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Time and Space Dynamics of Brucellosis in Albania in Relation to Control Interventions

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Abstract: ***Introduction: Brucellosis remains a common disease in many Mediterranean countries and continues to be a threat to the public health and the agriculture economy. This paper aims to analyse the changes in time and space of the human brucellosis in Albania, with a focus on the last decade and in the context of the prevention measures. Methods: for the human brucellosis analyses, two datasets are used; hospitalizations and epidemiological surveillance. Study period is 2010-2020, but other historical data are also used to feed the analyses. Additional data from veterinary service about clusters of the disease in animals, as well as timeline of vaccination programs, were also collected. Results: This is the first study to document the continuous decrease of brucellosis incidence rates in humans since 2005, and especially since 2011, when nationwide control programs were introduced. From 37.5/100000 in 2004, yearly incidence fell to 3.4/100000 in 2019, with an average decrease of 10%-20% every year. The prevalence of infection in animals followed a similar trend. The decline in incidence over the ten years was highest in Korce (6.5 times) and lowest in Diber (only 50%). The fall of reported cases in the pandemic year 2020 was unexpected, with 4.2 times less cases than those reported in the previous year. Conclusion: The sustained decline in cases of human brucellosis is associated with the mass vaccination of animals. Although under control in 2019, the brucellosis is far from being eradicated in Albania, with cases reported from more than half of municipalities and an apparent stagnation in northeastern regions.***

Keywords: Brucellosis rate trends; Albania; Zoonoses control programs

1. Introduction

Brucellosis, known also as Malta fever is a typical zoonotic infection. The disease occurs worldwide but the Mediterranean region has been particularly affected (1). Although brucellosis is eradicated in many high income countries, it remains a common disease in humans and animals in most countries of Eastern Mediterranean and North Africa. The incidence in humans in those countries ranges from 1 to 70 cases per 100 000 inhabitants per year (2). The Mediterranean basin has always had cases of brucellosis due to climatic conditions for extensive livestock production in most countries of this region (3).

The rates in high income countries of European Union have been very low at around 0.1/100000, with only Grece and Portugal reporting 1 or more cases for 100000 inhabitants (4). Some high income Mediterranean countries like France have virtually eradicated the disease (5). Globally, there are reported each year about 500000 cases of brucellosis in humans (5). Nonetheles, this figure is considered a vast under estimation by a number of authors. Many of the most affected countries do not have the infrastructure for diagnosis and the broad spectrum of symptoms are shared with other febrile infections (6). This is especially true for mild cases of brucellosis or chronic brucellosis which is extremely hard to diagnose.

Humans are infected by direct contact with animal tissues or indirectly by consumption of infected animal foods such as meat or diary. The aerosolized particles containing the brucellae bacteria can also be inhaled by persons manipulating the contaminated products (7). Most cases are caused by unpasteurized goat or sheep milk or cheese. Person to person transmission, although rare, is also reported. Brucellosis is considered an occupational hazard to persons engaged in certain professions such as veterinarians, slaughterhouse workers, and farmers (8).

The disease may take acute, sub-acute or chronic forms and usually causes weakness, headache, lethargy, weight loss, fever, and sweating. The fever is typically remittent, giving the disease the name, undulant fever (9, 10). The incubation period is usually from 2 to 4 weeks, but may be highly variable. The common reservoirs for Brucellae bacteria that may infect humans are cattle, dogs, sheep, goats, and pigs. Brucellosis often causes damage to the urinary-genital tract of domestic and wild animals, giving the disease another name, contagious abortion. This disease is one of the causes of significant economic losses in livestock production due to reproductive disorders and reduced production of affected animals (10, 11).

The brucellae are gram-negative aerobic coccobacilli with brucella melitensis the most prevalent species mostly because of difficulties in immunizing goats and sheep (12).

Brucellosis remains an important public health problem and being a zoonotic disease, its control in humans implies preventive measures of a veterinary nature.

Although well studied in global level, publications about brucellosis epidemiology and control in Albania are scarce. We have not found any peer reviewed documents during last decade to describe comprehensively time trends and geography of brucellosis within the country, in the context of prevention efforts. The aim of this work is to present a full picture of brucellosis time and space distribution changes in Albania, as well as the dynamics of socio-demographic characteristics. We also aim to explain the changes over time in the light of control programs.

