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Epidemiology of tick-borne diseases - Lyme disease and nodular Scar Fever - epidemiological data from the years 2012 and 2021 in the Regional Health Administration of Lisbon and Tagus Valley

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ABSTRACT
Diseases transmitted by ticks constitute a problem within the scope of community health and public health. Over the years, national authorities have been making efforts to reduce these diseases, increasing the literacy of the Portuguese population regarding this problem. Diseases transmitted by these vectors have been appearing or reappearing in the national territory, because of different climatic, demographic, and social changes, associated with genetic changes in the vectors themselves. Therefore, we developed a literature review in several available computer sources and physical collections, supported by epidemiological and biostatistical data at national level (Portugal), in the years 2012-2021, focusing on the region of the Regional Administration of Lisbon and Vale do Tejo, for convenience. of researchers. Therefore, we intend to alert and sensitize the academic and care provider community to the need to be aware and respond to specific norms and indications regarding the approach of users, implementing nursing interventions based on national strategies and guidelines, to raise awareness among the population, hoping that in the future the number of diseases transmitted by ticks would decrease.

Keywords: Tick-borne diseases, Prevention, Intervention strategies, Community Nursing.

1 INTRODUCTION

The epidemiological mobilization of the phenomena by the nurse is an essential tool for the provision of health care, and its application in professional practice is considered very important.

Epidemiology is a discipline that offers important resources for the planning, administration, execution and evaluation of the provision of health services, and is also an extremely important tool in research, which makes it mandatory in the training of nurses. The object of epidemiology is not only disability, illness or death, but also the improvement of health indicators and health promotion. The term "disease" encompasses all unfavorable changes in health, including accidents and mental illnesses (Gomes, 1994).

Nurses who specialize in community nursing must have knowledge and integrate environmental variables in the recognition of the main determinants of health, establishing a network

of causality of health problems in a community (Ordem dos Enfermeiros, 2018). In the Portuguese legislative framework, one of the specific competencies of the nurse specialist in community nursing around community and public health nursing is the performance and collaboration in epidemiological surveillance of demographic scope (Ordem dos Enfermeiros, 2018). "Regardless of the data that will be identified, the initial stage of an epidemiological study always presupposes the observation of the phenomenon, calculating its current state and verifying changes in its pattern." (Melo, 2020:117).

Epidemiological research is essential to the identification of risk groups, targets of priority investment in screening programs for early detection and early intervention in the disease, with the objective of reducing mortality and morbidity caused by this disease. In addition, if we compare different therapeutic approaches with the natural history of the disease, we realize how effective they are. (Santos, 2019)

Disease surveillance presupposes the systematic collection of data by the Public Health Functional Units of the ACES (Health Center Groupings), aggregated by the Public Health Departments (DSP) of the ARS (Regional Health Administration) and by INSA (National Institute of Health Dr. Ricardo Jorge). It is essential for the planning of services, health infrastructures and the professional and academic training of health professionals. It aims to provide the basis (genetic and environmental) for the development of public policies for health promotion and disease prevention (Santos, 2019).

In Portugal, the diseases with the greatest impact on public health, "caused" by ticks, are Nodular Scar Fever and Lyme Borreliosis, so we developed a literature review on these pathologies. Therefore, this work arises with the general objective of epidemiologically analyzing tick-borne diseases (Lyme Disease and Nodular Scar Fever), using scientific articles and available official documents. Specifically, to report and interpret relevant biostatistical results in the design and evaluation of strategies, programs or projects implemented in this theme at the national level (Portugal), particularizing in the ARSLVT, for the convenience of researchers.

We will address ticks as a vector of the diseases mentioned above, associating them with these pathologies, then analyzing biostatistical data related to ARSLVT and conclude with a reflection on the data obtained and what is being developed in Portugal, the existing programs, and their importance for Public Health in this context.

2 TICKS ASSOCIATED WITH INFECTIOUS PATHOLOGIES IN PORTUGAL

Vector-borne diseases (mosquitoes and ticks) have emerged or are re-emerging as a result of climate, demographic and social changes, genetic changes in infectious agents, resistance of vectors to insecticides and changes in public health practices. Vector-associated infectious diseases are a group of diseases of great clinical, epidemiological, and laboratory importance (Instituto Ricardo Jorge,

2019).

