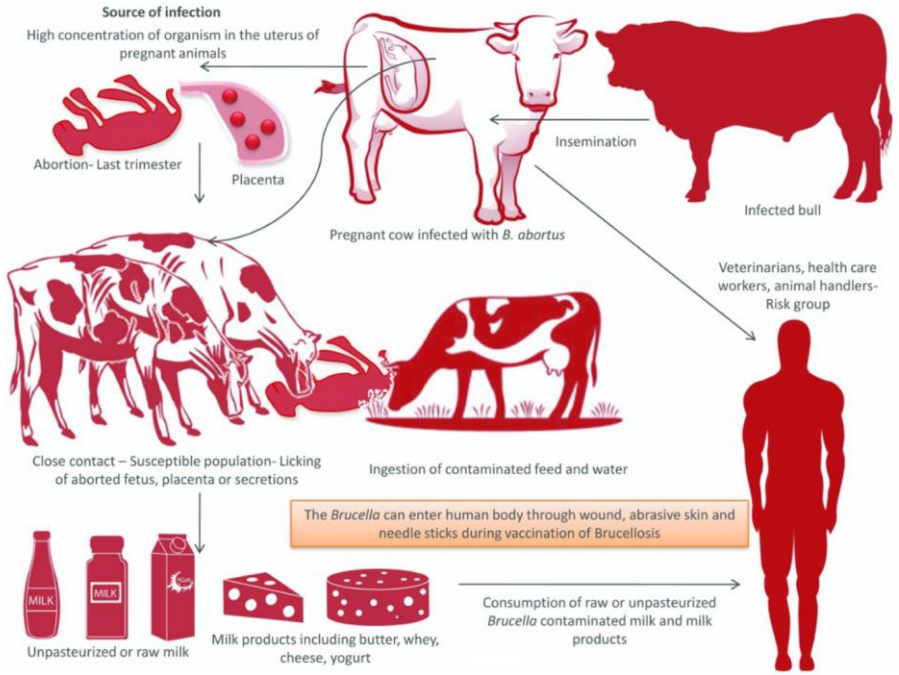
EPIDEMIOLOGY OF BRUCELLOSIS



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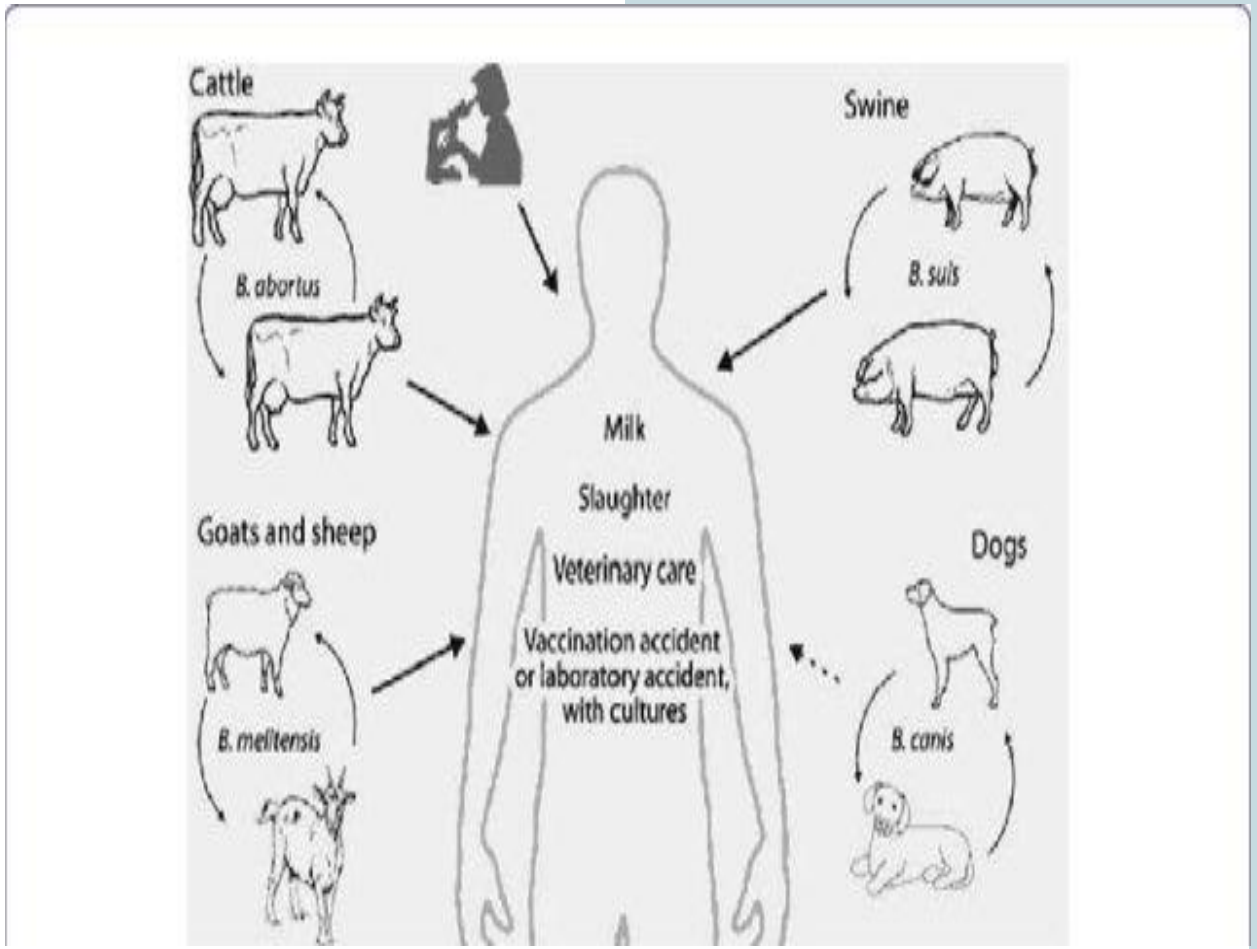
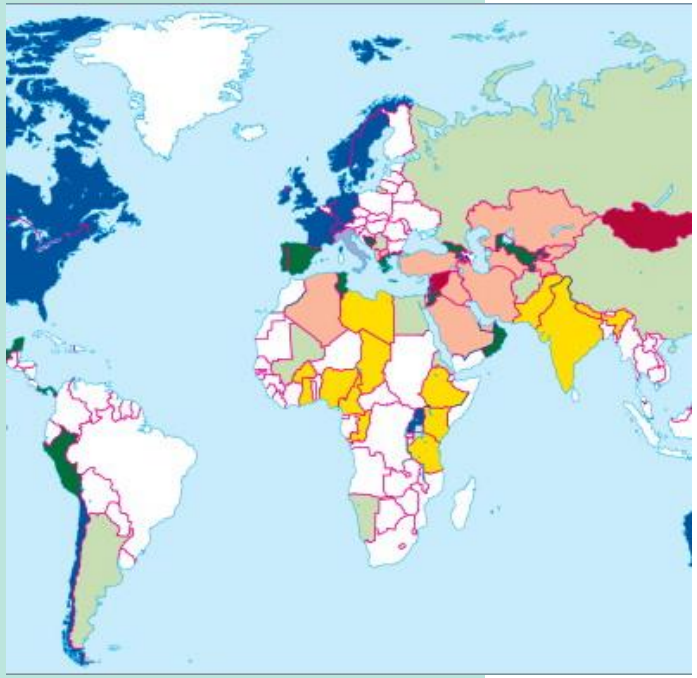
AGENDA

1. INTRODUCTION
2. MICROORGANISM
3. GENERAL EPIDEMIOLOGY AND TRANSMISSION
4. GLOBAL EPIDEMIOLOGY
5. EPIDEMIOLOGY IN IRAN





INTRODUCTION

Brucellosis is a zoonotic infectious disease caused by bacteria of the genus Brucella. It primarily affects animals, but can be transmitted to humans through direct contact with infected animals or consumption of contaminated animal products.

