

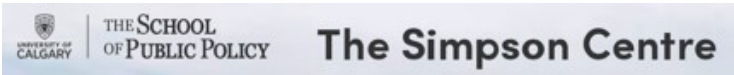
Global Burden of Animal Diseases

Assessing the socio-economic burden of AMR in livestock

Antimicrobial use and resistance in livestock production in a One Health context symposium
Edinburgh | 22nd May 2023

Sara Babo Martins, João Sucena Afonso, Ben Huntington,
Christina Fastl, Jonathan Rushton, and GBADs partners

GBADs funders, partners, collaborators



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The biomass of your livestock?

The economic investment of cattle, sheep, goats, pigs, and poultry?

Do you know



How much your poultry sector spends on veterinary products?

Which diseases have the biggest impact on production?

How do the current animal health and disease problems impact the wider economy and food supply?

Slide credit: Jonathan Rushton

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Investment plans which ensure there are adequate animal health systems

Allocation of resources to problems that most affect their health and wellbeing

Evaluation of animal health investments to ensure they are **delivering on societal outcomes**

Slide credit: Jonathan Rushton

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Analytical structure

What is the value of the animals under our management?

What is our exposure to risk?
Their biomass and the inputs

Is that exposure changing – seasonally, annually?

How large is the gap in production from a perfect health state?

What makes up that gap – species, mortality, morbidity?

What is the balance between expenditure and loss?

What is the balance between public and private expenditure?

Which health hazards are most problematic?

What is the balance between expenditure and loss for the problematic hazards?

Are solutions such as technology access, research or education appropriate based on current impact and resource allocation?

Who is impacted by the current health status?

Does the current public and private expenditure balance reflect societal needs?

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Analytical structure



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AMU/AMR burden in livestock – why it matters?

Advocacy tool

Understanding impact and burden information as the basis of cost-effectiveness analysis

Understanding data needs and current data gaps - strengthening data collection systems in livestock and at the human-livestock interface

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AMU/AMR burden in livestock – what we know



Animal health and production



Focus on AMU: AMU alternatives & cost-effectiveness of change

Framework thinking

Externalities – human and ecosystems health

Data gaps

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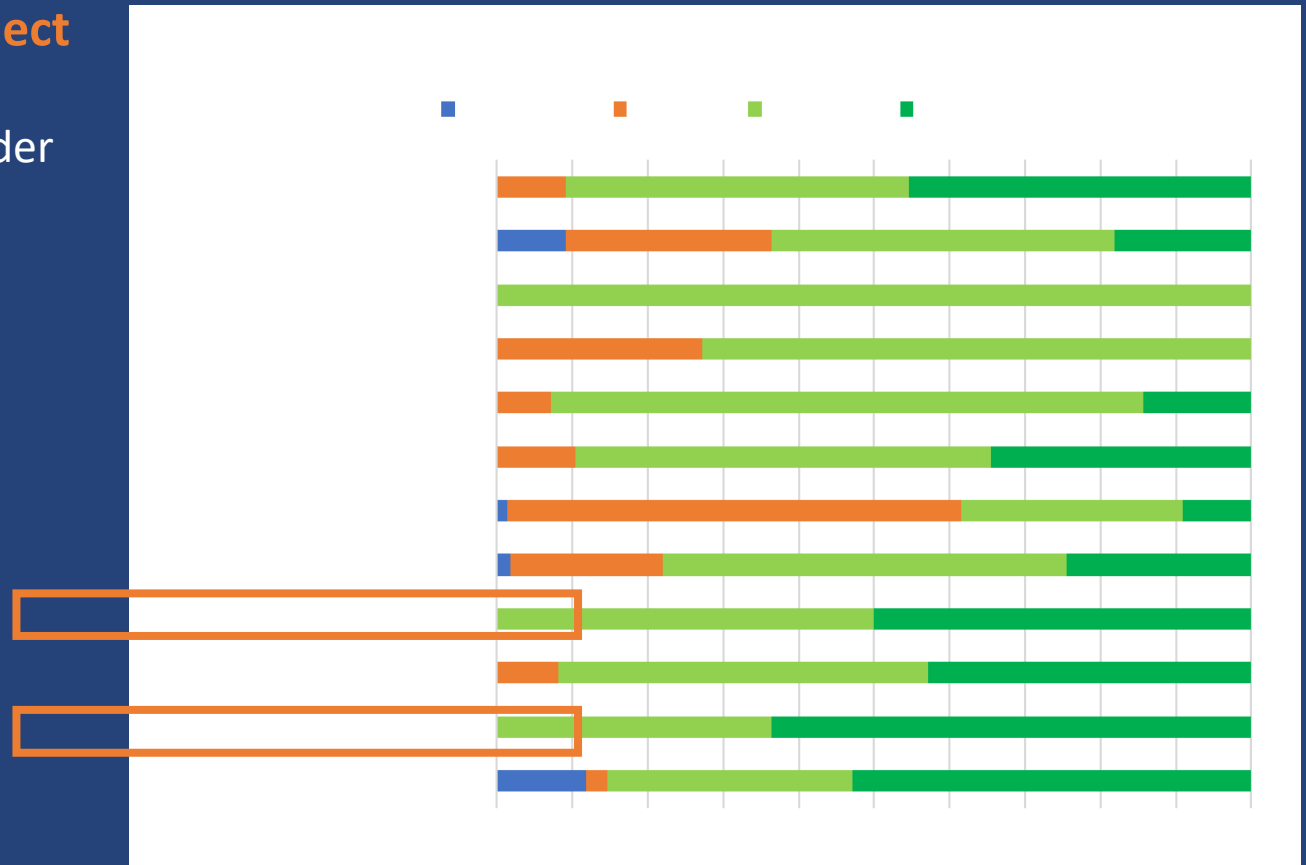
AMU/AMR burden in livestock – what we know

