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Disinfection Showdown: Automated Vapor, Soaking, and Foam Methods Under the Microscope

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PURPOSE

This poster presents a comparative summary of three methods of high-level disinfection for ultrasound probes, evaluating disinfection time, cost per cycle, and workflow impact, including transport time and setup requirements. Its purpose is to guide clinicians toward solutions that maintain patient safety while optimizing efficiency and cost across varied healthcare environments.

BACKGROUND

Effective disinfection of ultrasound probes is essential for infection prevention. Choosing the right method remains challenging due to differences in probe design, clinical use, and available technologies.

Guidelines vary by procedure type, requiring high-level disinfection for endocavitary use but less stringent protocols for percutaneous applications. In some cases, recommended solutions are viewed as impractical or overengineered, disrupting workflow without improving patient safety. To protect probe integrity, manufacturers may prohibit the use of certain disinfectants—such as alcohol or bleach-based products—adding another layer of complexity.

The lack of consensus and the wide range of practice environments—from busy emergency departments to outpatient clinics—make decision-making difficult for clinicians and administrators. Practical factors, such as equipment availability, integration into workflow, disinfection time, and cost per use, further shape what can be implemented in real-world settings.

To address these issues, this poster compares three high-level disinfection technologies used in U.S. healthcare facilities. Our goal is to help guide method selection based on workflow fit, time efficiency, infection prevention and control priorities, and cost.

RESULTS

Three technologies for high-level disinfection of ultrasound probes were evaluated for workflow, time, and cost: vaporized hydrogen peroxide in a closed apparatus, glutaraldehyde soak, and chlorine dioxide foam applied with a proprietary wipe (see Table I).

Showdown at a Glance: Performance Characteristics of Three HLD Modalities

Performance Characteristic	Nanosonics Trophon2[1]	Glutaraldehyde in GUS Soaking Station[2]	Tristel ULT[3]
			
Active Ingredient	Hydrogen peroxide (H_2O_2)	Glutaraldehyde ($C_5H_8O_2$)	Chlorine dioxide (ClO_2)
Technology and Method of Application	Vaporized mist sprayed within a closed apparatus	Liquid used in a manually prepared soak	Foam applied manually with a proprietary dry wipe
Single Use or Reusable	Single use dose for each application; use of pass/fail test strip required for each cycle	Liquid may be reused, but minimum effective concentration must be verified using test strips prior to each disinfection cycle	Single use dose for each application; test strips to confirm concentration are available, but their use is not required
Processing Time (minutes)	7 (+5 min warm-up time)	8–20	2
Equipment Cost (US$)	14,047[4]	3,079[5]	0
Consumables Cost/Cycle (US$)	10–14[6]	0.13[7]	3.16[8]

Table I. Performance characteristics for three high-level disinfectant methodologies. Figures do not include indirect costs for items such as facilities, utilities, labor, transport, minimum effective concentration testing, service contracts for equipment, expanded device inventory to accommodate turnaround times, or potential device damage due to disinfectant incompatibility.

Transport time can affect the overall efficiency of high-level disinfection. Vaporized hydrogen peroxide and glutaraldehyde methods require access to a specific machine or sterile processing area, which may be located away from the point of care. In contrast, chlorine dioxide foam can be applied in the patient room, including bedside in the intensive care unit. Per manufacturer instructions, both vaporized hydrogen peroxide and chlorine dioxide foam are single-use only. Glutaraldehyde can be reused only if its concentration is re-checked (a process that takes a few minutes daily); if the solution is above or below the minimum effective concentration, the solution must be discarded and replaced. Vaporized hydrogen peroxide and glutaraldehyde also involve upfront equipment purchases and ongoing maintenance costs.

CONCLUSIONS

All three technologies achieve high-level disinfection, but they differ in workflow efficiency, cost, and portability (see Table II). Chlorine dioxide foam applied with a wipe provides the quickest turnaround and avoids transport delays by allowing disinfection at the point of care. While actual costs depend on purchasing agreements and facility layout, chlorine dioxide is generally the most economical and convenient choice, especially in decentralized settings. Newly introduced to the U.S. market, chlorine dioxide foam offers a practical addition to current disinfection options. Limitations of these comparisons include differences in institutional workflows and the use of manufacturer-reported data for cost and performance characteristics.

Time Is Money: Out-of-Service Steps Add to HLD Reprocessing Costs

Transducer Out-of-Service HLD Reprocessing Steps	Trophon2	Soak	Tristel ULT
Immediate Post-Use Handling a. Wiping b. Containment for transport	a,b	a,b	–
Transport a. Outgoing: transport soiled device container to reprocessing area (if not done at point of care). b. Return: place probe in clean transport container with dust cover and clean sticker; return to patient care area	a,b	a,b	–
Cleaning a. Manual cleaning with enzymatic detergent to remove organic matter or debris that could interfere with the disinfection process b. Don PPE (gloves and eye protection) c. At bedside, clean probe with disinfectant wipe; change gloves; wipe probe with lint-free cloth; place cleaned probe on clean dry drape d. In reprocessing area, prepare soaking bin with detergent; soak, scrub, rinse, and dry device per facility protocol; place cleaned probe on clean dry drape. When finished, empty, rinse, wipe, and dry soaking bin per facility protocol. Prepare new soaking bath for the next round e. Doff PPE and perform hand hygiene	a,b,d,e	a,b,d,e	b,c,e
Disinfection Processing a. Follow medical device and disinfectant manufacturers' instructions for use for high-level disinfection using automated system, soaking, or wipe modalities, complying with all time and temperature requirements b. Perform hand hygiene and put on new gloves	a,b	a,b	a,b
Residue Removal a. If required, rinse with sterile water to remove residual disinfectant b. For Tristel ULT, use a proprietary dry wipe to remove residue	a	a	b
Drying and Storage a. Dry with a clean, lint-free cloth to prevent recontamination b. If not for immediate reuse, store in container or sealed bag with 'clean' label	a,b	a,b	b
Documentation and Tracking a. Record all steps of the HLD process, including date, time, patient MRN, probe serial number, personnel involved, disinfectant used, and test results	a	a	a
Monitoring a. For automated systems, use test strips to confirm the concentration and effectiveness of the solution for each disinfection cycle b. For reusable soak solutions, use test strips to confirm the concentration and effectiveness of the solution for each disinfection cycle c. For Tristel ULT, use test strips to complete quality control when a new container is opened or as institution policies require (optional) d. Document QC	a,d	b,d	c,d

Table II. Out-of-service reprocessing steps for three high-level disinfection modalities used to disinfect ultrasound transducers. Disinfection performed in a central service sterile processing unit typically adds steps related to transport and handling, with additional time and costs.

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