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UNIVERSIDADE DO PORTO

Relatório Final de Estágio
Mestrado Integrado em Medicina Veterinária

Veterinary management systems: a look into retrieving data to Vet-OncoNet

Ana Filipa Pereira Castro

Orientadora:

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ABSTRACT

Cancer is one of the major public health problems in this day and age, even in domestic animals, with over 4.2 million dogs and 412/100.000 cats being diagnosed annually. Cancer registries generate a significant amount of scientific knowledge and dogs are a remarkable model to monitor advances in human oncology. Vet-OncoNet is the first animal oncology registry in Portugal with a three-dimensional work strategy – ACR (Animal Cancer Registry, pathology-based), RFR (Risk Factors Registry, owners-based) and COR (Clinical Oncology Registry, a hospital-based information registry). Unlike the other registries, the COR received few records in the last two years. Thus, the aim of this study was to assess the data exchange between Vet-OncoNet and clinical practices.

To reach this goal, four studies were conducted. The first aimed to understand the reasons for the lack of data retrieved from VetPractices to Vet-OncoNet through the use of a questionnaire. The second study aimed to perform data collection and analysis from VetPractices. With the use of flowcharts, the third study assessed clinical oncology data paths and the identification of weak points. The final aim was to develop a solution to contradict the grievance found in data retrieval. The assessment to the adherence of VetPractices revealed that practitioner's lack of time was the main reason for non-submission of data. Regarding the VetPractices study, data from the Hospital de Referência Veterinária Montenegro showed that of 339 neoplasms, 89.1% (n=302) occurred in dogs and 10.9% (n=37) in cats, representing a hospital-based incidence of 13.2% of oncological cases. For dogs, 30.5% were no-breed (n=92) with a mean age of 11.4 years, followed by Labrador retrievers (18.5%; n=56) with a mean age of 8.8 years. Regarding cats, 70.3% (n=26) were European shorthairs with a mean age of 12.2 years, followed by Persians with 8.1% (n=3) of cases and a mean age of 9.4 years. For both species the most common topographies were skin (57.7%; n=196), mammary gland (9.8%, n=33) and lymph nodes (6.5%, n=22). For dogs, the most common neoplasms were lipomas (19.9%, n=60), followed by mast cell tumors (14.3%, n=43) and carcinomas (5.3%, n=16). In cats, lymphomas (24.3%, n=9), adenocarcinomas (13.5%, n=5) and squamous cell carcinomas and carcinomas NOS with 8.1% (n=4) were the most prevalent neoplasms. Cytology was by far the most used diagnosis technique, with 40.1% (n=136) of the records and surgery was the most common therapeutic decision with 40.4% (n=137). What concerns the clinical outcomes, 50.6% (n=171) of the records had no follow-up. The creation of a flowchart for oncological data allowed the understanding of the information conduction through the different management systems and guided the creation of a solution to favor data exchange.

Thus, an oncology record was created in partnership with GuruVet® which will enable an automatic retrieval of data.

In conclusion, hospital-based oncology registries are scarce and complex. However, they present valuable information that can empower VetPractices, enabling solid evidence-based decision-making.

KEYWORDS: Cancer registry; Companion animals; Data; Management system; Vet-OncoNet

«Para a forca hia um homem: e outro
que o encontrou lhe dice: Que he isto se-
nhor fulano, assim vay v. m.? E o enforca-
do respondeo: Yo no voy, estes me lleban.»

P.e Manuel Velho
In Memorial do Convento

«Outra terra é agora a terra que me fez,
Que não tarde e serei eu também terra de outras terras,
Da terra que me fez e da terra onde me fizeram.»

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Ao Deus 9,5, santuário com trejeitos de culto que não se une por sangue, mas se tornou uma família. A tudo o que temos, das alegrias ictéricas, tristezas partilhadas, rotinas ignotas e tudo mais que nos aproxima e separa, que esta instituição se estenda até ao fim dos nossos dias.

Ao Primeiro Esquerdo que foi abrigo. Mais abrigo foi quem as paredes albergavam e que seguem como égide contras as intempéries do destino. Preferencialmente, de tom de voz mais comedido.

Aos meus amigos conterrâneos, que da terra onde brotamos criamos também raízes, os anos que já nos pesam continuarão em soma, somando também tudo aquilo que vivemos e viveremos.

Ao João, como se dissesse bar, mas não de canto.

Ao meu pai, irmã, avó, avô, tios e prima, a minha casa. Crasto Castro, que subsiste e suste e é o ar que respiro. A única certeza que se impõe, em medidas desmedidas sobre a razão e sobre o sentir é aquilo que nos une. Sem nunca esquecer onde está a chave.

Para o Horácio, os dias todos.

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ABBREVIATIONS

CHV	Centro Hospitalar Veterinário
COR	Clinical Oncology Registry
CVBN	Clínica Veterinária da Boa Nova
DVM	Doctor in Veterinary Medicine
HRVM	Hospital de Referência Veterinária Montenegro
HX	Hospital X
HY	Hospital Y
IARC	International Agency for research in Cancer
MCT	Mast Cell Tumor
PMS	Practice Management System
UK	United Kingdom
VetPratices	Clinical Veterinarians
WHO	World Health Organization

1. INTRODUCTION

In the 21st century, cancer is one of the biggest public health problems worldwide and a leading cause of sickness and death in humans, peaking at 1.3 million deaths in 2020 across Europe (European Comission, 2020). Cancer is also a common disease in companion animals. Over 4.2 million dogs and 412/100.00 cats are diagnosed with cancer each year, with mortality rates of 15-30% in dogs and 26% in cats (Arnesen K, 1998; Manuali et al., 2019; Schiffman & Breen, 2015). Oncological disorders are naturally occurring diseases that are similar and often identical between humans and dogs in terms of development, etiology, and treatment response (Kol et al., 2015; Pang & Argyle, 2016). The study of these naturally occurring tumors in dogs provides a remarkable model for perusing advancements in human cancer. Not only does the canine model share striking biomolecular features with humans (Di Cerbo et al., 2014; Graf et al., 2015) and a resemblance in its natural progression, but excessive breeding has resulted in a high-risk model for certain breeds with genetic restriction that allows for easier genetic mapping of the disease (Schiffman & Breen, 2015). In addition, the shorter lifespan allows for a briefer evaluation of clinical traits allowing the study of new methods in the diagnosis, treatment, and prevention of cancer (Albert et al., 1994; Di Cerbo et al., 2014; Schiffman & Breen, 2015). In addition, companion animals share the same environment with humans, making them susceptible to the same risk factors (Amy K LeBlanc, 2020; Backer LC, 2001; Bettini G, 2010; Bukowski & Wartenberg, 1997; Gruntzig et al., 2016; Marconato et al., 2009) and allowing investigation in a shorter time frame. The animal-human bond also plays a role in cancer dynamics, as tumors in companion animals, apart from the consequences of pathology per se, have a tremendous impact on the relationship with their owners and their mental health (Pang, 2009). This concept of animals as models is the basis of comparative oncology, a growing field that studies cancer risk and development across species (Schiffman & Breen, 2015). Therefore, comparative oncology plays an essential role in improving human and animal health and adds value to the One Health approach (Manuali et al., 2019).

In order to achieve the comparative oncology concept, it needs to exist information about cancer, for that The World Health Organization (WHO) has defined cancer surveillance programs as permanent and ongoing sources of data that provide the basis for research on cancer causes, prevention, prevalence, and trends in risk factors. They allow an assessment of the extent of cancer burden and its evolution, in order to monitor the

impact of early detection, treatment, and palliative care (World Health Organisation, 2002). It is important to understand that surveillance is defined as “a systematic measurement of environmental and heath factors, the record and transmission of data and its interpretation to detect changes in the health and environment of populations” (Parkin, 2008). This means that the act of surveillance is the continuous collection, analysis, feedback, and dissemination of data (Parkin, 2008). Therefore, a cancer surveillance strategy is arbitrary and, as in humans, the existence of cancer registries, a tool for this surveillance, proves to be crucial for the creation of these strategies in cancer prevention and control (Das, 2009; Gruntzig et al., 2015; Nodtvedt et al., 2012).

Human cancer registries generate a considerable amount of scientific evidence (International Agency for Research in Cancer (IARC), 2021) disclosing more and more knowledge. They first appeared in the 1920s and are now well-established and required by law in many countries, with multiple working links worldwide (Bronden et al., 2007). There are two main types of cancer registries: population-based – recording all new cases in a defined and numbered population, usually within a geographic area, providing an estimate of tumor incidence – and hospital-based – recording all cases in a specific hospital or laboratory without information about the area or population at risk. Population-based registries are the most sought-after types of registries because they enable the determination of frequencies and survival rates, and comparisons between populations and associations within the cancer registry area (Bronden et al., 2009).

Regarding carcer registries for companion animals, they were first established in the 1960s in response to an increasing mortality from spontaneous tumors (Gruntzig et al., 2015). However, research on animal cancer registries shows that they are sporadic, few in number, and lack communication and collaboration (Bronden et al., 2007). The first known initiatives were from Kansas University between 1961 and 1972 (Bronden et al., 2007); the California Animal Neoplasm Registry, one of the best-known, active from 1963 to 1966 (Bronden et al., 2007); the Tulsa Registry of Canine and Feline Neoplasms in Oklahoma, from 1972 to 1977 (MacVean et al., 1978); the Purdue Comparative Oncology Program, established in 1979; and the Cancer Registry and Surveillance System for Companion Animals from Cornell in New York State in 1980. The active cancer registries are The Veterinary Medical Database, established in 1964; the VetCancer Registry, a web-based registry created in 1994 (Vet Cancer Registry, 2001); the Norwegian Canine Cancer Registry, started in 1990 (Bronden et al., 2007); the Danish Veterinary Cancer Registry, created in 2005 and based on the Danish Cancer Registry for Humans (Bronden, Eriksen, et al., 2010); the VetCompass, established in 2007 and owned by the Royal Veterinary

College (Royal Veterinary College, 2021); and the SAVSNet, started in 2008 by the British Small Animal Veterinary Association and the University of Liverpool. The latter is now only under the university's umbrella, collecting clinical data from veterinary practitioners and data concerning various diseases tested in veterinary laboratories across the United Kingdom (UK) (Small Animal Veterinary Surveillance Network, 2021). The former projects have been discontinued for different reasons, nevertheless the era of Big Data has begun and new technologies and tools to improve preventive and veterinary medicine are now available (Paynter et al., 2021). The canine cancer data present in registries can be used in epidemiological studies and, through quantitative comparisons, it is possible to identify cancer frequencies (Baioni et al., 2017; Bronden et al., 2009). These are useful for research and to generate hypotheses about the cause of different tumors and to identify risk factors, as well as the temporal distribution of cancer (Baioni et al., 2017; Bronden et al., 2009).

In addition, registries can be used to evaluate treatments, trends in distribution, and breed predispositions (Bronden et al., 2009). However, the lack of census data for companion animals makes compilation of data challenging. For this reason, tumor banks and insurance databases are sometimes used as sources of information, or reliance is placed on the compilation of hospital-based registries (Dobson et al., 2002; Egenvall et al., 2005; Nodtvedt et al., 2012). Analysis of hospital-based data, on companion animal illnesses, provides robust evidence on which conditions have the greatest impact on animal health and well-being and the cost-effectiveness of different treatments and respective care options. Furthermore, this information feeds evidence-based decisions (Paul McGreevy 1 et al.).

It is well established that the One Health concept includes more than major infectious and zoonotic diseases; it comprises a broader arc of causes and effects between species and ecosystems, and all risk factors for animal and human health that result in environmental change (Evans & Leighton, 2014). It is also understood that the human-animal relationship and the ecosystem interactions have carved, and continue to shape, the course of human history (Evans & Leighton, 2014). With animals and the public health paradigm in mind, different surveillance systems have been developed around the world to control and prevent disease (Jones et al., 2008). Considering the progress made and the importance of cancer registration mentioned above, Vet-OncoNet – The Veterinary Oncology Network (ICBAS, 2020) was launched in December 2019 by the School of Medicine and Biomedical Sciences – ICBAS – of the University of Porto, Portugal, in partnership with ISPUP (Institute of Public Heath University of Porto) and UTAD (University

of Trás-os-Montes e Alto Douro) (K. Pinello et al., 2022). This is a pioneer platform for an animal cancer database, whose “mission is to produce scientific evidence and knowledge on animal and comparative oncology, bearing in mind the perspective of “One Health”, as well as to provide streamlined communication in animal oncology to veterinary clinics and pet owners” (K. Pinello et al., 2022).

Vet-OncoNet operates within the framework of a three-dimensional strategy. The data collected comes from veterinary diagnosis laboratories, veterinary practices, and owners. The information coming from the above sources is integrated into the system and each source feeds a different registry. For example, laboratories provide information to the Animal Cancer Registry (ACR), which allows for the creation of a pathology-based registry, Enabling the drawing of conclusions about the occurrence of neoplasms. Owners feed the Risk Factors Registry (RFR). Records of oncologic animals and animals without cancer (controls) can be retrieved here and contribute to the creation of risk factor-based case-control studies. Within the RFR area, an interface has also been established for community networking, particularly among owners of animals with oncologic diseases, called Pet-OncoNet (Vet-OncoNet, 2021). Veterinary practices feed the Clinical Oncology Registry (Backer LC) which records information on diagnostic methods, therapeutics, staging, and outcomes used in the clinical context (K. Pinello et al., 2022). The collected information is integrated, analyzed, and modulated before being included in the registries and can later be visualized in interactive dashboards. Figure 1 illustrates the data management of Vet-OncoNet. The dashboards allow partners to assess their information and understand their data within seconds via the Internet (K. Pinello et al., 2022). The registries are not interconnected, resulting in independent databases with different results.

