

## Animal health in semantic web

refining ontologies in collaboration with veterinary institutions in Finland

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### Abstract:

#### Introduction and aim of the study

A veterinary practitioner needs current scientific information in his everyday clinical work. Peer reviewed articles are needed for building a knowledge-based academic profession. In medicine, time is an essential factor when better clinical practices are looked for. Therefore, a well designed and constructed system for delivering scientific information for animal health professionals benefits vets and other actors in the field. This study will explore how to support a collaborative method to create a reliable bank of terminology where the concepts are defined, validated and accepted by the scientific community.

#### Reviewing the Veterinary ontologies today

In computer science and information science, ontology formally represents knowledge as a set of concepts within a domain, using a shared vocabulary to denote the types, properties and interrelationships of those concepts. Ontologies are the structural frameworks for organizing information in the Semantic Web. In veterinary medicine there is e.g.: The National Center for Biomedical Ontology, ADO, which supports the Animal Diseases Knowledge Base, and AgriVIVO, an Ontology-based Store of URIs and Relations between Entities in Agricultural Research.

#### Prospect: Finnish Veterinary Ontology

The need of veterinary terminology in Finnish was recognized already in late 19<sup>th</sup> century when the Finnish Veterinary Association was established in 1892 with one of its goals to develop and disseminate veterinary terminology in Finnish to serve cattle and horse owners as well veterinarians. The Finnish Veterinary Journal started in 1893 and published the first list of Finnish veterinary terms in 1897. The words were collected from the practitioners who worked as teachers in agricultural schools (Helminen 2017). Although the work started long ago, there is still no official veterinary vocabulary. Indexers has used MeSH, Barnard classification (translated in 1962) and General Finnish thesaurus YSA.

#### The present situation in Finland

Ontologies are hosted by the National Library, as a Finnish Ontology Service named “Finto”. It includes KOKO, a collection of Finnish core ontologies. The ontologies include the Finnish General Upper Ontology YSO and ontologies that extend and refine YSO, e.g MeSH.

The current project, reported in this paper, is part of this initiative and started within the Faculty and Campus library, University of Helsinki together with EVIRA (Food Safety Agency) and Ministry of Agriculture, Dept. of Vet. Med. with the aim to create in a reasonable way a Finnish veterinary terminology. (Iivonen & al. 2014)

#### Information needs and information behaviour of veterinarians

To map the terminology used in the veterinary field, the study includes a review of the search habits among veterinarians. Data is found from the literature, e.g. Huntley & al. (2016). The review is complemented with data from the Reader survey of Finnish Vet J 2017 and finally with a small survey during Annual Conference 2017, where a questionnaire is delivered to the participants, to explore the information needs and behaviour of practicing veterinarians aiming to reveal which **search terms** they use.

#### Benefits

A better findability by refining search tools will serve both academic and practicing fields of the veterinary business. Though a relative good accessibility of scientific information in Finland, it is of no use if not discoverable. From the One Health point of view the results of this project will ameliorate the quality of life of all species – including humans.

*This conference paper describes some backgrounds supporting the collaborative initiative in creating a Finnish veterinary ontology.*

## **Introduction and aim of the study**

A veterinary practitioner needs current scientific information in his everyday clinical work. Peer reviewed articles are needed for building a knowledge-based academic profession. In medicine, time is an essential factor when better clinical practices are looked for. Therefore, a well designed and constructed system for delivering scientific information for animal health professionals benefits vets and other actors in the field. This study will explore how to support a collaborative method to create a reliable bank of terminology where the concepts are defined, validated and accepted by the scientific community.

## **Reviewing the Veterinary ontologies today**

### *Ontologies*

In computer science and information science, ontology formally represents knowledge as a set of concepts within a domain, using a shared vocabulary to denote the types, properties and interrelationships of those concepts. Ontologies are the structural frameworks for organizing information in the Semantic Web.

Knowledge organization systems (KOS) originate from library and information science, where they are used as schemes for organizing information and promoting knowledge management. Ontologies and other knowledge organization systems, such as controlled vocabularies, can be used to enhance the findability of information.

