Polyvinyl chloride endotracheal tubes (PVC ETTs) were first introduced to anesthetic practice in the 1960s. Although reuse of ETTs in human medical practice has not been considered acceptable since the 1980s, PVC ETTs are frequently reused in small animal practice, presumably to reduce the cost of anesthesia care. To date, no ETT cleaning protocol has been tested for both efficacy and safety in clinical veterinary patients. Although cleaning recommendations for ETTs have been published, none are evidence-based. In veterinary medicine, there is a single laboratory study examining the efficacy of 5 disinfection protocols applied to sterile ETTs purposely inoculated with Streptococcus equi ssp zooepidemicus and Bordetella bronchiseptica. In that investigation, ETTs were treated by spraying with accelerated hydrogen peroxide (AHP) or soaking in an AHP bath, 0.5% chlorhexidine gluconate (CHG) bath, 0.3% triclosan-containing soap bath, or tap water bath. Although elimination of vegetative bacterial growth on ETTs was incomplete regardless of protocol, the authors concluded that processing ETTs with a 0.5% CHG bath, AHP spray, or AHP bath were practical options when ETT sterilization was not possible.

The objectives of the present study were as follows: 1) determine ETT reuse and cleaning practices of board-certified veterinary anesthesiologists using an online survey distributed to American College of Veterinary Anesthesia and Analgesia (ACVAA) diplomates and 2) compare the efficacy of 4 cleaning protocols—informing survey responses—applied to ETTs collected at extubation from a clinical population of anesthetized dogs at a veterinary teaching hospital.

**OBJECTIVE**
To compare the efficacy of 4 cleaning protocols applied to endotracheal tubes (ETTs) collected from anesthetized dogs.

**SAMPLE**
100 ETTs (25 per protocol).

**PROCEDURES**
A 10-question survey designed to determine ETT reuse and cleaning practices was distributed via email to a sample of veterinary anesthesiologists. Informed by survey results, 4 ETT cleaning protocols were selected for use in a prospective clinical study. Dogs were intubated with sterile polyvinyl chloride ETTs. At extubation, each ETT was cultured for bacterial growth, randomly assigned to 1 of 4 protocols [water scrub (P1), detergent scrub (P2), detergent scrub and chlorhexidine gluconate (CHG) soak (P3), or detergent scrub and bleach soak (P4)], and cultured again after drying. Bacterial genera were identified using mass spectrometry and 16s rRNA sequencing. Proportions of ETTs exhibiting no post-cleaning growth were compared between protocols using the Fisher exact test with Bonferroni correction.

**RESULTS**
Half of survey respondents that reused ETTs did not sterilize them before reuse, cleaning methods varied widely, and no reported methods were evidence-based. After use, the number of ETTs exhibiting no post-cleaning bacterial growth were 15/25 (60%), 14/25 (56%), 20/25 (80%), and 17/25 (68%) for protocols P1, P2, P3, and P4, respectively. Pairwise comparisons did not reveal any statistically significant differences between protocols.

**CLINICAL RELEVANCE**
In small animal patients, some veterinary anesthesiologists reuse ETTs without sterilization and cleaning protocols vary widely. No differences between the studied protocols were identified. Further research is necessary to identify a safe, efficacious ETT cleaning protocol for use in small animal practice.
hospital. The protocols tested were: tap water scrub only (P1); detergent scrub followed by tap water rinse (P2); detergent scrub followed by tap water rinse, 1 hour 0.04% CHG bath soak, and a second tap water rinse (P3); and detergent scrub followed by tap water rinse, 1 hour 300 ppm bleach bath soak, and a second tap water rinse (P4). The outcome of clinical interest was the presence or absence of growth on post-cleaning bacterial culture. We hypothesized that protocols P2, P3, and P4 would result in greater proportions of ETTs showing no post-cleaning bacterial culture growth compared with protocol P1. We further hypothesized that significant differences in the proportions of ETTs showing no post-cleaning bacterial culture growth would be observed when making pairwise comparisons between protocols P2, P3, and P4.

Materials and Methods

Survey

A survey consisting of 10 questions examining small animal ETT reuse, materials (eg, PVC versus silicone), specific cleaning processes, storage methods, and evidence-based support for the chosen cleaning protocol was developed by the authors. After initial testing on 2 veterinary anesthesiologists and 2 veterinary anesthesia technicians, the questions were edited for clarity and an online survey (Qualtrics) was created. Survey questions were designed to determine specific processes and rationale behind ETT cleaning protocols used by board-certified veterinary anesthesiologists employed at veterinary teaching hospitals and included yes/no, multiple choice, and open response items (Supplementary Table S1).