Sucena Afonso et al, forthcoming | ROADMAP project

Structured scoping literature review on the effect of alternatives to AMs in animal food-producing species under real production context

Approx. 200 manuscripts in all production systems from 9k

Heterogeneity of study designs and outcomes of interest – qualitative assessment of the effect



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AMU/AMR burden in livestock – what we know

Fastl *et al*, forthcoming | GBADs Human Health theme/Sciensano

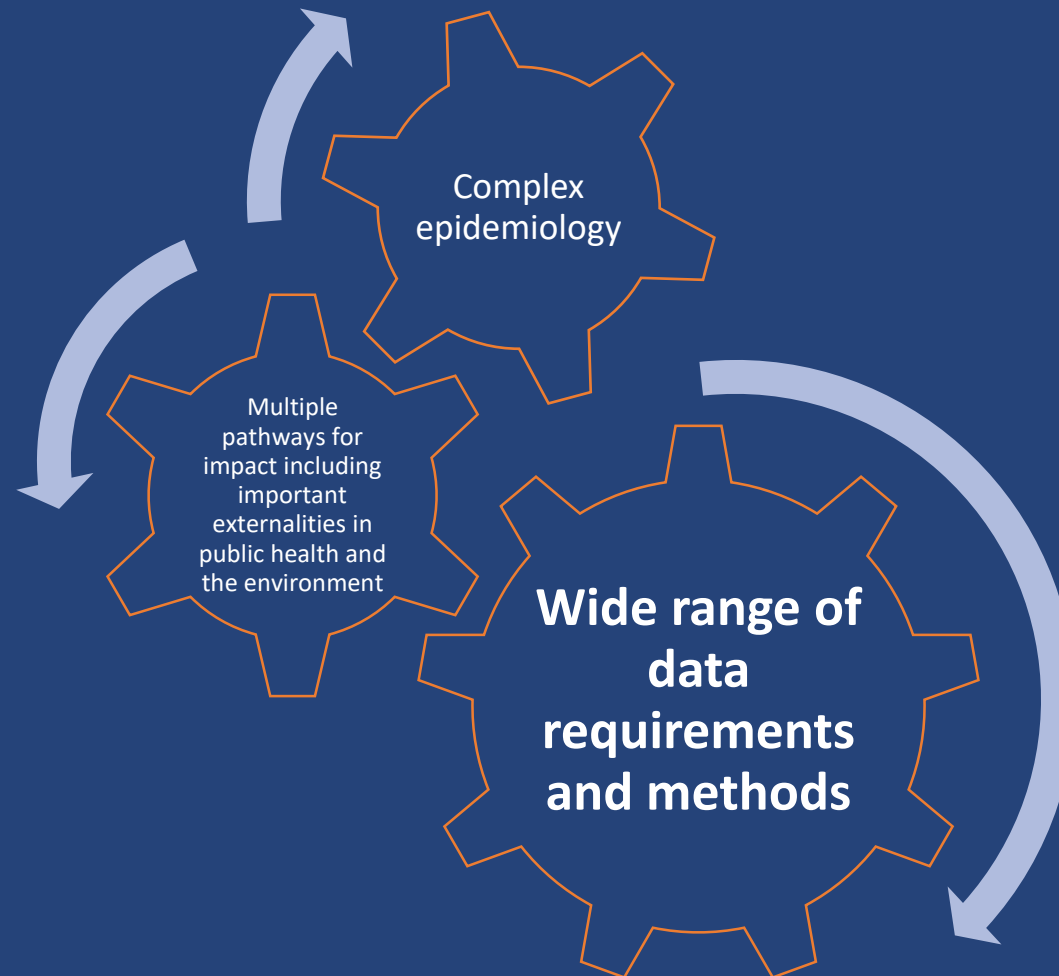
Systematic literature review identifying and describing studies investigating the direct impact of animal sources on human AMR, focusing on the methodologies they used
Directly attributing the burden

