production corrected by census data
					Tonnes/Heads	Mean weight*0,78 (conversion factor)	Mean weight live * # heads slaughtered	Biomass slaughtered + (Census * Sow pop. Proportion (9%) * Mean Sow weight)
Country 1	A	2 950 713	5 227 573	514 892	98	126	660 117 949	723 853 350
Country 2	A	5 217	9 100	472	52	66	605 128	717 815
Country 3	A	1 367 423	1 458 334	98 018	67	86	125 664 103	155 200 439

Biomass Swine = Biomass Slaughtered Swine + Biomass of Living Sows for reproduction

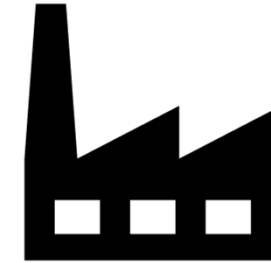
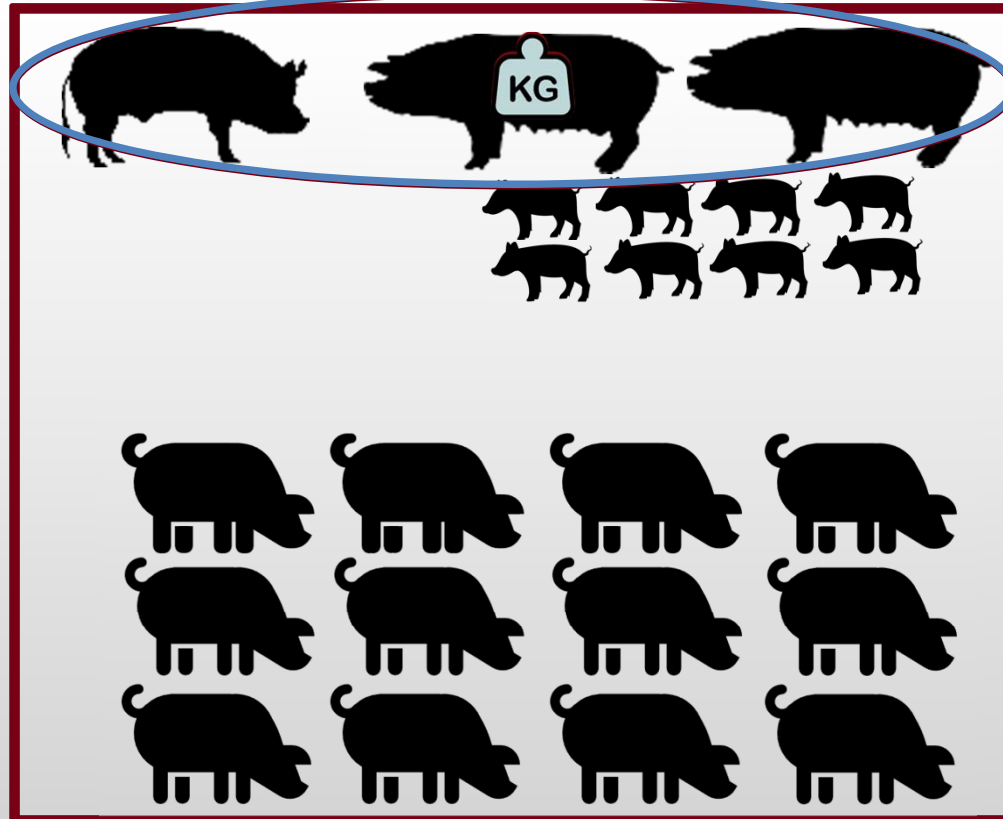
Fixed variables

$$\text{Biomass Swine} = (\#Hs * Wl) + [\#Hl * \text{Sow P. pop (9\%)} * \text{Region Mean Sow weight}]$$