The survey population of interest was identified by searching the webpages of AVMA-accredited veterinary colleges in the United States for email addresses of ACVAA diplomates. Each identified ACVAA diplomate was contacted via email and provided with information about the survey including its purpose and length, as well as a link to the survey webpage. Participants were informed that their participation, while appreciated, was completely voluntary. When multiple veterinary anesthesiologists were identified at the same institution, each one received a recruitment email. Three weeks after contact emails were sent to identified individuals, the survey was closed to responses. Any survey responses received after this period were excluded from analysis. The survey was approved and determined exempt from review by the University of Missouri Institutional Review Board.

Study design

The study was performed at the University of Missouri, Veterinary Health Center from October 2020 to January 2022. During this period, data were intermittently collected resulting in a convenience sample in which all weekdays were equally represented. On each data collection day, randomization occurred at two levels. First, only a single cleaning protocol was applied on each data collection day and this protocol was randomized using a pseudorandom number generator (Matlab version R2018b; MathWorks). Second, ETTs included in the study were randomly selected from the day’s canine anesthesia caseload using a coin flip. Polyvinyl chloride ETTs from dogs of any signalment that were scheduled for anesthesia on each data collection day were eligible for inclusion. Data were collected until 25 ETTs were obtained in each protocol. Endotracheal tubes of inner diameter (ID) < 3.5 mm were excluded because the culture swabs were unable to fit into the distal tube interior and miniature culture swabs were not available due to supply chain deficits caused by the COVID-19 pandemic. Endotracheal tubes of ID > 12 mm were also excluded because they were made of a different material (silicone). This portion of the study was exempt from Animal Care and Use Committee research approvals because it did not require alteration or manipulation of patient care.

After induction of anesthesia, each dog’s trachea was intubated with an appropriately sized, sterile PVC ETT removed from its sterile packaging just prior to intubation. Anesthesia personnel were not allowed to lubricate or touch the cuffed end of the ETTs. Following intubation, all anesthetic care proceeded at the discretion of the attending anesthesiologist. Immediately following extubation, a pre-cleaning bacterial culture sample was collected from the distal interior of the ETT between the beveled edge and Murphy eye using a bacterial culture swab (ESwab; Copan Diagnostics Inc). The ETT distal interior surface was selected for swabbing based on the perceived difficulty of effectively cleaning this region compared to exterior surfaces. If multiple extubations occurred simultaneously, ETTs were individually placed in new, clean 1-gallon plastic bags (Ziploc; SC Johnson) for short-term storage until sample collection could occur. Pre-treatment sample collection always occurred within 10 minutes of extubation.

Collected ETTs were labeled with manila tags that included an identification number and cleaning protocol identifier. Tags were attached to ETTs at the patient end using flexible wire and covered in clear packing tape to waterproof them for the cleaning process. To remove the possibility of inter-protocol cross-contamination, each cleaning protocol had a dedicated set of nylon cleaning brushes (48-inch Nylon Industrial Tube Brushes, sizes 3/16, 3/8, 1/4, and 5/8 inch; Justman Brush Co) of varying diameter and separate, clean plastic bins for ETT soaking and drying. No brushes or bins used for ETTs in any protocol were allowed to contact ETTs allotted to any other protocol. However, ETTs from each individual treatment group were simultaneously soaked in the same bin on the same day (so-called batch processing). During soaking and drying, ETTs were separated from and not permitted to physically contact one another. After scrubbing or soaking, ETTs were rinsed in tap water and air-dried. Once ETTs were completely dry, post-cleaning bacterial culture samples were obtained as for pre-cleaning samples. Each culture swab was labeled with a unique iden-
tifier which corresponded to a spreadsheet row in which ETT and case information were recorded. This labeling process blinded diagnostic laboratory personnel to the collection time (pre- versus post-cleaning) and the cleaning protocol corresponding to each submitted sample.