The main arthropod vectors are mosquitoes, sandflies, ticks, fleas and lice. Its study is of great importance, not only because they can transmit a set of infectious disease agents, but also because some of these diseases are considered to have the highest mortality and morbidity worldwide (Instituto Ricardo Jorge, 2019).

Ixodids, also known as ticks, are strict hematophagous arthropods that are ectoparasites of terrestrial vertebrates. These arthropods are present in almost all zoogeographic regions, there are several species associated with the transmission to humans of important etiological agents, responsible for the appearance of several infectious diseases. (Silva et al., 2006).

Ticks are a group of vectors that transmit infectious diseases in which recurrent tick fever, Lyme borreliosis, tularemia, Q fever, ehrlichiosis, anaplasmosis, babesiosis, nodular scares fever and other rickettsioses are the best known. However, there are other diseases caused by viruses that must also be taken into account, such as tick-borne encephalitis, Crimea-Congo hemorrhagic fever and other arboviruses caused by Bhanja, Thogoto, Dhori, ribec, Tettnang and Eyach viruses (Instituto Ricardo Jorge, 2019).

The biological cycle of ixodids comprises four evolutionary phases: an inactive phase - egg and three active phases - larva, nymph and adult (male or female). In the transmission of the infectious agent, ticks can act either as mechanical or biological vectors. In the first case, the survival of the agent depends on its ability to withstand the conditions of the arthropod's digestive tract, until it is transmitted to the vertebrate host, the pathogen does not multiply in the vector and the arthropod only transmits it mechanically, from one vertebrate host to another. In the case where the tick is a biological vector, the infectious agent invades the body of the arthropod, proliferating in its tissues before being transmitted to another vertebrate host, which is the most frequent situation (Silva et al., 2006).

For the evaluation of the effectiveness of a tick as a vector there are two main parameters: the vector capacity and the competence of the vector. The vectorial capacity is the ability of a given species to transmit the pathogen in time and space, while the competence of a vector is the intrinsic ability of a tick to maintain the infection and consequently biologically transmit the infectious agent during feeding (Silva et al., 2006).

In general, the transmission of the infectious agent to a vertebrate host is due to the bite of an infected ixodid, with the consequent inoculation of salivary secretions containing the pathogen. However, it can also occur in the following situations: When the tick feeds, its mouthparts are contaminated with infected blood, coming from a host to which it has previously attached; when the infected tick releases contaminated faeces, on any cutaneous discontinuity, resulting from the feeding act or when it is crushed on that site and when the infected tick is swallowed.

Pathogens can be found in various types of mammals, domestic or wild, and human infection

results from contact with these mammals or their environment, through activities related to the profession (agriculture, pastoralism or others) or leisure (camping, hunting, hiking, among others) (Silva et al., 2006). In humans, the infection results in most cases from the bite of the infected tick. It is considered, however, that it is necessary to have a certain period of tick fixation in order to have an effective transmission of the infectious agent to humans, which in the case of rickettsiales, which cause scaronodular fever, can be 6-20 hours (Silva et al., 2006).

Regarding ticks, the highest population densities were found in the warmer months (July and August), although adult forms are found in almost all months of the year (Instituto Ricardo Jorge, 2019; Silva et al., 2006)

Currently, 21 species classified in the family Ixodidae have been identified, of which several are recognized vectors of etiological agents that cause disease in humans. *Rhipicephalus sanguineus* is responsible for the transmission of strains of the complex - Rickettsia conorii, agents of botonous or scaro-nodular fever, which, in our country, is the main disease associated with ixodids and classified as a notifiable disease. *Ixodes ricinus* is the main vector of *Borrelia burgdorferisl*, the etiological agent of Lyme borreliosis, also classified as a notifiable disease (Instituto Ricardo Jorge, 2019).

