Collecting data on antibiotic use in animals.

Workshop Proceedings

22nd & 23rd October 2018

Entebbe

Acknowledgements

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Executive summary

Antibiotic use (ABU) is often described as a key driver of antibiotic resistance (ABR) (Adeyi *et al.* 2017). A particular concern is the continued increasing usage in the livestock sector (Van Boeckel *et al.* 2014), especially in low and middle income country (LMIC) settings (Klein *et al.* 2018). However, currently we lack reliable data on the volume, mode and reasons for antibiotic use. Improving the surveillance and understanding of antibiotic use is a key objective in the OIE's strategy on AMR (OIE 2016), the FAO's action plan (Food and Agiculture Organisation of the United Nations 2016), and in the WHO's Global Action Plan (WHO 2015). In line with the CGIAR AMR strategy (Wieland et al, 2018) the Improving Human Health programme supported a workshop to bring together researchers with experience of collecting ABU data at a granular level.

Workshop participants included representatives from ILRI, LSHTM, FAO, SLU, the Vietnam Academy of Social Science, and the Universities of Liverpool and Makerere. Experiences were presented from researchers working in Cambodia, Ethiopia, Malawi, Tanzania, Thailand, Uganda, and Vietnam.

Experience of tools used to measure ABU highlighted similar strengths and weaknesses to that of a previous review (Queenan *et al.* 2017b). Being site and sector specific, the tools presented were able to gather rich qualitative information, which is recognised as being pivotal in understanding the context of ABU and the complexity of the drivers surrounding usage. However, while some of the tools were able to generate proportional quantitative data on ABU, none were able to generate any level of meaningful and reliable volumetric data, an aspect which is desired by many stakeholders for ABU surveillance systems. If such systems are to contain elements of volumetric data, then the challenge to find effective methods to collect this information need to be overcome.

While the harmonisation of tools used to collect ABU data across human and animal use was viewed as desirable in working towards a One Health approach to the issue, it was recognised that this goal presents key challenges. The simplification that would need to take place to allow a tool to be used in multiple settings without taking too much time of interviewees would limit its ability to collect finely granular local level data. It was also recognised that an advantage of having multiple tools at this point in time was that these provide a multifaceted

approach to data collection to find the best solutions, and a single tool could miss crucial aspects of information vital to our understanding of ABU. An alternative to a completely harmonised tool could be to have one with a core structure which sets out a range of data collection objectives, with additional parts which, using defined methodologies, could be adapted to particular local settings, with the vision to move towards a harmonised tool in the future.

Workshop participants emphasised that to interpret data collected through an ABU surveillance system, the complex systems surrounding ABU and the drivers which influence them must be understood and all actors in the system engaged with. Frameworks should be set out to allow critical appraisal of the usefulness of collected data to ensure that effective intervention strategies are applicable at the local level and allow recognition of what data is not being captured.

The shared experiences of the researchers who attended this meeting demonstrated that several ABU data tools exist which are able to capture granular level information. Further work is needed to establish whether the tools presented are sufficient to evaluate ABU in a surveillance scenario which is useful for policy planning within a 'One Health' context. Following on from the workshop, recommendations for further work include; 1) comparison of the existing data collection tools from the livestock and human sectors, 2) ascertaining whether generation of specific volumetric data is necessary for ABU surveillance, 3) establishing which aspects of data collection could be harmonised across sectors, and 4) understanding what resources would be needed to upscale site-specific research into a surveillance programme.

Contents

Abbreviations

A4NH – Agriculture for Nutrition and Health

ABR – Antibiotic Resistance

ABU – Antibiotic Usage

AMIS – Antimicrobials In Society

AMR – Antimicrobial Resistance

AMU – Antimicrobial Usage

AMUSE – Antimicrobial Usage tool

CAHW - Community-based Animal Health Workers

CGIAR - Consultative Group on International Agriculture Research

CRP – CGIAR Research Programme

FAO – Food and Agriculture Organisation of the United Nations

ILRI – International Livestock Research Institute

LMIC – Low- and Middle-Income Countries

LSHTM – London School of Hygiene and Tropical Medicine

OIE – World Organisation for Animal Health

SLU – Swedish University of Agricultural Sciences

vDDD – veterinary Defined Daily Dose

WHO – World Health Organisation

Introduction

Antibiotic use (ABU) is often described as a key driver of antibiotic resistance (ABR) (Adeyi *et al.* 2017). Use of antibiotics in animals is understood to be increasing (Van Boeckel *et al.* 2014), and this has been the focus of concern internationally (World Health Organisation 2015; OIE 2016). A particular concern has been placed on increasing usage in low and middle income country (LMIC) settings (Klein *et al.* 2018) but at the same time we lack reliable data on the volume, mode and reasons for use. Improving the surveillance of antibiotic use and understanding of antibiotic use is a key objective in the FAO action plan (Food and Agiculture Organisation of the United Nations 2016) as well as in the WHO's (2015) Global Action Plan. This is both important to provide more accurate data on levels of use but also data that can be analysed in conjunction with ABR data to understand the linkages between ABU and ABR. However, as yet there are no agreed protocols for the collection and comparison of AMU data in animal and human populations.

