A Description of Needs

for a

Veterinary-Farm-Call

Animal Health Surveillance and Pharmacological Use

Data System

v 1.3.1

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Introduction

- There have been calls to improve animal health surveillance in Canada to better detect important changes in health, and to provide evidence of health in support of trade.
- Example reports of such studies include:
    - "Surveillance in a Time of Transition in Farmed Animal Health", 2011
    - "Developing a Framework for Improved National Coordination of Animal Health Surveillance in Canada", 2013
    - "Further Evolution of Animal Health Surveillance in Canada Through a Focus on Governance", 2014
- Also, effective January 2017, Health Canada will require increased veterinary oversight in the use of medically important antimicrobials in feed and water. Similar steps will be taken in the USA, also effective January 2017.
- This will require additional and tighter record-keeping by veterinarians, feed companies, animal owners and pharmaceutical companies.
- In addition to the current collection of animal health surveillance data at laboratories and abattoirs, there are epidemiological advantages to collecting additional surveillance data "further upstream", such as when veterinarians interact with farms, regardless of whether or not they submit samples to a diagnostic laboratory.
- Such "veterinary-farm-call" data provide an additional dimension to health surveillance, especially when it is combined with pharmacological-use-data as will be increasingly required with increased veterinary oversight of medically important drugs used in feed and water.
- Accordingly, there is a need to implement a system of data collection, storage, analyses, report and documentation distribution of animal health and pharmaceutical use/oversight data associated with visits or contacts by licensed veterinarians with farmed animals.
- The objective of this document is to describe what a veterinary-farm-call animal health surveillance and pharmacological use/oversight data system needs to be able to do.
- This will facilitate subsequent evaluation of options and proposals to meet those needs.

System Needs

Overall System Needs

- An easy-to-use electronic system to collect, store, analyze, summarize and report veterinary farm-call data including pharmaceutical use/oversight data, to contribute valuable information to the Canadian Animal Health Surveillance System (CAHSS) and document veterinary oversight of pharmaceutical use, to assist stakeholders including: veterinarians, animal owners/custodians, feed mills / pharmacies, animal industry / exporters, animal health and public health officials, researchers, veterinary licensing organizations and pharmaceutical industry organizations.
- Provide customizable reports, documents, maps, tables, graphs, charts that are of value to the above stakeholders including electronic production, storage and distribution of specific

prescriptions/veterinary feed authorizations (VA) from veterinarians to, animal owner/custodians, feed mills/pharmacies.

Core Outputs

- Rapidly produce reports, tables, maps, graphs charts, which:
    - Demonstrate surveillance coverage by licensed veterinarians
    - Detect and demonstrate trends, changes in trends, and unusual animal health events
    - Demonstrate evidence of freedom from specific diseases in support of trade
    - Summarize use of pharmaceuticals as it relates to incidence of disease and other factors
- Easily write, electronically sign, store and distribute case-specific prescriptions / VA's copied /emailed to the: issuing veterinarian, applicable animal owner/custodian, applicable feed-mill/pharmacy that will prepare the feed/medication.

Core Components

- Rapid, easy, mobile electronic data collection (smart phone, tablet or laptop)
- Database storage real-time sync with mobile internet/cellular communications
- GIS spatial data collection, analyses (map generation)
- Data analyses
- Report writing/distribution including text, tables, graphs, maps, charts
- Fill in standardized prescriptions/VA's with appropriate specific detail, electronically sign and distribute appropriately.