The National Institute of Health Doutor Ricardo Jorge (INSA) is in Portugal, the competent authority in epidemiological surveillance, training and dissemination of entomological knowledge, participates through the Center for the Study of Vectors and Infectious Diseases (CEVDI), being responsible for the implementation and execution of the REVIVE program (Vector Surveillance Network), a national project for the surveillance of vector arthropods.

In Portugal, according to the Ricardo Jorge Institute, many of these diseases are not reported and even in those of mandatory notification, underreporting is high, leading to a lack of knowledge of their real epidemiological situation.

2.1 LYME DISEASE

Lyme borreliosis is a disease of epidemiological importance (Instituto Ricardo Jorge, 2019). It is the pathology transmitted by tick bites with the highest incidence in Europe and North America (Garrido & Borges-Costa, 2018).

It is caused by infection with spirochetes of the Borrelia burgdorferi sensu lato (sl) complex, which currently encompasses 21 different species, and which was first detected in the early eighties of the last century, in the vector arthropod, the ixodid, Ixodes scapularis (Garrido & Borges-Costa, 2018).

Lyme disease is a multisystem disease that includes dermatological (erythema migrant), cardiac (blockages, carditis), neurological (facial paralysis, meningitis, meningoencephalitis) and rheumatologic (arthritis) issues. It can occur at any age, but with a higher incidence in two age groups: 2-15 years and 30-55 years. It is a multisystem infection, whose nonspecific symptoms can mimic

other infections, making the diagnosis dependent on the degree of suspicion (Mariano et al., 2009).

The first described case of Lyme disease in Portugal dates back to 1989, given that the vector that transmits the disease has forests and woodlands with high humidity as its habitat, it is expected that the incidence of this pathology will increase from south to north. In Europe, it is estimated that about 65,000 cases occur annually (Silva et al., 2006).

For the diagnosis of Lyme disease to be considered, an individual must have been exposed to the risk of being bitten by a tick vector, so the best preventive method is to prevent it from occurring (Instituto Ricardo Jorge, 2019).

According to Order No. 1150/2121, published in the Official Gazette, which establishes the notifiable diseases, Lyme Disease or Lyme Neuroborreliosis, as mentioned in the order, is subject to mandatory clinical and laboratory notification (Order No. 1150/2021, 2021).

The treatment of Lyme borreliosis involves the application of antibiotics, although it is known that their effectiveness decreases with the evolution of the disease, regardless of the antibiotic used. In recent studies on the therapy to be applied to Lyme borreliosis, it is usually recommended that early infections be treated with oral penicillin or tetracyclines for 10 to 20 days, depending on the speed of the patient's response (Instituto Ricardo Jorge, 2019)

On a personal level, there are some basic rules that are easy to apply, the adoption of which is the most effective measure in terms of preventing Lyme borreliosis. These rules are:

- avoid ixodid-infested areas,
- wear light-colored clothing to make it easier for ixodids to see,
- carefully inspect clothing and body after passing through endemic areas,
- avoid wearing open-toed shoes,
- immediately remove the ticks, with the help of forceps, grasping the anterior end of the ixodid, as close as possible to the skin and making a small twisting (rotating) movement,
- use a repellent,
- frequently inspect domestic animals and remove ixodids that are present,

Consult a doctor if any dermatological lesion is detected in the days following the ixodid bite.

2.2 FEBRE ESCARO-NODULAR (FEN)

Rickettsiosis are zoonoses caused by bacteria belonging to the genus Rickettsia , and transmitted by infected arthropods. They are obligate intracellular gram-negative coccobacilli, divided into two groups, the Exanthematous Fever Group and the Typhus Group. ENF belongs to the group of Exanthematous Fevers and is the most prevalent zoonosis in Europe, especially in rural areas, its etiological agent is Rickettsia conorii (Ruivo, 2021).

It mainly affects the countries of the Mediterranean basin and southern Europe, and is an

endemic disease in Portugal. Currently, this disease can appear anywhere in the world as a consequence of tourism and the great mobility of populations (Portuguese Society of Pediatrics, 2005).

