

Investigation of a market approach for a dust extractor

Bachelor Thesis

EQUINE, LEISURE AND SPORTS

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Abstract

Dit onderzoek werd uitgevoerd voor het Nederlandse bedrijf Hurkyson. Het bedrijf heeft een nieuw product ontwikkeld: een stofafzuigmachine en wil dit product op de markt brengen in september 2010. Maar om uit te vinden of hun marktbenadering van toepassing is moeten ze hun doelgroep beter begrijpen.

De stofafzuig machine reinigt droog strooisel en ruwvoer materiaal voor paarden. Maar waarom is een dergelijke machine nuttig?

Voorafgaande onderzoeken hebben aangetoond dat respiratoire problemen een veel voorkomend probleem bij paarden is (50% van de paarden hebben er last van), en dat deeltjes in de stallucht deze problemen kunnen veroorzaken (Robinson, 2001 ; Fleming, 2004; Dannenbrink, 2004; Kroehnert, 2009; Mack, 2009). Deze potentieel schadelijke deeltjes komen naast in het ruwvoer hoofdzakelijk uit het strooisel dat gebruikt wordt in de paardenstall. Aangezien de meeste paarden en vooral sportpaarden worden gehouden in stallen zijn zij de meest tijd dat blootgesteld aan een potentieel luchtwegaandoeningen inducerende omgeving. Met het gebruik van de stofafzuigmachine, kunnen tot 90% van deze potentieel schadelijke deeltjes worden verwijderd en daarom het risico voor respiratoire aandoeningen aanzienlijk verminderd wordt.

Aangezien dit product is aangesloten op de gezondheid en het welzijn van het paard, is het denkbaar dat paardeneigenaren hun dierenartsen voor advies over de stofafzuigmachine vragen. Volgens een rondvraag in het Duitse paarden tijdschrift "Cavallo" hebben paardeneigenaren vertrouwen in hun dierenartsen en luisteren naar de aanbevelingen die zij geven (Krueger, 2010). Daarom wil Hurkyson weten of dierenartsen geïnteresseerd zouden zijn om de invoering van de stofafzuig machine te ondersteunen? Het doel van dit onderzoek was om uit te vinden of er een markt is voor de stofafzuigmachine van Hurkyson. Met hulp van een vragenlijst werden de twee doelgroepen geïnterviewd: In totaal 20 professionele stal eigenaren en 22 dierenartsen.

De resultaten toonden aan dat 85% van de ondervraagde stal eigenaren denken dat de machine nuttig is en 50% van de stall eigenaren zijn geïnteresseerd in de machine. 86% van de ondervraagde dierenartsen denken dat de machine nuttig is en 55% zou geïnteresseerd zijn in het ondersteunen van de invoering van de stofafzuigmachine. Deze resultaten wijzen uit dat er een markt is voor de stofafzuigmachine, en dat de geplande markt te benaderen, via dierenartsen passend is, maar de doelgroepen zijn niet geheel geïnteresseerd. Daarom moet het bedrijf Hurkyson zich focussen op bewustmaking en informatie van hun.

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1. Introduction

This research is being executed for the company Hurkyson in Doorwerth, Netherlands. Hurkyson is a small-scale company that focuses on the development, production and sales of horse related products. They pay special attention to the needs and well-being of the horse and develop their products according to that. Recent products are a horse solarium and a free-horse walker.

Hurkyson has developed a new machine that dry-cleans bedding and roughage material. Motivation for the company to develop that product was that many horses suffer from respiratory issues and therefore they saw a market for that machine.

What are the benefits of the dust extractor machine?

- It dry cleans the materials
- Cleans all kinds of material (roughage as well as bedding, straw, shavings etc.)
- Removes up to 80% of dust and mould

(Detailed information about the machine (incl. functional description) is provided in chapter 1.2 The dust extractor machine)

How is this product connected to respiratory issues?

Former research has shown that respiratory issues are a common problem in horses, and that particles in the stable air can cause these problems (Robinson, 2001; Fleming, 2004; Dannenbrink, 2004; Kroehnert, 2009; Mack, 2009). As most horses, especially sport horses are being kept in stables for most of the time they are exposed to a potential airway disease inducing environment.

Most horses are stabled on bedding materials as wheat straw, wood shavings, flax or hemp shives. It is commonly known that horses which are coughing should not be stabled on wheat straw and should be fed wet hay. Reason for that is the dust in the roughage and bedding material, which influences the air quality in a stable, and bad air quality can be directly linked with several airway diseases (Fleming et al., 2008).

Two diseases that are directly influenced by dust or mould are described in the following chapter (2. Literature review). Recurrent airway obstruction (RAO) and inflammatory airway disease (IAD) are common diseases that are treatable with medicine but it is most important to improve the stable environment. Without this the treatments cannot succeed and the disease can be prolonged (Robinson, 2001; Laan, 2010). At this point there is still no cure for RAO (Deprez, n.d.; Wagner, 2008; Kroehnert, 2009), but the dust extractor machine can improve the air quality in the stable and therewith improve respiratory issues.

Due to the fact that this product (the dust extractor machine) is connected to health, welfare and well being of the horse it is natural that veterinarians should be informed about its benefits. According to a survey in the German horse magazine "Cavallo" horse owners do trust their veterinarians and would always ask them for advice (Krueger, 2010).

The company Hurkyson wants to launch this product in September 2010. The product shall be advertised in equine related magazines, stand work and bannering. It shall also be available to look at, at big yards. Next to that the company would like to involve veterinarians in the introduction of the product. This may work on a commission base or just that veterinarians inform horse owners about the machine and hand out brochures.

However before Hurkyson can start the product launch they want to understand the market better and find out if the planned market approach will be appropriate.

This research was carried out to answer the following questions:

1. Is there a market for the dust extractor machine from Hurkyson?
2. What could be the role of veterinarians in regard to sales of this product?

These main questions can be divided in the following sub questions:

1. Are veterinarians interested/ willing to work together with Hurkyson to improve the above mentioned problems?
2. To what extent are professional horse/ yard owners and veterinarians aware of respiratory problems and airway diseases like IAD and RAO?
3. Are professional horse/ yard owners interested/ willing to invest to improve the above mentioned problems?

Structure of the report

This research is designed to answer the above mentioned questions. Firstly the background problem will be explained: airway diseases connected to the stable environment and also work regulations for humans will be explained. After that the way in which information was gathered and evaluated will be explained. Then the results will be presented and discussed on the basis of which the above named questions will be answered. Finally recommendations will be given to the company Hurkyson

1.2 The dust extractor machine

The dust extractor machine was developed to lower airborne particle concentrations in stable. The idea came up because of the frequency of respiratory issues and its relation to dust as shortly shown above (more info in chapter 2).

Mr Van den Hurk constructed a machine that dry cleans bedding materials and roughages. The advantages of dry cleaning firstly are that particles are removed instead of just attached to the material (as for example when soaking hay) and secondly that the material does not have to be used right away.

How does it work?

Loose material enters the machine; inside the particles are loosened through a three-dimensional movement. Then the material passes over a vacuum which extracts the before loosened particles and collects them in a container underneath (see figure 1). Then the material is transported outside, either as loose material that can fall directly into a wheelbarrow or as pressed material (without a string) that can fall directly on a flatbed trailer. The total flow of material can be seen in figure 1.

The machine is closed and will stop processing when being opened.

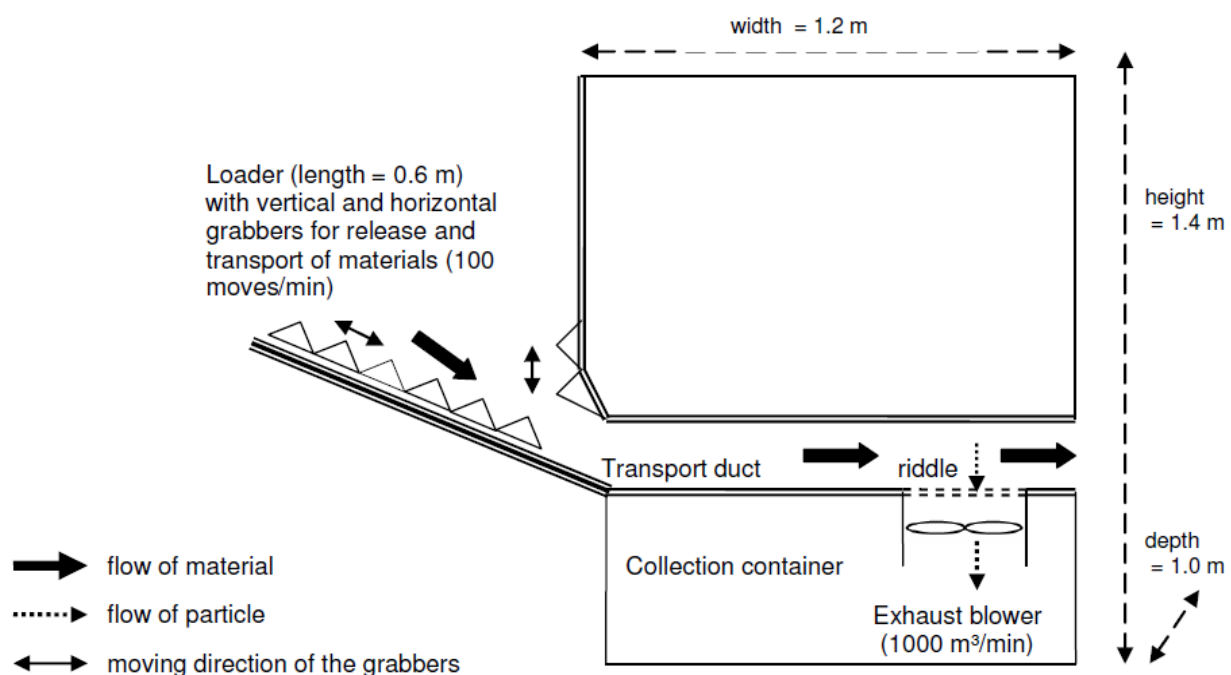


Figure 1: Treatment machine including the particle separation technology.
(Garlipp et al. n.d.)

There will be four different sizes:

- Small: 2500 €
- Two medium sizes: 4500 and 7500€
- Large: 30-35000€

The main differences are related to the size; the small machines are designed for small bales. Depending on how much one is willing to invest, the machine can either loosen material before or the material has to be loosed by hand. The large machine is developed for

big bales; the large bales just need to be placed in front of the machine, the machine takes the bale, loosens it, cleans it and brings it out again as either loose or pressed material.

The smaller machines clean 2.5- 3kg of product per minute, the large machine approximately 4-5kg per minute.

There is a guarantee for one year on the machine as well as a warranty for up to 5 years, but the details for this are in development at this moment.

The machine has been tested in the setting of a scientific research in cooperation between the company Hurkyson, NHB Deurne and the Georg-August-University of Göttingen. This research has not been published due to commercial reasons; however results show that up to 80% of the airborne particles could be extracted. See table for overview (further graphs in annex 1):

Material	PM₂₀	PM₁₀	PM_{2.5}	PM_{1.0}
Hay	-43.8%	-38.1%	-44.8%	-60.9%
Haylage	-43.3%	-56.3%	-54.6%	-94.1%
Wheat straw	-79.8%	-79.4%	-74.9%	-44.2%
Wood shavings	-75.1%	-71.4%	-83.4%	-61.6%
Flax shives	-35.6%	-45.8%	-70.8%	-63.9%
Hemp shives	-59.5%	-36.6%	-48.1%	-15.4%

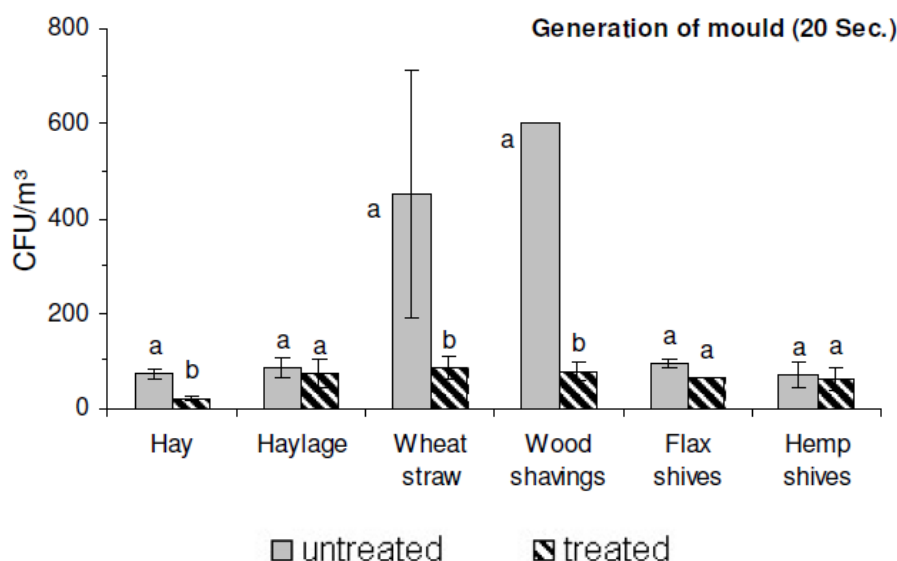
Table 1: Mean reduction of different airborne particle size concentration in analyzed materials in percentage (Garlipp et al., n.d.).

The “PM” values in the graph represent different sizes of the particles; these will be described in detail in the literature review (chapter 2.4 Dust). Particles that are smaller than PM₁₀ are most harmful to the (lower) respiratory tract.

Another important factor is the reduction of mould in the materials. Most successful results were seen in:

- In wood shavings - 92.4%
- Wheat straw – 88%
- Hay – 85.8%

See the following graph 1 for further results in mould reduction:



Graph 1: Mean content of mould in 20 second sample* (Means \pm SE) (per 1.5 kg) of all untreated and treated materials; a,b = within each sample and material, means without a common letter differ significantly ($P < 0.05$) (Garlipp et al., n.d.). (CFU= mould generation)

*The experiment was executed in a box with a paddle to circulate air. The materials were placed inside the box (each 1.5kg) and mould generation was measured with the use of Petri dishes which were placed for either 10 or 20 seconds inside the box (which was filled with a material). The above shown results are from the 20 second sample.

1.2.1 Competitive environment

According to the author's findings there is one other dry cleaning machine on the market. It has been developed by a Swiss company called "Lanker AG".

Lanker Heurüstmaschine für Hand- und Kranbefüllung (Heuruestmaschinen, n.d.)	Hurkyson dust extractor
Differences	Differences
<ul style="list-style-type: none"> Extracts dust and contaminant, not mould 2 sizes Additional machine to load and To loosen material Outcome as loose material No stop/safety button On the market for 30 years Price: 6315€ - 15000€ 	<ul style="list-style-type: none"> Extracts dust and mould Different sizes (small, 2 medium, large) Easy to load Optional load loose or pressed material Optional loose or pressed outcome Stops itself + safety stop New machine/ no recommendation Price: 2500€ - 33000€

Table 2: Direct competitor comparison; Hurkyson vs. Lanker dust extractor.

However there are other alternatives as partly already mentioned above. Most traditional methods for reduction of dust are:

- soaking or sprinkling hay with water
- Feeding Silage
- Use of wood shavings or flax as bedding material

Use of shavings for stables of horses with respiratory issues or other alternative materials is, according to research done by Garlipp et al. (n.d.), Flemming et al. (2008) and Haake (1992), only useful if dust is removed from the material. Not all wood shavings for example have been dust-extracted.

There are machines available that work with water or hot steam. Two examples:

Hay moistener, MFD- Franz Bornemann (MFD-Bornemann, n.d.)	HAY GAIN, hay steamers (HAYGAIN, 2010)
Advantages	Advantages
<ul style="list-style-type: none"> • Soaks hay effectively • Partly removes dust • Saves water (compared to buckets) • Horses can be fed directly out of box • Portable • Different sizes 	<ul style="list-style-type: none"> • Soaks hay effectively • Mould and fungal spores are killed • Can be used for straw as well • Portable • Different sizes
Disadvantages	Disadvantages
<ul style="list-style-type: none"> • Mould is not removed • Particles get loose again when dry • Only for smaller amounts (25-70kg) • Only for hay (straw) 	<ul style="list-style-type: none"> • Dust is not removed • Dries quickly • Not for big bales (max 25kg)
Price: ca. 1500€ - 2550€	Price: 1190€ - 1950€

Table 3: Competitor comparison; Hay moistener, MFD vs. HayGain hay steamers.

These competitors all focus on roughage material and not on bedding, but bedding actually has the highest influence on dust in the stable (Garlipp, et al., n.d.). So there is still a market niche for a product that cleans bedding material. Next to that is the dust extractor machine from Hurkyson available in different sizes and therefore also usable for bigger stables.

2. Literature review

This chapter starts with horse keeping overall because the horse stable and the air quality in the stable play an important role in the development of airway diseases (Fleming et al., 2008; Robinson, 2001).

To understand the diseases connected to dust, a short summary of the equine airways is included. A few sentences about airway diseases will show how common these issues really are. This will be, followed by a more detailed explanation of two diseases and their connection to dust.

Finally dust itself will be explained to understand what it actually is and what makes it so dangerous for horses, but also; humans. This leads to the final part about work regulations for humans as dust also has a negative influence on human health.

2.1 Horse keeping

Under natural circumstances horses live on plains and move ca. 16 hours a day. (McGreevy, 2004; Deutsche Reiterliche Vereinigung, 1998). Today many horses are stabled 16 hours a day or longer. The responsibility for the maintenance and accommodation of the horses is up to the individual owner. There are guidelines, but no laws and regulations in regard to stable construction, size or maintenance in most countries including the Netherlands (personal conversation Dutch veterinarian, 2010). Most sport horses are held in inside and outside stables with restricted space and airflow (Art et al., 2002; Arndt, 2001). Leisure horses usually are more often stabled in outside stables or at least spend more time on the pasture than sport horses (Arndt, 2001). Opinions vary about the best way of horse keeping even though both ways can be suitable if managed correctly (Haake, 1992).

The most common bedding material is straw and shavings, (Bureau et al., 2000). Criteria for a good bedding material are according to Meyer (1992) the ability of the material to absorb and bind manure, create an additional insulation and finally to protect the horse from injury. Straw fulfils these demands and also has the advantage that it is easy to dispose as it rots quicker than wood shavings (Pferdebetrieb, 2010).

This report focuses on inside and outside stables in which according to Arndt (2001) most sport horses are stabled. Some of the advantages of this method of stabling are that the horse tends to have less skeletal injuries as unrestricted, free movements are minimized, the horse is clean and does not grow long hair. Long hair has the disadvantage that the horse sweats more and needs to be cooled down longer (Houghton et al., 2003). In a stable the owner can also monitor the feed and water intake of a horse better, this is especially important for high performance horses, because they need their energy and water (electrolytes) (Clayton, 1991). Disadvantages are that these stables give higher restrictions in the natural needs of a horse; the horse is a herd animal which needs companions as well as it spends up to 18h per day with feed intake in nature (Hastie, 2001). In a stable horses have only little contact with fellow horses through a fence and get most commonly three meals per day. This may lead to abnormal behaviour and digestive problems (McGreevy, 2004; Deutsche Reiterliche Vereinigung, 1998). As said above the need for movement is also restricted, this can lead to muscular-skeletal problems.

Next to all this, it is difficult to maintain a fresh, but warm and healthy climate especially in winter months in a closed stable. This can lead to respiratory problems (Fleming, et al., 2008; Arndt, 2001; Laan, 2010; EQUISTRO, 2008; Holcombe, 2005; Dannenbrink, 2004; Newman-Taylor, 1996; Robinson, Berney et al., 2003; Christley, 1999; Malikides, 2003; Haake, 1992; Robinson, 2001).

2.2 The equine respiratory tract

Of all the organs, the respiratory tract presents the largest and most delicate surface for contact with potentially deleterious airborne material (Art et al., 2002). The live operations in every single cell of mammals and thus also of the horse, depend on the supply with oxygen (Vogel, 1990).

Respiration involves the absorption, the transport and the expulsion of gaseous materials, especially oxygen and carbon dioxide. The oxygen is used for burn-up of materials taken in with food. Where as carbon dioxide is the end product of the metabolism (Loeffler, 1994).

Oxygen enters with the air by the breathing movement into the alveoli of the lung; there it diffuses into the blood, so that the tissues are supplied with O₂. The CO₂ goes the opposite way.

Everything that restricts the airflow reduces the quantity of oxygen available for the blood for disposal. Therefore the athletic performance of a horse is to a large extent depending on the respiratory tract. A horse can have the best heart and cardiovascular system and receive the best feed, but will be limited in its performance if the oxygen supply is reduced for some reason (Vogel, 1990; Dannenbrink, 2004).

Anatomically and functionally is the equine respiratory system divided into upper and lower portions:

2.2.1 The upper airways

The upper respiratory tract extends from the nostrils through the nasal passages, the pharynx and larynx as well as the trachea to the point where the trachea enters the thorax (see figure I). It is responsible for regulating the temperature and humidity of the inspired air, for phonation, and for protecting the airways against the entry of foreign bodies (Clayton, 1991; Dahme and Weiss, 1999).

Unlike most other animal species that have the option of breathing either through nose or mouth, horses are obliged to breathe through the nose (Clayton, 1991).

2.2.2 The lower airways

The lower respiratory tract lies within the thorax. The trachea divides into left and right bronchi, which enter the left and right lungs. Within the lungs they divide into successively narrower bronchi and bronchioles. The small bronchioles terminate by opening into millions of alveoli that are surrounded by a dense network of blood capillaries. The alveolar air is in very close contact with the blood, the only barrier between them being the fine alveolar membrane and capillary wall through which gas exchange occurs (Clayton, 1991).

The inhalation is an active process; an expansion of the thorax reduces the intrathoracic pressure and stimulates inhalation. The diaphragm as well as the elastic rib muscles contributes to the expansion of the thorax. For exhalation these muscles relax, the thorax reduces its size and the air is pushed out (Clayton, 1991; Dannenbrink, 2004; Flemming, 2004). Therewith is exhalation a passive process.

The lungs of the horse are very powerful and can enlarge the air volume from ca 5 litre at rest to approximately 15-20 litres at maximal load (Dannenbrink, 2004; Flemming, 2004).

