

## REPORT OF THE USAHA/AAVLD COMMITTEE ON ANIMAL HEALTH SURVEILLANCE AND INFORMATION SYSTEMS

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The Committee met on October 11, 2009 at the Town and Country Hotel, San Diego, Calif., from 12:30 p.m. to 5:30 p.m. Drs. Case and Elvinger introduced the topics to be presented and announced one business item to be addressed during the business session regarding the formation of a National Animal Health Surveillance System (NAHSS) subcommittee as a successor committee to the former NAHSS Steering Committee.

One Time-Specific Paper was presented by Dr. John Huntley, State Veterinarian of New York, and Kathleen Finerty, New York State Cattle Health Assurance Program (NYSCHAP) coordinator, entitled "The New York State Cattle Health Assurance Program and Animal Health Information Environment, Towards Informed Animal Health." The paper in its entirety is included at the end of this report.

Dr. Sarah Tomlinson, National Surveillance Unit (NSU), USDA-APHIS-VS Centers for Epidemiology and Animal Health (CEAH), presented the State of the National Animal Health Surveillance System (NAHSS). The NAHSS is in its fifth year. In 2004, the NAHSS Steering Committee was formed, the NAHSS strategic plan was written and Veterinary Services' National Surveillance Unit (NSU) was created. The NAHSS strategic plan and its twelve guiding objectives served as the means to illustrate the progress of the NAHSS. These accomplishments cannot be attributed to NSU or VS alone, instead to the NAHSS partnerships and alliances that have been developed.

Some of the major accomplishments of the NAHSS include: Coordination and collaboration on the design and implementation of surveillance, including the establishment and multiple examples of successful application of the surveillance development process; development of and international collaboration on surveillance standards; initiating changes in the VS data management system that reflect a comprehensive surveillance approach; establishment and maintenance of an animal health surveillance inventory; improved collaboration with Federal, State and International partners for sharing surveillance information; enhancement of surveillance reporting systems such as the National Animal Health Reporting System (NAHRS) and development of routine surveillance reports to inform decision-making; collaboration with industry, States, and universities on animal disease education efforts; and surveillance methods development for planning and analysis.

Looking forward, surveillance is one of the focuses of VS' 2015 vision. The Surveillance for Action working group will use the foundations of the NAHSS to form specific action plans to implement some of the components. Further, the comprehensive and integrated surveillance approach will continue to progress, using the success of the comprehensive swine surveillance as the model to follow.

Dr. Willeberg commented that international programs within the OIE should all make their surveillance databases available for aggregate studies. The national ownership of the data is one of the reasons that is given for the lack of participation. While the current disease data are available for viewing, they are not in a format that is amenable for easy integration into analytical tools that might be used to provide added value. Current member countries cannot, without effort, retrieve data for their own countries. Dr. Weber mentioned that there are efforts to streamline surveillance guidelines between NAHSS and the OIE. The impression from Dr. Willeberg as a former chief veterinary office (CVO) is that to get data from other countries, you would have to get permission from those CVOs. However, the World Animal Health Information Database (WAHID) system provides a large amount of standard tables, but these data are

not available in a downloadable format. The amount of effort to extract these data could be reduced if a standard download format were provided.

Dr. Stan Bruntz, NSU, USDA-APHIS-VS-CEAH presented the National Animal Health Reporting System (NAHRS) 2008/09 update. The NAHRS Steering Committee met September 16-18, 2009 in Fort Collins, CO. The following issues were discussed and were brought forward to the full committee: Participation—as of September 2009, forty-six States are currently reporting to NAHRS. NAHRS information continues to be an important source of information used by Veterinary Services to complete U.S. animal disease status reports for the World Organization for Animal Health (OIE). NAHRS Steering Committee Membership changes include: Dr. Jim Logan, Wyoming State Veterinarian will be the Small Ruminant Working Group representative; Dr. Bruce Stewart-Brown, Perdue Farms, Poultry Working Group representative; Dr. Flint Taylor, Western Region National Assembly of State Animal Health Officials (NASAHO) representative; and Dr. Josie-Traub Dargatz, Colorado State University, will replace Dr. Tim Cordes as Equine Working Group representative. The committee will look at filling the North Central, NASAHO representative, the cattle commodity representative, and the NPIP representative positions. The 2008 NAHRS Annual Summary Report included resource information on OIE listed diseases and an overview of National Animal Health Surveillance System (NAHSS) surveillance activities in the United States. The expansion of NAHRS aquaculture reporting moved forward with all OIE aquaculture diseases being included on the 2009 NAHRS reports. Dr. Heidel, the Aquaculture Working Group, and NSU are currently working on NAHRS aquaculture disease reporting criteria. NAHRS On-line Reporting Tool, version 2, had about 6 weeks when it was down in July/August due to security downloads that caused a glitch in the system. VS security downloads and requirements have been an issue and a source of frustration for NAHRS participants, which is set for release in November 2007. The NAHRS Steering Committee discussed the possibility of NAHRS being included in the VS AHMS Cooperative Agreement process—all members agreed that States should gain credit for general surveillance and FAD surveillance through participation in NAHRS. It was also reported that OIE changes in 2009 included removing malignant catarrhal fever from the OIE list and adding of Epizootic hemorrhagic disease (EHD).

The NAHRS Steering Committee meeting concentrated on the response to 2008 USAHA Resolution # 10, on the development of a United States National List of Reportable Animal Diseases (NLRAD). The NAHRS Steering Committee in conjunction with the VS CEAH National Surveillance Unit has developed a NLRAD overview paper and proposed NLRAD. This proposed NLRAD list and white paper will be routed through the Veterinary Services Management Team (VSMT), NASAHO, commodity groups, and other stake holders in 2009- early 2010. The goal is to bring the proposed list to the 2010 USAHA meeting for approval.