Treatment protocols
Based on the results of the previously described survey and consultation with a board-certified veterinary microbiologist, 4 ETT cleaning protocols (P1, P2, P3, and P4) were selected for study. For P1, ETTs were rinsed in lukewarm tap water and scrubbed on their interior and exterior surfaces with a nylon brush of at least the same length and ID of the ETT, as recommended by the WHO.\textsuperscript{10} The scrub process was repeated until the ETT was free of visible foreign material. After scrubbing, P1 ETTs were rinsed in lukewarm tap water until the water ran clear and laid on a clean, industrially laundered towel inside an open-air, protocol-dedicated plastic bin to dry for 2 hours. If visible moisture remained on any ETT surface after 2 hours of drying, an additional 2 hours was allowed for drying prior to culture. During drying, tubes were not allowed to contact one another. After drying, a post-cleaning bacterial culture sample was collected from each ETT. For P2, ETTs were rinsed in lukewarm tap water and 1 teaspoon of detergent (Ivy Ultra-concentrated liquid dish detergent; Procter & Gamble Corp) was applied to the cuff, beveled edge, and Murphy eye of the ETT. Tubes were then scrubbed with nylon brushes, rinsed in lukewarm tap water, dried as described for P1, and sampled for post-cleaning bacterial culture as described for P1. For P3, ETTs were rinsed in lukewarm tap water and scrubbed with detergent as described for P2. After rinsing, ETTs were completely submerged together in a bath of 0.04% chlorhexidine gluconate (CHG) solution, prepared fresh daily from concentrated stock solution (Nolvasan Solution 2%; Zoetis) with tap water, and left to soak for 1 hour. After soaking, ETTs were removed from the bath, rinsed in lukewarm tap water, dried as described for P1, and sampled for post-cleaning bacterial culture as described for P1. For P4, ETTs were rinsed in lukewarm tap water and scrubbed with detergent as described for P2. After rinsing, ETTs were completely submerged together in a 300-ppm bleach solution, prepared fresh daily by adding 1 tablespoon of bleach (Clorox Bleach; The Clorox Co) to 1 gallon of tap water, and left to soak for 1 hour. After soaking, ETTs were removed, rinsed in lukewarm tap water, dried as described for P1, and sampled for post-cleaning bacterial culture as described for P1. At the conclusion of each data collection day, nylon brushes and plastic bins used for the assigned protocol were treated with the same cleaning agents as the ETTs and dried in a similar fashion.

Laboratory analysis
Culture swabs were submitted to the diagnostic laboratory at the authors’ veterinary college for analysis at the end of each data collection day. Swabs were struck on plates using a 4-quadrant pattern. For aerobic culture, tryptic soy agar (TSA) with 5% sheep blood, MacConkey, and chocolate agar plates were used and incubated at 36 °C. Chocolate plates were incubated in a 5% CO\textsubscript{2} environment. For anaerobic culture, pre-reduced TSA with 5% sheep blood plates were used. These plates were reduced in a nitrogen chamber for at least 24 hours before being struck. Anaerobic plates were incubated at 36 °C in a Mitsubishi box with an anaerobe sachet producing a < 1% O\textsubscript{2} environment. Anaerobic conditions in the Mitsubishi box were verified with a colorimetric oxygen indicator. All plates were incubated for 72 hours and inspected by a bacteriologist every 24 hours for growth. Bacterial species identification was performed using matrix assisted laser desorption/ionization time-of-flight mass spectrometry and/or 16S rRNA gene sequencing. These methods were chosen for ease of use and rapidity of sample processing.\textsuperscript{11,12} Both aerobic and anaerobic bacterial culture growth results were reported as none, light (< 25 colony-forming units [CFUs] per agar plate), moderate (25 to 100 CFUs), or heavy (> 100 CFUs). If more than one bacterial isolate was obtained from a single bacterial culture, recorded results were categorized according to the heaviest level of growth.

Statistical analysis
Prior to analysis, semi-quantitative post-cleaning culture data were coarse grained to a binary variable representing the presence or absence of bacterial culture growth. Based on this variable, each protocol was compared to every other protocol via 6 pairwise comparisons using the Fisher exact test with Bonferroni correction of \( P \) values for multiple comparisons. Statistical analysis was performed using standard software (SAS version 9.4; SAS Institute Inc) with significance defined by \( P < .05 \).

Results
Survey
Contact information for 25 ACVAA board-certified veterinary anesthesiologists was identified from the webpages of AVMA accredited veterinary colleges in the United States. These 25 anesthesiologists represented 16 of the 33 veterinary colleges (48.5%) accredited at the time of the survey (early 2020). At 9 of these 16 colleges (56%), the email addresses of at least 2 anesthesiologists were displayed publicly. Of the 25 distributed emails, 3 were returned as undeliverable, 22 were delivered, and 11 surveys were completed resulting in a sample population response rate of 50% (11/22). No responses were received after the survey closed.