The disease is found worldwide, with varying levels of prevalence in different regions. It is particularly common in countries with large livestock populations and inadequate control measures.

Brucellosis can affect a wide range of animals, including cattle, sheep, goats, pigs, and dogs. Each species may have its own specific Brucella species.

In humans, brucellosis can cause a range of symptoms, including fever, fatigue, joint pain, muscle aches, and sweats. It can also lead to more severe complications if left untreated.

TYPE OF MICROORGANISM

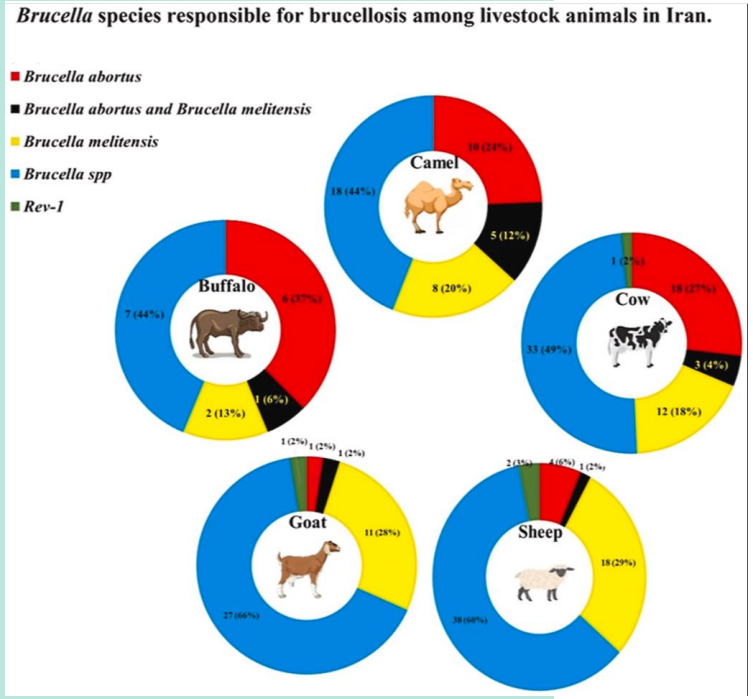
Three species of Brucella are particularly dangerous to both animals and humans, and are prevalent in most countries, especially those with limited resources.