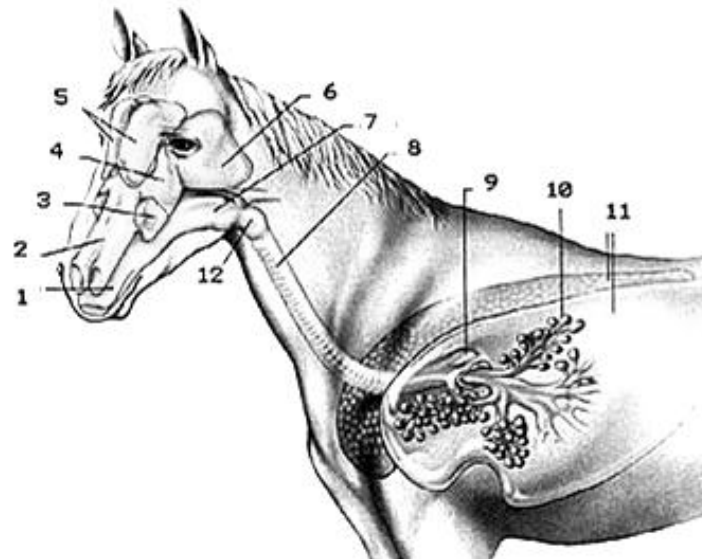


Figure 2: Respiratory system (The Running Horse, n.d.)

- | | |
|------------------------------------|---------------|
| (1) Buccal cavity | (7) Pharynx |
| (2) Nasal Cavity (open to pharynx) | (8) Trachea |
| (3) Inferior maxillary sinus | (9) Bronchus |
| (4) Superior maxillary sinus | (10) Alveolus |
| (5) Frontal sinuses | (11) Lungs |
| (6) Guttural pouch | (12) Larynx |

2.3 Airway diseases

Airway diseases are one of the most common diseases in horses (Holcombe, 2005; Dannenbrink, 2004; EQUISTRO, 2008; Wagner, 2008). According to Dr. Feige (2009) suffers every second horse from subclinical airway diseases (Kroehnert, 2009, Mack, 2009).

A research in a slaughter house by Butler and Armbruster (1984) investigated the reasons for the death due to a disease in the horses. The following results were found:

- 42.4 % Airway diseases
- 23.7 % Lameness (overall)
- 10.7 % Broken legs
- 7.7 % Equine podotrochlosis syndrome
- 4.4 % Laminitis
- 2.4 % Tendon injuries
- 2.4 % Digestive diseases

A study showed that 60% of the horses held in Switzerland suffer from lung-diseases (Kroehnert, 2009) and Arndt (2001) states in her research that chronic respiratory diseases are among the disorders of the musculoskeletal system one of the most common diseases of domestic horses (Hug, 1937; Gerber, 1973; Köning, 1983; Sommer et al., 1988; Bracher et al., 1991). In a study in Bavaria by Breuer (1987) over the period of one year, 22% of 400 horses were treated for airway diseases. Dannenbrink (2004) states that it is assumed that approximately 80% of stabled horses show signs of existing damage to the airways and that veterinarians are most commonly called for airway diseases next to colics (Wagner, 2001).

According to Oke (2010) as many as 50% of racing thoroughbreds and racing standardbreds have inflammatory airway disease. Holcombe (2005) says: "IAD is common in racehorse populations, with a prevalence of 12%, the annual prevalence of IAD in 2 year olds

approached 80%.” In a study by Dixon et al. (1995a) 54.8% of 270 examined horses suffered from recurrent airway obstruction (RAO), while 16.7% were diagnosed with an acute respiratory infection (Arndt, 2001).

Oke (2010) states in an article: “Respiratory system dysfunction is the second-leading cause of exercise intolerance and poor performance in athletic horses, following musculoskeletal disorders”. Other studies have shown that up to 30% of horses are taken out of the top sport due to chronic airway diseases (Fleming, 2004; Dannenbrink, 2004). Wagner (2008) confirms this: RAO is one of the most common reasons why horses have to be taken out of the sport.

There are three main respiratory disease categories: infection, inflammation and allergy (Houghton Brown, 2003), located either in upper or lower airways.

The causes are still not always 100% clear; a lot of research is still needed to give clarity.

Infections of the upper and lower airways are due to the international horse transport quite common nowadays. Pathogens are mainly viruses (Influenza, Herpes, etc.).

Chronically coughing horses have usually more than one health problem. In the beginning it might be a virus infection and sometimes a bacterial infection may develop as well. Up to 8 weeks after the infection it is still a risk that, due to an overreaction of the immune system, an allergy to dust or other particles may develop (Dannenbrink, 2004; Nehls, C., n.d.; Holcombe, 2005).

Most common cause of acute diseases of the respiratory tract is a viral infection. Rarely bacteria, parasites and fungi are causative agents. Abiotic factors are the stable air (dust, dry air, irritating gases) and stress, which can lead to immune suppression (Hamann, 1999).

As some of these factors can be significantly reduced by cleaning bedding and roughage materials with the dust extractor machine, two of the most common inflammatory disease will be described: IAD and RAO. They are specifically interesting as they are to some extent connected to allergies and/ or contaminants in the stable air (Nehls, C., n.d.; Dannenbrink, 2004).

2.3.1 Recurrent Airway Obstruction

Recurrent airway obstruction or short RAO is an inflammatory, obstructive disease of the lower airways (Robinson, 2001). Formally it was known under the term COPD (chronic obstructive pulmonary disease). “However, because of differences between equine and human COPD, a recent workshop recommended that the terms RAO or heaves, rather than COPD, be used for the horse disease.” (Robinson 2000, 2001)

“A similar syndrome, summer pasture-associated obstructive pulmonary disease (SPAOD) occurs in the south-eastern United States, Britain and California in horses that are kept on pasture when the weather is warm and humid (Seahorn et al., 1993). Evidence to date suggests that the two syndromes are the same disease but with different initiating factors” (Robinson 2001).

2.3.1.1 Causes

RAO occurs mainly in the northern hemisphere in middle-aged horses of any breed or gender (Reed et al., 2004; Robinson, 2001; Gerber, 1973; Arndt, 200; McPherson et al., 1979b). Deprez and others indicate that there is a predisposition in some horses for the development of this disease (Laumen et al., 2009; Reed et al., 2004; Robinson, 2001; Mair and Derksen, 2000).

It mainly occurs in horses that spend a lot of time being stabled. When put outside the clinical signs often become less severe, depending on the temperature and condition of the pasture. In a dusty pasture RAO affected horses may still suffer from acute bouts of respiratory distress.

Thomson and McPherson (1984) were able to get horses with RAO in a symptom free state by pure conversion to a hay-and straw-free management within 4 to 14 days (Arndt, 2001).

In horses with SPAOD the clinical signs resolve in winter, but recur each summer (Robinson, 2001).

According to Deegen et al. (1987) and Sasse (1995) RAO starts with an infection caused by viruses, bacteria or parasites or inhalation of antigens, or endotoxins. Robinson (2001) confirms this, saying that the changes described below are evidence of a chronic inflammation.

Two main processes are disturbed in the development of chronic respiratory diseases: the bronchial hyper-reactivity and the disturbance of the mucociliary clearance (Deegen, 1984; Sasse et al., 1985a; Deegen et al., 1987; Kraft et al., 1987; Sasse, 1995). In the hyper-reactivity the horses get very sensitive to stimuli that would not affect a normal horse (Robinson, 2001). And disturbance of mucociliary means that the cleaning mechanism of the airways is disturbed (Drommer and Kaup, 1984). The cleaning of the airways of foreign particles is next to the cough reflex and the cleaning of surfactant done via the mucociliary clearance (Kraft et al., 1987; Sasse, 1995).

Deegen et al. (1987) says the inhalation of a particle-rich air leads to disruption of trachea-bronchial (mucociliary) clearance. It results in an unapparent form of RAO without immunological reactions taking place.

Lack of exercise can also lead to a disruption of the pulmonary cleaning, as the through movement caused stimulation of mucociliary clearance fails (Deegen, 1992; Hamann, 1999).

A massive exposure to stable dust causes intensification of symptoms or prolongation of the duration of the respiratory disease regardless whether it is allergic or not (Clarke, 1993a; Laan, 2010, Deprez, n.d.).

2.3.1.2 Signs

The signs for RAO may differ depending on the severity or the horse and are being discussed. However most often named signs are:

- Chronic cough (often connected to stable activity and exercise)(Mayer, 1980; Robinson, 2001; Wagner, 2008; Reed et al., 2004)
- Decrease in performance and delayed recovery from exercise (McPherson and Thomson, 1983; Robinson, 2001; Reed et al., 2004; Wagner, 2008)
- Increased respiratory rate (Reed et al., 2004)
- Challenged skin in the nostrils (Kühn, Wagner, 2008)

In more severe cases of RAO:

- respiratory distress
- flared nostrils
- increased respiratory rate
- exercise intolerance
- use of abdomen to assist expiration (heaves)
- weight loss
- nasal discharge
- abnormal lung sounds

(Robinson, 2001; Wagner, 2008; Reed et al., 2004; Clarke, 1987c; Sasse, 1996; McPherson and Thomson, 1983; Clarke et al., 1987; Eyre, 1972; Beech, 1991)

According to Goerlich (1988) chronic inflammation is associated with cough (75.8%), pathological auscultation findings of the lung (46.8%) and nasal discharge (28.6%) (Arndt, 2001).

2.3.1.3 Diagnosis

The diagnosis of RAO is connected with quite a lot of technical effort and should be based on the history and typical clinical signs (Reed et al., 2004).

Robinson (2001) describes the following diagnostic procedures:

- blood gas measurements
- BALF (Endoscopic examination)
- mucus analysis
- administration of a bronchodilator
- lung function tests

2.3.1.4 Treatment

Robinson (2001) says: “management and prevention of RAO and SPAOD involves three principles, environmental control, use of corticosteroids to reduce inflammation, and administration of bronchodilator drugs to relieve respiratory distress. The same principles must be applied at all stages of the disease”. In addition, it may also be useful to assist in removal of mucus from the airways.

As for this research environmental control is most relevant, the use of corticosteroids and bronchodilator drugs is not explained in detail.

Environmental Control involves elimination of mould or dust and is the most beneficial (Reed et al., 2004; Laan, 2010; Robinson, 2001). In a RAO-susceptible horse, a few minutes contact with hay may be sufficient to induce attacks of coughing and heaves that last for days (Fairbairn et al., 1993).

It is most efficient to keep an effected horse outside as much as possible (Laan, 2010; Reed et al., 2004; Lowell, 1964; Jackson et al., 2000). However most owners take horses inside as soon as the temperature drops or they think the risk of injuries is too high. According to Robinson (2001) horses do well outside with temperatures as low as -30°C, as long as they have shelter from wind and precipitation. Horses do not need to be kept in a warm building to stay healthy. Marten and Jaep (1991), Art et al. (2002) and Zeitler-Feicht (1993) even say that through natural variations in temperature, the temperature regulation mechanisms of horses are trained. Thus, the animals get harder and less susceptible to diseases. If the horse however does stay in a stable, open boxes are desirable (Laan, 2010).

Most of the airborne particles and endotoxins in the horse stable come from the bedding material and roughage (Crichlow, Yoshida et al., 1980; Clarke and Madelin, 1987; Webster, Clarke et al., 1987; Woods, Robinson et al., 1993). Clarke (1987c) confirms this and says that bedding material and hay are main reservoir of fungal spores. Therefore pelleted feed is often recommended, but this may bring digestive problems over a longer period of time (Clayton, 1991; Hastie, 2001).

Most common changes in roughage are sprinkling or soaking of hay (Haake, 1992; Dixon et al., 1995; Markham, 1656). “Sprinkling water on the surface of the hay is unlikely to be very effective because it will not soak into the centre and will rapidly evaporate.”(Robinson, 2001; Keller, 1981; Thompson and McPherson, 1983). Soaked hay may prevent worsening of lung

function, but does not result in improvement. Additionally the risk of mould development rises with moistening materials (Haake, 1992). Silage is according to Vandenput et al. (1998; Vandenput et al. b 1998) very effective in maintaining normal airway function, but horses being fed silage and kept in a stable still have airway hyper-responsiveness, which suggests that the airway inflammation is not totally resolved.

If a RAO-affected horse is stabled with other animals that are being fed hay, it is according to Robinson (2001) still beneficial to provide the affected animal with silage or a complete cubed (Thomson et al., 1984) or pelleted diet (Jackson et al., 2000). Art et al. (2002) say in comparison that it is more beneficial to change roughage and bedding of the entire stable.

Lowest particle concentrations in bedding material are in straw pallets, then wood shavings, wheat straw and highest in hemp, linen and flax (Flemming et al., 2008; Garlipp et al., n.d.). Most common bedding materials are straw and wood shavings (Zeitler et al., 1984). Findings in this research confirm this. Most common recommended changes in bedding material are to change from straw to shavings (Haake, 1992).

However the mould and toxin development and concentrations are also very much depending on the storage of materials (Clarke, 1987a,c). Next to that maintenance of the stable and the stable itself have a significant influence on particle concentrations (Clarke et al., 1988; Marten, 2000; Newman-Taylor, 1996).

As dust concentrations during stable work raise significantly, Laan (2010), Marten (2000) and Spendlove (2008) recommend keeping horses outside of the stable for at least 20 min after cleaning.

Stables should be constructed to support a natural air flow. Important factors that influence particle concentrations as well as fungal and bacteria development are ventilation, humidity and temperature (Bartz, 1992). Jordan-Goossens (1998) showed in her investigations lower overall levels of germs and fungus germs in the stable air in summer than in winter, traceable to poorer ventilation in winter.

“The management of the horse with SPAOD requires removal from the offending pasture and stabling the horse in a cool stall with clean hay or pellets for feed.” (Robinson, 2001)

According to Reed et al. (2004) is medical management indicated because changes in stabling take several weeks to quiet the pulmonary inflammation.

2.3.2 Inflammatory Airway Disease

Inflammatory airway disease (IAD) is in an inflammation of either upper or lower airways with different factors as initiators. As most research in the field has been focused on RAO, there is still a lot to learn about IAD (Hodgson and Hodgson, 2002).

While RAO is common in older horses, IAD is often seen in young horses. Especially young racehorses are often affected (Holcombe, 2005; Malikides and Hodgson, 2003; Hodgson and Hodgson, 2002). According to Reed et al. (2004) the relationship between IAD in young horses and RAO in mature horses is unknown and the condition of IAD is not necessarily to progress to RAO. In contrast to this Dr. Kühn, says IAD is the preliminary stage of RAO (Wagner, 2008; Viel, 1997).

2.3.2.1 Causes

Definite cause of IAD is currently unknown (Reed et al., 2004). However many possible causes have been suggested through research. It is also possible that several agents may be required to act in concert for the development of IAD, and the temporal relationship

between causes must be taken into consideration. Finally, it is unlikely that a single etiological factor is responsible for all cases of IAD (Hodgson and Hodgson, 2002; Rush, 1999).

“In general, the proposed etiological agents fall into two categories, infectious and non-infectious.” (Hodgson and Hodgson, 2002)

Below in figure II, a summary of assumed causes can be found.

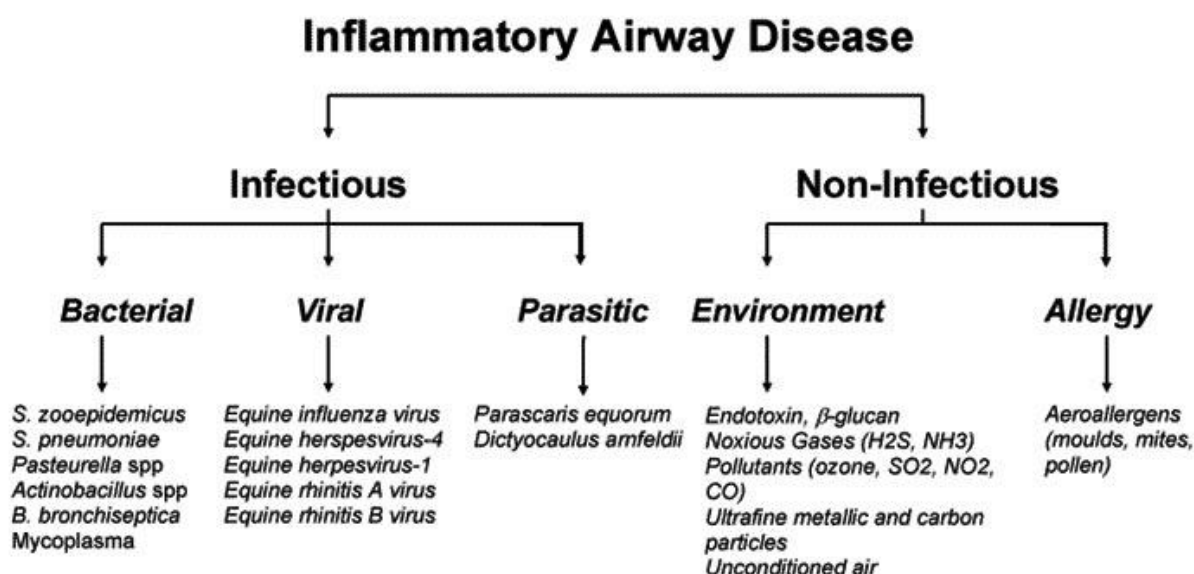


Figure 3: Proposed etiological agents of lower airway inflammation in young racehorses (IAD). (International Veterinary Information Service, Hodgson and Hodgson, 2002)

For this study non-infectious causes are most relevant.

Airborne particles compounds in the equine stable are potentially able to induce airway inflammation (Art et al., 2002). Several studies indicate that a stable environment alone is capable of inducing lower airway inflammation in young horses (Holcombe et al., 2001; Clarke et al., 1987; Hodgson and Hodgson, 2002).

However there are many debates about the causes, many believe that airway inflammation is non-infectious and others believe it is. Studies indicate both possibilities may be a cause (Viel, 1997; Burrell, 1985; Sweeney et al., 1992; Burrell et al., 1996; Hoffman, 1995; Derksen, 2001; Viel b) 1997; Clarke, 1987; Robinson, 1997; Hodgson and Hodgson, 2002).

2.3.2.2 Signs

The clinical signs of IAD in young performance horses may differ depending on the site of inflammation, the causing agent involved and the degree and type of inflammation present. Few studies have determined the specific clinical signs associated with the different presentations of IAD (Hodgson and Hodgson, 2002).

Most common described signs are similar to many other respiratory conditions and are often subtle and therefore easy to miss (Hodgson and Hodgson, 2002):

- coughing and/or nasal discharge (Burrell et al., 1996)
- Abnormal breath sounds and mildly increased respiratory efforts (Moore, 1996; Couetil, 2002)
- decreased performance (Gerber, 2009)

Typically affected horses are afebrile, bright and responsive and have a normal appetite (Rush, 1999). Also decreased performance is often only in racing horses discovered. This is probably due to the fact that leisure or for example dressage and jumping horses do not reach maximal cardio-respiratory effort (Gerber, 2009). "In lower level sport horses with average riders, and most likely in leisure horses, these effects appear to be absent or at least go unnoticed as long as the horses do not cough." (Gerber, 2009)

Absence of bronchospasm and airway obstruction resulting in an overt and prominent increase in breathing effort distinguishes this syndrome from RAO (Derksen, 2001; Gerber et al., 2001).

2.3.2.3 Diagnosis

There are many different techniques to diagnose IAD; this is one of the most contentious areas regarding this syndrome. Different techniques sample different areas of the lung, which influences the results obtained (Hodgson and Hodgson, 2002). Therefore only few will be named in this report.

First a clinical and historical examination should be done. Questions regarding performance, management procedures and clinical history are required for that (Hodgson and Hodgson, 2002). As other diseases have a similar history and clinical signs, like EIPH for example, IAD cannot be diagnosed from the history and clinical signs alone (Hodgson and Hodgson, 2002).

Endoscopy, Tracheal Aspirates and Bronchoalveolar Lavage are recommended by Reed et al. (2004) as well as Hodgson and Hodgson (2002). Other techniques are Thoracic Auscultation, Hematology and Biochemistry (Hodgson and Hodgson, 2002).

2.3.2.4 Treatment

Therapy for IAD should include 3 main steps: 1. environmental management, 2. treatment of airway inflammation, and 3. bronchodilation (Couetil, 2002).

There is a growing body of evidence to suggest that most cases of IAD in young performance horses are not the result of viral infection. Environmental factors are implicated as being key in the pathogenesis of this disease, with bacteria being variably implicated (Hodgson and Hodgson, 2002).

Environmental management as treatment for IAD includes the same measures as described in the treatment of RAO (2.3.1.4 Treatment): decrease exposure to pro-inflammatory agents present within the horse's environment. These are dust/ airborne particles including mould and fungal spores as well as endotoxins. But also stable construction, air circulation, humidity and temperature are important (Holcombe, 2005; Clarke et al., 1988; Marten, 2000; Newman-Taylor, 1996; Laan, 2010; Spendlove, 2008; Hodgson and Hodgson, 2002; Art et al., 2002).

Also the treatment of airway inflammation is similarly treated as RAO. Usually the same medications are used with adaption in doses and duration of treatment (Hodgson and Hodgson, 2002).

2.4 Dust

Airborne particles are everywhere and are usually called "dust". Many of these airborne particles are of inorganic nature, and are often as well industrial - urban influenced (Seedorf and Hartung, 2002). The Commission for the Investigation of Health agents of the German Research Foundation (DFG) defines dust as dispersed distribution of solids in gases, caused by mechanical processes or stirred up.

Dust is an aerosol, this term (bio-aerosols) includes several components which result from animate and inanimate elements (Deutsche Forschungsgemeinschaft, 1991). The particles have a biological origin and development of a biological activity. The animate components of the dust cover the group of microorganisms, including bacteria, fungi, viruses, mites, or protozoa. Inanimate and animate particles enter as joint agglomerate the air. Approximately 80% of the microorganisms in the air are attached to particles and form with them so-called Cluster (Müller et al., 1977).

Therefore do the particles serve as a vehicle (Deprez, n.d.; Cargill, 1999). The Microorganisms themselves are able to influence the quality of bioaerosols through their metabolic products or cell components. Thus a bioaerosols has potential of infectivity, sensitization, toxicity or can also be attributed to pharmacological effects (Dannenbrink, 2004). The particle sizes of such Bioaerosols vary generally between 0.5 and 100 microns (Arndt, 2001). But in the actual breathing zone of a horse is actually only a part of these particles, called respirable dust. Dust particles with an aerodynamic diameter of ≤ 5 are most dangerous as they can enter the intra-thoracic respiratory system during inhalation (Art et al., 2002; Flemming et al., 2008; Garlipp et al., n.d.; Deprez, n.d.). The particle size plays a crucial role in the assessment of health risk due to dust.

