

One Health Minnesota Antibiotic Stewardship Collaborative Five-Year Strategic Plan



Authored by One Health Minnesota Antibiotic Stewardship Collaborative

Endorsed by Commissioners of Health, Agriculture, Pollution Control,
and Board of Animal Health Executive Director

July 1, 2016

One Health Minnesota Antibiotic Stewardship Collaborative Five-Year Strategic Plan

Table of Contents

Executive Summary.....	1
Background	3
Mission.....	4
Vision.....	4
Goals and strategies.....	4
Evaluation	4
Risks	5
Resources.....	5
Acronyms	5
Table 1. Logic model: To promote understanding of One Health antibiotic stewardship	6
Table 2. Logic model: To improve human antibiotic stewardship efforts	8
Table 3. Logic model: To improve animal stewardship efforts.....	10
Table 4. Logic model: To develop an antibiotic footprint and improve understanding of environmental considerations.....	11
Figure. Antibiotic footprint model	13
Table 5. Evaluation table.....	14
Contributors.....	15

One Health Minnesota Antibiotic Stewardship Collaborative
July 1, 2016

Executive Summary

Antibiotics are critical public health tools. However, widespread use of antibiotics has resulted in an alarming increase in antibiotic-resistant infections. Antibiotic stewardship is a One Health issue, affecting the health of humans, animals, and the environment. On January 19th, 2016, Minnesota held its first One Health Antibiotic Stewardship State Summit, an inter-agency effort from the Minnesota Department of Health, Department of Agriculture, Board of Animal Health, Pollution Control Agency and Department of Human Services. The summit discussion themes formed the foundation of a five-year Minnesota One Health Antibiotic Strategic Plan. After the meeting, technical workgroups were tasked with composing the strategic plan and obtaining partner concurrence.

The mission of the One Health Minnesota Antibiotic Stewardship Collaborative five-year plan is to provide a collaborative environment to promote judicious antibiotic use and stewardship and to reduce the impact of antibiotic resistant pathogens of human, animal, and environmental health importance. We hope that the One Health approach will create a public and professionals that are informed, and can communicate and achieve a more holistic approach to antibiotic stewardship. Intended audiences are comprised of a range of One Health partners: universities, human and animal health professional associations and boards, human healthcare systems/organizations including inpatient, outpatient, and long-term care (i.e. medicine, pharmacy, nursing, infection prevention and control), agriculture associations and cooperatives, human and animal pharmaceuticals, and relevant government bodies.

The plan consists of goals and strategies, an evaluation plan, and risks and resources to consider. Goals and strategic activities have been prioritized as follows (see *“Goals and Strategies”*):

1. To promote understanding of One Health antibiotic stewardship across disciplines
 - a. Activities focus on experience-sharing across practitioners in human, animal, and environmental health using online tools, active participatory learning, and team building.
2. To improve human antibiotic stewardship efforts
 - a. Activities focus on developing goals, a roadmap, and incentives for healthcare facilities to develop a stewardship program including support for the collection and use of prescribing data.
3. To improve animal antibiotic stewardship efforts
 - a. Activities focus on supporting existing activities such as participation in and communication of national antibiotic use data collection, support for producer quality certification programs, veterinary feed directive, diagnostic testing, and companion animal practice resources.
4. To develop an antibiotic footprint tool and improve understanding of environmental considerations
 - a. Activities focus on the development of a tool to describe antibiotic use and environmental loading and advocacy for environmentally-friendly antibiotic disposal.

Necessary resource inputs, short-term outcomes (i.e. 1-2 years), and long-term outcomes (i.e. 3-5 years) have been also described for each strategic activity (see *Tables 1-4 and Figure 1*).

To assess progress and improve implementation, the plan’s evaluation component details indicators, data sources, when the information will be collected, and who will collect the information (see *Table 5*). Potential risks could include challenges related to resources, collaboration, and research or data analysis. Resources to consider could include state funding, federal funding, private funding, shared organizational resources, student assistance, and existing literature.

We hope this plan will provide effective strategic direction on the issue of antibiotic stewardship and encourage collaboration across One Health partners. It is intended to be a ‘living’ document where progress is regularly reviewed by partners and the plan is amended as needed to improve implementation.