Following the time specific paper a report was given on the National Animal Health Information Technology Board (NAHITB) Roadmap report by John Picanso, USDA-APHIS-VS. He provided an overview of the current technology efforts underway at APHIS-VS as well as an overview of the technology roadmap for VS. He emphasized the IT Execution strategy that centers around 5 initiatives; data acquisition and exchange, security, software services and delivery, governance, and modernization of legacy IT applications.

Data acquisition – the emphasis in this area is in mobile information management (MIM) to get devices closer to the data acquisition site. The initial results show that there is nearly a break even between the cost of the technology and a team of data collectors, but the improvement of data quality makes the benefits much higher. A national implementation strategy has been developed for MIM as well as R&D and training as well as 3rd party integration of these tools. The future is to develop more of the applications that are accessible on MIM devices. About 332,000 activities have been performed on these devices in the last year.

Future tasks include integration with VS Laboratory Submission (VSLS), APHIS wildlife surveillance and exploring hardware solutions for animal side data collection and management. Enterprise messaging is another area of emphasis and they have developed a VS surveillance message schema that will be available for users to review and implement in the near future. Web services, terminology standards are also being supported. A commercial enterprise services bus has been purchased and is being implemented within VS.

Security – recent moves by the DHS to increase the number of cybersecurity experts will impact the security levels that will need to be adhered to by VS systems. There will be much more stringent security

required for any interconnecting system with VS. Most of this initiative is in progress due to the recent expansion of security requirements.

Software services and delivery – Activities include an enterprise reporting strategy and the leveraging of enterprise services to accomplish a shared environment. The security aspect of this has been accomplished to meet the new security requirements. Mr. Picanso gave an example of the National Veterinary Logistics Systems Project. The information technology aspect of this is a modified commercial off-the-shelf product that meets the majority of the needs to manage the project. The Emergency Management Response System (EMRS) is still being used to manage significant disease outbreaks in a number of states. Although there are concerns about performance and functions of EMRS, it is still providing services that there are not currently resources to replace. EMRS training was performed in a number of states for both technical and emergency management personnel. VSPS for health certification was utilized in 33 states over the past year for generation and all of the US was involved in the destination of animal movement. Nearly 2.74 million certificates were issued through the system in FY 2008-09. A new release of the standard premises registration system with revised geospatial functions is being developed. The central functions of animal traceability are approximately 90%. Currently 534,000 premises registered.

Governance – Internal to VS and not presented

Modernize Legacy IT systems – this is the most challenging area due to the limited resources available to do the necessary foundational work. A substantial effort is required to address the new accreditation requirements that will go into effect in January 2010. A number of specific legacy systems that are being evaluated for updating were discussed. Finally, a qualitative summary of the status of the 5 initiatives was presented showing the current status of each.

Dr. Leah Estberg, NSU, USDA-APHIS-VS-CEAH provided an update on the current status of the National Animal Health Laboratory Network (NAHLN). The Laboratory Registry and Reporting system functionality is currently in production (live) in the NAHLN IT system. Labs recorded in the Lab Registry are able to report test results electronically. They are able to send the results using Health Level Seven (HL7) messages. HL7 standardized messages support a high level of data quality that enables useful, automated processing of information exchanged directly between Laboratory Information Management Systems (LIMS) and the NAHLN IT system. This data quality is also improved by standardizing the terminology used to communicate specimen type, animal taxonomy, test performed, etc. with SNOMED, LOINC and HL7 terminology standards. The NAHLN IT system receives the results messaged, routes them to the VS Laboratory Submission (VSLS) IT system, stores them, and makes them accessible for viewing online by the lab that sent the message. As of October 1, 2009 a total of 10 labs had messaged 2,392 CSF results and a total of 8 labs had messaged 3,142 wild bird AI results.

Mr. Joe Mlakar Center for Animal Health Information and Analysis (CAHIA), USDA-APHIS-VS-CEAH presented efforts of the CAHIA to generate the Emerging Disease Identification Plan and described the process used by CEAH for identifying emerging animal diseases. Specifically, he spoke on motivation, objectives, criteria for defining emerging diseases, data sources, analysis methods, means of communication, and how CEAH intends to evolve its process of identifying emerging diseases and communicating its findings in the future.

He also described a pilot project with the objective of developing methods for weekly monitoring of abattoir condemnation data in order to identify emerging animal diseases or unusual changes in condemnation rates over time. Data sources for these projects include: Argus – open source data mining for animal health related events; ProMed; OIE reports; eADRS – electronic Animal disposition reporting system from FSIS; EMRS; LEMIS – law enforcement MIS; and atlases for import/export trends.

Dr. Mo Salman (Colorado State University) presented some statistical methodologies to assess options in reviewing control measures using surveillance data. An understanding of the sensitivity and specificity of surveillance data is crucial. Application of the appropriate statistical techniques is important and an evaluation of the available techniques was performed and examples were provided. Example data were FSIS data for national PRV surveillance, like slaughter samples for serology as well as random meat juice samples from slaughtered swine. Six statistical assessment method types were discussed. The important consideration was that there was a good understanding of the source data in order to make

informed decisions on which statistical methods are both best suited to the type of data and the desired outcomes of the analysis.

Dr. Andres Perez, University of California, Davis presented progress, current uses and future developments of the BioPortal project as well as some recent enhancements and expansion of disease coverage. Access to the Foot and Mouth Disease Bioportal website is open to the public (with registration) and may be accessed from <http://fmdbiportal.ucdavis.edu/>.

Dr. Todd Behre, National Animal Health Policy & Programs, USDA-APHIS-VS, presented USDA's National Veterinary Accreditation Program, the soon-to-be implemented changes, and relevance and applications to surveillance.

The National Veterinarian Accreditation Program (NVAP) oversees the activities of 71,000 veterinarians in the nation who provide regulatory duties for United States Department of Agriculture (USDA). Accredited veterinarians examine and certify the health status of hundreds of millions of animals moving in domestic and international commerce every year. APHIS' mission to "Safeguard Animal Health", thus ensuring a plentiful and safe food supply for our citizens, would not be possible without NVAP's leveraging of accredited veterinarians' expertise and roles in the communities they serve.

