Durability of Disposable Overboots Under Simulated Field Conditions

Kendra Miller, BS; Josie L. Traub-Dargatz, DVM, MS, Diplomate ACVIM*; David Dargatz, DVM, PhD, Diplomate ACT; Chad Zadina, BS

If disposable overboots are to be used by equine practitioners under field conditions as part of a biosecurity plan, boot selection should be based on anticipated use as durability of overboots varies by type. Authors’ addresses: Colorado State University, College of Veterinary Medicine and Biomedical Sciences, Department of Clinical Sciences, Animal Population Health Institute, Fort Collins, CO 80523 (Traub-Dargatz, Miller, Zadina); and USDA:APHIS:VS Centers for Epidemiology and Animal Health, 2150 Centre Street, Building B, Fort Collins, CO 80526 (Dargatz); e-mail: Josie.Traub-Dargatz@colostate.edu. © 2008 AAEP. *Presenting author.

1. Introduction
Equipment that allows for implementation of barrier precautions is an important component of a complete biosecurity plan. A complete biosecurity program should include hand hygiene, barrier nursing, adequate space to separate animals, personal protective equipment, cleaning and disinfection, waste disposal, and foot traffic control.1 The key characteristics of every day biosecurity are preventing or reducing introduction of a disease agent and biocontainment. Biocontainment refers to measures taken to prevent spread once a disease agent is on a premises or an index case is identified.2

In preparation for examination of cases of probable contagious disease, it is recommended that veterinarians have a biosecurity kit readily available.3 Veterinarians can either assemble a kit on their own by purchasing individual component or purchase one of several prepackaged biosecurity kits.4,5,6 These kits contain personal protective equipment (PPE) such as masks, gloves, disposable gowns or coveralls, and overboots. Use of such PPE is only effective as a physical barrier if they are durable enough to withstand the intended use and are implemented correctly. The use of reusable rubber overboots along with a means to disinfect the reusable footwear have been evaluated for decreasing spread of disease agents.4,5 Data have shown that both rubber and plastic boot material can harbor ampicillin-resistant E. coli bacteria for at least 1 day.6 Currently there are no data available on the durability of various types of disposable overboots in the typical large animal veterinary field setting. The objective of this study was to evaluate the durability of four different disposable overboots under simulated field conditions.

2. Materials and Methods
Four different types of commercially available disposable overboots were selected for the study4,5,6,7 (Fig. 1).

A 265-ft walking course was designed at an equine facility at Colorado State University. The walking
course included three surfaces: a gravel parking lot (100 ft), cement barn aisleway (142 ft), and rubber stall mats (23 ft; Fig. 2).

Ten veterinary students were divided into two groups based on shoe size and wore either size large or extra-large overboots. Every time a participant walked the course, they wore a new pair of overboots. Each participant wore each type of boot 3 times and thus walked the course a total of 12 times. The overall order in which the boots were worn was randomized, with each participant wearing the boots in the same randomized order.

After the participants walked the course wearing the boots, the porosity was measured. Two liters of water was poured into each boot, and the amount of water that leaked into a plastic bin in 1 min was measured using a graduated cylinder (Fig. 3). Specialized software was used to analyze the data because of the hierarchical (nested) structure of the data. Continuous data (volume of water leaked) were analyzed using SAS Proc Mixed. Independent variables evaluated included boot type, boot size, and right versus left foot. Categorical data (whether a boot leaked or not) were analyzed using Sudaan to determine whether there were differences in the proportion of boots that leaked by boot type.

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Fig. 1. Four different types of disposable overboots used in the study. Clockwise from top left: clear boot (top left), blue boot (top right), lightweight yellow boot (bottom left), and heavy-weight yellow boot (bottom right).

Fig. 2. (A–C) The walking course was designed to mimic typical field situation and included a section of gravel in the parking lot (A), concrete in barn aisleway (B), and rubber stall mats (C).

Fig. 3. Method of measurement of porosity used to assess durability. The boot on the left is leaking from multiple sites. The boot on the right has no visible leakage.
type, boot size, and right versus left foot. Statistical significance was set at \( p < 0.05 \). The repeatability of the measurements of volume of leakage was assessed by randomly selecting 10 clear boots and 10 blue boots for repeat evaluations. The volume of leakage for each of the 20 selected boots was determined three times. These data were analyzed using SAS Proc Mixed to account for repeated measures.

