

'High health, high performance' horses: risk mitigation strategies for OIE-listed diseases

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Summary

The 'high health, high performance' (HHP) horse concept has been developed by the World Organisation for Animal Health (OIE) together with the Fédération Equestre Internationale and the International Federation of Horseracing Authorities. This concept is outlined in the OIE *Terrestrial Animal Health Code* (Chapter 4.16). It aims to address impediments to the international movement of competition horses through a harmonised, practically feasible, globally applicable framework based on simplified certification requirements for the temporary importation of HHP horses and for their return to their country of usual residence.

Based on the principle of compartmentalisation, the high health status of these horses would be established by the application, at all times, of stringent health management practices and biosecurity measures to

create and maintain a functional separation between horses within the defined compartment and all other equids. These provisions are intended to mitigate the risk of disease spread for most OIE-listed diseases.

For six OIE-listed diseases (African horse sickness, equine influenza, equine infectious anaemia, equine piroplasmiasis, glanders and Venezuelan equine encephalomyelitis), the OIE recommends disease-specific mitigation measures, which have been included in a model HHP Veterinary Certificate, to provide additional guarantees to mitigate the risk of disease spread.

This article presents the HHP disease risk mitigation strategy. It demonstrates how continuous observance of the HHP biosecurity measures and health management practices provides a scientific rationale for limiting the list of diseases for which HHP horses should be screened with respect to their temporary importation for competition purposes.

Keywords

Disease – Epidemic – Horse – International movement – Outbreak – Risk.

Introduction

To address impediments to the international movement of competition horses, the World Organisation for Animal Health (OIE), together with the Fédération Equestre Internationale (FEI) and the International Federation of Horseracing Authorities (IFHA), has developed the concept of the ‘high health, high performance’ (HHP) horse. It is intended to enable more countries/regions to benefit from the expansion of the sport horse industry while safeguarding the equine health status of the receiving country and the country in which the competing horses usually reside. It is expected that the concept, and the associated model HHP Veterinary Certificate will provide an opportunity for countries and horse industries in all parts of the world to engage in key international competitions should they wish to do so.

It offers an alternative to horse movements systems already in place under bi-lateral and regional arrangements and general OIE standards.

The HHP concept was developed to enable a specific subpopulation of horses to be moved temporarily to compete in international equestrian and racing events, but not for the purposes of breeding, or for permanent residency. HHP horses are international athletes registered by the FEI or the IFHA; they are under continuous veterinary supervision and have special characteristics certified by veterinary authorities. The HHP concept aims at ensuring safe international sport horse movements. Its purpose is to minimise the risk of spread of disease agents that could trigger an outbreak at an event venue and enable the safe return of HHP horses to their countries of origin or to other temporary destinations. The HHP concept aims to facilitate international sport horse movements by reducing and harmonising the number of infectious diseases that horses need to be screened for in transiting from one performance event to another.

The HHP approach is based on the concept of compartmentalisation, as defined and described in the *Terrestrial Animal Health Code (Terrestrial Code)* Chapters 4.3 and 4.4 (1, 2). The principles for establishing a high-health-status subpopulation (compartment) of horses are outlined in the OIE *Terrestrial Code* Chapter 4.16 (3). The compartment should be established during a specific qualification period during which HHP biosecurity measures and health management practices should be ensured at all times (during travel and at competitions as well as at the home stable). The compartment must be approved by the Veterinary Authority before it can qualify; moreover, the Veterinary Authority should continue to monitor and audit the compartment to ensure that it maintains its high health status and continues to comply with HHP conditions (4). These HHP provisions mitigate the risk of disease spread for most OIE-listed diseases of relevance to equines. However, for a few diseases, a risk of disease spread within or from the compartment may persist notwithstanding observance of HHP biosecurity measures and general health management practices. For these diseases, the establishment of the high health status should be based on the recommended disease-

specific mitigation measures (such as laboratory testing, treatments, vaccinations) that are included in the model HHP Veterinary Certificate (4). The OIE promotes the universal use of the HHP certificate and Member Countries wishing to make use of the concept are encouraged to adopt the principles and health requirements as stipulated in the model.