APHIS anticipates the publication regulations this Fall which will substantially change the business processes of the program, creating greater educational opportunities for accredited veterinarians. The regulation was conceived through the collective efforts of several national and international organizations, and is specifically aligned with ensuring the credibility of the world in NVAP's work.

From the proposed rule in 2006: "We are proposing these changes in order to support the Agency's animal health safeguarding initiatives, to involve accredited veterinarians in integrated surveillance activities, and to make the provisions governing our National Veterinary Accreditation Program more uniform and consistent. These proposed changes would increase the level of training and skill of accredited veterinarians in the areas of disease prevention and preparedness for animal health emergencies in the United States."

Dr. Behre presented the most recent updates to the National Veterinary Accreditation Program. There are 71,000 accredited veterinarians. Only 20,225 are working on food and fiber species. The initiative is aimed at improving the knowledge of accredited veterinarians in order to better prepare for emergency detection and response. Needs include time allotted in the curriculum, appointment of regulatory instructors, teaching materials and continuing education. A number of web based modules have been created to provide education to the existing accredited veterinarian base. Many of the new rules may result in a number of accredited veterinarians dropping out of the program.

### **Committee Business**

The committee meeting concluded with the Committee Business session in which two items were discussed.

Dr. Willeberg requested that the Committee consider action regarding the current disease data from OIE that are available for viewing, but not in a format that is amenable for easy integration into analytical tools that might be used to provide added value. Current member countries cannot, without effort, retrieve data for their own countries. The committee decided to develop this over the next year.

The second item involved the folding of the former VS sponsored and appointed National Animal Health Surveillance System committee into a USAHA Committee subcommittee. Drs. François Elvinger and Sarah Tomlinson informed the audience about history, charge, and functions of the former Steering committee. The original committee was formed as a result of the 2001 safeguarding review recommendation that stated a steering committee be formed to provide guidance, priorities, feedback and evaluation to the NSS. The review also recommended that a surveillance director position be established. The committee was formed in 2004 to satisfy a charge based on the safeguarding review. Dr. Elvinger reviewed the charge and functions of the committee. The strategic plan that was established was presented by Dr. Tomlinson in her earlier presentation. He summarized the makeup of the group and their actions in the early years of their existence. With the renewed enforcement of the Federal Advisory Committee Act (FACA) the charge of the committee and its functions were rewritten to remove any consensus guidance roles in order to comply with the law. This removed a large amount of the effectiveness of the committee. Thus it was proposed that this committee be moved to become a subcommittee of the AHSISC, which would allow it to fulfill the initial functions and be an advocate for

NAHSS through the USAHA resolution process. The discussed subcommittee is to take over the function of the former steering committee. It has support from CEAH and makes sense given the advancements that have taken place within the NSS. An alternative considered and rejected was the creation of a new separate USAHA/AAVLD Committee. There is a need to make sure that the makeup of the committee be the same representation as on the original steering committee. During discussion a question was raised as to whether there was a precedent for this type of committee? Indeed the Animal Health Emergency Management Committee went through the same proposed process, as also the NAHLN steering committee was rolled up under this type of structure. Further discussion involved the committee's involvement with the VS Vision 2015 Surveillance for Action workgroup and it was suggested to keep as close as possible contact to the vision process. Combining the current NAHRS Steering committee with the newly proposed subcommittee was suggested but at this time decided to be kept separate as it is working well to date and fulfills very specific functions.

The Committee had a quorum of 11 members present, a motion was proposed, seconded and positively voted on to form a National Animal Health Surveillance Systems subcommittee of the USAHA / AAVLD joint Animal Health Surveillance and Information Systems committee.

**New York State Cattle Health Assurance Program and  
Animal Health Information Environment  
Towards Informed Animal Health**

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**Introduction**

Animal health information systems are essential to meet the present and future needs of the animal agricultural industry. The increased speed of commerce and the reduced emphasis on traditional disease control programs challenge current methods of managing population level animal health. New York State has considered the requirements of an animal health information system that will support population animal health in today's environment. This strategic planning effort has identified five principles of a successful animal health information system. Those principles are:

1. Data acquisition must be designed to maintain transaction accuracy, ease of use and the speed of commerce. Data acquisition is often the limiting factor in realizing the full potential of animal health information systems today.
2. The system must support day-to-day decision making at all levels of the production continuum. These decisions support on-farm health, preharvest food safety goals, and state or national population animal health goals. A system designed only for emergency animal health events will likely fail when it is needed.
3. A successful system must integrate data from key sources using common, standardized definitions and business rules.
4. Analytical tools must support effective and efficient epidemiologic activities, including tracing, trending, spatial analysis and outbreak mapping. These tools should also help define and track the extent (spatial and temporal) and the quality of the data collected.
5. The implementation of a capable, extensible system as the foundation for more strategic goals ensures current success and permits evolution to meet future needs.

In response to these requirements, New York State has established, over the past 10 years, three integrated and mutually supporting animal health information applications within the New York Animal Health Information Environment (Fig 1). In addition, the voluntary New York State Cattle Health Assurance Program (NYSCHAP) provides a framework in which weak, vulnerable or problem areas on a production unit may be identified and addressed through the implementation of a farm specific herd plan.

Determining and mitigating animal health risks on farms will support animal health in state or national animal populations. The New York Animal Health Information Environment was designed to assist producers in meeting their animal health and production goals. These efforts also support collective state and national animal health goals.

**Objective:**

The objectives of the New York Animal Health Information Environment are:

- Move towards a web based, immediately accessible core database to underpin more advanced goals.
- Integrate key data representing the state of animal health in New York's animal populations to allow analyses across programs.
- Inform animal health and production management decisions on the farm.
- Manage the information necessary to support state and national animal health programs.
- Achieve collective recognition and benefits associated with managed animal health risks.
- Better characterize the determinants of animal health and production on the farm.