Existing ABU analyses rely on partial data for example 'consumption' data provided by the IMS Health database (e.g. Collignon *et al.* 2018) or estimates of consumption data from member countries provided to OIE or WHO. Such data however are not sufficiently finely grained to guide interpretation or intervention at the national or sub-national level (Queenan *et al.* 2017b). A review of methods and metrics for measuring antimicrobial use demonstrated that there are multiple approaches, and no standardised tool (ibid). In November 2017, a group of 38 researchers, health practitioners and policy professionals were brought together in London for a roundtable to discuss how best antibiotic use can be measured at a granular level (Queenan *et al.* 2017a). This is a major challenge across different settings given the variety of antibiotics in use, the variety of sources and supply chains for antibiotics, the large size of informal markets and the difficulty of knowing what is prescribed and what is finally used by an individual, and for how long. Even more challenging is how we might meaningfully measure and compare antibiotic use across human and livestock sectors, which includes not only terrestrial farming but also aquaculture (fishery) use. The methodological issues raised included how to generate metrics for volumes that can be comparable with those generated for human health, and that can be captured reliably on the ground; around devising indicators

that can be meaningfully interpreted to assess unnecessary use; and around understanding the reasons for antibiotic use.

Since the time of the LSHTM meeting in November 2017, various studies linked to the CGIAR Research Programme (CRP) Livestock and CRP Agriculture for Nutrition and Health (A4NH) as well as other research groups that are expanding their methodologies from the public health field have been collecting data on the use of antibiotics in animals. These studies use different approaches, and likely answer different questions within the area of antibiotic use. Responding to the need to share experiences from using different approaches and tools used by public health and veterinary sectors, a workshop was convened in Uganda in October 2018 to see whether it may be possible to generate comparable data through unifying methods and metrics. This workshop brought together public health and veterinary researchers to discuss ongoing work and develop a common understanding on what resolution for measurements in the livestock sector is needed and feasible given variability in livestock production systems.

The meeting objectives were:

- *To understand the range of questions that existing AMU data collection activities have been answering.*
- *To share and compare experiences with different methodological approaches to studying AMU.*
- *To consider whether a shared framework / tool or suite of tools may be usefully created that can generate comparable data across settings, and that may be comparable with data on human use.*
- *Map complexities around measuring AMU*

The workshop was held over two days, the details of the agenda can be found in Appendix 2. Following a short introduction where participants had the chance to get to know each other

presentations were given by researches working in the field, who shared their experiences of using different tools to collect antibiotic usage data. Each researcher gave a short presentation describing their work reflecting on the points in the following table:

Table 1. Points of discussion for ABU tools

1. Brief overview of study objectives and tool used
2. Key results/findings if available, focus on AMU indicator findings
3. Did the study cover any One Health issues? If so which ones and how?
4. Comment on strengths and weaknesses of the tool used
5. Explain key challenges encountered overall
6. Explain key challenges encountered to 'quantify' use/dosage & how they have dealt with it
7. Any surprises in the field that the tool was not able to capture?
8. Remaining gaps in the tools, suggestions on how to address these

Researchers then took questions from the other delegates. At the end of the first day, key questions and themes arising from the presentations and discussions were noted and informed the topics for group discussion on day two. On day two, delegates were split into three groups and using a bus-stop approach each group discussed three themes: theme 1, led by Ulf Magnusson (SLU, Sweden) focused on the appropriate use of antibiotics; theme 2, led by Barbara Wieland, focused on the quantification of use and dosage; and theme 3, led by Laurie Denyer Willis, focused on the 'One Health' aspects, specifically the human/animal/environmental interfaces, and the role of gender on the impact on ABU. All three groups were encouraged to consider the phrasing of question used with the tools, involvement of other value chain actors, and ways in which harmonisation of tools could be achieved. In the afternoon of day two a, groups mapped out the complexities around the drivers of ABU at the farm level and in the wider context, followed by plenary discussion.

This report begins with an overview of the tools being used to measure ABU presented at the workshop and the experiences of the researchers using them. Thereafter the report will outline the main themes and key points which arose during the group discussions and finish with a discussion of the drivers of ABU.