System Access

- web/internet/cell
- desktop/laptop/tablet/smartphone (level of sophistication and tools available may be less for smartphone cell based than for desktop internet based access to the system)
- need mobile data collection even if out of cell range, but sync when within cell or WiFi range

Users

- To ensure appropriate interpretation of information, the system is targeted primarily for use by veterinarians for veterinarians, including: *(below see restrictions to detailed data access)*
    - Farm-animal veterinarians
        - to provide better service to their clients through better understanding of diseases and changes in diseases around them that may threaten their clients' animals; and through better provision of veterinary oversight of pharmaceutical use including documentation storage and transmission
            - *Note: While farm animal veterinarians are the initial target, the system must be initially set up in a manner that it could evolve to be used by companion animal veterinarians in future.*
    - Surveillance program veterinarians and epidemiologists in government and industry health surveillance organizations.
    - Animal Health and Public Health Regulatory veterinarians and epidemiologists to analyze animal health surveillance data and pharmaceutical use data (federal and provincial)
    - Export regulatory veterinarians to be able to sign-off on export certificate conditions

- o Laboratory veterinarians and epidemiologists to help anticipate diagnostic needs and refine laboratory services.
- o Veterinarians in licensing organizations to help investigate complaints and demonstrate good professional conduct.
- To improve interpretation of data and information, direct log-on-use will be limited to veterinary professionals or epidemiologist or people under their supervision.
- While animal owners and the public will not be given direct log-in access, they may request report to be produced and interpreted for them by those professionals with direct access to the data and information.
- Researchers may submit research proposals to the oversight committee to obtain data for approved research.
- Routine summary reports may be produced by authorized users for use by industry or other organizations.

Specific Users

- Each direct user must be approved by system administrator and assigned a unique user ID and password for use (see below re: multiple levels of access)
- Each entry or data change is tracked by the user ID that made that entry
- At first sign-up or request for an account, each user must agree (electronically or in writing) to abide by the terms and conditions of use of the system.

Controlling Access to Detailed Data

- The level of detail that a specific user can see is controlled in the following manner:
    - o A unique user may view and edit any and all detailed data they entered (as tracked by their user ID)
    - o A unique user may view (but not edit) any and all detail entered by another user provided that second user has given electronic permission for the first user to view their data (e.g. multiple veterinarians within a single clinic may give each other permission to view each other's detailed data, or veterinarians working on a common project may give each other permission to view detail of all records related to that project, e.g., PRRS ARC&E).
    NOTE: See section below on privacy and personal information, why users must be extremely careful to whom they give permission to view data they entered.
    - o Unless given permission to do so, a unique user cannot see detailed data on records they have not entered, but may see less detailed aggregate data or may generate reports using data from all other users but only to a certain level of detail (e.g. can produce maps or summary tables only to the county or township level but not the actual specific location of farms.)

User Groups

- As per access to detailed data above, the system allows individual users to form electronic groups of users by giving them each electronic permission to view their detailed data (analogous to "friends") *NOTE: It is not yet clear if the best approach will be to allow individual users to give other users access to their data without going through the system administrator OR to set the system up that both sides must apply to the system administrator to actually electronically authorize such access. This needs further discussion of advantages and disadvantages of different technical approaches.*

Specific Classifications of Users

- The system must be designed in a way that different types or classifications of users may be established with different levels of access to some specific types of data.
- Classifications of users need include:
    - Basic User
    A Basic User Classification will be assigned to most user accounts including clinicians, laboratory, most disease surveillance and pharmaceutical use trends users. They may view and edit data they entered but see less detailed aggregate data or may generate reports using data from all other users but only to a certain level of detail (e.g. can produce maps or summary tables only to the county or township level but not the actual specific location of farms.). Specific Basic User accounts my be linked in specific user groups (see above)
    - Regulatory Listed Diseases User
    Has the same access as a Basic User plus they can view and map the specific location of records of clinically suspected or laboratory confirmed cases of federally or provincially reportable or notifiable diseases and the name and phone number of the veterinarian who entered the information.   *Note: This implies that cases of "listed" diseases must be flagged in the system so that such users have required access.*
    - Regulatory Export Certification User
    Has the same access as a Basic User plus can view specific locations of cases on maps generated by the system for the purposes of reviewing/authorizing export certifications requiring statements of no evidence of specific diseases within a specific radius of the location of the animal(s) requiring export certification. *Note: This implies that cases of diseases included in export certification must be flagged in the system so that such users have required access.*
    - Veterinary Licensing Organization User
    Has the same access as a Basic User but has access to all relevant detail when formally investing a specific complaint. *Note: This implies the system administrator is able to provide or give access to all detailed data entered by a specific user within limitations of the complaint.*
    - System Administrator
    Full access, ability to see and edits all detail, ability to add, edit and remove codes and terms in tables, ability to set up and block user accounts, ability to create groups, ability to pull and export specific data for approved research projects or official complaint investigations.