- Provide a framework for effective emergency response to animal health events.
- Provide a platform to leverage the benefits of technology to support animal health and production goals on the farm and as part of state and national programs.

### **Design:**

The system framework consists of voluntary and mandatory elements that support the acquisition and analysis of animal health and production data. The New York Animal Health Information Management Environment is supported by three relational databases that store data and relationships on farm demographics, operational characteristics including production and health parameters, and individual and pooled diagnostic data. Information gathered from these transactional databases is integrated within a data warehouse for trending and aggregate level analysis. Common data definitions are enforced to minimize translational activities at interfaces as data moves from one platform to the other. Data security is assigned according to user type and role and is managed through the lightweight directory access protocol (LDAP).

### **Sample Population:**

New York State continues to maintain its position as the third largest dairy production state in the nation. All New York producers are participants in the New York Animal Health Information System core programs. NYSCHAP is a voluntary program consisting of a subset of New York State dairy and beef producers. Dairy NYSCHAP participants account for 14% of the total herds and 35% of the dairy cows (1) in the State.

### **Methods:**

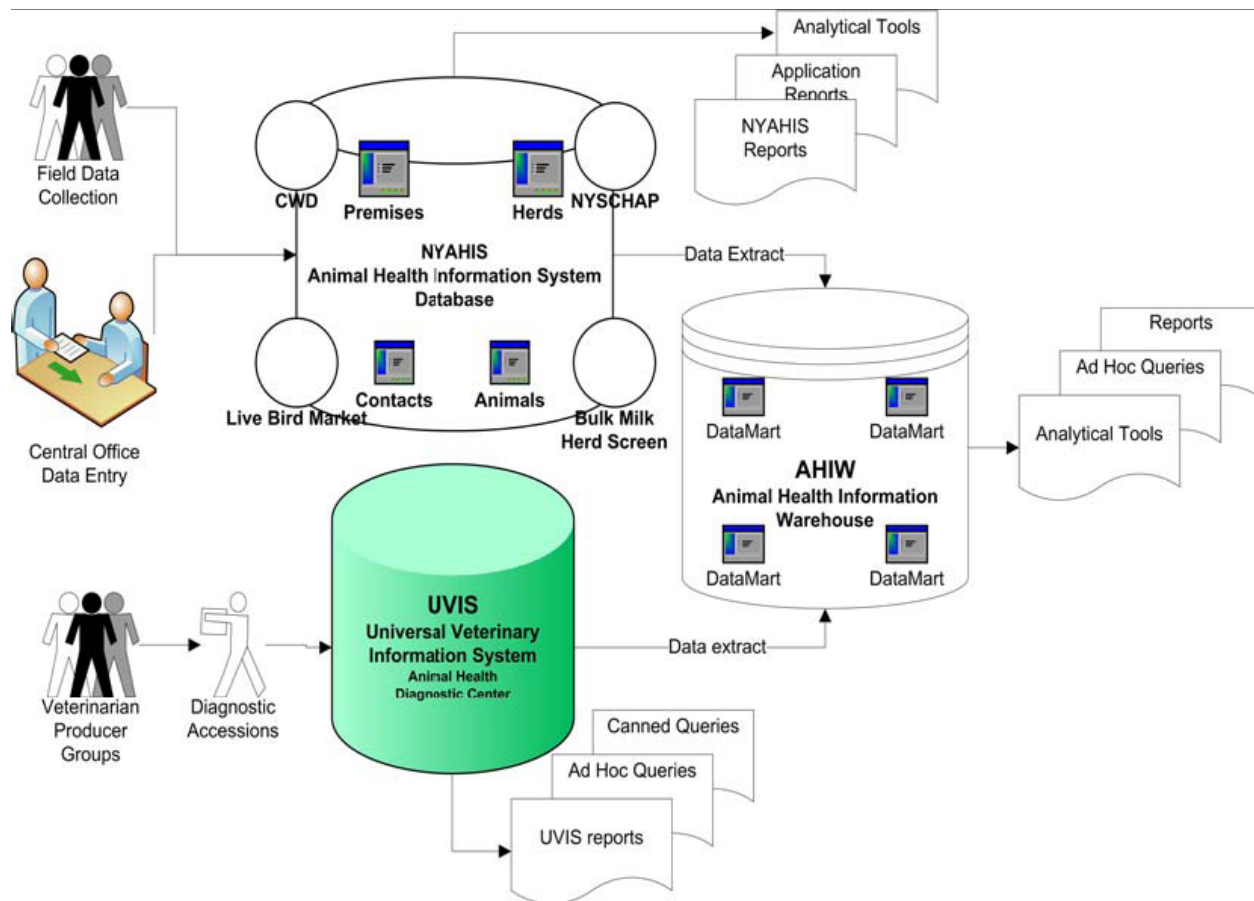
#### **Components: New York State Animal Health Information Management Environment.**

The New York State Animal Health Information Management Environment (Fig 1) is composed of four major elements representing four distinct information levels.

- **New York Animal Health Information System (NYAHIS)** : Statewide comprehensive animal health information management, reports and epidemiological tools
- **Universal Veterinary Information System (UVIS)** : Diagnostic laboratory information management and reporting
- **New York State Cattle Health Assurance Program (NYSCHAP)** : Producer health and production information management application within NYAHIS
- **Animal Health Information Warehouse (AHIW)** : Animal health information integration, analysis, and epidemiological tools

The integrated package of animal health information system tools was developed to meet current and future needs for the maintenance of population animal health and program status.