31 studies included out of around 10k screened

Evidence on the relative direct contribution of animal sources to human AMR is scarce...but growing.

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AMU/AMR burden in livestock – the challenge



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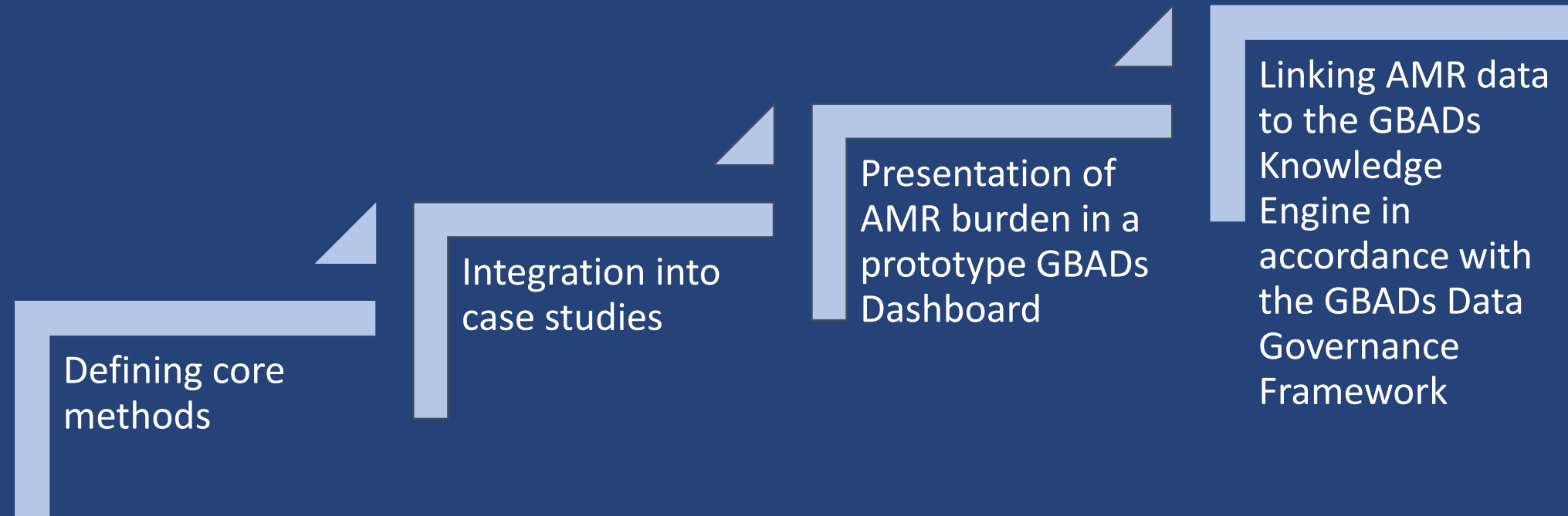
AMU/AMR burden in livestock – our approach

