

VETERINARY INFORMATION MANAGEMENT SYSTEM (VIMS) IN THE PROCESS OF NOTIFICATION AND MANAGEMENT OF ANIMAL DISEASES

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A prerequisite to the development of an efficient animal health, food safety and traceability management system in the animal food production chain is the implementation of an integrated veterinary informational management system (VIMS) capable for the capture, storage, analysis and retrieval of data and providing the opportunity for the cumulative gathering of the knowledge and capability for its competent interpretation. Such a system will enable collecting appropriate data, including quality management and inspection controls, from all establishments and commodities in the "from farm to fork" food production chain (farms, holdings, slaughterhouses, laboratories, traders etc.) in a structured, predefined format, and facilitate competent analyses and reporting of such data, as well as the improvement of the existing programs and strategies. The role of information system in animal disease diagnosis, surveillance and notification, control of national and international trade of commodities, food safety management, investigation of diseases, predictive microbiology and quantitative risk assessment is of great importance for the quality of veterinary service. Integral part of the VIMS is animal disease notification system designed according to and in compliance with international requirements, standards and recommendation and able to exchange relevant information with similar information systems. The aim of this contribution is to describe national animal disease notification system which is in place in Serbia as a part of VIMS.

Key words: animal disease notification system, animal health control, food safety, risk analysis, veterinary information management system

INTRODUCTION

Animal health, animal welfare and food safety have been recognized worldwide as a major issues that helps to protect the health of consumers but that also may create international trade barriers for live animals, products of animal origin, animal genetic material and biological products. Prominent examples of animal health and food safety issues that have emerged over the last decade include epizooties of Foot and Mouth disease, Classical Swine Fever, Bluetongue Highly Pathogenic Avian Influenza Bovine spongiform encephalopathy, genetically modified foods, dioxins and acrylamide (Thrusfield, 1995; Anderson *et al.*, 1996; Ferguson *et al.*, 1997; Prusiner, 1997; Ramsay *et al.*, 1999; Petersen *et al.*, 2002; Reilly, 1999; Smith *et al.*, 1999; 2004; Verbeke, 2001; Claus *et al.*, 2008).

In the face of this complexity of the food supply, the application of up-to-date information technologies (IT) and information systems (IS) are becoming more and more important for production and trade of animals and food of animal origin (Boehlje and Hurt, 1996; Dijkhuizen and Morris, 1997; Leslie and Upton, 1999; CEC, 2000; Zepeda *et al.*, 2002; Tešić *et al.*, 2004; Plavšić, 2005). The application of hazard-focused early warning IS with comprehensive databases, identification and reporting of diseases, use of predictive modelling software, laboratory information systems, risk assessment and decision trees, application of quantitative epidemiology, geographic information system (GIS), largely facilitates animal health and veterinary public health control and management of the risk caused by the appearance of diseases, infection or contamination (Bellini *et al.*, 2000; James, 2005; Morris, 1999; Tešić *et al.*, 2005; Plavšić, 2005; McMeekin, 2006).

In the past ten years, IT has revolutionised the conduct of surveillance for animal diseases in order to detect and identify specific hazards. This has ranged from widespread use of free software for collection of epidemiological data, to web-based systems for surveillance of infections and outbreaks constructed by countries, international organizations or states unions e.g. European Union (Morris *et al.*, 1992; Lubroth, 2006; O'Brien and Fisher, 2006; McGiven, 2007).

The organisational structure of Serbian Veterinary Directorate (VD) and the mission of the veterinary service in Serbia are implemented in the functionalities of the Veterinary Information Management System (VIMS). According to the literature data and preliminary research, in this work we want to shortly elaborate the new VIMS's computerised module for notification of animal diseases, designed and constructed in 2005 in Serbia (Plavšić, 2005).

MATERIAL AND METHODS

As the material for this work, the scientific and practical models have been used based on animal health surveillance and monitoring, animal disease notification, epizootiological investigations, risk analysis, gathering of relevant data and economical and statistical interpretation of the data which are the basis for designing of animal disease control programmes (Morris *et al.*, 1992; Dijkhuizen and Morris, 1997; Horst *et al.*, 1999; Rushton *et al.*, 1999).

VIMS is modern web-based e-government intranet system, which includes a number of registries, databases and applications. The system is the support tool for business processes under the competence of the VD, but also for veterinary organizations (VO) in Serbia, acknowledging the geographical distribution. The National Animal Disease Notification System (NADNS) software application, as integral segment of VIMS, is a notification system with the main purpose of rapid alert, registration and documentation of animal diseases obliged to be officially notified to competent authority which ensures collection of detailed information about outbreaks. This permits immediate access to information and appropriate management of such events in order to combat outbreaks of contagious animal disease effectively.

