WHITE PAPER

IT'S TIME TO HANG HAIs OUT TO DRY

A summary of the new drying study published in *AJIC*, up-to-date societal drying guidelines and best practices from industry experts

CANTEL

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DRYING IS A CRUCIAL PROCEDURE IN THE ENDOSCOPE REPROCESSING CYCLE

Dark, wet and filled with food — it's the perfect environment for bacteria to thrive. It's also what the inside of an endoscope is like after being used in a procedure. And when the endoscope is not dried or stored correctly, the problem can escalate.

Ideally, high-level disinfection (HLD) eliminates all microbes before going into storage to help reduce infection risk. However, drying is also a crucial procedure in the endoscope reprocessing cycle; it dries the endoscope, which creates an environment that is not hospitable for bacterial growth. But if an endoscope is not entirely dry, the presence of water during storage promotes bacteria proliferation and biofilm formation. In other words, improper drying can cancel out all the hard work done in the previous steps of the reprocessing cycle.

We know that thorough drying completes the process to make endoscopes safe for patient use, but current industry standards don't include constructive advice on how to do it. On top of that, cost reduction and time pressures interfere with best practice — leaving healthcare facilities with little clarity to repeatedly produce a dry, safe, patient-ready endoscope.

Based on a recommendation from a study published in 1991, the accepted industry standard for the minimum dry time before an endoscope is stored has traditionally been 10 minutes.[1]

A more recent study published in 2018 showed residual moisture and waterborne pathogens were present in endoscopes after 24 to 48 hours in storage.[2] Researchers dried the endoscopes for 10 minutes using pressure regulated medical-grade air in a high efficiency particulate air (HEPA)-filtered storage area, but they found this process still leaves residual moisture and doesn't eliminate microbial growth.

See the pattern emerging? It has become clear that the accepted industry protocol is lacking, leaving patients at a higher risk of hospital-acquired infections (HAIs).

However, there is a push for change. Compelling new data, published in the *American Journal of Infection Control (AJIC)*, strongly suggests that it's time to elevate drying's role in infection prevention. In this guide, we break down the study and provide a simplified, directive action plan to instill confidence and help you close the endoscope safety gap.

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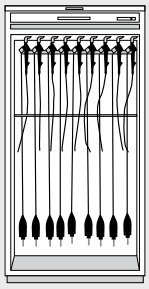
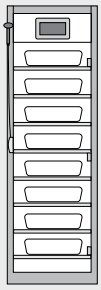
residual moisture and **waterborne pathogens**
were **present** in **endoscopes**
after **24** to **48 hours** in **storage**.[2]

04 *AJIC* STUDY SUMMARY

The researchers, led by professors Ryan Perumpail, MD; Neil Marya, MD; Betty McGinty MS, HSA, BSHSA, RN, CGRN, CER; and V. Raman Muthusamy, MD, MAS, FACG, AGAF, FASGE, know drying is an important step in reprocessing. Their study, "Endoscope reprocessing: Comparison of drying effectiveness and microbial levels with an automated drying and storage cabinet with forced filtered air and a standard storage cabinet," published in *AJIC's* September 2019 issue, evaluated the efficiency of an automated drying and storage cabinet compared to a standard storage cabinet. The researchers wanted to understand how well each cabinet can produce a dry endoscope and reduce the risk of microbial growth.

They performed their evaluation by assessing dryness using cobalt chloride paper at various times — 30 minutes, one hour, two hours, three hours and 24 hours — after HLD was completed.

DRYING CABINET COMPARISON

Standard drying cabinet Cabinet commonly used in the U.S.	**Automated drying cabinet** Cabinet used in the *AJIC* study. (ENDODRY™ Drying and Storage Cabinet)
	
No compressed air	Constant flow of instrument-grade air for direct-connection channel drying
No direct airflow through internal channels or over external surfaces	Endoscopes dry horizontally
Endoscopes hang in vertical position and rely on gravity	Cabinet circulates air within to dry external surfaces
Still has fluid internally at 24 hours	Verified to dry internal lumens within 1 hour and external endoscope within 3 hours
Takes 24 hours to dry externally (not verified)	Study has shown endoscopes can be stored up to 31 days before needing to be reprocessed again
Can be stored for up to 7 days before needing to be reprocessed again	

THE RESULTS

The findings showed that the endoscopes stored in the standard storage cabinet retained fluid internally at 24 hours and was only able to dry the external surfaces within that time. The slower dry time is a result of the endoscopes hanging vertically without any airflow through the internal channels or over the external surfaces. Standard storage cabinets rely solely on gravity and ambient air to dry any residual fluid.