Background

Antibiotics are critical public health tools. However, widespread use of antibiotics has resulted in an alarming increase in antibiotic-resistant infections and therapeutic options for the treatment of bacterial infections are becoming increasingly limited, expensive and often more toxic. CDC has estimated that antibiotic-resistance bacteria causes 2 million illnesses in people and 23,000 deaths each year. Antibiotic resistance also affects the health of animals. The National Antimicrobial Resistance Monitoring System monitors antimicrobial resistance among bacteria isolated from food animals (i.e. chicken, turkey, swine, and cattle) as well as humans and retail meats. In 2013, approximately 29% of turkey, 18% of swine, 17% of beef, and 9% of chicken non-typhoidal *Salmonella* isolates were multi-drug resistant (i.e. resistant to 3 or more classes of antimicrobials). Antibiotics and antibiotic resistance genes are being detected in the environment. The U.S. Geological Survey and Minnesota Pollution Control Agency measured organic chemicals in groundwater underlying urbanized areas in Minnesota and found that the antibiotic sulfamethoxazole was the most frequently detected contaminant. Questions are being raised about individual antibiotic environmental fate or degradation, antibiotics' effect on the natural microbial community, and municipal wastewater treatment as one part of antibiotic resistance control.

In 2015, the US government released the National Action Plan for Combating Antibiotic-Resistant Bacteria to prevent the development and spread of resistant infections, increase surveillance efforts, develop new drugs and diagnostic tests, and promote international collaboration to prevent and control antibiotic resistance. In Minnesota, stakeholders recognized the need to come together and discuss a strategic direction forward to combat antibiotic resistance and promote antibiotic stewardship. The issue was approached with a One Health lens, acknowledging that the health of humans, animals, and the environment are interconnected and that stewardship should be a collaborative effort between multiple disciplines. On January 19th, 2016, Minnesota held its first One Health Antibiotic Stewardship State Summit, an inter-agency effort from the Minnesota Department of Health (MDH), Department of Agriculture (MDA), Board of Animal Health (BAH), Pollution Control Agency (MPCA), and Department of Human Services (DHS). Participants included leading university researchers and representatives from human and animal health professional associations and boards, human healthcare systems/organizations including inpatient, outpatient, and long-term care (i.e. medicine, pharmacy, nursing, infection prevention and control), agriculture associations and cooperatives, human and animal pharmaceuticals, and relevant government bodies. Meeting objectives aimed to share an overview of antibiotic use, stewardship, and resistance from the human, animal, and environmental perspective, share best practices and lessons learned, and discuss strategic priority activities, outcomes, necessary resources, and potential barriers that could inform a statewide strategic plan on antibiotic stewardship. After the summit, all meeting documents including small-group and individual notes were qualitatively coded and analyzed to describe stakeholder discussion themes. These discussion themes formed the foundation of the Minnesota One Health Antibiotic Strategic Plan.

Stakeholders who expressed interest during the summit were asked to serve on technical workgroups for the development of the strategic plan. Four technical workgroups were created for each of the plan's goals, composed of one chair and 8-15 members. These workgroups were tasked with drafting a strategic plan that would use the results of the summit discussion, encourage partner accord, and provide effective future strategic direction. To do this, a series of conference calls and in-person meetings were conducted. After this work, an initial draft of the plan was shared with key state leaders across human, animal, and environmental health to ensure that their feedback was also incorporated into the plan. The One Health Minnesota Antibiotic Stewardship Collaborative five-year plan consists of the following components: Mission, vision, goals and strategies, evaluation, risks, and resources.

Mission

Provide a collaborative environment to promote judicious antibiotic use and stewardship and to reduce the impact of antibiotic resistant pathogens of human, animal, and environmental health importance

Vision

Minnesota leaders in human, animal, and environment health will work together to raise awareness and change behaviors to preserve antibiotics and treat infections effectively

Goals and strategies

The plan can be divided into four goals. Strategic activities were prioritized for each of these goals:

1. To promote understanding of One Health antibiotic stewardship across disciplines
 - a. Share One Health targeted resources and current data through an online platform
 - b. Develop a One Health antibiotic stewardship communications plan
 - c. Develop a series of in-person One Health exchanges between human, animal, and environmental practitioners (e.g. Grand Rounds discussions)
 - d. Support public engagement on One Health antibiotic stewardship
 - e. Support One Health antibiotic stewardship curriculum
2. To improve human antibiotic stewardship efforts
 - a. Make tools to enable tracking of antibiotic use and other components of antibiotic stewardship available to healthcare entities across the continuum of care and lifespan
 - b. Determine support needed at healthcare facilities for tracking data, antibiotic benchmarking, and antibiotic use policies
 - c. Develop state human health antibiotic goals specific to syndromes and settings
 - d. Develop a tiered honor roll recognition system for healthcare facilities
3. To improve animal antibiotic stewardship efforts
 - a. Participate in and communicate progress on national antibiotic use data collection efforts for livestock
 - b. Support producer quality certification programs best practices
 - c. Support veterinary feed directive (VFD) and farmer/feed stores capacity-building
 - d. Support public engagement on animal antibiotic stewardship
 - e. Improve capacity of veterinary diagnostics laboratory (VDL)
 - f. Improve access to stewardship resources for companion animals and equine veterinarians
4. To develop an antibiotic footprint tool and improve understanding of environmental considerations
 - a. Develop a 'living' antibiotic footprint
 - b. Improve adherence to guidelines for disposal