This article presents the risk-based rationale to limit the list of diseases for which HHP horses should be certified with respect to their temporary importation for competition purposes.

HHP risk mitigation strategy

The HHP risk mitigation strategy relies on four pillars ('HHP standard conditions'). These pillars are detailed in the *OIE Handbook for the Management of High Health, High Performance Horses (HHP Handbook)*: HHP biosecurity measures, HHP health management practices, traceability, and contingency planning (Fig. 1) (4). Their implementation requires close and continuous collaboration between private operators (persons responsible for a compartment), private veterinarians, the horse industry (FEI and IFHA) and the Veterinary Authority.

In addition, the HHP disease risk mitigation strategy includes disease-specific mitigation measures established for certain diseases for which there is a risk of spread within and from the compartment despite the implementation of the HHP standard conditions (Fig. 1) (4).

HHP standard conditions

The *HHP Handbook* provides detailed guidelines for the establishment and maintenance of the HHP standard conditions (4).

Biosecurity

The handbook outlines the need for the continuous and fully documented application of HHP biosecurity measures as a means of creating and maintaining a functional separation between HHP horses and other equids. Such a separation mitigates the risk of disease

introduction or transmission by horses from outside the compartment or by other animals, people, vehicles, equipment, feed, water or pests. The risk of venereal transmission is also addressed by the prohibition of breeding activities in the compartment. Relevant biosecurity provisions should also be considered to ensure appropriate vector protection, depending on the local situation in the country/zone of residence, place of competition, transport routes and lay-over points.

Health management

HHP health management practices include continuous veterinary supervision (i.e. at least one veterinary visit per week), daily observation, a twice daily temperature check and prompt isolation of any horse in the compartment that may develop clinical signs of disease.

Traceability

Traceability is of extreme importance for the integrity of the HHP concept.

HHP horses should bear a permanent unique identifier and individual veterinary records should be kept on veterinary visits and interventions, as should records of the dates of issuance of the HHP Veterinary Certificate, the horse's departure from and return to the compartment, and the horse's arrival and departure at/from an event. For easy retrieval, all these records should be stored in an international database.

Compliance with HHP conditions should be documented and monitored, and corrective action should be taken if conditions are not being met. Non-compliance can result in suspension of the high health status of the compartment or in the suspension of the horse's HHP membership.

Contingency planning

The aim of HHP health management practices is to rapidly detect any sign of disease, so that, in conjunction with sound contingency

planning, appropriate measures can be taken to minimise the risk of spread. Contingency planning is an integral part of the HHP concept and a contingency plan should be developed for all places where HHP horses are held (home stable, temporary places of residence, event venue, transport vehicles).

Disease-specific mitigation measures

To identify the diseases for which the establishment of the high health status would require specific mitigation measures, the risk of disease spread within or from the compartment under the HHP standard conditions was assessed. Disease-specific mitigation measures were established for the diseases for which a risk of spread was identified under the HHP standard conditions (Fig. 2).

The risk of spread was assessed for all of the OIE-listed diseases of relevance to equines (as well as for some non-listed diseases of concern for the equine industry, i.e. epizootic lymphangitis, horse mange, horsepox, infection with Hendra virus, infection with Nipah virus, strangles, vesicular stomatitis). The OIE lists 18 diseases of relevance to equines: African horse sickness (AHS), anthrax, contagious equine metritis (CEM), dourine, Eastern equine encephalomyelitis (EEE), equine infectious anaemia (EIA), equine influenza (EI), equine piroplasmiasis, equine viral arteritis (EVA), glanders, infection with equid herpesvirus-1 (EHV-1), Japanese encephalitis (JE), rabies, screwworm myiasis, surra, Venezuelan equine encephalomyelitis (VEE), Western equine encephalomyelitis (WEE) and West Nile fever (WNF).