The use of ontologies as domain models enables the machine-processability of contents, semantic reasoning, information integration, and other intelligent ways of processing the data. (Tuominen 2017)

### *Veterinary ontologies*

Although veterinary medicine is an established field, the use of ontologies in veterinary medicine is a small but growing area. Ontologies are currently used in disease surveillance systems, in hospital case repositories and are being tailored for utilization in practice management systems. E.g. the National Center for Biomedical Ontology supports biomedical researchers in their knowledge-intensive work, by providing online tools and a Web portal enabling them to access, review, and integrate disparate ontological resources in all aspects of biomedical investigation and clinical practice.

In France, the National Agricultural Research Centre provides ADO (Animal diseases Ontology) which supports the Animal Diseases Knowledge Base.

The collaboratively developed ACO (Animals in Context Ontology) includes classes that develop when animals are put to practical use. These classes are commonly invoked by individuals involved in animal husbandry, production and veterinary care. It is produced by the Veterinary Terminology Services Laboratory (VTSL), dedicated to practical application of standardized medical terminologies. It facilitates the recording and analysis of clinical information, supports translational research activities and thereby improve animal and public health.

An ontology-based inference engine was developed following the diagnosis task definition provided by CommonKADS methodology, motivated on knowledge representation and veterinary domain this project aims at using semantic technologies to develop a tool which supports veterinary diagnosis. This research proceeded in the Pontificia Universidad Catolica del Peru, Lima, aimed to apply Knowledge Engineering (KE) methods and Semantic Web (SW) technology for the development of a prototype of diagnosis system to supports veterinary diagnosis. (Melgar et al. 2015)

### **Prospect: Finnish Veterinary Ontology**

The need of veterinary terminology in Finnish was recognized already in late 19<sup>th</sup> century when the Finnish Veterinary Association was established in 1892 with one of its goals to develop and disseminate veterinary terminology in Finnish to serve cattle and horse owners as well veterinarians. The Finnish Veterinary Journal started in 1893 and published the first list of Finnish veterinary terms in 1897. The words were collected from the practitioners who worked as teachers in agricultural schools (Helminen 2017). Although the work started long ago, there is still no official veterinary vocabulary. Indexers have used MeSH, Barnard classification (translated in 1962) and General Finnish thesaurus YSA.

#### *The present situation in Finland*

Ontologies are hosted by the National Library, as a Finnish Ontology Service named “Finto”. It is a Finnish service for the publication and utilization of vocabularies, ontologies and classifications, providing a user interface for browsing the vocabularies and open interfaces to utilize them in other applications. It includes KOKO, a collection of Finnish core ontologies, including the Finnish General Upper Ontology YSO and ontologies that extend and refine YSO, e.g MeSH.

Medical Subject Headings (MeSH) is a structured thesaurus in the domain of medicine. This version of MeSH in SKOS format is based on the year 2017 version of MeSH and includes the Finnish translation of MeSH (FinMesh); the vocabulary also includes Swedish terms from the SweMeSH 2017, a thesaurus created by Karolinska Institutet.

The translation process of medical terms into Finnish to help the health professionals in their everyday work has a long history. Today the updating is done at the Campus Library Terkko situated in the premises of the University Hospital. Terkko is producing the Finnish medical database Medic, where the articles are indexed using FinMeSH terms; after MeSH update is translated into Finnish using the Medic platform, it is transferred on the Finto interface, once a year.

The current project, reported in this paper, is part of a collaborative initiative started in 2012 within the Veterinary Faculty and Viikki Campus library (University of Helsinki) together with EVIRA (Food Safety Agency) and Ministry of Agriculture, Dept. of Vet. Med. with the aim to create in a reasonable way to produce a Finnish veterinary terminology. (Iivonen et al. 2014).

The need of Finnish veterinary terms is still acute, and an update to the original initiative should be reconsidered. The MeSH service as a corpus including veterinary terms is a solid ground to build an ontology in the One Health spirit to serve all the users of veterinary and other medical information.