Data Ownership and Authorization for Use

- Although still up for discussion it is likely that responsibility for data ownership and authorization for use will need to be taken on by a defined committee with defined governance and legal identity.
- For a user to obtain a user ID and access to the system, a user must agree to the terms and conditions for use of the system. *Note: Legal advice is needed. This may be achieved through electronic click on agreement or may require more formal signed documentation similar to system of account approval and set-up currently used in the Canadian Network of Public Health Intelligence (CNPHI).*

- Those terms and conditions will need to be worked out among appropriate committees of system owners and users with legal guidance.
- Examples of such terms and conditions include (but are not limited to) each user giving permission for data they enter to be used in the following ways:
    - To allow any user with a user-ID to view aggregate data or generate, use or share reports, tables or maps only to the species level (not animal type) and provincial, county or township level (no more specific location than that). Therefore, unless approved by the originator of the data, no user can view any personal information of the veterinarian who entered the data, nor of animal-owners.
    - To allow federal and provincial regulatory users to view and map the specific location of records of clinically suspected or laboratory confirmed cases of federally or provincially reportable or notifiable diseases and the name and phone number of the veterinarian who entered the information. This will allow the regulatory veterinarian to contact the veterinarian that entered the data, but not view the personal information of the owner (see below).
    - Allow export-certification-veterinarian users to view specific locations of cases on maps generated by the system for the purposes of reviewing/authorizing export certifications requiring statements of no evidence of specific diseases within a specific radius of the location of the animal(s) requiring export certification.
    - To allow a designated committee (e.g. relevant OAHN species committee) to review academic research proposals and release data to approved research proposals only to the level of detail required by the research. *Note: Rules and guidelines will have to be established by system owners and relevant committees for review and documentation of research proposals and restrictions on use of data released for research.*

Interpretation and Responsible Use

- Users (primarily restricted to veterinarians or under the supervision of veterinarians) are responsible for interpretation and use of information and reports (tables, maps, etc.) generated by the system. As such they must apply professional interpretation and responsible use of the information aligned with the regulations and ethics of their profession.

Data Security

- The system must be secure with all reasonable steps taken to continuously prevent unauthorized access e.g.
    - A protocol for creation and authorization of accounts by the system administrator will be established and followed (e.g. cross-check with known sponsor / reference)
    - Unique user account IDs and highly secure passwords requiring frequent changes (e.g. every 60 days)
    - Second level of security for access to more detailed data (e.g. user type or group member)
    - Electronic classification of users (e.g. general, group member, regulatory, export, licensing, administrator) with different levels of access.
    - Data encryption
    - Data back-up and recovery strategy
    - Data access by system owners/administration 24 hour 7 days a week even if host organization fails

Server Location and Ownership

- Provided security needs are met, system servers may be located at any of the following:
    - Appropriate University, Laboratory, Government or Industry organization
    - Appropriate reputable experienced data business or server farm (e.g., with at least 2 years' experience)
    - Within or beyond Canada
    - Accessible by cellular, WiFi, or hard wire connections
- Servers may be owned by the respective organization listed above and leased to a system oversight committee or their designate.

Software Ownership and Licensing

- Central committee(s) own or have permanent licensed use (with no ongoing fees) of any and all software built specifically for this system.
- Software components obtained from existing software packages (e.g., GIS software or statistical analyses or report generating software) will be licensed for use at annual license fees approved by the central committee.

Equipment Ownership

- Users are responsible for the purchase, ownership, maintenance, security, replacement of any and all computers (barcode-readers, smartphones, tablets, laptops, desk tops) and printers they use for the system.