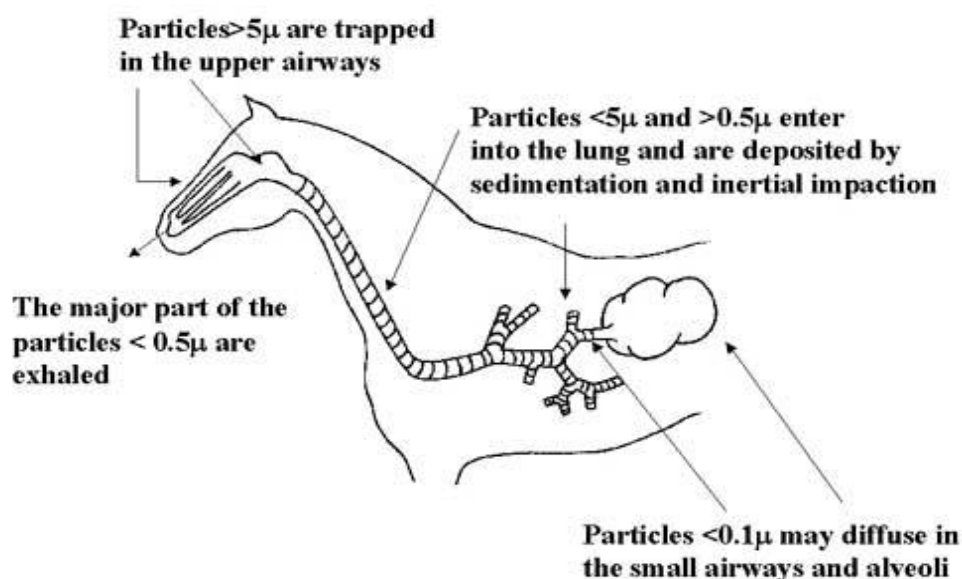


Figure 4: The majority of inhaled particles deposit within the upper airway and central airways, with few reaching the alveoli. (International Veterinary Information Service, Art et al., 2002)

As airborne dust present in equine stables is a mixture including organic and inorganic contaminants, which include bacteria, viruses, moulds, mite debris and faeces, plant material, bacterial endotoxins, β -glucans and inorganic dusts (Rylander, 2001), these agents are potentially able to induce airway inflammation. This can be done either by initiating infection, by inducing allergy, by direct toxicity, or indirectly by overwhelming the pulmonary defence mechanisms.

Risk associated with dust is dependent on 3 main points: the quantity, the size (as shown above) and the composition of particles inhaled. Therefore the elimination of the airborne dust from the environment of horses must consequently focus not only on the quantity of residual dust but also on the quality of this residual dust (Art et al., 2002).

When a classic management system is applied (i.e., hay and straw), airborne dust level is 6 to 7 times greater in the horse's breathing zone than in the stall itself (Woods, 1993).

Zeitler (1985) and Arndt (2001) say that 4 mg/m³ should be maximum tolerated amount of airborne dust and that in well managed stables average dust concentrations are between 2-3 mg/m³.

When mucking out, dust levels are significantly higher and may reach 10 - 15 mg/m³, comprising 20 - 60% respirable particles (Art et al., 2002; Haake, 1992). This equates to 12,000,000 inhaled particles per breath. It is thus clear that many stables contain concentrations of total dust which exceed the suggested provisional air hygiene standard for biologically active dust exposure in cotton mill workers of < 2.5 mg/m³ (Health and Safety Executive, 1997).

As said above the dust concentrations in equine stables are depending on location, the stable itself, the type of horse and amount of horses in a stable, type and consistence of feed and bedding material, cleaning management, temperature, humidity as well as type and intensity of air circulation (Bartz, 1992).

Since ventilation does not fully remove the dust challenge in the breathing zone when the horse is eating and sniffing, changing the forage and bedding material is essential to significantly decrease the respirable dust level (Art et al., 2002). According to Art et al. (2002) may effective hygiene measures reduce dust exposure by up to 90%.

The impact of dust on equine health is described in the respiratory diseases (points 2.3). More and more researches show that there is a connection between airway diseases and dust concentrations in the stable environment (Fleming, et al., 2008; Arndt, 2001; Laan, 2010; EQUISTRO, 2008; Holcombe, 2005; Dannenbrink, 2004; Newman-Taylor, 1996; Robinson, Berney et al., 2003; Christley, 1999; Malikides, 2003; Haake, 1992; Robinson, 2001; Art et al., 2002).

2.5 ARBO

In the Netherlands there are no laws regarding the keeping and management of horses. In Germany in comparison are laws for stable size and height as well as standard values for ammonia, hydrogen sulphide, carbon dioxide, humidity as well as temperature and light (Bundesministerium für Ernährung, Landwirtschaft und Verbraucherschutz, 2009). However Welfare is also becoming more important in the Netherlands (personal conversation with Dutch veterinarians, 2010).

In The Netherlands, the Arbocatalogus gives information and guidelines for safe and healthy handling of agricultural animals (Arbocatalogus, 2010). For example the international "MAC-waard" (TLV - Treshold Limit Value) is used to set guidelines for example for endotoxins (Van Zwam, 2007; Stigas, 2010). Also the Labour Inspection gives guidelines for employees and employers to ensure a safe work environment (Stigas, 2010; Arbeidsinspectie, 2010).

The average exposure to endotoxins in a stable is three times higher than the acceptable dust level of 50 EU/m³ (Van Zwam, 2007).

As dust also causes health problems in humans, for example asthmatic problems, it is desirable to lower airborne particle concentrations also from this point of view.

2.6 The Dutch equine industry

The Netherlands have a well established equine industry. Overall there are approximately 450,000 horses and around 480,000 riders (KNHS, n.d.). Members of the KNHS (Royal Dutch equine sports federation) are:

- 15,000 young riders (under age 8)
- 340,000 recreational riders
- 82,000 competition riders

About 75,000 Dutch people are active in equine sports (with “sports-card”); most people ride dressage and then show jumping. The disciplines of racing, endurance and western are quite small. The regions North Brabant and Gelderland are the strongest (Paardensport.nu, 2009).

Most horses are held in/ at: - Home: 42.6%

- Riding school: 29.6%

- Livery: 18%

- Private livery 9.8%

The Dutch equine industry has a total turnover of about 1.2 billion€ (Sectorraad Paarden, n.d.; Equus, n.d.)

-1/3 turnover from professional equine yards etc

-2/3 turnover related to all equine yards, services and competitions

There are approximately 420 veterinary practices which treat horses and about 300 of these are licensed equine veterinarians. 8 veterinary practices are focused on surgery, 5 are focused on internal diseases and 3 are focused on reproduction (Groep Geneeskunde van het Paard, n.d.).

Amount of equine veterinarians (registered in GGP) in regions:

Drenthe: 16

Flevoland: 8

Friesland: 32

Gelderland: 63

Groningen: 10

Limburg: 25

North Brabant: 78

North Holland: 28

Overijssel: 33

Utrecht: 55

Zeeland: 10

South Holland: 46

3. Methods and Materials

Main goal of this research was to understand the market and find out what experiences people have made with the topic respiratory distress. The second goal of the research was to investigate whether the planned market approach (via vets) is appropriate. In order to investigate this, an empirical research was chosen to be executed. Professional yard owners and veterinarians were interviewed in person and some exceptions over the phone or via e-mail.

This chapter will give an overview of firstly the participants of the market research, like why they were chosen and who actually was interviewed. Secondly the material (interview) with which the participants were interviewed will be explained. Thirdly a short description about a test interview and fourthly the way the interviews were executed will be described as well as sixthly: an explanation of the data analysis, to show how the results in the following chapters were gathered and evaluated.

Each section is divided into two parts according to the research questions:

1. Is there a market for the dust extractor machine from Hurkyson?
 - This refers to the possible customer → yards
2. What could be the role of veterinarians in regard to sales of dust extractor machines?
 - This refers to possible partnerships or support organizations → veterinarians

3.1 Participants

1. Is there a market for the dust extractor machine from Hurkyson?

To select possible customers for the interview the target group for the dust extractor had to be qualified. The dust extractor machine is quite an investment and as it is supposed to be used for bedding and roughage materials, could people that do not own or keep a horse themselves be excluded. Horse owners were divided into two groups: horse owners that keep their horse(s) by themselves (at home) and horse owners that stable their horse(s) at a livery yard. The focus was set on yards, as private kept horses are often stabled in small groups, resulting in less data to compare and also they often go out on the pasture, so the risk of respiratory issues is lower, as the risk rises with the amount of time the horses are in the stable (Arndt, 2001). The yards were divided into sport and leisure yards, where the focus was set on sport yards because sport horses again spend more time in their stable as leisure horses to prevent them from injuries in the pasture, also the commercial value of the horses rises with the ability to perform in (top) sport (Arndt, 2001). Even though leisure or private stables may be possible customers of the dust extractor, the product mainly aims at sport yards (sport horses).

Sport yards or sport horses were defined as horses that are regularly competing on a high level or are trained to compete on a high level. Yards that were selected for this study should have at least 10 active sport horses.

As the product launch is planned to be firstly only in the Netherlands, stables from all over the Netherlands were chosen. Attention was paid to select yards from all regions to be able to draw conclusions to certain areas in the end. Also yards with all kinds of disciplines were selected, to be able to compare if horses in a certain discipline have more respiratory problems or owners are more open to a product like the dust extractor.

The yards were found in the internet, equine magazines like "PAARD & Spul" and "Bit" and via a personal network and contacts. Overall 20 yards were selected, 4 dressage, 4 jumping, 1 carriage, 1 western, 6 racing, 1 eventing and 3 dressage and jumping. As the interviews

were mainly executed in personal interviews at the yards, a realistic number of participants had to be chosen because time was limited to visit all of them.

2. What could be the role of veterinarians in regard to sales of the dust extractor machine?

Horse owners trust their veterinarians and often ask for their advice before they buy a new product, especially if it concerns health or welfare related products (Krüger, 2010). Therefore Hurkyson would like to inform Veterinarians about the product and if possible would like to sell the dust extractor via Veterinarians. This part of the research aims to find out what role veterinarians could play in this context, as described in the research question.

To interview a realistic number of veterinarians it was decided to select ca 25 veterinarians from the Netherlands. The participants were selected from a database with names and addresses of Veterinarians. This database was supplied by the external marketing and communication consultant, who is currently working for Hurkyson. From this network, key veterinarians were selected that are specialized in horses or work in equine clinics. Here it was also made sure that the veterinarians are from all regions from the Netherlands to be able to draw conclusions from that.

3.2 Material

Two different interviews were developed: one for the yards and one for the veterinarians. Both interviews were prepared as quantitative questionnaires with mainly closed questions. Reasons for that were to give the people interviewed several options or some ideas and to ease the analysis and evaluation of the answers (Stangl, 1997). To have an answer that is not influenced by any given answers or options, a few open questions were chosen (see explanation of questions below). As the interviewer was not able to execute the interview in Dutch, both interviews were available in English and German. The participants could choose which language they preferred.

The questions in the interview were developed to give answers to the research questions. A detailed explanation of the interview and the each question can be found in annex 2.

The product was introduced in a short “info pack”. This was handed out to each participant at the interview to present the product better and to give the participants some information about the product that they can keep to show colleagues or take a further look into. The information in the “pack” included:

- Study purpose
 - information about the study and the research
- Problem formulation
 - Reason for development of machine
- References
 - Background information about the influence of dust
- Dust extractor machine
 - Information, explanation and prices of dust extractor machine
 - The “info pack” for the veterinarians included a slide about:
 - the promotion of the product
 - the possible role of veterinarians
- Information
 - Contact information of student, university and company

Please find the complete “info pack” in annex 2.

3.3 Test interview

To ensure that the interviews were understandable and the questions not too difficult, three test interviews were undertaken. One sport horse owner and rider was interviewed to test the interview for yards and two veterinarians were interviewed to test the interview for veterinarians.

According to these tests some improvements have been made in the interview for veterinarians: Question 10 and 11 were added to be able to estimate the treatments and their effects. Some other questions were reformulated to put the focus more on the target group.

All test participants understood the interview and the information about the machine. The time was stopped to estimate the expenditure of time that participants had to invest. The interviews take on average ca 15 minutes. It did not have to be shortened.

3.4 Procedure

The interviews were done in the period from April 26th to June 12th 2010. The calls to contact the participants were done a week prior and in some days in-between as not all participants were reached right away. Especially veterinarians were difficult to reach, therefore was the period of interviewing extended from 3 weeks to 5 weeks in total.

The participants were contacted via phone. This was a simple way to get an answer and make an appointment right away. The interviews were mainly executed in personal meetings/visits at the participants yards or practices because it is less time and effort for the participants than an online questionnaire for example. Some exceptions were made when the participants preferred that, they were too far away or an appointment could not be made, then the interview was sent via mail or done on the phone. This was discussed and agreed on the phone. The participants did not need to prepare for this interview.

When a participant was interviewed, he or she got a hand-out which included the interview and the "info-pack". This was helpful so they could follow the interview easier and read through the questions as well as see the possible answers. The info-pack was discussed towards the end of each interview (in the interview for yards after question 25 and for veterinarians after question 19). In this way they did not know too much about the machine before answering the questions and were therefore not influenced. The questions asked after the info-pack were related to the machine.

All participants were offered to get an article (Fleming et al., 2008) about dust concentrations in bedding material and were asked if they would like to receive the final article about the research as well as more info material about the machine.

3.5 Data analysis

The data gathered in the interviews was entered and analyzed with the statistical program SPSS. All answers to the open questions were summarized and categorized to be able to analyze them in SPSS. All answers were analyzed in frequency tests by SPSS to see numbers (mode) and percentages of the answers as well as missing or double (multiple) answers. Due to the small sample of 20 or 22, correlation test were not possible.

After analyzing both groups separately (yards and veterinarians), one SPSS file was created with questions that were present in both interviews. These were:

- Do you see a connection between air quality and airway issues?
- What are the costs for the treatment?
- Do you see ARBO regulations as an issue that you need to address in the future?
- Do participants think that the machine is useful?

In this file, differences between the answers of yards and veterinarians could be analyzed. However the number of this group (42) was also too small to show significant differences. Therefore the results of these tests are not shown in the report, but can be found in the annex 3.

All graphs were made in Microsoft Word. The reason for that is that it was not possible to get graphs of multiple answers in SPSS and to have the same style and design in all graphs and tables, these were made in Microsoft Word.

4. Results

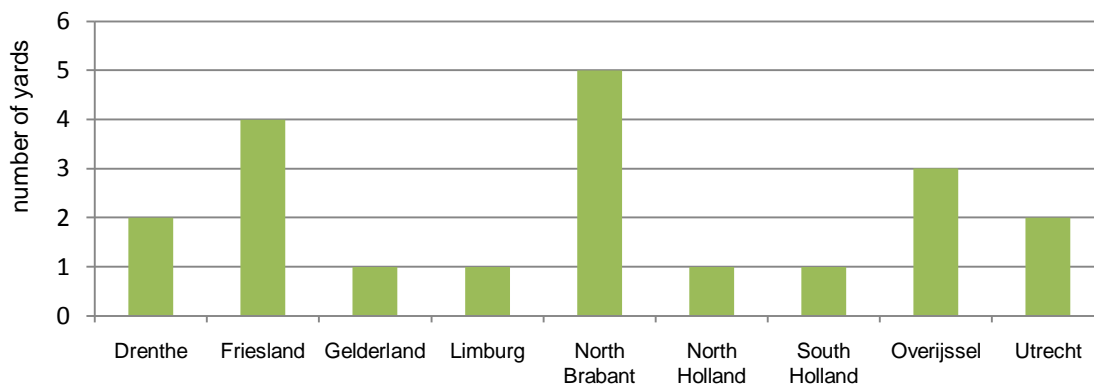
This chapter simply presents the results found in the statistical analysis, starting with the results of the yards interview and second the veterinarians interviews. Further meanings and interpretations can be found in the following chapters.

33 yards and 27 veterinarians were planned to be contacted for this research, but these numbers were elevated to 35 yards and 50 veterinarians. Out of these 35 contacted yards, 7 did not participate and 8 did not reply. That makes a response rate of 57% for the group of yards. Out of 50 veterinarians that were contacted, 10 did not participate and 18 did not reply. That makes a response rate of 44% for the group of veterinarians.

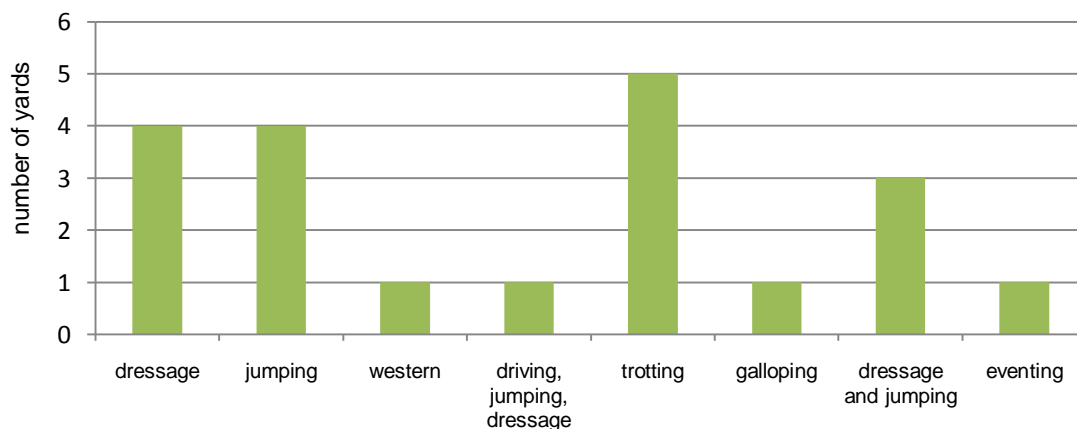
Reasons for the yards not to participate were either that the yard owners were too busy or they were not focussed on sports, but on breeding. Most veterinarians did not participate because they were too busy.

4.1 Yards

In total 20 yard owners were interviewed from different provinces in the Netherlands and with different disciplines.



Graph 2: Location of interviewed yards in provinces.



Graph 3: Main sport specialisation of interviewed yards.

Question 1. "How many horses do you have?" and question 2. "How many active sport horses (do you have)?"

On average the yards have more than 25 horses with 20-25 of them being active sport horses.

Number of horses	Total horses Number of yards	%
10-15	1	5
15-20	2	10
20-25	2	10
more than 25	15	75

Table 4: Number of horses in total.

Number of horses	Sport horses Number of yards	%
10-15	5	25
15-20	3	15
20-25	6	30
more than 25	6	30

Table 5: Number of sport horses of interviewed yards.

Question 3. "How many hours per day are these horses stabled?"

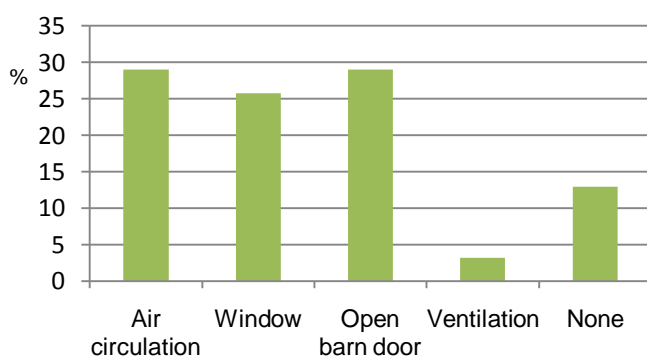
Most horses are stabled for 20-23 hours per day (11 yards, 55%), 7 yards (35%) keep their horses inside 15-19 hours and 2 yards (10%) have their horses inside for 10-14 hours.

Question 4. "What kind of stable?"

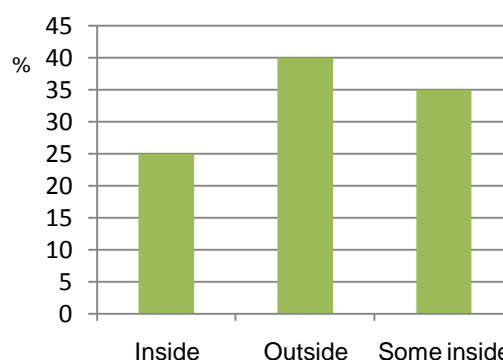
Most common stable types are big barns with an air-circulation construction, a window or an open barn door.

Question 5. "Are the horses inside during stable work (cleaning)?"

On most yards, all or a number of horses are outside during stable work.



Graph 4: Stable types of interviewed yards.



Graph 5: Where are the horses during stable work (of interviewed yards)?

Question 6. "On what kind of bedding material are your horses stabled?"

Straw and shavings are commonly being used at the interviewed yards. 80% of the yards (16 yards) use straw for bedding, 50% (10 yards) use wood shavings and 15% (3 yards) use flax shives. This was a multiple answer, several yards use two types of bedding, therefore the total percentage is 145%.



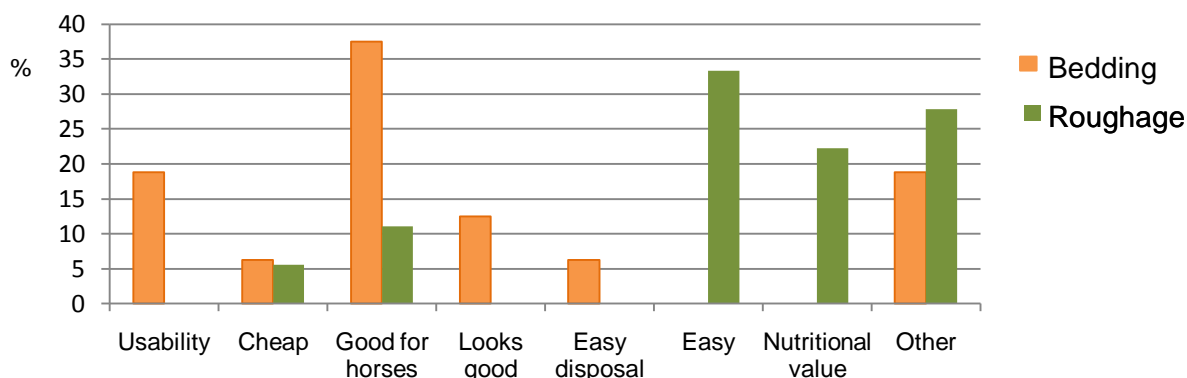
Graph 6: Most commonly used bedding material at interviewed yards.