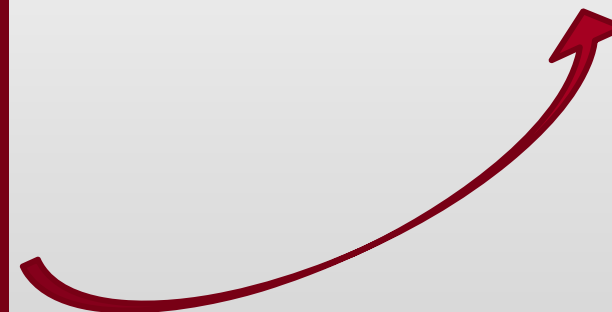
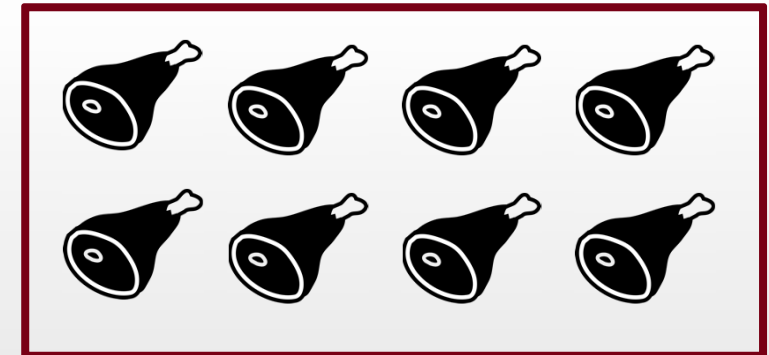
Swine calculation refinement



