

# Management of the Isolation Unit when Nursing a Foal with Rotavirus



**Written by:** Michelle McDonald  
**Student No:** D00168892

Word Count: 2,990

## **Table of Contents**

### **Section 1: Introduction**

- Page.....	3
-------------	---

### **Section 2: Rotavirus**

- Page.....	4
-------------	---

### **Section 3: Biosecurity and Biocontainment**

- Page.....	6
-------------	---

### **Section 4: Rotavirus Foal Isolation Management Plan**

- Page.....	7
-------------	---

### **Section 5: Conclusion**

- Page.....	13
-------------	----

### **References**

- Page.....	14
-------------	----

## **Introduction**

The isolation centre is an area of the equine hospital that requires strict management in order to maintain biosecurity. Without a well-functioning isolation centre that can categorically assure disease biocontainment, the risk of contagious disease spread through the equine hospital increases dramatically. Rotavirus is a common, but highly contagious, disease of foals that requires isolation protocols to be implemented from the outset of clinical signs. Effective isolation procedures enable affected animals to recover optimally whilst simultaneously protecting the integrity of the 'healthy' foal unit in the general hospital.

The veterinary nurse has an opportunity to occupy a niche role in isolation centre management and this paper empowers nurses to take control of their own centres to ensure that best practice standards are upheld at all times. The 'Rotavirus Foal Isolation Management Plan' is designed to equip the veterinary nurse with the information required to create an exemplary foal isolation centre with the aim of preventing the transfer of rotavirus from sick foals to immunologically naive neonates. Within this plan, isolation centre set-up, inventory, infection control, personnel, personal protective equipment, barrier nursing, hand hygiene, cleaning and disinfection, and waste disposal are comprehensively expressed with regards to how they should be carried out by the veterinary nurse in response to the mechanisms of rotavirus spread.

## Rotavirus

It is important for veterinary nurses to understand the pathogenesis and mechanisms of equine rotavirus prior to caring for an affected foal in isolation so that the most appropriate controls can be implemented to ensure effective biocontainment (*see figure 1*). Rotavirus, from the *Reoviridae* family, is a non-enveloped RNA micro-organism (Darling and Jones 2012), transmitted via contact with infected faeces (Quinn and Markey 2012). The non-lipid structure at the core of the virus means that it is resistant to certain chemical agents (Quinn and Markey 2012).

Disease	Agent and Incubation Period	Mode of Transmission	Clinical Signs	Diagnostic Tests	Disinfection	Biosecurity
Rotavirus.	Rotavirus Group A. 12-24 hrs.	Faecal-oral route: spreads via contact with infected faeces and fomites.	Mild to life-threatening diarrhoea.	Faecal swabs (Virogen, Rotatest, Rotazyme, ELISA).	Phenolic disinfectants.	Isolation procedures and barrier nursing.

**Figure 1:** Rotavirus breakdown (Greet 2008).

Rotavirus is a common presentation in neonates and young foals under two months of age (Bernard and Barr 2012). Adult horses, most of which have antibodies to the virus, are the primary source of foal infection as they shed particles of the virus in their faeces but do not succumb to clinical infection (Bernard and Barr 2012). Immunologically naïve neonates ingest the rotavirus pathogens via the faecal-oral route and a local infection manifests in the gastrointestinal tract (Cullinane 2017). Due to the non-vaccination of the broodmare, in many cases, the foal will not have received enhanced antibodies from the colostrum required to fight rotavirus infection (Lane 2016).

The virus replicates in the cells of the intestinal villi which leads to destruction of the microvilli brush-border and underlying enterocytes (Colville 2008), impairing the ability of the GIT to absorb nutrients from the mare's milk (Bernard and Barr 2012). Diarrhoea is frequently seen as the most common characteristic of rotavirus as the intestinal tract is flooded with water to help remove undigested milk (Dwyer 2000). Lactase can no longer be produced by the destroyed microvilli, inducing an osmotic diarrhoea effect (*see figure 2*) as lactose passes

undigested through the large intestine (Stewart 2016). It is often profuse, watery and heavily contaminated with the viral pathogen; resulting in a disease that is highly contagious and difficult to control with regular cleaning and disinfection (Bernard and Barr 2012).