In the countries of the Mediterranean basin, the main vector is the ixodid, Rhipicephalus sanguineus, known as the dog tick. The usual reservoirs are dogs, foxes and small rodents (Portuguese Society of Pediatrics, 2005). Rickettsias are transmitted to humans by the bite of the infected tick while it is eating its blood meal, or by contaminating the mucous membranes with body parts of infected ixodids. For there to be effective transmission of rickettsia to humans, between 6-20 hours of parasitization by the arthropod are necessary, however, man is an accidental host (Instituto Ricardo Jorge, 2019).

FEN occurs mainly in the warm months of spring, summer and early autumn, and predominates in rural areas. This distribution is related to the life cycle of the tick (Ruivo, 2021). ENF disease, most of the time benign, usually presents with a nonspecific, abrupt picture of fever, headache, myalgia, nausea and vomiting, with the appearance of a maculo-papular rash with palmoplantar involvement, usually 3 to 5 days after the onset of symptoms, the incubation period varies from 3 to 7 days after the tick bite, but it can be longer (Instituto Ricardo Jorge, 2019; Redhead, 2021).

It is characterized by a process of generalized vasculitis, resulting from the destruction of blood endothelial cells by rickettsias. From the bite site, rickettsias reach the bloodstream, producing vasculitis affecting the intimacy and middle of the blood vessels (Portuguese Society of Pediatrics, 2005). In most cases, the diagnosis is relatively simple, especially when eschar is present. The diagnosis of NSF is essentially clinical, combining the symptoms and signs presented by the patient with an epidemiological association. The place of residence, professional activity, contact with animals, outdoor activities, recent trips, as well as the time of year should be taken into account (Ruivo, 2021).

Epidemiological surveillance through notification is essential for the knowledge of the evolution of the disease. If EFF is suspected, empirical antibiotic therapy should be started as early as possible. The first-line antibiotic in rickettsiosis is doxycycline, which belongs to the tetracycline class, and is prescribed in more than 80% of EFPs. In severe cases, it should be administered intravenously. The second-line antibiotics recommended in the literature are azithromycin, clarithromycin, and ciprofloxacin (Ruivo, 2021).

The prevention of EFN is based on avoiding contact with vectors and, in means conducive to their presence, the use of repellents and appropriate clothing, that is, those that cover the greatest possible extent of the skin, such as trousers, long socks and long-sleeved shirts; good hygiene, to detect ticks early. In some countries, the treatment of animals has been shown to be effective in preventing human infection (Ruivo, 2021; Silva et al., 2006).

3 ANALYSIS OF EPIDEMIOLOGICAL DATA IN THE ARSLVT

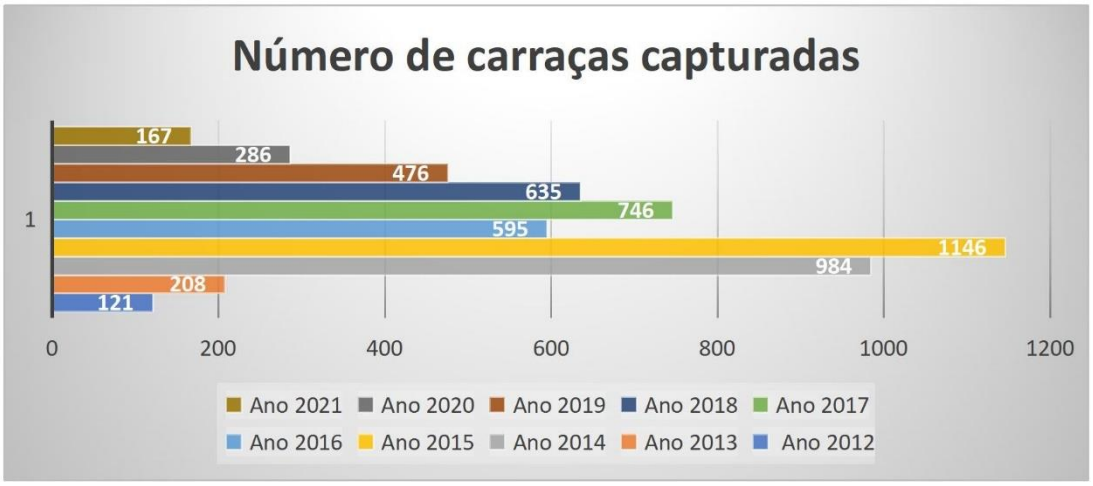
The REVIVE programme is the result of a protocol between the Directorate-General for Health, the Regional Health Administrations of the Algarve, Alentejo, Centre, Lisbon and the Tagus Valley and the North, the Institute of Social Affairs and Health of Madeira, the Regional Directorate of Health of the Azores and the National Institute of Health Doutor Ricardo Jorge (Directorate-General for Health, 2022).