These species are **B. abortus**, which mainly affects cattle; **B. melitensis**, which infects sheep and goats; and **B. suis**, which primarily affects pigs.

RESERVOIRS OF INFECTION

- Ultimate source of infection are major food-producing animals: cattle, sheep, goats, pigs as well as marine mammals, including dolphins and seals.
- B. melitensis is the most commonly reported and isolated type causing human brucellosis. It is also the most virulent type and is associated with severe acute disease. While the organism is typically associated with infection in sheep and goats, it can also infect other species such as dogs, cattle, and camels.
  - Bovine infection is a significant concern due to the large amount of infected milk that can be produced by a single animal and the extensive environmental contamination that can result from even a single abortion or infected birth.
- B. abortus is the most common cause of infection, but it is associated with much less human disease. Cattle are the primary source of B. abortus, but bison, buffalo, camels, and dogs are also important sources in some areas.

RESERVOIRS OF INFECTION



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B. suis is less common than B. melitensis and B. abortus, but it can still cause severe human infections. Biovars 1, 2, and 3 are associated with pigs and hares, with biovar 2 having low pathogenicity for humans. Biovars 1 and 3 are highly virulent and can cause severe disease. Biovar 4 is associated with infection in caribou and reindeer in Alaska, Canada, and Northern Russia but rarely causes human disease. There have been no reported cases of naturally acquired human infection with biovar 5.

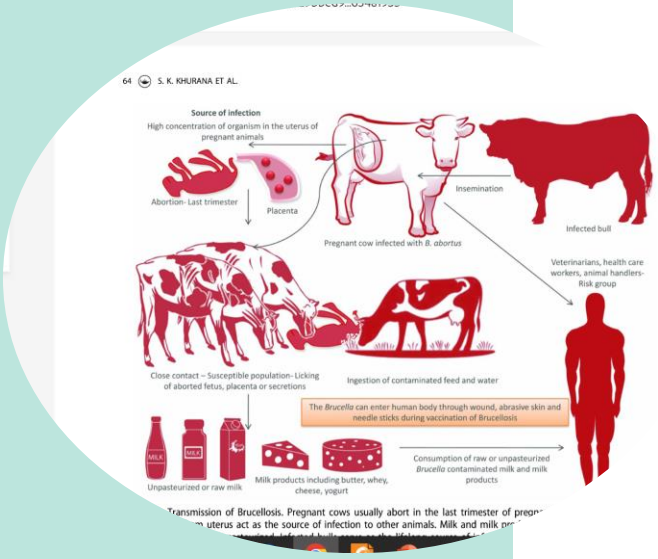
B. canis is a common infection in dogs in many countries, but it is rarely associated with human disease. Reported cases of human infection have typically been mild in nature.

SURVIVAL PERIOD

Table 3. Survival periods of *B. abortus* or *B. melitensis* in various substrates.