Define the burden of AMR/AMU (in terms of the expenditure and production losses)

Explore the links of AMR in livestock to human health

Within the GBADs methodology - Animal Health Loss Envelope

Global Burden of Animal Diseases Work plan



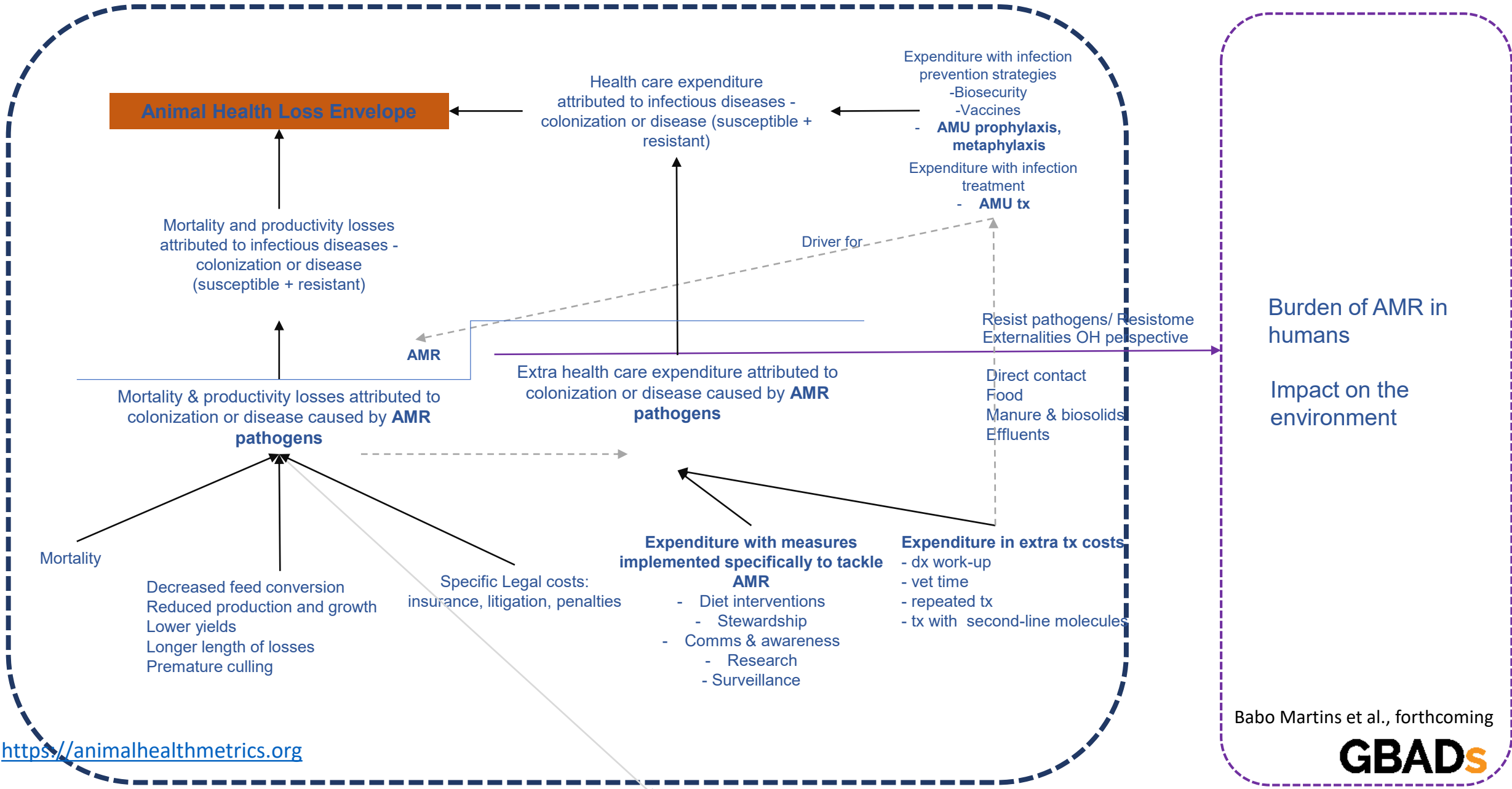
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Developing Core methods