REVIVE-Carraça aims to identify the species of ticks in circulation in Portugal and to research pathogens transmitted by them, such as bacteria of the genus *Rickettsia and* Borrelia *in order to contribute to the knowledge of the geographical distribution, abundance and periods of activity of species important in public health (Directorate-General for Health, 2013).*

Analysing the data at local level, they are presented, for the ARSLVT, in the period 2012 and 2021. This period was chosen because the program began in 2011, with ticks, and this year was considered experimental (Directorate-General for Health, 2013).

Graph 1 shows the data on the number of ticks captured and analysed between 2012 and 2021.

Graph 1 – Number of Ticks Caught between 2012 and 2021

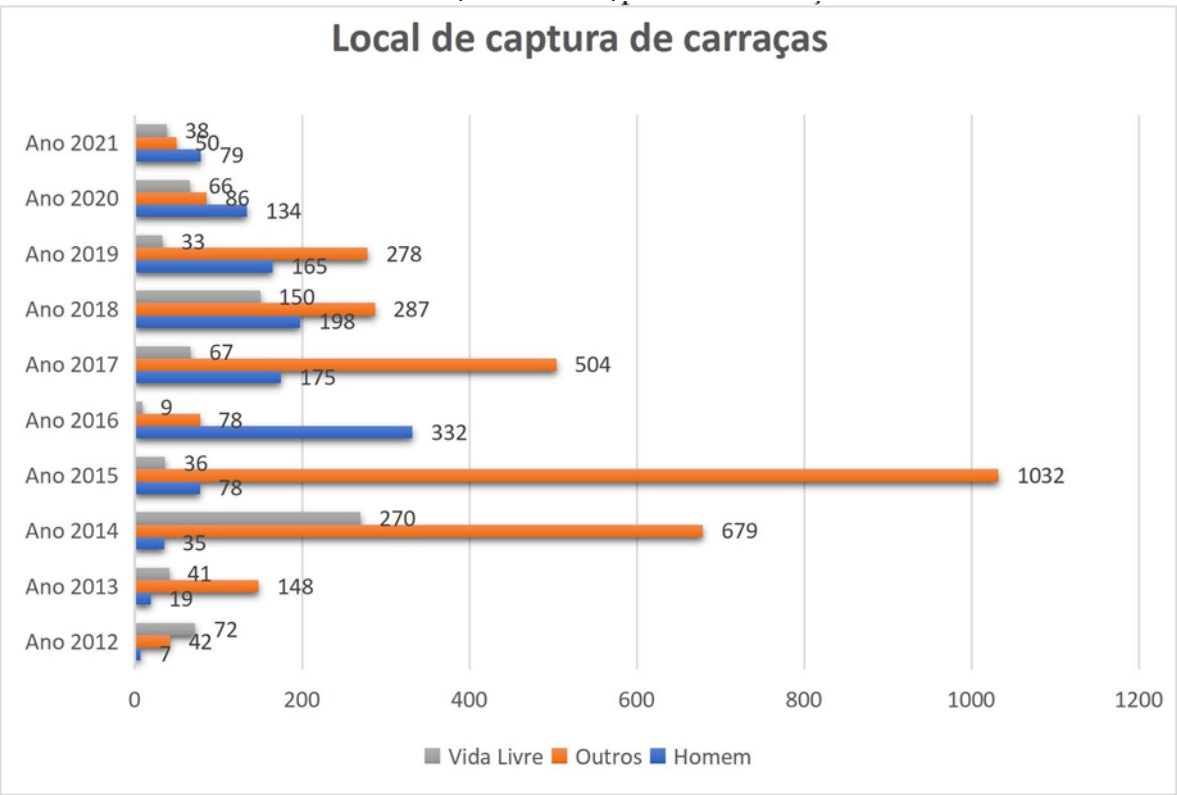


Source: Directorate-General for Health (2022)

According to the graph, there is an increase in harvests over the years, having reached a peak in 2015, decreasing again, with the 2020/2021 harvests being more seduced, probably as a result of the Covid19 pandemic.