The salient features for the classification of the risk of spread of these diseases under the HHP standard conditions are summarised below. A detailed assessment (as well as an assessment for the non-listed diseases of concern for the equine industry) is available online www.oie.int/fileadmin/Home/eng/Our_scientific_expertise/docs/pdf/Chevaux/HHPRiskMitigation.pdf. (For all of the non-listed diseases of concern for the equine industry considered, the risk of spread was assessed as mitigated by the HHP under standard conditions.)

Assessment of the need for disease-specific mitigation measures

Risk of disease spread mitigated by HHP Standard conditions

The HHP standard conditions mitigate the risk of disease spread for the following diseases: anthrax, CEM, dourine, EVA, glanders, JE, EHV-1, rabies, screwworm myiasis, surra, EEE, WEE and WNF (Fig. 3).

Diseases for which horses are dead-end hosts

Rabies

All mammals, including horses, are susceptible to rabies, but only a limited number of species act as reservoir hosts. Controlled access of animals to the compartment should prevent horses in the compartment from being exposed to this infection (4). The incubation period of rabies can vary considerably and there may be a (very low) risk of non-detection of rabies in a horse incubating the infection during the qualification period.

Spread: Horses are considered dead-end hosts, it is therefore extremely unlikely that transmission of rabies would occur within or from the compartment (5).

Eastern equine encephalomyelitis, Japanese encephalitis , Western equine encephalomyelitis, West Nile fever

These diseases are zoonotic mosquito-borne viral diseases (6, 7, 8, 9, 10). Consideration should be given to vector protection to prevent the introduction of these diseases into the compartment. Consideration can also be given to vaccination to protected horses from the infection. In horses, clinical disease due to JE, EEE, WNF or WEE may be observed, but infections are frequently unapparent (6, 7). They may therefore not be detected via HHP veterinary supervision.

Spread: Horses are generally considered dead-end hosts for these diseases, it is therefore extremely unlikely that transmission would occur within or from the compartment (6, 7, 9, 10, 11).

Mitigation by HHP health management and HHP biosecurity

Anthrax

Anthrax is a serious zoonotic disease that can affect most mammals but is particularly important in herbivorous species (12, 13). Horses become exposed when they ingest spores in soil or on plants in pastures (13). The risk of introduction of anthrax into a compartment should be mitigated by the recommendations for biosecure stabling and feed and water quality (4). In view of the short incubation period of anthrax in horses (three to seven days) and of the absence of asymptomatic carriers, and considering that horses typically develop acute disease, the HHP continuous veterinary supervision should detect the presence of the disease in the compartment (13).

Spread: Since the risks of anthrax being present in, or being introduced into, a compartment are extremely low, the risk of spread of the disease within or from the compartment should not be of concern.

Contagious equine metritis and dourine

Contagious equine metritis and dourine are venereal diseases of horses that can be transmitted during breeding, and, in the case of CEM, through contact with contaminated fomites (14, 15, 16). The prohibition of breeding activities in the compartment and the implementation of biosecurity measures to prevent fomite transmission from outside the compartment should prevent the introduction of these diseases into the compartment (4). Carrier stallions display no clinical signs of CEM and mares can become asymptomatic carriers after acute infection (14). The incubation period for dourine can be up to several years and subclinical infections can occur. The presence of CEM or dourine in the compartment may therefore not be detected through continuous veterinary supervision.

Spread: The prohibition of breeding activities in the compartment and the implementation of HHP standard biosecurity practices to prevent the risk of transmission through contaminated fomites should prevent the risk of spread within and from the compartment.

