



Talk On “Innovative Technology and Infection Control

by Ir. Shamila Ariaratnam

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The Healthcare and Biomedical Engineering Working Group under the Electrical Engineering Technical Division of The Institution of Engineers, Malaysia organized a talk On “Innovative Technology and Infection Control” on 22 November 2017. A total of 25 members attended in the talk. The main speaker was Mr Navarro Rompas, Draeger Product Manager covering ASEAN market for hospital consumables and accessories and the complementing speaker was Ir. Shamila Ariaratnam, Manager, Biomedical Engineering from RSD Hospitals Sdn Bhd – Subang Jaya Medical Centre.

Hospital Acquired Infections (HAI) are still existent despite the various measures taken to bring it under control. According to World Health Organization (WHO), HAI also referred to as nosocomial or hospital infection is an infection occurring in a patient during the process of care in a hospital or other health care facility which was not present or incubating at the time of admission. Figure 1 illustrates the infection transmission pathway from the source to recipient. Yearly hundreds of millions of patient worldwide are affected by HAI as stated by WHO. WHO declares that these infection occur on average in developed countries, 7 out of 100 patients and in developing countries, 10 out of 100 patients. The major consequences of HAI are prolonged patient stay within hospitals, additional emotional stress on patients and their families, increased treatment length and costs as well as damage to the good reputation of hospitals.

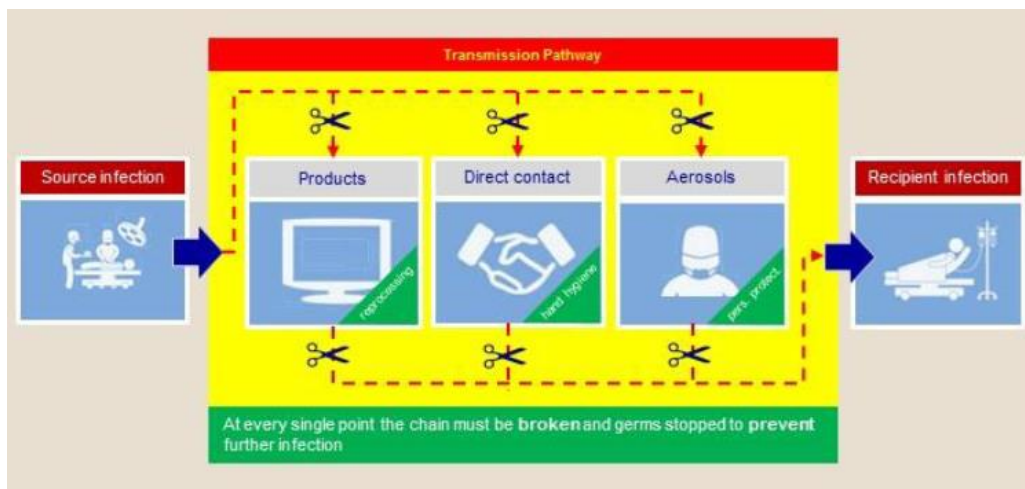


Figure 1: Infection Transmission Pathway (Courtesy of Draeger)

WHO identifies the major infection prevention challenges worldwide are Ebola virus, Tuberculosis and Antimicrobial Resistance (AMR). The definition for AMR is resistance of microorganisms including bacteria, fungi, viruses and parasites to an antimicrobial drug that was originally effective for treatment of infections caused by it. Hence, standard treatments become ineffective and infections persist. Therefore a patient with AMR in addition to the major consequences faced by a patient with HAI would also be subject to decreased effectiveness of procedures undergone for example organ transplants, increased treatment complexity and costs and mortality rates. Although the existence of AMR is a natural phenomenon, certain human actions accelerates its existence such as inappropriate use of drugs, including the use of antibiotics on poultry and meat. This means resistant bacteria can also be transmitted to humans through food. Currently, there is research on going on antibiotic resistant breakers and cold plasma treatments hoping to battle AMR.