Due to the low minimal infective dose of rotavirus, its resilience in the environment and its resistance against many types of disinfectants, outbreaks often occur (Sattar et al. 1994). Complications resulting from rotavirus outbreaks include severe epidemics in neonates (Bernard and Barr 2012), so excellent isolation management procedures are required alongside optimal nursing care of the patient in order to prevent the spread of rotavirus between hospitalised foals and to optimise patient recovery (Greet 2008).



**Figure 2:** Osmotic diarrhoea in a foal with rotavirus (Conley-Koontz Equine Hospital 2017).

## **Biosecurity and Biocontainment**

Biosecurity refers to all of the measures that can be implemented to prevent the transmission of disease (Ruple et al. 2012) and it is implicated in areas such as animal welfare, human health, international trade and legal accountability (AB.VMA 2014). Management of a foal isolation unit with the goal of biocontainment – i.e. successfully confining the rotavirus to the isolation unit – will help to ensure biosecurity throughout the entire foal unit of the general hospital. Veterinary nurses can occupy a niche role in isolation management and a well-controlled isolation unit will protect the integrity of the hospital. Specific biosecurity measures should be tailored to each individual case (AAEP 2017), so this is why it is so important for veterinary nurses to understand the mechanisms of the disease prior to preparing the isolation unit. The nurse should devise an Isolation Management Plan to supplement the patient's medical care plan.

Important factors to consider when drawing up the Isolation Management Plan include:

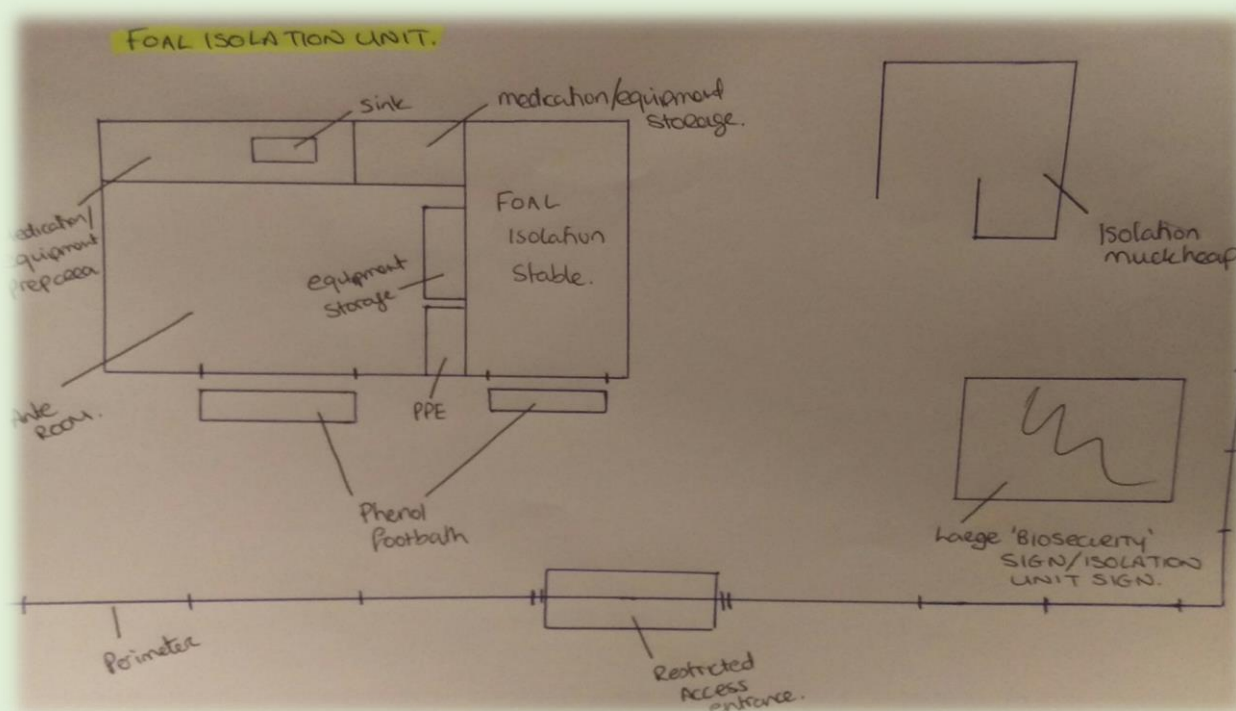
- ✓ Isolation centre set-up
- ✓ Isolation centre inventory
- ✓ Infection control plan
- ✓ Isolation personnel
- ✓ Personal Protective Equipment
- ✓ Barrier nursing
- ✓ Hand hygiene
- ✓ Environmental cleaning and disinfection
- ✓ Waste disposal