Equine viral arteritis

Equine viral arteritis is a viral disease that can be transmitted by the respiratory and venereal routes or transmitted indirectly through contaminated fomites. Only acutely infected horses shed the virus via the respiratory route (17). The risk of introduction of EVA should be reduced by the prohibition of breeding activities in the compartment and the implementation of HHP biosecurity measures to prevent introduction through fomites and prevent contact with horses that are not in the compartment (4). The majority of cases of EVA infection are subclinical, therefore HHP veterinary supervision may not detect EVA in the compartment (18).

Spread: Considering that the risk of introduction of EVA into the compartment is mitigated and that the incubation period is short (two days to two weeks), the risk of acute EVA infection in a qualified compartment (and therefore the risk of respiratory transmission within the compartment) should be mitigated (19). In addition, the prohibition of breeding activities and the implementation of HHP biosecurity measures should prevent the risk of transmission through the venereal route or through contaminated fomites.

Infection with equid herpesvirus-1

Infection with equid herpesvirus-1 is ubiquitous in horse populations worldwide. Transmission most frequently occurs through close direct contact with infected animals, aborted fetuses, placentas, or placental fluids (20). The HHP biosecurity measures should mitigate the risk of introduction of EHV-1 into the compartment through contact with horses from outside the compartment, or contacts with fetuses or placentas (4). Horses can be asymptomatic carriers of EHV-1 and therefore the infection may not be detected through HHP veterinary supervision. Many adult horses are latently infected with EHV-1 and,

following viral reactivation, will subsequently shed the virus for a limited period of time (20). Stress or immunosuppression may result in virus reactivation, recrudescence of disease and shedding of infectious virus (20).

Spread: The management of the compartment should prevent animal stress as much as possible to reduce the risk of reactivation of the infection. There should be no risk of transmission via fetuses and placentas under HHP standard conditions (4). Veterinary supervision may detect fever or clinical signs associated with an EHV-1 episode, which should trigger the prompt isolation of the infected animal and thus minimise the chances of transmission (21).

Screwworm myiasis

Screwworm myiasis is caused by fly larvae that feed on living flesh, creating draining or enlarging wounds (22, 23). Consideration should be given to vector protection to prevent the introduction of screwworm myiasis into the compartment. The HHP continuous veterinary supervision should enable detection of infested wounds (4).

Spread: The HHP continuous veterinary supervision should allow for the detection and prompt treatment of any affected horse, thereby preventing the possibility of further spread.

Surra

Surra is a protozoal disease mechanically transmitted by flies (24). In horses, surra can be a chronic disease with recurrent episodes of parasitaemia (25). Consideration should be given to vector protection to prevent the introduction of surra into the compartment. The existence of chronic carriers may remain undetected despite HHP veterinary supervision.

Spread: Pyrexia is directly associated with the recurrent episodes of parasitaemia (25). HHP veterinary supervision (temperature checked twice daily) should enable the rapid detection of any episodes of pyrexia and result in the prompt isolation of an infected horse in a vector-protected environment, thus mitigating the risk of spread.

Risk of disease spread not mitigated by HHP standard conditions

A risk that disease could spread despite compliance with the HHP standard conditions was identified for the following diseases: AHS, EI, EIA, equine piroplasmiasis, glanders and VEE (Fig. 4).

Risk of respiratory transmission

Equine influenza

Equine influenza is a highly contagious respiratory disease of horses and other equid species (26). Transmission of EI occurs primarily by the respiratory route (26). The HHP biosecurity measures would not completely eliminate the risk of introduction of EI into the compartment by the airborne route (4). Infected horses may shed virus in their respiratory secretions during the incubation period (26). Partially immune animals (e.g. previously vaccinated older horses) may be infected subclinically (27). HHP veterinary supervision would not be able to detect situations in which pre-symptomatic or subclinical virus shedding is taking place.

Spread: Considering that the HHP standard biosecurity measures would not fully prevent respiratory transmission within the compartment, the undetected presence of a horse shedding the virus in the compartment would pose a significant risk of subsequent spread.