Question 7. "Why did you choose that bedding material?"

Main reason for the choice of bedding is according to the yard owners that it is "good for horses" (60%, 12 yards).

Question 8. "What kind of roughage do you feed your horses?"

For roughage material, 14 (70%) of the interviewed yards prefer to feed hay, 4 (20%) feed haylage and 2 (10%) silage. Reason provided for this is that it is easy to use. Then other reasons provided are nutritional value and "good for horses".



Graph 7: Reason for choice of bedding and roughage material of interviewed yards.

Other reasons for choice of bedding and roughage were the following:

"other" reason	Bedding Number of yards	Roughage Number of yards
Easier storage (haylage+ silage)		5
Less dust (haylage+ silage)		3
Horses eat too much straw (wood shavings+ flax shives)	3	
Respiratory issues (wood shavings+ flax shives)	2	
Dry	1	
"I like it" *	1	1
Isolation/ make it warmer	1	
Less flies	1	
"It was always like that"*	1	1

“feeling”*		1
Horses chew more		1

* Quotations of answers from yard owners.

Table 6: “Other reasons for choice of bedding of interviewed yards.

Question 6.I and 8.I. “What size of bales do you use?”

Big square bales of bedding (straw) and roughage are most often used at the interviewed yards. For bedding do 15 out of the 20 yards (75%) use big square bales, 2 (10%) have the material (1 shavings, 1 flax shives) delivered and stored as loose material, 2 (10%) in 100L bags and 1 (5%) uses small pressed bales.

Also for roughage do 15 out of 20 yards (75%) use big square bales, 3 (15%) use big round bales, 1 (5%) uses small pressed and 1 (5%) uses loose roughage material.

(The bales categorized are:

- small= ca. 50-100kg, 40x50x100cm
- big square= ca. 600-900kg, 120x100x250cm
- big round= ca. 300-700kg, 120x150cm)

Question 9. “Do you have experience with respiratory issues?”

45% of the interviewed yards (9 yards) have no experience with respiratory issues at their yard. 55% (11 yards) do have experience with respiratory issues at their yard.

Most often experienced respiratory issues at these 11 yards are in 69% of the cases (9 yards) simple coughs due to a virus or infection and in 23.1% (3 yards) due to allergies. One yard (7.7%) names other respiratory issues.

As 9 yards did not have experience with respiratory issues, the next 9 questions were only answered by 11 yards. (total = 11)

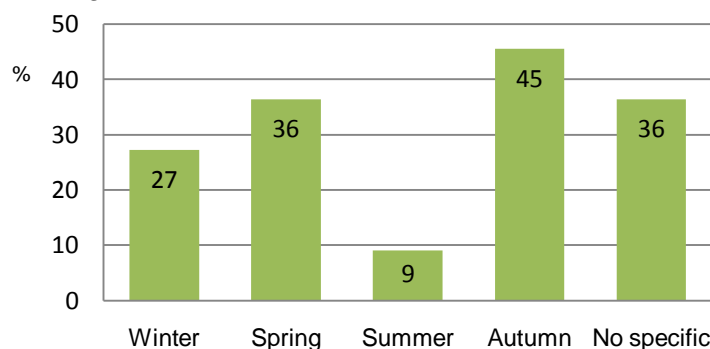
Question 10. “How many horses with respiratory issues do you have per year?”

6 (30%) of the 11 yards have had 1-2 horses with respiratory issues and 2 (10%) had 3-5 horses. 1 yard (5%) had 6-8 horses, 1 had 9-10 (5%) and another 1 (5%) had more than 10 horses with respiratory problems.

Question 11. “In what period of the year do your horses have the most respiratory issues?”

Multiple answers were possible to select a certain period when respiratory issues occur most commonly according to the experience of the interviewees.

Results were the following:



Graph 8: Period for signs of respiratory disease named by interviewed yards.

Question 12. "Do you know what caused these issues?"

Most yard owners say they know what caused these respiratory issues and name the following causes:

Cause	%
Infection	66 %
Dust	22 %
Allergy	11 %
Other	22 %

Table 7: Causes for respiratory diseases named by interviewed yards.

This was a multiple answer question; therefore the total is 122%.

Do yards see a connection between air quality and airway issues?

50% do see a connection (10 yards)

20% do not see a connection (4 yards)

5% "maybe" see a connection (1 yard)

Question 13. "Did you call the veterinarian?"

5 yards (46%) say they did not call a veterinarian for the respiratory issues, another 5 (46%) say they did call the veterinarian and 1 (9%) says sometimes the veterinarian was called.

On average, when a veterinarian was contacted, he or she had to see the sick horse more than 2 times. (Veterinarian came more than 2 times → 3 yards (43%), veterinarian came two times → 2 yards (29%), veterinarian came once → 2 yards (29%)).

6 of the 11 yards (75%) spent less than 100 € on the treatment of respiratory issues. 1 (13%) has spent 100-200€ and another 1 (13%) has spent over 500€ on the treatment.

Question 14. "How did you treat these issues?"

Most often used treatment is medication (72%; 8 yards). Special feed and change in the environment were both second with 27% (3 yards). As respiratory issues are often treated in a combination, this was a multiple answer question (total= 145%) (2 yards, 18% named other treatments).

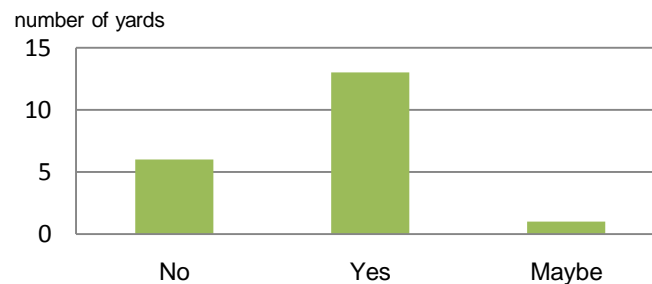
Question 15. "What do you know about these diseases?"

Yard owners that have experience with respiratory issues say they know:

Causes	31.0% (9 yards)	
Signs	34.5% (10 yards)	(Percentages of how many yard owners did say they know)
Consequences	34.5% (10 yards)	

Question 16. "Do you see respiratory issues as a problem?"

30% of the yards (6 yards) do not see respiratory issues as a problem, 65% (13 yards) do see respiratory issues as a problem.

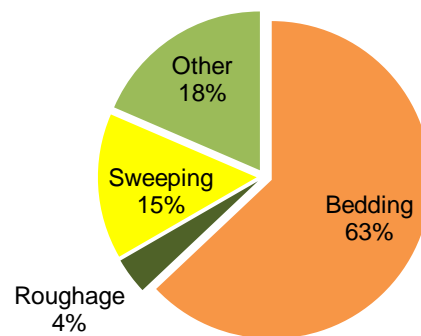


Graph 9: Amount of interviewed yards that see respiratory issues as a problem.

Question 17.

“What has according to your experience the highest influence on dust in the stable?”

According to the interviewed yard owners the bedding has the highest influence on dust in the horse stable (17 yards). (This was a multiple answer question, therefore the total percentage is 135%)



Graph 10: Factors having the highest influence on dust in the horse stable according to interviewed yards.

Other causes for dust according to the interviewed yard owners were:

Influence on dust in the stable	Number of yards
Depends on quality	3
Cleaning stables/ change bedding	3
New straw	1
“Air” in stable	1

Table 8: Other factors having the highest influence on dust in the horse stable named by interviewed yards.

Question 18.

“Do you have experience with health problems from staff due to the work environment?”

3 of the 20 yards (15%) have experience with health problems from staff due to the work environment. 17 yards (85%) do not have experience with that.

Question 19. “Are you familiar with the Arbocatalogus or the Arbeidsinspectie?”

15 yards (75%) are familiar with the Arbocatalogus (ARBO) or the Arbeidsinspectie and 5 (25%) are not familiar with it.

Question 20.

“Did you have to adapt anything in your stable or make a plan according to the regulations?”

Out of 16 yards (missing: 4; were not familiar with ARBO) did 5 yards (31%) adapt something in their stable according to the ARBO regulations. 11 yards (68%) did not have to adapt anything.

Question 21.

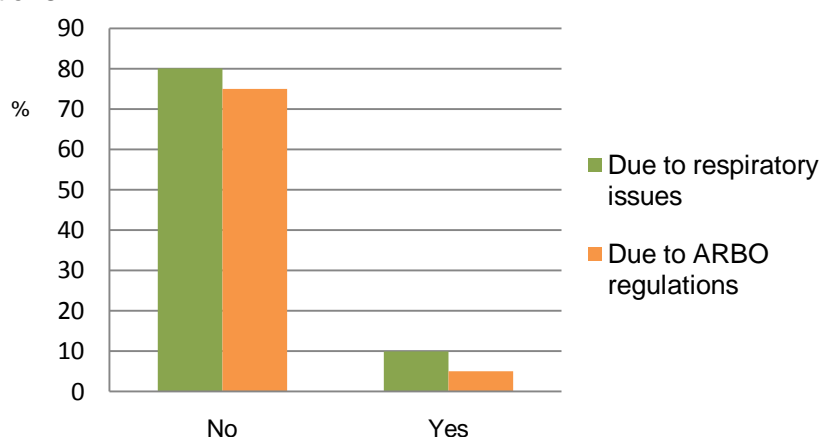
“Do you see these regulations as an issue that you need to address in the future?”

In total 19 yard owners answered the question if they see the ARBO regulations as an issue they need to address in the future (missing= 1). 12 yard owners (63%) do not see it as an issue to address in the future, 6 (31%) do and 1 (5%) does maybe.

Question 22. “Did you make financial losses due to...?”

2 (11%) of the interviewed yards (total=18, missing= 2) have made financial losses due to respiratory issues. The other 16 yards (88.9%) said they did not make financial losses due to respiratory issues.

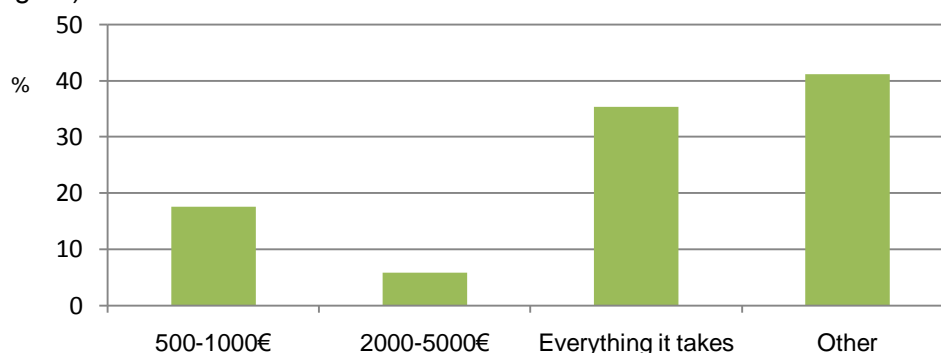
1 (6%) of the interviewed yards (total= 16, missing= 4) has made financial losses due to ARBO regulations. The other 15 yards (94%) said they did not make financial losses due to ARBO regulations.



Graph 11: Did the interviewed yard think that they made financial losses due to
1. respiratory issues or 2. ARBO regulations?

Question 23. “To what extent would you be open to invest more to improve these problems?”

3 yards (18%) are open to invest 500- 1000€, 1 yard (6%) 2000-5000€ and 6 yards (35%) would invest everything it takes. (7 yards (41%) named “others” (see below explanation) as to what they are willing to invest). 3 owners did not answer this question (total= 17). (Total= 17, missing= 3)



Graph 12: Are the interviewed yards open to invest (more) to improve respiratory issues?

The following table shows “other” answers to invest more according the interviewed yards.

Answers to further investments to prevent or improve respiratory issues	Number of yards
Everything it takes/ “do it good”	6
Depends on results	2
Precaution: built new stable	2
Precaution: ventilation	1

Table 9: Explanation of “other” answers whether interviewed yards are open to invest more and what they are willing to invest.

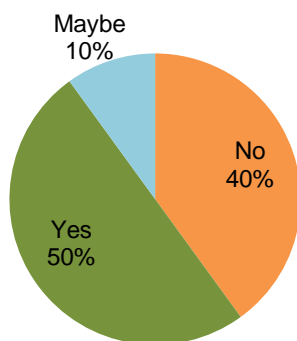
Question 24. “If there was a machine that improves the dust levels and the respiratory issues, would you be interested in it?”

If there was a machine that improves the dust levels and the respiratory issues, 10 of the interviewed yard owners (50%) would be interested in it. 2 (10%) were not sure and said maybe and 8 (40%) were not interested in it.

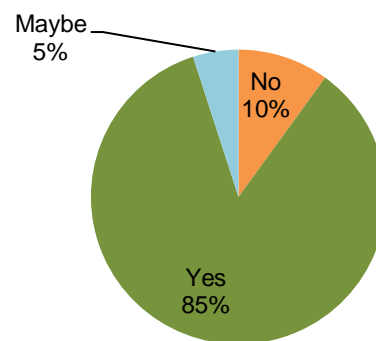
Question 26. “Do you think that a machine like that could be useful?”

17 of the interviewed yard owners (85%) think that the machine could be useful and 1 (5%) was not sure and answered “maybe”. 2 (10%) do not think it could be useful.

Interested in machine



Think machine is useful

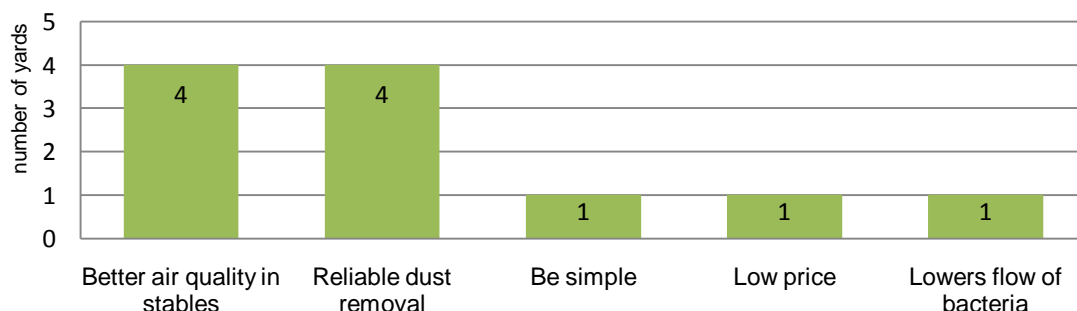


Graph 13: Number of interviewed yards that are interested in the dust extractor machine.

Graph 14: Number of interviewed yards that think that the dust extractor machine is useful.

Question 25. “What requirements should this machine meet?”

Requirements that the interviewed yard owners came up with, as it was an open question, were categorized. However 9 yard owners did not answer this question (total= 11).



Graph 15: Expectations of interviewed yards on the dust extractor machine.

Additionally the numbers of yards which said that they had experience with respiratory issues were compared to the answers of question 24 (If there was a machine that improves the dust levels and the respiratory issues, would you be interested in it?) and question 16 (Do you think that a machine like that could be useful?).

Have experience with respiratory issues	Are interested			Think it is useful		
	Yes	Maybe	No	Yes	Maybe	No
Yes (11)	8	1	2	11	-	-
No (9)	2	1	6	6	1	2

Table 10: Comparison of number of interviewed yards with respiratory issues or not and their interest in the machine, or if they think the machine is useful.

By evaluating comments made by the yard owners, further results that were not included in the interview questions could be found:

	Number of yards	Experience with respiratory issues	
		Yes	no
Yards sometimes make the hay wet for horses with respiratory issues.	5	5	-
Yards are planning to build a ventilation system in their stables.	2	1	1

Table 11: Evaluation of comments made by the interviewed yard owners during the interview.

- The yard that has a ventilation system in one barn has also experience with respiratory issues.

Due to a limited time span for this project, the number of participants was limited to 20 (22) of each category (yards and veterinarians). Further statistical analyses as for example correlations between different questions were not possible (not significant) with a sample of 20 and are therefore not further shown or discussed.

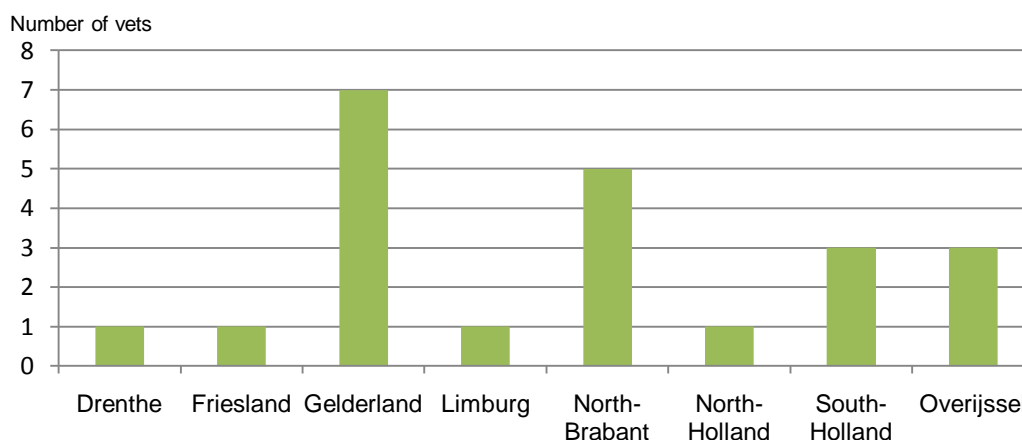
Additional comments of yard owners in regard to the dust extractor machine:

Comment	Number of stables
Too expensive	4
Need more research on the horse	4
Interesting for producers/ wholesalers of raw materials	4
Useful for bigger stables	3
Yards rather invest in material than time	1
Too much handling	1
Would like a try-out-phase	1

Table 12: Summary of additional comments made by the interviewed yards during interview.

4.2 Veterinarians

In total 22 veterinarians that are focused on horses from different provinces in the Netherlands were interviewed. The veterinarians are either working in an animal practice and have a mobile clinic or are working at an equine clinic.



Graph 16: Location of interviewed veterinarians in provinces

Question 1. "How many horse customers do you have on average per year?"

Question 2. "How many horse customers per year have respiratory issues?"

Most veterinary practices (15) had more than 1000 horse customers (customers) and most practices said that 10-30% of the horse customers had respiratory issues.

Number of customers	Number of veterinary practices	%
less than 500	2	9
500-700	3	13
700-1000	2	9
over 1000	15	68

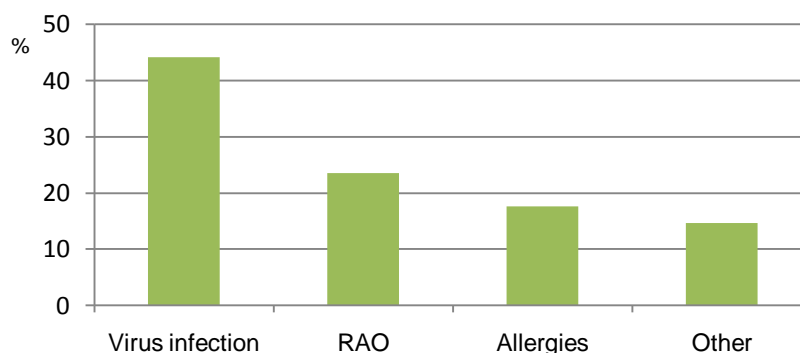
Table 13: Number of horse customers in interviewed practices per year.

Percentage of respiratory issues	Number of veterinary practices	%
less than 10%	9	41
10-30%	12	55
30-50%	1	5

Table 14: Percentages of respiratory issues of total horse customers in interviewed practices.

Question 3. Which respiratory issues are most common?

Most common respiratory issues, according to the interviewed veterinarians are virus infections. 15 veterinarians (44%) named these as most common illness of the respiratory tract; 8 veterinarians (24%) named recurrent airway obstruction (RAO) and 6 (18%) named allergies. 5 veterinarians (15%) named others.



Graph 17: Most common respiratory issues named by interviewed veterinarians.

Other issues named were:

- IAD: 4 veterinarians
- EIPH: 1 vet

Question 4. “How severe were respiratory issues or airway diseases your horse customers had in the last year?”

The interviewed veterinarians ranked these respiratory issues mainly as “medium” (50%; 11 vets), 36% (8 vets) ranked them as “simple” and 1 veterinarian (5%) ranked them as “severe”. Two veterinarians did not answer this question. They said that all ranks are possible and could not say which was most common.

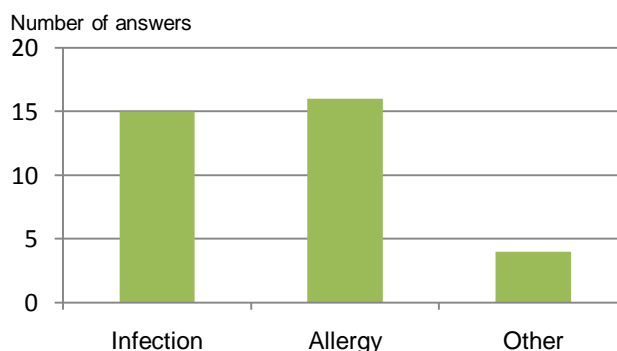
Question 5.

“How many times do you on average have to visit horses with respiratory issues?”

On average, horses with respiratory issues have to be treated 1-2 times. 13 out of 22 interviewed veterinarians (59%) say this. 6 veterinarians (27%) say that they have to treat horses with respiratory issues once and 1 veterinarian (5%) says they have to be treated 2-3 times. 2 veterinarians did not answer this question.

Question 6. “What are the main causes for respiratory issues?”

Causes for respiratory issues are according to 43% of the veterinarians (15 vets) infection and to 46% of the veterinarians (16 vets) allergies.



Graph 18: Most common causes for respiratory issues named by interviewed veterinarians. This was a multiple answer question, therefore is the total number of choices 35.

Question 7. “Do you see a connection between air quality and respiratory issues?”

20 out of 22 veterinarians (90%) do see a connection between air quality and respiratory issues. 2 (9.1%) do not see a connection.

Question 8. "What are the main causes for dust in the stable?"

