ACETIC ACID: A Safer Alternative as Surface Disinfectant

St. Paul Hospital – Tuguegarao City

GGHH Agenda Goals

- Chemicals

Hospital Goal

- Identify safer alternatives to hazardous chemicals currently being used at the hospital.
- Promote utilization of safer alternatives in non-critical areas such as hallways and rooms.

Progress Achieved

Saint Paul Hospital- Tuguegarao (SPH-Tuguegarao) was able to minimize the use of chemical laden disinfectants. Highly hazardous chemicals including: sodium hypochlorite (bleach), formaldehyde, ethylene oxide and glutaraldehyde, were replaced with alternative less toxic disinfectants.

The alternatives were used for surface cleaning of non-critical areas in the hospital. Since 2008, the SPH Tuguegarao's housekeeping department has used diluted 4-7% acetic acid as part of their efforts to come up with a cleaning alternative that is cost- effective, efficient and safer for the hospital staff as well as the environment. Since adopting the practice, the hospital has been able to reduce its cost of buying commercial disinfectants. The table below presents the non-critical areas where the acetic acid are applied, highlighting the savings made when other chemical-based alternatives are used.

Table 1.0 Cost Comparison of Using Acetic Acid and Toxic Chemical – Based Alternative

Hospital Area	Consumption in terms of Volume per Month	Cost Expenditure per Month	Savings from Using

Patients					Alternative
	Conventional Chemical-based Disinfectant	Alternative	Conventional Chemical-based Disinfectant	Alternative	
Room (Private and Ward,	Previously 24 gallons per month prior to using g alternatives Reduced to 8 gallons per month	16 gallons per month (Php 95.70 (USD 1.80) per gallon)	Php 2,668.80 (USD 50.35)- Previously (at 24 gallons per month) Php 889.60 (USD 16.70)- Present / (at 8 gallons per month)	Php 1,531.20 (USD 28.89)	Php 248.00 (USD 4.68) per month

In areas where acetic acid and safer chemical-based disinfectant were applied, pathological and microbiological sampling was conducted. The result shows that acetic acid and other safer chemical – based disinfectant are similarly effective both in inhibiting growth and eliminating selected microorganism and bacteria.

Table 2.0 Gram Stain Results Before and After Disinfection

Area	Baseline	Disinfectant Used	After 5 mins	After 15 mins	After 30 mins	After 1 hour	After 2 hours
Discharged Room	0-1 oil immersion field of gram-positive cocci	Zonrox	No Microorganism seen	No Microorganism seen	No Microorganism seen	No Microorganism seen	No Microorganism seen
		Vinegar	No Microorganism seen	No Microorganism seen	No Microorganism seen	No Microorganism seen	No Microorganism seen
		Virusolve + - , RTU	No Microorganism seen	No Microorganism seen	No Microorganism seen	No Microorganism seen	No Microorganism seen
		Biguand Flache	No Microorganism seen	No Microorganism seen	No Microorganism seen	No Microorganism seen	No Microorganism seen
Operating Room	No Microorganism seen	Zonrox	No Microorganism seen	No Microorganism seen	No Microorganism seen	No Microorganism seen	No Microorganism seen
		Virusolve + - , RTU	No Microorganism seen	No Microorganism seen	No Microorganism seen	No Microorganism seen	No Microorganism seen
		Biguand Flache	No Microorganism seen	No Microorganism seen	No Microorganism seen	No Microorganism seen	No Microorganism seen
Cytoscope	No microorganism seen	Virusolve EDS , RTU	No Microorganism seen	No Microorganism seen	No Microorganism seen	No Microorganism seen	No Microorganism seen

Area	Baseline	Disinfectant Used	After 5 mins	After 15 mins	After 30 mins	After 1 hour	After 2 hours
		Perfektan Endo	No Microorganism seen	No Microorganism seen	No Microorganism seen	No Microorganism seen	No Microorganism seen
		Deconex	No Microorganism seen	No Microorganism seen	No Microorganism seen	No Microorganism seen	No Microorganism seen