Ongoing Management and Decision Authority

- An appropriate system ownership and oversight committee will have to be designated to oversee ongoing management, license fee payment and decisions (e.g. OAHN Executive, CSHIN Executive, NFAHWC, CAHSS Directors Group)

Bilingual English French

- Facilitate a user to set up their account so that data entry and report generation is in either French or English for all future use by them.
- Drop down tables in French and English for front-end data entry and later report generation BUT single system of coding in backend data storage, so that data entered in either French or English can generate reports in either French or English regardless of which language was used to enter the data initially. *Note: This implies that when the system administrator is adding a new disease or clinical sign or term approved by the oversight committee, it must be created/coded in English and in French and in an unilingual back-end code in appropriate tables to be available in relevant bilingual dropdown menus and reports.*

Operating Systems

- Make so can work on all common operating systems including:
    - iPhone, Android, Black Berry (mobile operating systems)
    - Apple, Windows 7 (Desktop/Laptop operating systems)
- It is acceptable to have some complex reports more easily viewed on large desktop screens than on small smartphone screens, but basic reports should be viewable (and zoom-able) on small smart-phone screens. *Note: Detailed vs basic reports will be defined in collaboration during system build.*

- Allow data collection even if out of cell or Wi-Fi range (i.e. off-line data collection) but sync later when within range.
- Routinely capture data during each farm-visit, but also allow record-entry or edit at later date (see below).

Scalability

- The Canadian Swine Health Intelligence Network (CSHIN) has built and is currently testing and implementing a swine veterinary farm call data system especially in western Canada that will likely be tried out in Ontario for swine.
- The Ontario Animal Health Network (OAHN) is interested in a system for all farm-animal species in Ontario.
- Epidemiologically the ideal would be a system for all animal species used by all veterinarians across Canada, allowing any authorized user from anywhere to generate reports/maps for any species, time-window, disease, geographic location/area, permutation or combination, in English or French from one back-end data file linked to many front-end drop-down tables for data entry and report generation.
- Therefore, while it may be built and used (and paid for) in steps, it must be done in a way that does not rule out eventually scaling up to the ideal national system.
  Note: More specific information will need to be provided in and official RFP to potential bidders (e.g. expect 1000 user accounts in first year, with Basic Users entering 5 to 10 records per day and each user making an average of 2 queries per day requiring tables, maps, graphs or charts to be produced per query and expand to 5000 users within three years)

Assurance of Consistent Coding

- Most of the time, drop-down pick lists will be used to ensure consistent coding
  (very rarely free text will be permitted)
- Options listed in specific pick-lists will be conditional on earlier selections
- For example, if a veterinarian sets up his/her account indicating they practice only swine medicine, then to speed-up and simplify subsequent data entry, all subsequent drop-down lists available to view on that account pertain only to swine (or whatever species or combination of species the veterinarian indicated at set-up).
- Similarly, logic based conditional dropdown pick-lists will be used for other parts of data (e.g., disease list conditional on animal type, etc.)
- Veterinary clinicians, pathologists and other specialists will be made available to the project manager and system designers to provide lists of appropriate terms for respective tables of drop-down-lists and rules for conditional drop-down lists.
- Coding used in the back-end main data file must be consistent regardless of whether French or English was used in the drop down lists to capture data or produce reports.
- Such tables must be able to be changed, updated or added by the system-administrator while the system is in use, without having to go back to the programmer or company who built the system (e.g., add a new disease to be available in a pick-list, including front-end and report name in English and French, and unilingual back-end table terms)