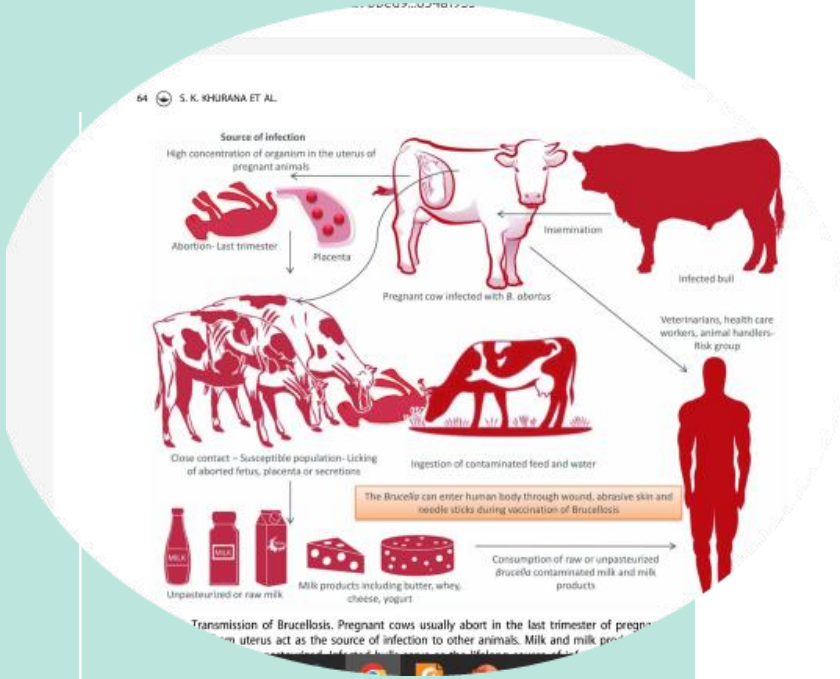
Medium	Temperature or environment	Survival
B. abortus		
Solid surfaces	<31 °C, sunlight	4–5 hours
Tap water	–4 °C	114 days
Lake water	37 °C, pH 7.5	<1 day
Lake water	8 °C, pH 6.5	>57 days
Soil – dried	~20 °C	<4 days
Soil – wet	<10 °C	66 days
Manure	summer	1 day
Manure	winter	53 days
Farm slurry animal waste	ambient-temperature tank	7 weeks
Farm slurry animal waste	12 °C tank	>8 months
B. melitensis		
Broth	pH>5.5	>4 weeks
Broth	pH 5	<3 weeks
Broth	pH 4	1 day
Broth	pH <4	<1 day
Soft cheese	37 °C	48–72 hours
Yoghurt	37 °C	48–72 hours
Milk	37 °C	7–24 hours

Brucellosis in human and animal, 2006



TRANSMISSION

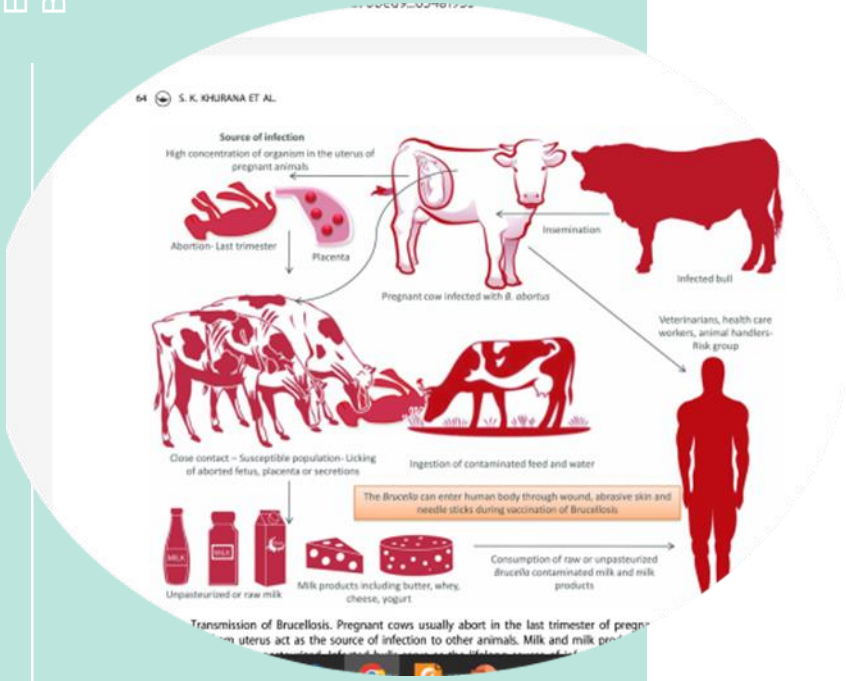
1. Person-to-person transmission: Brucellosis can be transmitted through close contact, blood donation, or tissue transplantation. Donors should be screened for brucellosis and those who are infected should be excluded. Transmission to attendants of brucellosis patients is unlikely, but precautions should still be taken. Laboratory workers who process samples from patients are at a greater risk of contracting the disease.



TRANSMISSION 2

2. Infection from a contaminated environment: Brucellosis may occur more frequently than reported, but it is challenging to document. Animals infected with brucellosis can contaminate populated areas, streets, yards, and marketplaces, especially during abortions. Inhaling contaminated dust or dried dung can lead to inhalation brucellosis. Contact infection can occur through skin or eye exposure to contaminated surfaces. Water sources, including wells, can also become contaminated by recently aborted animals or rainwater runoff from contaminated areas. Brucella bacteria can survive for extended periods in various substances such as dust, dung, water, slurry, aborted fetuses, soil, meat, and dairy products.