Most respondents (10/11, 91%) indicated that ETTs were reused in small animal patients at their institution and 9 of these 10 (90%) did not have a limit on the number of times an ETT could be reused. Regarding ETT material, responses included mentions of PVC (10) and silicone (10), but no other materials. Descriptions of ETT cleaning processes included variable mentions of physical scouring of ETTs with...
Endotracheal tube bacterial cultures

The sample consisted of 100 PVC ETTs, 25 for each protocol. Complete data sets were available for all ETTs included in the study. Data from 1-6 ETTs were collected on each data collection day. Following extubation and prior to cleaning, 88% (22/25), 88% (22/25), 76% (19/25), and 84% (21/25) of the ETTs from protocols P1, P2, P3, and P4, respectively, displayed light, moderate, or heavy growth of at least one bacterial species on culture. Overall, pre-cleaning cultures identified 28 bacterial genera, all of which were aerobes, facultative aerobes, or facultative anaerobes. Fifteen of these genera are considered oropharyngeal commensals not typically associated with respiratory tract disease while the remaining 13 are considered potentially pathogenic in the respiratory system or elsewhere (Supplementary Table S2).

Following application of each cleaning protocol, culture growth was categorized as none in 60% (15/25), 56% (14/25), 80% (20/25), and 68% (17/25) of the ETTs from protocols P1, P2, P3, and P4, respectively. Based on post-cleaning bacterial culture results (i.e., growth versus no growth), pairwise comparisons between protocols with the Fisher exact test did not reveal any significant differences as follows: P = 1.00 for the P1-P2 comparison, P = 0.22 for the P1-P3 comparison, P = 0.77 for the P1-P4 comparison, P = 0.13 for the P2-P3 comparison, P = 0.56 for the P2-P4 comparison and P = 0.52 for the P3-P4 comparison. Post-cleaning cultures identified 22 bacterial genera, including 1 anaerobe. Fifteen of these genera are considered oropharyngeal commensals while the remaining 7 are considered potentially pathogenic in the respiratory system or elsewhere (Supplementary Table S2).

Discussion

This study investigated the efficacy of 4 ETT cleaning protocols applied to ETTs collected at extubation from a clinical population of anesthetized dogs. Pairwise comparisons between cleaning protocols failed to reveal any statistically significant differences in the primary outcome variable of presence or absence of growth on post-cleaning bacte-

rial culture. The protocols studied included water scrub only (P1), detergent scrub only (P2), detergent scrub with 0.04% CHG bath (P3), and detergent scrub with 300 ppm bleach bath (P4). Contrary to our hypothesis, protocols P2, P3, and P4—each of which included detergent scrub or soak in a disinfectant bath—were not more effective at reducing post-cleaning bacterial culture growth compared to protocol P1 (water scrub alone). The cleaning protocols used in this study were partially informed by the described survey of ETT reuse and cleaning practices of ACVAA board-certified veterinary anesthesiologists employed at AVMA accredited veterinary schools in the United States. The survey found that most respondents reused ETTs in small animal patients, that CHG was the most used disinfectant for cleaning ETTs, and that half of those who indicated reusing ETTs did not sterilize them prior to reuse. Interestingly, only 2 of 10 respondents that indicated using CHG provided a specific concentration of CHG. The WHO defines cleaning as the removal of visible soil, organic, and inorganic material from objects and surfaces. Cleaning, which can be accomplished manually or mechanically using detergents, is necessary before disinfection and sterilization because the presence of residual foreign substances results in poor penetration of heat and chemical disinfectants. Thus, improper cleaning may lead to reduced efficacy of the disinfection process. To address this issue, an initial detergent scrub was incorporated into 3 of the study protocols (P2, P3, and P4), one of which (P2) constituted a detergent scrub only. Furthermore, WHO guidelines for cleaning reusable medical devices with lumens state that brushes should be long enough to exit the distal end of the device and of the same diameter as the device to ensure all internal surfaces can be reached. Adhering to these guidelines, each ETT in this study was physically scoured with a 48-inch nylon brush of at least the same diameter as the ETT inner diameter to ensure equal contact with all interior tube surfaces, in addition to all exterior surfaces. Note that it is possible that aggressive scouring with nylon brushes could create microscopic ETT abrasions that may accumulate over multiple cleaning cycles. Such surface damage could support focal bacterial growth that may escape cleaning and disinfection.