Necessary resource inputs, short-term outcomes (i.e. 1-2 years), and long-term outcomes (i.e. 3-5 years) have been described for each strategic activity as seen in Tables 1-4 and Figure 1.

Evaluation

The goal of the plan's evaluation component is to assess progress and improve implementation and use of resources throughout the span of the strategic plan. Indicators, data sources, when the information will be collected, and who will collect the information has been described in Table 5. Progress reports compiling the status of the evaluation indicators as well as the success and challenges experienced with each of the strategic activities should be prepared quarterly and should be made public on the collaborative website. Workgroups will continue to meet quarterly to also review progress and adapt the plan accordingly.

Risks

During the life of the plan, risks should be assessed and solutions should accordingly be developed.

These following risks were discussed as challenges to be aware of during the plan's implementation:

- Resources: Lack of committed funding or high costs, lack of time and competing priorities, lack of committed personnel
- Collaboration: Inability to find consensus within and between silos or different opinions, lack of communication or process workflow, politics and vested interests, lack of leadership buy-in
- Research/Data analysis: Knowledge or data gaps, data privacy, confidentiality, quality, usefulness, complex measurements or outputs, lack of willingness to share data and experiences
- Other: Inability to maintain political will and inspire appetite for change, inability to reach all audiences, general population fear, overregulation stifles innovation

Resources

The plan will necessitate committed resources and funding to effectively implement the strategic activities. The following potential resources were discussed as ideas to explore and pursue:

- State funding: Inter-agency legislative proposal, legacy amendment fund, environment and natural resources trust fund, affordable care act and state innovation model
- Federal funding: Centers for Disease Control and Prevention, National Institutes of Health, National Science Foundation, Agency for Healthcare Research and Quality, Food and Drug Administration, United States Department of Agriculture
- Private funding: Industry, healthcare plans/systems, food corporations, foundations (e.g. McKnight, Joyce, Sloan and Robert Wood Johnson)
- Shared organizational resources: Subject matter experts, marketing, IT, logistics
- Professional societies/organizations: Minnesota health professional societies (e.g. Minnesota Medical Association and Minnesota Veterinary Medical Association), agricultural organizations (e.g. Minnesota Pork Producers, Minnesota Milk Producers Association, Minnesota Beef Council, etc.), other national associations (e.g. Infectious Diseases Society of America, Society of Infectious Disease Pharmacists, Society for Healthcare Epidemiology of America, American Veterinary Medical Association)
- Other: Student assistance (e.g. graduate level projects), existing data and literature

Acronyms

BAH: Board of Animal Health

CE: Continuing Education

DDD: Defined Daily Dose

DHS: Department of Human Services

DOT: Days of Therapy

FFA: Future Farmers of America

FIPCC: Foundations of Interprofessional
Communication and Collaboration

HEDIS: Healthcare Effectiveness Data and
Information Set

MDA: Minnesota Department of
Agriculture

MDH: Minnesota Department of Health

MPCA: Minnesota Pollution Control Agency

NHSN: National Healthcare Safety Network

PIPP: Provider Incentive Payment Program

QIIP: Quality Improvement Incentive Payment
Program

QIO: Quality Improvement Organization

TPT: Twin Cities Public Television

U of MN: University of Minnesota

VCPR: Veterinarian-Client-Patient Relationship

VDL: Veterinary Diagnostics Laboratory

VFD: Veterinary Feed Directive

Table 1. Logic model: To promote understanding of One Health antibiotic stewardship

Intended Audience: All public and professional groups active in human, animal, and environmental health