Experiences of researchers using tools to collect ABU data

On the first day of the meeting eight researchers presented work looking at ABU, the tools used to collect the data, and their experiences of using these tools in the field. All field work discussed occurred in either Africa (Ethiopia, Malawi, Tanzania, and Uganda [represented twice]) or South-East Asia (Cambodia, Thailand, and Vietnam). A summary of the key study characteristics can be found in Table 2.

Table 2. Key study characteristics

		Sector		Study Question						Methodology						
Country	Project	Human	Livestock	Identify drivers	Understand KAP	Measure antibiotc quality	Describe nature of use	Mesure antibiotic quantity	Measure ABR prevalence	Questionnaire/Survey	Use of drug box	In depth interviews	Focus group discussions	Participant observetion	Record books/logs	Sampling for ABR bacteria
Cambodia			Pigs		x		x	x	x	x						x
Ethiopia	AMUSE		Sheep/goats/cattle	x	x					x	x					
Malawi		x	x					x	x	x						x
Tanzania		x	Mixed	x			x	x	x					x		x
Thailand	AMUSE		Pigs	x			x	x	x	x						
Uganda	AMUSE		x	x	x					x	x		x			
Uganda	AMIS		x	x			x			x	x					
Vietnam	VIDA-PIG	x	Pigs	x		x		x	x	x		x	x	x	x	x

Seven of the studies discussed focused primarily on understanding and/or measuring antibiotic use, with the remaining study (in Malawi) focusing primarily on antibiotic resistance, with usage being investigated as a risk factor for the development of resistance. Research questions relating to ABU fell into four main categories; 1) identification of drivers for ABU, 2) understanding knowledge, attitudes, and practices around ABU and use other veterinary drugs, 3) understanding the nature of how antibiotics are being used, and 4) measuring the quantity of antibiotics being used. Four of the studies focusing on antibiotic usage also collected data on the prevalence of antibiotic resistance bacteria within the sample site. One study (in Vietnam) also collected data on antibiotic quality.

All of the studies were primarily focused on livestock production, three looking at just pigs, and the others a mixture of livestock. Three of the studies also collected data on ABU in people. Other 'One Health' aspects that were discussed included; 1) the use of human antibiotics for farm animals, 2) disposal of antibiotics into the environment, 3) consumption of antibiotics in foods of animal origin (eggs, meat, and milk), and 4) the role of zoonotic diseases in ABU.

Only the research in Vietnam included a longitudinal approach within the study, with bins being provided to store medicines packages, which were collected by researchers after one month. The remaining studies collected data at one point in time, something which many of the researchers acknowledged as a weakness in their studies.

All but one of the studies used questionnaires as a data collection method, with five sites using the Open Data Kit (ODK) equipment for data entry. While the ODK was felt to be an effective and efficient method of data capture, it was mentioned that in some settings it took time to train enumerators to use the kit, and there were limitations placed on the length of participant responses. In the three studies which used either the AMUSE or AMIS data collection tools it was necessary to complete scoping activities of local drug suppliers and stores in order to ascertain which antibiotics were present in this setting, the time taken to complete this task being dependant on the number of outlets in the research area. Other methods of data collection included; 1) focal group discussions, 2) participant observation, and 3) in-depth interviews.

All of the studies produced qualitative and quantitative, descriptive data describing some of the 'whys', 'hows' and 'whens' of antibiotic usage. The ability to collect this finely granular data was seen as a strength of the tools used, and key in understanding the drivers for antibiotic usage. Five of the studies were able to generate proportional quantitative data (such as the percentage of farmers with access to veterinary care, frequency of drug use, or the percentage of animal feed that contains antibiotics). Proportional data of this kind, if

reliable and repeatable, has the potential to allow comparisons to be made between settings, measure trends over time, and before and after interventions. None of the studies discussed used tools that were able to successfully generate volumetric data (such as mg of antibiotic per population corrected unit or defined daily doses [DDD] per number of people at risk) on ABU, which was noted as a limitation by the majority of researchers. Lack of information about drug doses, and reliable data on duration and frequency of treatment, were cited as some of the reasons for being unable to generate volumetric data using these tools. Additionally, lack of data on the specific reasons for usage due to absence of diagnoses meant that very few of the studies were able to comment on the 'rational' or 'appropriate' use of antibiotics.

The other limitations of the data collection tools which were discussed included; 1) doubtful accuracy of the information collected due to lack of written records and recall bias of participants, with some researchers suggesting that participants should not be asked to recall data longer than a period of two months, and 2) social desirability bias of the participants inhibiting truthful answering of questions, especially in settings which have started to legislate on antibiotic use (e.g. in Vietnam since the Ministry of Agriculture and Rural Development banned the introduction of some antibiotics into animal feed at the start of 2018).