In contrast, the automated drying and storage cabinet showed that internal channels were measurably dry at one hour and external surfaces at three hours in all endoscopes.

The faster dry time can be attributed to a few factors:

- Air is filtered to instrument-grade levels (meaning no particles, moisture or oils) and is continuously circulating over the exterior of the scope
- A connector block with separate ports is hooked up to the endoscope for a constant flow of compressed air through internal channels
- The endoscopes are placed horizontally in a cassette system

The study also evaluated which type of cabinet could store endoscopes longest with no measurable moisture. Current market belief is that in the standard drying cabinet, endoscopes could only be stored up to seven days before needing to be reprocessed again.[3] **The automated drying cabinet used in the study can store endoscopes up to 31 days, over four times longer than the standard cabinet.**

If you're interested in learning more about the study, you can read the full version in *AJIC's* September 2019 issue. For now, read on to discover how you can apply the studies' findings to your practice.

Every year in the United States, **20 million** people receive a colonoscopy or esophagogastroduodenoscopy (EGD). **Twenty thousand** of those individuals will be hospitalized for an infection within seven days, and as a result, $200 million will be wasted. This information gleaned from a Johns Hopkins study published in 2018, provided evidence to show that infection rates from upper-GI endoscopies and colonoscopies in the U.S. are much higher than what was thought previously.[4]

Additional investments in quality research focused on infection prevention have also led to a greater understanding of the importance that drying can play in preventing devastating and costly infection outbreaks. In their study, "Residual moisture and waterborne pathogens inside flexible endoscopes: Evidence from a multisite study of endoscope drying effectiveness," Ofstead and Associates reported that the current methods of reprocessing weren't effective.[2]

They came to this conclusion after finding that moisture remained in 49 percent of the endoscopes that were tested, and 71 percent of the endoscopes were found to have microbial growth. In addition, not one of the three hospitals in the study eliminated waterborne pathogens or residual fluid from the endoscopes that were tested.[2] The lead researcher, Cori Ofstead, said they were surprised to find that accredited hospitals were "skipping steps or doing them poorly."[2]

According to Ann Hewitt, RN, BSN, MM and Cantel Clinical Education Fellow, at a minimum, hospitals should be following the most up-to-date current societal guidelines which all discuss the importance of drying in infection prevention.[5] So if these accredited hospitals in the Ofstead study were following the relevant societal guidelines, then why did such a high percentage of the endoscopes have microbial growth? Are the societal guidelines regarding drying inadequate?

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Lead researcher, Cori Ofstead, said they were surprised to find that **accredited hospitals were "skipping steps or doing them poorly."[2]**

TO MAKE SURE WE'RE ALL ON THE SAME PAGE, LET'S QUICKLY REVIEW EACH DRYING-RELATED GUIDELINE. AS YOU READ THROUGH, CONSIDER THE FOLLOWING QUESTIONS:

- How do these organizations define "dry?"
- How long is an appropriate dry-time according to each set of guidelines?
- Are the guidelines intuitive and actionable? Do they help me repeatedly produce a dry endoscope?
- What types of tools do the societal guidelines recommend I use?

AAMI[6]

Drying scopes and accessories are necessary before moving to storage.

Facilitate drying by flushing channels with 70-80% ethyl or isopropyl alcohol, followed by a forced-air purge using medical-grade air.

Scope channels should be dried by flowing air through them for a pre-determined time. Do not use syringes to dry the channels.

Do not attach accessories to their named scope when placed in storage. Keep accessories with their named scope as a unique set.

AORN[7]

Drying is as important as cleaning and high-level disinfecting in the prevention of pathogen transmission.