Rotavirus transmission between foals occurs mainly via the faecal-oral route (AAEP 2017) and is also spread through fomites – i.e. inanimate transmitters of disease – (Moreira 2017b), such as clothing, brushes and PPE (Sattar et al. 1994; AB.VMA 2014), therefore, these causative factors should form the foundations of the Isolation Management Plan.

## Rotavirus Foal Isolation Management Plan

### 1. Isolation Centre Set-Up

The isolation centre should ideally be a stand-alone, self-contained barn (Zimmel 2009) some distance away from the main hospital (UT VETV 2012) (*see figure 3*). This is to avoid any potential disease transmission between foals with rotavirus and the unaffected, but immunologically susceptible, neonates and paediatrics in the main foal unit (Sonder 2015). The centre should comprise of a unit for the foal and an ante-room for storage and preparation of all isolation medications and equipment specific to the individual patient (Slovis et al. 2012). The isolation stall should be constructed with non-porous materials suitable for high-level surface cleaning and disinfection (Zimmel 2009).



**Figure 3:** Sample foal isolation unit (design by author).

The ante-room should contain a water and electricity supply, sink, handwashing facilities, and medication preparation area (Zimmel 2009). The design of the isolation unit should be under negative pressure which functions to suck air into the facility, thereby preventing the inadvertent transmission air out of the unit when opening and closing the door (Emory University 2014). Traffic around the isolation unit should be restricted to isolation personnel only (Greet 2008), so the perimeter may be cordoned off, preferably using a permanent structure such as a fence or wall (AB.VMA 2014). It is ideal to create a sign for the door of the



isolation unit and the gate opening into the enclosed yard clearly stating “Isolation Centre: Authorised Personnel Only”, to deter staff, clients or students from entering the facility (Emory University 2014; AB.VMA 2014).

## **2. Isolation Centre Inventory**

Rotavirus particles can be transmitted via fomites, so it is important that everything in the isolation room is either disposable, or can be cleaned and disinfected or sterilised. The isolation unit ante-room should be fully stocked at all times, only with equipment and materials used to treat the individual patient (Greet 2008; Zimmer 2009); this not only reduces clutter, but it also forms the basis of effective organisational management of the isolation unit and it reduces the amount of waste produced (Slovis et al. 2012).

It is a good idea for the nurse to create pre-made packs for the foal that can be stored in plastic bags, or cardboard boxes, depending on how much equipment is required. None of the equipment in the isolation centre should ever be returned for use in the general hospital. Some of this equipment includes: wheelbarrow, pitchfork, medications, microwave, disinfectants, cleaning materials and footbaths. The veterinary nurse may decide to label all of the reusable equipment in the isolation unit to prevent accidental removal of equipment that are potential fomites to be introduced to the main hospital (AB.VMA 2014).

## **3. Infection Control Plan**

The veterinary nurse has a crucial role in developing an effective Infection Control Plan; they should take charge of the isolation centre in order to assess, maintain and revise procedures to consistently achieve high levels of infection control (Darling and Jones 2012). In the case of the foal with rotavirus, the nurse should first perform a thorough risk assessment of the situation (AB.VMA 2014) and draw up a procedure highlighting the nature and mode of pathogen transmission, cleaning and disinfection protocols specific to the rotavirus micro-organism and suitable barrier nursing techniques (Ruple et al. 2012).

The risk assessment and plan should be laminated and placed on the wall in the prep room to alert isolation personnel to the specific considerations to be taken into account before they enter the patient’s facility (*see figure 4*).