3. Results

The proportion of boots that leaked was different \( (p < 0.001) \) by boot type. There were 50 of 60 (83%) clear boots and 55 of 60 (92%) blue boots having detectable leaks, whereas only 1 lightweight yellow boot leaked and none of the heavyweight yellow boots leaked. Both the clear boot and blue boot were significantly more likely to leak than either the lightweight yellow or heavyweight yellow boots \( (p < 0.05) \).

The mean volume of water that leaked from the blue boots was 209.0 \( \pm \) 55.9 (SE) ml. The mean volume of water leaked from the clear boots was 57.7 \( \pm \) 10 ml. For the lightweight yellow boots, the mean volume of water that leaked was 0.7 \( \pm \) 0.7 ml. None of the heavyweight yellow boots had any detectable leakage. The volume of water that leaked from the blue boots was significantly more than for all other boot types \( (p < 0.05) \). There was no significant difference in the volume of water leaked by boot size (large versus extra-large) or between right and left feet.

There was no difference \( (p = 0.99) \) in the volume of water leaked by time when 10 clear boots and 10 blue boots were each evaluated three times, indicating good repeatability for the volume measurement.

4. Discussion

According to a 2004 American Veterinary Medical Association economic survey, 65% of equine veterinary practices provided mobile or ambulatory services. Ambulatory clinicians are often called on to manage and treat cases of infectious diseases. When a veterinarian is called to evaluate a suspected infectious disease case, they have two main responsibilities: First and foremost is to do no harm. For example, do not enter into a barn or stall before having a plan to leave it in a manner that will prevent the spread of disease agents. The second responsibility a veterinarian has is to respond to the worst potential case scenario until a diagnosis has been made. To do this, veterinarians must have PPE readily available for their use.

For a biosecurity plan to be applied, it must be viewed as practical and affordable. Convenience and cost are factors that likely influence a practitioner’s preference in PPE. All of the boots used in this study are readily available and the cost ranged from $0.30 to $2.20 per pair. All of the boot types can be stored efficiently in an ambulatory vehicle and come in various sizes to accommodate the different foot sizes of equine practitioners. If a practitioner would elect to wear reusable overboots instead of disposable boot covers, they must plan ahead and have extra equipment available for disinfection. After the reusable boots are worn on a farm, the practitioner must have a container large enough to stand in, access to water and disinfectant, a brush to remove gross contamination, and a means to dispose of the used disinfectant that complies with the material safety data sheet (MSDS) recommendations.

The decision of which disposable overboot to use should be based on the conditions of anticipated use. This study was designed to mimic an ambulatory clinician walking from their vehicle across a gravel parking area, onto the concrete aisleway of a barn to reach a stall, into a stall with rubber floor mats to examine a horse, and back to their vehicle. This study shows that, in this scenario (265 ft over surfaces typically encountered in equine practice field setting), some of the available disposable overboots are not durable enough to accomplish the goal of a physical barrier when walked in for a distance of 265 ft over surfaces typically encountered in equine practice field setting. Both the blue and clear boots were significantly different from the lightweight yellow and heavyweight yellow boots in terms of leakage. The blue and clear boots are not durable enough under these conditions to serve as a physical barrier. In this scenario, both the lightweight yellow and heavyweight yellow boots were durable enough to provide a physical barrier. The boot types tested were those commonly found in various biosecurity kits on the market for use by equine practitioners or ones in use in a veterinary teaching hospital as protection of footwear while in the surgical suite.

References and Footnotes

Meeting of the American Association of Equine Practitioners 2006;107–108.

*Jorgensen’s Laboratory, Loveland, CO 80538.
1Global Protection, LLC., West Berlin, NJ 08091.
2Dupont, Wilmington, DE 19801.

4Blue Plastic Boot, Jorgensen Laboratories, Loveland, CO 80538.
5Heavy weight yellow boot, Global Protection, West Berlin, NJ 08091.
6Light weight yellow plastic boot, Global Protection, West Berlin, NJ 08091.
7SAS, SAS Institute, Inc., Cary, NC 27513.
8Sudaan, Research Triangle Institute, Research Triangle Park, NC 27709.