The occurrence of any animal diseases in the frame of the Law of Veterinary Matters (RS Official Gazette No. 91/05), the Regulations on Determination of the List of Particularly Dangerous Transmittable Diseases, the List of Diseases for Compulsory Notification, as well as the method of their notification and denotification (RS Official Gazette Directive No. 49/06) on methods and behaviour of inspectors upon reporting of transmittable animal diseases No. 323-02-1783/2007-05 from 2007, have to be notified to the VD. The basis for the national list of animal diseases for compulsory notification is OIE's list of notifiable diseases, but also relevant EU regulations. Such approach and methodology enable VD to demonstrate harmonization with requirements defined by EU in the country's accession process, as well as compliance with OIE's standards and requirements as Serbia is obliged to report all relevant animal diseases and epizootiological events.

Notification of disease or suspicion will trigger a cascade reaction which begins with immediate on the spot inspection, clinical and epizootiological investigation, sampling and laboratory investigation, in order to identify and characterize such hazard. Following events have to be officially reported and send to the VD for notification, within 24 hours: (i) first occurrence of a listed disease and/or infection; (ii) re-occurrence of a listed disease and/or infection following a report declaring the outbreak ended; (iii) first occurrence of a new strain of a pathogen; (iv) a sudden and unexpected increase in the distribution, incidence, morbidity or mortality of a listed disease; (v) an emerging disease with significant morbidity or mortality, or zoonotic potential; (vi) evidence of change in the epidemiology of a listed disease (including host range, pathogenicity, strain) in particular if there is a zoonotic impact. Veterinary authority, in the case of confirmed outbreak, is obliged to monitor the outbreak and to carry out all prescribed measures, defined by specific regulations or the Contingency plan.

Standardized formats for collecting data in a prescribed, structured way concerning, among others, the number of affected animals or animals at risk, the cause, affected and at risk species, location of the outbreak, traces back or forward, and other additional factors that contributed to the occurring outbreak, are used on the field. Official predefined, structured reports, which provide further information on the evolution of an incident, should continue to be sent to VD until the situation has been resolved through either the disease being eradicated or it becoming endemic so that weekly, six-monthly and annual reporting to the OIE

will satisfy the reporting obligation of the country. In any case, veterinary inspector should submit a final report on the incident.

All of these steps and activities are covered by the software application in NADNS module of VIMS. Data from these paper forms will be entered into NADNS which has the same format, by official veterinary inspector or approved person. These data facilitate the conduct of outbreak trend analyses, the epidemiology of diseases or infection, the identification of sources of outbreaks, statistical, economical and other analysis. In the web-based electronic forms, gathered information is entered, but some automatism is also implemented (geographical distribution, official veterinarians, approved private veterinarians and responsible veterinary stations, link to holding register and I&R system). The base of the system is a network of specific databases and registers such as: holding register, animal disease register, animal register, register of veterinary organizations, veterinarians, laboratories, veterinary inspectors, slaughterhouses etc. The VD publishes reported data through VIMS interface to all approved users of the system but also to the public.

RESULTS AND DISCUSSION

In order to achieve appropriate efficiency in application of VIMS, a standardised database and registry has been created, as well as a document management system, which are involved into VD roles and responsibilities. Also, interoperability, data exchange and the direct connection has been ensured between different registries in accordance with different criteria, including geographical distribution based on the regional organisation of Serbia.

The analysis of the previous animal disease notification system of data collecting and managing which was in force before 2005, proved to have some deficiencies, with plenty of unreliable and unreadable data and information without a uniform structure. The basic advantage of the new system is that the data collected from the animal diseases surveillance and monitoring programme conducted in Serbia actively or passively, are uniformed, legible and depth-comparable, in terms of territory, time or authorisation and/or competence. Hence, the most important objective of VIMS is integration of the overall production process and animal and/or food trading (Hugh-Jones, 1975; Thrusfield, 1995; Dijkhuizen and Morris, 1997; Petersen *et al.*, 2002).

The NADNS is a unique software support tool for the prescribed procedures for animal diseases notification and reporting, including notification of zoonosis. Its aim is not only timely collecting of accurate and reliable data in the prearranged forms but also their adequate analysis and rapid respond, as well as support in informing the public in the country and international organizations and agencies. The aim of ADNS is to make animal diseases notification as efficient and rapid as possible, so that certain veterinary sanitary and control measures could be undertaken on time. Apart from availability of different registries with unique codes (e.g. animal disease register), this application also contains direct links with the registered holding(s), which have unique ID's where disease has appeared available to all authorised veterinarians, inspectors and VO, all of which are

accompanied with unique ID's. As such, the application of the NADNS enables the appropriate management and eradication of animal diseases and provides traceability of the data collected (Gosser and Morehouse, 1998; Pfeiffer, 1998; Plavšić, 2005). The links in ADNS to animal holdings and farms register and animal I&R register, are created with the aim of easier relating of the data which already exist in the IS as well as a comprehensive analysis and appropriate interpretation of the collected data. Such an approach is aimed to establish functional relationship between all subjects covered by veterinary controls in the food production chain, in the way which is reportable and readable for experts.

