ENVIRONMENTAL SURFACE DISINFECTANTS

critical information (2-2015)

TRAC RESEARCH
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1. Do all disinfectants kill equally well?

No – different formulations and chemical ingredients sold under different brand names kill very differently. This is particularly true when human proteins such as blood, saliva, etc. are present.

2. Should disinfectants be tested by an independent lab to confirm kill claims?

Yes –because marketing and promotional claims can be *very* misleading.

In the U.S., environmental surface disinfectants must kill 99.9% of a specified test organism (3 $\log_{10}$ reduction of a 1 million organism challenge) to be registered as disinfectants by the Environmental Protection Agency (EPA). Unfortunately EPA does not test disinfectants to validate performance data submitted by companies.

EPA has suggested kill of the tuberculosis bacteria as the benchmark for disinfectants used in healthcare. However, our work has shown that disinfectants that can kill the tuberculosis bacteria often cannot kill some of the more difficult-to-kill viruses. Yet, virus kill is not required for EPA registration. However, it is viral infections that present the highest risk to dental clinicians in the U.S. today.

Since 1985 we have accumulated a large database using the tuberculosis bacteria and the virus known as poliovirus I (Mahoney strain) in tests performed in triplicate on well over 150 different disinfectant formulations from around the world. We now know that only high ethyl alcohol formulations (≥70% ethyl alcohol) or chlorine based (≥2.5% sodium hypochlorite) can perform the kill needed in the presence of human proteins such as blood, saliva, crevicular fluid, suppuration (pus), etc, which are ALWAYS PRESENT ON SURFACES IN CLINICAL SETTINGS due to aerosols, spatter, spills, and body contact that occur during every treatment.

However, 70% ethyl alcohol is *NOT* the whole story. To kill in the presence of fresh human whole blood, the formulation requires a specific grade of ethyl alcohol plus surfactants and other trace ingredients to retard evaporation, facilitate even spreading, and aid protein wetting. Our data indicate that only two commercial formulations (Lysol III and GermXtra*) are able to kill in the presence of the human proteins enumerated above, and penetrate to kill the organisms trapped within.

3. Should I clean *before* I disinfect?

Yes, clean – but use a generous coating of a disinfectant that kills in the presence of clinically relevant proteins as the cleaner (Lysol III or GermXtra*). Then after removal of the visible debris, re-apply the Lysol III or GermXtra* for the disinfection step. In other words, spread Lysol III or GermXtra* twice – once to clean and once to disinfect.

Because most disinfectants are NOT able to kill in the presence of human proteins, clinicians have been directed to clean before they disinfect. Unfortunately, clinicians have chosen to clean with products that do not kill in the presence of human proteins. This forces the cleaning person into direct contact with contaminated surfaces at a time when the organisms are most likely to be still viable. *INSTEAD*, surfaces should be spread generously with a broad spectrum disinfectant that kills in the presence of proteins.

*GermXtra is not sold currently in the U.S.

OVER

4. Why is it a bad idea to spray disinfectants directly onto surfaces?

There are three answers to this question: (1) Spraying leaves many areas uncovered with liquid between the spray droplets in which organism kill does not occur; (2) *All* disinfectants are strong chemicals that should not be aerosolized; and (3) Hand pump spray containers used by most for direct application draw in air that is used to expel the liquid. Exposure of the disinfectant chemicals to air degrades their kill potency.

INSTEAD OF SPRAYING DIRECTLY ONTO THE SURFACE – spray liberally into an applicator, such as a 4x4" gauze sponge, and then use it to spread the disinfectant evenly over the surface to be disinfected. The surface should be left generously wet for a period of time to allow the disinfectant to penetrate and kill the microorganisms. This wait period is called "contact time". *All* disinfectants require a contact time that varies according to the formulation of the disinfectant. Directions on many disinfectant containers specify 10 minutes. Most clinicians make the mistake of wiping sprayed surfaces too quickly after application.

5. Are pre-wet wipes, such as the popular CaviWipes, a good solution for surface disinfection?

No—for two reasons: (1) The quaternary ammonium compound chemical used in this product (and most other wipes) is neutralized by human proteins which exposes the user to any pathogens present; and (2) The pull-out dispensing exposes the chemicals on the wipes to air degradation and the wipes to drying.

We have tested many different brands of pre-wet wipes, and NONE achieve a broad spectrum kill, either in the absence or presence of human proteins. For this reason we consider pull-out-dispensed pre-wet wipes to be dangerous to both patients and clinicians in clinical settings.

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Course Handout
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Surface Disinfection: Can it be effective, safe, and easy?