### **Fig 1 Components of the New York Animal Health Information Management Environment**



The development and function of each element is described below:

1) **New York Animal Health Information System (NYAHIS) - Statewide comprehensive animal health data management:** NYAHIS is the statewide core animal health information system. It is a web-based Oracle 10g relational database maintained by Trace First Ltd that informs management in support of collective animal health activities, including animal disease tracking, epidemiology, animal movement, and farm contact information. It also supports program level decisions and analysis. The information is used to establish priority of effort, efficient use of resources, and the identification of high risk populations. Core activities within NYAHIS include:

**Premises and Demographic Data:** Premises and herd data, contact information, location, and general farm operation information serves as the backbone of the New York animal health information system. This information is established and maintained through the combined efforts of producer groups, veterinarians, and animal health officials. The enforcement of well established business rules surrounding this core information establishes valid relationships between animals, herds, premises and animal program status and ensures data integrity. An important feature of the premises data of the NYAHIS is that it complements the requirements of the national premises registration system.

**Herd Data:** NYAHIS supports the collection and management of herd level data. Disease certification program and quality assurance program status is validated using herd level data.

**Individual Animal Data:** Animal level data supports movement analysis, individual animal health status, trace functions, and the generation of a virtual exposure cohort.

**Passive Data Collection:** New York State recognizes that a critical and limiting feature of the expanded use of electronic information systems and tools is data acquisition, especially at the individual animal or transaction level. Efforts continue to improve individual animal data acquisition without placing a burden on the production manager. Several solutions to improve individual animal level data acquisition have been developed. Passive data capture systems are those that do not require operator action to

collect data. Such systems have been developed for the cervid and live bird market poultry industries in New York State.

2) The **Universal Veterinary Information System (UVIS) - Animal diagnostic laboratory information management:** UVIS was designed as the transactional database that maintains animal health diagnostic testing data and results. The database, developed and customized by the Ross Group Inc.(2) and implemented and maintained by the Animal Health Diagnostic Center at Cornell University, manages information surrounding diagnostic accessions and results for the veterinarian and producer community. The UVIS system informs veterinarian and producer actions on the farm. Diagnostic test results and interpretations serve as the criteria to validate animal health disease control program status. Analytical tools within the UVIS application assist in the assessment of diagnostic resource needs and diagnostic test usage. Additional business intelligence tools provide *ad hoc* query and developed reporting capabilities from UVIS data. Such tools permit broader analysis of spatial and temporal coverage of diagnostic surveillance testing.

3) **New York State Cattle Health Assurance Program (NYSCHAP) - Animal production unit health and production information management:** The **NYSCHAP** application within NYAHIS is an information application that facilitates the acquisition and analysis of production and animal health data, and supports management decisions intended to meet farm animal health and production goals. The foundation of the program is a group of general “core management practices” that serve as a framework for the maintenance of animal health, animal care, and production targets.

**Fig 2**



Conceptually, these best management practices occupy the center of the animal health assurance wheel (See Fig 2) and can be expected to support production, animal health, food safety, product quality and profit goals on the farm. The core consists of principles and practices that support general livestock health. The core management principles can best be described as representations of a comprehensive farm biosecurity system.

The modules represented by the spokes around the wheel are specific integrated activities designed to impact a particular issue, disease, or area of concern. Modules have been developed to address Johne's disease, farm expansion, cattle welfare, bovine leukosis, beef quality/residue avoidance, mastitis, Salmonella, bovine lameness and bovine viral diarrhoea. Modules addressing environmental pathogens and nutritional assessments are currently in the development phase. Module activities supplement the core management principles to achieve disease or issue specific goals.

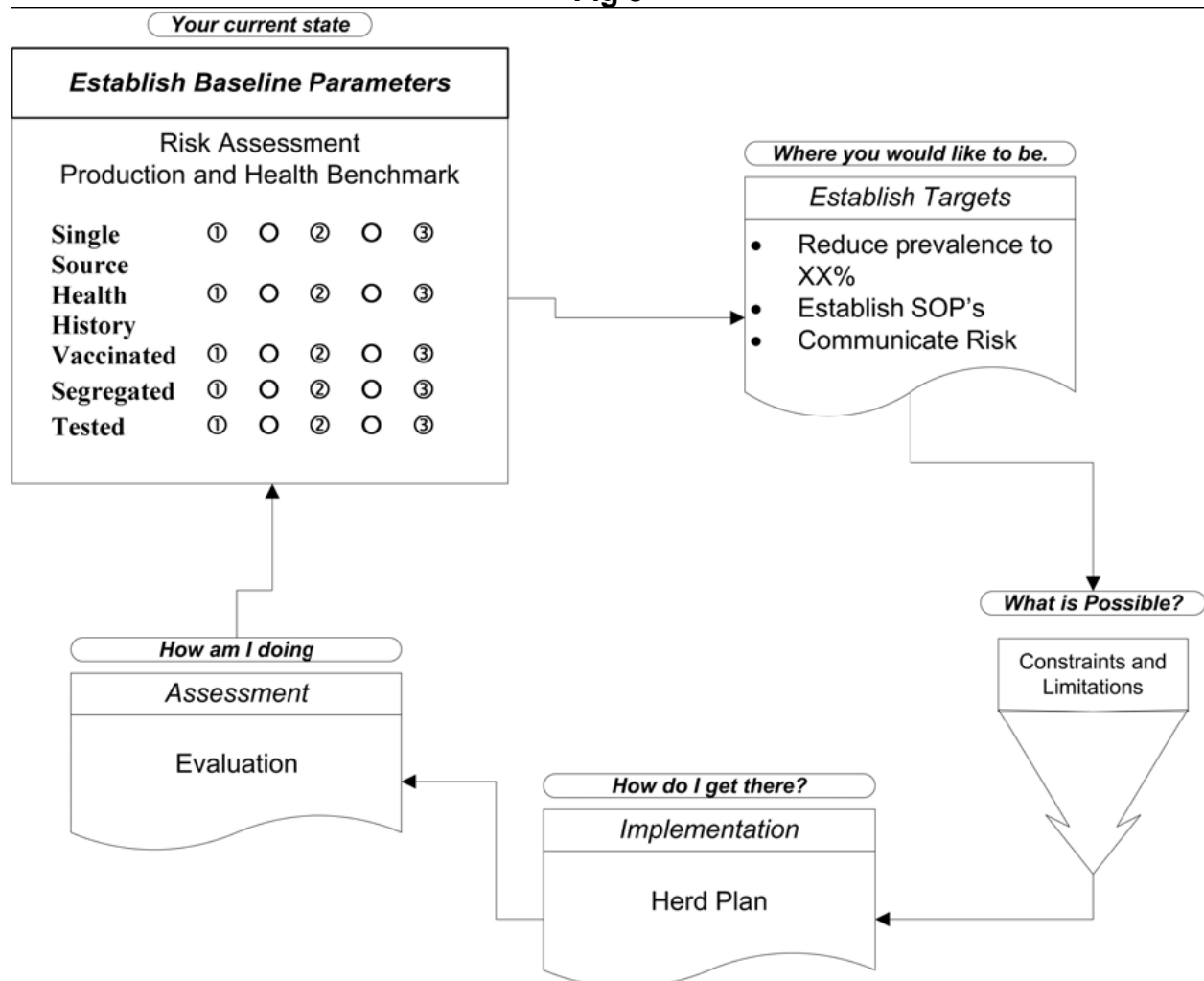
**Farm Evaluation and Herd Plan Implementation (Fig 3): The NYSCHAP Process**