The new NADNS is divided into four segments: a) outbreak notification, b) outbreak monitoring, c) laboratory tests reference and d) animal disease de-notification, for each of which the forms have been made containing different groups of predefined data. Each application contains the layout of the list of animal diseases with different ways of classification. Each animal disease has its own single identification number, automatically generated by the system. By selecting this number at the internet portal, the access to specified data is available with a number of additional information (Figures 1 and 2).

The screenshot shows the 'Prijava zaraze' form in the VIMS system. The form is divided into several sections:

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- Ugrožene životinje:** Prijemljive Svinje, Ostale životinje. List of animals: Goveda, Bivolci, Mačke, Mekušci, Ovce, Kamile, Ptice, Ljuskari, Koze, Psi, Pčele, Druge životinje, Konji, Zečevi/kunjad, Ribe.
- Lokacija:** Opština Piroć, Mesto Piroć, Geo. širina, Geo. dužina, Ime vlasnika Neman Žlatanov, Adresa Piroć, Veternarski stan JVS "Pilot" (PRIVATIZOVANA).
- Opis zaraze:** Uvođenje novih živ. ili proizvoda živ. porekla, Ljudi ili predmeti i materijali, Legalan transport životinja, Vazduh, Ilegalan transport životinja, Vektori, Transzit životinja, Kontakt sa divljim životinjama, Kontakt sa inficiranim živ. na paši ili napajalištu, Hrana za životinje, Ishrana neprokuvanim pomijama, Drugo.

Figure 1. Segment for outbreak notification with specific information: a) local veterinary inspector who manage the outbreak and fill the prescribed forms; b) list of susceptible animals (automatically listed for a chosen disease); c) list of other animals on the holding; d) source of infection; e) holding ID (linked with holding register); f) authorised VS for this place (automatically linked with the location of the outbreak).

The screenshot shows the 'ZARAZE' section of the VIMS web application. The interface includes a sidebar with navigation options and a main content area. The main content area displays details for a specific outbreak, including a table of affected animals and a list of control measures. Red circles and arrows labeled 'a)' through 'e)' highlight specific elements: 'a)' points to a menu with options like 'Prijava', 'Detalji', 'Lab. uput', 'Lab. rezultat', 'Odjava', and 'Troškovnik'; 'b)' points to the 'Formulari' link in the sidebar; 'c)' points to a table with columns for 'Ugroženo', 'Zaraženo', 'Ozdravilo', 'Zaklano', 'Umišeno', and 'Uginulo'; 'd)' points to a list of control measures; and 'e)' points to the inspector's name and date.

Figure 2. Segment for outbreak monitoring with links to segments for notification, specific details for some diseases (CSF), laboratory tests reference, animal disease de-notification and cost details of outbreak (a); details about holding and geographic location and outbreak ID (b); details about affected animals (c); list of ordered control measures directed by the veterinary inspectors (d); name of inspector and date of control

With reliable information which could be shared and disseminated between unlimited users, establishment of the system of "Good practice of animal diseases control" is ensured (Boehlje and Hurt, 1996; Dijkhuizen and Morris, 1997; Truszczynski, 1998; Edwards and Alexander, 1998; Holden, 1999; Marsh, 1999; Ramsay, 1999; Donaldson and Alexanderson, 2002; Tešić *et al.*, 2004).

NADNS has been created by compilation of rules for animal diseases notification prescribed by the OIE, and EU requirements for member states and trading partners. This primarily refers to CSF and the data structure which is in accordance with EU regulations. Each animal disease on the software module has its "extension" for entering the additional data such are: costs of the outbreak of a disease where costs for laboratory investigations, vaccination, euthanasia, safe removal of dead animals' bodies, disinfection, disinsection, deratization etc. as well as the costs of compensation of the damage to the animal owner (Horst *et al.*, 1999; Morris, 1999; Rushton *et al.*, 1999; Tešić *et al.*, 2003; James, 2005).

The basic requirement of every veterinary IS is to determine the most important health and production problems and their territorial distribution. Based on the data obtained, the incidence and prevalence of the most important

diseases should be determined and the estimation should be made of the economic consequences. Obtaining these data is significant for the creation of a national strategy for animal health control measures. It can be used for the creation of new upgraded programmes or provision of the additional funds necessary for their implementation (Grandin, 1994; Dijkhuizen and Morris, 1997; Tešić *et al.*, 2003).