Core Health Surveillance Data to Be Captured

- Aim to capture one record for every farm-visit-species-animal-type-health-issue combination each veterinarian makes, all the time.
- That is, it should not be limited to unusual infectious disease cases, but also include records of routine herd-health-visits, visits for injuries, and other non-infectious health problems, etc. This will make the data more epidemiologically sound and document surveillance coverage by DVMs. This will help to support export trade and the economy by providing hard data on surveillance coverage by DVMs. Such data can and have been used internationally to retain or regain OIE disease-free classification and access to export markets.
- Veterinarians enter one record per farm-visit-species-animal-type-health-issue-combination. Therefore, if during one farm visit to a swine farm, a veterinarian works with one issue in dry sows and a separate issue in weaner pigs, then 2 separate records are created. The date, location and species data would be the same in both records, but the rest of the data would differ.
- The veterinarian must be able to fill out each record easily (i.e. logical pick lists) and rapidly (average less than 1 minute per record, maximum 2 minutes for a record), remotely by cell phone, tablet, or laptop, within or beyond cell-range.
- The back-end main data file will be a relatively simple flat file (table) in unilingual/standardized codes, but it will be linked to several relational files (tables) which provide various pick-lists for data entry and report generation.
- Facilitate the following data types to be captured for each record as core information (with the potential to add more types of data as the system evolves): *Note: Veterinary specialists working on the design team will provide complete appropriate and logical lists for drop-down menus developed by programmers.*
  - date and time (automatic)
  - longitude and latitude (automatic) or premises ID or both or link one from other
  - reason for farm visit "health problem" vs. "herd or flock health checkup"
  - species: bovine, equine, porcine, ovine, caprine, etc. (must be able species limit drop-down-list to the species with which a specific veterinarian Basic User works)
  - animal-type: (drop-down-list conditional on species, e.g., porcine: dry-sows, nursing sows, nursery piglets, weaner pigs, feeder/growers, finishers, boar(s), Chicken: broiler-breeder, broiler, layer-breeder, layer, etc.)
    - o Allow option to add more detailed text or user codes for viewing by the individual or their group.
  - primary body system affected drop-down: respiratory, digestive, nervous, reproductive, musculoskeletal-joint, integumentary, blood, immune, multi-systemic.
  - main clinical signs observed**,** click on one or more from following list (the actual drop-down list viewed will be conditional on previous choices, e.g., no mastitis in poultry)

Abdominal distension	Abnormal gut sounds	Abnormal heart rate
Abnormal lung sounds	Abnormal vaginal discharge	Abnormal vocalization
Abortion	Alopecia	Anestrus
Anorexic	Arrhythmia	Ataxic
Bloat	Circling	Colic
Conjunctivitis	Coughing	Depressed
Dermatitis	Diarrhea	Difficulty swallowing
Down	Dyspnea	Drooling

Fever	Lameness	Lesion
Lump	Mastitis	Nasal discharge
Not milking	Nystagmus	Ocular discharge
Paddling	Paralysis	Peripheral edema
Persistent estrus	Poor conception/Infertility	Pruritus
Sore mouth	Stiffness	Stillbirth
Sudden death	Swollen joints	Trembling
Wasting/thin	other	

- primary infection vs. primary non-infection +/-secondary infection
    - subsequent primary infection drop-down-list of specific diseases to include: all diseases of interest to the species network (e.g. OAHN Swine Committee) conditional on species, plus all provincially notifiable (which includes all federally reportable) affecting that species, plus an "other". Allow user to use the free text notes field to enter "other" disease not included in drop-down. Allow system-administrator to add or subtract specific diseases from pick-lists approved by appropriate management committees.
    - non-infection drop-down-list: injury, poisoning, nutritional, metabolic, welfare, herd/flock health (*others?),*   plus "other".
- Clinical diagnoses only vs. clinical plus supporting laboratory evidence
    - Allow / encourage updating from "clinical only" to "supporting lab evidence"
- Total number of head of this species-animal-type on the premises on farm-visit-date.
- Among those, the total number of head of this species-animal-type on the premises on the farm-visit-date that were affected with the condition recorded. (stick to collecting data in numbers, let computers calculate percentages).
- Whether or not diagnostic samples were sent to laboratory AND if so, a code for which laboratory they were sent to and ability to later fill in (manually or automatically) the case or submission ID number/code assigned to those samples at the lab
- Whether or not pharmaceuticals were used to treat animal or a prescription/VFD was written
- And IF pharmaceuticals were used or a prescription/VFD written capture the appropriate data   (see below for information on pharmaceutical use module).

