

Classification of determinants

- A. primary and secondary
- B. intrinsic and extrinsic
- C. Host, agent and environment

A Primary and secondary determinants

- **Primary determinants**; are factors whose variations exert a major effect in inducing disease. (primary determinants are necessary causes).

For **example** exposure to distemper virus to cause disease of canine distemper.

- **Secondary determinants** correspond to predisposing, enabling and reinforcing factors. For **example**, sex is a secondary determinant of canine heart valve incompetence: male dogs are more likely to develop incompetence than females

Table 5.1 Primary and secondary determinants.

PRIMARY DETERMINANTS <i>Intrinsic determinants</i>	الحياتية		<i>Extrinsic determinants</i>		
	<i>Animate</i>		<i>Inanimate</i>		
	<i>Endoparasitic</i>	<i>Ectoparasitic</i>	<i>Physical</i>	<i>Chemical</i>	<i>Allergic</i>
Genetic constitution	Viruses	Arthropods	Trauma	Excess	Allergens
Metabolism	Bacteria		Climate	Deficiency	
Behaviour	Fungi		Radiation	Imbalance	
	Protozoa		Stressors	Poisons	
	Metazoa			Photosensitizers	

SECONDARY DETERMINANTS <i>Intrinsic determinants</i>	<i>Extrinsic determinants</i>
Genetic constitution (including sex, species and breed)	Location
Age	Climate
Size and conformation	Husbandry (housing, diet, general management, animal use)
Hormonal status	Trauma
Nutritional status	Concurrent disease
Immunological status	Vaccination status
Functional status (e.g. pregnant, lactating)	Stressors
Behaviour	

B Intrinsic and extrinsic determinants

- Intrinsic determinants (endogenous, Greek: endon = within); are internal to the host, for example, genetic constitution, species, breed and sex.
- External determinants are extrinsic, (exogenous, Greek: exo = outside). Are external to the host; transportation, which may result in physical trauma, producing bruising of carcasses.

Table 5.2 Some determinants of canine pruritus. (Simplified from Logas, 2003; Mason, 1995.)

Intrinsic determinants		Extrinsic determinants				
Host characteristics	Internal disease	Chemicals	Environment	Diet	Parasites	Bacteria, fungi and yeasts
Breed	Neoplasia:	Irritant contact dermatitis	Solar dermatitis	Adverse food reactions	Hookworm dermatitis	Bacterial folliculitis
Age	mast cell tumour	Calcinosis cutis			<i>Pelodera</i> dermatitis	Deep pyoderma
	mycosis fungoides				Schistosomiasis	Dermatophytosis
	Immune-mediated disorders:				Dirofilariasis	<i>Malassezia</i> dermatitis
	systemic lupus erythematosus				Scabies	
	Hormonal hypersensitivity				Pediculosis	
					Demodicosis	
					<i>Otodectes cyanotis</i>	
					Trombiculiasis	
					Cheyletiellosis	

C Determinants associated with host, agent and environment

- Most infectious agents enter the host as challenges from the environment, and, when fetal infection occurs, the dam can be the 'environment' too.
- Determinants commonly are classified into those associated with the **host**, the **agent** and the **environment**, called the **Triad**

1-Host determinants

- Genotype
- Age
- Sex
- Species and breed
- Other host determinants

Genotype

- is the genetic constituent of a host.
- an example is haemophilia A and B in dogs.

Age;

- Many bacterial and virus diseases are fatal, in young than in old animals
- dog tumours are more common in old than in young animal.

Sex

- Bitches are more likely to develop diabetes mellitus than dogs

Species and breed

- Dobermann Pinschers react more severely to canine parvovirus enteritis than other breeds

2-Agent determinants

A. Virulence and pathogenicity

B. Gradient of infection

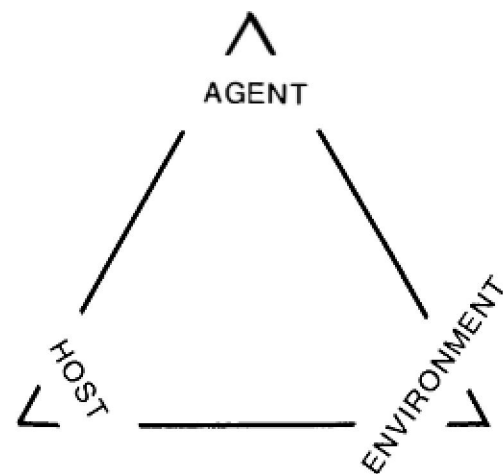


Fig. 5.1 The 'triad': three main headings under which determinants can be classified.

- **Virulence and pathogenicity**

Virulence is the ability of an infectious agent to cause disease, in a particular host, in terms of severity.

Case fatality is an indicator of virulence when death is the only outcome

Pathogenicity refers to the quality of disease induction.

Pathogenicity and virulence are commonly intrinsic characteristics of an infectious agent and are either **phenotypically** or **genotypically**

Phenotypic changes are transient, and are lost in succeeding generations.

Genotypic changes result from a change in the DNA (and RNA, in RNA viruses) of the microbial genome

Gradient of infection

1. Inapparent (silent) infection
2. Clinical infection

1- Inapparent (silent) infection

- This is infection of a susceptible host without clinical signs
- Subclinical infection occurs without overt clinical signs.