However, long-term accessibility does not come without commitment to continuous maintenance. An essential question for further discussion is the time aspect: how to ensure that the vocabulary keeps up with language, which is in constant flux. Not only the construction, but also the

maintenance of vocabulary tools is very labour-intensive and requires a permanent allocation of resources. (Niininen, Nykyri & Suominen 2017)

### **Information needs and information seeking behaviour of veterinarians**

It is important to remember that the final aim of controlled vocabularies - including multilingual concept schemes – is to provide better search results and easier access to information. Furthermore, the features of a system of ontologies are based on analysing the needs of the main of its user groups, and therefore a shift should be made closer to the information seeker. Much research has been done to understand the information needs, seeking, and use among different professionals. These studies have among other things shown that it is important to recognize that much information seeking takes place in groups, and that sharing of information with others is common. (Case 2012, p. 27) However, veterinarians' information behaviour is an under-researched area and in order to be able to develop purposeful tools to support information seeking, it would be important to focus their information behaviour more in detail.

In the following section the few studies done on veterinarian's information needs and information seeking behaviour will be presented.

#### *United Kingdom (UK)*

In 2010 T.D.Nielsen & al. conducted a survey of the UK veterinary profession: common species and conditions nominated by veterinarians in practice. The aim of this study was to describe the UK veterinary population, and what species and conditions veterinary clinicians think they commonly encounter in practice. A second aim was to gather data relating to how much information veterinary clinicians perceived was available for these species.

The target population was all members of the veterinary profession within the UK. The sampling frame was the RCVS (Royal College of Veterinary Surgeons) register of members. The questionnaire was made up of 36 questions and had four main sections. The questions in the first section concerned the collection of demographic information about respondents. The second section was made up of open questions requiring clinicians to nominate up to four species they most frequently encountered, and the three main conditions or complaints they thought they saw most commonly in those species with associated perceived information levels.

This study highlights specific areas in which research could be pertinent for veterinarians in the UK; skin conditions were mentioned frequently in small animals, and reproductive conditions and musculoskeletal conditions in cattle and sheep, and equines, respectively.

There is a perception that little information exists for certain species; further research is required to identify whether this information exists and if it is accessible to veterinarians to aid decision making in practice. (Nielsen et al. 2014)

The second part of the survey was published in 2015 with the subtitle "sources of information used by veterinarians". The aim of this study was to identify what resources the UK veterinary profession access and regard as most useful. Colleagues were the preferred choice for information or evidence

for clinicians when requiring assistance for difficult clinical cases, with practice manuals preferred less frequently.

All subgroups of clinicians nominated that they preferred to go to a colleague for advice when they had a difficult clinical case, with textbooks ranked second. The current study gives information on respondents from the different types of practice (eg, small animal, equine, farm animal) as well as non-clinicians, and can potentially lead to improvements in relation to how researchers communicate research findings, and how veterinarians can further integrate evidence into practice. (Nielsen 2015)

### *Other countries*

An international Evidence-Based Medicine survey of the veterinary profession (information sources used by veterinarians) was conducted in 2011 via an online questionnaire. This is the first study to report the types of resources used, and those which are perceived as most useful, by veterinarians internationally. The target population was all veterinarians working outside of the UK; there was no definitive global list of veterinarians or organisations available.

Clinicians are likely to have different information needs from non-clinicians and this was observed in the study, albeit with some overlap between groups. Although the results of the survey suggest that different groups of veterinarians across the world have different information preferences it appears they have broadly similar information seeking behaviour with the majority of both groups accessing three or four journals and one electronic resource.

Clinicians prefer to read the sections that succinctly provide ‘the answer’ to the question posed in the paper. This discrepancy between clinicians and non-clinicians may be due to the time constraints of the busy clinical role, since the time required to adequately assess the scientific information available can be a barrier. It may also be due to the different emphasis on information needs between clinicians and non-clinicians particularly because the non-clinician respondents were likely to be made up of a high proportion of researchers.

Another reason for the differences in information seeking behaviour of clinicians and non-clinicians could be the training required to undertake thorough literature searching and appraisal. (Huntley & al. 2016).