TRANSMISSION 3



3. Occupational exposure: People who work with farm animals, such as farmers, veterinarians, and animal attendants, are at high risk of brucellosis infection. They can become infected through direct contact with infected animals or exposure to a heavily contaminated environment. Infection can occur through inhalation, conjunctival contamination, accidental ingestion, skin contamination, and accidental self-inoculation with live vaccines

   -Recently aborted animals can infect entire households, and using dried dung as fuel can also introduce infection

   -Children can be particularly at risk

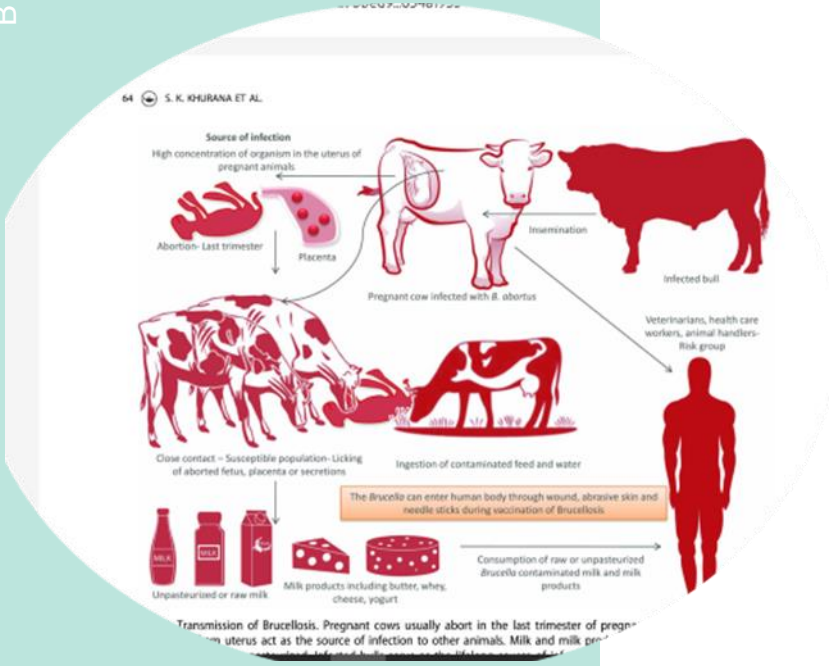
   -Person involved in the processing of animal products may be at high risk of exposure to brucellosis: slaughtermen, butchers, meat packers, collectors of fetal calf serum, processors of hides, skins and wool, renderers and dairy workers

   Laboratory staff involved in culturing Brucella are at particular risk

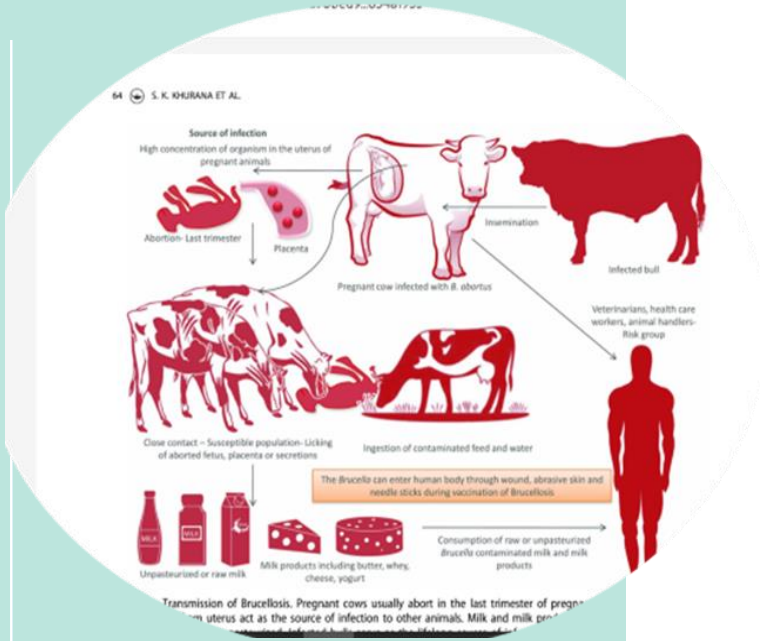
TRANSMISSION 4

4. Foodborne transmission: main source of brucellosis for urban population

- Cow, sheep, goat or camel milk contaminated with B. melitensis is hazardous as it is drunk in large volume. Butter, cream or ice-cream prepared from such milk also are high risk
- Soft cheeses prepared from sheep or goats milk by addition of rennet are particularly common source of infection in Mediterranean and Middle Eastern countries. The cheese-making process may actually concentrate the Brucella organism which can survive for up to several months in this type of product
  - Such cheeses should be stored in cool conditions for at least six months before consumption.
- Hard cheeses prepared by lactic and propionic fermentation present a much smaller risk. Yoghurt and sour milk are less hazardous,
  - Brucella dies off fairly rapidly when the acidity drops below PH 4 and very rapidly below PH 3.5
- Meat products are less frequently associated with infection as they are not usually eaten raw
  - Muscle tissue usually contains low concentrations of Brucella organism but liver, kidney, spleen, udder and testis may contain much higher concentration.



