How can Infection Preventionists change "what should be" to "what is" in cleaning and disinfection in the healthcare arena?

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The proper disinfection of objects and surfaces is an arduous task in any institution whether healthcare or food related, and there are many articles and opinions on the subject. The ongoing assumption by most individuals is that whatever is being used must have been approved by someone, will do the job, is safe to use, and therefore do not question the choices. We all make assumptions about products. When you go to the grocery store to buy a disinfectant for the home and you see a label such as "Clorox", most think that this implies bleach is contained in the product; if it says "Lysol", the assumption is that the old fashioned phenolic used for generations is in the bottle. But, this is not the case. The reality is that most individuals, whether in healthcare, foodservice or at home, are using products and have no idea what the active ingredients are or how they work.

In the role of an Infection Preventionist (IP), you are charged with making sure that the product being used in the healthcare facility is adequate to perform the disinfection necessary for the area being treated. This can be a complicated task. The IP must evaluate what product is being used, what areas need to be treated, and how it is applied. Since healthcare infections, otherwise known as HAIs, have been a growing concern for many years, the IP has to make sure that the disinfection products are adequate to kill the organisms that are of concern. Does the product work effectively against the standard organisms such as VRE, MRSA, CRE, TB, *Pseudomonas*, *C. diff*, fungi, enveloped and non-envelop viruses, etc.? Does the product pose harm to the user? Is the product being used in the NICU, OR or throughout the hospital? Does the staff know how to apply it according to the directions, and do they do it that way? How is the staff being trained and results being evaluated? Key to the success of environmental cleaning and disinfection is *knowledge, consistency* and *evaluation* of end results:

Knowledge: is gained through reading the literature and understanding how the claims for the products are being made; this allows the IP to make decisions to answer the question "Will this product work effectively against the organisms we want to kill/deactivate in the locations we want to use it?" The Environmental Protection Agency (EPA) is responsible for setting the criteria with regards to log kills of an organism and the surfaces/locations it is safe to use a product. Then it is a question of reading the fine print and sorting though the advertising hype and claims associated with each product and to understand the studies that support the claims. What type of product is it (fog/spray/mist)? Are the products used effective on surfaces being cleaned and is there potential harm to the user or the patient? Is there a residue? Is the smell tolerable to staff and patients? Is the contact time reasonable? What are the costs? Too many products can create confusion. Can a facility reduce the number of products used and achieve good HAI rates as well as a safe and clean environment? Answering these questions allows the IP to recommend the best product for a particular use and take into account all products being used in the facility.

Consistency: The product used is only part of the question as the application of the product is key to the product's efficacy. Is the product being delivered at a constant strength and applied for the correct contact time? Are the workers following the recommendations indicated on the label? Are they following the recommended application sequences? Have they performed the appropriate pre-cleaning

to remove soil and serum based proteins? What timelines have been established for the job? How much area is being cleaned? Is it cost effective? If the product is wiped on using microfiber cloth, how does one assure that all the surfaces have been reached and the crevices cleaned and disinfected appropriately? Data suggests that as staff gets fatigued the likelihood of washing their hands decreases significantly. It's likely that the environmental service staffs faced with the terminal cleaning of 5-10 rooms per day have a similar fatigue onset and may miss many areas. Since the organisms are not visible, who is to know? Systems to evaluate efficacy including a product such as a "fluorescent solution" or products measuring ATP levels on surfaces are sometimes used to evaluate the staff's performance. Do these assessments really make a difference and are they being used in a consistent manner?

Evaluation: A good disinfection program should yield low infection rates, but to know the product is working a measurement system must be put into place. Questions the IP can ask to evaluate effectiveness go beyond simple infection rates. Can the healthcare facility validate changes in HAI rates based on efficacy of products used? Did the use of a product reduce time of labor as well as costs associated with the products? Are the successes publicized and credit given to the environmental staff? There are many systems to track results; the important thing is to determine who will be doing the tracking, what will be tracked, and set benchmarks so you can evaluate changes.

A Recent Scenario:
Let's look at a recent and real scenario. In a small acute care inner-city hospital, the IP was faced with increasing HAI rates. A myriad of products were being used some of which were not safe for the employees and disturbing to the patients. How was the IP to approach making changes without creating confusion and push-back? The IP needed to partner with the director of environmental services to understand his/her challenges with regards to labor, square footage, age of the building, and to ascertain his knowledge of the products being used. Partnering with the supplier of products was also important. Changing vendors overall was really not in the mix. This did not happen rapidly. Product technology was undergoing a rapid change in delivery methods. Use of various high intensity UV robots for disinfection was gaining a lot of popularity, but cost was prohibitive. Several companies were promoting the use of highly concentrated solutions of peroxide, some companies were promoting heated alcohol vapor delivered as a mist or fog. New products containing "activated" peroxide in combination with citric acid or Ag+ ions hit the market. Bleach wipes were gaining popularity for high touch areas and *C. diff* spores, etc. What was the advantage of each?