As for the COR, the information stored in this registry is of great value and contributes to advancing evidence-based veterinary medicine and understanding the panorama of veterinary oncology practice in Portugal. To better understand the collection of data and the importance and quality of the information residing in COR a preliminary study was conducted to better understand the data transfer between VetPractices and the Network. The focus was on retrieving data from the Veterinary Hospital of the University of Porto (UPVet). The work was conducted between August 2020 and February 2021 using data from the practice management system (PMS), GURUVET®. Six hundred and twenty records were exported and individually reviewed. Only records with confirmed neoplasms were selected adding up to a total of 231 cases. Two hundred and two of these were dogs (87%) and 29 were cats (13%). In addition to the species, the most commonly affected

breeds, diagnostic methods, affected system, morphology and therapeutics modalities were also reported (Universidade do Porto, 2021). During this study, some problems were encountered in the systematization of data collection. In our experience, a lack of clinical oncological information and the absence of a definitive diagnosis was found (Universidade do Porto, 2021). The preliminary study also showed that valuable and relevant oncological data for clinicians can be obtained from the COR, but further studies are needed to improve the registry.

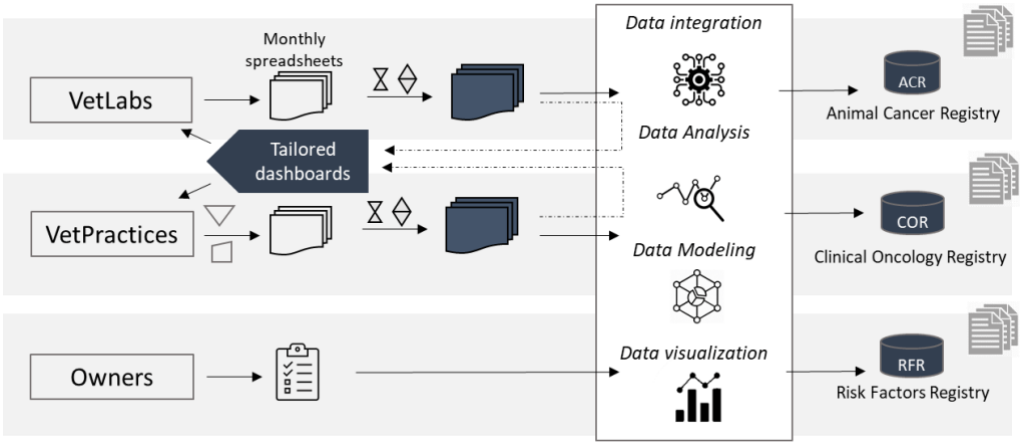


Figure 1. Vet-OncoNet data management: representation of the outputs of the system, structured data from the Animal Cancer Registry, Clinical Oncology Registry and Risk Factors Registry, and the dashboards to partners. (K. Pinello et al., 2022)

With the COR alone, it is possible to understand diagnostic decisions, staging procedures, outcomes, and treatment decisions and their respective results in companion animal cancer, as well as provide advances in early detection and prevention options (K. Pinello et al., 2022). Until May 2021, the COR counted 27 partners and only 400 records – 231 collected in the preliminary study. Complications related to the poor quality of the information coming from this source, as well as a great heterogeneity in the creation and existence of clinical records, have been identified. Often, the information is incomplete and disintegrated leading to difficulties in data processing (K. Pinello et al., 2022).

2. OBJECTIVES

The main goal of this study was to assess the data exchange between Vet-OncoNet and VetPractices. To reach this goal, the study was divided into four specific aims:

- To assess adherence of veterinary practices and analyze the transmission pathways of the information on Vet-OncoNet;

- To collect data from partner VetPractices and conduct its processing, treatment and analysis;
- To analyze the information flow through the systems, the way data is entered and its reach points;
- To create a solution that encourages the exchange of data.

3. MATERIALS AND METHODS

3.1. Veterinarian Practices Adherence Study

To better understand the defaults perceived during data retrieval to the COR from the VetPractices' and the general perceptions of the network, a survey was made to all Vet-OncoNet partners.

A list of current partners and their contacts was used, and all were contacted by phone call. As soon as it was possible to talk to the VetPractices in charge, a presentation was made, and the questionnaire was completed. The questionnaire was created on the Google Forms® platform and completed during the call or emailed to the VetPractices. It consisted of twenty-six questions that were either multiple choice or short answer and were divided into five broad topics (Figure A1, Annex A). The telephone contacts with the clinicians started on July 14th, 2021, and continued until July 17th, due to some of the clinician's work schedule constraints. Those who still could not be reached by phone were sent the questionnaire by email. The platform used to compile the questionnaire, allowed an Excel spreadsheet containing all the answers to be automatically extracted. After the deadline given to the partner VetPractices to answer the questionnaire, the responses were edited, validated and standardized. The standardization of the data required special attention because some of the questions were open-ended, and it was particularly challenging to group them. Unfortunately, this standardization was not possible for some of the questions due to the length and personal imprint in the opinion questions, nevertheless, all the answers were taken into account and helped to understand the clinical end in the dilemma.

3.2 Veterinarian Clinical Practices Data Extraction Study

The clinical data extraction study was conducted with the aim of achieving complete coverage of the types of data and manners of extraction. A study was carried out using three different veterinary practices. The objective of this work was to understand how this extraction could be performed by the VetPractices, considering the different ways of recording clinical information and the different PMS used in veterinary practice.

Consideration was also given to how the PMS might respond to such data and characterize the oncology population in a given time frame, to facilitate subsequent retrieval of data on Vet-OncoNet. An initial example of the data extraction method can be seen in Figure 2, where the clinical data chain includes all information about the oncological situation and is later inserted into the PMS. With the use of the PMS, it is then possible to perform the data collection. The three veterinary hospitals involved in different ways in this study were Hospital de Referência Veterinária Montenegro (HRVM), Centro Hospitalar Veterinário (CHV) and Clínica Veterinária da Boa Nova (CVBN).

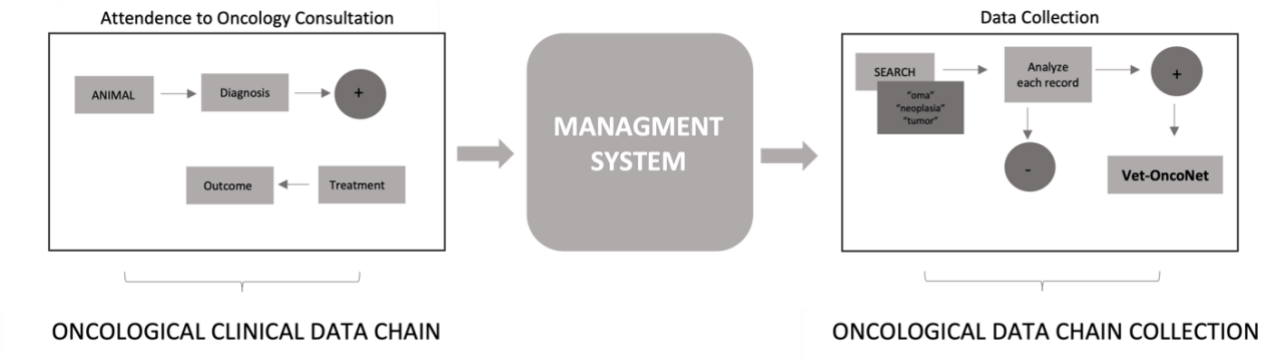


Figure 2 Clinical oncology information flow: oncological clinical data chain and oncological data chain collection and PMS at use integrated.

3.2.1 Hospital de Referência Veterinária Montenegro

After an initial introduction to the PMS used – WinVet® – and its operation, by DVM (Doctor in Veterinary Medicine) Cristina Moreira, data extraction was performed between September 14th and November 17th, 2021. In order to cover the oncological population, a period from August 2020 to August 2021 (1 year) was chosen.

The manual procedure of cancer data collection followed a complex process with innumerous sequenced tasks. Opening the billing tab to create lists of clinical cases was the starting point of search. Here it was only possible to search for items that were billed or for information written in the patient's medical history. Often, oncology-related terms are not billed in an oncology case, so searching the entire medical record was preferred, knowing that a suspicion or other diagnosis would cause the record to appear in the list. The first term sought was "neoplasia", followed by "citologia", "quimioterapia", "quimio" and "anatomia patológica". One of the terms used in the preliminary study was the suffix "oma" – related to neoplastic conditions – it was also attempted to do the same, but the PMS was different, and all words written in the medical history were automatically searched, resulting in numerous entries unrelated to oncology. Because the PMS was not able to extract information from 13 months at once, the search was performed in groups of months. The

list retrieved after this search included the intern treatment code, animal and owner name, date, and place of residence as showed in the process graphic illustration in Figure A2 in Annex A. Here a general search tab was used, in which the animals' name and owner were entered. Each clinical record was then opened. For a quicker assessment, a methodology was used by clicking on the analysis tab – to understand if a diagnostic report was attached and read it if so – subsequently opening the animal's clinical record – prompt reading it and search for neoplastic conditions involvement. If it was a record of an animal with a neoplasm, the required data were collected and written onto a Microsoft Excel spreadsheet. If not, the tab was closed, and another record was searched. The information collected was the date of diagnosis, microchip, species, date of birth, sex, reproductive status, breed, place of residence, zip-code, method of diagnosis, topography and morphology, treatment decisions, and outcome.

After this phase, the data underwent an initial phase of data cleaning and preparation, which included data editing, validation, and standardization of terms. This standardization occurred since different VetPractices and pathologists denominate the same subjects with different terms – e.g., breeds, morphologies, topographies – and not all parameters were written the same way at the moment of recall. Then, a classification was performed for each dataset according to anatomical tumor location (topography) and histological type (morphology) using the Vet-ICD-O-1 classification system – the canine counterpart of the human classification, ICD-O-3.2 (International Classification of Diseases – Oncology, version 3.2) (K. Pinello et al., 2022). This is a classification system developed by the Global Initiative on Veterinary Cancer Surveillance (GIVCS) in close collaboration with IARC (K. Pinello et al., 2022). Regarding breed classification in dogs and cats, if nothing was written by the VetPractices, the animal was classified as "no breed" – though it should be noted that this lack of information could be due to forgetting to fill it out or due to stray animals. Some of the records lacked parameters due to incomplete filing by the DVM. Regarding diagnostic modalities, records that performed computer tomography (CT), ultrasound, radiography, or magnetic resonance imaging (MRI) were fit into the imaging category. Regarding therapy, benign tumors that did not require treatment, e.g., lipomas, were categorized as "no treatment needed". The purpose of this distinction was to distinguish a benign neoplasm for whom treatment was not needed to extend the life span from a malignant neoplasm in which the owners intentionally did not pursue the needed treatment. In therapeutic modalities, records designated as "no treatment" were those in which no treatment was performed but information about the animal was still recorded. The ones designated as "alternative treatment" were the ones that an unconventional treatment was chosen, such as homeopathy. Those designated as "no follow-up" were those for which

no further information was available after the diagnoses. Age was calculated using the difference between the date of diagnosis and the date of birth. An interactive dashboard (Data Studio®, Google – Figure A3 in Annex A) was created and provided to the respective DVM in charge to track the incoming data. The total number of animals presented during this period was recorded, taking into account only those records that attended general consultations in HRVM, excluding veterinary medical specialties or hospitalizations.

3.2.1.1 Statistical Analysis

Data analysis and descriptive analysis were performed on Microsoft Excel, using counts and percentages for categorical variables, and mean and standard deviation (SD) for continuous variables. The Z-test was used to assess differences between proportions, and Student's t-test was used for continuous variables. The statistical analysis was prepared using the online tool EPITOOLS®.

3.3 Flowchart of Data Pathway

In order to retrieve data from a source, regardless of the type, it is necessary to know how this information flows through the systems and how it is inserted. Therefore, a study was conducted that resulted in flowcharts of data pathways that can be compared between hospitals.

By creating a flowchart of the data pathway from the moment the animal enters the service to the moment it leaves, it is possible to see when each piece of information is gathered and at what point in the process it can be assessed, who might interfere with it and, most importantly, it enables the identification of points of failure from which the lack of information on these records comes from. Only with a more comprehensive view of the data flow can errors be eradicated. The first day in the veterinary practices detailed how the clinical records were filled, by whom, and at what stage of the appointment, since the moment the patient entered the waiting room. Data pathways were evaluated in two veterinary hospitals – X and Y - and both were constructed according to Ferrante et.al. (2016), Baresi et.al (1999), Assimakopoulos (2000), Reichert et.al.(2003) and Van der Aalast (2005).

3.4 Interface of Clinical Data Exchange

After the data analysis in the previous studies, it seemed useful to develop a tool capable of linking the routine reality of daily veterinary practices with the information needed for epidemiological studies – to be performed on Vet-OncoNet. The existence of this

oncological record only makes sense as an interface if there is an automation of the data exchange. To achieve this, Vet-OncoNet has partnered with the PMS GuruVet®. Thus, an "Oncological Record" was created in collaboration with DVM clinical oncologists Andreia Santos (ICBAS), Hugo Gregório (CHV) and Joana Lourenço (CVBN). These VetPractices were interviewed so as to assess the oncology file, to understand if all the clinical record necessities were met, and if this file would be an asset for tracking the follow-up of oncological cases.