Discussion groups

Appropriate usage of antibiotics

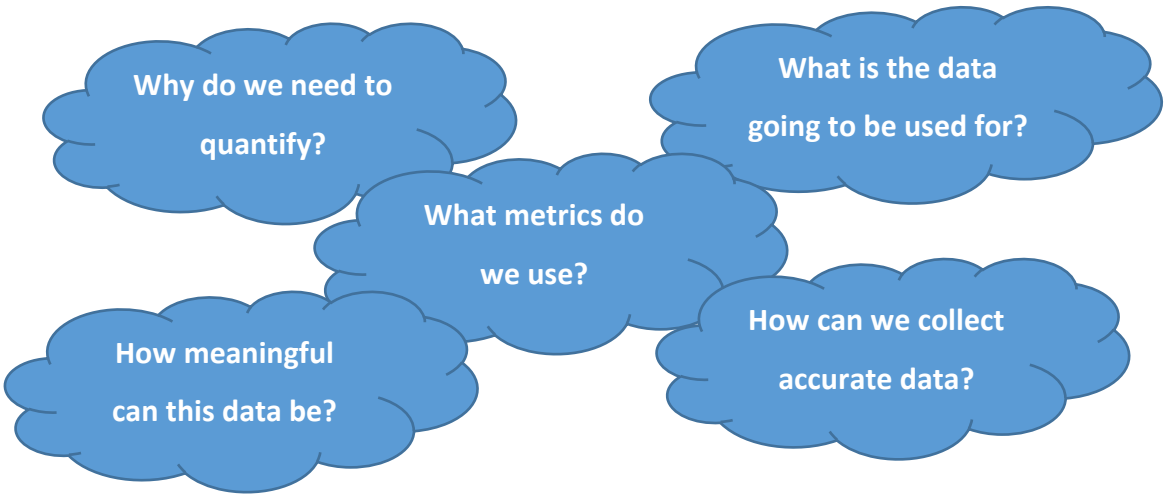
It was recognised that in order for the use of antibiotics to be considered completely appropriate then diagnostics are needed to allow clinical diagnoses to be made. Diagnostics of this kind (lab analysis, post mortem) are costly and frequently unavailable in LMIC settings and are one of the key bottlenecks for proper animal health care at the moment. In most instances, diagnoses are made based on presenting clinical signs, the reliability of which is dependent on an individual's skill and past experiences. The groups discussed that it was often farmers making the diagnosis themselves, sometimes in discussions with peers and neighbours. Sometimes service providers, such as vets or community-based animal health workers (CAHW) would be consulted, which would usually result in costs to the farmer. The reliability of vets and CAHWs is dependent on their ability to make an accurate clinical diagnosis, something which can vary greatly, due to level of training and experience. Decision tree were mentioned as a method of improving the rationale behind ABU, aiding decisions of vets and farmers on a course of action and which antibiotics to prescribe/use. An example in Uganda was mentioned where workers in intensified farms had known about the varying competencies of different service providers and would use this knowledge to interpret the advice they received. Animal drug sellers are also known to provide advice to customers, and it was discussed how it would be difficult to capture the advice and information given during these encounters.

It was noted that care should be taken when considering how to interpret the 'appropriateness' of ABU. Interventions which aimed to improve 'appropriate' use of ABU did so at the individual, patient level and often failed to consider a wider approach and the influence antibiotics have had on the development of systems. Antibiotics could be considered elements of architecture in allowing intensive agricultural systems to develop and broader approaches such as structural adjustment programmes may be needed to address the 'appropriateness' of ABU at a larger scale.

Quantification of use and dosage

Discussions around quantification of ABU came up in all three groups and covered a range of concerns (Figure 1).

Figure 1. Questions raised concerning the quantification of ABU



From a research point of view of the delegates present, it was postulated that measuring the quantity of antibiotics used was less important than knowing the proportion of inappropriate use and understanding the driverss for usage and the knowledge, attitudes and practices that surround usage.

The generation of consumption data (such as mg/PCU/year or vDDD) as detailed in the OIE standards were discussed by the delegates who deliberated on the value of such information given the questionable reliability of macro level data and assumptions needed to generate the values. It was also felt that this type of data gave no information on the reason of use (prophylaxis vs. treatment) or if group treatment or individual application occurs.

As in the fieldwork tool discussions on the previous day, it was noted that cross-sectional studies for data collection were of a single time point with limiting factors; 1) data is not representative of whole year, 2) seasonality is missed, and 3) user recall for more than a month difficult. It was considered better for data to be collected using longitudinal approaches. Example were given such as in Ethiopia where village level enumerators have been trained to collect data and in Uganda where record keeping books have been distributed coupled with regular follow-up visits from the researchers. Several delegates talked about trash/rubbish bucket methods to collect medicine packages over a certain period of time,

though they acknowledged that the reliability of this data could be varied and difficult to establish.