ONE HEALTH			
Strategic Activities	Resource Inputs	Short-term Outcomes (1-2 years)	Long-term Outcomes (3-5 years)
Share One Health targeted resources and current data through an online platform	<ul style="list-style-type: none"> - Coordinator to manage logistics - Website manager to support website changes and maintenance - Subject matter expertise 	Using the MDH platform, define site structure: <ul style="list-style-type: none"> - Who are you (target audience: Human clinicians, health systems, veterinary clinicians, producers and farmers, allied industry, environmental practitioners, laboratorians, public) - Consider <u>why</u> it is important to each group and <u>how</u> can they become involved: <ul style="list-style-type: none"> o About: Mission, history, partners o News o Prioritize current multidisciplinary data (antibiograms, trends of infections and prescribing, state and federal, animal sampling, environmental data) o Antibiotic footprint o Human, animal, environmental, public (including school-aged kids) audience-specific resources: Guidelines, action items, webinars, videos to tell stories, subject-area liaisons, cases, myth-busters o Contact and sign-up listserv - Pilot site using a survey to improve usability 	Collaborative site or one-stop shop with accessible repository and ability to connect stakeholders, promote coalition-building, advertise in-person meetings/webinars, and send regular update emails
Develop a One Health antibiotic stewardship communications plan	<ul style="list-style-type: none"> - Coordinator to manage logistics - Funding for in-person meetings - Website manager to assist with email updates 	Determine planned stakeholder engagement <ul style="list-style-type: none"> - Website listserv and regular email updates - Each year: two conference calls, one workgroup in-person, and one full group in-person meeting 	Coordinate the One Health antibiotic stewardship plan effectively and engage stakeholders accordingly
Develop a series of in-person One Health exchanges between human, animal, and	<ul style="list-style-type: none"> - Coordinator to manage logistics - Funding for exchange meetings - Subject matter expertise 	<ul style="list-style-type: none"> - Develop structure such as Grand Rounds-like at University of Minnesota (U of MN) medical school (series of cases), MDH, or at producer farms 	Educate stakeholders in animal/agriculture, human, and environment, and foster a common understanding

environmental practitioners (e.g. Grand Rounds discussions)		<ul style="list-style-type: none"> - To identify interested parties, could solicit limited number through listserv 	
Support public engagement on One Health antibiotic stewardship	<ul style="list-style-type: none"> - Coordinator to manage logistics - Funding for project ideas 	<ul style="list-style-type: none"> - Develop One Health antibiotic stewardship messages (leverage human-animal bond) - Host a video competition possibly during Get Smart about Antibiotics week (e.g. scenarios; could be at high school level or public) - Explore opportunities with Twin Cities Public Television (TPT) and other media. - Explore One Health education during specific months: June is Dairy Month, May is Beef Month, October is Pork month, and November is Turkey month - Explore opportunities with Carver County fairs, MN State Fair (eg. Miracle of Birth table, bring in pets, 4H, Future Farmers of America [FFA], MDH Health Fairs workshop) including media coverage of such events - Explore opportunities with local newspapers, hospital newsletters, online Mayo Patient Education Link, Patient Education Section Handout - Arrange a TED-like talk on the One Health perspective on antibiotic stewardship 	Public better understands One Health antibiotic stewardship concept
Support One Health antibiotic stewardship curriculum	<ul style="list-style-type: none"> - Coordinator to manage logistics - Subject matter expertise - Funding for course development 	<p>Develop core curriculum goals for:</p> <ul style="list-style-type: none"> - U of MN interprofessional health students first year course: Foundations of Interprofessional Communication and Collaboration (FIPCC) (i.e. 1 hour interactive class with small student groups) - U of MN grand challenges courses - Contact health professional organizations for the development of a 1-2 hour continuing education (CE) workshop on Antimicrobial 	Practitioners better understand One Health antibiotic stewardship concept

		<p>Stewardship (e.g. Stewardship 101 Moving Knowledge to Action). Participants could get recognition/ certification (basic, advanced or Levels I, II, III)</p> <ul style="list-style-type: none"> - Explore other curriculum additions for vet sciences 	
--	--	--	--

Table 2. Logic model: To improve human antibiotic stewardship efforts

Intended Audience: Human health care system, clinicians, pharmacists, and the public