3. RESULTS

3.1 Veterinarian Practices Adherence Study

In this study, 25 DVM were contacted, however only nine responded (Table B1 in Annex B). Of these, 88.9% (n=8) used a PMS as a record holder and 11.1% (n=1) used both a PMS and paper. Fifty-five-point six percent (n=5) had already sent data to the network. 55.6% (n=5) had only sent 0-5 records and 22.2% (n=2) had sent more than 11 records. Regarding the frequency of oncological cases, 55.6% (n=5) had more than one case per week and 22.2% (n=2) had more than four per week. What concerns the reasons for not submitting data to Vet-OncoNet, 77.8% (n=7) mentioned lack of time, 11.1% (n=1) forgetfulness and 11.1% (n=1) the length of the questionnaire.

Respondents were also asked for ways to improve the number of records submitted to the Vet-OncoNet network. Six out of nine (66.7%) answered that an automatic migration process should be created that would require less time and work; two (22.2%) had no opinion on this matter, and one (11.1%) suggested sending the data all at once in a Microsoft Excel file instead of answering individual questionnaires.

3.2 Veterinarian Hospitals and Clinics Data Extraction Study

Subsequently, to comprehend and analyze data chains from oncological appointments, data extraction was performed. This was only at possible at HRVM. At CHV, the process was not performed due to the lack of systematic data introduction and a difficulty in searching the PMS. At CVBN, the data was not made available for reasons beyond our knowledge. The HRVM was the only practice in which clinical data were indeed collected and further analyzed.

3.2.1 Hospital de Referência Veterinária Montenegro

Exactly 3720 records were analyzed - resulted from de search in the one-year time frame -, with 339 records confirmed and collected. Of these 339 neoplasms, 89.1% (n=302) occurred in dogs and 10.9% (n=37) in cats. Based on the total population attending HRVM during a year – 2657 records – the hospital-based annual cancer incidence was 13.2%.

The age ranged from 0.5 to 18.7 years in dogs and 1.5 to 19.8 years in cats, with a global peak at 10 years followed by a peak at 9 years of age. For dogs the age peak is in accordance with the global, however for cats the age peak was at 15 years followed by 14 years of age. Age distribution can be seen un Figure 3. Table 1 shows that the mean age for tumor incidence was lower in dogs than in cats ($p<0.05$). A higher prevalence was found in female dogs. In cats, despite the similarity, a higher prevalence was observed in males.

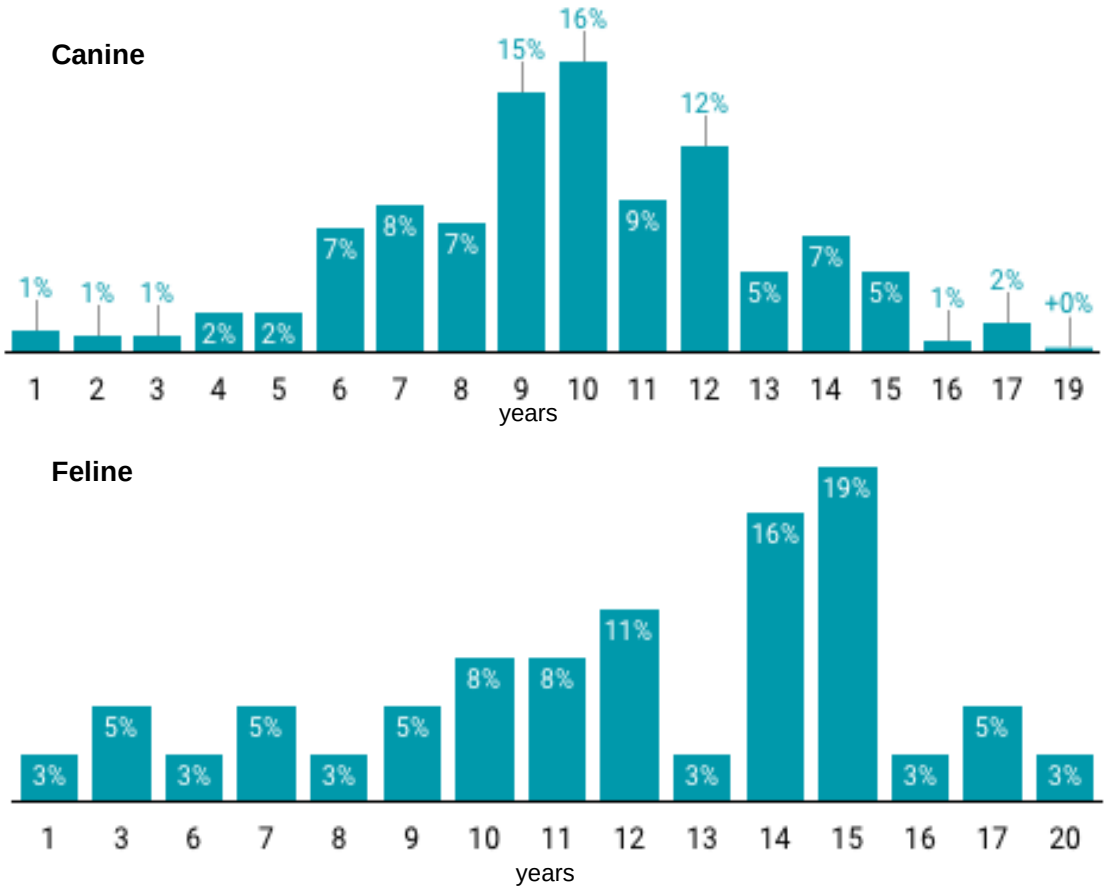


Figure 3. Age distribution in years by species.

52.5% (n=178) of the animals were neutered, of which 70.2% (n=125) were females. 45.1% (n=153) of animals were non-neutered, of which 62.1% (n=95) were males. 78.4% (n=29) of cats and 49.3% (n=149) of dogs were neutered.

Table 1. Age and reproductive state analysis of animals with neoplasms by species and sex.

Tumors in	**Dogs n (%)**	**Cats n (%)**	**Total n (%)**
Total number of records	302 (89.1)	37 (10.9)	*339*
Sex			
Females	170 (56.3)	18 (48.7)	188 (55.5)
Neutered	112 (65.9)	13 (72.2)	125 (66.5)
Non-Neutered	53 (31.2)	5 (27.8)	58 (30.9)
Males	132 (43.7)	19 (51.3)	151 (44.5)
Neutered	37 (28.0)	16 (84.2) ^{N}	53 (35.1) ^{N}
Non-Neutered	92 (69.7)	3 (15.79)	95 (62.9)
Age			
Mean (SD) **Min-Max**	9.8 (3.2) $^{0.5\text{-}18.7}$ **	11.8 (4.1) $^{1.5\text{-}19.8}$	10.0 (3.4) $^{0.5\text{-}19.8}$
Females	9.9 (3.1) $^{0.5\text{-}18.7}$ *	12.0 (3.8) $^{3.8\text{-}16.6}$	10.1 (3.3) $^{0.5\text{-}18.7}$
Males	9.7 (3.3) $^{0.9\text{-}17.2}$ *	11.7 (4.5) $^{1.5\text{-}19.8}$	9.9 (3.5) $^{0.9\text{-}19.8}$

Comparison between species: t-test: *p<0.05. ** p<0.001; Z-test: ^{N} p<0.001

Regarding breed, the most reported cases (30.5%; n=92) involved no-breed dogs with a mean age of 11.4 years, followed by Labrador retrievers (18.5%; n=56) with a mean age of 8.8 years and French bulldogs (6.6%; n=20) with a mean age of 8.5 years. Among the cats, 70.3% (n=26) of cases corresponded to European Shorthairs with a mean age of 12.2 years, followed by Persian cats with 8.1% (n=3) of cases and a mean age of 9.4 years and no-breed also with 8.1% (n=3) of the records and a mean age of 14.5 years for incidence.

The Table C1 shows the analysis of age and sex by breed and species with the respective mean ages for incidence. In no breed dogs we saw that females have a 71.7% (n=66) of representation over males and a younger mean age. Regarding Labrador retrievers sex distribution was not relevant. French bulldogs had a mean age of 8.5 years and 65%(n=13) were males with a mean age of 8.9 years. Beagles represented 2% (n=6) of all dogs and had a mean age of 10.6 years and Boxers had a mean age of 8.9 years and represent 1.7% (n=5) of all dog population. In cats, European's shorthair had 46.2% (n=12) of females with a mean age of 11.9 years old. Persian cats only had female representation and Siamese have an equal number of females and males (n=1). Figure 4 represents the geographic distribution of the oncology population attending HRVM with a greater prevalence in the Oporto area.

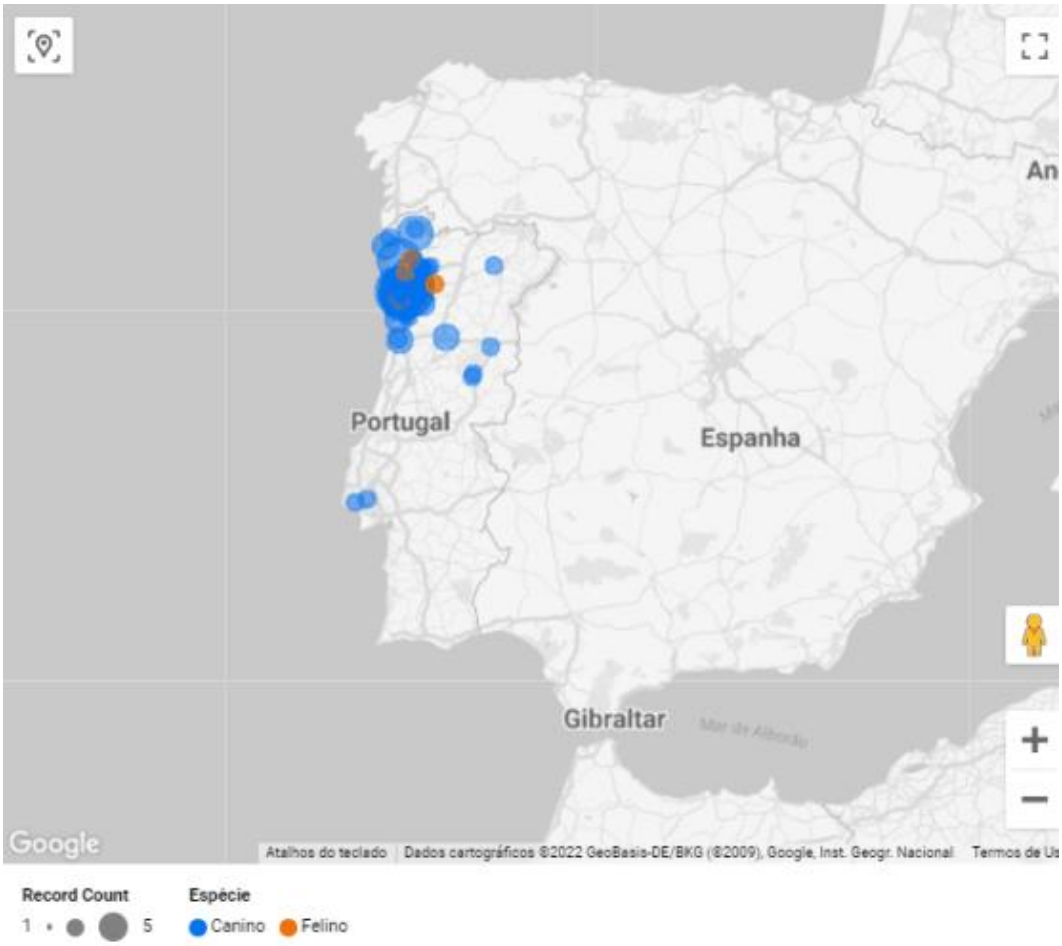
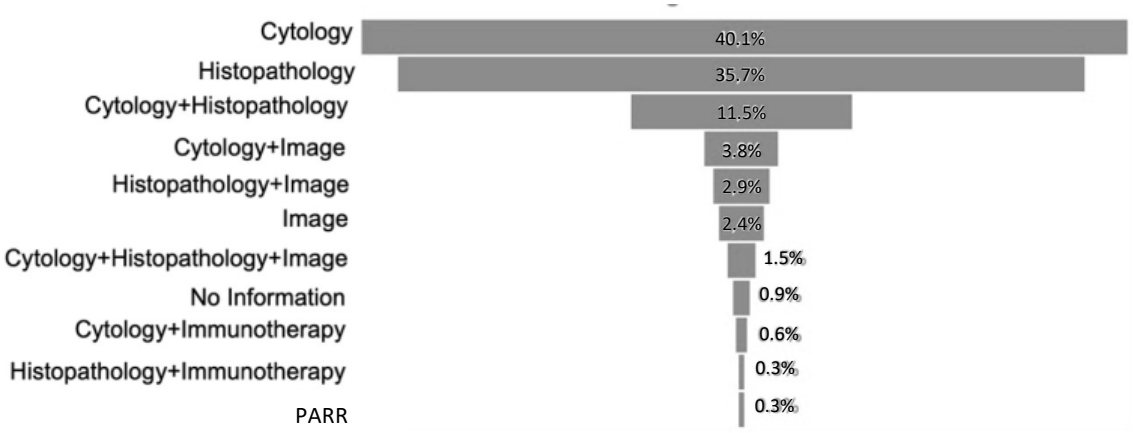


Figure 4. Geographical distribution of residence regarding oncological animals attending HRVM.

Diagnosis Methods

When evaluating the diagnostic techniques, as shown in Figure 3, cytology appears to be the most frequently used method singularly with 40.1% (n=136) of the records while in combination with other techniques it reaches 57.5% (n=195). Histopathology appears as the second most used technique singularly at 35.7% (n=121) and reaches 51.9% (n=176) when combined. In third place appear the records that combined cytology and histopathology at 11.5% (n=39). CT, Echography, X-Ray, MR (referred as imaging combined) immunotherapy, and PARR were also used. Cytology was the most frequently used diagnostic method in dogs (39.7%; n=120) and cats (43.2%; n=16).