The creation and introduction of VIMS into veterinary medicine in Serbia, as well as its further developing and especially the introduction of the GIS, ensures better control of a disease and a better system functionality, especially in establishing the sanitary status of the flock, certain regions or the whole of the country, as well as the control of trading of animals and food. The basic factor of the efficient control of the whole veterinary system is the efficiency of collecting and forwarding of the data, their uniformity, preciseness and accuracy, which the analytical services can present to decision-makers through synoptic, standardised and updated reports. With the adequate methodology, these data are the necessary precondition for the risk analysis process which is important not only for risk-management by the authorised bodies but also for the international requirements, regional countries and domestic consumers (Marsh, 1999; Morris, 1999; Bellini *et al.*, 2000; Tešić *et al.*, 2003). The aforementioned advantages will be recognised by international institutions and business partners and will directly influence the development of our country's agriculture and the economy in general including rural development (Ferguson *et al.*, 1997; Anderson *et al.*, 1996; Blaha, 1996; Prusiner, 1997; Leslie and Upton, 1999; Caporale *et al.*, 2001; Zepeda *et al.*, 2001; Tešić *et al.*, 2004). For establishing and permanent improving of the VIMS, besides clear plans and programmes, solving the issues of data safety, continual maintenance, improving the infrastructure and advances, of crucial importance will also be the constant training of all users, which presents a condition for successful realisation of the planned objectives (Blaha, 1999; CEC, 2000).

CONCLUSIONS

Different incidents have highlighted the need for early detection and identification of animal diseases and food safety hazards before they become real risks. Effective notification of animal diseases is implemented in national veterinary legislation, as well as in the national Veterinary Information Management System, as the software module called National Animal Disease Notification System, in accordance with standards prescribed by the OIE but also by EU regulations.

The functioning of notification, monitoring, de-notification and reporting of animal diseases in Serbia, with comprehensive software tools, provides the support to decision-makers and facilitates the activities aimed to rapid responding to outbreaks, transparent informing of activities in those problems but also international obligation to report such events to OIE or EU in a transparent way.

Sustainable development of the VIMS, especially the introduction of the GIS with epidemiological tools, such is zoning, and exchange of the relevant data with

some external systems, such as a laboratory information system, will ensure better control of animal diseases, improved system functionality, especially in establishing the sanitary status of individual animals, flocks, zones and compartments or the whole country, as well as the control of the trading of animals and animal products. The introduction of information systems into the veterinary system would ensure availability of accurate and reliable data for expert analysis, but also needed for improvement of quality management in the food chain. This would influence decrease of the number of outbreak in animal and human population but also increase of reliability of the food production chain for customers.

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VETERINARSKI INFORMACIONI MANADŽMENT SISTEM (VIMS) U PROCESU PRIJAVLJIVANJA I MENADŽMENTA ZARAZNIH BOLESTI

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SADRŽAJ

Preduslov za uspostavljanje efikasnog sistema menadžmenta zdravstvene zaštite životinja, bezbednosti hrane i sledljivosti u lancu proizvodnje hrane je uvođenje integrisanog veterinarskog informacionog menadžment sistema (VIMS) razvijenog na takav način da omogući prikupljanje, čuvanje, analizu i povlačenje podataka i obezbedi kumulativno skupljanje saznanja i njihovu stručnu interpretaciju. Takav sistem će omogućiti prikupljanje podataka, uključujući one iz upravljanja kvalitetom i u okviru inspekcijskih kontrola, od svih objekata u sistemu proizvodnje hrane "od farme do viljuške" (farme, gazdinstva, klanice, laboratorije, lica koja se bave prometom i dr.) u strukturirano, unapred definisanom obliku, i obezbediti kompetentnu analizu takvih podataka kao i unapređenje postojećih programa i strategija. Uloga informacionih sistema u dijagnostici, nadzoru i prijavljivanju zaraznih bolesti, kontroli unutrašnjeg i međunarodnog prometa, upravljanju bezbednošću hrane, istraživanju žarišta zaraznih bolesti, prediktivnoj mikrobiologiji i kvantitativnoj analizi rizika je od izuzetnog značaja za kvalitet veterinarske službe. Sastavni deo VIMS-a je sistem za prijavljivanje zaraznih bolesti dizajniran prema i u saglasnosti sa međunarodnim zahtevima, standardima i preporukama i osposobljen da vrši razmenu određenih podataka sa sličnim informacionim sistemima. Cilj ovog rada je da se opiše nacionalni sistem za prijavljivanje zaraznih bolesti koji je u Srbiji u primeni kao deo VIMS-a.