HUMAN HEALTH			
Strategic Activities	Resource Inputs	Short-term Outcomes (1-2 years)	Long-term Outcomes (3-5 years)
Make tools for tracking of antibiotic use and other stewardship tools available to facilities across the continuum of care and lifespan	<ul style="list-style-type: none"> - Coordinator to manage logistics - Funding for website - IT support for website maintenance 	<ul style="list-style-type: none"> - Compile tools such as workflow algorithms including diagnostic testing (reference new rapid diagnostic assays), audit and feedback tools, and electronic decision support tools - Consider all settings across the continuum of care including dentistry and across the lifespan - Develop online platform for compiled tools - Review list of tools with stakeholders to ensure comprehensiveness and pilot website 	Facilities will have access to a usable online platform of tools that is regularly updated
Determine support needed at healthcare facilities for tracking data, antibiotic benchmarking and antibiotic use policies	<ul style="list-style-type: none"> - Student to lead survey - Funding for survey and subsequent support 	<ul style="list-style-type: none"> - Conduct a survey to assess antibiotic use policies, necessary capacity for data collection, National Healthcare Safety Network (NHSN) antibiotic use module, telemedicine antimicrobial stewardship programs, electronic medical record audit for antimicrobial stewardship, etc. 	Facilities will have the support needed to track antibiotic use and resistance data and implement stewardship throughout the state
Develop state human health antibiotic goals specific to syndromes and settings	<ul style="list-style-type: none"> - Funding for data access - Epidemiologist to develop and track goals including all related analyses - Subject matter expertise 	<ul style="list-style-type: none"> - Focus first on overall use (eg. broad-spectrum, carbapenems, fluoroquinolones) and then syndrome-specific appropriateness (i.e. Upper respiratory infection, bronchitis, urinary tract infection, asymptomatic bacteriuria) - Explore various data sources: 	Minnesota will have state antibiotic goals to benchmark and measure progress over time

		<ul style="list-style-type: none"> ○ Minnesota Community Measurement HEDIS measures ○ All-payers claims dataset, IMS Health ○ Nursing Homes Minimum Dataset 3.0 N0400 ○ Hospital pharmacies antibiotic utilization data and cost - Would need to adjust by case mix index (i.e. claims data by institution) to consider acuity and consider units (e.g. DDS, DOT) - Consider heat map, track data on website 	
Develop a tiered honor roll recognition system for healthcare facilities	<ul style="list-style-type: none"> - Coordinator to manage logistics - Funding for program implementation 	<ul style="list-style-type: none"> - Define tiered honor roll standards with existing standards - Frame advantages of recognition system <ul style="list-style-type: none"> ○ Antimicrobial stewardship as patient safety ○ Centers for Disease Control and Prevention: Healthcare-associated infection prevention stories from the states ○ Recognition by Health Professional Societies/Organizations - Consider regulatory requirements or financial incentives to participate or integrate with existing programs (e.g. QIO, QIIP, PIPP) - Provide roadmap/tools to achieve honor roll milestones - Provide subject-matter mentors (e.g. volunteer Infectious Disease physicians and pharmacists for complex cases) 	Facilities will be recognized for good stewardship to continue to improve standards

Table 3. Logic model: To improve animal stewardship efforts

Intended Audience: Animal healthcare, agriculture, public as it relates to awareness-raising

ANIMAL HEALTH			
Strategic Activities	Inputs	Short-term Outcomes (1-2 years)	Long-term Outcomes (3-5 years)
Participate in and communicate progress on national antibiotic use data collection efforts for livestock	<ul style="list-style-type: none"> - A coordinator to manage logistics - Consulting subject matter experts - Potentially funding for data source 	<ul style="list-style-type: none"> - Consult with U of MN researchers actively involved in this area to ensure appropriate integration of efforts - Follow available developments in measurements, methodology (eg. which antibiotics, by species, from who, etc.), and data sources (e.g. vet. hospitals, Animalytix, Farm Business Management program, etc.) - Participate as appropriate and communicate baseline benchmarks and progress - Review other case studies (e.g. Netherlands) 	National antibiotic use data and benchmarking progress is communicated
Support producer quality certification programs best practices	<ul style="list-style-type: none"> - A coordinator to manage logistics - Funding for meeting - Funding for website - IT support for website maintenance 	<ul style="list-style-type: none"> - Conduct a species-specific needs assessment to determine best practices for stewardship inclusion in quality certification programs <ul style="list-style-type: none"> o Interview active veterinarians in this area o Host a meeting with packers, sale barns, and other stakeholders working with producers to elicit their feedback (e.g. Central Livestock Association, American Food Group) - Compile species-specific program information, best practices and educational tools on a common website 	Increased compliance with best stewardship practices part of quality certification programs
Support veterinary feed directive (VFD) and farmer/feed stores capacity-building	<ul style="list-style-type: none"> - A coordinator to manage logistics - Funding for website - IT support for website maintenance 	<ul style="list-style-type: none"> - Compile existing key VFD factsheets and Veterinarian-Client-Patient Relationship (VCPR) definitions on a common website - Use VFD information in public myth-buster awareness campaign 	Improved communication and access to resources regarding VFD implementation
Support public engagement on animal antibiotic stewardship	<ul style="list-style-type: none"> - A coordinator to manage logistics - Consulting subject matter experts 	<ul style="list-style-type: none"> - Develop myth-busters factsheet (consider human-animal bond, VFD, etc) 	Improved public understanding surrounding One Health antibiotic stewardship concept