Note: *PARR – PCR for Antigen Receptor Rearrangements (Real time PCR that defines lymphocyte clonality and immunophenotyping)

Figure 5. Description of diagnosis methods used to confirm neoplasms.

Topography and Morphology

The analyzis of tumors´distribution per topography (Table 2) considers the three main ones and shows that the skin is the most frequently affected topography with 57.7% (n=196) of total records - 61.3% (n=185) of dogs and 29.7% (n=11) of cats - followed by the mammary gland with 9.8% (n=33) of records - 8.9% (n=27) of dogs and 16.2% (n=6) of cats - and the lymph nodes with 6.5% (n=22) of records - 5.3% (n=16) in dogs and 16.2% (n=6) in cats. The distribution of topography per system is similar both in dogs and cats, however there are differences in topography concerning the item.

Regarding morphologies, the highest prevalence in dogs were lipomas (19.9%, n=60), followed by MCT (14.3%, n=43) and carcinomas (5.3%, n=16). In cats, the lymphomas ranked first with 24.3% (n=9) followed by adenocarcinomas (13.5%, n=5), squamous cell carcinomas and carcinoma, NOS coming each at 8.1% (n=4).

Table 2. Analysis of Topography and Morphology of neoplasms by species.

Topography	**Dogs**		**Topography**	**Cats**	
Morphology	**n**	**%**	**Morphology**	**n**	**%**
Skin	**185**	**61.2**	**Skin**	**11**	**29.7**
Lipoma, NOS	59	31.9	Squamous cell carcinoma, NOS	3	27.3
Mast cell tumor, NOS	37	20.0	Carcinoma, NOS	2	18.2
Canine cutaneous histiocytoma	6	3,2	Malignant Lymphoma, non-Hodgkin, NOS	2	18.2

Sarcoma, NOS	6	3.2	Soft tissue sarcoma, NOS	1	9.1
Mammary Gland	**27**	**8.9**	**Mammary Gland**	**6**	**16.2**
Adenocarcinoma, NOS	5	18.5	Tubular adenocarcinoma	2	33.3
Complex Adenoma	5	18.5	Adenocarcinoma, NOS	2	33.3
Tubular Carcinoma	4	14.8	Solid adenocarcinoma, NOS	1	16.8
Lymph Nodes	**16**	**5.3**	**Lymph Nodes**	**6**	**16.2**
Malignant Lymphoma, non-Hodgkin, NOS	7	43.8	Malignant Lymphoma, non-Hodgkin, NOS	5	83.3
Mast Cell tumor, NOS	2	12.5	T-cell lymphoma, NOS	1	16.7
Hepatoid Gland Adenocarcinoma	1	6.3			

Regarding the most common morphologies in the most represented breeds for dogs and cats (Figure 3), lipomas were highly represented in dogs for both no-breed and Labrador retrievers (27.2%, n=25; 33.9%, n=19, respectively). MCT were the second most common neoplasms in no-breed and Labrador retrievers (8.7%, n=8; 16.1%, n=9, respectively) and the most frequent in French Bulldogs and Yorkshire terrier (45.0%, n=9; 41.2% n=7, respectively).

For cats, lymphomas were the most common morphology in European shorthair (23.1%, n=6) and 100% (n=3) of breeds other than Persian and Siamese.

Table 3. Analysis of Morphologies of neoplasms by breeds and species.

Breed	**Dogs**		**Breed**	**Cats**	
Morphology	**n**	**%**	**Morphology**	**n**	*****
No-breed	**92**	**30.5**	**European shorthair**	**26**	**70.3**
Lipoma, NOS	25	27.2	Malignant Lymphoma, non-Hodgkin, NOS	6	23.1
Mast cell tumor, NOS	8	8.7	Carcinoma, NOS	3	11.5
Carcinoma, NOS	6	6.5	Sarcoma, NOS	2	7.7
Sarcoma, NOS	4	4.3	Squamous cell carcinoma, NOS	2	7.7
Labrador retriever	**56**	**18.5**	**Persian cat**	**3**	**8.1**
Lipoma, NOS	19	33.9	Tubular adenocarcinoma	2	66.7
Mast cell tumor, NOS	9	16.1	Solid adenocarcinoma, NOS	1	33.3
Carcinoma, NOS	2	3.6			
Sarcoma, NOS	2	3.6			
French bulldog	**20**	**6.6**	**No-breed**	**3**	**8.1**
Mast cell tumor, NOS	9	45.0	Adenocarcinoma, NOS	2	66.7

Osteoma, NOS	1	5.0	Sarcoma, NOS	1	33.3
Sarcoma, NOS	1	5.0			
Osteossarcoma, NOS	1	5.0			
Yorkshire terrier	**17**	**5.6**	**Siamese**	**2**	**5.4**
Mast cell tumor, NOS	7	41.2	Squamous cell carcinoma, NOS	1	50.0
Hepatoid gland adenocarcinoma	3	17.6	Adenocarcinoma, NOS	1	50.0
Carcinoma, NOS	2	11.8			
German shepherd	**8**	2.6	**Others**	**3**	**8.1**
Sertoli cell tumor, NOS	2	25.0	Malignant Lymphoma, non-Hodgkin, NOS	3	100.0
Myxosarcoma, NOS	1	12.5			
Hemangiosarcoma, NOS	1	12.5			

Note: OTHERS – Ragdoll + Russian Blue + Main coon

Table 4 shows the diagnosis performed within the most common morphologies (by species). Cytology again ranked first for most cancer types, with the exception of feline squamous cell carcinoma, which was diagnosed by histopathology in 66.8% (n=2) of cases.

Table 4. Main Morphologies and respective diagnosis method, by species.

Morphology	**Dogs**		**Morphology**	**Cats**	
Diagnoses Method	**n**	**%**	**Diagnosis Method**	**n**	**%**
Lipoma, NOS	**60**	**19.9**	**Malignant lymphoma, non-Hodgkin, NOS**	**9**	**24.3**
Cytology	50	83.3	Cytology	6	66.8
Histopathology	9	15.0	Cytology+Image	2	18.2
Cytology+Histopathology	1	1.7	Cytology+Histopathology +Image	1	11.1
Mast Cell Tumor, NOS	**43**	**14.2**	**Adenocarcinoma, NOS**	**5**	**13.5**
Cytology	16	37.2	Cytology	4	80.0
Histopathology	11	25.6	Cytology+Image	1	20.0
Cytology+Histopathology	11	25.6			
Carcinoma, NOS	**16**	**5.3**	**Squamous cell carcinoma, NOS**	**3**	**8.1**
Cytology	7	43.8	Histopathology	2	66.8
Histopathology	5	31.3	Cytology	1	33.3
Cytology+Image	3	18.8			

Therapeutic Decisions

Among treatment modalities, displayed in Figure 4, the surgery ranked first with 40.4% (n=137) when used alone, followed by 45.72% (n=155) when in combination with chemotherapy or target therapy. No-treatment-needed appears with 14.2% (n=48) and palliative treatment with 12.1% (n=41).Chemotherapy only appeared in 9.7% (n=33) of records and metronomic chemotherapy in 0.9% (n=3). Eight-point three percent (n=28) of animals did not undergo any treatment and 6.8% (n=23) didn't had follow up. 1.5% (n=5) underwent target therapy alone and 3.2 (n=11) when combined. 0.9% (n=3) underwent alternative treatments. In dogs, 42.7% (n=129) underwent surgical treatment alone and 48.3% (n=146) in combination with other. In cats, the most commonly used therapeutic method was chemotherapy alone with 32.4% (n=12).

The analysis of age and treatment modalities by morphology and species (Annex C, Table C2) shows that in dogs with lipomas a "no treatment needed" approach was chosen in 81.7% (n=49) of cases, in MCT surgery was the most used treatment (34.9%, n=15) at a mean age of 8.4 years old followed by palliative treatment (used in 20.9% (n=9) of records) that showed a mean age of 11.7 years old. Most of carcinomas (31.3%, n=5) where left untreated in animals with a mean age of 11 years old and 18.8% (n=3) of animals were submitted to alternative treatment with a mean age of 10.4 years old. In sarcomas, palliative treatment was chosen in 42.9% (n=6) of cases with a mean age of 9.3 years old and 21.4% (n=3) of animals with a mean age of 12.3 years old had no treatment. Adenocarcinomas showed a mean age of 12.4 years old for incidence with 20% (n=2) of patients not being submitted to any treatment (in those a mean age of 13.3 years old was seen). For lymphomas, 55.6% (n=5) of patients were submitted to chemotherapy with a mean age of 8.5 years old. Regarding cats, those with lymphomas showed a mean age of 8.6 years old for incidence and 55.6% (n=5) were submitted to chemotherapy; palliative treatment was chosen in 22.2% (n=2) with a mean age of 14.8 years. 60% (n=3) of patients with adenocarcinomas underwent chemotherapy, with a mean age of 14.4 years old. 33.3%(n=1) of cats with squamous cell carcinomas were submitted to palliative treatment at a mean age of 16.6 years old. All patients with lymphomas were submitted to chemotherapy at a mean age of 12.3 years old. 66.7% (n=2) animals with sarcomas and a mean age of 15 years old were left untreated.

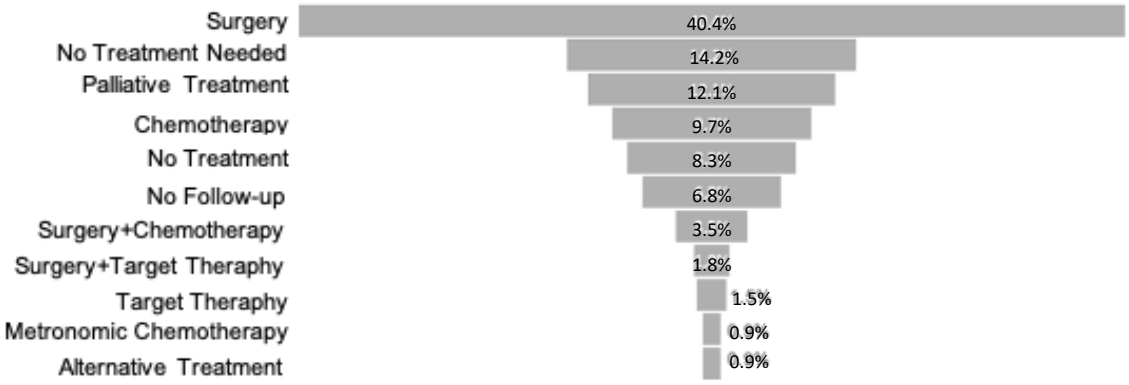


Figure 6. Description of therapeutic decisions used in oncological patients.

Clinical Outcome

Figure 5 shows that 50.6% (n=171) of the records had no follow-up. Note that of these, only 5.3% (n=9) had a no-treatment-decision and 10.5% (n=18) had no follow-up after diagnosis. All the others animals stopped being followed up after some type of treatment or did not need any. 16.8% (n=57) animals were euthanized and 9.7% (n=33) died. 10.6% (n=36) were under observation and 5% (n=17) were resolved. Only 7.1% (n=24) were in treatment.

The majority of dogs' records had a description of a no follow-up (53.0%; n=160) and in cats' euthanasia (35.1%; n=13). Table C3 presents the analysis of age and outcome by morphology and species. In dogs with lipomas, it was seen that 93.3% (n=56) had no follow-up and a mean age of 9.9 years old; those with MCT, 34.9% (n=15) were under surveillance at the time of collection with a mean age of 8.5 years old, 32.6% (n=14) had no follow-up with a mean age of 9.3 years old and 14% (n=6) were submitted to euthanasia with a mean age of 11.4 years old. In dogs with carcinomas, 56.3% (n=9) were submitted to euthanasia with a mean age of 11.1 years old. 35.7% (n=5) of dogs with sarcomas had no follow-up, 21.4% (n=3) were submitted to euthanasia with a mean age of 12.1 years old and 14.3% (n=2) were under treatment at the time with a mean age of 4.8 years old. 55.6% (n=5) of dogs with lymphomas were submitted to euthanasia with a mean age of 7.5years. In cats with lymphoma, 55.6% (n=5) were submitted to euthanasia at a mean age of 9.6 years and 22.2% (n=2) were still under treatment with a mean age of 12.5 years. In cats with adenocarcinomas, 60% (n=3) died with a mean age of 14.4 years, and 20% (n=1) had no follow-up. For those with squamous cell carcinoma, 33.3%(n=1) were under treatment

at the time, the same amount had no follow-up or were submitted to euthanasia. In cats with carcinomas, 66.7% (n=2) were submitted to euthanasia with a mean age of 11.7 years.

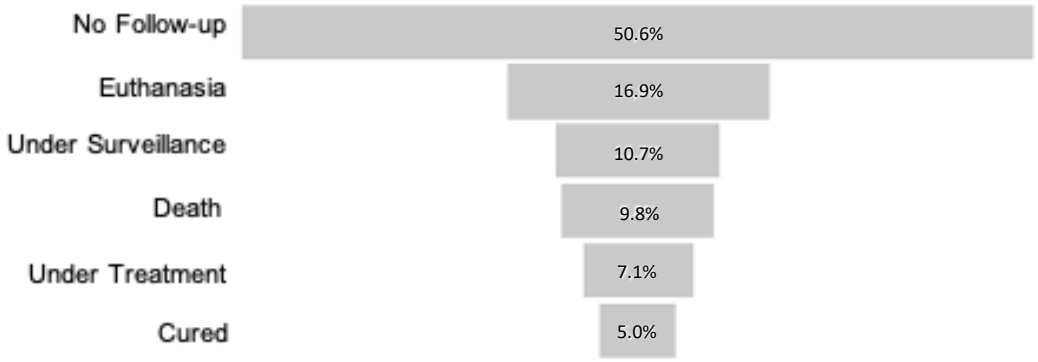


Figure 7. Description of clinical outcomes described in animals records.