Scope channels should be purged with instrument air or dried in a mechanical drying system.

Scope surfaces should be dried by hand with a lint-free, soft cloth.

All removable scope components should be dried.

If a scope is HLD manually, the scope should be manually rinsed and, if the scope will be stored for future use, the scope's external surfaces should be dried with a clean, lint-free cloth. The scope's internal lumens should be dried with instrument air.

Filtered air is necessary to avoid re-introducing contaminants into a post-HLD scope.

The scope should be handled carefully to avoid contact with the HLD soaking and rinsing containers, or with surfaces such as counters; contact could cause recontamination

CDC-HICPAC[8,9]

After reprocessing is complete, store endoscopes and accessories in a manner that prevents recontamination, protects the equipment from damage and promotes drying. Store processed flexible endoscopes in a cabinet that is either:

- Of sufficient height, width, and depth to allow flexible endoscopes to hang vertically without coiling and without touching the bottom of the cabinet.
- Designed and intended by the manufacturer for horizontal storage of flexible endoscopes.
- After HLD, rinse scopes and flush channels with water, followed by 70%-90% ethyl or isopropyl alcohol.
- Follow alcohol rinse with forced air purge to reduce the potential for contamination by waterborne pathogens & to facilitate drying.

FDA[10]

Incorporate a final drying step into reprocessing protocol, as long as this is not listed as a precaution or contraindication in the manufacturer's instructions. This applies whether you manually reprocess your endoscope or use an AER. Studies have demonstrated that a final drying step that includes flushing all channels with alcohol, followed by purging with air (to remove the alcohol), greatly reduces the possibility of recontamination of the endoscope by water-borne microorganisms.

SGNA[11]

Drying is a critical element in reprocessing. Moisture allows microorganisms to survive and multiply; therefore, all channels and exterior surfaces must be thoroughly dried before storage. Drying and storage are as important to the prevention of disease transmission and nosocomial infection as cleaning and HLD.

Moisture promotes biofilm development. Biofilm accumulation results in decreased efficacy of cleaning solutions and high-level disinfectants. Because the bacterial load is not reduced, possible transmission can occur.

Drying the endoscope after every reprocessing cycle, both between patient procedures and before storage, is crucial. Dry all channels with forced instrument air.

Follow the manufacturer's reprocessing manual to determine the air pressure limits for the particular model of endoscope.

Scopes must be flushed with 70-90% isopropyl alcohol and dried with pressurized filtered air.

Required steps are:

a. Flush all channels with 70% isopropyl alcohol until the alcohol can be seen exiting the opposite end of each channel.

b. Purge all channels with air.

c. Remove all channel adapters.

d. Dry the exterior of the endoscope with a soft, clean, lint-free towel.

e. Thoroughly rinse and dry all removable parts. Do not attach removable parts (e.g., valves, etc.) to the endoscope during storage.

08 WHAT THE SOCIETAL GUIDELINES SAY ABOUT DRYING

AAMI (Association for the Advancement of Medical Instrumentation) states that it is necessary to dry endoscopes and accessories before moving to storage, and endoscope channels should be dried by flowing air through them for a pre-determined period of time.[6] In addition, **SGNA (Society of Gastroenterology Nurses and Associates)** suggests that all channels and exterior surfaces must be thoroughly dried before storage.[12]

AORN (Association of Perioperative Registered Nurses) says that endoscope drying is as important to the prevention of nosocomial infection as cleaning and HLD.[7] And **SGNA** concurs — almost verbatim — because moisture allows microorganisms to survive and multiply.[12]

It's important to note that any amount of moisture remaining on an endoscope can put a patient at risk — especially those who are immunocompromised. And according to Hewitt, "A significant number of patients who come into contact with an endoscope are immunocompromised — which makes this conversation all the more important — because as healthcare professionals, our obligation is to keep patients safe, keeping in mind that every patient you care for is someone's child or parent."[5]

when it comes to best practice, the guidelines fall short of clearly stating what it takes to produce a dry endoscope.