Core Pharmaceutical-Use Data to be Captured

- Effective January 2017 Health Canada will require tighter veterinary oversight (and resultant increased documentation) of use in animals of pharmaceuticals important to human health, especially the use of antimicrobials in animal feeds and water.
- Similar regulations will come into force at the same time in the USA (Canada's largest export market).
- Therefore, there will be advantages to: animal industry, veterinarians, feed mills / pharmacies, animal and public health regulators, export systems, and the pharmaceutical industry; if Canadian and American approaches are compatible and harmonized as much as possible.
- While the initial focus will be on tighter veterinary oversight of use of antimicrobials in animal feeds and water, it is possible that at sometime in the future veterinary oversight of a broader range of pharmaceuticals, applications and animals will be required.
- Therefore, there will be advantages to develop the system in such a manner that it can be scaled up to managed a broader range of pharmaceutical use data in the future.

- In summary, the system must also be able to capture, securely store, analyze, and use data to write prescriptions/VA's, electronically sign them and electronically distribute (email?) them to: the respective feed-mill/pharmacy that will prepare the product, animal-owner/custodian who will use the product in their animals, and the veterinarian who wrote /authorized the prescription/VFD.
- The exact back-ground and auto-fill-in wording and formatting of electronic (printable) prescriptions/VFDs is yet to be finalized, but will be provided to system developers.
- The veterinarian must be able to easily, rapidly, accurately and remotely (within or beyond cell range) fill-in an electronic template, then sync with the data base and electronically distribute the document appropriately (when back within cell-range).
- This will require use of bar-code reader on their remote devise (cell-phone, tablet or laptop) to identify the pharmaceutical being used from the package or a sheet of barcodes or pre-entered files of pharmaceuticals that that veterinarian routinely or is likely to use or prescribe / VFD.
- Examples of the type of data needed to be captured or be available in pre-recorded data files include:
    - The date
    - The veterinarian's personal name, business name, address, office phone and cell phone number, email address and GIS coordinates of their office.
    - The animal owner/custodian's personal name, business name, address, phone number, email address and GIS coordinates of the location of the animals being treated
    - The feed mill or pharmacy that will fill the prescription - business owner name, business name, address, phone number, email address, GIS coordinates of the location of the business.
    - Drug name,
    - Number of animals to be treated
    - Drug concentration
    - Drug dosage
    - Directions for use
    - Withdrawal time
    - Duration of the prescription
    - Warnings and cautions
- *NOTE: To automate product lists, the system will likely have to be linked to data provided and frequently updated by pharmaceutical companies directly or through the Canadian Animal Health Institute*
- *NOTE: To prevent having to re-enter the above information for every separate prescription, individual veterinarians or a group of veterinarians in practice must be able to pre-enter (and update) the above information about their clients for whom they routinely write prescriptions, and the pharmaceuticals they usually use, so that info then be available (only to those veterinarians) in drop down lists to quickly and easily write new prescriptions. The owner/custodian names first available on the drop-down list could be conditional on the veterinarians GIS coordinates at the time (i.e., their cell-phone / tablet knows where they are and picks owners from the data closest to their current location as being most likely for whom they are writing the prescription, if not they can pick from an alphabetical list).*