In dogs, a “no treatment needed” approach was used in 81.7 % (n=49) of lipomas cases – 98% (n=48) of those diagnosed by cytology, the rest underwent surgery – 72.2% (n=11) and were diagnosed by histopathology only. The MCT’ patients were subjected to surgery in most cases (34.9%, n=15), and 20.9% (n=9) received palliative treatment. Of those receiving palliative treatment, 55.6% (n=5) were under observation at the time of data collection and 22.2% (n=2) had been euthanized; the remaining had no follow-up or were still receiving treatment. 20.9% (n=9) of cases had received sole or combined chemotherapy and 20.9% were on target therapy combined or alone. 31.3% (n=5) of the patients with carcinomas remained untreated resulting in 40% (n=2) of the animals dying, 40% of the animals euthanized and one (20%) being under observation. Among the cases with carcinomas that underwent palliative treatment, either death (66.7%; n=2) or euthanasia (33.3%; n=1) of the animal occurred. However, surgical procedures, types of chemotherapy, and target therapies also mostly resulted in euthanasia. 42.9% (n=6) of patients with sarcomas were treated palliatively (50% of which died), and 21.4% (n=3) did not had any type of treatment, and 14.3% (n=2) had no follow-up; only 20% of records described surgery as treatment modality. Only 20% (n=2) of patients with adenocarcinomas were submitted to surgery and 50% (n=5) underwent palliative treatment; 60% (n=3) of which were still undergoing treatment at the time of recording. 55.6% (n=5) of lymphomas were under chemotherapy treatment and 11.1% (n=1) were submitted to surgery and chemotherapy.

In cats with lymphomas, 55,6% (n=5) of cases went chemotherapy and 22.2% (n=2) did palliative treatment (100% of which were euthanized). 60% (n=3) of the adenocarcinomas were submitted to chemotherapy, 100% (n=3) of which died; the remainder received no type of treatment or had no follow-up. Among carcinomas, 60% (n=3) received chemotherapy, and the remaining received no type of treatment or had no follow-up. 12.1% (n=41) of all records received palliative treatment at a mean age of 11.4 years old. 8.3% (n=28) of animals were voluntarily left by the owner without treatment. 6.2% (n=21) had no follow-up after diagnosis. In a total of 14.5% (n=49) of cases, no action was taken. Chemotherapy, chemotherapy plus surgery, or metronomic chemotherapy was used in 14.2% (n=42) of cases. 50.4% (n=71) of cases had no follow-up - 15.8% (n=27) of which had no follow-up immediately after diagnosis or a no treatment approach.

3.2.2 Clinica Veterinária da Boa Nova

It was not possible to collect data regarding the oncological records from CVBN.

3.2.3 Centro Hospitalar Veterinário

It was not possible to collect data regarding the oncological records CHV.

3.3 Flowchart of Data Pathway

Hospital X (HX) (Figure 6) and Hospital Y (HY) (Figure 7) flow diagrams showed differences mainly regarding HX that had two PMS, one for regular consultations and one for animals in internment. In HX, laboratory results have their own income box that are accessed by a specific person who links it to the animal's clinical record. HY occupied a particular place in the study because it does not work with a typical veterinary PMS, but with a CRM (Customer Relationship Management) platform called Salesforce®, which the DMVs in charge adapt to the needs of the PMS. This platform incorporates marketing, sales, commerce, and service onto a single platform. HY has an integrative platform, and everything that happens in the clinic is within the CRM. The only data outing is when oncology samples leave the clinic and the results come in via email and are later uploaded to the CRM at the front desk.

In HY, there is only one place where information is out of the PMS, and that is everything that happens at the reception desk: the arrival of the animal – that enters the system at that moment -, then the exit of the laboratory samples that physically leave the clinic at the front desk, and later the reception of results through an email inbox - the person in charge of the front desk attaches to the system - at that moment the information is again available digitally. After everything is done, the last exit is when the animal leaves the clinic,

and the release is done in the system along with the invoicing. HX is a little different, first, as said before, for having two PMS, one that's global and ends having all the information's and one that's specifically for the internment. Concerning the outings of the information, initially the animal comes to the front desk and enters the system; if the animal is after referred to the internment, his information also enters the second PMS. There's then a physical exit of the lab samples, that are received in an email inbox specifically for the lab results and someone then attaches it to the animal record but not at the main desk. The information then floats within the hospital and the PMS, if the case, it can be interchanged between the two systems and as the previous one once the animals leave the hospital its release is noted in the system and the invoicing made and paid at the front desk.

The main defects of information flows for HY were the requirement of manual insertion of laboratory results. For HX is also this manual insertion and the presence of two PMS in the same hospital for the same animals that results in dispersion of information.

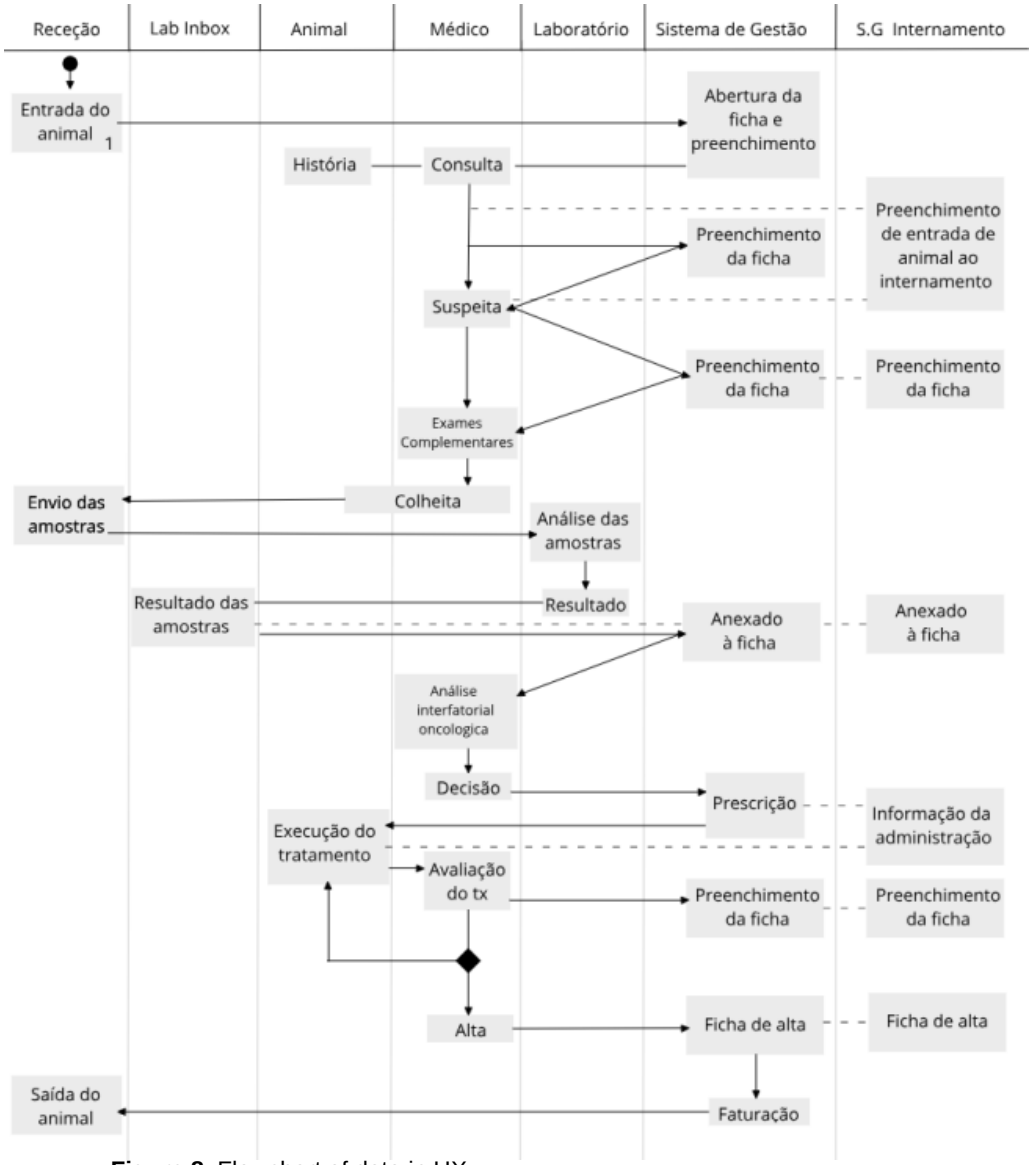


Figure 8. Flowchart of data in HX**.**

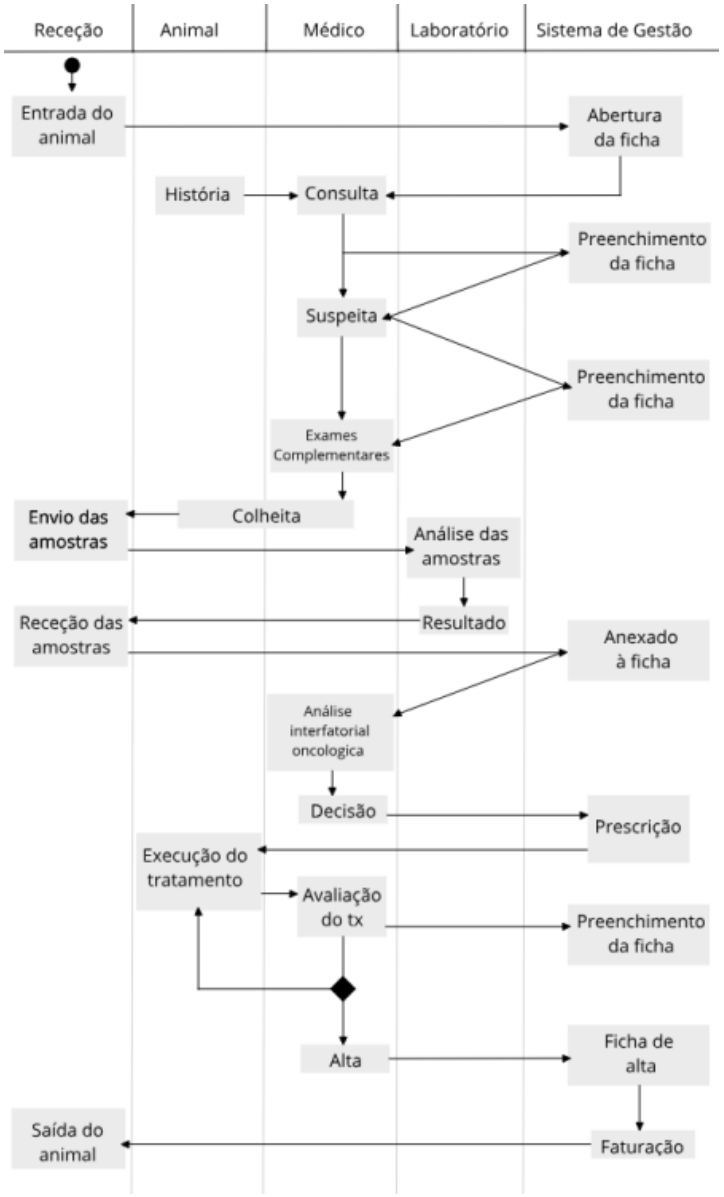


Figure 9. Flowchart of data in HY.

3.4 Interface of Clinical Data Exchange

The theory of a clinical data exchange interface led to an oncology record, which can be found in Annex C, Figure C1. The oncology variables include topics such as clinical signs, tumor characteristics, topography, and morphology accordingly with VET-ICD-O list, treatment, outcomes, and follow-up.

4. DISCUSSION

This study aimed to investigate the retrieving data to Vet-OncoNet from VetPractices and it was disclosed that the main difficulty was the DMV's lack of time in submitting data to Vet-OncoNet. It was also showed, through the clinical data extracted, that in HVRM, oncological cases represented 13,9% of the hospital population, mostly belonging to dogs and females and the preeminent breeds. The flowcharts revealed different and important information chains between network partners and the difficulties in accessing information. As a solution, and with a partnership with GuruVet®, this study established an oncology record crested which will allow the standardization of data coming into the network and subsequently growth of COR.

Regarding the Veterinary Adherence Study, as showed, the main issue was the lack of time. Some of Vet-OncoNet partners who did not respond to the questionnaire admitted that, for the same urge of clinical practice, did not have time to insert the data onto the network. Regarding the record holder form, one of the clinical veterinary practitioners used a paper record in combination with a PMS. Although PMSs have been referenced as an incredible asset to clinical practice, their use is sometimes neglected, but in accordance with previous studies, we can observe an increase in their presence in routine clinical practice (Hsiao & Hing, 2012; Jamoom et al., 2012; Lorenzi et al., 2009; Zandieh et al., 2008). The already proven importance of cancer registries and the information derived from clinical practice, as discussed above, is again underscored. Knowing that the use of these registries relies on the reliability of the original clinical records and interferes with the representation of neoplasms for the population, something needs to be done (Bronden et al., 2009). Thus, there is an urgent need to investigate an efficient methodology for the systematic retrieval of clinical animal oncology data, that does not increase the workload for clinicians.

It was found a 13.9% of incidence of oncology records at HRVM, which is much higher than the ones previously reported (Arnesen K, 1998; Manuali et al., 2019; Schiffman & Breen, 2015). This may be due to the fact that HRVM is a reference center for animal treatment and, being oncology a sensitive topic for owners, they may prefer to take the

animals to a hospital with all the services and options available. There is also other theories for this higher incidence, such as an improvement in veterinary care, in preventive examinations and better access to diagnosis methods that results in more cases diagnosed (Cray et al., 2020). Environmental factors and a higher lifespan can also lead to a higher and growing incidence of cancer in companion animals (Cray et al., 2020).