Hazard	Risk	Risk Level	Plan	Review	Signed/Dated
Faeces infected with Rotavirus. Fomites in the isolation centre.	Transmission of disease throughout the 'healthy' foal unit in the main hospital.	High risk level due to high morbidity associated with the disease.	Barrier nursing, adhere to strict disinfection and waste management protocols.	All isolation personnel will review the plan in two weeks' time (28/02/17).	<i>Michelle McDonald</i> 01/04/17.

**Figure 4:** Example of a risk assessment for the ante-room (AB.VMA 2014).

Using this information, the nurse may co-ordinate a process for evaluation of these procedures, i.e. environmental monitoring should be carried out after the discharge of the foal to ensure that the plan is effective in controlling the virus. Standard culture procedures and Real Time Polymerase Chain Reaction assays (Greet 2008) can be used to detect rotavirus RNA in the environment, so the nurse can take control of this task by swabbing different areas of the isolation unit and sending the swabs to the laboratory to check for its presence (Altona Diagnostics 2017). Negative results will prove that the Infection Control Plan is a useful tool in rotavirus management in the isolation unit, but a positive result requires revision of the risk assessment and entire Rotavirus Foal Isolation Management Plan.

#### 4. Isolation Personnel

Each day, designated isolation staff should be chosen to work in the isolation unit; this means that they are not permitted to re-enter the main hospital for the remainder of the day or until they have fully changed clothing and showered to remove any virus particles they may be carrying on their clothing, skin or hair (Bentz 2014). Isolation personnel should fill out the sign-in sheet in the ante-room so ensure that only personnel supposed to be in the isolation unit are there.

Exceptions to this include visiting professionals and students; in these instances, it is important that the regular isolation personnel – who are trained and are knowledgeable with regards to biosecurity surrounding rotavirus – ensure that standards are maintained as normal. The veterinary nurse can create a fantastic biosecurity programme, but it will only be viable if all isolation personnel fully implement the procedures and can freely interact with the plan (Ruple et al. 2012).

## **5. Barrier Nursing**

Barrier nursing refers to the use of Personal Protective Equipment (PPE) to create a ‘barrier’ of protection between isolation staff and the patient. This technique reduces the risk of cross-contamination between patients and will protect immunocompromised patients from external pathogens that could result in secondary infection to rotavirus (Greet 2008). The foal with rotavirus will be a highly contagious source of infection, especially if diarrhoea is present, so there are a number of different articles of PPE isolation personnel must wear each time they enter the isolation unit. These items include: gloves, isolation footwear, shoe covers, hair cover and biohazard suit (Slovis et al. 2012; Bentz 2014; Sonder 2015; Stewart 2016).

Phenol footbaths (Greet 2008) outside the door of isolation are required for personnel to stand in for the stated contact time – depending on the product used – prior to entering the ante-room (Stewart 2016). It is important to relay to isolation personnel that the PPE must be changed immediately after exiting the isolation stable and returning to the ante-room and must be fully changed between patients (Sattar et al. 1994; Bentz 2014).

## **6. Hand Hygiene**

Hand hygiene is a three-step process: gloves, hand washing and sanitisation in that order. Hand hygiene is the most important infection control procedure to carry out when nursing a foal with rotavirus (Sattar et al. 1994; Greet 2008; Slovis et al. 2012). Iodine and iodophor-based antiseptics are useful preparations for hand hygiene in this case because they are suitable for use against viruses (Slovis et al. 2012). The six-stage handwashing technique (NHSGGC 2017; Moreira 2017b) is advised to optimally remove organic debris (Greet 2008) and contamination from hands after handling a foal with rotavirus. Wall-mounted sanitisers should be placed in the prep room and all personnel should routinely use them upon exiting isolation (Komurek 2014).

## **7. Environmental Cleaning and Disinfection**

Alongside hand hygiene, environmental cleaning and disinfection ranks extremely highly in importance with regards to biosecurity, infection control and general isolation unit management (Slovis et al. 2012). As discussed in the section on rotavirus, this pathogen requires a specialised cleaning and disinfecting programme with a high-level phenol disinfectant (Rubin 2016). A Standard Operating Procedure (SOP) should be designed and placed on the wall in the ante-room beside the risk assessment and should address: the product

used, rationale for choice, concentration, calculations, mixing procedure, application method, contact time and safety precautions (AB.VMA 2014; Moreira 2017c).