2 Clinical infection

Clinical infection produces clinical signs.

- **Mild** disease.
- **abortive reaction**: If the disease is very mild with an illness too indefinite to permit a clinical diagnosis.
- **frank clinical reaction**: a severe disease, when the intensity is sufficient to allow a clinical diagnosis (clear clinical signs),
- **severest reaction** results in death.

Outcome of infection

- Clinical disease
 - long-standing chronic clinical infection,
 - recovery
 - death.
 - The carrier state
 - latent infection.
- Chronically infected cases are potential sources of an infectious agent.
 - Death usually removes an animal as a source of infection, except e.g. anthrax infection where carcasses contaminate the soil.
 - Recovery may result in sterile immunity following an effective host response, which removes all of the infectious agent from the body.

Note: Two states are important determinants:

1. the carrier state;
2. latent infection

The carrier state;

Is any animal that sheds an infectious agent without demonstrating clinical signs.

Thus, an inapparently or subclinically infected animal may be a carrier, and may shed agent. carriers may be important sources of infection to susceptible animals during these periods.

Latent infection

A latent infection is one that persists in an animal, and in which there are no overt clinical signs. Thus, the distinction between latency, chronic infection and the carrier state is blurred.

In persistent bacterial infections (e.g., tuberculosis), a balance occurs between host and agent such that the agent replicates, but the disease may not progress for a long time.

Unidentified latent infections can be obstacles to the control of disease.

Incubatory carriers are animals that excrete agent during the disease's incubation period. For instance, dogs usually shed rabies virus in their saliva for up to 5 days before clinical signs of rabies develop, and periods as long as 14 days have been reported.

Convalescent carriers are animals that shed agent when they are recovering from a disease, and the agent may then persist for prolonged periods (foot-and-mouth disease).

Microbial colonization of hosts

- **The exogenous pathogens** are not usually present in the host
Examples include canine distemper, rinderpest, and the other traditional animal plagues.
- **The endogenous pathogens** are often found in healthy animals, commonly in the gastrointestinal and respiratory tracts, and usually do not cause disease unless the host is stressed
- **note:** Some pathogens possess characteristics of both groups as in *Salmonella* spp.
- **Opportunistic pathogens**
- Some organisms cause disease only in a host whose resistance is lowered; for example by drug therapy and other diseases. Such organisms are opportunistic, may colonize the host at any time during life, and may be endogenous or exogenous.

3-Environmental determinants

- Location
- Climate
- Husbandry
- Stress

Location

Local geological formations, vegetation and climate affect the spatial distribution of both animals and disease. The incidence of jaw tumours in sheep, is associated with the distribution of bracken, and illustrates the value of maps in identifying causes of disease, also affected by location because of the seasonal effects of climate.

Climate Types of climate can be identified:

1. macroclimate
2. microclimate.

Macroclimate

The macroclimate comprises the normal components of weather to which animals are exposed: rainfall, temperature, solar radiation, humidity and wind, all of which can affect health

- low temperatures induce hypothermia, to which newborn animals.
- Wind and rain increase heat loss from animals. Wind also can carry infectious agents (e.g., foot-and-mouth disease virus) and arthropod vectors
- Solar ultraviolet radiation has already been mentioned in relation to cutaneous squamous cell carcinoma, and cause of infectious bovine keratoconjunctivitis, in which the primary determinant is infection with *Moraxella bovis*

Microclimate

A microclimate is a climate that occurs in a small, defined space. This may be as small as within a few millimetres of a plant's or an animal's surface or as large as a calf house.

- a) **Terrestrial microclimate** affects the development of arthropods and helminths. (over the surface of leaves).
- b) **Biological microclimate** can change during the course of a disease, assisting in its spread. (over the surface of a host's body), sweating during the parasitaemic phase of human malaria increases the humidity of the body's surface and attracts more mosquitoes to the humid skin surface.

Husbandry

- Housing
- Diet
- Management (including animal use)

Stress

- In veterinary medicine, it is often considered as arising from factors:
 - weaning,
 - overcrowding,
 - transportation,
 - changes in diet
 - and other environmental factors

Interaction

- refers to the inter-dependent operation of factors to produce (or prevent) an effect
- Nutritional intake of protein and gastrointestinal parasitism interact because the parasitism induces protein deficiency by increasing the demands for amino acids in the alimentary tract

Diseases caused by mixed agents

- 1. diseases in which clinical signs can be reproduced by single agents independently, although mixed infections usually occur in animals;
- 2. diseases in which two or more microbial components are necessary to induce disease.

Biological interaction

Biological interaction involves dependence between two factors based on an underlying physical or chemical association and reaction - also therefore termed **mechanical interaction**

- there is a chemical interaction between the K88 antigen of *E. coli* (the agent) and receptors in the intestines of some pigs (the host)
- **Statistical interaction** is a quantitative effect involving two or more factors.
- disease occurrence does not depend simply on the presence or absence of a factor; there may be continuous variation in the frequency of occurrence of disease associated with both the strength of a factor (e.g., the frequency with which dairy farm personnel milk cows and infection with *Leptospira spp.*