Regarding HRVM data, the clinical oncology population was constituted mainly by females dogs which was in accordance with previous results (Katia; Pinello et al., 2022). Although the mean age for tumors´ occurrence was similar between dogs and cats, cats had older ages, which has been corroborated by previous studies (Cray et al., 2020). Most animals were neutered, cats and females more than dogs and males, respectively. In cats, more males were neutered, while in dogs were the females, which is consistent with previous published results (Graf et al., 2015);(Gruntzig et al., 2016). However, dogs presented at HRVM were withal neutered what is not common in prior published literature and may indicate a shift in ownership tendencies (Gruntzig et al., 2016). No-breed dogs were the most commonly affected, followed by Labrador retrievers, as described before (Gruntzig et al., 2016; Gruntzig et al., 2015). In the group of no-breed dogs, females had a statistically significant higher incidence of tumors. Regarding age distribution for dogs and cats and comparing to ACR previous studies, our results showed a higher peak for ages, this might be due to a smaller population (Pinello, Pires et al. 2022).

European shorthair was the most cancer affected breed in cats in agreement with the previous study (Graf et al., 2015). The second and third most affected cats in Graf et al (2015) study were Persians and no-breeds, which is different from our findings since both had the same number of records (Graf et al., 2015). In both studies, no-breed dogs and cats had a higher mean age of tumors incidence, with the gap age intensifying in breeds with high public interest, which may be due to presumably higher rates of inbreeding (Dobson, 2013; Egenvall et al., 2005). However, more extensive and refined information is needed to better characterize the importance of breed, age and sex in tumor development (Graf et al., 2015). Cytology was the main tumor diagnostic method used, alone or in combination, which interestingly differs from ACR and prior studies (Graf et al., 2015; Gruntzig et al., 2015) (Bronden et al., 2010).

Cytology is widely used in clinical practice because it’s simple, quick, and inexpensive. The aforementioned difference may arise from the under report of cytology results to the network or the selection of non-partner laboratories to perform them. It is also important to consider the issue of presumptive diagnoses, i.e., diagnoses made using

imaging techniques that won't be listed in the ACR since they are performed in clinical practice. This form of diagnosis is often used for brain tumors because some types of neoplasms cannot be accessed with certainty despite evolutionary surgery and histopathology, and imaging combined with clinical features is sufficient (Bentley, 2015).

In terms of topography, skin, mammary gland, and lymph nodes were the most commonly affected tissues in both species. In cats, the first most common is in accordance with Graf et al. (2015) and Pinello et.el (2022), the following were not. In dogs, the higher incidence of skin and mammary gland tumours are in agreement with Bronden et al. (2010), Gruntzig et al. (2015) and Pinello et.al.(2022) results. These results may be influenced by the easiest visual access for the owner and clinician.

The most common morphologies were lipomas, mast cell tumors, and carcinomas in dogs. For no-breed dogs and Labrador retrievers, skin and mammary gland were also the most common topographies (Gruntzig et al., 2015), however, it was observed a higher prevalence of mast cell tumors than usual in this population. Among cats, lymphomas, adenocarcinomas, squamous cell carcinomas, and carcinomas were the most common morphologies. In the literature, skin topography is also cited as the most frequent site for tumors in cats (Graf et al., 2015).

Regarding the most common breeds and their highest incidence morphologies, lipomas were again strongly represented in both no-breeds and Labrador retrievers. MCT were the second most common in no-breed and Labrador retrievers and the first most common morphology in French bulldogs, and Yorkshire terriers. This MCT distribution is in accordance with Dobson (2013) report. Regarding German shepherds, Sertoli cell tumors were the second most common tumor morphology and hemangiosarcoma's, which were the most commonly reported tumor type according to Dobson (2013), was found in only one record, this however cannot be accounted given the small population size. In cats the most common morphology was lymphoma in European's shorthair and other breeds such as Main coons and Ragdolls, which is not in accordance with the data reported by Graf et.al. (2016). However, it should be acknowledged that the different sample sizes of previous studies may be the reason for these differences, as a smaller population, such as the one in this thesis can add immense bias to the results (Dobson, 2013; Graf et al., 2016). Consideration should also be given to differences in the genetics of populations originating from different geographic contexts, as cancer has a multifactorial etiology and environmental and hormonal factors have been disclosed as risk factors for some types of neoplasms (Dobson, 2013; Graf et al., 2016). Consequently, population-based studies

regarding risk breeds are helpful but should not be taken as dogma, as they vary with breed prevalence and popular tendencies within the at-risk population explaining different results in different locations (Dobson, 2013; Graf et al., 2016). Nonetheless the consistent display of similar predispositions between breeds and certain morphologies is very significant and may help to better understand the influence of genetic and heritable elements in cancer development.

When compared with the results published by Vet-OncoNet (Katia; Pinello et al., 2022), this study draw similar conclusions such as the higher age incidence in cats, the no differences between sexes within species, and the predominance of females in the general oncological population (Pinello, Pires et al. 2022). The two most represented topographies were also skin and mammary gland for both dogs and cats (Katia; Pinello et al., 2022). However, the third most common differs, having been previously stated the genito-urinary in dogs and digestive organs in cats, here lymph nodes close the top three for both (Katia; Pinello et al., 2022). We can also denote differences in the most common morphologies, with lipomas raking first in this population followed by MCT and carcinomas were in Vet-OncoNet, malignant mammary subtypes were the most common, followed by benign ones, MCT and only in fourth place lipomas. These discrepancies are due to the distinct data source, as the Vet-OncoNet results are from a laboratory-based registry, and this thesis results reflects the clinical practice casuistic. For this reason, other variables were analyzed in this work such as diagnostic methodologies other than cytology and histology, and also the cases with presumptive diagnosis (based in image and clinical context). In addition, it was also possible to understand the path of case conduction after an oncological diagnosis and what type of treatment and outcome is expected given the particularities of such morphologies. These variables give a new meaning to cancer registries by granting knowledge of clinical practice and strengthening the evidence based veterinary medicine (Pinello, Pires et al. 2022).

In dogs, the results' integration showed that in lipomas no treatment was required in most cases, which should be expected since it is a benign neoplasm, and its removal is aesthetic most of times. Most MCT cases were treated by surgery, as expected, since is the treatment modality with the greater chances of cure improving when clean margins are obtained (Seguin et al., 2001). Fewer cases were treated with target therapy alone or combined. Most of animals with carcinomas remained untreated resulting in an expected all-cause death or euthanasia of the animal, which may reveal the existent disbelieve in treatment. The carcinomas cases that underwent an alternative treatment also resulted in death or euthanasia; this however does not infer anything about the quality of treatment.

Again, the idea that cancer in animals does not have the same outcome perspective as for humans where a completely cured patient is expected must be maintained. However, as referred in the literature, treatment does extend the overall life span and palliative treatment guarantees the well-being of the animal during the disease progression (Berg et al., 1997; Leach et al., 2012). However, with palliative treatment, median survival is lower when compared to chemotherapy (Clemente et al., 2009). Regarding sarcomas cases, most were treated palliatively as were half of the adenocarcinomas. Animals with lymphomas were manly subjected to chemotherapy, in accordance to the literature, since is a treatment with satisfactory results for complete remission of the neoplasm (Simon et al., 2006). Also regarding lymphomas, the age of incidence of 8.5 years is also similar to the published before (Pittaway et al., 2019).

In cats, lymphomas developed in younger ages (mean age of 8.6 years old), contrarily to other tumors, which is consistent with the results presented by Graf et.al.(2016) and other studies (Court et al., 1997; Gabor et al., 1998). Most lymphomas, adenocarcinomas and carcinomas underwent chemotherapy. This may suggest that cat owners are more inclined for long-term and more costly treatments or simply that this are the tumors with better response to chemotherapy. Regarding therapeutic decisions, surgery was the most employed followed by the decision not to treat for not needing it. The third most common therapeutic decision was palliative treatment at a mean age of 11.4 years old – a higher mean age than overall age – indicating the increasing importance of providing a stable and pacifist approach to oncology in older animals. This also opens the possibility to reconsider and expand the palliative services offered by veterinary medicine, as already suggested by literature (Di Cerbo et al., 2014). According to 14.5% of records, nothing was made to help the animal fight the condition. This leads to great concern about the animal's welfare. If we look at the use of chemotherapy, one of the most recommended and scientifically proven treatment for different types of cancer, the combination of chemotherapy, chemotherapy and surgery or metronomic chemotherapy it's only been used in 14.2% of cases. This information could indicate that there is no predisposition to this type of treatment due to the cost and longevity, or that the diagnosis of cancer is still considered a death sentence by the owners and no effort wants to be made. Since it appears after the choice of palliative treatment, one can understand that the welfare of the animal is increasingly being taken into consideration. A better picture can be drawn from these results, since not only most were animals subjected to treatment but the results in question are also a consequence of the pandemic context in which the world was at time.

The clinical outcomes that were most widely reported were loss to follow-up and euthanasia, respectively. Reporting the numerous cases with no follow-up (50.6%), is an alarming find given the lack of consistency already shown in veterinary oncology casuistic. However, these numbers of no follow-up also reflect cases that already had treatment or did not need treatment at all. Looking at the integrated results actually only 15.8% of cases had no follow-up immediately after diagnosis or no treatment was chosen by the owner, that being reading a 50% loss of follow-up can be deceiving.

Regarding the flowcharts, they have shown to be a good tool to identify the substantial differences between the VetPractices in study. In the HY flowchart we can see that everything is happening at the same place, and all the information can be found in the animal's record; the only flaw was the absence of an automatic attachment of the lab results, which can end in the loss of the information if someone doesn't attach it to the record. The same is seen in HX; there were two PMS that are not synced to share all the information, which results in information dispersion and interferes with the access of the data. Besides the mentioned constraints, there's also restrictions to data search on the PMS. The PMS are created not only to keep records of the animals but mainly to coordinate the financial rut and to ease the invoicing.

Thus, these PMS are not tailored for an easy and effective term search, which from a manual data collect perspective, makes them time and effort consuming. These distresses not only pose a problem to Vet-OncoNet registries but to veterinary epidemiology as a whole, which can represent a danger to public health regarding zoonotic illnesses. A study performed in Massachusetts in 2014 (Krone et al., 2014) had already warned that PMS – or as called in the study electronic veterinary medical records – were underutilized as a tracking tools for improving population health and identifying emerging diseases. Seven years later we can still take the same conclusions.

Consequently, if the goal is to improve general data information and to feed a registry with the smallest amount of bias – which in this case comes mainly by the human insertion error – and with the biggest number of records possible, the wisest decision is to automatize the process of retrieval. With this automatization, and bearing that even with PMS flaws, the most reasonable hypothesis is that the system makes the exportation of data in a simple click, becoming irrelevant in the time-consuming tasks that DMVs perform. Imposed by this decision, the issue of how to achieve the "one click" interface appears. Data retrieval has a lot of implications; besides, creating a digital interface would be a big challenge particularly in the coding. But even if that could be made, an external platform would still convey the trouble of a time costing activity. For that reason, in accordance with other data interchange

registries – VetCompass and SAVSNET (Royal Veterinary College, 2021; Small Animal Veterinary Surveillance Network, 2021) – the possibility of existing within a PMS was the wisest hypothesis. If so, the function would be the same as the one explained by VetCompass® - all the users with a PMS with the Vet-OncoNet "one click" platform could be part of the exchange. The ones who didn't agree to do so have an "opt out" option.

Within the project time frame, a partnership with PMS GuruVet® was possible. This led to the creation of an oncological record that served the "one click" purpose. The categories that suited all necessities for clinicians and epidemiologists were made part of this record. Within the topography and morphology, closed tabs were created with the classification list regarding Vet-ICDO allowing a standardization of information. The record is now under trials to improve coding definitions and missing parameters. After improved, the intention is to test in the clinical context. This collaboration, if consented so by DMVs when filling the oncological record, allows to automatically export the data to the Vet-OncoNet base.

These efforts intend that veterinary medicine becomes a good scientifically based profession, with evidence based decisions and conducts, which is not always the case (Lanyon, 2016). For this goal, a collective effort must be made in order to create strategies to ease the burden of submitting clinical information, and veterinarian professionals must be compelled to understand the links between all the factors surrounding cancer. This change of mindset should be the least obstacle to the implementation (Lanyon, 2016). Besides, alongside with mandatory registry for human oncology, governmental authorities should impose a closer surveillance over companion animal disease and control over the existence population at risk – already insured in.

This study presents several limitations, such as the impossibility of obtaining population data at HRVM by sex and species to better characterize the incidence; the absence of records from CVBN and CHV, which didn't allow the comparison of populations from different veterinary practitioner and mostly the difference between a PMS that allowed the extraction of all the oncological information at once, excluding the need of manual and independent collect. The manual collection of the data was also a limitation since it introduces the chance of human error by fatigue or simply misunderstanding. In addition, the different classification used by laboratory results reports or clinicians could have led to a miss-classification in data collection. Finally, the small sample size and the fact that was from only one VetPractices, may bias the results presented.

Therefore, further studies and efforts are needed to improve cancer epidemiology in veterinary medicine that is determinant to evidence-based clinical decisions.

6. CONCLUSION

Concluding, oncological registries are scarce and complex, especially the hospital-based and more work is needed. This study intended to improve the efficacy of COR, leading to bigger findings and constant enhancement of Vet-OncoNet, however difficulties were found in harmonizing people, systems and terms used. The limitations exposed must be fought, different results understood, and changes implemented (such as veterinary laboratories starting to include cytology in data record). Furthermore, the international classification VET-ICD-O must be adopted so a comparison of oncological disease frequency can be made globally, the data analysis and treatment can be simplified, and the bias from unclear classification eliminated. The comparison of incidence rates is of greater importance, especially for comparative oncology, but for that a reliable number of animals at risk must be known, what is closer to reality since its now mandatory that all companion animals have a microchip with an untransmissible number.