Once the foal is discharged from isolation, food, bedding, buckets etc. inside the unit needs to be stripped out, manually cleaned and scrupulously disinfected (Moreira 2017c). Once all organic matter has been taken out, an appropriate high-level disinfectant (Moreira 2017c) should be used to destroy the rotavirus pathogen; several sources (Caveney 2012; Zimmer 2009) recommend phenolic compounds (*see figure 5*) due to the fact that they remain active in the presence of organic debris (Smith 2015; Moreira 2017a), and have consistently proven to be effective in rotavirus outbreaks (Dwyer 2000; Dowling 2017).

Phenols	Mode of Action	Concentration	Complications	Safety
Aka. Carbolic acid.  They have good penetrating power into organic matter.	They work to denature proteins and are general protoplasmic poisons.	0.1-1% = bacteriostatic  1-2% = bactericidal, virucidal and fungicidal  5% = strongly irritating and corrosive to tissues	The wrong concentration, oral ingestion or extensive application can result in systemic toxicity, central nervous system and cardiovascular effects and death.	Following the datasheet instructions is very important. Use only as directed by trained staff and use PPE to protect face, eyes, mouth and hands.

**Figure 5:** Phenol disinfectants (Wickstrom 2016).

The ante-room should be cleaned and disinfected after each use by personnel and the isolation barn should be mucked out multiple times a day to preclude the virus settling into the environment. All organic waste should be transported to the enclosed isolation muck heap (*see figure 3*), and a phenol disinfectant must be used, at the correct concentration, to be scrubbed onto the floor and walls of the unit (Dowling 2017). It is not safe to use a power hose to clean an isolation unit that contained a foal with rotavirus; the high pressure of the hose aerosolises the pathogen in the environment and will widen the area of contamination, so low-pressure sprayers are preferable (Caveney 2012; Moreira 2017c). Once the stable is adequately disinfected, the floor should be squeegeed into the drains at the rear of the stable and the unit should be left to fully dry out before introducing a new patient (Dunne 2017).

## **8. Waste disposal**

Prompt removal and disposal of infectious faeces is an effective means of controlling the spread of rotavirus, and a designated isolation muck heap should be used. This muck heap should be located in an enclosed area, or in a holding tank to eliminate the risk of run-off into water bodies. The waste from the isolation unit should be piled up daily and turned frequently, otherwise varying temperatures can accrue at different layers of the muck heap (Dowling 2017). Over a couple of weeks (Dunne 2017), the high temperatures will sterilise the pathogen.

## **Conclusion**

The objective is that the 'Rotavirus Foal Isolation Management Plan' will empower the veterinary nurse to take control of their isolation centre and create a fantastic biosecure facility. Isolation management should not be perceived as a chore, but a crucial element to equine hospital biosecurity. Neonatal care in the hospital is maximised by a strong isolation management plan, and this document provides an example of such. Rotavirus is just one contagious disease - amongst a host of others that affect horses - that requires an isolation management plan. It is recommended that nurses tweak this plan for other diseases based on their mechanisms of transmission. The key to effectively executing this plan is to ensure that a strong, dedicated member of the veterinary team remains in charge of the facility and upholds the standards at all times.

## References

Alberta Equestrian Federation., Alberta Veterinary Medical Association., Growing Forward 2. (2014). *Equine Biosecurity Principles and Best Practices* [Online institutional repository]. Available at: file:///C:/Users/shell/AppData/Local/Packages/microsoft.windowscommunicationsapps\_8wekyb3d8bbwe/LocalState/Files/S0/3080/2014\_biosecurity\_book[3276].pdf [Accessed 17/03/17].