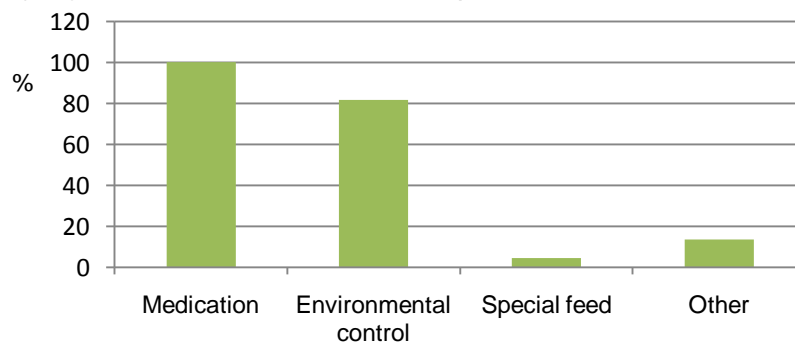
Bedding and roughage material have both an equal amount of answers (64%, 14 each) from the interviewed veterinarians. 36% (8 vets) of the answers are "other" reasons, these are:

"Other" causes of in the stable	Number of veterinarians
Cleaning/ sweeping	2
Stable construction itself	3
Quality of material	1
Management (open windows, clean)	3
(no) Ventilation	1
Various	1

Table 15: Explanation of "other" causes for dust in the stable named by interviewed vets.

Question 9. "How do you normally treat respiratory issues?"

All interviewed veterinarians said that they treat respiratory issues with medicine. Apart from that do 18 veterinarians (82%) say that they advice the owners to change the environment of the horse and 1 (5%) veterinarian also advices a special feed.



Graph 19: Most common treatments for respiratory issues used by the interviewed vets. This is a multiple answer question, therefore is the total 200%.

Other treatments are according to the interviewed veterinarians:

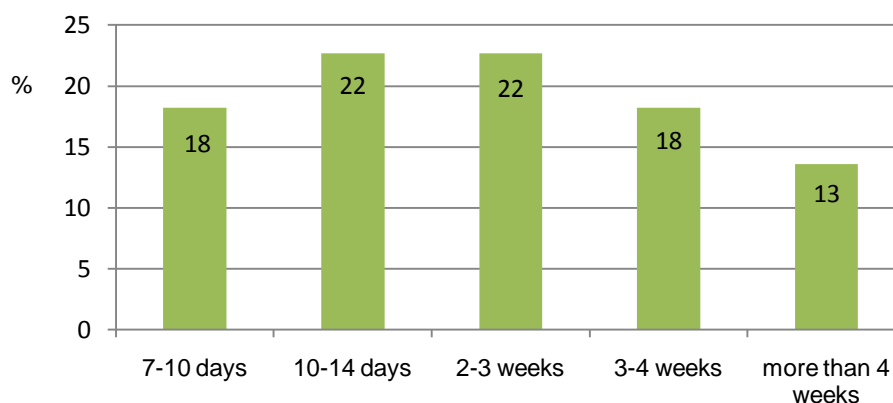
- Rest 1 veterinarian
- Keep horse outside 2 veterinarians

Question 10. "What are the costs for the most typical treatments?" andQuestion 10.I "How long do horses on average have to be treated/ medicated?"

The costs for the treatments as well as duration of treatments of respiratory issues seem to vary:

Costs of treatment	Number of veterinarians	%
50-100€	9	41
100-150€	6	27
150-200€	2	9
More than 200€	4	18

Table 16: Average costs for treatments named by the interviewed veterinarians.



Graph 20: Average duration of treatment named by the interviewed veterinarians.

1 veterinarian did not answer these questions, therefore is the total percentage in the graphs above 93% instead of 100%.

Question 11. "Do these medications have an impact on competitions?"

All veterinarians said that the medications have an impact on competitions (doping). 1 veterinarian did not answer this question, therefore answered 21 veterinarians this question with yes.

Question 12.

"Do you check stables and give the customers advice about stable management?"

All of the interviewed veterinarians check the stable management and give advice about that.

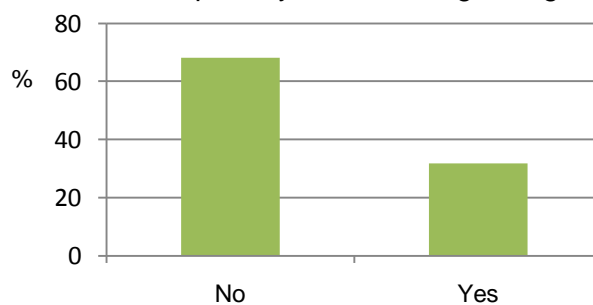
Check stable environment	Number of veterinarians	%
Yes	18	82
Sometimes	3	14

Table 17: Amount of interviewed veterinarians that check the stable environment of horses suffering from respiratory issues.

1 veterinarian did not answer this question.

Question 13. "Do you see respiratory issues as a growing concern?"

15 Veterinarians (68%) do not see respiratory issues as a growing concern and 7 (32%) do.



Graph 21: Interviewed vets that do (not) see respiratory issues as a growing concern.

Question 14.

“Do you have experience with health problems from staff due to the work environment?”

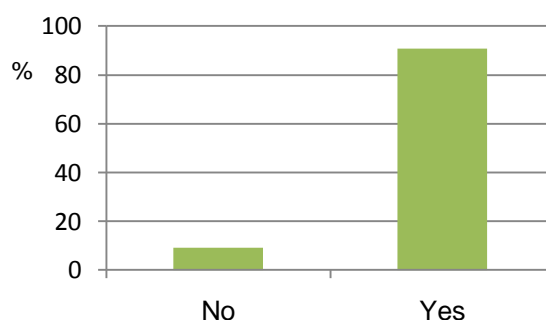
1 veterinary practice (5%) had experience with health problems from staff due to the work environment. 18 other practices (82%) did not have experience with that and 3 did not answer this question.

Health problems due to work environment	% of veterinarians
No	82
Yes	5

Table 18: Amount of interviewed vets that have (not) experience with health problems from their staff due to the work environment.

Question 15. “Are you familiar with the Arbocatalogus or the Arbeidsinspectie?”

2 of the interviewed veterinarians (9%) are not familiar with the Arbocatalogus and twenty (91%) are familiar with it.



Graph 22: Interviewed veterinarians that are (not) familiar with the Arbocatalogus.

Question 16.

“Do you see the ARBO regulations as an issue that you need to address in the future?”

Most veterinarians do not see the ARBO as an issue that they need to address in the future. However the numbers are close:

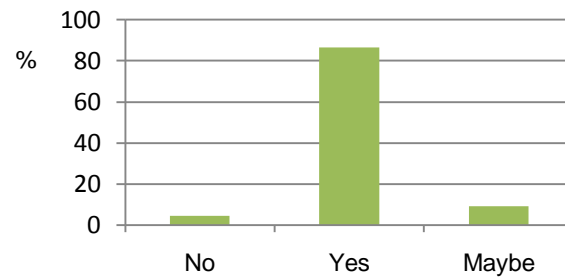
ARBO as an issue to address	Number of veterinarians	%
No	8	47
Yes	6	35
Maybe	3	18

Table 19: Interviewed veterinarians that do (not) see the Arbocatalogus as an issue to address in the future.

5 veterinarians did not answer this question (total= 17)

Question 17. “If there was a machine that improves the dust levels and the respiratory issues, do you think that it could be useful?”

19 out of 22 interviewed veterinarians (86%) think that this machine could be useful. 2 (9%) think that “maybe” it is useful and 1 (5%) does not think it could be useful.

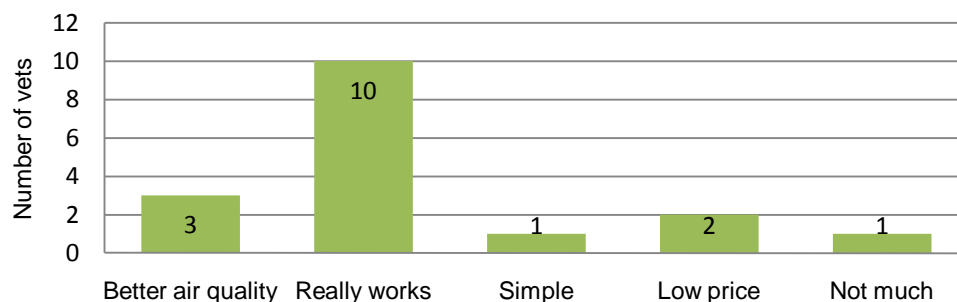


Graph 23: Amount of interviewed veterinarians that think that the dust extractor machine could be useful.

Question 18.

“What requirements should this machine meet? What would you demand/expect from it?”

Most of the veterinarians demand that the machine really works and really lives up to its promises. Other demands and expectations named by the interviewed veterinarians were:



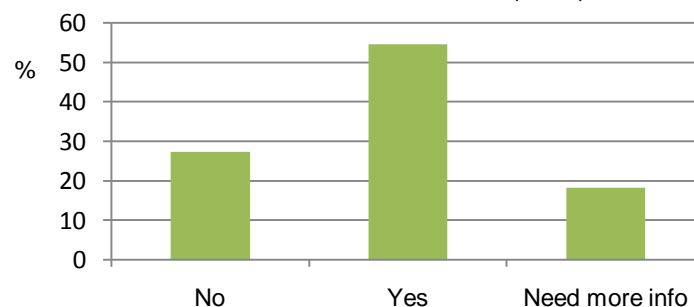
Graph 24: Expectations that the interviewed vets have on the dust extractor machine. Five veterinarians did not answer this question.

Question 19. “If dust in stables is reduced, do you think that respiratory issues will improve?”

Respiratory issues will improve if dust in stables is reduced, say 19 of the interviewed veterinarians (86%). 2 (9%) say maybe it will improve and 1 (5%) says that it will not improve.

Question 20. “Would you be interested in supporting the introduction of this product as a solution to these issues?”

12 veterinarians (55%) would be interested in supporting the introduction of this product. 4 (18%) need more information or more research first and 6 (27%) are not interested in that.

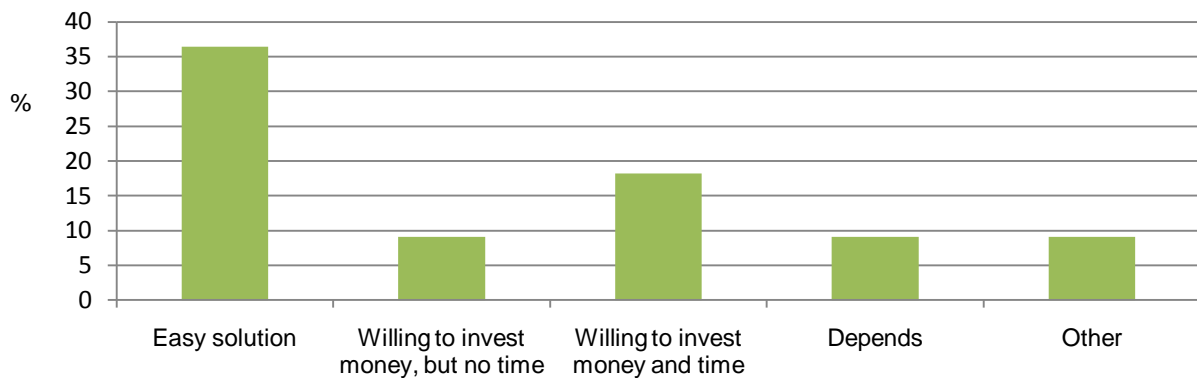


Graph 25: Amount of interviewed veterinarians that are interested to support the introduction of the dust extractor machine.

Three veterinarians (14%) said that they would be interested in handing out flyers or brochures.

Question 21. "What do you think clients look for as a solution for respiratory problems? And what do you think are clients willing to spend?"

According to the interviewed veterinarians horse owners mostly look for an easy solution (8 vets, 36 %). Other criteria named by the veterinarians were:



Graph 26: Solutions for respiratory issues that horse owners look for named by interviewed veterinarians.

Four veterinarians did not answer this question (total= 18/ 82%).

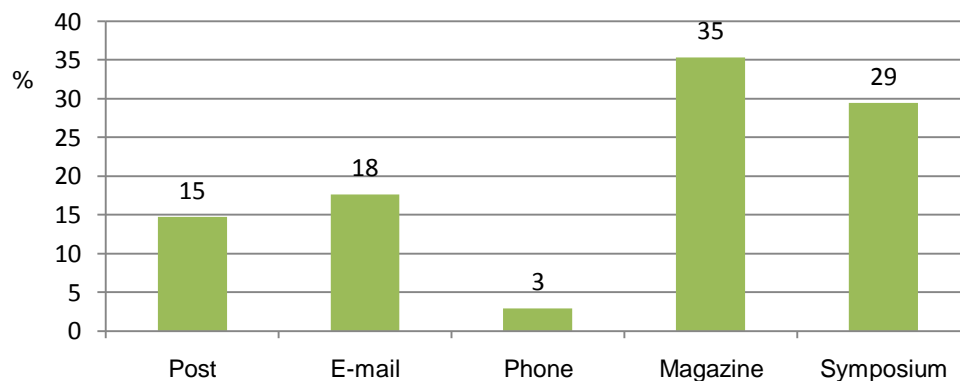
9 veterinarians answered the question how much they think, horse owners are willing to spend (total= 9, missing= 13).

Amount horse owners are willing to invest according to veterinarians	Number of veterinarians	%
Less than 500€	3	33
500-1000€	5	56
2000-5000€	1	11

Table 20: Amount that horse owners are willing to invest in respiratory issues named by interviewed veterinarians.

Question 22. "What do you think Hurkyson should do to reach Veterinarians effectively to inform them about the product?"

According to the interviewed veterinarians is the most efficient way to reach further veterinarians to inform them about the product via magazines (12 vets; 35%).



Graph 27: Ways/ Tools to reach veterinarians effectively (to inform them about the dust extractor machine) named by the interviewed veterinarians.

Magazines recommended are:

Newspaper	Number of veterinarians
Tijdschrift voor Diergeneeskunde	8
Groep Geneeskunde van het Paard	1
Equine Veterinary Journal	2
Equine Veterinary Education	2

Table 21: Magazines recommended by interviewed veterinarians to present and explain dust extractor machine to specific audience (vets).

Apart from these specialized magazines they recommend:

Het Sportpaard	1
Hoefslag	2
Bit	2

Table 22: Newspapers recommended by interviewed veterinarians to advertise dust extractor machine.

As already said in the yards results, the sample is too small to make successful correlation or comparison tests. The results of these tests are not significant.

However some comparison tests between veterinarians and yards were done; results can be found in annex 3.

5. Discussion

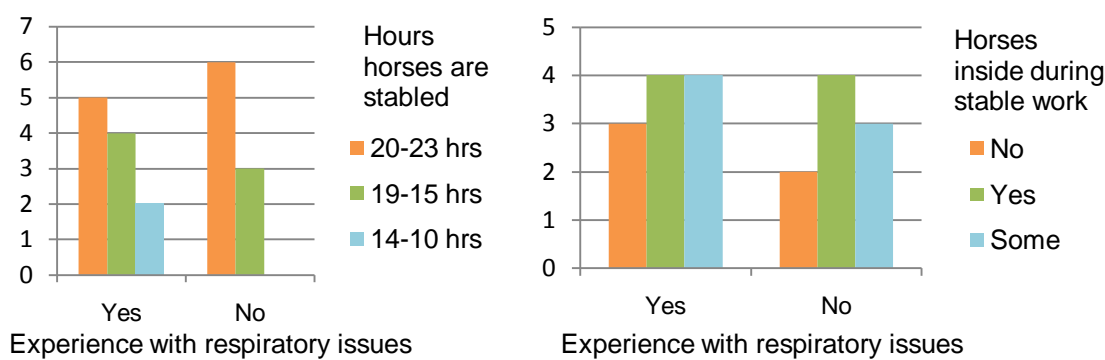
In this chapter the key results will be interpreted and discussed. Not only the results relevant to answer the research questions are discussed, but also results that are not clear standing by itself without further interpretations.

As in the previous chapters, this chapter is also divided in separate sections on “yards” and “veterinarians”.

5.1 Yards

Stable hours

The literature review showed that sport horses are stabled longer than leisure horses. Results from this research cannot compare leisure and sport horses, but they show that 55% of the horses spend 20-23 hours per day in their stable. Additional 35% of the interviewed yards keep their horses stabled for at least 19-15 hours per day. These numbers match the information given by literature.



Graph 28: Amount of horses with airway issues at interviewed yards in relation to time they spend in the stable (stable hours).

Graph 29: Amount of horses with airway issues at interviewed yards that are inside during stable work (correlation).

Due to the small sample can correlations between stable hours or stable type or whether horses are inside during stable work and frequency of respiratory issues not be calculated. The graphs above show that the differences between the groups are very low, which can be explained with the small size sample.

Awareness of the influence of stable activity on the horse's health

The results show that most horses go outside during stable work, which indicates that the owners do consider the effect it has on the horse. Results from question 17 confirm this, showing that 15% (4 yards) of the yard owners think that sweeping has the highest influence on dust in the stable (17 yards, 63% think bedding has highest influence) and another 3 yards say cleaning/ renewing bedding has a high influence too. That means that a few yard owners (4 that say sweeping has the highest influence + 3 saying renewing the bedding has the highest influence = 7 yards) are aware about the effect stable activity has on the horses' health. But it also needs to be considered that horses may be taken out of their stables for safety reasons or to ease and speed up the stable work; when horses are outside the doors can stay open, rakes or other tools can stay in the stable, etc.

Awareness of the role of bedding material

As already said in the introduction and the literature review straw is the most common bedding material. The main reason for that is simple, but reasonable: It is “good for horses”. This shows that it is desired to use this material as bedding. As shavings are often used either to stop horses from eating too much straw or for horses with respiratory issues, straw cleaned with the dust extractor machine could be again suitable for more horses. Apart from that also shavings or other materials, which are not always dust-free, can be cleaned with the dust extractor.

This research showed also that yard owners are aware that bedding material has the highest influence on dust in the stable and may therewith see the benefit of cleaning bedding material.

Awareness and knowledge of causes of respiratory issues and the role of dust

50% of the participating yards do see a connection between air quality and respiratory issues. This shows again that yards are aware of the influence of dust and air in the stable.

On the other hand yard owners think that main cause for airway issues are infections (66.7%), then dust (22%) and allergies (11.1%). This indicates that they are not aware of the role that dust and allergies play in the development of respiratory issues.

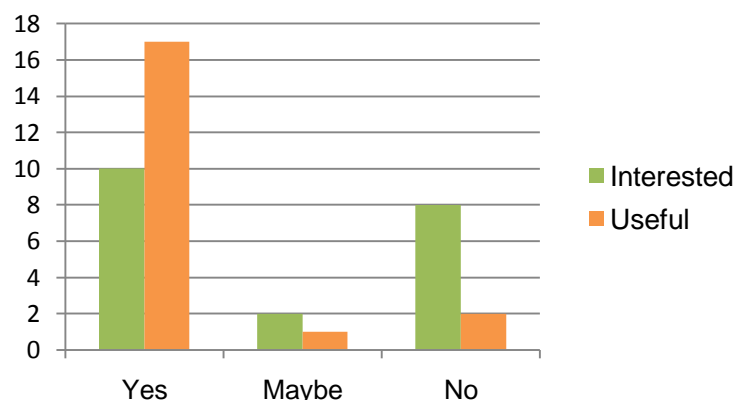
Still 9 out of 20 yard owners say they know the causes of respiratory issues, while 10 out of 20 say that they know the signs and consequences. This shows that not all yard owners are aware of causes, signs and consequences and might therefore not understand the need for the dust extractor machine.

In the end it can be said that approximately half of the interviewed yard owners know the causes and do also see a connection between air quality and respiratory issues.

Interest in the dust extractor machine

The above mentioned number (50% see connection between airway issues and air quality) is conform with the number of yard owners that are interested in the machine. 50% of the interviewed yards said that they are interested in the machine. Additionally did 10% say that they are maybe interested. That means that at least 10 yards are interested in the machine.

Results from question 26 are: 85% of the interviewed yards think that the dust extractor machine could be useful. But when this number is compared to the awareness of causes and the understanding of the connection between respiratory issues, it can be seen that 7 more yard owners thought it was useful than were interested in the machine.



Graph 30: Comparison of the amount of interviewed yards owners that are interested in the machine and that think that the machine could be useful.

This can be due to the fact that the question whether they think the machine could be useful was asked after the presentation of the machine and some background information. This indicates that the yard owners need more information about the machine, perhaps in connection to some background information as in the “info-pack” to be open to such a product as the dust extractor machine.

On the other hand may people think that the machine could be useful, but are not interested in it, because they do not have respiratory issues at their yard. However they do see that overall, or for example for other yards that do have problems with respiratory issues, the machine could be useful. The result that only 50% of the yards are interested in the machine may be less than one would have expected, because the literature suggests that it is a common problem and therefore more people may be interested.

Considering that the dust extractor machine is also useful to prevent horses to get respiratory issues makes the group of 85% of the yard owners that think that the machine is useful and 65% see respiratory issues as a problem as potential customers. That means:

10 people interested in machine (the above mentioned 50%)
+ 7 that think the machine could be useful (35%)*
(not counting the ones that are “maybe” interested or think the machine is “maybe” useful)
(*17 (85%) think it is useful – 10 (50%) that are interested in it = 7 (35%))

That makes 10 potential buyers and 7 that see the benefit, but may need to be convinced to buy. This is most relevant for the potential sales of the dust extractor machine and indicates that there is a market.

Respiratory issues seen as a problem

13 yards said that respiratory issues are a problem in regard to welfare and sport performance, thus only 11 yards do have experience with respiratory issues. This also indicates that even though some yards do not have respiratory issues at their yard, they still see them as a problem in general. This problem can be improved with the help of the dust extractor machine. Turning point is for the people that have this problem or think it could become a problem to become aware that the dust extractor machine could be the solution.

Investments

To find out how much yards have already spent on respiratory issues, several questions in the interview were focused on the treatment of respiratory issues. Most important point was to find out the costs for respiratory treatment. Six of the yards with respiratory issues have spent less than 100€ on the treatment per horse, one yard spent between 100 -200€ and one spent more than 500€. That makes a total cost for medical treatments of respiratory issues of 200-300€ for 2 (the average amount of sick horses) per year. This shows that even though the expenses made due to respiratory issues were rarely above 500€, they did spend money on it. But in contrast to that, did only two yard owners say that they have made financial losses due to respiratory issues.

12 of the interviewed yards say that they would invest “everything it takes” to improve respiratory issues. This indicates that they are willing to invest. On the other hand did an evaluation of the comments made by the yards during the interview show that 4 of the yard owners thought that the machine is too expensive. But that still leaves 16 yards* that are willing to invest to improve respiratory issues or issues connected to the ABRO.