08 GAPS IN THE DRYING GUIDELINES

Each of the guidelines state the importance of drying, but unfortunately, the current drying guidelines don't go into specifics as to what is defined as "thoroughly dry," as discussed by SGNA. In addition, there is no direction given about how long that "period of time" mentioned by AAMI should be. The only industry-accepted timeframe is 10 minutes shown by the 1991 study — mentioned above — which is now almost 30 years old[1] and seemingly outdated.

Although most would agree that the guidelines put forth by respected governing bodies such as AAMI, AORN, CDC-HICPAC, SGNA and the FDA are critical to keeping patients safe — **when it comes to best practice, the guidelines fall short of clearly stating what it takes to produce a dry endoscope.**

It's time we as an industry evolve our drying practices. Let's dive deeper into how we can raise the bar, start to close the education gap and enhance best practices.

This lack of specific direction from the current guidelines has propelled further research about endoscope drying, such as the recent *AJIC* study summarized on page four. This new study will be exceedingly valuable for healthcare facilities that want to follow best practices, because it fills the information gap with evidence-based data.

To reiterate, in this first-of-its-kind study, the goal of the researchers was to measure the effectiveness of a storage cabinet compared to an automated drying and storage cabinet in drying endoscopes post-reprocessing and reducing microbial growth.[13]

Let's break down the difference between an automated drying and storage cabinet and a standard storage cabinet because this can be confusing to many — aren't they the same? The answer is no. **There are many different cabinet options out there, but there are two main cabinets that exist: standard cabinets and automated drying cabinets.**

In the *AJIC* drying study, a standard storage cabinet — without HEPA or compressed air — was used. This is currently the most popular cabinet used in the U.S.,[13] possibly for the simple reason that its capabilities are what the guidelines suggest as a baseline.

The most basic standard cabinet is just that, a cabinet used to store the endoscopes after following drying guidelines; flushing the channels with alcohol, purging channels with compressed air, removing channel adaptors and drying the exterior of the endoscope with a soft, clean lint-free towel.[12] There is no airflow through channels or over external surfaces and the endoscopes hang vertically.

When it comes to infection prevention, the challenge with a standard cabinet is that is relies on gravity to dry the internal lumens, which leaves the possibility for residual moisture that can lead to microbial growth. In addition, standard cabinets generally don't have a locking mechanism, and in a busy setting, the cabinet doors could be left open — leaving the newly cleaned and disinfected endoscopes open to microbial growth.

There are, of course, other varieties of the standard cabinet that do lock and use HEPA-filtered air to circulate throughout the cabinet. These cabinets also rely mainly on gravity for drying the internal lumens. In addition, like with a basic conventional cabinet, because they are hanging vertically there is a possibility of damaging the distal tips of the endoscopes, which can be expensive and complicated to repair and/or replace.

In contrast, automated drying cabinets (most often used in Australia and Europe) generally utilize HEPA filters and are designed to control humidity, air quality. They keep surfaces dry by purging endoscope channels with microbial-free air.[12]

The automated drying cabinet that was utilized in the *AJIC* drying study uses instrument-grade air delivered by direct connections to the endoscope's internal channels.[13] The automated cabinet also continuously circulates HEPA-filtered air within the cabinet which enhances drying of the external surfaces of the endoscopes.

In addition, the automated cabinet utilized in the study includes a cassette system that allows endoscopes to be dried and stored horizontally (instead of vertically) giving the reprocessing technician hands-free access to endoscopes. This hands-free capability also decreases the possibility of recontamination and damage to the endoscope.

The drying study researchers found that the automated cabinet could store all three endoscopes for 31 days[13] with low microbial levels without reprocessing again. When evaluated against a flat seven-day storage time[3] there may be an advantage to utilizing an automated cabinet.

STANDARD CABINET OR AUTOMATED?