Social desirability bias was discussed again, noting that there could be a lack of willingness to report ABU in some settings. It was discussed how it is important to gain the trust of interviewee, place emphasis on diseases and how they address challenges in their farms, involve local community leaders and ensure feedback sessions are organised to maintain engagement.

Triangulation of data collection, either by including other value chain actors, or by using different data collection methods on the same value chain, was discussed as a method of validating the accuracy of data collected. It was mentioned that a three-tiered approach to data collection has started in Vietnam, using questionnaires, record books, and package bins to acquire data on ABU.

'One Health' aspects (Human/animal/environment interface) and the role of Gender

Experiences were shared on how to address issues around 'One Health' (OH) of ABU and how this could be implemented on the ground. Some of the technical issues around implementing a OH approach were discussed, such as funding and power imbalances, recognising that there is normally a greater focus on human health than animal and environmental health. Some delegates noted that while there has been government calls for a OH AMR platform, this often only results in cross sectoral representation at meetings with little joint implementation occurring at the local level. Concerns around zoonotic diseases were acknowledged to have improved multisectoral work, but some felt there was still a culture of blaming farmers rather than sharing the responsibility.

The role of environmental aspects were discussed and noted that they were often neglected, with a focus on livestock only. While animal and antibiotic waste management formed part of some of the tools used, the data collected was often overlooked, and it was noted that there is potential for this to from a part of background surveillance.

When considering the role of gender, it was acknowledged that attention must be paid to the local context. Even when major shifts do occur in women's empowerment, gender dynamics in dealing with service providers, such as vets and CAHWs, can mean that men speak to men, despite women being responsible for some of the animal health management, especially caring for sick animals.

Tool harmonisation and surveillance

When considering whether a shared framework/tool or suit of tools could be created to generate comparable data across setting and sectors, all delegates agreed that this was a desirable goal, but several limitations and risks of this approach were highlighted. Ideally a harmonised tool would facilitate the development of national and international surveillance systems for ABU, allow metanalyses to be performed, and promote the collection of data in a 'One Health' approach. It was noted that it was important for such a tool to be able to measure spatial and temporal trends, including seasonality variations, thus requiring a longitudinal aspect to be considered.

It was acknowledged that the main strength of having a site-specific tool was in its ability to generate detailed, rich, and granular level data to facilitate contextual understanding of ABU at that site. This data is necessary for rapid situational assessments and to allow targeted policy and interventions. Creating a single harmonised tool that could be used across a variety of settings would require a degree of simplification and thus reduce the ability of the tool to collect local data as the content validity for specific sites would be reduced. Several delegates suggested that a solution would be to standardise part of the tool, and to set out a standardised methodology for adapting the remainder of the tool to become site specific.

It was mentioned that while the harmonisation should be an end goal, we may not be ready to start the process just yet. An advantage of having numerous tools at this stage of research is that they can be tested against each other, exposing weaknesses and strengths, and that one tool may capture an element of AMU which has not yet been considered, and could prove an important aspect of understanding the topic.

It was also noted that it was important for surveillance work on ABU to continue to link back to data on ABR prevalence. An ABU surveillance system may provide an opportunity to collect ABR samples/data and aid epidemiological studies needed to elucidate these issues at both a national/macro and local level.

Understanding the drivers of ABU

In the afternoon of day two, delegates discussed how the reasons, incentives, and rationales which lead to antibiotics being used are numerous, varied, and complex. These 'drivers' come in many forms, act at different levels within the supply chain, and influence actors in different ways. Drivers may be classed as, for example, social, economic, political, industrial, geographical, ethical, and microbiological in their nature. They may exert a direct effect on ABU or interact with other drivers within more complex relationships. Using a systems-based approach to the value chain which antibiotics exist within offers an opportunity to comprehensively elucidate all significant drivers acting in the chain and design appropriate intervention strategies.

The importance of attempting to understand these drivers in order not to forget the reality facing those who use and depend on antibiotics in their daily lives was noted. Forgetting or ignoring the drivers of ABU could lead to naïve and unrealistic expectations of how to reduce ABU and mitigate the problem of ABR.

The groups discussed the various drivers which they considered had an impact on ABU, a summary of which can be found in Table 3. Three main levels of actors were considered; 1) farmers (animal owners and/or herdsmen), 2) suppliers (Agrovet shops, pharmacies, drug stores, vets), and 3) actors from a wider context (importers, exporters, pharmaceutical companies and their sales organisations, and wider policy environment and other stakeholders). A summary of the drivers the groups discussed can be found in figures 2, 3, and 4.