Glanders

Glanders is a zoonotic bacterial disease (28). It can be spread through direct physical contact or by indirect means through horses sharing feed troughs, water buckets or harness items contaminated with infective material. HHP biosecurity measures should mitigate the risk of introduction through fomite transmission and direct transmission from horses that are outside the compartment (4). Horses may become chronic asymptomatic carriers; therefore, in countries that are not free from the disease, the presence of glanders in the compartment may not be detected through continuous veterinary supervision (28).

Spread: Subclinically infected carrier horses play an important role as a reservoir and a means of spread of glanders in equine populations (29). HHP general biosecurity measures would not completely prevent direct transmission of glanders by the respiratory route within the compartment, consequently the undetected presence in the compartment of a subclinically infected carrier horse would pose a significant risk of subsequent spread of infection.

Risk of vector-borne transmission

African horse sickness

African horse sickness is an arthropod-borne viral disease transmitted by midges (30, 31). In countries that are not recognised as officially free from the disease by the OIE, consideration should be given to vector protection to prevent its introduction into the compartment. Concerns have been expressed over the risk of viraemia induced by live attenuated vaccines routinely used to control AHS in endemic regions and the risk of incomplete vaccine protection leading to subclinical viraemia. There is therefore a risk of AHS being undetected in the compartment.

Spread: Midges are widespread and the importation of a horse that is not free from the AHS virus would pose a significant risk of subsequent spread.

Equine infectious anaemia

Equine infectious anaemia is a non-contagious viral disease of horses and other equid species. The primary mode of transmission is by the mechanical transfer of virus-infective blood by haematophagous insects between horses kept in proximity to one another (32). Consideration should be given to vector protection to prevent the introduction of EIA into the compartment; however, EIA virus persists in blood leukocytes for the life of the infected animal (life-long carrier state). EIA virus could be undetected in the compartment despite HHP veterinary supervision (33).

Spread: Even though symptomatic horses are more likely to transmit the disease than animals with inapparent infection, the risk of transmission by an asymptomatic horse cannot be ruled out. Insects that can mechanically transmit EIA virus are widespread and the importation of a horse that is not free from EIA would pose a significant risk of subsequent spread.

Equine piroplasmosis

Equine piroplasmosis is a tick-borne protozoal disease of horses (34). Infected horses can be long-term carriers and can act as sources of infection for ticks (34, 35). Consideration should be given to vector protection to prevent the introduction of the disease into the compartment. Horses that are asymptomatic carriers of the parasites can remain undetected in the compartment despite HHP veterinary supervision.

Spread: Competent tick vectors may be widespread in certain regions and inapparent carriers can act as sources of infection (natural transmission or iatrogenic spread). The undetected presence of a carrier in the compartment would pose a significant risk of subsequent spread.

Venezuelan equine encephalomyelitis

Venezuelan equine encephalomyelitis is a zoonotic mosquito-borne viral disease (36). Infection with certain subtypes of the virus ('epidemic VEE viruses') can give rise to extensive epidemics. Depending on the local situation, consideration should be given to vector protection to prevent the introduction of VEE into the compartment. In equids, VEE may be asymptomatic and may therefore remain undetected in the compartment despite HHP veterinary supervision (8).

Spread: Epidemic VEE viruses can be readily amplified in equids owing to the widespread distribution of competent vectors. If a horse that is not free from the infection was to be imported, it would pose a significant risk of subsequent spread.

Establishment of disease-specific mitigation measures (model HHP Veterinary Certificate)

For the six diseases for which there is a risk of spread despite observance of the HHP standard conditions, disease-specific mitigation measures were defined for HHP veterinary certification. These requirements, which must be adhered to during transport and at events, are summarised hereafter and detailed in the *HHP Handbook* and associated model HHP Veterinary Certificate (4). The model HHP Veterinary Certificate provides specific health requirements for the temporary importation of HHP horses for the purpose of competition with respect to the six selected diseases. An HHP horse can travel to multiple destinations using multiple issuance of the HHP Veterinary Certificate, up to a maximum of 90 days, after which time it must return to the country of usual residence.