Altona Diagnostics. (2017). Instructions for Use. *RealStar Rotavirus RT-PCR Kit 1.0* [Online institutional repository]. Available at: [https://www.altona-diagnostics.com/tl\\_files/downloads/B%20-%20neue%20Manuals%20ab%20Februar%202017/MAN-561010-EN-S02\\_Rotavirus%20RT-PCR%20Kit%201.0\\_WEB.pdf](https://www.altona-diagnostics.com/tl_files/downloads/B%20-%20neue%20Manuals%20ab%20Februar%202017/MAN-561010-EN-S02_Rotavirus%20RT-PCR%20Kit%201.0_WEB.pdf) [Accessed 09/03/17].

American Association of Equine Practitioners (2017). *General Biosecurity Considerations* [online]. Available at: <https://aaep.org/guidelines/infectious-disease-control/biosecurity-guidelines-control-venereally-transmitted-diseases/general-biosecurity-considerations> [Accessed 07/03/17].

Bentz, A.I., Javsicas, L.H., Garber, J.R.O., Stock, M.L. (2014). Large Animal Medical Nursing. In: Bassert, J.M., Thomas, J.A., eds. *Clinical Textbook for Veterinary Technicians*. 8<sup>th</sup> ed. Missouri: Elsevier, p.739.

Bernard, W., Barr, B.S. (2012). *Equine Pediatric Medicine*. London: Manson Publishing Ltd, pp.128-131.

Caveney. (2012). Effective Cleaning and Disinfection In: Caveney, L., Jones, B., Ellis, K. ed. (2012). *Veterinary Infection Prevention and Control*. Sussex: Wiley-Blackwell, pp.107-127.

Colville, T. (2008). The Digestive System. In: Colville, T., Bassert, J.M., eds. *Clinical Anatomy and Physiology: for Veterinary Technicians*. 2<sup>nd</sup> ed. Missouri: Elsevier, p.277

Conley-Koontz Equine Hospital (2017). *Rotavirus – Foal Diarrhoea* [image online]. Available at: <http://www.ckequinehospital.com/page/172/Rotavirus-Foal-Diarrhea> [Accessed 10/03/17]

Cullinane, A.A. (2017). Virus Disease on Stud Farms [online]. *VETSS7008: Equine Nursing*. Dundalk Institute of Technology, Department of Applied Sciences. Available from: [file:///C:/Users/shell/Downloads/2.%20Biosecurity\\_Dr\\_Ann\\_Cullinane.pdf](file:///C:/Users/shell/Downloads/2.%20Biosecurity_Dr_Ann_Cullinane.pdf) [accessed 07/02/17].

Darling, K.T., Jones, B. (2012). Microbiology Review. In: Caveney, L., Jones, B., Ellis, K. ed. (2012). *Veterinary Infection Prevention and Control*. Sussex: Wiley-Blackwell, pp.21-39.

Dowling, D. (2017). Biosecurity Instructions [online], *VETSS7008: Equine Nursing*. Dundalk Institute of Technology, Department of Applied Sciences. Available from: [https://moodle.dkit.ie/201617/pluginfile.php/66703/mod\\_resource/content/1/Biosecurity\\_instructions%20aaep.pdf](https://moodle.dkit.ie/201617/pluginfile.php/66703/mod_resource/content/1/Biosecurity_instructions%20aaep.pdf) [accessed 06/02/17].

Dunne, K. (2017). Isolation [unpublished]. *VETSS7008: Equine Nursing*. Dundalk Institute of Technology, Department of Applied Sciences.

Dwyer, R. (2000). *Rotavirus in Foals* [online]. Available from: <http://www.thehorse.com/articles/10150/rotavirus-in-foals> [accessed 05/02/17].

Holtgrew-Bohling, K. (2012). *Large Animal Clinical Procedures: for Veterinary Technicians*. 2<sup>nd</sup> ed. Missouri: Elsevier, p.316.

Emory University. (2014). *Emory University Hospital Isolation Unit* [video online]. Available from: <https://www.youtube.com/watch?v=63cTXQxntbw> [Accessed 09/03/17].

Greet, T. (2008). Hospital Design and Organisation. In: Corley, K., and Stephens, J., eds. *The Equine Hospital Manual*. Oxford: Blackwell Publishing Ltd, p.189-195.