On a particular note, the regulation of vaccinations as a driver was discussed by the group. It was considered that while antibiotics are readily available vaccinations are not as they are often regulated by government institutions and require a cold chain. Vaccinations normally

need to be done at herd level and therefore require financial and physical resources as well as planning, whereas treatment of sick animals with antibiotics is normally at the animal level and often occurs without planning.

It was discussed that farmers are concerned about the health and welfare of their animals, and financial constraints, pressure to intensify farming with limited land, and shifts to exotic breeds with higher susceptibility for disease can make disease prevention difficult. Antibiotics, as well as allowing these intensive or bio-insecure systems to be productive, also help to protect capital investments.

Figure 2. Drivers for antibiotic usage identified at the farm level

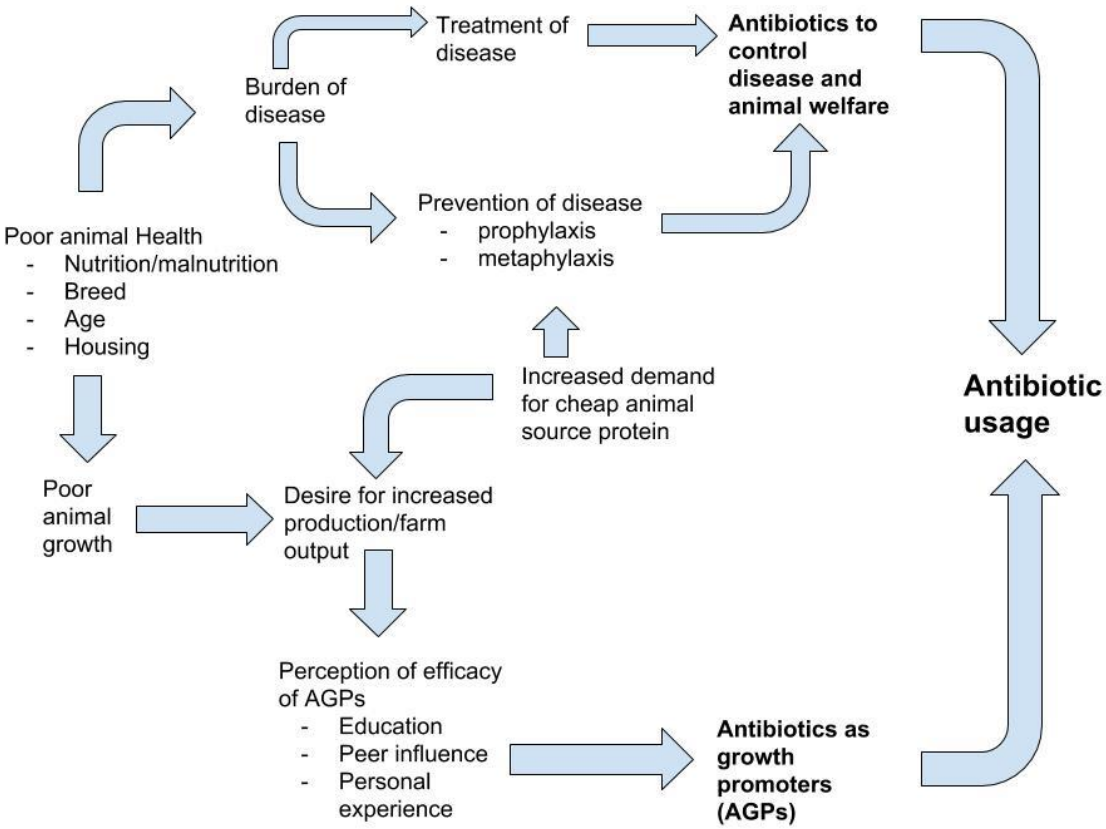


Figure 3. Drivers for antibiotic sales

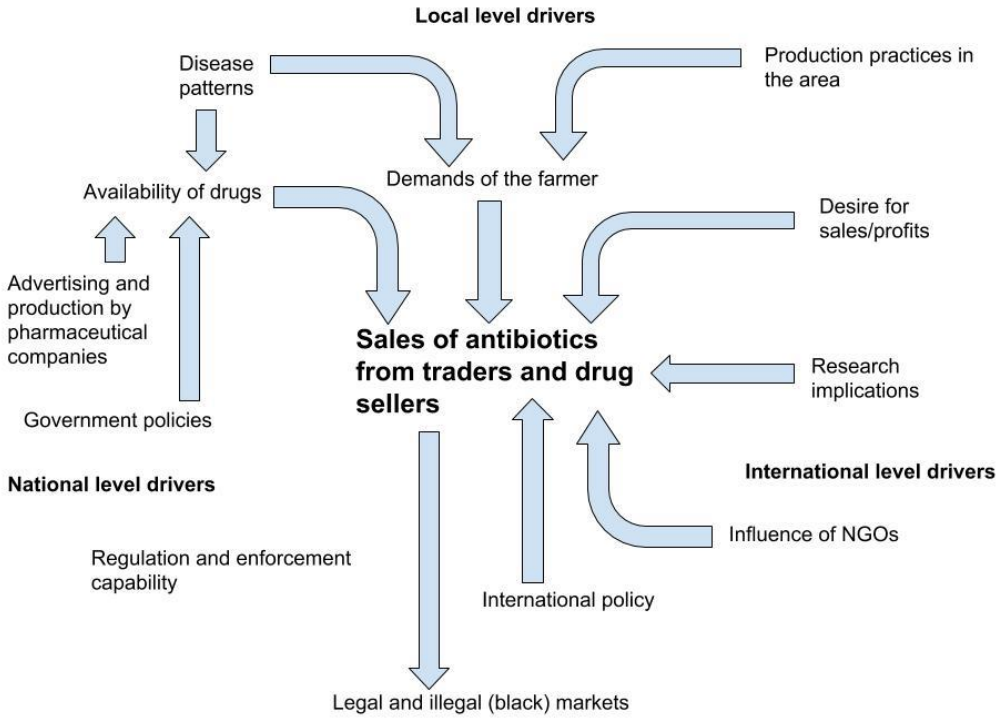
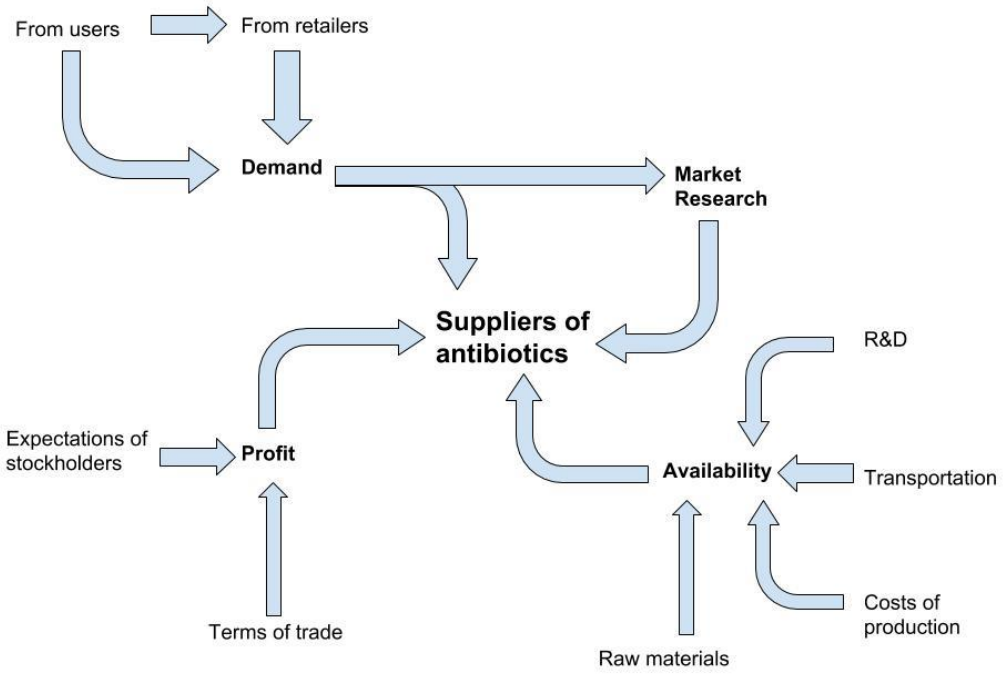


Figure 4. Drivers for suppliers of antibiotics in the wider context



Conclusion

The shared experiences of the researchers who attended this meeting demonstrated that several ABU data tools exist which are able to capture granular level information. However, it must be established whether the tools presented are sufficient to evaluate ABU in a research or surveillance scenario. Additionally, while the majority of the tools presented were able to provide detailed qualitative information about usage, few were able to provide reliable and meaningful volumetric data at the local user level.

Once it has been established whether the existing ABU data collection tools are fit for purpose then it can be considered whether it is possible to construct a harmonised, or partially harmonised, tool which could be developed into a multi-sectoral surveillance system. For such a harmonised tool to exist, it must be determined what the tool should measure and if can be upscaled from site specific research into national and international surveillance. To ensure that such data are interpreted appropriately, the complex systems surrounding ABU and the drivers which influence them must also be understood and all actors in the system engaged with. Frameworks should be set out to allow critical appraisal of the usefulness of collected data to ensure that effective intervention strategies are applicable at the local level and allow recognition of what data is not being captured.