AMR/AMU in the livestock production context

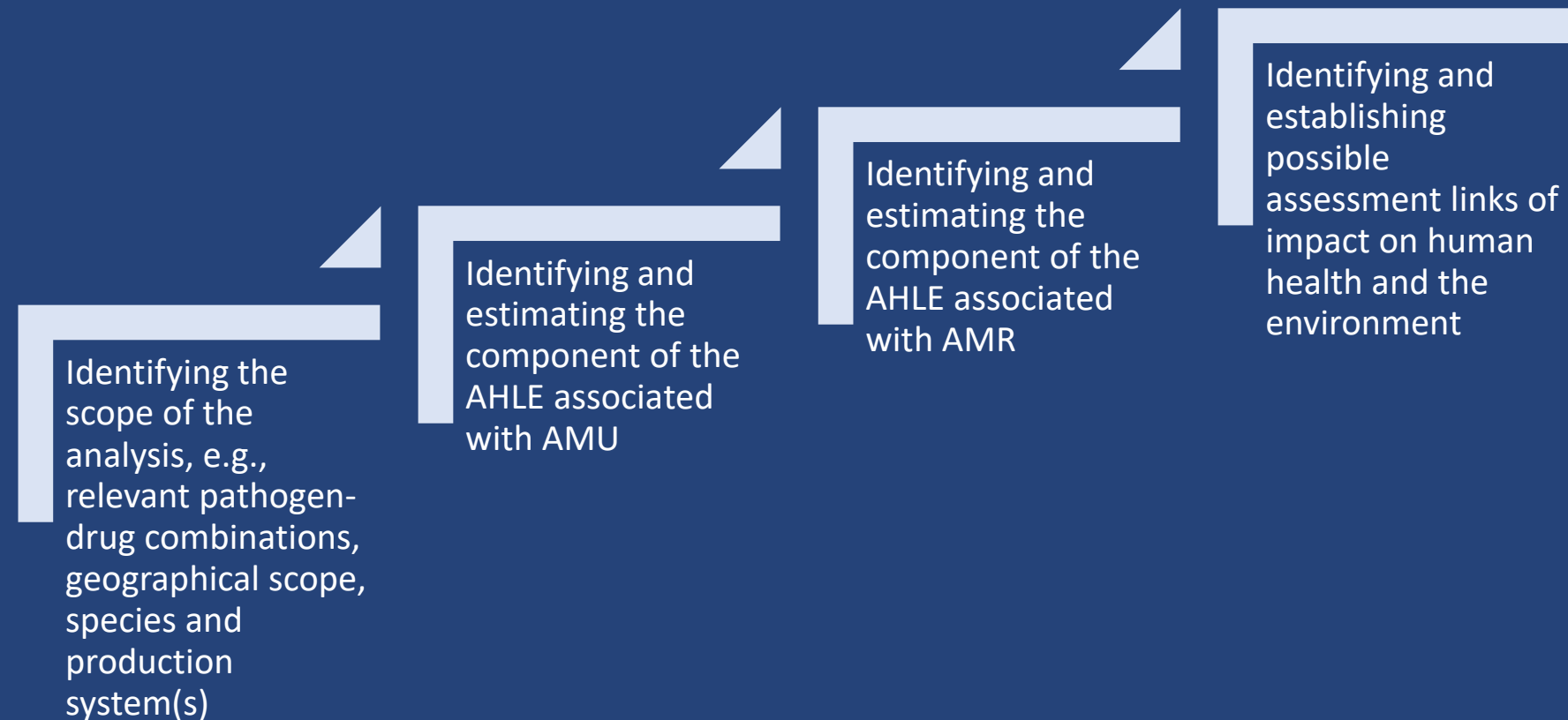
Animal Health Loss Envelope

AMR/AMU in the livestock production context



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Defining core methods – analytical steps