In a tick surveillance programme, it is necessary to ensure that harvests are carried out throughout the year, in the free-living phase (on vegetation) and in their parasitic phase (on the host). (Directorate-General for Health, 2022). Graph 2 is representative of these data.

Graph 2 – Tick capture location



Source: Directorate-General for Health (2022)

In this graph, it can be seen that there has been an effort to capture ticks over the years, and 2015 has scored with the effort to collect samples from animals other than humans. In 2016, only 9 species were captured in the wild in the entire ARSLVT. Again in the years 2020 and 2021, there was a decrease in harvests, probably due to the Covid19 pandemic.

All those collected in the wild, including homes, walls, dwellings, clothing, soil, etc., were considered to be harvested in the wild (Directorate-General for Health, 2022).

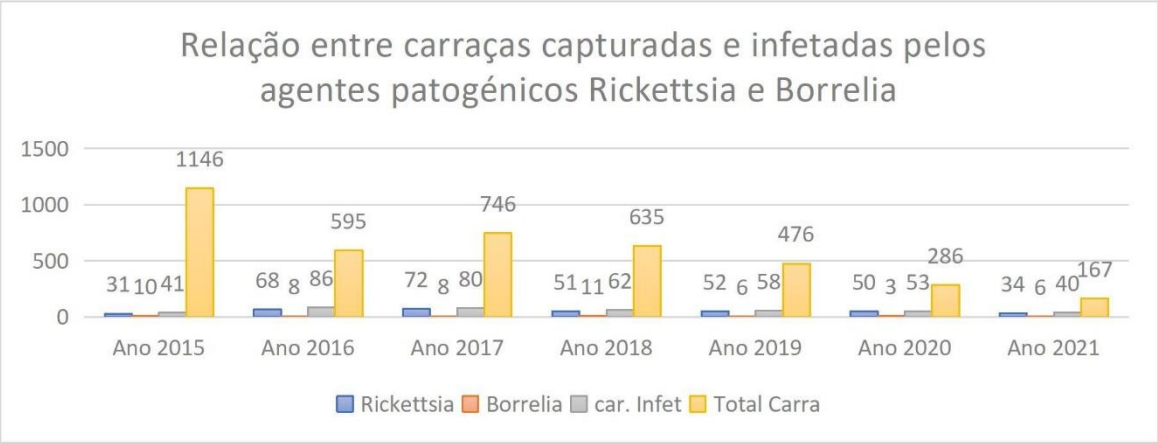
Within the scope of REVIVE, from 2011 to 2021, 11 species of ixodids were identified in the ARSLVT region, one of which was imported, *Amblyomma* spp. *D. marginatus, H.* lusitanicum, H. *marginatum*, I. ricinusI. ventalloi , R. pusillus *and* R. sanguineus *are the* species that were always caught during the period considered. Most of the species were harvested in the adult stage (Directorate General for Health, 2022).

Once the species has been identified, each tick is washed and processed individually for DNA or RNA extraction. In ticks removed from humans, extraction is carried out in an automatic extractor. The search for specific DNA of *Rickettsia* and *Borrelia* is performed by the conventional PCR and/or real-time PCR technique. The positive samples are then sequenced for confirmation and identification of the agent species (Directorate-General for Health, 2022).

The following graph (Graph 3) shows the data related to the research of infectious agents for the diseases studied. The data refer to the 2015-2021 range, as they were not previously identified or

reported in the tick reports with agents *Rickettsia* and *Borrelia*.