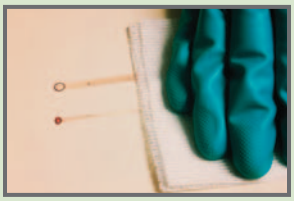
Gordon's Clinical Bottom Line: Infection control is probably *not* your favorite topic, but it is of utmost importance since **most surface disinfectants are *clinically* inadequate**. *For this report, TRAC Research recently tested 5 ethyl alcohol based and 3 other popular products and makes suggestions for you to upgrade handling of contaminated surfaces.*

TRAC RESEARCH

Each patient expects the treatment area to be clean and free of microbes from previous patients. Each member of the dental team expects the workplace to be safe and free of pathogens. No one wants to be sick, even if the illness is not life threatening. Today, critical points in surface disinfection are:

- Dental treatment scatters saliva, blood, crevicular fluid, biofilm, and hard and soft tissue on everything and everyone.
- The contamination comes mostly from aerosols that travel everywhere, but also from smears, splatters, and spills.
- Oral microbes are contained *within* the various fluids and tissues, and are rarely found free on clinical surfaces.
- ***When microbes are mixed with oral complex proteins, all disinfectants do NOT kill equally well.***
- Marketing has misled clinicians, and they continue to choose products that cannot deliver the kill they expect.
- Current industry guidelines direct to clean BEFORE disinfecting which seriously compromises exposure prevention.

This report shows the science, the products, and the procedures necessary for effective, safe, easy surface disinfection in 2015.



We need disinfectants that kill and clean at the same time

1. How can clinicians tell which surface disinfectants kill well?

Chemical formulation is the key. In the U.S., all disinfectants must list ACTIVE and OTHER ingredients on the label using the exact form **shown to the right** for the example Lysol Spray III. Clinicians should always look for this listing on their surface disinfectant.

Example Label

ACTIVE INGREDIENTS:
Alkyl (50%C_{14}, 40%C_{12}, 10%C_{16}) dimethyl benzyl ammonium saccharinate 0.10%
Ethanol 58.00%
OTHER INGREDIENTS: 41.90%
TOTAL: 100.00%

Many years ago researchers characterized the kill potential of chemicals used worldwide for disinfection *(see published works by Block, S.S. and by Morton, H.E.)*. TRAC Research has re-confirmed this work repeatedly since 1989 *(see JADA, Oct. 1989, and many CRA Newsletters and Clinicians Reports)*, testing over 170 products sold in 6 countries. The chart below summarizes results using two pathogens known as difficult to kill with chemicals *(tuberculosis bacteria and polio virus 1 Mahoney Strain)* in the absence and presence of fresh human whole blood:

TABLE 1: General kill potential of commonly used surface disinfectant active ingredients

= Inactivated 3 $\log_{10}$ of a 1 million organism challenge *(99.9% kill)*. = Failed to inactivate 3 $\log_{10}$ of 1 million organism challenge *(99.9% kill)*.

6 Major Active Ingredients used alone or in combination in commercially available environmental surface disinfectants used in dentistry	NO Blood in test system		Fresh Human Whole Blood in test system	
	Tuberculosis bacteria	Poliovirus 1 *(Mahoney)*	Tuberculosis bacteria *(+50% blood)*	Poliovirus 1 *(Mahoney)* *(+10% blood)*
CHLORINE 2.6% by volume	killed	killed	not killed	killed
ETHYL ALCOHOL ≥70% by volume/58% by weight	killed	killed	killed	killed
IODOPHOR	not killed	killed	not killed	not killed
ISOPROPYL ALCOHOL ≥70% by volume	killed	not killed	killed	not killed
PHENOLIC	killed	not killed	not killed	not killed
QUATERNARY AMMONIUM COMPOUND	not killed	not killed	not killed	not killed

Chart Summary:

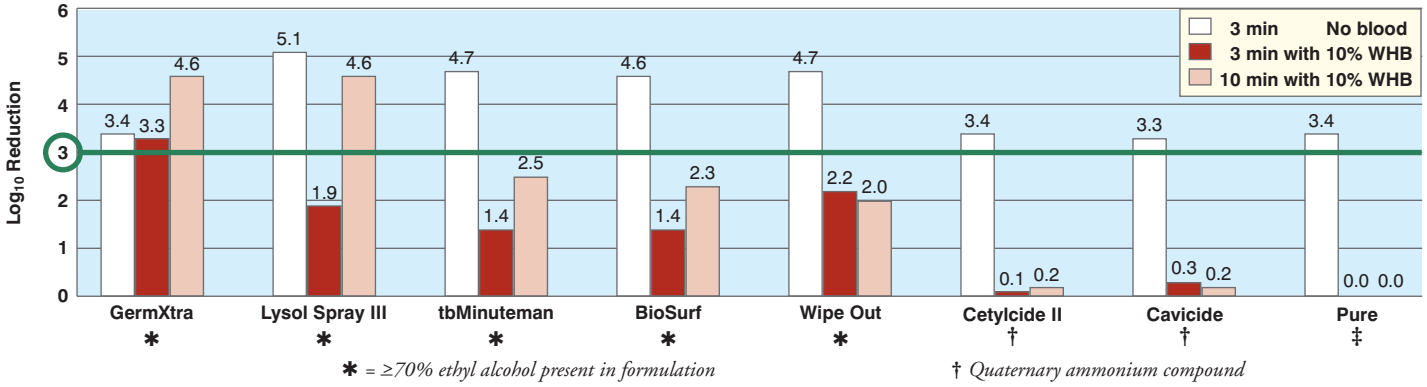
- **Certain formulations based on high ethyl alcohol kill well both in the absence and presence of fresh human whole blood *IF* a specific grade of ethyl alcohol is used along with OTHER INGREDIENTS that allow even spreading, retard evaporation, and aid protein wetting.**
- **Products whose formulations rely primarily on the other 5 chemicals generally fail to kill under the above test conditions.**
- **Clinicians can generally predict a disinfectant's kill by comparing active ingredients on the label to Table 1 above.**