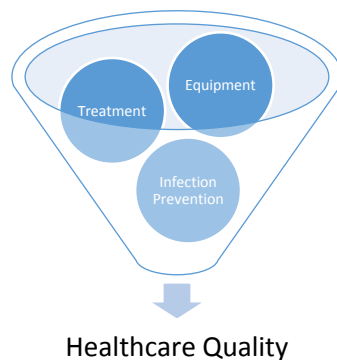


Figure 2: Three Key Determinants of Healthcare Quality in Patient Safety

There are numerous contributing factors that make the process of reducing the spread of pathogens in health care institutions an overwhelming task. Effectively measuring healthcare quality in terms of patient safety can reduce infection. As shown in Figure 2, there are three key determinants of healthcare quality. The first is clinical expertise, confirming right diagnosis and choice of appropriate treatments. Second is quality of delivered treatment as per setting entered into a medical device and the third is control of cross contamination by avoiding healthcare associated infections.

When clinical expertise is mentioned the first group of people that come to mind are doctors. Their vast experience, sound education and clinical competence is definitely needed in reducing HAI. These group of specialists make their conclusions by referring to the medical devices that they use in the care and treatment of patients. Therefore, the reliability and safety of medical devices are essential in ensuring the patient is diagnosed correctly and treated successfully. Hence the role of biomedical and healthcare engineers are essential too. It is important for all medical device features and modes including all options or capabilities to be functioning as per manufacturer's specifications. Moreover, the medical device must be tested together with its sub systems and accessories where applicable and not just the main unit. Entire system must be evaluated as one, from the main unit to the selected consumables and from the installed spare parts to the connected software. The full functionality of the entire system as one is crucial as compared to testing it individually as testing as a full system ensure total performance of the medical device system. It is also important to look out for declaration of compatibility of the medical device as this certifies combination testing. Hence, the medical devices may be compatible to other sub systems or accessories. Testing for chemical and physical adherence to international quality standards is also central

in ensuring the medical device withstands the exposure to cleaning agents. Biocompatibility analysis is integral to ensure no harmful or toxic comes to living tissues. Material resilience compliance and resistance is also necessary to ensure that the medical device lasts as long as it should. Periodical user training and checking for understanding is fundamental in ensuring patient safety.

At any point if a faulty diagnosis is received from the medical device will only lead to improper treatment. Hence, the role of the engineer is definitely significant in ensuring optimum operational condition of equipment. Inspection to fixing before it fails, preventive maintenance to replace before it fails and corrective maintenance to repair it back when it fails. All these activities is accompanied with proper planning schedules for testing and adequate recording. Control of cross contamination is the third measure in effectively measuring healthcare quality. Cross contamination is the transfer of microorganisms directly from one person to another or indirectly from one person to a second person via a vector. The usual modes of transfer are products, direct contact or aerosol. It is important that at every single point the chain must be broken and germs stopped to prevent further infection.

It is interesting to note that device-associated infections are showing the highest percentage for preventability among HAI. The common methods of disinfecting medical devices are cleaning to remove contamination where microorganisms are partly removed by a mechanical process, disinfection where 10^5 reduction of germs and 99.999% free of infectious microorganisms, sterilization where 10^6 reduction of germs and 99.999% free of all forms of viable microorganisms and the final method is disposal where contaminants are totally eliminated.

Furthermore, research and development have gone into designing medical devices that reduce cross contamination. Examples include, definition of surfaces that are relevant for reprocessing, disassembling / assembling of devices and components, accessibility and roughness of medical device surfaces, integrated cable management channels, ceiling mounted systems and etc.

As a concluding message, WHO mentions that preventing HAI is possible but it will take a conscious effort of everyone – clinicians, healthcare facilities and systems, public health, quality improvement groups, government working together towards improving care, protecting patients and saving lives.



Figure 1: Ir. Shamila as the complementary speaker



Figure 2: Token of appreciation by EETD to Mr. Navarro Rompas