* (12 that invest everything it takes + 3 that would invest 500-1000€ + 1 that would invest 2000-5000€ = 16 yards open to invest)

Comparison investments yards - veterinarians

Results in the interview with veterinarians showed that veterinarians think that yards mainly look for an easy solution (36%). But they also thought that yards are willing to invest either money and no time (9.1%) or money and time (18.2%). That would then mean that 27.3% of the interviewed veterinarians think that yard owners are willing to invest money (27.3% = 9.1% willing to invest money, no time + 18.2% willing to invest money and time). Veterinarians (5 vets) do also think that most yards would invest 500 -1000€. Here it has to be considered that it is a personal opinion of 5 veterinarians and is therefore subjective. Combined these results match the results found in the yards and indicate that most yard owners are willing to invest in respiratory (and ARBO) issues.

Treatments and awareness of the role of the environment

Most often used treatment for respiratory issues by yard owners is medication (80%). Special feed and change in the environment were both second with 30%. This again shows, like already discussed above, that not all yard owners are aware of the importance of the environment (air quality / dust) in regard to airway disease development and cure. Veterinarians however say that the most common treatments are:

Medication (100%)

Environmental control (81.8%)

The literature showed similar findings, but always placed environmental control as most important. Also in regard to medication; as Dr. Laan (2010) and Robinson (2001) said: medication as treatment can only be effective if the environment of the horses is improved.

This shows that yard owners are not as well informed as they might think, but also that a few veterinarians might not be totally informed. If both groups and especially the yards would be aware of the influence of the environment, then the chances are higher that they will see the use of the dust extractor.

Frequency of respiratory issues

Literature said that about every second horse suffers from airway diseases, and even though 55% of the interviewed yards had experience with respiratory issues; so more than every second yard, these numbers do not confirm that every second horse has nor had respiratory issues. Most of the interviewed yards have more than 25 horses and most of them say that 1-5 horses of these 25 had respiratory issues. That means that less than half of the interviewed yards have experience with respiratory issues. Therefore these findings do not match the findings in the literature. This can be due to that fact, that many signs for respiratory issues are easily overseen or that dressage or jumping horses do not train that hard to show these signs, as described in the literature review. You cannot always see the disease on the outside of the horse, but it is there. Horse owners only see a limited % of horses with problems. Therefore the problem may be underestimated amongst horse owners. It could be that some horses showed "only" a mild cough and the yard owners did not see that as a respiratory issue and therefore counted in this study as "no airway issues". In a study with medical examinations that can be different.

For Hurkyson that means that the "core" problem is not as big as expected, or it is not seen as such a common problem by yards. The problem of respiratory issues does exist.

ARBO

Another concern of the company Hurkyson was that dust concentrations in the horse stable do not only have a negative effect on horses, but also on humans. In this research 3 out of

the 20 interviewed yard owners have experienced health problems due to the stable environment (2 airway issues). Still only 5 yard owners were not familiar with the ARBO, all others (15) were familiar with it. Out of these, 5 yards had to adapt something in their stable (5 yards: safety updates and 1 yard: ventilation system). 6 yard owners see the ARBO regulations as an issue that they need to address in the future (+ 1 does maybe). This shows that most yards are familiar with the ARBO, but do not necessarily see it as an issue they will have to address.

In regard to the dust extractor machine that means that this is not such a strong market “base” as respiratory issues are. The ARBO is important, but as there are also no regulations, only guidelines for dust concentrations in stables, is that not a reason for a company to buy the dust extractor machine.

Veterinarians involved

45% of the yard owners that had experience with respiratory issues contacted a veterinarian to treat the horse(s) with respiratory issues. One yard owner (9%) said “sometimes” the veterinarian is called. So ca. 50% of the yards that have experience with respiratory issues, do call the veterinarian for treatment. On one site that indicates that half of the yards with respiratory issues are willing to spend money to improve the problem the horse has, but on the other hand that veterinarians do not play such an important role for yards in regard to the treatment of respiratory issues. Only half of the yard owners called their vet. That means for Hurkyson that only half of the yards with respiratory issues are being reached via veterinarians. So another channel to reach the remaining half is necessary.

5.2 Veterinarians

Frequency of respiratory issues

Just as the results about frequency of respiratory issues from the yards interviews, do also the results from the veterinarians interviews not match the literature. Most veterinary practices have more than 1000 horse customers per year and most veterinarians (12) say that 10-30% of these have respiratory issues. 9 veterinarians even say less than 10% of their horse patients have respiratory issues. So the numbers of the yards and veterinarians do not match the findings in literature. This may be due to the fact that most research about respiratory issues was done in race horses (mainly gallopers). In the Netherlands is racing not very big, which leads to the next point which might influence the difference in numbers: most research was also done in other countries like UK, USA or Australia and few in Germany. These countries have firstly a bigger horse racing industry, but are also bigger in total. As said above, many signs for respiratory disease may be easily overseen if the horse does not reach maximal cardio-respiratory effort (Gerber 2009). Also did most studies include medical examinations and detailed observations of the horses. This study (Hurkyson-dust extractor) was just a survey.

Again, for Hurkyson this means that there might not be as many airway problems as suspected.

Respiratory issues seen as a growing concern

68% of the interviewed veterinarians do not see respiratory issues as a growing concern. 31% of them do see it as a growing concern. This means that according to the interviewed veterinarians, respiratory issues are not a big problem or at least not a growing problem. Most veterinarians also ranked respiratory issues on average as medium – simple. So there are respiratory issues, but these are not a growing problem.

Awareness and knowledge of causes and the role of dust

As only 2 of the interviewed veterinarians do not see a connection between air quality and respiratory issues and 20 do see a connection, the veterinarians seem to be informed about the influence the environment has on airway issues. Answers to question 19 do confirm this: 19 veterinarians agree that if dust in stables is reduced, respiratory issues will improve. Two further veterinarians said maybe and only one said that they would not improve.

The interviewed veterinarians did also name firstly allergies (45%) and then infections (43%) as cause for respiratory issues, confirming the above. This is also similar to what the literature showed.

Think the machine is useful

Except for one veterinarian and two that said maybe, all veterinarians (19) think that the dust extractor machine could be useful. What is interesting is that the veterinarians did not see all information about the machine before they answered that question and still 86% think that it could be useful. Yards compared to that did see the information about the machine before. However it needs to be considered that the question for the veterinarians was formulated differently (vets: "If there was a machine that improves the dust levels and the respiratory issues, do you think that it could be useful?"; Yards after info-pack: "Do you think that a machine like that could be useful?"). The question for the veterinarians is more "hypothetical" while the question to the yard owners was referring directly to the machine.

This clearly shows that most veterinarians are informed about the influence of environment on respiratory issues.

Awareness of the role of bedding material

Not matching the literature are the answers to question 8: interviewed veterinarians name bedding and roughage as equal cause of dust in the stable. But the literature showed that bedding is main cause. That indicates that veterinarians may not be as well informed about the details on what really causes dust in the stable than they are in the influence dust has on the horse's health.

Awareness of the role of the environment

Most of the interviewed veterinarians check the stables of their patients and advice them to adapt the environment according to the horse's condition. This again shows that they pay attention to the factor environment in the pathogenesis of respiratory issues.

ARBO

Similar to the results in the yards interview regarding the ARBO, are most veterinarians familiar with the ARBO. Only 1 veterinary practice has experience with health problems from staff and this was not related to dust. In this context it has to be considered that not all of the interviewed veterinarians work at a horse clinic and therefore not all veterinarians have horse stables at their practice. The veterinarians that do not work at a practice with horse stables did not answer this question. Of the veterinarians that have answered these questions (17), did 6 see the ARBO regulations as an issue to address in the future, 8 didn't and 3 said maybe.

So most veterinarians are also aware of the ARBO, but if they see it as a problem in regard to respiratory health of their employees is doubtful. It is also difficult to draw a conclusion whether it is an issue to address in the future for veterinarians because the numbers are so close (47.1% say no, 35.3% say yes and 17.6% say maybe).

Interest to support dust extractor machine

Key question in the veterinarians interview is if they would be interested to support the dust extractor machine. 12 veterinarians (55%) would be interested in supporting the introduction. 4 (18%) need more information or more research first and 6 (27%) are not interested in that. The fact that 7 veterinarians more think that the machine is useful than veterinarians are interested to support the product (same as in yards results) can be explained: Most of the veterinarians that did not want to support the product, did not want to do that because they want to keep examining and treating horses and not selling products.

Overall that means for Hurkyson that half of the veterinarians are open to work together with them. So the product may be supported by 12 veterinarians additionally 4 veterinarians say that they need more information, which means that they could also support the dust extractor. This shows that there is more potential to get veterinarians to support the product. It will need to be considered how much more information these additional veterinarians need or what kind of research they need to support the dust extractor. If they request extensive studies with horses, it has to be questioned whether it would be worth to invest in convincing them.

Another result from this research was that only half of the yards with experience with respiratory issues contacted a veterinarian to treat their horses with respiratory issues. This shows on one side that veterinarians are an important factor to get to the yards, but on the other side that it also needs to be focused on other channels to get to the half of the yards that does not call the veterinarian or perhaps those that do not have any problems yet, but could be interested in a machine as a precaution.

Treatments

According to the overall results from the interviewed veterinarians can the treatment of respiratory issues endure from 7-10 days up to more than 4 weeks; the average is 10-21 days. This means for a horse owner or trainer, that the horse cannot be trained or go to competitions during that time. For sport stables that can mean that they are not making money at that time with the effected horse, actually even spend money on the treatment. Additionally are the standard medications according to the veterinarians in this research listed as doping. Therefore can the horse not compete during treatment and until the medication is totally out of the blood.

This is unpleasant for the yard owner and may be a reason to invest in a precaution as the dust extractor machine.

6. Conclusions

Purpose of this research was to provide the company Hurkyson a better understanding of the target market for the dust extractor product, and to find out whether the planned market approach will be appropriate. The company is planning to launch the dust extractor in September 2010 and would like to involve veterinarians in the introduction of the dust extractor machine to the market.

This chapter will summarize the key findings and will give answers to the research questions and clarify what this means for the introduction of the dust extractor machine to the market.

First objective of this research was to give insight in the equine market, in particular in the group of professional sport yard owners. Second objective was to show whether the planned market approach via veterinarians is appropriate. Based on the results of this research the following conclusions can be drawn:

- There is a market for the dust extractor machine from Hurkyson. Half of the interviewed veterinarians are interested in the dust extractor and further 30% think it is useful. This indicates that there are further potential customers.

The research has shown that respiratory issues are not as common as literature suggested. Reason for that could be those yard owners do not recognize them as such. However, most yards:

- see respiratory issues as a problem.
- are not totally aware of the influence of dust on respiratory issues.
- are aware of the role of bedding regarding dust concentrations.
- are not aware of the causes of respiratory issues.
- are willing to invest to improve respiratory (and ARBO) issues.
- The ARBO is not seen as an issue that needs to be addressed in the future.

To summarize, although yards are not fully aware of all aspects connected to respiratory issues, they are willing to invest in improving or preventing them.

Veterinarians in comparison are aware of most aspects connected to respiratory issues. Even though they do not see them as a *growing* concern, most of them think that the dust extractor machine is useful.

Regarding the intended strategy of Hurkyson to collaborate with veterinarians for the introduction of the dust extractor machine to the target market, the research shows that most veterinarians are interested in supporting the dust extractor. Therefore the following conclusion can be drawn:

- The planned market approach for the dust extractor machine is appropriate.
- Veterinarians may work on commission base or hand out info material about the dust extractor machine

Limitations of this study and further enhancements

In total it can be said that this research would have had stronger results if the groups of participants were bigger. For example correlations would have been possible then. Due to the limited time span for the research this was not possible. For further research it is to advice that veterinarians should be interviewed at late summer or winter. This research was conducted in the breeding season, which is a busy time for veterinarians, but also for some yards. Therefore another, more quiet season would be more efficient.

6.1 Recommendation

For the company Hurkyson these findings show that there is a market for their new product and that their planned market approach, through veterinarians, is appropriate.

Based on the results of this research it is recommended to focus on the target group (yard owners) and raise awareness about respiratory issues and their causes, the role of dust in relation to respiratory issues and most importantly the benefits of the machine. Therefore it is advisable to advertise the product for example in combination with an article on the topic in a magazine. This approach gives the opportunity to inform the target group better about the problem and at the same time present “the solution” to it. The interviewed veterinarians also recommend this approach for the end user but also for veterinary magazines.

An additional approach could be a brochure that explains the benefit of the dust extractor machine in connection to respiratory issues. Due to the fact that veterinarians are interested in handing out info material about the dust extractor, the development of a brochure is recommended.

The internet is becoming more and more important in regard to brand management, also in the equine industry. Therefore it is also recommended to present the dust extractor machine on the internet. This could be done over the regular homepage of Hurkyson, or the dust extractor could have an own brand page, e.g. <http://www.dustextractor.com>. The info brochure could also be presented and distributed over the internet.

Overall it can be said that riding and equestrian sport are an emotional hobby. Riders care about their horses and are concerned about their horses' health and wellbeing. The sales figures of the equestrian market (presented in chapter 2, 2.6 The Dutch equine industry) confirm this.

This research shows that some veterinarians are willing to support the dust extractor machine, and it also shows that some yards contact veterinarians for help and advice for respiratory issues of their horses. That means that it is important to inform both, the target group and the veterinarians about the product. When the yard owner hears/ reads about the product and asks his/ her veterinarian for advice, it is important that the veterinarian is then informed about the benefits of the product. Here it would be helpful if the veterinarian had brochures of the dust extractor machine.

One of the interviewed veterinarians suggested advertising first in veterinary magazines and then in magazines for the target group (see list of magazines in 5. Discussion). When the horse owners then ask their veterinarian for advice they may already be informed. In case some veterinarians have not read/ heard about the product at that point, they will then look for more information on the product to be able to advise their customers. That is the point when Hurkyson could offer further information to the veterinarians; for example info-evenings/ symposiums or direct (postal) mailings.

As also half of the interviewed yard owners do not contact their veterinarian for the treatment of respiratory issues it is recommended to find other channels to get to this group.

Veterinarians recommended the magazines “Hoefslag”, “Bit” and “Het sportpaard”. But also the brochure and the internet are appropriate for this group.

Veterinarians to collaborate with Hurkyson to introduce the dust extractor should be focused on horses and preferable have either no specific specialization or a specialization in internal diseases. Reason for that is that veterinarians who are specialized in for example breeding

often assign other veterinarians for their cases with internal diseases or other problems outside his field of expertise. It would be inefficient to invest in these veterinarians, because they do not deal with a lot respiratory cases.

According to findings in this research horses have the most respiratory issues from autumn to spring. Therewith the planned time to launch the dust extractor, in September 2010 is appropriate. But also for the marketing of the dust extractor that means that these seasons are the most efficient to make advertisements.

For any further research on this topic it may also be advisable to do it in autumn, winter or spring because the possibility is higher that more horses show signs of respiratory disease at that time.

Another point for further research is the other part of the target group from the dust extractor: Horse owners that keep their horses at a private stable. That group was excluded from this research due to the limited time span.

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8. Appendices

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1. Dust extractor machine

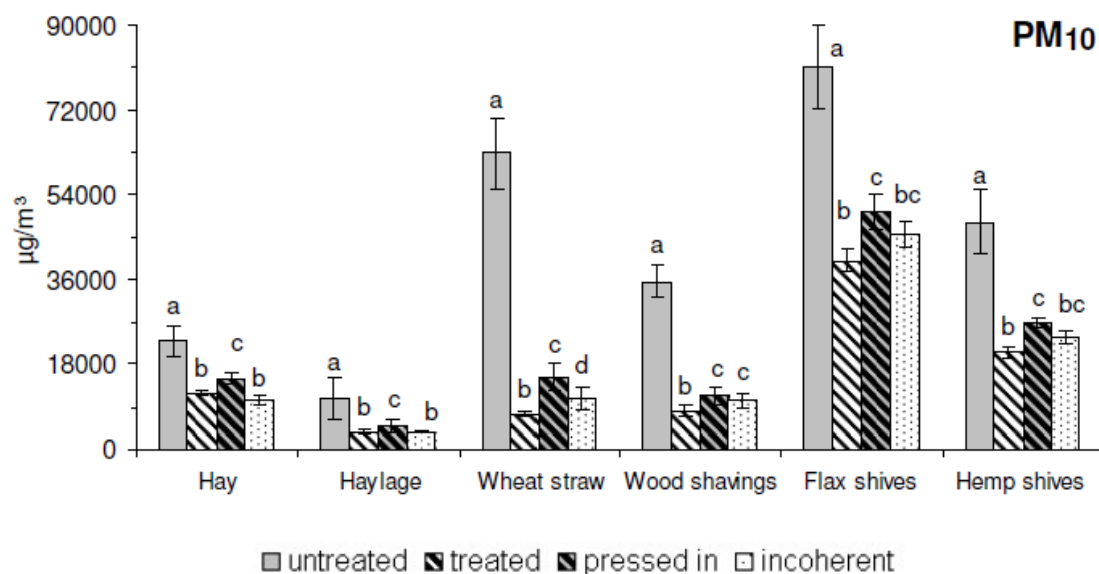


Figure 1: Mean maximal airborne particle concentrations PM₁₀ of all untreated, treated, storage pressed (8 weeks) and storage incoherent (8 weeks) materials.

2. Interviews

Yards questionnaire with explanations

Question 1. "How many horses do you have?" and

question 2. "How many active sport horses (do you have)?"

Question 1 and 2 were designed to find out how big the yards were and how many of these horses were active in the sport. This was interesting because sport horses usually spend more time in the stable.

Question 3. "How many hours per day are these horses in their stables?"

Question 3 was designed to find out if these sport horses actually spend more time in the stable and if there are differences between the disciplines. This will be valuable for Hurkyson, as they can define their target group better.

Question 4. "What kind of stable?"

Question 4 was designed to find out was designed to see how most sport horses are stabled. Later this can be compared to number of respiratory issues or to disciplines.

Question 5. "Are the horses inside during stable work (cleaning)?"

Question 5 is valuable as previous research showed that dust contents in stables are significantly higher during stable work and horses should not be in the stables 15-30 min after stable work (Art et al. 2002; Haake 1992). Through this question it can be compared if sport horses that are inside during stable work actually show more respiratory issues.

Question 6. "On what kind of bedding material are your horses stabled?"

Question 8. "What kind of roughage do you feed your horses?"

Question 6 and 8 will be interesting for the size of the machine. If most stables use loose materials for example, then the machine does not need a tool to loosen the materials and it might not be promoted as much.

Question 7. "Why did you choose that bedding material?"

Question 6.I and 8.I. "What size of bales do you use?"

Question 7 and 8-I builds up on question 6 or 8. They are designed to find out if the yard owners have already considered the influence on air quality and the respiratory system of the horse when they chose the bedding or roughage material.

Question 9. "Do you have experience with respiratory issues?"

Question 9 is one of the key questions and also a filter question. It is designed to find out if respiratory issues really are that common and also it can be compared between disciplines and regions. If the yard owners do not have experience with respiratory issues they can continue with question 16.

Question 10. "How many horses with respiratory issues do you have per year?"

Question 10 is again to see how many horses actually suffer under respiratory issues. This is interesting for Hurkyson to see if only few horses in a stable are affected or more. This can also influence the size and demand for the machine.

Question 11. "In what period of the year do your horses have the most respiratory issues?"

Question 11 is designed to find out if there is a certain period of the year when most horses are affected. This will be useful for the promotion of the product.

Question 12. "Do you know what caused these issues?"

Question 12 is designed to find out how good yard owners are informed about causes of respiratory issues. This is interesting to estimate the awareness and knowledge about that problem and to evaluate the demand for the machine.

Question 13. "Did you call the veterinarian?"

Question 13 is designed to find out how much the yards had to invest to solve the respiratory problem. This gives an insight in how much the yards are willing to invest and answers the research sub-question number 2: Are professional horse/ yard owners interested/ willing to invest to improve the above mentioned (respiratory) problems?

Question 14. "How did you treat these issues?"

Question 14 is connected to the veterinarian interview. It is designed to find out if they did use medicine. In the veterinarian interview these medications are clarified, especially their influence on competitions. If the sport horses are treated medicine that are specified as doping, then the horse can not compete and that again has a negative influence on the owner who wants to compete. Often competing is connected with a lot of money, if the horse is not shown or not successful at a lot of shows, it is not worth as much (ref???).

Question 15. "What do you know about these diseases?"

Question 15 again gives clarity how much yard owners know about the respiratory problems and therewith contributes to research sub-question number 1: To what extent are professional horse/ yard owners and veterinarians aware of respiratory problems and airway diseases like IAD and RAO?.

Question 16. "Do you see respiratory issues as a problem?"

Question 16 is designed to show if respiratory issues really are seen as problems that need to be solved, in this case with the dust extractor machine.

Question 17.

"What has according to your experience the highest influence on dust in the stable?"

Question 17 is a sort of "check-up" on question 7 and 8-I to find out if yard owners know what really causes the dust. If they know that bedding and roughage materials cause the most dust (Crichlow, Yoshida et al. 1980; Clarke and Madelin 1987; Clarke and Madelin 1987; Webster, Clarke et al. 1987; Woods, Robinson et al. 1993) then the chance is higher that they understand that the dust extractor is useful.

Question 18.

"Do you have experience with health problems from staff due to the work environment?"

Question 19. "Are you familiar with the Arbocatalogus or the Arbeidsinspectie?"Question 20.

"Did you have to adapt anything in your stable or make a plan according to the regulations?"

Question 21.

"Do you see these regulations as an issue that you need to address in the future?"

Questions 18 to 21 are designed to get some clarity of the role and awareness of the Arbocatalogus. The Arbocatalogus recommends that stables have a certain stable climate and air quality. This is difficult to achieve for normal stables (Stigas 2010). The dust extractor machine can improve the stable air and can therewith be useful for stables in that aspect as well.

Question 22. "Did you make financial losses due to...?"Question 23. "To what extent would you be open to invest more to improve these problems?"

Question 22 and 23 are a sort of "check-up" for question 13; there the participants tell how much they have spent on a veterinarian. Question 22 clarifies if this is actually seen as a financial loss and then question 23 shows how much they were willing to invest. This is interesting for Hurkyson to see if the dust extractor machine is within their "budget" or which size- price category machine is probably the most suitable.

Question 24. "If there was a machine that improves the dust levels and the respiratory issues, would you be interested in it?"

Question 24 is designed to answer the research question: Is there a market for the dust extractor machine from Hurkyson? Even though a positive answer to this does not mean that there is a demand for the product, but it shows whether yards are interested in general or not.