Each participating farm establishes a farm team for the purpose of assessing and implementing key control practices designed to address risk areas on the farm. The process involves the following steps:

- Establish the baseline herd health and production status
- Define the farm system and areas of concern
- Conduct the herd risk assessment and analysis
- Establish production or animal health targets
- Establish control strategies for the risk areas noted during the assessment
- Prioritize the control strategies and reconcile with available farm resources
- Establish and implement the herd plan
- Evaluate the herd plan and adjust as required

**Genesis of the NYSCHAP Herd Plan**

**Fig 3**



4) **Animal Health Information Warehouse (AHIW) - Animal health information integration, analysis, and epidemiological tools:** The AHIW is designed to provide the platform for the integration of data from the three component transactional databases. The AHIW is an Oracle(3) Data Warehouse consisting of a number of designated Data Marts constructed to filter and present the data in a form that is useful for establishing associations, trends, reports, and other useful animal health analyses. The stage is set to explore associations between animal health and production management practices on the farm and the predictive value of these measures for production or animal health outcomes. Validation of derived metrics and indices, as described in the results section will be initiated in budget year 2010-2011.

## Results

### **Statewide comprehensive animal health data management:**

The New York Animal Health Information System is the central informational tool for managing daily animal health transactions and for meeting emergency or outbreak needs. The transactional database was created by a team of experts from Trace First Ltd (4), a software development company with substantial background and experience providing animal health information systems and constructing integrated packaged tools that would meet the current and future needs of the production and animal health communities. Queries and reports support basic epidemiologic analytical functions that inform animal health decisions. Some of the tools include the generation of a virtual cohort of exposed animals, animal tracking and movement, animal restriction flags, outbreak mapping, and premises description information. Emergency contact information is also maintained within the system.

NYAHIS is the central integration point for the collection of data associated with the qualification and maintenance of status in disease control programs. The success of the system lies in the well designed architecture that reflects the structure of the animal production systems it models. Table relationships facilitate the collection and maintenance of key data and reports. The data relationships permit views and analysis with appropriate granularity, permitting the user to drill from the general to the specific. Applications are built on the core data and table structure within NYAHIS.

Specific examples illustrating the utility of NYAHIS in the support of animal health activities include:

**NYSCHAP:** This application is perhaps the best example of the utility of the NYAHIS system to support diverse animal health applications using the core data tables. This application is described in detail in the animal production unit section below. The application works offline supporting in-field data capture in remote areas.

**Avian influenza:** NYAHIS supports an application to receive delivery crate ID data, associate them with a time-date stamp and premises information, and create a biosecurity audit system. This ensures that crates are managed in a manner to prevent avian influenza from being introduced and amplified in the live bird marketing system, and subsequently infecting downstream poultry flocks. The application assists in the detection of the entry of unqualified birds or improper biosecurity. Breaches in biosecurity are signaled in real time.

**Chronic Wasting Disease (CWD) program:** NYAHIS supports an application to record visual and electronic ID to establish the mandatory annual inventory for qualification under the CWD captive cervid program. The application permits a download of data from a prior visit to a local laptop/tablet PC so that the inventory can be completed on a remote PC or other data collection device. Any cervid ID expected, but not visually or electronically seen, is flagged as an exception. The system ensures that animals are either tested for CWD, legitimately moved as live animals or remain residents of the herd. The application works offline supporting in-field data capture in remote areas.

**CWD response:** The analysis of the spatial and temporal characteristics of the 2004 CWD outbreak in New York was facilitated significantly by the mapping and analytical tools provided in the NYAHIS. The program provided visual projections of the infected premises and surrounding land for an appreciation of the potential wildlife exposure. In addition, high risk exposure links were flagged using tracking functions in the database, permitting rapid assessment and resolution of the outbreak.

**Deer Tuberculosis response:** NYAHIS supported the emergency response to the 2008 tuberculosis outbreak in a captive deer farm in New York. It facilitated the identification of at-risk

premises, dangerous animal movements, and potential at-risk adjacent farms and operations. It served as the centerpiece for the Incident Management System planning and response.

**Animal Disease Control Flags:** The NYAHIS provides the ability to flag records for restriction, including quarantine, permit, and other controls. This helps the administrative staff properly manage certificates of veterinary inspection, movement permits, and entry permits. It is a valuable aid to appropriate animal health management.