African horse sickness

In countries that have not been recognised as officially free from AHS by the OIE, the disease-specific mitigation measures included in the model HHP Veterinary Certificate aim at demonstrating freedom from infection of the horses in the compartment (by performing two polymerase chain reaction tests while under vector protection) and at preventing the risk of subclinical viraemia that may result from the use of live attenuated vaccines (by prohibiting vaccination against AHS within 40 days before the beginning of the qualification period).

Equine influenza

The risk of EI introduction and spread within and from the compartment is associated with a risk of airborne transmission. Since this route of transmission is difficult to circumvent (the source of infection can be outside the compartment), the disease-specific mitigation measures included in the model HHP Veterinary Certificate aim at protecting the horses in the compartment through vaccination (with vaccines updated with epidemiologically relevant strains according to annual recommendations on EI vaccine composition

provided by the OIE Expert Surveillance Panel on Equine Influenza Vaccine Composition).

Equine infectious anaemia

The risk of EIA spread within and from the compartment is associated with a risk of undetected presence of infected carriers in the compartment. The disease-specific mitigation measures included in the model HHP Veterinary Certificate aim at demonstrating freedom from infection of the horses in the compartment by performing a serological test.

Glanders

The risk of spreading glanders within and from the compartment is associated with a risk of undetected presence of subclinically infected carriers in the compartment. The model HHP Veterinary Certificate stipulates that freedom from glanders must be demonstrated by performing a serological test: two tests in countries not known to have been free from glanders for at least the past three years, and one test in countries that are free from glanders.

Venezuelan equine encephalomyelitis

For countries that have not been free from VEE for at least the past two years, the model HHP Veterinary Certificate recommends two strategies to address the risk of the undetected presence of infected horses in the compartment:

- demonstrating freedom from infection in the horses within the compartment (serological test while under vector protection)
- protecting the horses in the compartment from infection through appropriate vaccination.

Equine piroplasmiasis

HHP disease-specific mitigation measures for equine piroplasmiasis differ from the other five diseases in one major aspect: HHP horses should be tested for piroplasmiasis to establish their serological status

before they are certified as an HHP horse, but they should be allowed to qualify for HHP status even though infected by either of the causal agents of equine piroplasmosis (provided that they do not exhibit any clinical signs of disease at the time of veterinary examination and certification). Provisions to mitigate the risk of spread of equine piroplasmosis in the compartment should require physical separation of infected from non-infected horses, tick protection and control and the prevention of iatrogenic transmission (4).

Conclusion

The HHP concept is a risk mitigation approach. Applying biosecurity measures and health management practices at all times (home stable, travel, competition) mitigates the risk of spread of most OIE-listed diseases. For six OIE-listed diseases (AHS, EIA, equine piroplasmosis, glanders and VEE) there is a risk of disease spread, albeit at a variable level, despite observance of the HHP standard conditions; disease-specific mitigation measures have been established to mitigate this risk and are included in the model HHP Veterinary Certificate. The HHP risk mitigation strategies are designed to provide assurance to the countries of destination of the low health risk associated with the temporary importation of a particular animal. National animal health authorities are therefore encouraged to harmonise their entry requirements on the temporary importation of this class of horse with those of the model HHP Veterinary Certificate.

The importance of the roles that national Veterinary Services and equine industries need to play jointly in the operationalisation of the HHP concept cannot be overemphasised. Their support and oversight are critical to ensuring the success of this initiative and their close collaboration should be fostered at national level through the development of public–private partnerships.