TRANSMISSION

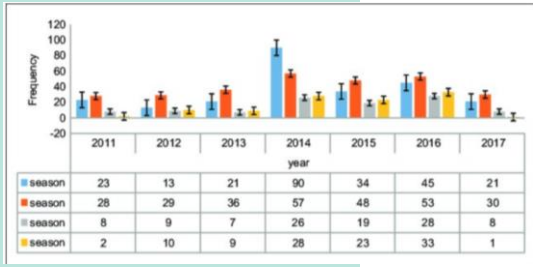


Foodborne transmission: fashionable consumption of “health foods” might be a risk by use of unpasteurized milk or milk products and raw vegetables contaminated by infected animals or even consuming “ethnic” food product

- -Person with achlorhydria or through consumption of antacids or H2 antagonists may have an increased risk of acquiring brucellosis

SEASONAL VARIATION

- In countries with temperate or cold climates, there is a seasonal variation in the occurrence of acute brucellosis. Most cases occur in the spring and summer, which aligns with the peak period for abortions and parturitions among farm animals. This is when people who attend to the animals and consume their milk have the highest level of exposure.
- The seasonal effect is more noticeable for ovine/caprine brucellosis compared to bovine brucellosis, possibly due to the longer lactation period in cattle. In tropical and subtropical areas, where animal breeding happens year-round, there is no seasonal influence on the incidence of brucellosis



	2011	2012	2013	2014	2015	2016	2017
season	23	13	21	90	34	45	21
season	28	29	36	57	48	53	30
season	8	9	7	26	19	28	8
season	2	10	9	28	23	33	1

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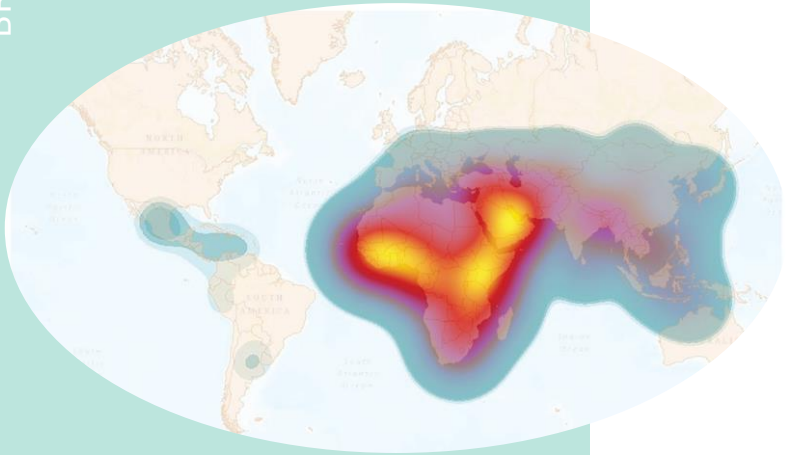
AGE AND SEX

- Brucellosis is an occupational disease in industrialized countries with strict food hygiene practices, affecting mostly males aged 20 to 45 years due to B. abortus or B. suis.
- In areas where B. melitensis is prevalent, the entire population, including women and children, is at risk due to poor hygienic practices in marketing and distributing sheep and goat milk products.
- In nomadic societies, children are mostly affected by acute brucellosis, as adults may have chronic infection without acute symptoms.

BIO-TERRORISM

- B. melitensis and B. suis have been developed as biological weapons by state-sponsored programs due to their stability in aerosol form and low infectious dose. These agents could be used to target human and/or animal populations.
  - It is estimated that ingesting as few as 10 to 100 organisms of Brucella can cause infection in humans.
- The impact would be most significant in areas where the disease is not endemic.