Security and Use of Personal Information

- Capture, storage and use of personal information required for prescription writing raises the bar (and liability) on security and controlled use of information.
- *Note: Legal advice will be required concerning definitions, secure storage and use of "personal information".*
- Storage of and access to such data must be very secure.
- Viewing and use of such data must be limited to only veterinarians that entered it (or other specific users the original veterinarian authorize to see or use the data.)
- Data must only be available for use as truly needed (e.g., only for prescription writing)
- The personal info must NOT be available for summary tables or maps of pharmaceutical use, the latter being limited to only rolled-up counts (no people's or business names), at the county or township level
- No names or maps of specific locations will be viewable except by the veterinarian who entered the data or their authorized group members, e.g., in their practice.
- An exception is that for federally or provincially reportable or notifiable diseases; then regulatory veterinarians with "Regulatory- Listed Disease User" accounts on the system (federal or provincial veterinarians) can see the name, town and office and cell phone number of the veterinarian who entered the record (NOT the owner's name nor specific location of the animals). The regulatory veterinarian must phone the veterinarian who entered the record to get more information about the case. If once they discuss the case it is appropriate for the regulatory veterinarian to use the authority of the legislation under which they work, they can then get the detailed information about the owner and location from the attending veterinarian.
- NOTE: This does NOT relieve the attending veterinarian of their legal responsibilities to report specific diseases. (e.g., If a veterinarian seriously suspects a federally or provincially immediately reportable disease they must phone appropriate authorities immediately and enter the data in the system) and not wait for the authorities to phone them because the record was seen the system.
- For less serious laboratory notifiable diseases for which clinical veterinarians are not required to report, this approach lets regulatory veterinarians follow up with clinical field veterinarians if they see an alarming change in trends of such diseases. *Note: Experts will provide system developers with appropriate lists of diseases. ALSO the system administrator must be able to add/edit/remove diseases from tables of these regulatory diseases as diseases are added to, changed or removed from official lists.*

Mobile Data Capture

- Once the system administrator has assigned an account to a specific veterinarian (e.g. Basic User), they can then set up their account to indicate which species and animal types they work with, so that drop-down pick-lists for all subsequent entries are limited to that or those species and types (e.g., just poultry or just poultry broilers, or just equine or just equine Thoroughbred, or bovine and swine, or just bovine dairy, etc.). Allow a user to reset the species they work with at a later date.
- Data capture software must run on any/all common smart-phone, tablet and laptop systems, facilitating data capture within or beyond cell or Wi-Fi range with automatic or manually trigged updating and syncing with main server as soon as within range.
- Allow creation or editing of a record at a later date/time (e.g., the next day enter a record back at the office for a farm call made the previous day to enter the date and time of the

actual call and the GIS coordinates of the farm they were at (i.e., override or edit the auto entry of date/time, coordinates of the phone or tablet at the time of creation of the record, back at the office the next day) .

Data Storage

- Data must be stored in a secure manner on secure servers and backed up on independent secure servers at separate locations with a recovery strategy.
- The data must be stored and retrievable through software that is expected to be available for use over the long-term, through many inevitable hardware and software upgrades and versions.
- The data must be retained and retrievable in the system for period of 10 years (e.g. so a report showing maps or graphs with changes in trends over 10 years can be easily and rapidly produced with the built-in query system). Data older than ten years may be archived in a data warehousing facility but still be retrievable (all-be-it less easily), if a historical study is required.

Spatial (GIS) Analyses and Map Generation

- Use GIS technology on the website (to be viewed by desktop, laptop, tablet, or cell phone) to facilitate creation of a range of "heat maps", with polygons shaded by intensity of various numerator to denominator proportions as described below in data analyses and report generation.
- Use map polygons based on Consolidated Census Sub-Division (CCSD, i.e., Township level) and optional Consolidated Census Division (i.e, CCD, County level), provinces and the country. This has the advantage of much additional useful census-data being available for calculations in mapping. For example, census estimates of the number of premises (or the number of head) with/of that species, in that jurisdiction-polygon (e.g., township), could be used as denominators relative the data-counts (used as numerators, e.g., counts of disease X, disease Y, farm visits among species Z, etc.) for "heat- maps". *Note: The system must be able to pull in other polygon/background GIS map layers (e.g. watersheds, health unit boundaries etc. if required)*
- In such maps, the intensity of the shading of polygons (townships or counties) is relative to proportion of numerator to denominator within each respective polygon. Note: Also, the nested-ID-number-system for: province, county, township, land-parcel, could also be used to map land-parcel polygons cross referenced from detailed latitude and longitude captured.
- Facilitate generation of maps of specific farm locations (see query system below to pick premises) BUT view only the premises entered by that user or records for premises entered by all other member of the group for which that user has been approved. Locations must be viewable over standard map layers (e.g. roads, political boundaries, urban areas, water, woodlands, etc.)