There are considerable differences between the current study and the single in vitro veterinary study evaluating the efficacy of different ETT cleaning protocols. First, the current study used ETTs collected from a clinical population of anesthetized dogs whereas the in vitro study purposefully inoculated sterile ETTs with Streptococcus equi ssp. zooepidemicus and Bordetella bronchiseptica. Thus, the bacterial genera to which the current study’s protocols were exposed is likely more representative of clinical practice. Second, the in vitro study included a CHG-based protocol that was 10-fold more concentrated (0.5% versus 0.04%) than that used in the current study. Furthermore, although this higher CHG concentration was more effective at eliminating inoculated bacterial growth than the other studied protocols, complete elimination of growth...
was not achieved. Given that most survey respondents did not specify the concentration of CHG used in their practice, we elected to use 0.04% CHG solution because this is the lowest effective concentration suggested by the manufacturer. Third, the cited in vitro study did not include cleaning or post-cleaning drying processes (following inoculation, ETTs were soaked and immediately cultured after rinsing with tap water), presumably because that study was focused on the efficacy of various approaches to ETT disinfection. Finally, CHG-bath soaking time varied between the in vitro study and the current investigation which used a 5-minute immersion versus a 1-hour immersion, respectively. A 1-hour soaking time for the current study was selected because the disinfectant efficacy of CHG is known to depend on contact time and no evidence to support a particular immersion time for ETT disinfection is currently available.

We elected to collect pre- and post-cleaning bacterial culture samples from the distal interior of ETTs as opposed to whole tube sampling. This region was chosen because we believed it to be the most difficult ETT area to properly clean and disinfect and it simplified the sampling protocol with regard to ETT handling during sampling. However, this choice could have resulted in bacterial growth that was present but not sampled. For example, we found that 12% (3/25), 12% (3/25), 24% (6/25), and 16% (4/25) of the ETTs from protocols P1, P2, P3, and P4, respectively, had negative pre-cleaning bacterial cultures. Because the extent to which sampling of the distal interior of the ETT is representative of a whole ETT sample (wherein all surfaces are sampled) is unknown, lack of growth on pre- and/or post-cleaning bacterial culture in the current study should not be interpreted as absence of growth on the entire ETT.

An interesting finding of the current study relates to the water only protocol (P1). Contrary to our expectation that this protocol would result in very low efficacy, 60% of P1 ETTs had negative post-cleaning bacterial cultures. Because water is not a disinfectant, we suspect that physical removal of bacteria during the cleaning process and subsequent desiccation due to air-drying were sufficient to eliminate bacterial growth in some P1 ETTs. This reasoning is supported by the in vitro results of Crawford and Weese who found that, following inoculation, soaking in water in the absence of either cleaning or drying resulted in all ETTs displaying post-treatment bacterial culture growth. This finding for P1 also may indicate that the lack of statistically significant differences between P1, P2, P3, and P4 for post-cleaning bacterial culture growth elimination may be multifactorial with basic water cleaning and air-drying possibly important factors. However, it is also possible that the protocol sample size was insufficient leading to a Type II statistical error. Other factors that may have contributed to the absence of statistically significant findings include suboptimal CHG and bleach bath soak times, suboptimal CHG and bleach bath concentrations, and/or the use of industrially laundered towels, which may contain contaminants, for ETT drying.

To mimic what we believe to be common practice among small animal veterinary practitioners, we chose to batch process ETTs on each data collection day. Individual ETT cleaning and disinfection, which may well be a superior methodology, is likely not feasible in most practices for a variety of reasons including time and expense. However, it must be recognized that batch processing may be associated with cross-contamination of bacteria between ETTs and/or between ETTs and cleaning instruments or solutions. Although difficult to quantify based on the data collected in the current study, cross-contamination may have influenced the results. For example, we did observe some ETTs with increased bacterial culture growth from pre- to post-cleaning within some protocol batches. Endotracheal tubes cleaned in large batches may have had increased risk of cross-contamination due to greater overall bacterial load and more likely inadvertent contact. Additionally, batch processing may also create variable time lags between extubation and cleaning for each ETT in the batch. Delaying bacterial culture sampling or cleaning may lead to either bacterial growth or death on ETT surfaces, thereby influencing the collected data. However, such variability is likely more representative of conditions found in clinical practice.