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Defining core methods

Identifying and
estimating the
component of the
AHLE associated
with AMU

Identifying and
estimating the
component of the
AHLE associated
with AMR

Understanding data needs and collecting data

	Burden component	Variable level 1	Variable level 2	Variable level 3
I.1	Antimicrobial usage	Expenditure with AMU per bug-drug combination considered	Use of AM (mg/kg or tonnes)	
			Retail price (farm level) - cost of am USD/Kg	
I.2	Other interventions considered for infection control (vaccines, biosecurity, nutrition/diet, other)	Expenditure per measure implemented Details of variable will depend on the measure itself	Retail price (farm level) of intervention (e.g. vaccine)	
			Doses of intervention used	
			Cost of interventions delivery	Animal healthcare professional time (hour)
				Costs of Animal healthcare professional time (USD/ hour)
Costs of transport and other costs (USD)				
For national programmes - cost of planning, cost of evaluation				

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Integration into case studies

Denmark

- Identifying the scope of the analysis
- Identifying and gathering data needs and data gaps
- Identifying and estimating the component of the AHLE associated with AMU

Tanzania

- Scoping relevant ongoing activities

<https://gbadske.org/dashboards/ahle/>

<https://animalhealthmetrics.org>

Global Burden of Animal Diseases Prototype Dashboard

The screenshot shows the GBADs dashboard interface. At the top, there is a navigation bar with various menu items like 'Uni. Liverpool', 'ROADMAP', 'DECIDE', 'AMR/AMU', 'Syst Review', 'Data', 'Data collection', 'Stats', 'Epi/PH/Surv', 'Epi tools', 'Journals', 'Methods', 'R', 'CV and Network', and 'Seminars and cours...'. Below this is the main header with the GBADs logo and the tagline 'Inclusiveness Challenge Delivery Rigour Transparency'. A horizontal menu contains several tabs: 'User Guide & References', 'Global Overview [WIP]', 'Global AHLE Details [WIP]', 'Major Producers | Poultry', 'Major Producers | Swine', 'Ethiopia Case Study [WIP]', and 'Antimicrobial Usage (AMU)'. Below the tabs are several interactive buttons: 'AMU by Region & Importance', 'Visualization of AMU, Biomass, AMR & AM Costs', 'Exploring AMU/price Variability', 'Regional AM Expenditure Estimator', and 'Data Export'. The main content area is titled 'Livestock Antimicrobial Usage by Region & Antimicrobial Importance/Classes' and includes a sub-caption 'Displaying antimicrobial usage as reported to WOA (2018)'. There are four filter sections: 'Regional AMU Bar Display' with radio buttons for 'Total' (selected) and 'Percent'; 'AMU Units' with radio buttons for 'Tonnes' (selected) and 'mg per kg biomass'; 'Antimicrobial Grouping' with a dropdown menu set to 'Top Global Classes'; and 'Region' with a dropdown menu set to 'All'. Below the filters are two charts. The left chart is a bar chart titled 'Regional AMU Tonnes by Top Global Classes for countries reporting to WOA', showing a single pink bar. The right chart is a pie chart titled 'Global AMU Tonnes by Top Global Classes for countries reporting to WOA', with a legend for 'Top Global Classes' including Macrolides (light blue), Others (purple), Penicillins (yellow), and Tetracyclines (pink). The Tetracyclines slice is labeled with '8.8%'.

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Enduring obstacles



AMR/AMU in the livestock production context

Animal Health Loss Envelope

Health care expenditure attributed to infectious diseases - colonization or disease (susceptible + resistant)

Expenditure with infection prevention strategies
-Biosecurity
-Vaccines
- **AMU prophylaxis, metaphylaxis**
Expenditure with infection treatment

AMU Expenditure data

AMR/AMU in the livestock production context

Animal Health Loss Envelope

Health care expenditure attributed to infectious diseases - colonization or disease (susceptible + resistant)

Expenditure with infection prevention strategies
-Biosecurity
-Vaccines
- **AMU prophylaxis, metaphylaxis**
Expenditure with infection treatment
AMU...