Improve capacity of veterinary diagnostics laboratory (VDL)	<ul style="list-style-type: none"> - Funding to subsidize laboratory capacity 	<ul style="list-style-type: none"> - Advocate for increased state support behind the VDL (subsidized culture and sensitivity test; hired veterinary microbiologist; potential U of MN project evaluating diagnostic accuracy of delayed culture “send-out” compared to direct plating; VDL testing to speed up time to sample processing/plating) 	Improved VDL capacity to support stewardship decisions
Improve access to stewardship resources for companion animals and equine veterinarians	<ul style="list-style-type: none"> - A coordinator to manage logistics - Funding for website - IT support for website maintenance 	<ul style="list-style-type: none"> - Compile stewardship resources on a common website and direct veterinarians to these resources via Minnesota Veterinary Medical Association 	Improved veterinary access to stewardship resources across the state

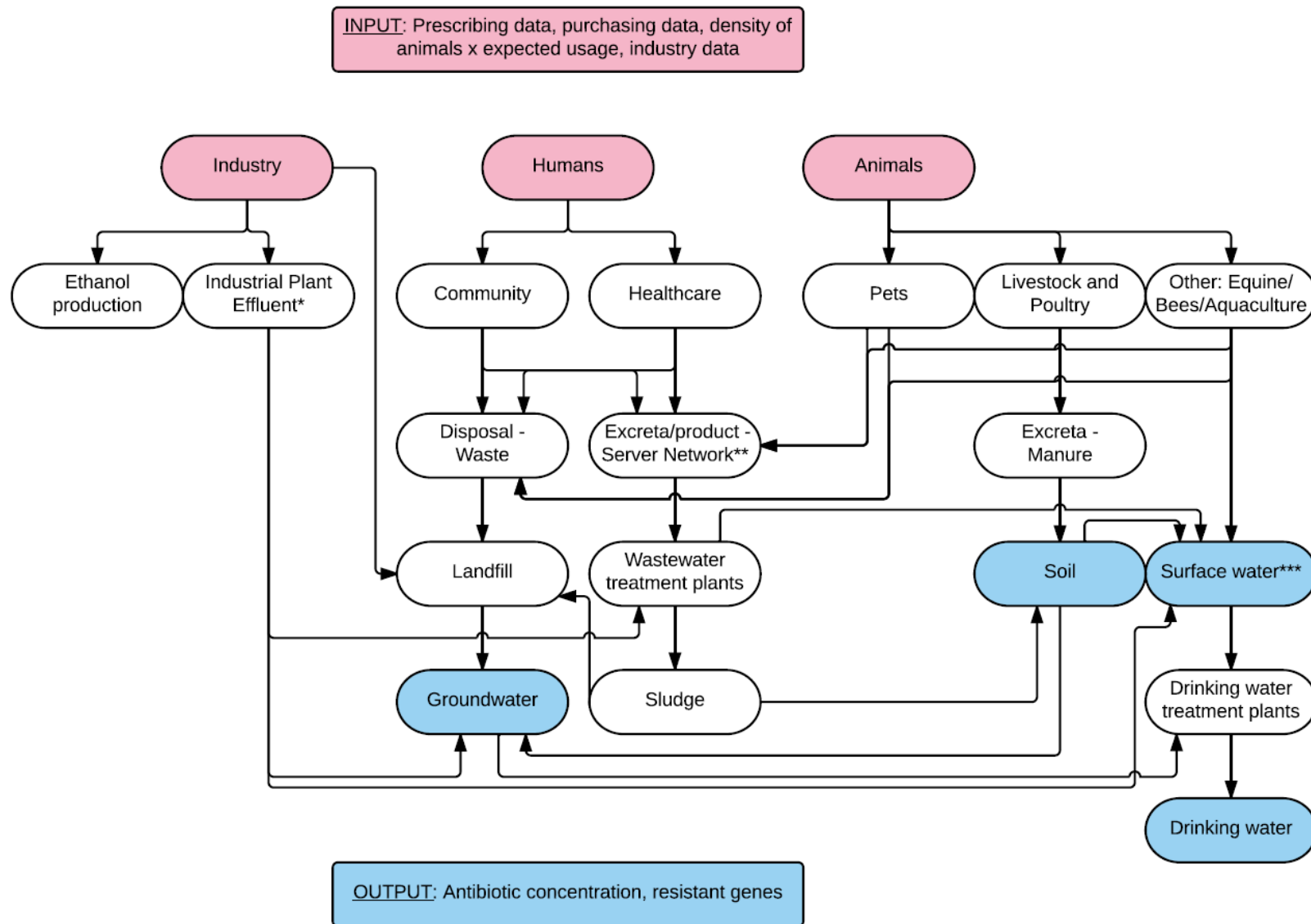
Table 4. Logic model: To develop an antibiotic footprint and improve understanding of environmental considerations