Table 3.0 Results of the Culture After Disinfection

Area	Baseline	Disenfectant Used	After 5 mins	After 15 mins	After 30 mins	After 1 hour	After 2 hours
Discharged Room	Light growth of coagulate – negative staphylococcus spp.	Zonrox	No Growth	No Growth	No Growth	No Growth	No Growth
		Vinegar	Very light growth of coagulate – negative staphylococcus spp.	Very light growth of coagulate – negative staphylococcus spp.	No Growth	No Growth	No Growth
		Virusolve + - , RTU	No Growth	No Growth	No Growth	No Growth	No Growth
		Biguand Flache	No Growth	No Growth	No Growth	No Growth	No Growth
Operating Room	No Growth	Zonrox	No Growth	No Growth	No Growth	No Growth	No Growth
		Virusolve + - , RTU	No Growth	No Growth	No Growth	No Growth	No Growth
		Biguand Flache	No Growth	No Growth	No Growth	No Growth	No Growth
Cytoscope	No Growth	Virusolve EDS , RTU	No Growth	No Growth	No Growth	No Growth	No Growth
		Perfektan Endo	No Growth	No Growth	No Growth	No Growth	No Growth
		Deconex	No Growth	No Growth	No Growth	No Growth	No Growth
Cytoscope	No Growth	Virusolve EDS , RTU	No Growth	No Growth	No Growth	No Growth	No Growth
		Perfektan Endo	No Growth	No Growth	No Growth	No Growth	No Growth
		Deconex	No Growth	No Growth	No Growth	No Growth	No Growth

Issue

St. Paul Hospital is a twenty-three-years old secondary level institution catering patients from within the vicinity and extending up to its neighboring provinces and regions. With a wide variety of cases handled each day, it is vital to prevent and control cross contamination through its efforts of maintaining the sanitation and decontamination of all areas and facilities.

Throughout its years of service, a lot of chemicals have been used, replaced, re-used and tested in order to keep up with the present demands. Chlorine and Sodium Hypochlorite (Bleach) has been widely used for the past years. From hospital surfaces, to blood spills to soaking solutions, these chemicals were responsible in keeping the hospital clean. Additional chemicals used were Chlorhexidine, which was later replaced with Deconex due to its cost and availability. Lysol

disinfectant spray was also utilized in the operating room which was highly recommended by the surgeons.

With the hospital's advocacy to ensure environmental conservation, it has been found out that the aforementioned chemicals are harmful to health and has mercurial content. Thus, an effort has been made by the management and its employees to search for less toxic alternatives. Series of tests have been completed to help better understand the issue and provide guidance in the selection and application of appropriate disinfectant.

Traditional hospital practices in infection control can expose health care workers to chemicals that have adverse health effects. Health workers, who are exposed to hospital disinfectants, are at. risk of experiencing health problems.

Sustainability Strategy Implemented

A study was conducted to ensure the effectiveness of vinegar as surface disinfectant in 2013, the results are presented in Table 2.0 and Table 3.0. The study result shows that vinegar has the capability to remove microorganism in some surfaces. The results of the study were used by the hospital to support the transition to using safer chemical – based disinfectant.

After the various testing and analysis of results on the effectivity of Acetic Acid as surface disinfectant, St. Paul Hospital of Tuguegarao made the modification from toxic disinfectants to alternative substances as part of an effort to raise occupational health standards for its housekeeping staff and to lessen or eliminate the possible effect of the toxic substances to hospital personnel and the environment while maintaining infection prevention and control. The employees welcomed the initiative and have adhered to the protocol set by the hospital. The cost savings, though not substantial, also encourages the hospital's housekeeping department to continue the use of less toxic disinfectants as alternatives.

Further, employees and newly hired staff are informed on the following areas such as chemical safety, chemical usage and its harmful effects.

Implementation Process

During review of scientific evidence through culturing and gram-staining microorganisms after disinfection, the hospital's housekeeping department recognized the need to identify high-risk areas. These are the infectious units or the patient's under/inside the isolation areas.

Identification of the high – risk areas was conducted because of the difficulty in assessing the antimicrobial efficacy of the alternative agents. The hospital created specific protocols to use diluted acetic acid as a surface cleaner only in the terminal cleaning phase of non-critical items in the following areas:

- Rooms and bathrooms including fixtures and furniture of discharged patients with non-infectious diseases.
- Public and ward bathrooms.

To ensure antimicrobial efficacy, high level disinfectants are still being used in infectious units and patient isolation units.

On the other hand, the hospital's BIO-MAN, a person who manages the wastes from different sections of the hospital also started using a separate autoclave to sterilize the needles used in daily operation prior to sending to the holding area for sharps waste. This process has eliminated their practice of using hypochlorite for chemical disinfection of needles and other sharps prior to disposal through soaking. In effect, it has also reduced chemical consumption and potential occupational exposures.