Graph 3 – Ratio - ticks caught infected by the pathogens Rickettsia and Borrelia



Source: Directorate-General for Health (2021, 2022), INSA & DGS (2016, 2017, 2018, 2019, 2020)

It is observed that the pathogen that causes EFN prevails in the captured ticks. We can also see that it does not increase in relation to the numbers caught, because in 2015, ticks were caught in greater numbers, but nevertheless, the number of ticks infected with these pathogens was the lowest of all the years under study, except in 2021.

In the total of these years (2015-2021) the ticks captured and infected by the pathogens under study present a percentage of 10.12%, of this total of positive ticks for these agents, with a percentage of 87.32% of Rickettsia and 12.68% of Borrelia (Directorate-General for Health, 2022).

Regarding Scario-Nodular Fever, according to the DGS data available, there were a total of 114 cases of the disease reported in the years 2015-2018 (Transparencia.sns.gov, 2023)

The incidence rate for EFN in Portugal per 100,000 inhabitants, according to data from the DGS (2023) for 2015 is 1.3‰, for 2016 it is 0.9‰, and 2017 is 1.2‰.

By comparing the declared disease with the number of ticks harvested where the causative agent of the disease was detected, we found that in 2015 the disease was higher, but in the following years the proportionality was low (2016 – 29.41%; 2017 – 45.8%; 2018 – 56.86%), since the infected ticks were not captured only in humans, but also in the wild and in other animals.

Table 1 – Comparison of infected ticks and declared disease for FEN

Year	Ticks	Sickness
2015	31	32
2016	68	20
2017	72	33
2018	51	29

Cast Iron: DGS (2023)

It is important to reinforce the importance of including the suspected diagnosis of rickettsiosis in Portugal, particularly of EFN, in the differential diagnoses of an acute febrile syndrome, especially in the spring and summer months (Ruivo, 2021).

For Lyme Disease, according to the data available from the General Directorate of Health, there were a total of 17 cases of the disease reported in the years 2015-2018.

In short, the years 2015 and 2018, according to the General Directorate of Health, were the years with the highest number of reported cases. There is no dominance of the type of sex, but the low number in the younger age groups is remarkable.

The incidence rate for Lyme Disease in Portugal per 100,000 inhabitants, according to data from the Directorate-General for Health (2023) for 2015 was 0.1‰, for 2016 0.2‰, and 2017 0.2‰.

By comparing the declared disease with the number of ticks harvested where the agent causing the disease was detected, we can see that in proportion to the number of notified diseases and infected ticks caught, we have in 2015 – 50%; 2016 – 25%; 2017 – 50%, 2018 – 54.54%, bearing in mind that ticks caught with infection were not only caught in humans, but also in other animals and in the wild.

Table 2 - Comparison of infected ticks and declared disease for D. Lyme

Year	Ticks	Sickness
2015	10	5
2016	8	2
2017	8	4
2018	11	6

Cast Iron: DGS (2023)

It is important to remember that Lyme densel, although rare, is a reality in Portugal, being a notifiable disease, and that only by notifying is it possible to have a more accurate knowledge of its true extent in the Portuguese population (Mariano et al., 2009).

4 NATIONAL STRATEGIES TO ADDRESS THE TICK VECTOR PROBLEM IN PUBLIC HEALTH

In Portugal, since 2011, the REVIVE program has been capturing and researching infectious agents in ticks.

Bearing in mind the likelihood of the introduction of new vectors in certain geographical areas, as well as the possibility of unexpected outbreaks, in the European reality, the European Centre for Disease Prevention and Control (ECDC) reinforced the need for vector surveillance and designed guidelines for the implementation of a European surveillance network (ARS Alentejo, 2011).

The International Health Regulations (Notice No. 12/2008, D.R 1st series, No. 16 to 23 January

2008, as amended, adopted by the 58th World Health Assembly on 23 May 2005) recommends the establishment of surveillance and vector control programmes in the perimeter of ports and airports and encourages Member States to acquire, strengthen and maintain the requirements and mobilise resources for that purpose. In some areas of Europe, especially in the countries of origin of tourists who usually visit the Algarve, they have already warned of the danger of pets, especially dogs, being infested in the Algarve and transporting these ticks to the country of origin. Since the great adaptability of this species and its competence as a vector of *Rickettsia* to humans is known, this fact is a growing concern and it would be advisable to study some measures to control tick populations. However, for these measures to be effective, more data need to be collected, especially in the spring and summer months, when this species is most active (INSA & DGS, 2014).