Intended Audience: All public and professional groups active in human, animal, and environmental health

ANTIBIOTIC FOOT PRINT AND ENVIRONMENTAL CONSIDERATIONS			
Strategic Activities	Resource Inputs	Short-term Outcomes (1-2 years)	Long-term Outcomes (3-5 years)
Develop a ‘living’ antibiotic footprint tool	<ul style="list-style-type: none"> - A coordinator to manage logistics - Consulting subject matter experts - Research funding, investigators, statisticians/modelers - Funding for data source 	<ul style="list-style-type: none"> - Adjust goal as needed: ‘To communicate magnitude of antibiotic usage and environmental loading to inform providers and the public’ - Convene group every other month to quarterly to iteratively: <ul style="list-style-type: none"> o Complete final draft of flow chart (see Figure below) o Determine: <ul style="list-style-type: none"> ▪ Definition: Magnitude of antibiotic usage and environmental loading/degradation via the antibiotic life cycle ▪ Measurements: Days of human antibiotic therapy, concentrations of antibiotics (mg, gm, mcg/L), Density of 	Populate and disseminate antibiotic footprint tools; Have ‘antibiotic footprint’ term recognizable to allow for stakeholders to understand the impact of their choices

		<p>animals times expected usage, industry data (possibly resistant genes), etc.</p> <ul style="list-style-type: none"> ▪ Data Sources: Existing literature, prescribing data and/or purchasing data (e.g. Premier, UHC, etc.), environmental data, predictive modeling, state permits, Department of Commerce and United States Geographical Survey, etc. ▪ Methods: Input-output analysis, selected drugs (eg. fluoroquinolones, cephalosporins, sulfonamides, tetracyclines) <ul style="list-style-type: none"> ○ Consider scorecard including footprint markers among others for clinician use (i.e. stoplight – red, yellow, green) ○ Consider geosentinel predicted mapping for policy-making use and general public 	
Improve adherence to guidelines for disposal	<ul style="list-style-type: none"> - A coordinator to manage logistics - Funding for website - IT support for website maintenance 	<ul style="list-style-type: none"> - Compile disposal guidelines on a common website - Advocate for policy in support of increased pharmacy take-back programs and disposal instructions on medication containers 	Promote improved disposal practices

Figure. Antibiotic footprint model



*Industrial plants could include pharmaceuticals or manufacturers that use antibacterials in their products.

**Some homes have their own septic systems. Most have drain fields but well-maintained systems shouldn't affect ground water and surface water. Sludge from the tanks should be pumped out every 2-4 years and taken to a waste water treatment plant or land applied following permit guidelines.

*** In some regions in Minnesota, surface water drains freely to groundwater.

Table 5. Evaluation table

Activities	Indicators	Data Sources	When	Who
Create online platform	Number of suggestions implemented to improve website from initial pilot	Website pilot survey (developed listserv)	Year 1-2	Website manager
	Number of additions or changes made to website to maintain content	Planning records	Annually (Years 1-5)	Website manager
	Number of emails sent to listserv and opened to engage stakeholders in website content	GovDelivery analytics	Annually (Years 1-5)	Website manager
	Number of core organizations offering support and recognized on website	Planning records	Annually (Years 1-5)	Website manager
	Number of other websites that link to our site as a resource	Google analytics or social media metrics	Annually (Years 1-5)	Website manager
	Number of website or social media hits	Google analytics or social media metrics	Annually (Years 1-5)	Website manager
Develop a One Health antibiotic stewardship communications plan	Number of stakeholders (and disciplines represented) signed up to listserv that receive communications	Planning records	Annually (Years 1-5)	Plan coordinator
	Proportion of invited stakeholders who participate in the arranged conference calls	Planning records	Annually (Years 1-5)	Plan coordinator
	Proportion of invited stakeholders who participate in the in-person meetings	Planning records	Annually (Years 1-5)	Plan coordinator
Develop a series of traveling One Health field trip exchanges and discussions between human, animal, and environmental practitioners	Number of exchange events held	Planning records	Annually (Years 1-5)	Plan coordinator
	Number of participants (and disciplines represented) attending event	Planning records	Annually (Years 1-5)	Plan coordinator
	Number of meeting evaluation responses elicited from participants	Planning records	Annually (Years 1-5)	Plan coordinator
	Average ratings of meeting on evaluation forms received	Planning records	Annually (Years 1-5)	Plan coordinator
Support public engagement on One Health antibiotic stewardship	Number of videos submitted to Get Smart competition	Planning records	Year 1-2	Plan coordinator
	Number of viewers watching prepared educational videos	Planning records	Annually (Years 1-5)	Plan coordinator
	Number of participants at educational events	Planning records	Annually (Years 1-5)	Plan coordinator