2. Methods

We use original dataset about brucellosis diagnoses from Albanian hospitals during last 10 years (last year in the analyses is 2020) as well as other historic data collected at Tirana Institute of Public Health. Every hospital reports yearly the diagnosed brucellosis cases. Additionally, regional units of health care collect cases from every health care provider, on monthly bases. The information about hospitalizations is triangulated with epidemiology data.

The data are sex specific, age specific, year specific and region specific. For selected years there are more detailed data about occupation and animal exposure of infected individuals. Data were also collected from veterinary service about distribution and clusters of the disease in animals, as well as timeline of vaccination programs.

Descriptive analyses were performed to produce rates, with detailed population information retrieved from INSTAT estimates. Data were analysed in Excel software. All rates are per 100000 inhabitants.

3. Results

Time trends of brucellosis in Albania can be divided into two main phases. In the period from the mid last century to the beginning of the new century the trend takes a U-shaped pattern. From 1950 to 1990 brucellosis rate in humans drastically declines, following a fall in infection prevalence in farm animals. From around 40 cases per 100000 reported every year during the years 50s and early 60s of last century, the disease almost disappears in 1970s and 1980s. Then, in the 1990s brucellosis incidence increases again to reach the peak in the first decade of the new century. In 2004 the incidence rate was 37.5/100000, with over 1000 reported cases per year, which was similar to the levels of risk of 50 years ago. The prevalence of infection in animals follows a similar U-shaped trend (figure 1).

The second phase describes the gradual decrease of the incidence rate since 2005, going through a short stagnation during the beginning of the first decade of the century (2010-2013) then steeply declining again to fall under 100 new cases (under 3.5/100000) per year in 2019, for the first time since 1980s.

In both phases the differences between highest and lowest observed rates can be larger than ten times. The speed of reaching the decrease in incidence, during last 15 years is similar to that observed during the years 1960s and 1970s and the visual difference in figure 1 is mostly because of lower frequency of data before 2005.

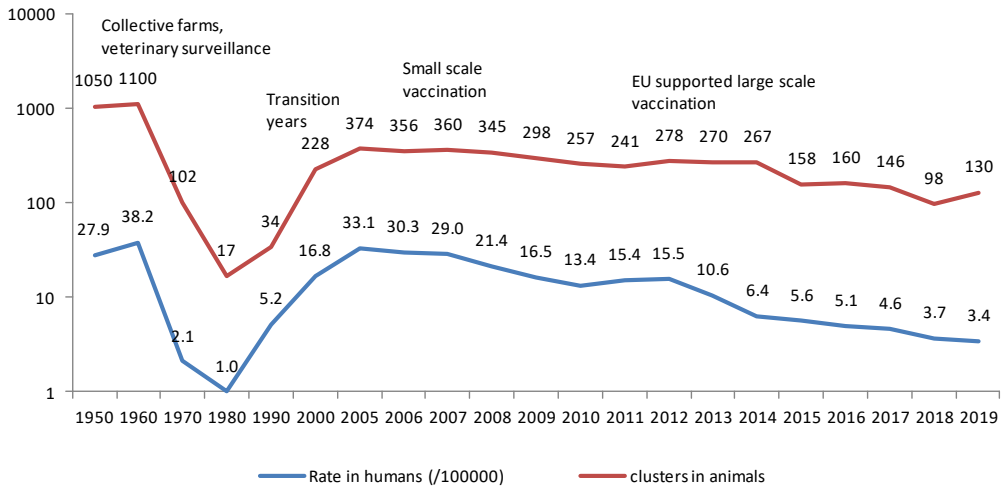

Figure 1: Brucellosis incidence rate (/100000) in humans and number of reported infection clusters in animals.1950-2019

Note: The figure 1 uses logarithmic scale to allow for simultaneous description of the two indicators.

Brucellosis incidence has been for 30 years higher in south and southeast of the country. The risk to get infected in regions of Vlore, Gjirokaster and Korce has been many times higher than in the rest of the country and it was even higher in some municipalities within those regions, especially those bordering Greece (figure 1). Nonetheless, although the declining trend have been noticed in most of the country regions, it has not been everywhere the same. In Korce during last 10 years the incidence has fallen 6.5 times, while in Gjirokaster only 3.5 times. Meanwhile in Diber, in northeast of the country, it is recorded only a 50% decline (data not shown). The ten years average incidence remains comparatively higher in some southern municipalities, but northeast municipalities of Diber

region bordering North Macedonia, are also among higher risk populations.