Next steps

Following on from the meeting, a consultant has been hired to continue evaluating the data collection tools with the following objectives:

- A detailed comparison of the data collection tools (for both livestock and human sectors) in order to establish which approaches and questions are most useful in being able to capture the necessary data on ABU.
- To ascertain whether volumetric data is a necessary requirement of a surveillance system of ABU at this time, and whether it is possible to collect this data in an economical manner in what are often resource limited settings.

- To establish which aspects of data collection could be harmonised across the human and livestock sectors in a way that provides information which is useful to public health policy decisions.
- To understand what resources would be needed to upscale site-specific research into a surveillance programme and explore which possible barriers could obstruct this process.

Appendices

Appendix 1: List of attendees

Name	Institution
Amia Winfred	ILRI Uganda
Barbara Wieland	ILRI Ethiopia
Biruk Alemu	ILRI Ethiopia
Catherine Nichole Hunt	Uni Liverpool
Christine Nabirye	LSHTM / AMIS (Uganda)
Clare Chandler	LSHTM (remotely)
David Kiryabwire	DVO -Mukono
Denis Byarugaba	Makerere University
Dickson Ndoboli	Makerere University
Hang Tran Ming	Vietnam Academy of Social Science
Esther Sophie Rottenburg	LSHTM/ AMIS (UK)
Gunilla Stroem	SLU
Laurie Michelle Denyer Willis	LSHTM/ AMIS (UK)
Lawrence Mugisha	Makerere University
Louis Omoya	ILRI Uganda
Mark Caudell	FAO
Michel Dione	ILRI Burkina Faso
Miriam Kayendeke	LSHTM / AMIS (Uganda)
Nichola Rochelle Naylor	LSHTM
Peter Oba	ILRI Uganda
Sheila Ayoo	ILRI Uganda
Susan Nayiga	LSHTM / AMIS (Uganda)
Ulf Magnusson	SLU

Appendix 2: Meeting programme

Workshop on collecting data on Antibiotic Use in Animals

22-23rd October, Entebbe, Uganda

Programme

22nd October	**Activity**	**Methods, presenter/chair**
Afternoon (13-17.30)	Overall introduction, setting the scene (30 min)	Presentation – Barbara Wieland
Break at 3pm	Presentations on different tools and experiences from different countries - AMUSE Uganda (Amia Winfred) - AMIS Uganda (Miriam Kayendeke) - Malawi (Cat Wilson) - AMUSE Ethiopia (Biruk Alemu) - Vietnam: anthropological considerations (Dr Hang) - AMUSE in Thailand (Ulf Magnusson) - Cambodia AMU surveys (Gunilla Ström) - Tanzania (Mark Caudell) Laurie, Barbara and Nichola taking notes on key questions that were given to presenters (to inform planning of day 2): - Brief overview of study objectives and tool used - Key results/findings if available, focus on AMU indicator findings - Did the study cover any One Health issues? Which ones? How? - Comment on strengths and weaknesses of the tool they used - Explain key challenges encountered overall - Explain key challenges encountered to 'quantify' use/dosage and how they have dealt with it - Any surprises in the field that the tool was not able to capture? - Remaining gaps in the tools, suggestions on how to address these	10 min presentation, 5 min questions (chair Ulf Magnusson)
23rd October		

Morning (08.30-12.30)	Use of data on AM use? Presentation Nichola - One Health - Surveillance - Modelling and evaluation Group discussion to generate a framework of the different questions being asked, and to map on which tools are suitable to answer each sets of questions. Use discussion to define Bus-stop questions	(Chair Laurie Denyer Willis)
Break at 10am	Group work on specific points emerging in the discussions in the morning Possible discussion points that somehow should be covered in the bus stops: - Volume: how to measure volume - Why and when they are used - Types of antibiotics and their appropriate use - Frequency (prevention vs. treatment) Measures? How count How to ask? Sampling? How many needed One Health What is missing in the tools we have? How could the missing issues be incorporated? - Challenges encountered during field work? - How to capture human antibiotic use for animals and vice versa and how can data collection on use be coordinated between humans and livestock use? Why needed? Do we have enough evidence for that? Should it be encouraged? How? - Can data collection tools be harmonised?	Bus-stop approach on 4 questions
12.30 Lunch		
Afternoon (until about 3.30pm)	Plenary discussion Mapping of AM-use complexity, which questions on what issues?	(Chair Barbara Wieland)

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