Question 25. "What requirements should this machine meet?"

Question 25 is the only open question and is designed to get some advice and tips from the possible customer as to what the machine should be like.

Question 26. "Do you think that a machine like that could be useful?"

Question 26 is asked after the presentation of the product (more info about the presentation see ____). It is also one of the key questions and contributes to answer the research question, whether there is a demand or not.

Vets interview questionnaire with explanations

Question 1. "How many customers do you have on average per year?" and

Question 2. "How many customers per year have respiratory issues?"

Question 1 and 2 are designed to get an overview of how many horses the veterinarian treats per year and how many of these have respiratory issues. This is relevant as it shows if respiratory issues really are as common as described in the literature.

Question 3. Which respiratory issues are most common?

Question 4.

"How severe were respiratory issues or airway diseases you had in the last year?"

Question 3 and 4 are designed to get an overview of the most common respiratory issues. On one hand to see if these are diseases caused or influenced by dust and on the other hand to see if the veterinarians name diseases like RAO and IAD without being specifically asked for it. Therefore is question 4 an open question, so the interviewee is not influenced by any answer options that are given.

Question 5.

"How many times do you on average have to visit horses with respiratory issues?"

Question 5 is designed to get an idea of the costs for treating respiratory issues as each veterinarian visit costs, also if the horse was not treated. This is an indicator for how much horse owner spend on respiratory issues.

Question 6. "What are the main causes for respiratory issues?"

Question 7. "Do you see a connection between air quality and respiratory issues?"

Question 8. "What are the main causes for dust in the stable?"

Question 6, 7 and 8 are designed to find out if veterinarians know what actually causes these respiratory issues and if they know that dust has an influence on respiratory issues. If they do know that, the machine may be more interesting for them.

Question 9. "How do you normally treat respiratory issues?"

Question 10. "What are the costs for the most typical treatments?" and

Question 10.I "How long do horses on average have to be treated/ medicated?"

Question 11. "Do these medications have an impact on competitions?"

Question 12.

"Do you check stables and give the customers advice about stable management?"

Questions 9 to 12 give an overview of treatments for respiratory issues and their effect. This is interesting as this strongly influences the horse owner in regard to costs connected to respiratory issues. Next to that it is interesting if veterinarians check stable conditions because then they pay attention to that and the dust extractor machine can be recommended as an improvement.

Question 13. "Do you see respiratory issues as a growing concern?"

Question 13 is mainly designed to get an idea if this is a serious problem in the opinion of the veterinarians. If they are, that is an indicator that there is a market for a machine like the dust extractor.

Question 14.

"Do you have experience with health problems from staff due to the work environment?"

Question 15. "Are you familiar with the Arbocatalogus or the Arbeidsinspectie?"

Question 16.

"Do you see the ARBO regulations as an issue that you need to address in the future?"

Questions 14 to 16 are the same as in the yards interview (see above).

Question 17. "If there was a machine that improves the dust levels and the respiratory issues, do you think that it could be useful?"

Question 18.

"What requirements should this machine meet? What would you demand/expect from it?"

Question 17 and 18 are similar as in the interview for yards. Question 17 contributes to answer the research questions; if veterinarians think it is useful and they tell that their clients, then they will probably become interested in it. Question 18, again an open question to simply get some tips and/ or ideas from professionals.

Question 19. "If dust in stables is reduced, do you think that respiratory issues will improve?"

Question 19 is a sort of "check-up" for questions 6 and 7, to see if they think that dust is a relevant factor. Also this question will indicate without a connection to the machine, if the veterinarians believe that a cleaner stable improves respiratory issues. If yes, then the machine is basically useful in their opinion.

Question 20. "Would you be interested in supporting the introduction of this product as a solution to these issues?"

Question 20 is asked after the presentation of the product (more info about the presentation see ____). It is the key question and contributes to answer the research sub-question, whether veterinarians are willing to support this product or not and under which conditions.

Question 21. "What do you think clients look for as a solution for respiratory problems?"

And what do you think are clients willing to spend?"

Question 21 is designed to get an idea of how veterinarians experience and rate their clients in regard to respiratory problems.

Question 22. "What do you think Hurkyson should do to reach Veterinarians effectively to inform them about the product?"

Question 22 is designed to help Hurkyson to get in contact with further veterinarians in an appropriate and effective way.

Info pack

Dust in the equine stable environment



DUST EXTRACTOR REMOVING DUST FROM
BEDDING AND ROUGHAGE

COMPANY: HURKYSON
APRIL 2010

Janna Hueneke
Hogeschool Van Hall Larenstein

Study purpose



- Janna Hueneke
- Bachelor thesis
- *Investigation of a market approach for a dust extractor from bedding materials and roughage*
- For the company Hurkyson
- Equine, leisure and sport
- Hogeschool Van Hall Larenstein, Wageningen
 - Part of Wageningen University

Problem



Respiratory issues and airway diseases
such as:

- RAO (COPD)
- IAD

Stable climate and air quality

References



- Only 5% of chronic coughing horses have a pollen allergy
 - (Deprez, Universiteit te Gent, n.d.)
- Every second horse suffers under airway diseases
 - (Kroehnert, 2009; Mack, 2009)
- Up to 30% of horses are taken out of the top sport due to chronic airway diseases
 - (Fleming, 2004; Dannenbrink, 2004; Wagner, 2008)
- Several airway diseases directly linked with air quality in stables
 - (Fleming, et al., 2008, Haake, 1992, Visser, et al., 2008)

References



- Different sizes of dust particles
- Small particles most dangerous
 - PM10 = aerodynamic diameter $\leq 10 \mu\text{m}$ and smaller (PM5, PM2.5, PM1)
 - Bigger particles (PM 20) not as dangerous
- Travel down into lower airways
 - (Fleming, et al., 2008; Garlipp, et al., n.d.; Deprez, n.d.)
- Dust particles carry mould and fungi spores into airways
 - (Deprez, n.d.; Van Zwam, 2007)
- Bedding material and stable activity have highly significant influence on airborne particle concentration
 - (Fleming, et al., 2008; Haake, 1992)

References



- Contamination of stables is to 80% due to bedding material and only 20% by feedstuff
 - (Garlipp, et al., n.d.)
- Lowest particle concentration in straw-pallets, then wood shavings, then wheat straw
- Highest particle concentration in hemp and linen
 - (Fleming, et al., 2008)

References



- Dust causes also health problems in humans
 - E.g. asthmatic problems
 - (Van Zwam, 2007)
- Arbocatalogus sets guidelines for safe work environment for employer and employee
 - (Stigas, 2010; www.agroarbo.nl; www.arbeidsinspectie.nl)
- Average exposure to endotoxins is 3 times higher than the acceptable dust level of 50 EU/m³
 - (Van Zwam, 2007)

Dust extractor machine



Function

- Dry cleaning of bedding materials and roughages
 - through *movement* and vacuum
- Different sizes and add-ons
 - Small, 2500 €
 - Medium, 4500 and 7500 €
 - Output loose
 - Large, 30-35000 €
 - Output as small compact bales, without string
 - On flatbed trailer
- Tool to loosen material before

Dust extractor machine

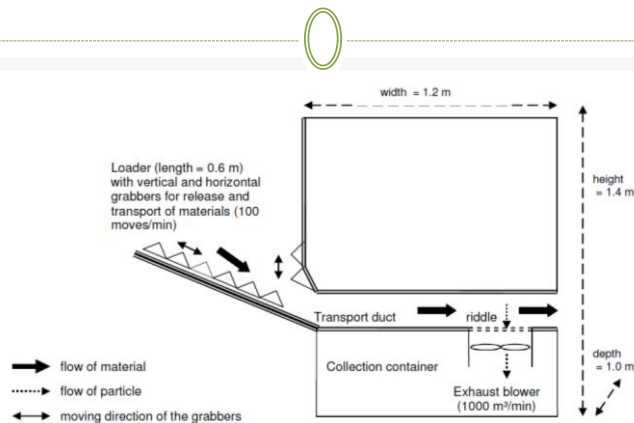


Figure 2. Treatment machine including the particle separation technology.

- big machines include a loader for the material to enter
- three-dimensional movement to loosen small particles before vacuum

Dust extractor machine

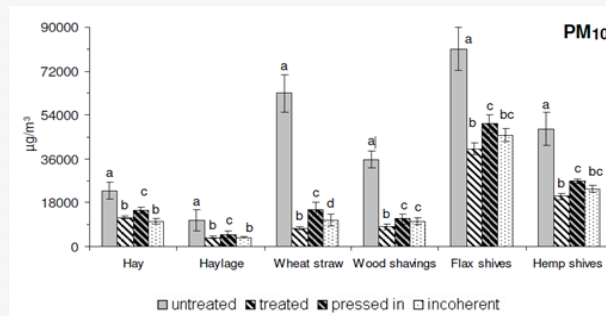
Results

- Research done by Hurkyson with NHB Deurne and Georg-August-University of Göttingen
- Cleaned materials show up to 80% lower airborne particle concentrations compared to the pre processed material
- Reduction of mold development
 - In wood shavings - 92.4%
 - Wheat straw – 88%
 - Hay – 85.8%

Dust extractor machine



- Mean maximal airborne particle concentrations



- Garlipp, F., Hessel, E.F., Van den Hurk, M., Timmerman, M.F., Van den Weghe, H.F.A., The influence of a particle separation technology on the generation of airborne particles from different roughages and bedding materials used for horses, Vechta, Doorwerth, Deurne

Dust extractor machine



Active marketing campaign

- Standwork, articles, bannerimg, big yards/names/users

Role of Veterinarians

- Recommend dust extractor machine as a possible solution
- Hand out flyers and/ or brochures
- Each practice is given a unique reference number
- Customer quotes the unique reference number
- The customer gets a 5% discount
- The vet gets 2-5% comission

Information



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3. Statistic results

Yards

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid 10-15	1	5.0	5.0	5.0
15-20	2	10.0	10.0	15.0
20-25	2	10.0	10.0	25.0
more than 25	15	75.0	75.0	100.0
Total	20	100.0	100.0	

Table 1: 1.How many horses do you have?

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid 10-15	5	25.0	25.0	25.0
15-20	3	15.0	15.0	40.0
20-25	6	30.0	30.0	70.0
more than 25	6	30.0	30.0	100.0
Total	20	100.0	100.0	

Table 2: 2.How many active sport horses?

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid 20-23	11	55.0	55.0	55.0
19-15	7	35.0	35.0	90.0
14-10	2	10.0	10.0	100.0
Total	20	100.0	100.0	

Table 3: 3.How many hours per day are these horses in their stables?

		Responses		Percent of Cases
		N	Percent	
stabletypes(a)	4.aircirculation construction	9	29.0%	45.0%
	4.window	8	25.8%	40.0%
	4.open barn door	9	29.0%	45.0%
	4.ventilation	1	3.2%	5.0%
	4.none	4	12.9%	20.0%
Total		31	100.0%	155.0%

a Dichotomy group tabulated at value 1.

Table 4: 4. What kind of stable do you have?

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid yes	5	25.0	25.0	25.0
no	8	40.0	40.0	65.0
some	7	35.0	35.0	100.0
Total	20	100.0	100.0	

Table 5: 5.Are horses inside during stable work?

		Responses		Percent of Cases
		N	Percent	
6. bedding material ^a	6.straw	16	55,2%	80,0%
	6.wood shavings	10	34,5%	50,0%
	6.flax shives	3	10,3%	15,0%
Total		29	100,0%	145,0%

a. Dichotomy group tabulated at value 1.

Table 6: What kind of bedding material do you use?

		Responses		Percent of Cases
		N	Percent	
reason bedding(a)	7.usability	6	18.8%	30.0%
	7.cheap	2	6.3%	10.0%
	7.good for horses	12	37.5%	60.0%
	7.looks good	4	12.5%	20.0%
	7.easy disposal	2	6.3%	10.0%
	7.other	6	18.8%	30.0%
Total		32	100.0%	160.0%

a Dichotomy group tabulated at value 1.

Table 7: 7. Why did you choose that bedding material?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Hay	14	70.0	70.0	70.0
	Haylage	4	20.0	20.0	90.0
	Silage	2	10.0	10.0	100.0
	Total	20	100.0	100.0	

Table 8: 8.What kind of roughage do you feed your horses?

		Responses		Percent of Cases
		N	Percent	
reason roughage(a)	8.II.easy	6	33.3%	46.2%
	8.II.cheap	1	5.6%	7.7%
	8.II.good for horses	2	11.1%	15.4%
	8.II.nutritional value	4	22.2%	30.8%
	8.II.other	5	27.8%	38.5%
Total		18	100.0%	138.5%

a Dichotomy group tabulated at value 1.

Table 9: 8.II Why did you choose that roughage material?

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid small pressed	1	5.0	5.0	5.0
Big round	3	15.0	15.0	20.0
Big square	15	75.0	75.0	95.0
loose	1	5.0	5.0	100.0
Total	20	100.0	100.0	

Table 10: 8.I.What size of bales do you use?

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid no	9	45.0	45.0	45.0
yes	11	55.0	55.0	100.0
Total	20	100.0	100.0	

Table 11: 9.Do you have experience with respiratory issues?

		Responses		Percent of Cases
		N	Percent	
experienced	9.I.cough/ virus	9	69.2%	81.8%
respiratory	9.I.allergies	3	23.1%	27.3%
issues(a)	9.I.other	1	7.7%	9.1%
Total		13	100.0%	118.2%

a Dichotomy group tabulated at value 1.

Table 12: 9.I Experienced respiratory issues

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid 1-2	6	30.0	54.5	54.5
3-5	2	10.0	18.2	72.7
6-8	1	5.0	9.1	81.8
9-10	1	5.0	9.1	90.9
More than 10	1	5.0	9.1	100.0
Total	11	55.0	100.0	
Missing System	9	45.0		
Total	20	100.0		

Table 13: 10.How many horses with respiratory issues do you have per year?

		Responses		Percent of Cases
		N	Percent	
specific	11.winter	3	17.6%	27.3%
period for	11.spring	4	23.5%	36.4%
signs of	11.summer	1	5.9%	9.1%
disease(a)	11.autumn	5	29.4%	45.5%
	11.no specific	4	23.5%	36.4%
Total		17	100.0%	154.5%

a Dichotomy group tabulated at value 1.

Table 14: 11. In what period of the year do your horses have the most respiratory issues?

12.1 causes for disease ^a	Responses		Percent of Cases
	N	Percent	
12.1 infection	6	54,5%	66,7%
12.1 allergy	1	9,1%	11,1%
12.1 dust	2	18,2%	22,2%
12.1 other	2	18,2%	22,2%
Total	11	100,0%	122,2%

Table 15: 12. Do you know what caused these issues?

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid no	4	20.0	26.7	26.7
yes	10	50.0	66.7	93.3
maybe	1	5.0	6.7	100.0
Total	15	75.0	100.0	
Missing System	5	25.0		
Total	20	100.0		

Table 16: 12.I.Do you see a connection between air quality and airway issues?

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid no	5	25.0	45.5	45.5
yes	5	25.0	45.5	90.9
sometimes	1	5.0	9.1	100.0
Total	11	55.0	100.0	
Missing System	9	45.0		
Total	20	100.0		

Table 17: 13.Did you call the vet?

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid once	2	10.0	28.6	28.6
two times	2	10.0	28.6	57.1
more than 2 times	3	15.0	42.9	100.0
Total	7	35.0	100.0	
Missing System	13	65.0		
Total	20	100.0		

Table 18: 13.I.How many times did the vet have to come?

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid less than 100€	6	30.0	75.0	75.0
100-200€	1	5.0	12.5	87.5
over 500€	1	5.0	12.5	100.0
Total	8	40.0	100.0	
Missing System	12	60.0		
Total	20	100.0		

Table 19: 13.II.How much did you spend on the treatment?

		Responses		Percent of Cases
		N	Percent	
treatment(a)	14.medication	8	50.0%	72.7%
	14.change of feed	3	18.8%	27.3%
	14.change in bedding	3	18.8%	27.3%
	14.other	2	12.5%	18.2%
Total		16	100.0%	145.5%

a Dichotomy group tabulated at value 1.

Table 20: 14. How did you treat these issues?

		Responses		Percent of Cases
		N	Percent	
knowledge(a)	15.causes	9	31.0%	81.8%
	15.signs	10	34.5%	90.9%
	15.consequences	10	34.5%	90.9%
Total		29	100.0%	263.6%

a Dichotomy group tabulated at value 1.

Table 21: 15. "What do you know about these diseases?"

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	no	6	30.0	30.0	30.0
	yes	13	65.0	65.0	95.0
	maybe	1	5.0	5.0	100.0
	Total	20	100.0	100.0	

Table 22: 16.Do you see respiratory issues as a problem?

		Responses		Percent of Cases
		N	Percent	
influence on dust in stable(a)	17.bedding	17	63.0%	85.0%
	17.roughage	1	3.7%	5.0%
	17.sweeping	4	14.8%	20.0%
	17.other	5	18.5%	25.0%
Total		27	100.0%	135.0%

a Dichotomy group tabulated at value 1.

Table 23: 17. What has according to your experience the highest influence on dust in the stable?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	no	17	85.0	85.0	85.0
	yes	3	15.0	15.0	100.0
	Total	20	100.0	100.0	

Table 24: 18.Do you have experience with health problems from staff due to the work environment?

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid no	5	25.0	25.0	25.0
yes	15	75.0	75.0	100.0
Total	20	100.0	100.0	

Table 25: 19.Are you familiar with the Arbocatalogus or the Arbeidsinspectie?

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid no	11	55.0	68.8	68.8
yes	5	25.0	31.3	100.0
Total	16	80.0	100.0	
Missing System	4	20.0		
Total	20	100.0		

Table 26: 20.Did you have to adapt anything in your stable or make a plan according to the regulations?

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid no	12	60.0	63.2	63.2
yes	6	30.0	31.6	94.7
maybe	1	5.0	5.3	100.0
Total	19	95.0	100.0	
Missing System	1	5.0		
Total	20	100.0		

Table 27: 21.Do you see these regulations as an issue that you need to address in the future?

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid no	16	80.0	88.9	88.9
yes	2	10.0	11.1	100.0
Total	18	90.0	100.0	
Missing System	2	10.0		
Total	20	100.0		

Table 28: 22.I.Did you make financial losses due to respiratory issues?

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid no	15	75.0	93.8	93.8
yes	1	5.0	6.3	100.0
Total	16	80.0	100.0	
Missing System	4	20.0		
Total	20	100.0		

Table 29: 22.II.Did you make financial losses due to ARBO regulations?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	500-1000€	3	15.0	17.6	17.6
	2000-5000€	1	5.0	5.9	23.5
	everything it takes	6	30.0	35.3	58.8
	other	7	35.0	41.2	100.0
	Total	17	85.0	100.0	
Missing	System	3	15.0		
Total		20	100.0		

Table 30: 23.To what extent would you be open to invest more to improve these problems?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	no	8	40.0	40.0	40.0
	yes	10	50.0	50.0	90.0
	maybe	2	10.0	10.0	100.0
	Total	20	100.0	100.0	

Table 31: 24.If there was a machine that improves the dust levels and the respiratory issues, would you be interested in it?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	better air quality in stables	4	20.0	36.4	36.4
	reliable dust removal	4	20.0	36.4	72.7
	be simple	1	5.0	9.1	81.8
	low price	1	5.0	9.1	90.9
	lowers flow of bacteria	1	5.0	9.1	100.0
	Total	11	55.0	100.0	
Missing	System	9	45.0		
Total		20	100.0		

Table 32: 25.What requirements should this machine meet?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	no	2	10.0	10.0	10.0
	yes	17	85.0	85.0	95.0
	maybe	1	5.0	5.0	100.0
	Total	20	100.0	100.0	

Table 33: 26.Do you think that a machine like that could be useful?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Drenthe	2	10.0	10.0	10.0
	Friesland	4	20.0	20.0	30.0
	Gelderland	1	5.0	5.0	35.0
	Limburg	1	5.0	5.0	40.0
	North Brabant	5	25.0	25.0	65.0
	North Holland	1	5.0	5.0	70.0
	South Holland	1	5.0	5.0	75.0
	Overijssel	3	15.0	15.0	90.0
	Utrecht	2	10.0	10.0	100.0
	Total	20	100.0	100.0	

Table 34: Where is the yard situated in NL?

6.1 + 8.1 bedding + roughage bales

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	small pressed	1	5,0	5,0	5,0
	big square	15	75,0	75,0	80,0
	100L bag	2	10,0	10,0	90,0
	loose	2	10,0	10,0	100,0
	Total	20	100,0	100,0	

Table 35: Bedding 6.I.What size of bales do you use?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	small pressed	1	5,0	5,0	5,0
	Big round	3	15,0	15,0	20,0
	Big square	15	75,0	75,0	95,0
	loose	1	5,0	5,0	100,0
	Total	20	100,0	100,0	

Table 36: Roughage 8.I.What size of bales do you use?

Veterinarians

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	less than 500	2	9.1	9.1	9.1
	500-700	3	13.6	13.6	22.7
	700-1000	2	9.1	9.1	31.8
	over 1000	15	68.2	68.2	100.0
	Total	22	100.0	100.0	

Table 37: How many customers do you have on average per year?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	less than 10%	9	40.9	40.9	40.9
	10-30%	12	54.5	54.5	95.5
	30-50%	1	4.5	4.5	100.0
	Total	22	100.0	100.0	

Table 38: How many customers per year have respiratory issues?

		Responses		Percent of Cases
		N	Percent	
3. Common respiratory issues(a)	3. RAO	8	23.5%	36.4%
	3. Virus infection	15	44.1%	68.2%
	3. Allergies	6	17.6%	27.3%
	3. Other	5	14.7%	22.7%
Total		34	100.0%	154.5%

a Dichotomy group tabulated at value 1.

Table 39: Which respiratory issues are the most common?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	simple	8	36.4	40.0	40.0
	medium	11	50.0	55.0	95.0
	severe	1	4.5	5.0	100.0
	Total	20	90.9	100.0	
Missing	System	2	9.1		
Total		22	100.0		

Table 40: How severe were respiratory issues or airway diseases you had in the last year?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1x	6	27.3	30.0	30.0
	1-2x	13	59.1	65.0	95.0
	2-3x	1	4.5	5.0	100.0
	Total	20	90.9	100.0	
Missing	System	2	9.1		
Total		22	100.0		

Table 41: How many times do you on average have to visit horses with respiratory issues?