Komurek, K. (2014). Small Animal Medical Nursing. In: Bassert, J.M., Thomas, J.A., eds. *Clinical Textbook for Veterinary Technicians*. 8<sup>th</sup> ed. Missouri: Elsevier, pp.704-705.



Lane, T.J. (2016). *Vaccination Program for Horses* [online]. Available from: <http://www.merckvetmanual.com/management-and-nutrition/health-management-interaction-horses/vaccination-program-for-horses> [accessed 06/02/17].

NHS Greater Glasgow and Clyde. (2017). *6 Step Hand Hygiene Technique* [online]. Available at: <http://library.nhsggc.org.uk/mediaAssets/Infection%20Control/A4%20-%206-Step%20HH.pdf> [accessed 06/03/17].

Moreira, S. (2017a). Chemical Disinfectants [unpublished]. *ANMSS7010: Animal Reproduction and Applied Microbiology*. Dundalk Institute of Technology, Department of Applied Sciences.

Moreira, S. (2017b). Disease Prevention Strategies [unpublished]. *ANMSS7010: Animal Reproduction and Applied Microbiology*. Dundalk Institute of Technology, Department of Applied Sciences.

Moreira, S. (2017c). Guidelines for Effective Cleaning and Disinfection [unpublished]. *ANMSS7010: Animal Reproduction and Applied Microbiology*. Dundalk Institute of Technology, Department of Applied Sciences.

Quinn, P.J., Markey, B.K. (2003). *Concise Review of Veterinary Microbiology*. Oxford: Blackwell Publishing Ltd, pp.116-117, pp.138-139.

Rubin, S.I. (2016). *Infectious Diseases of the GI Tract* [online]. Available from: <http://www.merckvetmanual.com/digestive-system/digestive-system-introduction/infectious-diseases-of-the-gi-tract> [accessed 06/02/17].

Ruple, A., Slovis, N.M., Jones, B. (2012). What is Infection Control and Biosecurity? In: Caveney, L., Jones, B., Ellis, K. ed. (2012). *Veterinary Infection Prevention and Control*. Sussex: Wiley-Blackwell, pp.3-18.

Sattar, S.A., Jacobsen, H., Rahman, H., Cusack, T.M., Rubin, J.R. (1994). Interruption of Rotavirus Spread through Chemical Disinfection. *Infection Control and Hospital Epidemiology* [online], 15(12), pp.751-756. Available from: [https://www.jstor.org/stable/30148419?seq=1#page\\_scan\\_tab\\_contents](https://www.jstor.org/stable/30148419?seq=1#page_scan_tab_contents) [Accessed 06/04/17].

Slovis, N., Jones, B., Caveney, L. Disease Prevention Strategies In: Caveney, L., Jones, B., Ellis, K. ed. (2012). *Veterinary Infection Prevention and Control*. Sussex: Wiley-Blackwell, pp.85-103.

Smith, B.P. (2015). *Large Animal Internal Medicine*. 5<sup>th</sup> ed. Missouri: Elsevier.

Sonder, C. (2015). *How to Set Up a Disease Isolation Unit on Your Farm* [online]. Available from: <http://www.thehorse.com/articles/36239/how-to-set-up-a-disease-isolation-unit-on-your-farm> [accessed 03/02/17].

Stewart, A.J. (2016). *Viral Diarrhea in Foals* [online]. Available from: <http://www.merckvetmanual.com/digestive-system/intestinal-diseases-in-horses-and-foals/viral-diarrhea-in-foals> [accessed 06/02/17].

UT VETV. (2012). *Equine Isolation Units Highlighted at University of Tennessee Veterinary Medical Center* [video online]. Available from: <https://www.youtube.com/watch?v=ARX6w0sdIJ4> [accessed 10/03/17].

Wickstrom, M. (2016). *Phenols and Related Compounds* [online]. Available at: <http://www.merckvetmanual.com/pharmacology/antiseptics-and-disinfectants/phenols-and-related-compounds> [accessed 5/03/17].

Zimmel, D. (2009). General Horse Management. In: Reeder, D., Miller, S., Wilfong, D., Leitch, M., Zimmel, D., eds. *AAEVT'S Equine Manual for Veterinary Technicians*. Iowa: Wiley-Blackwell, pp.4-6.