Tracking Progress

The Culture and Sensitivity testing results revealed the presence of different microorganisms capable of causing disease to patients, visitors and healthcare providers. It is imperative that we eradicate or at least lessen the contamination of pathogenic microorganisms in the hospital environment to ensure prevention of cross contamination.

Most isolated bacteria responded to the application of Acetic Acid to different surfaces. Although Pseudomonas Species, (Gram Negative opportunistic pathogen) may seem tenacious. Previous studies and recommendations emphasized that frequency, consistency and thorough cleaning and disinfection are the key to eradicating this type of bacteria. Moist or wet areas and equipment should be given more attention. Examples of these area or equipment are hospital's faucet, sinks, suction bottles etc. In the test performed, the degree of contamination decreased within 90 minutes of application, a good indicator of the success of the experimentation. As for the other samples such as the suction bottle, heavy contamination was initially found but was easily eliminated after the application of Acetic Acid Solution.

Another Gram-negative bacteria found in the test was Enterobacter, usually responsible for different types of infections such as respiratory tract infection, urinary tract infections and most often, diarrhea. This pathogen can be transmitted through direct contact or by fecal-oral route. Its presence in the faucet could be attributed to poor hand hygiene practices.

Gram Positive species were also found. These gram positive-species are Coagulase Negative Staphylococcus, Bacillus and Enterobacter. Although some of these bacteria are considered naturally occurring and generally less severe compared to Gram negative organisms, eradicating

their presence as a precautionary measure is advised. Door knobs had heavy growth of bacillus, which clearly indicates the lack of hand hygiene practice of people going in and out of the area.

From the result of the study, the hospital concluded that formulated chemical, Acetic Acid (1:1 Vinegar and Water) is **effective** in eliminating different types of microorganisms (Gram + and -) which are ubiquitous. It had a very good response in the initial tests performed and could be utilized as the main disinfectant of the institution.

Utilization of Sanosil Solution as Terminal Disinfectant

Recently, the hospital had started using Sanosil Solution as disinfectant mainly for terminal disinfection of patient rooms with infectious diseases, isolation rooms, including the special areas such as the Intensive Care Units and Operating Rooms and the Delivery Room Complex.

Challenges and Lessons Learned

During the initial implementation of Acetic Acid as the primary disinfectant for patients' room or hospital facility, the hospital received a lot of complaint from the employees, patients and patient's significant others due to its unpleasant smell. Through this continuous complaint of the customer, the infection control nurse, Ms. Amira Calata tried to incorporate 1 bottle of vanilla in 1 gallon of the solution (previous concentration of the solution is maintained). After the plan was implemented, complaints from different customer was lessened until no further complaints were received. It was found by the Housekeeping staff that the new alternative solution has no rusty effect in the different hospital facilities in comparison to previous disinfectant (zonrox). Additional noted effect of the Acetic Acid are the following;

- Removes yellowish stain color in toilet facilities and granite tables
- Removes hard particles of water (manganese) stocked in shower head, faucet filter and sink

Before using a chemical-based/ other disinfectant, it is important to assess its efficacy for its purpose and impact on the patient, personnel (using the disinfectant in cleaning), equipment, hospital facilities and environment.

Next Steps

After the standardization of the alternative disinfectant (Acetic Acid), the hospital will conduct continual monitoring and evaluation of its effectiveness. Further improvement of its usage and concentration of the solution may be implemented once deemed necessary. Other conventional

chemical-based disinfectant will still be in use, however, the hospital will evaluate the chemical content of the solution in order to lessen the possibility of putting environmental and human health at risk.

Demographic Information

Saint Paul Hospital- Tuguegarao, established in 1994, is a 150 -bed, non-profit, secondary level private Catholic Institution owned and managed by the Sisters of St. Paul of Chartres. It has 397 committed employees and 180 doctors who are competent and committed to providing holistic quality care in a Christ-centered ministry.

The current hospital area is 18,920 sqm. The average number of in-patients catered by the /institution on a monthly basis ranges from 900 to 1,200 patients. While for out-patient, an average of 700 patients are catered monthly.

The services offered by the hospital includes Emergency Room Services/Out-patient Consultations, Diagnostic Imaging Services (X-Ray, Ultrasound, Mammography and CT-Scan), Laboratory Services, Cardiovascular Diagnostic Procedures/Heart Station, Chemotherapy Services, Eye Center Facility, Dialysis Center, Rehabilitation Center, Nuclear Medicine, Respiratory Care Services and other special areas such as Endoscopy Services, Operating Room-Delivery Room Services, Intensive Care Services (for Neonates, Pediatrics and patients with medical and surgical cases).