GLOBAL EPIDEMIOLOGY OF BRUCELLOSIS

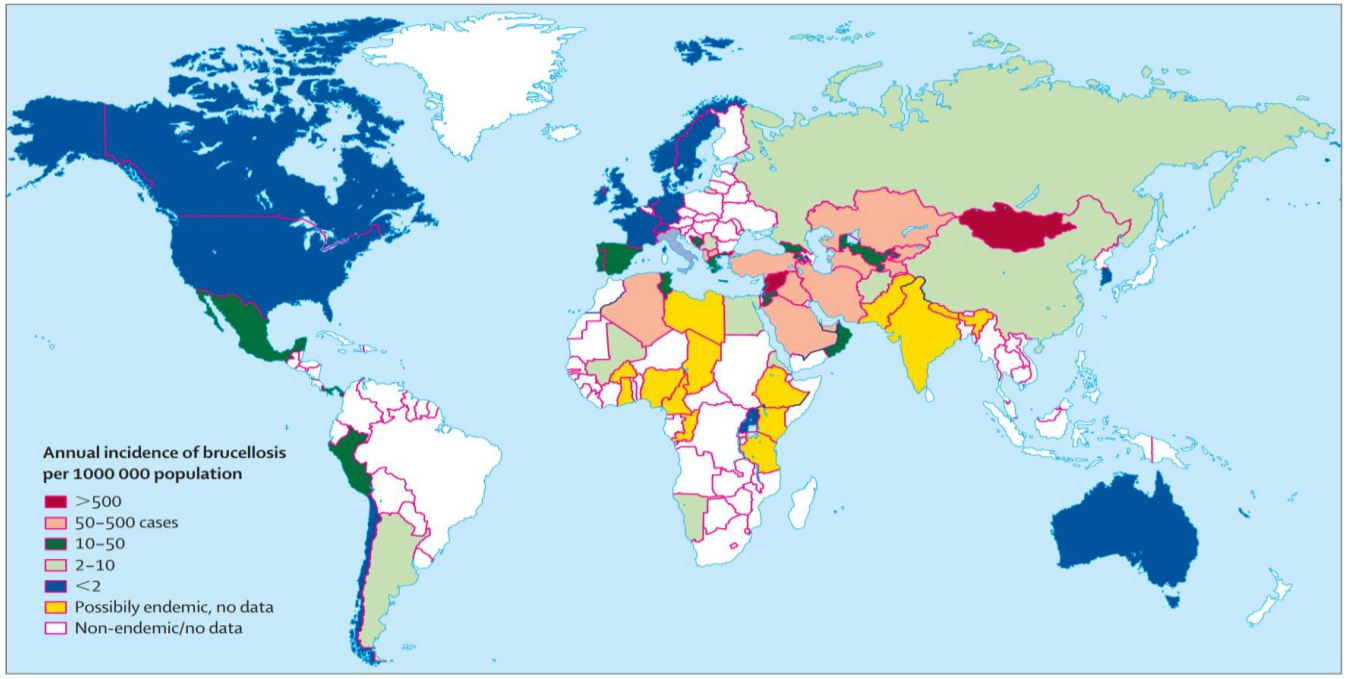


500 new cases per 1 million person at risk

According to the World Health Organization (WHO), brucellosis is endemic in many parts of the world, particularly in regions with high livestock populations and inadequate control measures.

The global burden of brucellosis remains significant, with an estimated half a million new human cases reported each year.

GLOBAL MAP


Annual incidence of brucellosis
per 1000 000 population
>500
50–500 cases
10–50
2–10
<2
Possibily endemic, no data
Non-endemic/no data

GLOBAL EPIDEMIOLOGY

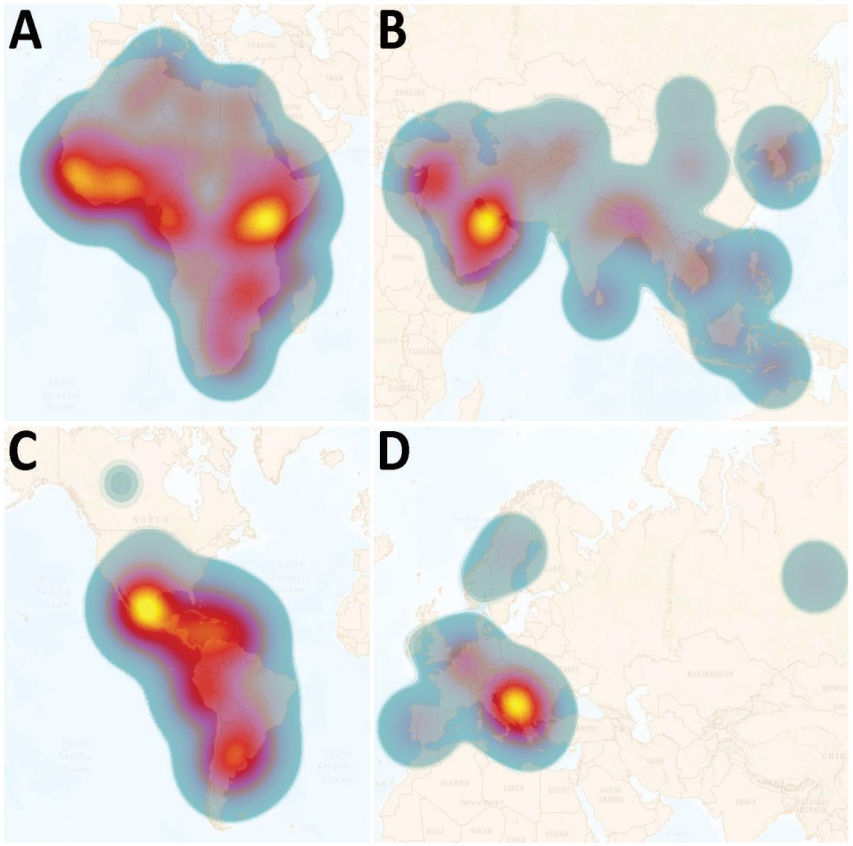


Figure 5. Heatmaps of regional annual incidence of human brucellosis estimated per 1 million population at risk. Each region has a different scale for incidence per 1 million population at risk. Heatmaps are intended to represent transnational zones that require priority control or surveillance initiative, not to represent the risk of individual countries. The heat scale shows high risk to low risk; yellow to blue. A) Africa: average risk is ≈750 new cases per million; high is >3,000. B) Asia: average risk is ≈500 new cases per million; high is ≥4,000. C) Americas: average risk is ≈20 new cases per million; high is ≥75. D) Europe: average risk is ≈10 new cases per million; high ≥100.