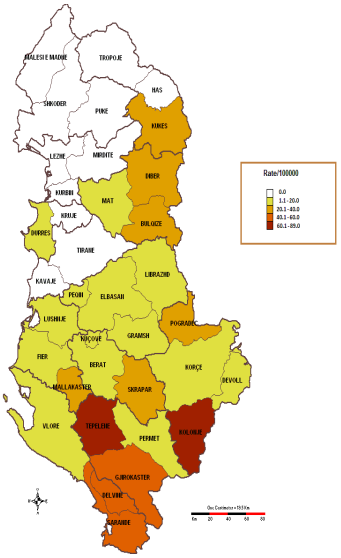

Figure 2: Geographical distribution of yearly average brucellosis incidence rate (/100000). Years 2013-2019

Data show that brucellosis was overwhelmingly an infection of rural populations and men. In 2019, only 25, 5% of the reported cases were female and only 33.4% were urban dwellers. Table 1 demonstrates that similar proportions are found around ten years ago in 2010, with slightly more infections in rural areas.

The disease was exceedingly rare among infants and toddlers, with risk becoming significant among children 5-14 years old. The bulk of cases were reported in young adults and those under 60 years old. Around 15% of cases were reported in people over 60 years old. Interestingly, the age distribution of the cases remained almost invariable in 2019 when compared to 2010. The distribution of the occupational status of reported cases reflects the rural residence of the persons infected, and most likely their exposure to livestock. The majority of the cases were farmers, although their proportion decreased from 68.3% in 2010, to 56.2% in 2019. There were identified only few cases of shepherds, butchers and veterinaries (around 1% or less) among the people infected, and their numbers remained similar through ten years under analyses.

Table 1: Distribution of brucellosis according to socio demographic characteristics 2010, 2019

Variables		2010		2019	
		Number	%	Number	%
Gender	Women	91	23.1	25	25.5
	Men	299	76.9	73	74.5
	Total	390	100	98	100
Age group	<1	1	0.3	0	0.1
	1-4	2	0.6	1	0.7
	5-14	16	4.1	6	6.3
	15-44	204	52.3	51	53.6
	45-59	109	27.9	22	25.4
	>60	56	14.8	16	16.4
	Total	388	100	95	100
Residence	Urban	85	21.9	31	33.4
	Rural	297	78.1	62	66.6
	Total	382	100	93	100
Occupation	Farmer	266	68.3	60	56.2
	Vet/inspector	2	0.6	1	1.1
	Butcher	1	0.3	1	0.9
	Shepherd	7	1.8	1	0.7
	School	34	8.7	5	4.6
	Pensioner	14	3.6	7	6.7
	Housewife	23	5.8	8	12.7
	Other	42	10.8	17	17.2
	Total	390	100	98	100

Data of brucellosis in 2020 are analyzed separately, because of the potential pandemic impact in utilization of care and monitoring of cases of infection. Comparison of the data presented in table 2 with those of figure 1 shows that the drop of reported cases in 2020 is much larger than expected. Indeed, the observed decline of brucellosis cases during the period 2005-2019 was on average 10-20% every year, the highest experienced in 2014, when it was recorded a 65% decrease in incidence compared to the previous year. The cases reported in 2020 were 4.2 times less than those reported in the previous year and 6.1 times less than the previous 5-years-average.

Table 2: Decrease in number of hospitalized cases of brucellosis in 2020 pandemic year compared to previous years

	2019	2015-2019 average	2020	Decrease in 2020 compared to 2019	Decrease in 2020 compared to previous 5 years average
Male	66	103	14	4.7 times	7.4 times
Female	31	37	9	3.4 times	4.1 times
Total	97	140	23	4.2 times	6.1 times

4. Discussion

In this work we aim to describe the dynamics in the levels of risk of being infected from brucellosis in Albania during the last decade in the context of historic and most recent interventions.

After the incidence rate of brucellosis in Albania fell to under 1 per 100000 for about 20 years during the years 1970 and 1980 it started to increase exponentially after the collapse of the past regime, to reach rates of almost 40/100000 in the beginning of the new millennium. This is the first study to document the continuous decrease of brucellosis incidence rates in humans since 2005, when efforts to control the problem started, and especially since 2011, when nationwide systematic programs were introduced (13).