		Responses		Percent of Cases
		N	Percent	
6. respiratory issue cause(a)	6. Infection	15	42.9%	68.2%
	6. Allergy	16	45.7%	72.7%
	6. Other	4	11.4%	18.2%
Total		35	100.0%	159.1%

a Dichotomy group tabulated at value 1.

Table 42: What are the main causes for respiratory issues?

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid no	2	9.1	9.1	9.1
yes, definitely	20	90.9	90.9	100.0
Total	22	100.0	100.0	

Table 43: Do you see a connection between air quality and respiratory issues?

		Responses		Percent of Cases
		N	Percent	
8. dust cause(a)	8. Hay	14	38.9%	63.6%
	8. Bedding	14	38.9%	63.6%
	8. Other	8	22.2%	36.4%
Total		36	100.0%	163.6%

a Dichotomy group tabulated at value 1.

Table 44: What are the main causes for dust in the stable?

		Responses		Percent of Cases
		N	Percent	
9. treatments for respiratory issues(a)	9. Medication	22	50.0%	100.0%
	9. Special feed	1	2.3%	4.5%
	9. Environmental changes	18	40.9%	81.8%
	9. Other	3	6.8%	13.6%
Total		44	100.0%	200.0%

a Dichotomy group tabulated at value 1.

Table 45: What are the most common treatments for respiratory issues?

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid 50-100€	9	40.9	42.9	42.9
100-150€	6	27.3	28.6	71.4
150-200€	2	9.1	9.5	81.0
more than 200€	4	18.2	19.0	100.0
Total	21	95.5	100.0	
Missing System	1	4.5		
Total	22	100.0		

Table 46: What are the costs for the most typical treatments?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	7-10 days	4	18.2	19.0	19.0
	10-14 days	5	22.7	23.8	42.9
	2-3 weeks	5	22.7	23.8	66.7
	3-4 weeks	4	18.2	19.0	85.7
	more than 4 weeks	3	13.6	14.3	100.0
	Total	21	95.5	100.0	
Missing	System	1	4.5		
Total		22	100.0		

Table 47: How long do horses on average have to be treated/ medicated?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	yes	21	95.5	100.0	100.0
Missing	System	1	4.5		
Total		22	100.0		

Table 48: Do these medications have impact on competitions? (doping)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	yes	18	81.8	85.7	85.7
	sometimes	3	13.6	14.3	100.0
	Total	21	95.5	100.0	
Missing	System	1	4.5		
Total		22	100.0		

Table 49: Do you check stables and give the customers advice about stable management?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	no	15	68.2	68.2	68.2
	yes	7	31.8	31.8	100.0
Total		22	100.0	100.0	

Table 50: Do you see respiratory issues as a growing concern?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	no	18	81.8	94.7	94.7
	yes	1	4.5	5.3	100.0
	Total	19	86.4	100.0	
Missing	System	3	13.6		
Total		22	100.0		

Table 51: Do you have experience with health problems from staff due to the work environment?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	no	2	9.1	9.1	9.1
	yes	20	90.9	90.9	100.0
Total		22	100.0	100.0	

Table 52: Are you familiar with the Arbocatalogus or the Arbeidsinspectie??

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	no	8	36.4	47.1	47.1
	yes	6	27.3	35.3	82.4
	maybe	3	13.6	17.6	100.0
	Total	17	77.3	100.0	
Missing	System	5	22.7		
Total		22	100.0		

Table 53: Do you see the ARBO regulations as an issue that you need to address in the future?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	no	1	4.5	4.5	4.5
	yes	19	86.4	86.4	90.9
	maybe	2	9.1	9.1	100.0
	Total	22	100.0	100.0	

Table 54: If there was a machine that improves the dust levels and the respiratory issues, do you think that it could be useful?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	better air quality	3	13.6	17.6	17.6
	really works	10	45.5	58.8	76.5
	simple	1	4.5	5.9	82.4
	low price	2	9.1	11.8	94.1
	not much	1	4.5	5.9	100.0
	Total	17	77.3	100.0	
Missing	System	5	22.7		
Total		22	100.0		

Table 55: What requirements should this machine meet? What would you demand/expect from it?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	no	1	4.5	4.5	4.5
	yes	19	86.4	86.4	90.9
	maybe	2	9.1	9.1	100.0
	Total	22	100.0	100.0	

Table 56: If dust in stables is reduced, do you think that respiratory issues will improve?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	no	6	27.3	27.3	27.3
	yes	12	54.5	54.5	81.8
	need more info/ see it first	4	18.2	18.2	100.0
	Total	22	100.0	100.0	

Table 57: Would you be interested in supporting the introduction of this product as a solution to these issues?

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid hand out flyer/ info	3	13.6	100.0	100.0
Missing System	19	86.4		
Total	22	100.0		

Table 58: What would be an interesting option for you?

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid depends	2	9.1	11.1	11.1
easy solution	8	36.4	44.4	55.6
willing to invest money but no time	2	9.1	11.1	66.7
willing to invest money and time	4	18.2	22.2	88.9
other	2	9.1	11.1	100.0
Total	18	81.8	100.0	
Missing System	4	18.2		
Total	22	100.0		

Table 59: What do you think clients look for as a solution for respiratory problems?

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid 500-1000€	5	22.7	55.6	55.6
2000- 5000€	1	4.5	11.1	66.7
less than 500€	3	13.6	33.3	100.0
Total	9	40.9	100.0	
Missing System	13	59.1		
Total	22	100.0		

Table 60: And what do you think are clients willing to spend?

		Responses		Percent of Cases
		N	Percent	
22. ways to inform veterinarians(a)	22. via post	5	14.7%	23.8%
	22. via e-mail	6	17.6%	28.6%
	22. via phone	1	2.9%	4.8%
	22. via newspaper	12	35.3%	57.1%
	22. via symposium	10	29.4%	47.6%
Total		34	100.0%	161.9%

a Dichotomy group tabulated at value 1.

Table 61: What are the most effective tools to reach veterinarians to inform them about the dust extractor machine?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Drenthe	1	4.5	4.5	4.5
	Friesland	1	4.5	4.5	9.1
	Gelderland	7	31.8	31.8	40.9
	Limburg	1	4.5	4.5	45.5
	North Brabant	5	22.7	22.7	68.2
	North Holland	1	4.5	4.5	72.7
	South Holland	3	13.6	13.6	86.4
	Overijssel	3	13.6	13.6	100.0
	Total	22	100.0	100.0	

Table 62: Where is the Vet situated in NL?

Yards and veterinarians comparison

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	no	6	14.3	16.2	16.2
	yes	30	71.4	81.1	97.3
	maybe	1	2.4	2.7	100.0
	Total	37	88.1	100.0	
Missing	System	5	11.9		
Total		42	100.0		

Table 63: Do you see a connection between air quality and airway issues?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	less than 100€	15	35.7	51.7	51.7
	100-200€	7	16.7	24.1	75.9
	200-500€	4	9.5	13.8	89.7
	over 500€	3	7.1	10.3	100.0
	Total	29	69.0	100.0	
Missing	System	13	31.0		
Total		42	100.0		

Table 64: What are the costs for the treatment of respiratory issues?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	no	20	47.6	55.6	55.6
	yes	12	28.6	33.3	88.9
	maybe	4	9.5	11.1	100.0
	Total	36	85.7	100.0	
Missing	System	6	14.3		
Total		42	100.0		

Table 65: Do you see ARBO regulations as an issue that you need to address in the future?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	no	3	7.1	7.1	7.1
	yes	36	85.7	85.7	92.9
	maybe	3	7.1	7.1	100.0
	Total	42	100.0	100.0	

Table 66: Is the machine useful?

				vet or yard		Total
				yards	vet	
what are the costs for the treatment	less than 100€	Count		6	9	15
		Expected Count		4.1	10.9	15.0
	100-200€	Count		1	6	7
		Expected Count		1.9	5.1	7.0
	200-500€	Count		0	4	4
		Expected Count		1.1	2.9	4.0
	over 500€	Count		1	2	3
		Expected Count		.8	2.2	3.0
	Total	Count		8	21	29
		Expected Count		8.0	21.0	29.0

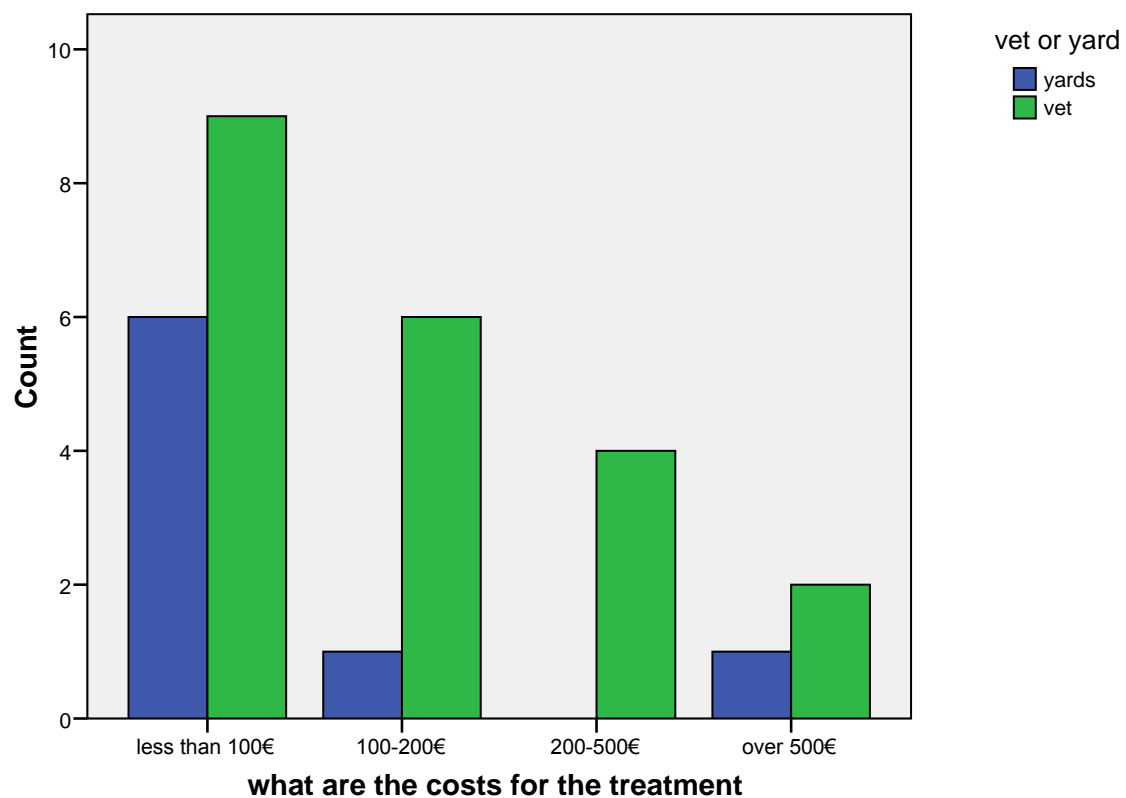
Table 67: what are the costs for the treatment * vet or yard Crosstabulation

	what are the costs for the treatment
Mann-Whitney U	59.000
Wilcoxon W	95.000
Z	-1.327
Asymp. Sig. (2-tailed)	.184
Exact Sig. [2*(1-tailed Sig.)]	.237(a)

a. Not corrected for ties.

b. Grouping Variable: vet or yard

Table 68: Mann-Whitney test; costs for treatment of respiratory issues according to yards and vets



Graph 1 : What are the costs for respiratory issues according to yards and vets?

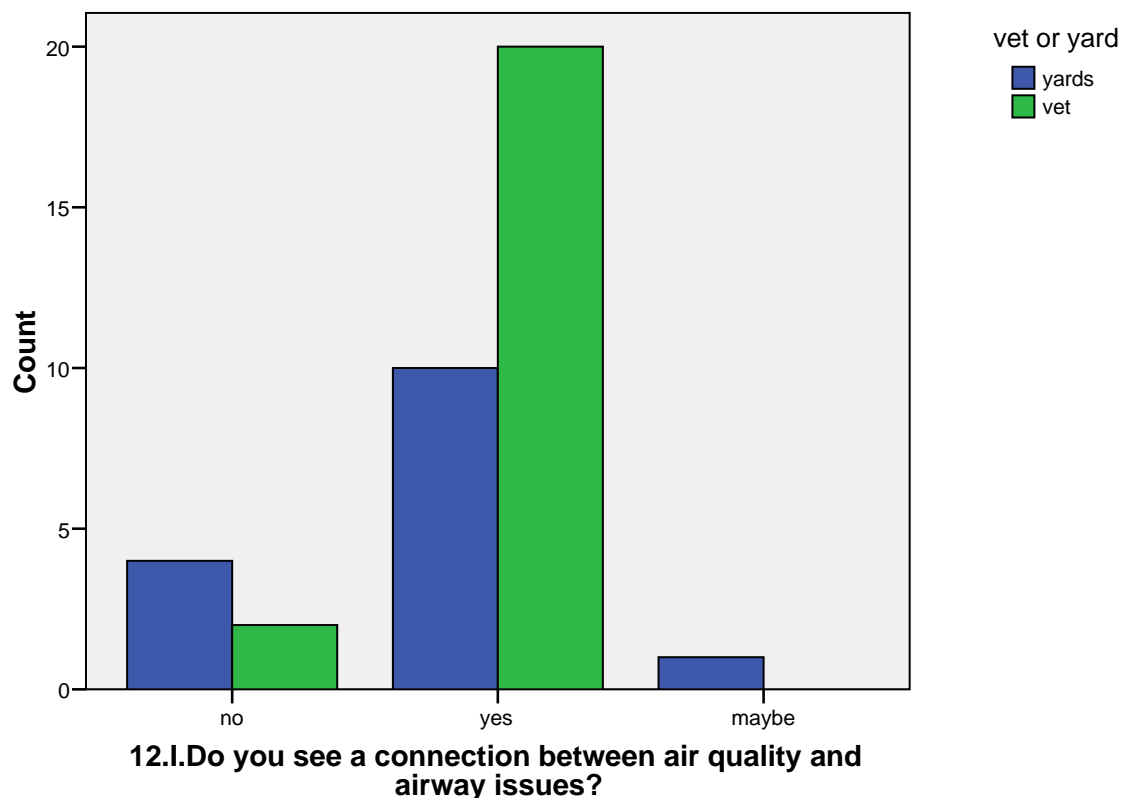
			vet or yard		Total
			yards	vet	
12.I.Do you see a connection between air quality and airway issues?	no	Count	4	2	6
		Expected Count	2.4	3.6	6.0
	yes	Count	10	20	30
		Expected Count	12.2	17.8	30.0
	maybe	Count	1	0	1
		Expected Count	.4	.6	1.0
Total	Count		15	22	37
	Expected Count		15.0	22.0	37.0

Table 69: .Do you see a connection between air quality and airway issues? * vet or yard Crosstabulation

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	3.812(a)	2	.149
Likelihood Ratio	4.132	2	.127
Linear-by-Linear Association	.604	1	.437
N of Valid Cases	37		

a. 4 cells (66.7%) have expected count less than 5. The minimum expected count is .41.

Table 70: Chi-Square Tests; yards and vets see a connection between air quality and airway issues



Graph 2: Do yards and vets see a connection between air quality and airway issues?

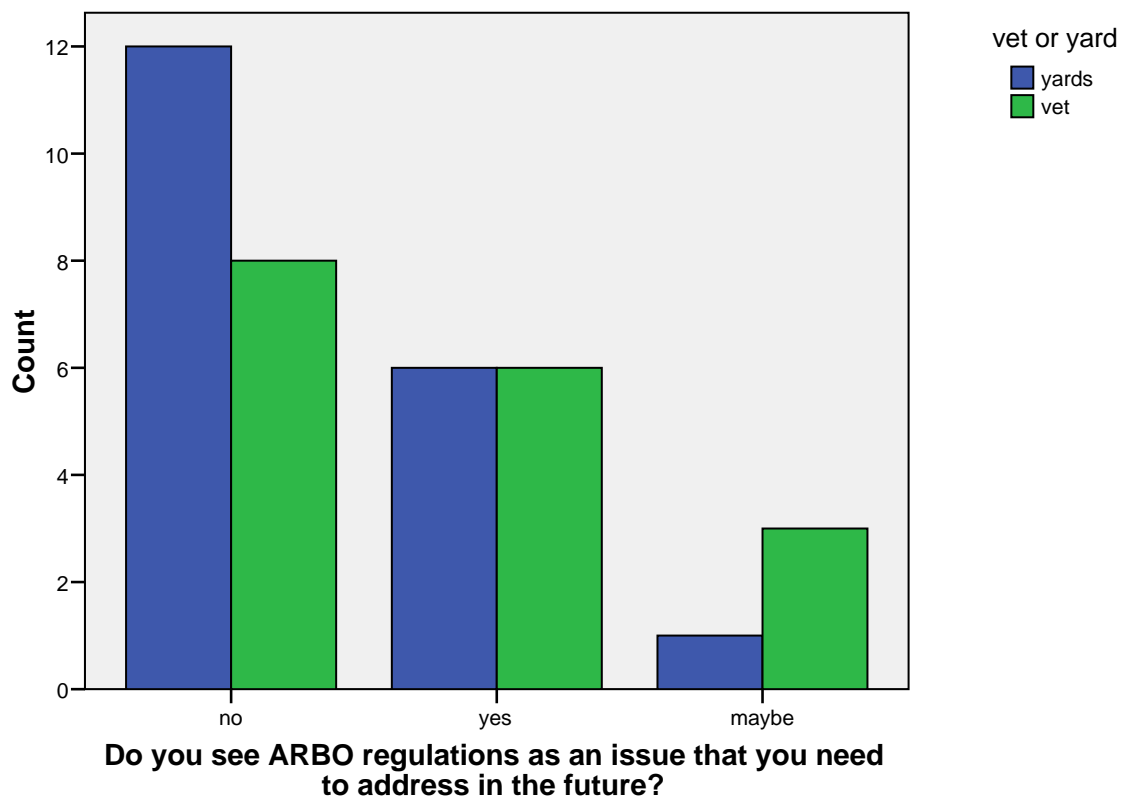
			vet or yard		Total
			yards	vet	
Do you see ARBO regulations as an issue that you need to address in the future?	no	Count	12	8	20
		Expected Count	10.6	9.4	20.0
	yes	Count	6	6	12
		Expected Count	6.3	5.7	12.0
	maybe	Count	1	3	4
		Expected Count	2.1	1.9	4.0
	Total	Count	19	17	36
		Expected Count	19.0	17.0	36.0

Table 71: Do you see ARBO regulations as an issue that you need to address in the future? *
vet or yard Crosstabulation

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	1.694(a)	2	.429
Likelihood Ratio	1.741	2	.419
Linear-by-Linear Association	1.508	1	.219
N of Valid Cases	36		

a. 2 cells (33.3%) have expected count less than 5. The minimum expected count is 1.89.

Table 72: Chi-Square Tests; ARBO as issue to address in the future for yards and vets



Graph 3: Do yards and vets see the ARBO as an issue to address in the future?

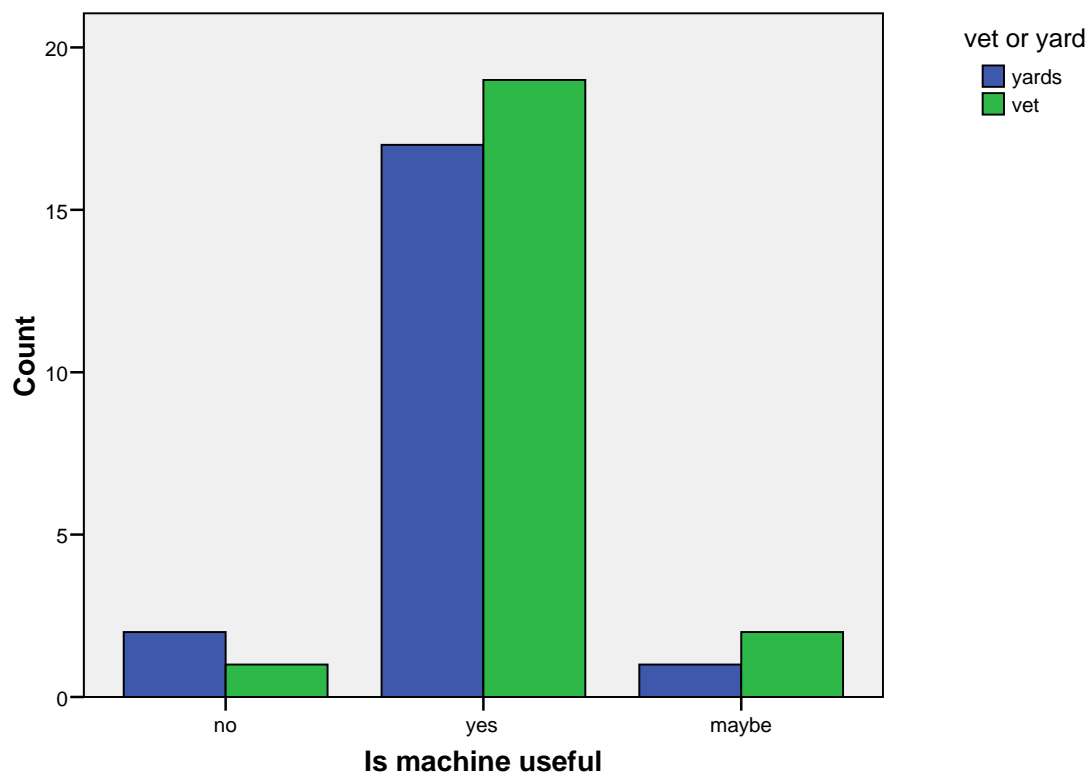
				vet or yard		Total
				yards	vet	
Is machine useful	no	Count		2	1	3
		Expected Count		1.4	1.6	3.0
	yes	Count		17	19	36
		Expected Count		17.1	18.9	36.0
	maybe	Count		1	2	3
		Expected Count		1.4	1.6	3.0
Total	Count			20	22	42
	Expected Count			20.0	22.0	42.0

Table 73: Is machine useful * vet or yard Crosstabulation

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	.684(a)	2	.710
Likelihood Ratio	.695	2	.706
Linear-by-Linear Association	.652	1	.419
N of Valid Cases	42		

a. 4 cells (66.7%) have expected count less than 5. The minimum expected count is 1.43.

Table 74: Chi-Square Tests; machine is useful for yards and vets



Graph 4: Is machine useful according to yards and vets