So the first step was to determine what products were being used in the facility and for what purpose (Knowledge). The products were then classed by active ingredients and their claims, contact times, relative cost, ease of application, etc. Why did we have a separate toilet bowl cleaner, a glass cleaner, a floor cleaner, a high touch surface cleaner, etc.? Were the products really different? Were any of the products detrimental or potentially detrimental to employees with consistent exposure? In addition certain departmental needs came to light which affected product use; how could we quickly turn an OR room around? Could we do this is less than 5 minutes? How could we safely clean keyboards, basinets, etc.?

At this time TOMI's SteraMist™ BIT™ was brought to our attention. The product used Activated Ionized Hydrogen Peroxide (AIHP). The product had some interesting properties including a hand held applicator, rapid delivery, short contact time and low odor. The product was easy to use and offered

broad spectrum kill. The Infection Prevention Committee liked it, but even with a reasonable price tag of $17,000 and low reagent costs, they were not able to purchase it. So the OR dilemma remained. Several peroxide wipe products were tried and found satisfactory but they were still faced with "was the surface really clean"? How do you effectively clean all surfaces, walls, etc. in a short time using disposable wipes? (Consistency)

So, a few months passed and suddenly EBOLA came to the US and all hospitals were driven to prepare for the admission of EBOLA patients. Not only were they required to admit patients, but they also had to transport patients. The Emergency Preparedness Director for the hospital was very innovative and had listened to the TOMI™ presentation. He applied for the grant and purchased the SteraMist™ BIT™ and told the state that they would take responsibility for transporting patients for the county with SteraMist™ BIT™ at his side. The EBOLA committee then prepared all the documentation for safe transport and decontamination of the ambulance and personnel. The ease of SteraMist™ BIT™ applications was the most important. The IP was surprised that suddenly the product that was to answer many of the hospitals issues, listed above, was onsite. Of course, the machine was sequestered and could only be used for EBOLA. When the fury and concern over EBOLA died down, the IP was able to use SteraMist™ BIT™ for certain processes. Four areas were targeted (Areas of Evaluation): 1. Carpeted areas where mold spores were present, 2. Biological hoods in pharmacy, 3. Contact precaution room discharges, and 4. OR terminal cleans post procedure day. The product was also used for *C. diff* rooms even though the EPA, at that point, had not registered SteraMist™ BIT™ the spore claim for *C. diff*. However, independent studies with TOMI™ featured spore claims for *Bacillus artrophasus, Geobacillus stearothermophilis, Bacilus subtilis, and C. diff* with >6 log kill done by independent laboratories. SteraMist™ BIT™ was applied to all surfaces in the OR including walls. Rooms underwent regular cleaning followed by a SteraMist™ BIT™ application. The ease of use made the product very popular and gave the staff confidence that the rooms were fully disinfected. Staff had confidence in the complete coverage offered by the SteraMist™ mist/fog vs a manual wipe to disinfect all areas of a room consistently.

Even though all *C. diff* rooms continued to be wiped with bleach wipes prior to the SteraMist™ application (since SteraMist has not yet received an EPA registration for use for C.diff spores), we found that once the SteraMist™ step was added the hospital's infection rates for C. diff took a dramatic fall. In a six month trial that included the added SteraMist™ step, we tracked a dramatic drop in C.diff rates from 6.4 to 2.2/10,000 patient days. The SSI rates have remained below 0.04%, the MRSA and VRE and other MDRO's rates were near zero. Labor cost remained constant as no extra labor was utilized for the application of SteraMist™, and it resulted in significant cost savings to the hospital in lower re-admission and Medicare penalties such as insurance reimbursement incentives.

In summary the choice of a disinfectant can be a complicated one. The product needs to fit the environment and assure complete disinfection. It has to be compatible with other agents in use, be safe, and free of noxious fumes. It has to protect and disinfect surfaces such as keyboards and monitors, and other equipment with no damage. It has to have rapid turn-around time. SteraMist™ BIT™ Activated Ionized Hydrogen Peroxide (AIHP) system meets those criteria in this case, with a relatively low cost and ease of use. By using the steps of *Knowledge, Consistency, and Evaluation*, a small inner city hospital changed the way it 'should' be disinfecting into the way it 'is' disinfecting, to lower infection rates, provide better safety for patients and staff, and subsequently saving costs.