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Fig. 1
Principles of the HHP risk mitigation strategy

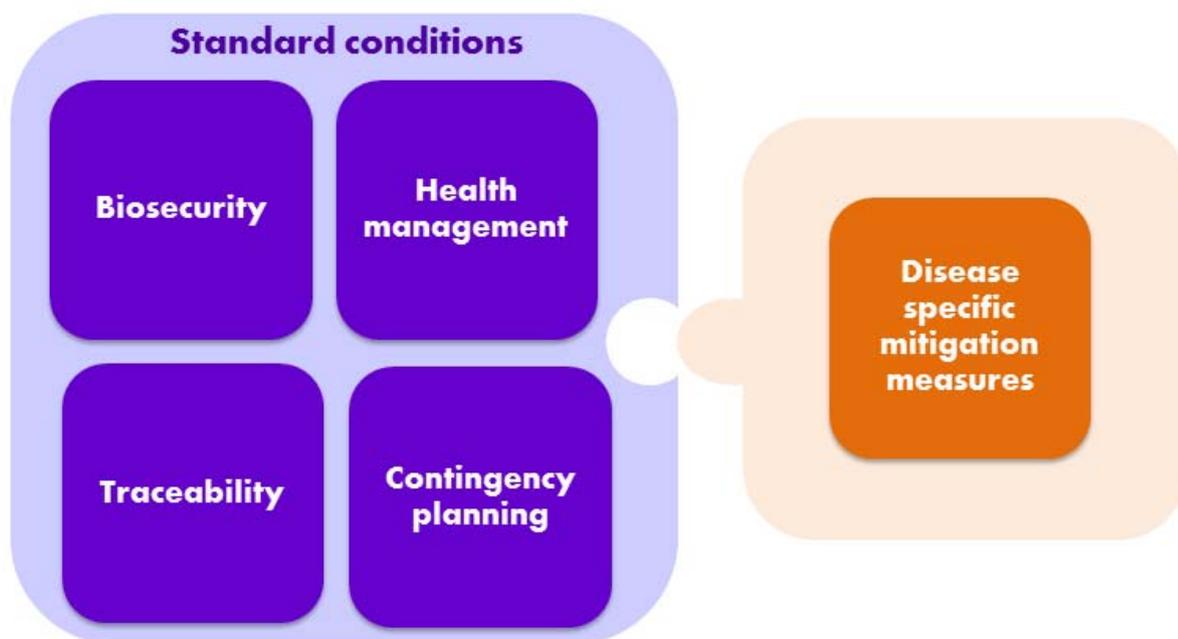


Fig. 2

Risk-based disease classification for the establishment of disease-specific mitigation measures