Cross-contamination between ETTs and cleaning brushes within or between ETT batches represents another source of variability. In this study, each protocol had a dedicated set of nylon brushes and, within each protocol, as is likely common in clinical practice, the brushes were reused. At the end of each data collection day, the nylon brushes were treated with the same protocol as the ETTs and allowed to air-dry. WHO guidelines suggest that cleaning brushes be thermally disinfected and dried each day after use. Thermal brush treatment was not performed, and bacterial culture samples of the brushes were not collected in this study. Thus, the impact of potential residual bacterial contamination of the cleaning brushes from one use to another, both within and between batches, is unknown. In future studies, performing cultures of cleaning equipment would be helpful to determine the contributions of cleaning equipment contamination to post-cleaning bacterial growth and differentiate this effect from that of the studied protocols.

An unresolved yet important issue is the level of ETT disinfection required to conduct safe anesthetic practice as defined by post-operative outcomes. The authors are unaware of published investigations relating ETT reuse and cleaning practices to post-anesthetic adverse events. Given the findings of this investigation, a portion of ETTs that have been cleaned and reused in small animal patients are likely contaminated with bacteria. However, it is possible that light bacterial contamination of ETTs with commensal organisms (as were commonly found in this study) carries little risk to the patient. In addition to the issue of bacterial contamination, failure to remove chemical residues from ETTs is also a safety consideration. For example, ETT CHG residues may cause mucosal sloughing in horses. Thus, thorough rinsing of ETTs with water...
after cleaning, as employed in the current study, is very important to reduce patient risk. Although evaluation of associations between ETT reuse and cleaning practices and post-anesthetic respiratory morbidity would be challenging to establish due to confounding issues such as aspiration, studies addressing this link would be very useful in delineating best practice as it relates to reuse of the ETT which is one of the most fundamental pieces of equipment employed when an animal is anesthetized.

Other study limitations include the exclusion of very small (< 3.5 mm ID) and very large (> 12 mm ID) ETTs. Tubes < 3.5 mm ID present unique challenges in that few nylon brushes and bacterial culture swabs are sized to properly fit inside them. Performing sterile fluid lavage of ETTs would facilitate bacterial culture sampling of these devices in a future study. An issue not addressed by the current study is the effect of storage conditions prior to ETT reuse on bacterial contamination. Storage in a dry environment might serve to decrease bacterial load, while an open, unprotected, or humid storage environment might increase bacterial load. The effects of different storage conditions (eg, in plastic bins, under sinks, or hanging from hooks) are worthy of study. Although ETT cuff lubrication is commonly practiced prior to intubation of small animal patients, we chose to forgo cuff lubrication to minimize the potential for environmental contamination of otherwise sterile ETTs prior to intubation. Whether use of water-soluble lubricant influences ETT bacterial populations is unknown. The methods used to identify cultured bacteria in the current study were limited to identification of genus. This is noteworthy because, within a genus, some species may be pathogenic, and some may not be pathogenic. For example, *Streptococcus canis* is considered a respiratory pathogen while *Streptococcus haloceri* is not and *Staphylococcus aureus* is pathogenic while *Staphylococcus xylosus* is not. Thus, exact determination of the pathogenic significance of cultured genera was not possible. Finally, the survey portion of the study, used to inform study design, included an undersized sample in that only 11 surveys were returned. Targeting the survey to ACVAA diplomates may have skewed results in that veterinary technicians may have more detailed knowledge of ETT cleaning practices due to greater involvement in that aspect of anesthetic practice. Additionally, such surveys would have greater generalizability if they included general practitioners, not just anesthesiologists.

Further work is required to define safe and efficacious ETT cleaning protocols for use in small animal anesthetic practice. Although the results of the current study suggest no differences in efficacy between the studied protocols, the authors do not recommend reuse of ETTs without some form of cleaning and disinfection as this practice, if improperly performed, likely poses minimal risk to the patient, and aligns with CDC and WHO recommendations. Studying ETT bacterial cultures from silicone ETTs and ETTs from other species would help generalize cleaning protocol findings across veterinary medicine. Finally, performing patient follow-up and collecting data on post-anesthetic complications relating to ETT reuse (eg, tracheitis or pneumonia) would allow outcome-based determination of protocol safety.

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**References**


**Supplementary Materials**

Supplementary materials are posted online at the journal website: avmajournals.avma.org