**Emergency contacts:** This utility permits notification of producer groups, veterinarians, trade associations and others of key information about animal health. Movement restrictions, disease risks and warnings, and situation updates have been issued using this utility. New York State continues to expand the use of this tool to disseminate timely information.

**Bulk Milk Tank Herd Health Screen:** A herd health screening system based on bulk milk tank samples has been created for the purpose of applying improved diagnostic tests on bulk milk tank samples for the detection of animal health issues in a herd, or monitoring progress of an animal health program. The NYAHIS bulk milk tank application notifies milk haulers to collect scheduled milk samples for analysis. The results are received from the UVIS laboratory system and integrated within the NYAHIS into a report for the producer's use. The program is currently at the pilot stage, while capacity and capabilities are being built. Once established, it is anticipated that the system will be used to provide a quick, easily applied indicator of population level animal health status for infectious agents of animal health or public health concern.

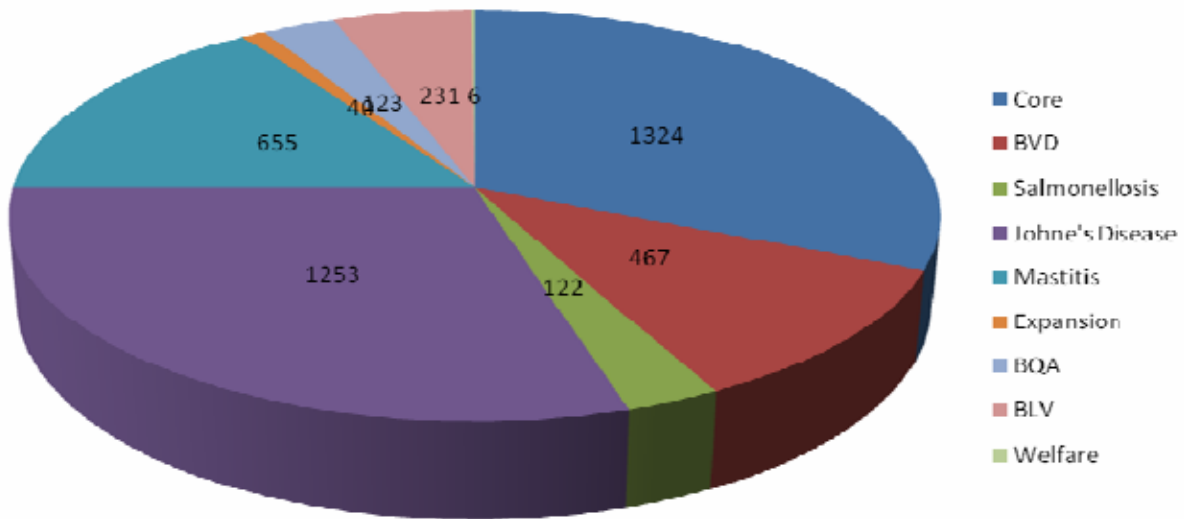
This system has a useful parallel as a surveillance tool in the event of a large scale or catastrophic animal health event where bulk milk tank samples may provide a readily available sensitive and accurate means of rapidly characterizing the extent or dissemination of an outbreak and permit the efficient assignment of response resources.

**Universal Veterinary Information System (UVIS) - Animal laboratory diagnostic information management:** The Animal Health Diagnostic Center at Cornell University has customized the UVIS transactional database to meet New York's diagnostic needs. The UVIS database holds diagnostic accessioning and test results for animal populations within New York State. It supports diagnostic accessioning and reporting within the teaching hospital at Cornell University, private practitioner community, and the New York State Department of Agriculture and Markets' animal health and surveillance programs. Selected diagnostic data collected and/or generated at the Animal Health Diagnostic Center is extracted and loaded into the Animal Health Information Warehouse for integration with other animal health data. The data in UVIS may be accessed by using developed reports or *ad hoc* queries that can be created using a browser-based business intelligence tool (Brio)<sup>(5)</sup> designed to work with Oracle Enterprise solutions.

**NYSCHAP - Animal production unit health and production information management:** The NYSCHAP program provides a framework to assist with herd management decisions for production and health. Over the 11 year period that NYSCHAP has been operational, more than 1300 of New York State's 5700 dairy farms have participated in the base program and one or more modules. The most popular module, in terms of participation, is the Johne's control program. The Johne's control program is particularly amenable to the NYSCHAP approach, since Johne's control depends heavily on the implementation of herd health management principles that reduce the introduction and amplification of *Mycobacterium avium ssp paratuberculosis* (MAP) within the farm, and the reduction of exposure to susceptible groups on the farm. Nearly 56% of the farms <sup>(6)</sup> have demonstrated progress as measured by a reduction in prevalence of Johne's disease in the cattle population employing this process. Participation in other modules is summarized <sup>(7)</sup> in Fig 4.

**Fig 4**

## Total Module enrollment as of 6/2009



In a study on the impact of the NYSCHAP program, this systematic approach strongly influenced the adoption of animal health practices. The average percentage of management practices that were actually implemented in the 1999 study was 79%, indicating that the average farm implemented 13.4 of the advised measures.(8)

Each year, the NYSCHAP team conducts an annual review to help establish new goals, objectives, and health and production targets. A herd plan is then developed and implemented to achieve those goals. Laboratory capacity has been expanded to support this population-based program, an expansion which also supports an emergency surge capacity within the diagnostic laboratory system.

The NYAHIS has been an essential tool to manage the organization and analysis of NYSCHAP data. The initial NYSCHAP implementation was supported by a paper based data collection system. Recognizing the need for data management and analysis, an electronic solution was sought. A contract was established with Trace First Ltd (4) to build a field-centric data information application that would support the NYSCHAP program. The construction of an integrated, animal health information environment became a priority. An electronic herd health and production baseline survey was constructed for the purpose of measuring known or expected determinants of animal health and production. The survey instrument was adapted to a *Microsoft Office* (9) *InfoPath* data collection form that facilitated the integration of the data into the New York Animal Health Information System via the NYSCHAP application. The *Microsoft Office InfoPath* product provides a platform for offline data capture and offers substantial flexibility for future changes in the survey instrument. A hard coded solution, by contrast, offered limited ability to accommodate future changes and conditions. The assessment tool provides a benchmark of important metrics that support animal health and production decisions on the farm. A performance history is maintained. The establishment of the survey and performance data in the NYAHIS facilitates the longitudinal comparison of outcomes within the herd. Problem areas are flagged for further investigation and correction in the subsequent herd plan.