AMU Expenditure data

Extra health care expenditure attributed to colonization or disease caused by **AMR pathogens**

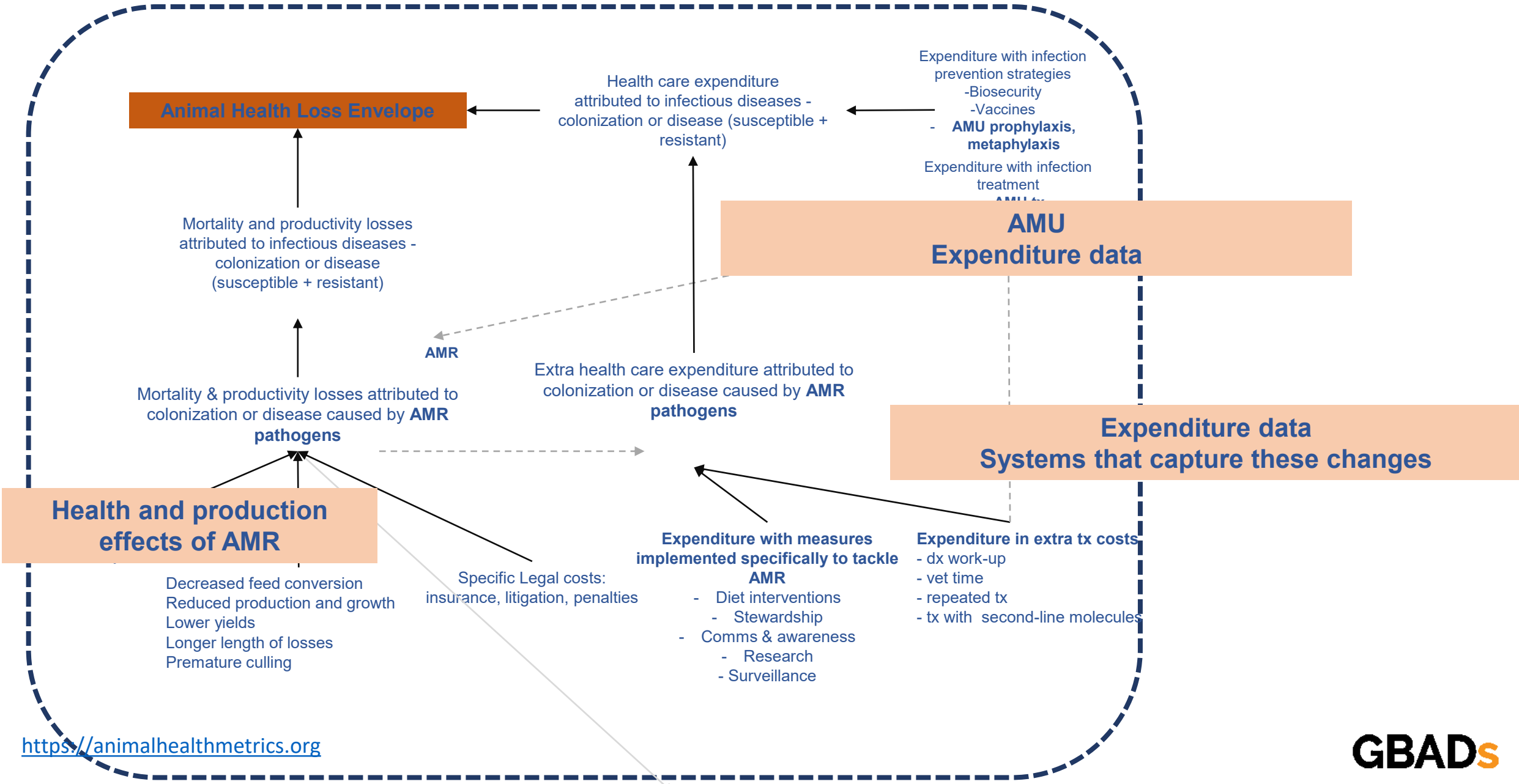
Expenditure data Systems that capture these changes