### *Finland*

The information needs of Finnish veterinarians are monitored using the results of the reader survey of the Journal – a continuum which gives reliable data in intervals of five years. The aim of the survey is to improve the quality of the Journal in general, therefore it is not easy to add special questions concerning literature searches.

- *Reader Survey 2017 (Finnish Veterinary Journal)*

The questionnaire was sent to all the members of the Finnish Veterinary Association as a printed letter, which was mailed back in an envelope. These respondents were definitely members of the Association. An open link to all readers gave 19% of the answers, probably members as well. The total number of answers is 500 – a very good rate. There are approximately 2100 veterinarians in Finland, and 85% of them are members of the Association.

The purpose of the Reader survey is to monitor how satisfied the members are to the services they pay for – the Journal is one of the most concrete ways to share information about anything. Readers are very content and appreciate their own Journal very much.

As for the delivery of scientific information for practical needs, the most useful were international journals online (34%), followed by colleagues and the Journal. The question was quite general and does not give the kind of answers expected when studying the information seeking behaviour.

- *Survey during the Annual Veterinary Conference 2017 Helsinki*

The author made a survey during the Annual Veterinary Conference 2017, where all the Finnish veterinarians gather to meet colleagues, participate to continuing education courses, and above all, spend some social life after a long period of hard workload.

A questionnaire was delivered to the participants, to explore the information needs and information seeking behaviour of practicing veterinarians aiming to reveal which **search terms** they use, since this was not asked in the Reader Survey. More or less the questions and answers about information needs were similar to the surveys (Nottingham Studies) mentioned above; the challenge was to find out how the searchers formulate their search strings, i.e. what **words** they use. Since the Finnish language differs so much from the Indo-European languages, it is a temptation to assume that finding relevant information on medicine is somehow difficult. However, the medical jargon is dominant, there has not been “too much” translation activities in the veterinary medical landscape, contrary to human medicine in Finland.

The most used database was PubMed. It is popular due to the free access and a quite satisfactory amount of open access articles. Apparently, the content of veterinary matters is enough to the needs of veterinary practitioners. The question about the terminology, whether it was accessible or not, was somehow mysterious. The search terms most used were found intuitively – that is common professional vocabulary, which seems to work well enough in PubMed’s search box.

### *Conclusion*

The results of the studies of information needs and the information seeking behaviour of the veterinarians seem to be very similar all over the world. It is quite natural since the profession itself is similar, as well the education and the practicing in clinics. This is previously studied and reported. (Nault & Baker 2011)

Like in other workplaces, also veterinarians ask their (senior) colleagues first, then open the textbook. Most of the informants worked in small animal clinics, with some other colleagues and veterinary technicians.

Information is one of the strategically most important resources of any workplace of organization (Widén-Wulff 2007). Veterinarians working in municipalities or private clinics are no exception, since the workflow must be smooth to get the best possible care to the patient, and that includes the fluent transfer of information through the whole organisation.

The practice of evidence-based veterinary medicine involves the utilisation of scientific evidence for clinical decision making. In Finland, the relationships between the Faculty and the practitioners are quite close, since the amount of people in the business is relatively small. But when activities will grow, a technically organized information delivery system will be needed. A well-

designed ontology will a reliable basis for creating information delivery systems to Finnish /Swedish speaking veterinarians in Finland.

Future studies should cover the information seeking behaviour of those veterinarians, who have studied e.g. in Tartu University, Uppsala etc. and work in Finland.

## Benefits

A better findability by refining search tools will serve both academic and practicing fields of the veterinary business.

Though a relative good accessibility of scientific information in Finland, it is of no use if not discoverable. From the One Health point of view the results of this project will ameliorate the quality of life of all species – including humans.

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*Web resources:*

Finto: <https://finto.fi/en/>

FinMeSH: <https://finto.fi/mesh/fi/>

Termix: <https://www.terkko.helsinki.fi/termix/>

KOKO: <https://finto.fi/koko/en/>

YSO: <https://finto.fi/yso/en/>

ACO and VTSL: <http://vtsl.vetmed.vt.edu/default.cfm>