The need for the vector surveillance network for Public Health is related to:

- Increase in international travel that is recreational, commercial and even motivated by immigration/emigration phenomena;
- Approach of invasive mosquitoes;
- The existence in Europe and Portugal of factors that can lead to the establishment of invasive vector species and factors that can lead to the frequent transmission of diseases by the species themselves;
- Be able to issue alerts for the adequacy of control measures, depending on the density of vectors and the level of infection (INSA & DGS, 2015).

Ixodids can be harvested in the wild or parasitic phase, and technicians should give preference to places with greater proximity and use by the population (paths or trails and sports/leisure spaces) and to places where there are detected or reported cases of bites and/or human disease (ARS Alentejo, 2011).

During the parasitic phase, ticks are firmly attached to their hosts and it is not always easy to remove them. It is up to the nurses to remove the ticks from the patients who present themselves, and they must be removed and properly accommodated for laboratory dispatch. Thus, you should:

- ✓ Trap the tick with tweezers, wearing gloves to avoid contact with the skin;
- ✓ As close to the insertion site on the skin as possible, rotate slightly until the skin comes loose;
- ✓ the bite site should be disinfected;
- ✓ Place the tick samples to be sent in plastic tubes/dry containers that should contain some vegetation to ensure favourable humidity conditions.
- ✓ Fill out the harvest report

Taken as a whole, the overall result obtained within the scope of the REVIVE-Carticks Program are contributing to a better eco-epidemiological knowledge of arthropod vectors of pathogens for

humans, for the identification of important pathogens in Public Health circulating in our country, as well as other microorganisms that, despite never having been isolated from humans in Portugal, have already been identified as pathogenic in other European countries (DGS, 2022).

This information is transmitted in a timely manner to the local authorities, which can then decide on the implementation of relevant control measures, depending on the density of the vectors and their level of infection (DGS, 2022).

The decrease in tick captures during the Covid19 pandemic was notorious, which did not happen with the number of reported cases of diseases, which suggests a continuation in the incentive to capture these specimens.

5 REFLECTION

Vector-borne diseases consist of a dynamic interaction between a pathogen, the vertebrate host, the vector and the environment (ARS Alentejo, 2011).

Over the years of this vector control project, in REVIVE, new species of ticks have been discovered, which until now were unknown in Portugal. Which, in a way, demonstrates the importance of these studies and the capture of specimens, in addition to:

- Identification of important pathogens in Public Health circulating in our country;
- Be able to issue alerts for the adequacy of control measures, depending on the density of vectors and the level of infection.

There are several products on the market to combat and prevent tick bites, but they are not always affordable enough, which makes it difficult to prevent infestations in animals and consequently in humans.

The relationship between epidemiology and public health is one of complexity and complicity. Currently, public health responds with a great demand and demand on epidemiology, and this corresponds with great utility (Melo, 2020).

Considering the global aspect of nurses' work, and in particular their actions in epidemiological surveillance, epidemiology plays an important role in these processes, not only in the aspects of prevention and surveillance of diseases or occurrences, in this case ticks or diseases caused by these vectors, but also in the evaluation and analysis of the impact of their actions. and correct action in capturing the specimen. Epidemiology serves to identify needs, risks, define priorities, improve the use of resources, among others (Gomes, 1994).

Nurses who are part of a public health unit must be specialists in community health and public health nursing. As such, and considering the competences, epidemiological surveillance is an important area of work for nurses who work in this context (Ordem dos Enfermeiros, 2008). In this sense, the participation of the nurses of the Public Health Unit in the epidemiological control, and the

sensitization of all nurses in the correct removal of the tick from man, and its subsequent packaging and sending for analysis is of great importance.

It will also be important to raise awareness among the general population, and to involve the community in the prevention of biting and the capture of ticks.

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