	Number of publications that cover antimicrobial stewardship in local media	Planning records	Annually (Years 1-5)	Plan coordinator
Support One Health antibiotic stewardship curriculum	Number of key stewardship messages identified for curriculums	Planning records	Annually (Years 1-5)	Plan coordinator
	Number of courses that begin to implement some stewardship content	Planning records	Annually (Years 1-5)	Plan coordinator
Determine support needed at healthcare facilities for tracking data and implementing stewardship	Number of facilities who participate in survey	Survey records	Year 1-2	Student researcher
	Number of facilities who use audit tools	Survey records	Year 1-2	Student researcher
	Number of changes resulting from the survey	Survey records	Year 1-2	Student researcher
Develop state human health antibiotic goals specific to syndromes and settings	Data access is obtained and benchmarking methodology is described	Planning records	Year 1	Plan coordinator
	Percent change in benchmark from baseline to target goal	Identified benchmark data source	Annually (Years 2-5)	Plan coordinator
Develop a tiered honor roll recognition system for healthcare facilities	Number of facilities participating in honor roll program	Planning records	Annually (Years 1-5)	Plan coordinator
	Number of facilities meeting top tier of honor roll program	Planning records	Annually (Years 1-5)	Plan coordinator
Participate in and communicate progress on national antibiotic use data collection efforts for livestock	Number of communication updates/materials given on status on antibiotic use data collection efforts	Planning records	Annually (Years 1-5)	Plan coordinator
Support producer quality certification programs and audit best practices	Number of participants at meeting with packers, sale barns, etc.	Meeting evaluation form	Year 2	Plan coordinator
	Average ratings of meeting on evaluation forms received	Meeting evaluation form	Year 2	Plan coordinator
Support public engagement on animal antibiotic stewardship	Number of times myth-busters factsheet is disseminated	Planning records	Annually (Years 1-5)	Plan coordinator
Improve capacity of Veterinary Diagnostics Laboratory (VDL)	Increased funding amount received by VDL	Budget records	Year 3 and Year 5	Plan coordinator
Develop a 'living' antibiotic footprint	Written editorial about initial idea	Planning records; Publication source	Year 1	Coauthors

	Number of drugs modeled through the flowchart	Planning records; identified data sources	Annually (Years 1-5)	Coordinator
	Acquisition of at least one research grant	Planning records; grant documentation	Year 1-2	Investigators
	Number of channels where the footprint tools are disseminated	Planning records	Year 3-5	Coordinator
Advocate for policy in support of increased pharmacy take-back programs and disposal instructions on medication containers	Number of policy review and recommendations produced	Planning records	Year 4-5	Coordinator

Contributors

Thank you to the large number of contributors that were involved with the development of the plan. Workgroups member affiliations included:

Abbott Northwestern Hospital

Allina Health

Association for Professionals in Infection Control and Epidemiology - Minnesota

Blue Cross Blue Shield

Children’s Hospital and Clinics of Minnesota

Emergency Physicians Professional Association - Minnesota

HealthEast

HealthPartners

Hennepin County Medical Center

Land O’Lakes

Leading Age Minnesota

M Health

Mayo Clinic

Merck Research Labs

Metropolitan Council

Minnesota Association of Physician Assistants

Minnesota Beef Council

Minnesota Board of Animal Health

Minnesota Board of Medical Practice

Minnesota Board of Veterinary Medicine

Minnesota Department of Agriculture

Minnesota Department of Health

Minnesota Farm Bureau
Minnesota Farmers Union
Minnesota Hospital Association
Minnesota Medical Association
Minnesota Milk Producers Association
Minnesota Nurse Practitioners
Minnesota Pollution Control Agency
Minnesota Pork Board
Minnesota State Cattlemen's Association
Minnesota Turkey Growers Association
North Dakota State University
Park Nicollet
Regions Hospital
Sanford Health
St. Paul Infectious Disease Associates, Ltd.
Stratis Health
University of Minnesota
University of St. Thomas
US Geographical Survey
Veterans Affairs Healthcare System
Zoetis Animal Health