Based on the results, the independent researchers found the automated cabinet "to be superior to a standard cabinet"[13] and concluded that automated cabinets may reduce costs because the need for reprocessing will most likely decrease.[13] **Additionally, vertical hanging of endoscopes "may become obsolete" because the horizontal storage used in automated cabinets can more effectively reduce the risk for waterborne pathogens and recolonization.[13]**

10 BEST PRACTICES TO IMPROVE DRYING PRACTICES AND PREVENT INFECTION OUTBREAKS

IT'S APPARENT FROM THE *AJIC* STUDY THAT JUST BY UTILIZING AN AUTOMATED DRYING AND STORAGE CABINET, a healthcare facility could not only save on drying time, but may save money and help to prevent infection outbreaks — which would potentially save lives. There are also many additional ways for a healthcare facility to improve drying practices and prevent infection outbreaks — find 10 best practices suggested below by Ann Hewitt, RN, BSN, MM and Cantel Clinical Education Fellow below.

1. **Educate and train endoscopy staff** (including physicians) about the significance of drying in infection prevention. Involve your infection preventionists and risk managers so they can support — or even drive — the integration of proper drying practices into the facility. Find continuing education and online courses designed by industry experts, like Identifying Gaps in GI Practice.[5]

2. **Be intimately familiar with the guidelines and instructions for use (IFU)** that focus on how to properly dry endoscopes and accessories. All guidelines recommend drying, but it can be hard to keep track of them all and their latest updates. Visit **www.endoinfectionprevention.com** for all the up-to-date drying guidelines.[5]

3. **Understand the difference between "drying" and "dry."** Hewitt likes to use an analogy of the spin cycle in your washing machine versus the drying cycle in your dryer. She says, "You don't fold up your damp towels and then put them in the linen closet after they've been spun in the washer. And you most likely don't hang them on the clothes line. You put them in the dryer. Endoscopes should be treated at least as well as your towels."[5]

   Research on drying pinpoints that completely dried endoscopes are almost equivalent to completely cleaned endoscopes in terms of the positive impact on microbe-free endoscopes for patient use. The air purge cycle in an automated endoscope reprocessor (AER) does not dry your endoscope. Its purpose is to remove gross moisture from the endoscope — akin to the way an automatic car wash dryer pushes water droplets toward the ground after your car is done with the wash cycle. But most likely after the wash your car will still be wet, and will dry with spots of dirty debris unless you dry it completely.[5]

4. **Choose a validated drying cabinet** that is proven to dry both internal and external surfaces within a prescribed amount of time. Keep in mind that a storage cabinet with a fan in it is not a drying cabinet, it's just a storage cabinet with a fan in it. In contrast, the automated cabinet used in the *AJIC* study not only dries the internal lumens, it constantly circulates HEPA-filtered air throughout the cabinet. In addition, it includes an endoscope tracking system and provides access control to keep endoscopes away from environmental contamination.[5]

5. **Perform routine drying checks of stored endoscopes** to monitor for retained/residual moisture. Use a borescope for this purpose and perform routine microbial surveillance of your endoscopes to monitor for bacterial growth.[5]

10 BEST PRACTICES TO IMPROVE DRYING PRACTICES AND PREVENT INFECTION OUTBREAKS

6 **Dry the internal lumens and external endoscope.** Many practitioners only dry the outside because they think they can "hang dry" it in vertical storage and it will drip dry. Doing anything more takes time, and they don't have time. But it's critical to dry the internal lumens because as noted above, any amount of moisture allows microorganisms to survive and multiply.[5]

7 **Allocate sufficient time to dry all surfaces:** exterior, interior and accessories. If done manually, use a litmus test to determine how long it will take per channel to achieve a dry internal surface. If done using a validated endoscope drying cabinet, follow manufacturer IFU for that equipment. Remember that accessories need to be treated the same way as the endoscope; they must be completely dry before going into storage.[5]

8 **Provide necessary supplies at the designated drying site.** At a minimum, you need a fresh, clean, low-lint drying cloth for every endoscope set. Some practitioners may reuse cloths because they may not have an adequate supply on-hand, but they don't realize that there could be contaminants on a cloth that's been used multiple times.[5]

9 **Provide the necessary utilities for successful drying.** Facilities should have access to compressed, instrument-grade air and a closed air delivery system.[5]

10 **Have ready access to appropriate personal protective equipment (PPE).** Gloves, gowns, masks, goggles, face shields, and head and shoe covers should be kept in each location where clean endoscopes will be handled. Clean gloves and face masks should definitely be accessible in storage areas.[5]

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