Data Analysis and Report Generation

- For web-access use on desk-top, lap-top, tablet (Note: *the quality/ease-of-viewing of some more complex reports may be reduced on small smart phone screen. Client will provide developers with guidance on what is acceptable)*
- User-friendly query-builder that allows a user to click on any combination of the following data-types to select records to create maps of interest to user from a potentially very large range of maps from the data. For example, an authorized veterinarian-user should be able to pick/specify:
  - any date range (time window)
  - any species or groups of species (in the system)
  - any animal-type or group of animal-types (within the species selected)
  - any body-system or group of body-systems
  - primary infection vs. non-infection (or secondary infection) or both primary and non (i.e., all reports within the above conditions)
  - any specific disease or condition in the system (conditional on the above)
  - clinical records without or with supporting laboratory diagnoses.
  - Pharmaceuticals used/prescribed
  - Note: the above query would select and count the number of records in the system that meet the selected criteria to serve as numerator counts.
  - Choose a map based on CCSD (township level) or CCD (county level)

Heat Maps

- Numerator-only map - to produce a heat-map shaded by e.g. 20th percentile grouping (5 shades) of the counts by polygon, e.g., township
- Numerator / Denominator heat-maps, with <u>denominator</u> options of:
  - Number of records of that/those species and/or animal type in the system, for that timeframe, by polygon (e.g., township)
  - Number of farms with that species from census data by polygon (e.g., township)
  - Number of head of that species from census data by polygon.

Note:

- A user could stop at any of the above levels, e.g., produce a map with counts of records within a date range for bovine, period (all and any records for bovine).
- Each map produced will automatically display the values selected in the query (e.g., date range, species, type, body system, pharmaceutical, etc. numerator and denominator etc.) which that heat-map depicts.
- Queries for maps frequently used by users could be saved such that those maps could be downloaded and viewed on the smart phone-app in addition to when the user's computer or tablet is connected to the web-site.

Time Series Analysis

- Produce time-series maps and time-histograms using the query system, but for larger time range (e.g., 2 year period), to produce series of maps or histograms by e.g. week, month or quarter, to show changes over time within the larger time-window. AND ability to show heat-maps and histograms of acceleration and deceleration over time, by dividing counts or proportions of one sub-time period by the same for the previous sub-time period or time period one year ago (e.g., week, month, or quarter), to show increases and decreases for the larger specific time window (e.g., 2014).

Tables, Pie Charts, Histograms and Graphs

- Ability to display counts from queries in sortable tables, pie charts, histograms and graphs

Report Viewing and Export

- Ability to annotate tables, maps, graphs, view on screen, print, export as PDF, cut and paste into Microsoft, export selected records as comma delimited files for analysis in other software.

Discussion

- In general, steps taken to increase the utility of the system to specific user-groups tend to increase the complexity of the system, its programming, and training required to learn how to use the system. Thus a balance must be found between utility and complexity.
- For example, if it is decided there is no need for the ability of groups of veterinarians to view each other's detailed data, nor is there a need for regulatory-veterinarians to use the system to approve export certificates; then the linking of records to specific users and types-of-users for viewing different levels of detail is eliminated. This would simplify the system considerably, but also reduce its utility.
- Decisions must be made concerning if and to what level of detail a pharmaceutical data will be included. For example, will the system be used to capture: a) only prescriptive use of antimicrobials in mass-medications (feed or water), b) all uses of only antimicrobials,, or c) all uses of all pharmaceuticals/biologicals (vaccines, antimicrobials, pain management, etc.)?