Census data

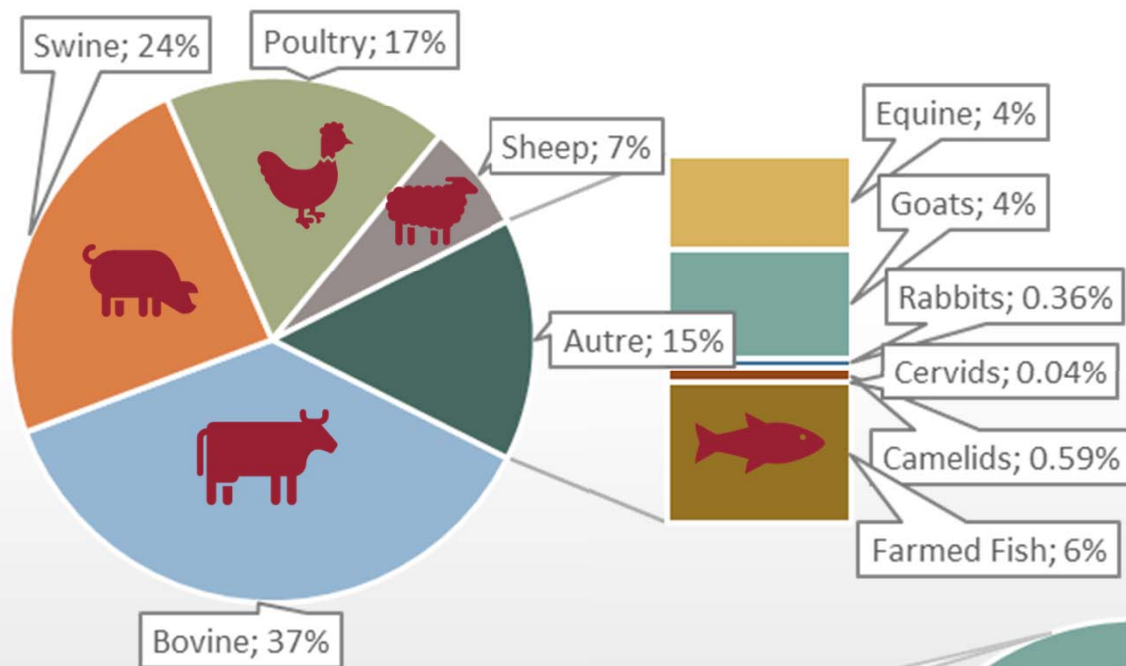


Production data

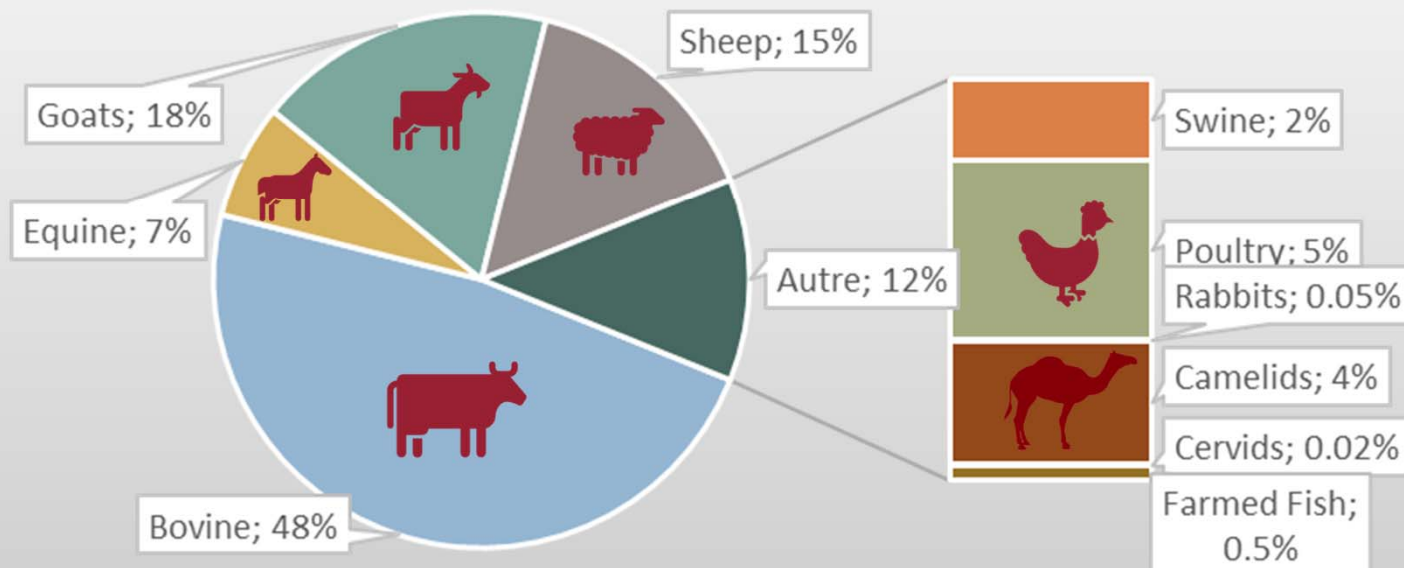


Species Composition in weight of Animal Biomass for Countries Reporting Quantitative Data for 2015

Global (91 Countries)



Africa (27 countries)



Refinement of Animal Biomass Calculation



- To refine the calculations of the Animal Biomass: considering region/country particularities
- Continued collaboration of the countries to research and verify :
 - Average animal weights
 - Carcass conversion coefficients
 - Distribution of age groups in a species
 - Cycle factors
- Evolution of **OIE-WAHIS** system: Importance of countries' commitment in reporting animal populations
 - Animal categories + sub-categories by age groups
 - Increased country-level understanding: Cycle factors, Mean live weight at slaughter...



— TO HANDLE —
ANTIMICROBIALS
— WITH CARE —

OIE Methodology- publication on 25th September 2019

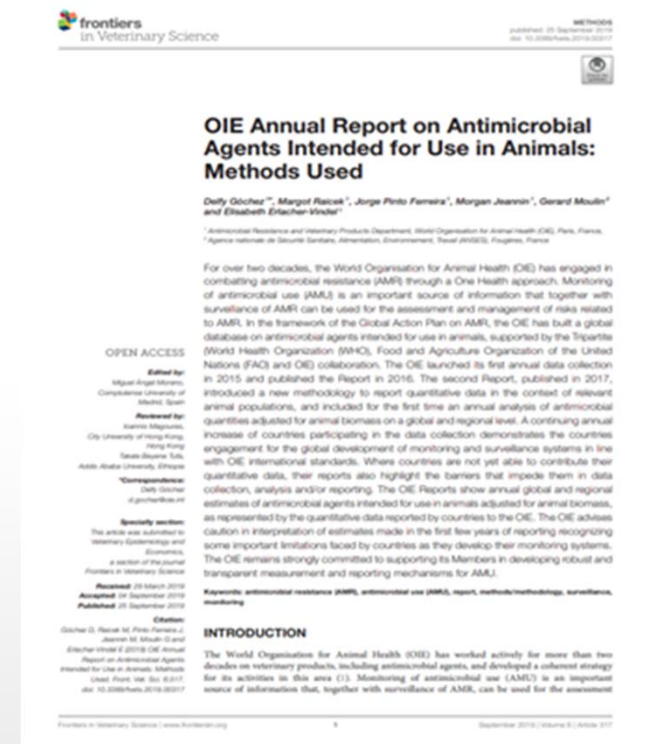
OIE Annual Report on Antimicrobial Agents Intended for Use in Animals: Methods Used

METHODS ARTICLE

Front. Vet. Sci., 25 September 2019

| <https://doi.org/10.3389/fvets.2019.00317>

➔ *Develops the Methodology of the OIE AMU Data Collection and the OIE Calculation of the Animal Biomass*



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Thank you for your attention



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