In 2019 incidence rate of reported cases of brucellosis in Albania was 3.4/100000, a more than 10 times decrease compared to the peak of epidemic, recorded in 2004. A steeper decline in cases of human brucellosis seem to be associated with the mass vaccination of small ruminants (sheep and goats), vaccination of replacement animals and the test and slaughter program introduced later.

A recently published review (14) using data from 23 high, middle and low income countries concluded that that both vaccination and test-and-slaughter could effectively reduce the incidence of animal brucellosis and disease transmission rate. On the other hand, although vaccination campaigns in farm animals followed by compulsory test-and-slaughter programs have contributed to the elimination of brucelae in some countries, it must be beared in mind that campaigns can be long, and complex to implement (15).

Although under control in 2019, the brucellosis is far from being eradicated in Albania, with cases reported from more than half of administrative municipalities. The experience of 20 years ago in the country, as well as recently reported situations from other countries (16, 17) show that circulation of infection in animals, even at low epidemic state, or very low rates, if left unchecked, may cause rapid return of the high circulation of the disease in humans. Also, partial or incomplete implementation of veterinary control measures may jeopardize the long term success of any eradication program. A very recent review of strategies to control brucellosis in Middle East countries demonstrated that while vaccination can decrease the epidemic rate of the disease from 45% to 1.8%, test-and-slaughter technique alone has not proven successful in the eradication of brucellosis (2). It is though paramount for Albania to continue with the systematic and comprehensive approaches of control of brucellosis in animals while strengthening the surveillance over the infection in animals and humans (18).

Another important finding from our work is the apparent stagnation of the progress of control in north eastern regions of the country. While focus has been for years in the southern hot spots of brucellosis in the country, the resurgence of the infection elsewhere may have been neglected. Further studies to better understand the causes there should include practices of selling seropositive animals and uncontrolled cross border trade of animals. Research shows that these practices, especially when reimbursement for slaughtered animals is not done routinely, may contribute to the failure of control programs in some areas, or to spreading and reintroduction of the infection to other areas (19, 17).

Time comparisons of the prevalence of socio demographic characteristics of disease show little variation in Albania during the last 10 years. Brucellosis predominantly remains a disease of men (around three in four cases are men) and rural communities (around two thirds of cases are farmers and live in countryside). This specific profile of persons diagnosed with brucellosis confirms that of an agriculture occupational disease and it is also found in other populations elsewhere (8). To avoid the occupational infections for agricultural workers in high risk areas it is recommended to support tailored health education programs, introduce occupational disease inspections when necessary, and manage direct contact with animal product in epidemic areas.

The relative increase of urban cases of brucellosis in humans from 31.8% in 2010 to 43.8% in 2019 may have been influenced by recent urbanizations trends in Albania (20). Measures to prevent the spread of the disease in urban areas should focus on ‘from farm to fork’ food safety strategies, including management of agricultural markets, as well as domestic transportation of livestock to prevent contaminated meat and its products from entering the market. Also, simple food hygiene, especially pasteurization of milk is of great importance to prevent human infections (21).

The ambition of Albania to join European Union makes it also critical the adaptation of EU legal framework and policies in the field of brucellosis control as laid out in the Directive 64/432/EEC (22).

Finally, it seems obvious that pandemic from COVID-19 has significantly decreased utilization of health care for human brucellosis, consequently affecting the surveillance of the disease. The massive drop of reported cases (more than 4 times compared to previous year) we observed in 2020 has on one hand increased the health consequences for those infected, and on the other hand has deteriorated the knowledge on the spread of the disease. The reduction of brucellosis hospitalizations during pandemic could be explained by a number of factors which include reduced care provision capacity and increased perceived risk during utilisation of care. This is a trend also observed globally (23). Preparedness strategies for future emergencies should include safe access to health care for infectious disease patients.

One limitation of this work is the fact that it is based on the historic surveillance system of reporting human brucellosis. The real number of human brucellosis cases may be higher, due to the potential for undiagnosed cases. Mild cases are particularly liable to be misdiagnosed or not even reported (24, 25). According to the World Health Organization, an approximation of the true number of cases in the Mediterranean countries can be obtained by multiplying at least by three the number of cases reported (26). Again, this is a common limitation of most similar analyses, and it is expected to be stable in time and space allowing these way systematic comparisons (27-29).

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