**New York Animal Health Information Warehouse (AHIW) - Animal health information integration, analysis, and epidemiological tools:**

Data from the transactional databases in the New York Animal Health Information Management Environment is sent to the data warehouse for higher level analysis and the production of integrated reports. The data in the AHIW may be accessed by using predesigned reports or *ad hoc* queries via a browser-based business intelligence tool (Discoverer Plus) (10) designed to work with Oracle Enterprise solutions. Several important reports have been developed in the effort to produce measures of progress, aggregate reports, and analyze performance over time. A summary of those measures follows:

**Outcome Measurement** It is recognized that on-farm outcomes are the result of a number of variables that are hard to characterize or control completely. Attributing a response to individual management practices is risky, given the multifactorial nature of production and health. Consequently, New York State has established three distinct indices designed to capture trends in animal health, production, and preventive practices. These indices are then combined into a single index to characterize progress, or lack thereof, within an individual production unit. These indices are described briefly (Fig 5):

**Herd Health Index:** This index is a weighted value comprised of herd health metrics including somatic cell count, reproductive measures, individual disease cases, lameness cases etc.

**Production Index:** This index is comprised of production metrics including calving interval or 21 day pregnancy risk, milk production, etc. of how sensitive an operation is to an adverse herd event. It includes management practices, surveillance procedures, standard operating procedures (SOP's) in place, training, management meetings etc. This index is important because it serves as an indicator of how vulnerable an operation is to an introduced infectious agent or other factor.

This information is generated within the data warehouse structure. Longitudinal analysis of individual parameters and collective indices provide an additional perspective on the data. The granularity of the individual data elements that comprise these indices is retained for additional targeted analysis to determine the relative contribution of the measure to the production or animal health outcome. The higher level analysis of this data has not yet begun and will likely be the subject of research studies suggested by the data set. Most of the current analysis is descriptive in nature.

The current functionality of the data warehouse and its summary statistics is restricted due to recent changes in the source databases feeding the warehouse. A priority project to update the warehouse and include additional analytical tools is underway. Future studies will explore the validity of the herd indices in assessing a production unit's animal health and production viability.

**FIGURE 5**  
**Composition of Derived Indices: Example**  
**Preventive Practice Index**

Metric	Index Value	Index Weight
Treatment Records	Y = +1 N= -1	6%
Herd Health Records	Y = +1 N= -1	6%
Animals Introduced to Premises - 5 yrs	Y = -1 N= +7	20%
Health Practices: Replacements or Additions	Vacc, Quarantine, Johne's test, BVD test, Mastitis Cult each +1 None = -2	20%
Neonatal Calf Mgmt.	25%	
<i>Calving area used exclusively for calving</i>	Y = +1 N= -1	
<i>Source of Colostrum</i>	Pooled = -2	
<i>Colostrum Test Status</i>	If either checked = +1	
<i>Initial Feeding</i>	0-2 = +2, 3-4 = +1, 5-6 = 0, 7-12 = -1, >12 = -2, Not Timed = -2	

<i>Qts. Colostrum Fed</i>	4 or > = +1, 3 = -1, 2 = -2, 1 = -3, 0 = -4	
<i>Bulls receive Colostrum</i>	Y = +1 N= -1	
<i>Milk Source</i>	Waste Milk = -2, Whole Milk = -1, Pasteurized Whole Milk = 0, Milk Replacer = +1	
<i>Calf Removed</i>	0-4 = +1, 5-8 = 0, 9-12 = -1, 13-24 = -2, >24 = -3	
<i>Dip Navel</i>	Y = +1 N= -1	
<b>Employee Mgmt.</b>		3%
<i>Regular meetings</i>	Y = +1 N= -1	
<i>Freq. of meetings</i>	monthly or < = +1, quarterly = 0, annual = -1, sporadically = -2	
<b>SOPs</b>	Milking Protocol, Maternity Mgmt., Newborn Calf Mgmt., Calf/Heifer Mgmt., Treatment Protocols, Drug Useage all +1 each all others = 0 each, No = -2	20%
<b>PPI Total</b>	<i>Sum of all metrics</i>	

### Conclusions and Clinical Relevance

The New York Animal Health Information Management Environment supports day-to-day animal health program operation, the application of controls, and the derivation of potentially useful summary statistics. Animal health indices may be considered in the same context as herd screening strategies. Indices that are inconsistent with established norms should prompt additional on-farm investigation to anticipate future problems, issues, or mitigation strategies. Overall this environment has:

- Demonstrated its utility as a resource to assist with the response to disease outbreaks, analysis of epidemiologically linked premises (dangerous contacts), and management of animal disease tracking, control efforts and strategies.
- Demonstrated the ability to accept automatically acquired data to support disease control programs.
- Generated data that suggest additional research questions, which are the subject of future targeted studies. This process offers the possibility that herd recommendations may be refined to produce desired animal health and production outcomes.
- Demonstrated that promotion of animal health and production goals at the local level supports state and national animal health goals at the global level.

Activities conducted to support the New York Animal Health Information Management Environment have generated the additional benefit of establishing positive working relationships between regulatory animal health officials, private veterinary practitioners, producers and the state diagnostic laboratory. These relationships result in an animal health support continuum that is useful to address endemic animal health problems and also strengthen the emergency response infrastructure. The NYAHIME ensures that regulatory veterinary medicine is an integral part of the agricultural community.

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