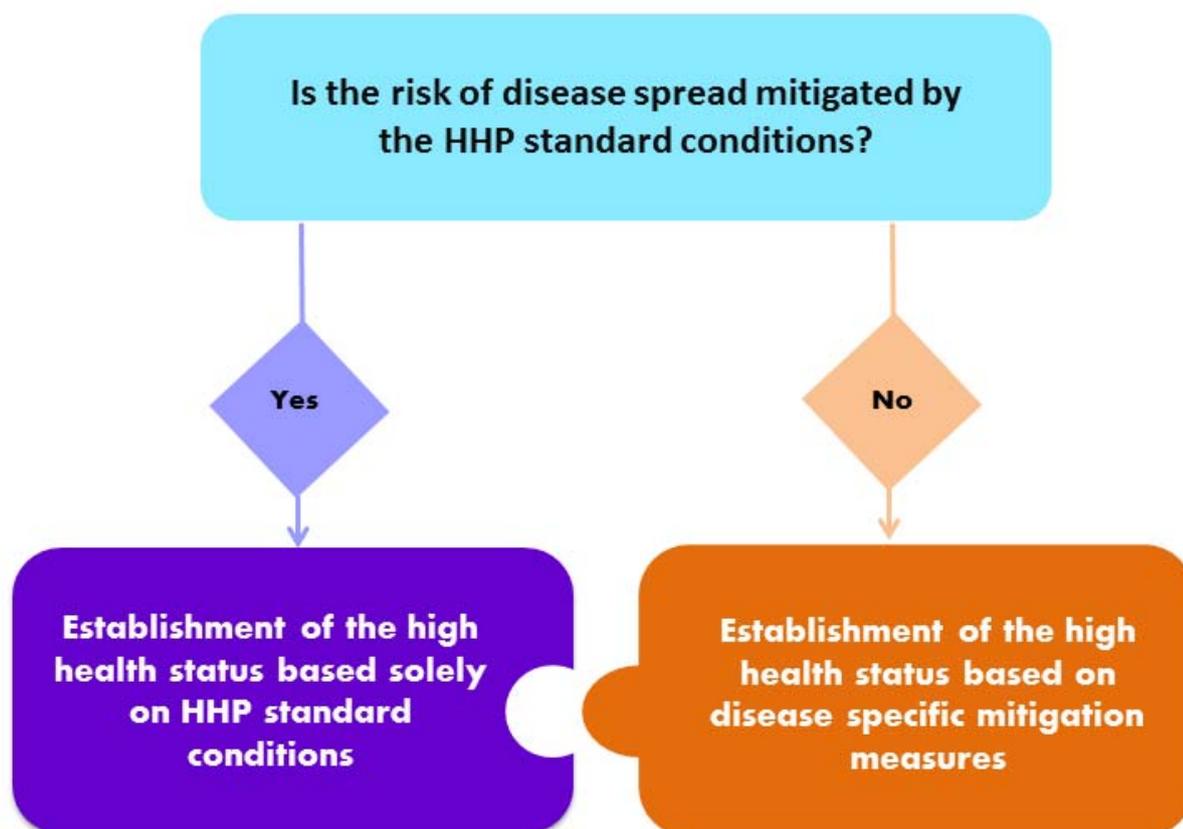


Fig. 3
Risk of disease spread mitigated by HHP standard conditions

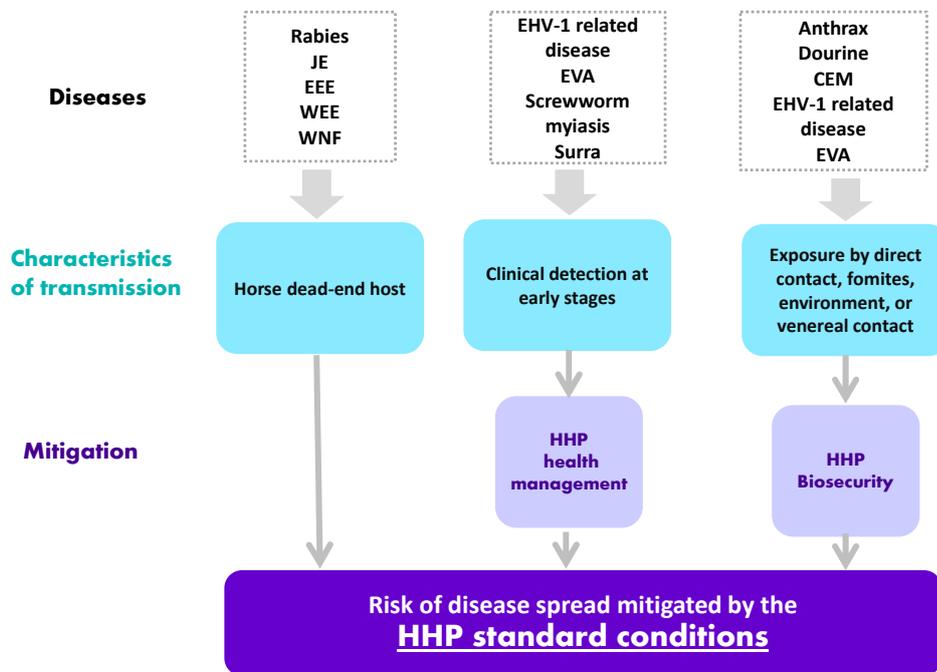


Fig. 4
Risk of disease spread despite management under HHP standard conditions