Despite the complexity that oncological registries pose, especially the hospital-based ones, efforts are being made to evolve in this field ans flowcharts proved to be an asset for doing so. It is important that population-based studies continue to be made over time so increasing or decreasing tendencies for different types of tumors may be perceived. The implementation of an exchange interface through the partnership with GuruVet® came as a physical expression of what began as a theoretical answer to a posing problem. Efforts and more studies are under enactment to assert the competence of this solution. Further studies and efforts are needed to improve cancer epidemiology in veterinary medicine and elevate evidence-based clinical decisions.

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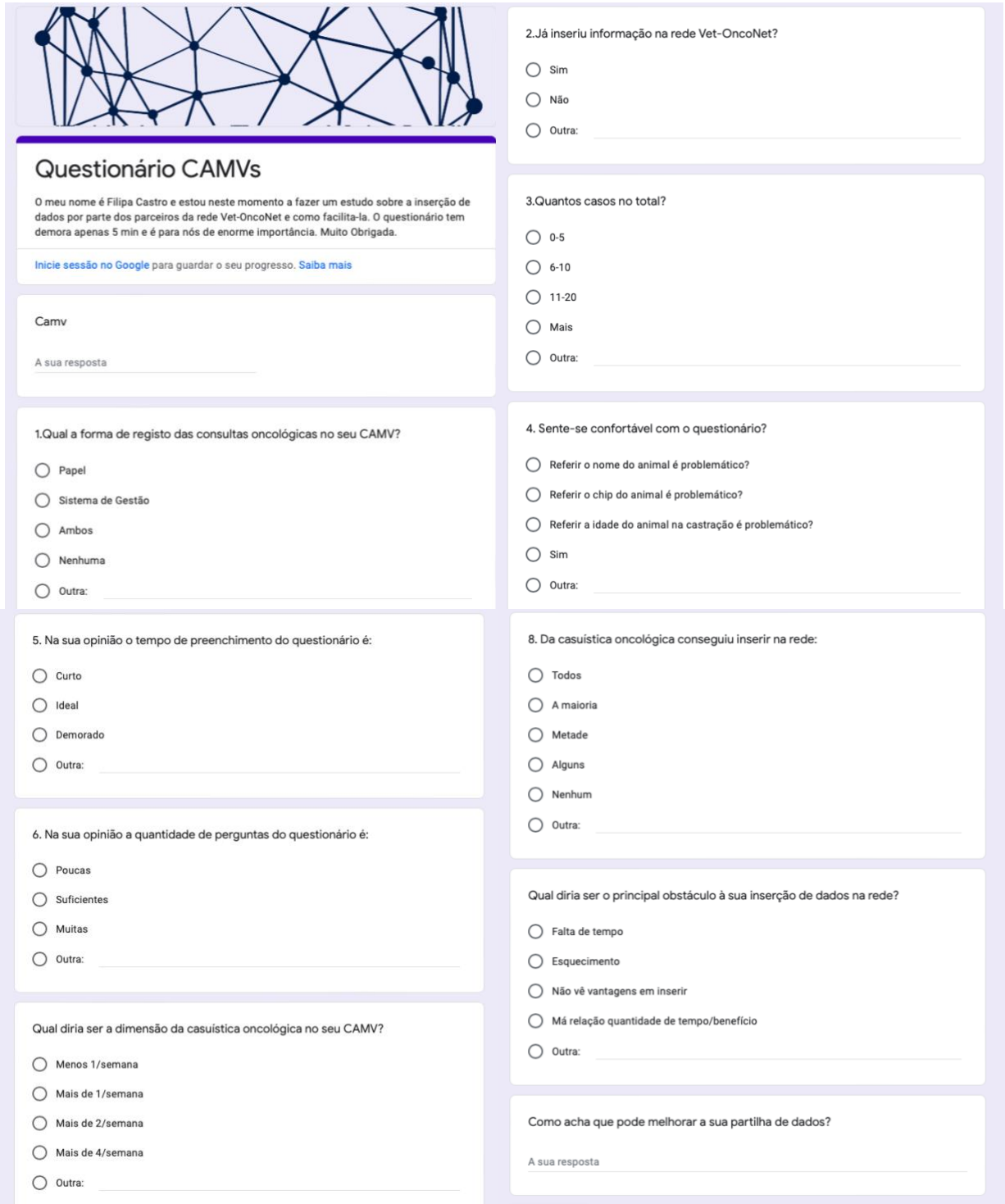
8. ANNEX

Annex A



Questionário CAMVs

O meu nome é Filipa Castro e estou neste momento a fazer um estudo sobre a inserção de dados por parte dos parceiros da rede Vet-OncoNet e como facilita-la. O questionário tem demora apenas 5 min e é para nós de enorme importância. Muito Obrigada.

Inicie sessão no Google para guardar o seu progresso. Saiba mais

Camv

A sua resposta

1.Qual a forma de registo das consultas oncológicas no seu CAMV?

- Papel
- Sistema de Gestão
- Ambos
- Nenhuma
- Outra:

5. Na sua opinião o tempo de preenchimento do questionário é:

- Curto
- Ideal
- Demorado
- Outra:

6. Na sua opinião a quantidade de perguntas do questionário é:

- Poucas
- Suficientes
- Muitas
- Outra:

Qual diria ser a dimensão da casuística oncológica no seu CAMV?

- Menos 1/semana
- Mais de 1/semana
- Mais de 2/semana
- Mais de 4/semana
- Outra:

2.Já inseriu informação na rede Vet-OncoNet?

- Sim
- Não
- Outra:

3.Quantos casos no total?

- 0-5
- 6-10
- 11-20
- Mais
- Outra:

4. Sente-se confortável com o questionário?

- Referir o nome do animal é problemático?
- Referir o chip do animal é problemático?
- Referir a idade do animal na castração é problemático?
- Sim
- Outra:

8. Da casuística oncológica conseguiu inserir na rede:

- Todos
- A maioria
- Metade
- Alguns
- Nenhum
- Outra:

Qual diria ser o principal obstáculo à sua inserção de dados na rede?

- Falta de tempo
- Esquecimento
- Não vê vantagens em inserir
- Má relação quantidade de tempo/benefício
- Outra:

Como acha que pode melhorar a sua partilha de dados?

A sua resposta

Figure A 1. Questionnaire made at Vet-OncoNet VetPractices partners

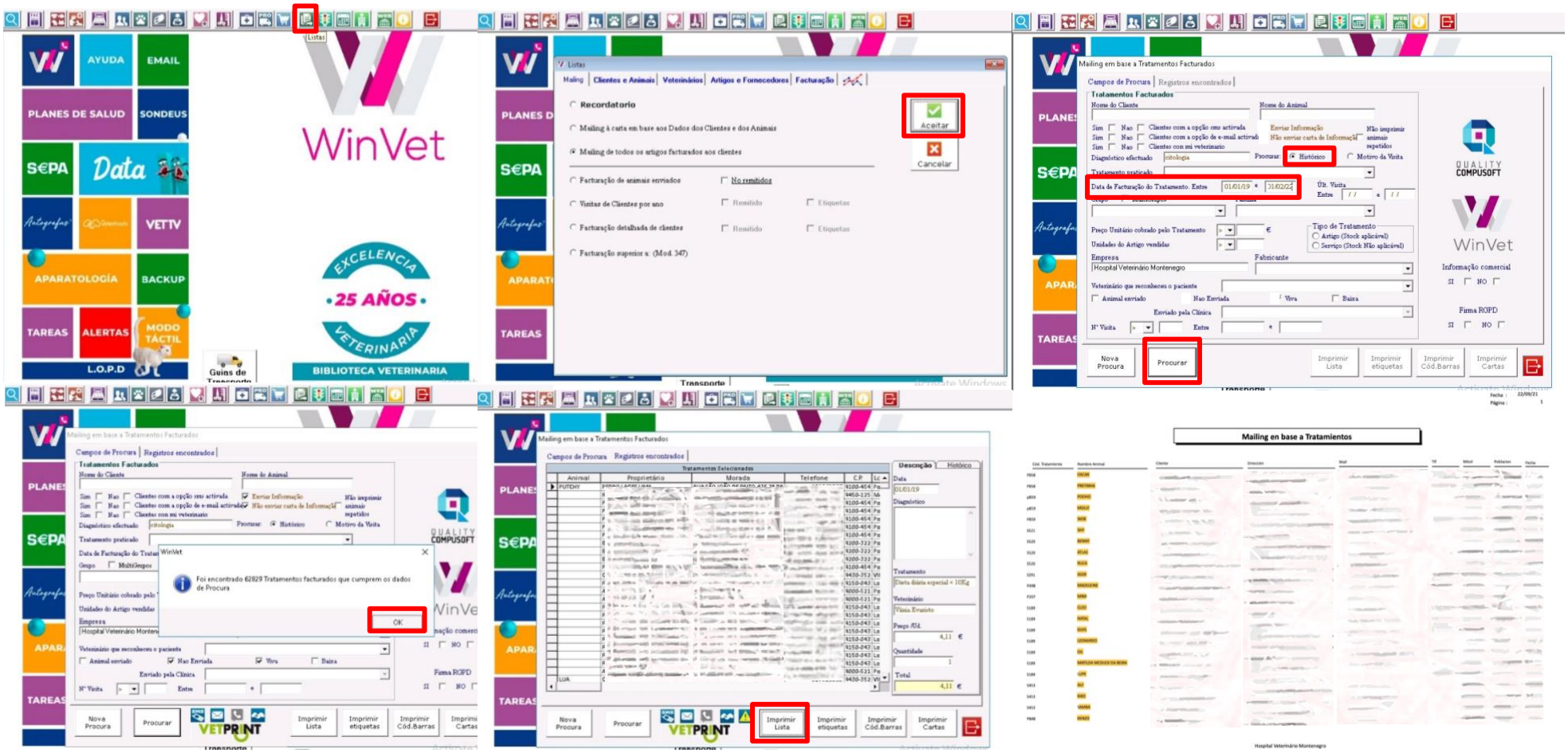


Figure A 2. Representation of the process of retrieval of records from WinVet®.

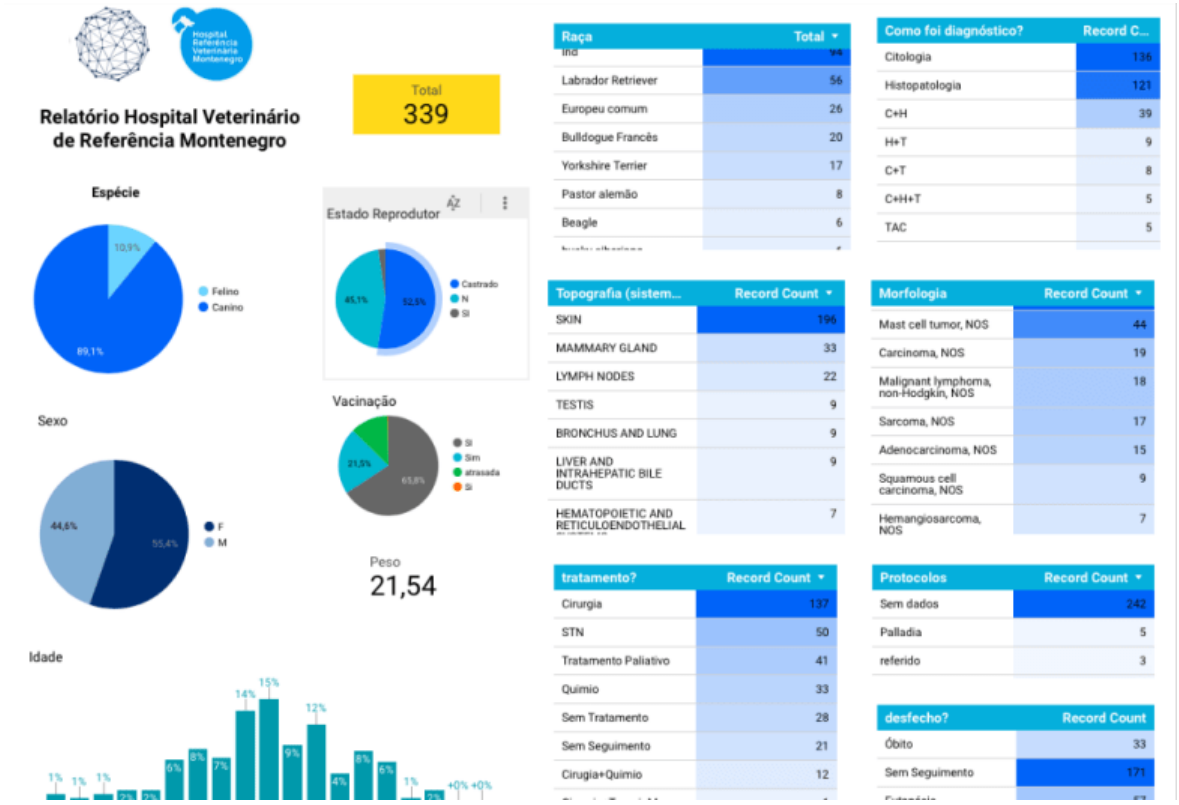


Figure A 3. HRVM Interactive Report (DataStudio®) figure.