NOTE: A clinician's technique and diligence CANNOT overcome a disinfectant's chemical inadequacy.

2. Do all surface disinfectants kill pathogens equally well?

NO. Generally, if a chemical kills 3 $\log_{10}$ *(99.9%)* of a million organism challenge, it can claim disinfection. Green line below indicates kill limit.

FIGURE 1: Kill profile at *3 & 10 min* of 8 environmental surface disinfectants on poliovirus 1 *in absence and presence of 10% fresh whole human blood (WHB)*



✱ = ≥70% ethyl alcohol present in formulation † Quaternary ammonium compound

Graph Summary:

- **All 8 disinfectants tested achieved the necessary 3 $\log_{10}$ kill of poliovirus within 3 minutes, *if blood was NOT present* *(white bars).***
- **With 10% blood, GermXtra passed after 3 and 10 minutes *(red and pink bars),* and Lysol Spray III passed after 10 minutes *(pink bar).***
- **The data illustrate clearly that disinfectant kill is: 1) highly *formulation* dependent; 2) seriously challenged by oral proteins.**

Disinfectant companies know their products fail to kill if complex body fluids are present. For years they have put clinicians at high risk by directing to clean ***before*** disinfecting. This dangerously puts "the cart before the horse" and places the cleaning personnel in harm's way. **We need disinfectants that kill and clean at the same time. TRAC tests show GermXtra and Lysol Spray III accomplish this goal.**

3. There are many products named Lysol, so how do I know which one to buy and the best place to buy it?

- Best way to KNOW you have the correct product is to check the label ingredients *(see #1 above).* Look for **58% ethanol** *(by weight).*
- Schein, Patterson, Benco, and Burkhart sell the 58% ethanol formulation under the name **Lysol I.C. Disinfectant Spray**.
- Local discount and groceries sell the 58% ethanol formulation under the name **Lysol Spray III** *(NOTE: Crisp Linen scent has least "flowery" scent).*

4. Why do speakers and/or authors tell me not to use ethyl alcohol *(also called ethanol)* for surface disinfection?

Reasons may include:

- They do not perform disinfectant testing themselves, so they may be easily misled by people with vested interests.
- They do not know that it is the ***formulation***, not just ethyl alcohol alone, that is needed.
- They may not have tested using difficult to kill viruses and clinically relevant types and amounts of human proteins.
- They may have other reasons or biases to promote certain products.
- They may not realize the health and safety of you and your patients are jeopardized by products that fail to kill in the presence of oral proteins.

5. Steps for effective, safe, easy surface disinfection.

Step 1. Pre-clean by holding a 4x4 inch cotton filled gauze pad over disinfectant orifice and spray dripping wet to create "custom wipe" just before use. ***Currently, no commercial pre-wet wipes provide kill in the presence of oral proteins.***

Step 2. Generously spread disinfectant evenly and scrub to remove visible debris. Re-wet the gauze pad frequently during wiping. Do not spray directly onto surfaces to avoid uneven wetting and excessive aerosols.

Step 3. Leave surfaces generously wet at least 3 minutes for GermXtra and 10 minutes for Lysol Spray III to allow disinfectant penetration of oral proteins and effective kill.

Step 4. Disinfect pre-cleaned surfaces using a second generously wet 4x4 pad, and leave surfaces damp, allowing to air dry or paper towel wipe to smooth streaks or puddles.

6. Can Lysol Spray III and GermXtra be used to disinfect all types of surfaces?

NO. High ethyl alcohol products need trial before liberal and regular use. ***Some*** rubbers, plastics, paints, and naugahydes require plastic barriers rather than routine treatment with chemicals. **Today, healthcare equipment needs to be upgraded to allow *effective* disinfection after each patient.**

TRAC Conclusions:

Environmental surfaces *can* be disinfected effectively, safely, and easily if efficacious disinfectants are chosen and used correctly. However, both the disinfectant industry and clinicians are urgently in need of change to make this happen routinely. Why change? When a serious pathogen hits unexpectedly, you are ready and all benefit—patients, staff, and doctors. **Currently of 170+ products tested by TRAC Research, only Lysol Spray III in the U.S. and GermXtra in Canada show consistent kill in the presence of human protein debris when used as directed in section 5 above.**