EPIDEMIOLOGY IN IRAN

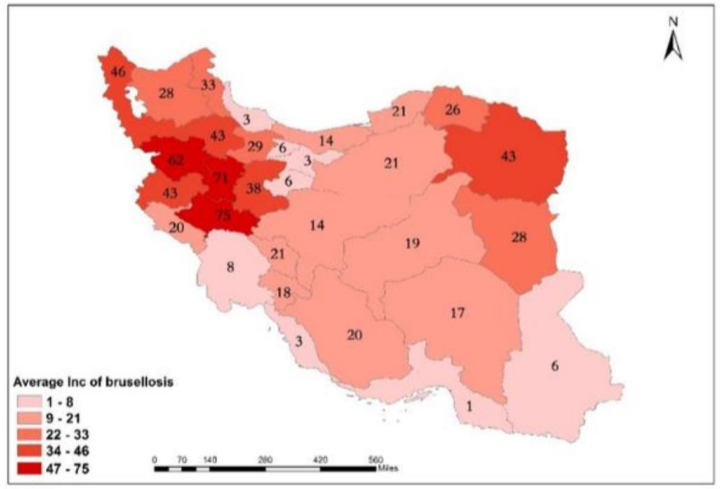
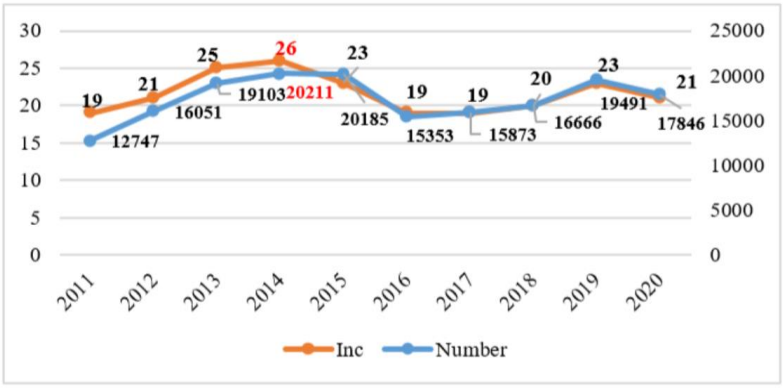


Fig. 1: The average incidence distribution of brucellosis cases in different areas of Iran, 2010-2020



EPIDEMIOLOGY OF BRUCELLOSIS IN IRAN

- The majority of brucellosis patients are male (=60%), with the highest incidence in the 20-30 year age group. The age distribution of cases differed between rural and urban areas, with more cases reported in the 20-30 age group in rural areas and in the 30-40 age group in urban areas.
- The most common modes of transmission were contact with infected animals and consumption of unpasteurized dairy products in both rural and urban areas.
- The peak incidence of brucellosis occurred between April and August, with the highest number of cases reported in June. The incidence of the disease increased from April in the spring until July, and then decreased during the winter months.

PEOPLE AT RISK

Brucellosis is a globally found and reportable disease that affects people of all ages and genders. The majority of cases in the general population are caused by **consuming raw milk or its derivatives,** particularly those made from sheep and goat products.

The disease is also considered an **occupational hazard** for those who work in the livestock sector, such as farmers, butchers, hunters, veterinarians, and laboratory personnel. These individuals are at an increased risk of contracting the disease due to their contact with **blood, placenta, foetuses, and uterine secretions**.

Brucella melitensis is the most common species causing human brucellosis worldwide, in part due to the **difficulty of immunizing free-ranging goats and sheep.**

PREVENTION AND CONTROL

- The prevention of brucellosis involves **surveillance and addressing risk factors.**
- The most effective strategy is to **eliminate infection in animals through vaccination.**
- **Testing and culling** can also be effective in areas with low prevalence.
- In countries where eradicating infection in animals is not feasible, prevention focuses on **raising awareness, food safety measures, occupational hygiene, and laboratory safety**. Pasteurizing milk and avoiding unpasteurized milk products are important steps in preventing transmission.
- In agricultural work and meat-processing, using protective barriers and properly handling and disposing of animal remains is crucial.

THANK YOU