Annex B

Table B 1. Descriptive analysis of the results from the Adherence Study questionnaire, answered by Vet-OncoNet's VetPractice partners, between 14/07/2021 and 17/09/2021**.**

Total of records (%)	**Phone Call** 8 (88.9)	**E-mail** 1 (11.1)	
Place of registration (%)	**Management System** 8 (88.9)	**Management System and Paper** 1 (11.1)	
Retrieved data to Vet-OncoNet (%)	**Yes** 5 (55,6)	**No** 4 (44,4)	
Number of records retrieved (%)	**0-5** 5 (55.6)	**6-10** 2 (22.2)	**11+** 2 (22.2)
Oncologic casuistry (%)	**-1/week** 2 (22.2)	**+1/week** 5 (55.6)	**+4/week** 2 (22.2)
Cause for non-retrieving data to Vet-OncoNet (%)	**Questionary extension** 1 (11.1)	**Forgetfulness** 1 (11.1)	**Lack of time** 7 (77.8)

Annex C

Table C 1. Analysis of aAge and sex by species and breed.

	n	%	Mean Age	SD		n	%	Mean Age	SD
Dogs	**302**	**89.1**	**9.8**	**3.2**	**Cats**	**37**	**10.9**	**11.8**	**4.1**
No-breed	**92**	**30.5**	**11.4**	**3.3**	**European shorthair**	**26**	**70.3**	**12,2**	**3.5**
F	66	71.7	11.3	3.2	F	12	46.2	11.9	3.8
M	26	28.3	11.7	3.6	M	14	53.8	12.5	3.4
Labrador retriever	**56**	**18.5**	**8,8**	**2,3**	**Persian**	**3**	**8,1**	**9,4**	**4,5**
F	27	48.2	8,3	2.4	F	3	100.0	9.4	4.5
M	29	51.8	9.4	2.2					
French bulldog	**20**	**6.6**	**8.5**	**3.4**	**No- breed**	**3**	**8.1**	**14.5**	**0.5**
F	7	35.0	8.0	2.3	F	2	66.7	14.2	0,0
M	13	65.0	8.9	4.0	M	1	33.3	15.1	-
Yorkshire terrier	**17**	**5.6**	**8.9**	**2.2**	**Siamese**	**2**	**5.4**	**14.3**	**2.3**
F	9	52.9	9.8	1.6	F	1	50.0	16.0	-
M	8	47.1	8.0	2.5	M	1	50.0	12.7	-
German shepherd	**8**	**2.6**	**8.5**	**1.6**	**Ragdoll**	**1**	**2.7**	**14.9**	**-**
F	4	50.0	8.7	1.8	M	1	100.0	14.9	-
M	4	50.0	8.2	1.7					
Beagle	**6**	**2.0**	**10.6**	**0.3**	**Russian Blue**	**1**	**2.7**	**1.5**	**-**
F	4	66.7	10.6	0.2	M	1	100.0	1.5	-
M	2	33.3	10.7	0.4					

Husky siberiano	**6**	**2.0**	**7.3**	**0.8**	**Main coon**	**1**	**2.7**	**2.6**	**-**
F	1	16.7	6.1	-	M	1	100.0	2.6	-
M	5	83.3	7.6	0.5					
Boxer	**5**	**1.7**	**8.9**	**1.9**					
F	3	60.0	10.0	1.5					
M	2	40.0	7.2	0.0					

For quantitative variables: t-test, * p<0.05; ** p<0.001; between sex intra-breeds

Table C 2. Analysis of age and treatment by morphology and species.

	n	**%**	**Age**	**SD**		**n**	**%**	**Age**	**SD**
Dogs	**302**	**89.1**	**9.8**	**3.2**	**Cats**	**37**	**10.9**	**11.8**	**4.1**
Lipoma, NOS	**60**	**19.9**	**9.8**	**2.9**	**Malignant Lymphoma, Non-Hodgkin, NOS**	**9**	**24.3**	**8.6**	**5.5**
No Treatment Needed	49	81.7	9.8	2.5	Chemotherapy	5	55.6	7.1	5.4
Surgery	11	18.3	10.0	1.3	Palliative Treatment	2	22.2	14.8	0.2
					No Treatment	1	11.1	9.7	-
					No Follow-up	1	11.1	3.1	-
Mast Cell Tumor, NOS	**43**	**14.2**	**9.0**	**3.2**	**Adenocarcinoma, NOS**	**5**	**13.5**	**14.3**	**1.3**
Surgery	15	34.9	8.4	2.6	Chemotherapy	3	60.0	14.4	0.3
Palliative Treatment	9	20.9	11.7	2.9	No Treatment	1	20.0	12.4	-
Surgery+Chemotherapy	5	11.6	8.1	3.9	No Follow-up	1	20.0	16.0	-
SurgeryTarget Therapy	5	11.6	7.6	4.5					

Carcinoma, NOS	**16**	**5.3**	**11.2**	**3.2**	**Squamous Cell Carcinoma, NOS**	**3**	**8.1**	**13.9**	**2.3**
No Treatment	5	31.3	11.0	2.7	Surgery	1	33.3	12.5	-
Alternative Treatment	3	18.8	10.4	1.3	Palliative Treatment	1	33.3	16.6	-
Surgery	3	18.8	11.2	6.6	Chemotherapy	1	33.3	12.7	-
Sarcoma, NOS	**14**	**4.6**	**9.4**	**3.5**	**Carcinoma, NOS**	**3**	**8.1**	**12.4**	**1.4**
Palliative Treatment	6	42.9	9.3	3.7	Chemotherapy	1	33.3	11.3	-
No Treatment	3	21.4	12.3	2.6	Palliative Treatment	1	33.3	14.0	-
Surgery	3	21.4	6.3	2.8	No Treatment	1	33.3	12.1	-
No Follow-up	2	14.3	9.9	1.4					
Adenocarcinoma, NOS	**10**	**3.3**	**12.4**	**1.4**	**Sarcoma, NOS**	**3**	**8.1**	**13.9**	**1.9**
Palliative Treatment	5	50.0	12.0	1.1	No Treatment	2	66.7	15.0	0.2
No Treatment	2	20.0	13.3	1.2	Surgery	1	33.3	11.7	-
Surgery	2	20.0	13.7	0.5					
No Follow-up	1	10.0	10.0	-					
Malignant Lymphoma, Non-Hodgkin, NOS	**9**	**3.0**	**8.6**	**3.1**	**T-cell Lymphoma, NOS**	**2**	**5.4**	**12.3**	**2.9**
Chemotherapy	5	55.6	8.5	3.5	Chemotherapy	2	100.0	12.3	2.9
No Treatment	2	22.2	6.4	2.1					
Palliative Treatment	1	11.1	10.6	-					
Surgery+Chemotherapy	1	11.1	11.7	-					

Table C 3. Analysis of age and clinical outcome by species and morphology.

	n	%	Age	SD		n	%	Age	SD
Dogs	**302**	**89.1**	**9.8**	**3.2**	**Cats**	**37**	**10.9%**	**11.8**	**4.1**
Lipoma, NOS	**60**	**19,9**	**9.8**	**2.3**	**Malignant Lymphoma, Non-Hodgkin, NOS**	**9**	**24,3**	**8,6**	**5,5**
No Follow-up	56	93.3	9.9	2.4	Euthanasia	5	55,6	9,6	5,4
Cured	2	3.3	8.9	2.1	Under Treatment	2	22,2	12,5	2,8
Death	1	1.7	9.0	-	No Follow-up	1	11,1	3,1	-
Euthanasia	1	1.7	10.1	-	Lost	1	11,1	1,5	-
Mast Cell Tumor, NOS	**43**	**14.2**	**9.0**	**3.2**	**Adenocarcinoma, NOS**	**5**	**13,5**	**14,3**	**1,3**
Under Surveillance	15	34.9	8.5	3,1	Death	3	60,0	14,4	0,3
No Follow-up	14	32.6	9,3	3,3	No Follow-up	1	20,0	16,0	-
Euthanasia	6	14.0	11,4	3,8	Euthanasia	1	20,0	12,4	-
Death	5	11.6	7,8	1,9					
Carcinoma, NOS	**16**	**5.3**	**11,2**	**3,2**	**Squamous Cell Carcinoma, NOS**	**3**	**8,1**	**13,9**	**2,3**
Euthanasia	9	56.3	11,1	3,9	Under Treatment	1	33,3	16,6	-
Death	5	31.3	11,2	1,9	No Follow-up	1	33,3	12,5	-
Under Surveillance	2	12,5	11,8	4,3	Euthanasia	1	33,3	12,7	-

Sarcoma, NOS	**14**	**4,6**	**9,4**	**3,5**	**Carcinoma, NOS**	**3**	**8,1**	**12,4**	**1,4**
No Follow-up	5	35,7	10,3	4,2	Euthanasia	2	66,7	11,7	0,6
Euthanasia	3	21,4	12,1	1,1	Under Treatment	1	33,3	14,0	-
Under Treatment	2	14,3	4,8	1,7					
Under Surveillance	2	14,3	7,6	2,2					
Death	2	14,3	9,3	0,6					
Adenocarcinoma, NOS	**10**	**3,3**	**12,4**	**1,4**	**Sarcoma, NOS**	**3**	**8,1**	**13,9**	**1,9**
No Follow-up	3	30,0	13,8	0,5	Euthanasia	1	33,3	14,9	-
Under Treatment	3	30,0	12,7	0,0	No Follow-up	1	33,3	11,7	-
Death	2	20,0	10,1	0,1	Death	1	33,3	15,1	-
Euthanasia	2	20,0	12,0	0,5					
Malignant Lymphoma, Non-Hodgkin, NOS	**9**	**3,0**	**8,6**	**3,1**	**T-cell lymphoma, NOS**	**2**	**5,4**	**12,3**	**2,9**
Euthanasia	5	55,6	7,5	3,3	Euthanasia	1	50,0	10,2	-
Death	2	22,2	9,9	2,6	Under Treatment	1	50,0	14,3	-
Under Treatment	2	22,2	10,1	3,5					

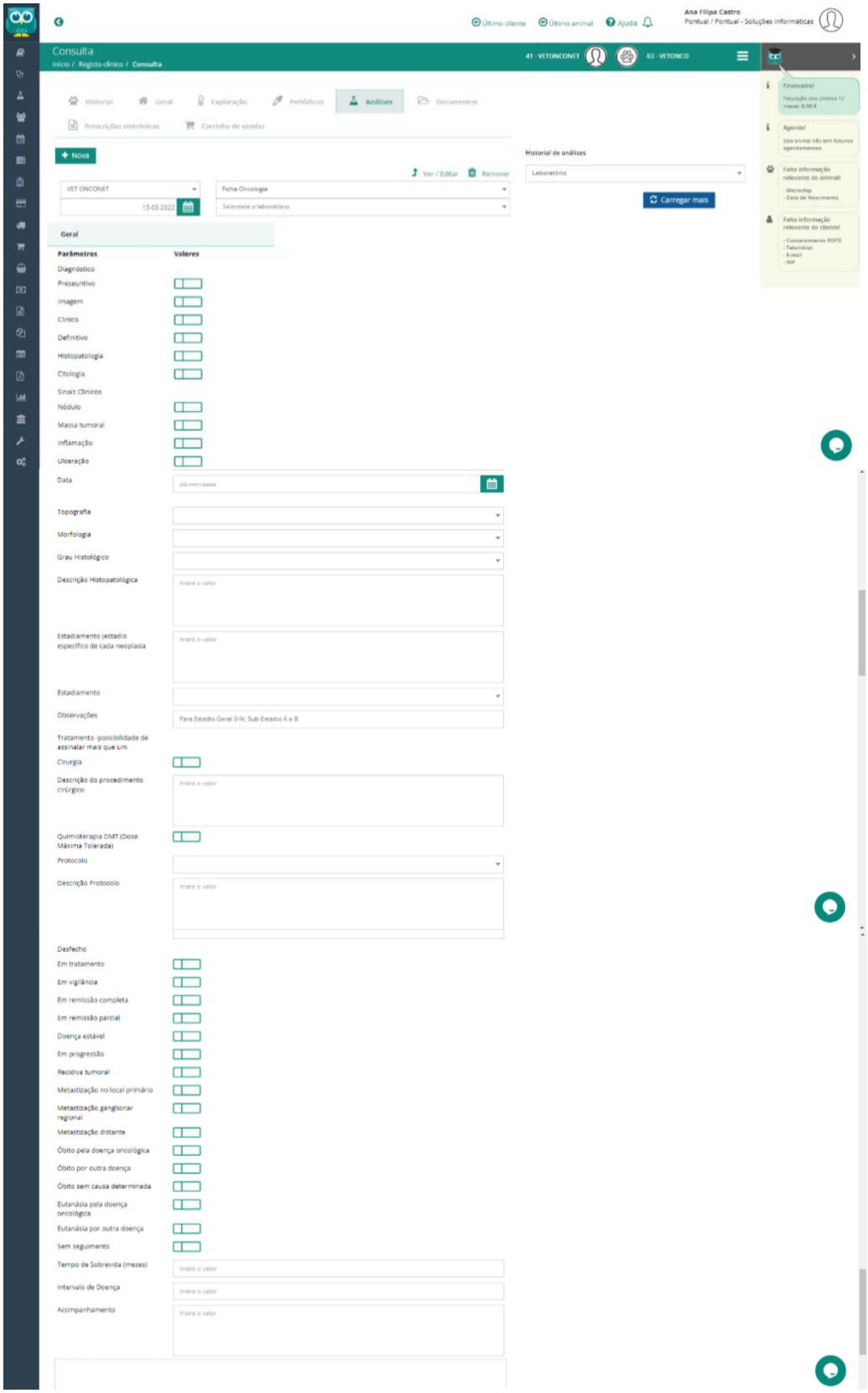


Figure C 1. Oncology Record created in partnership with GuruVet®.