Expenditure with measures implemented specifically to tackle AMR

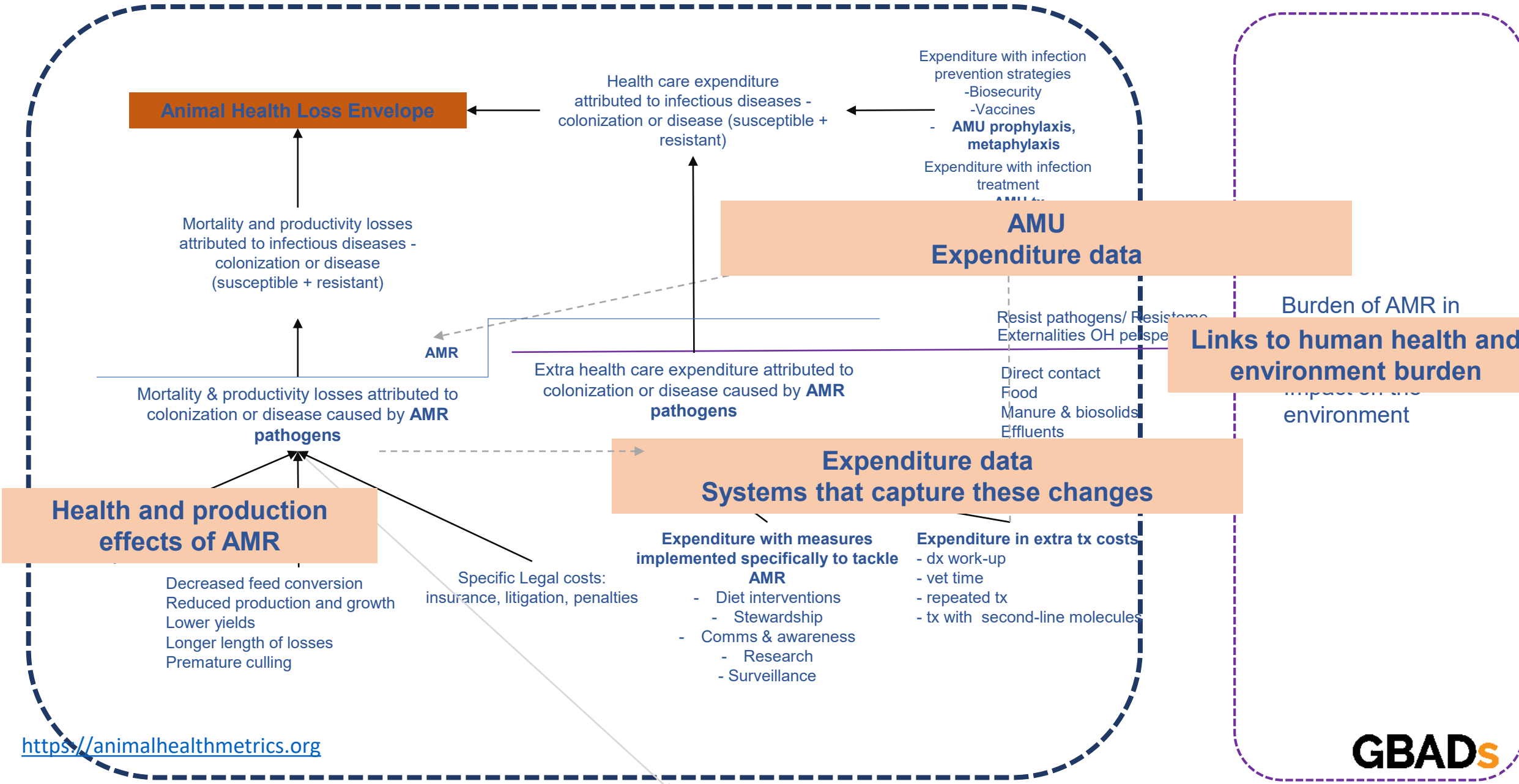
- Diet interventions
- Stewardship
- Comms & awareness
 - Research
 - Surveillance

Expenditure in extra tx costs
- dx work-up
- vet time
- repeated tx
- tx with second-line molecules

AMR/AMU in the livestock production context



AMR/AMU in the livestock production context



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Moving forward

Data capture and integration

- Ongoing work on the epidemiology of AMU/AMR are the cornerstone of burden assessment
- Mechanisms to better capture socio-economic data

Feedback loop on how burden assessment results within GBADs can add value to ongoing work on research and on the science-policy interface issues

Thank you

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World Organisation for Animal Health (WOAH)
and University of Liverpool
Joint proposal to Fleming Fund