### **Putting some juice on your lectures and workshops on sterilization** A blend of methods





Healthcare through Appropriate and Reliable Technology

Quadenoord 2, 6871 NG Renkum, THE NETHERLANDS *Tel:* +31-317-316756 Mobile: +31-617918924 *e-mail:* jh@heartware.nl *www:* http://www.heartware.nl



### **Putting some juice on your lectures and workshops on sterilization** A blend of methods



- Training of CSSD staff and technicians: focus on developing world
- Challenge: Sterilization, an abstract topic about invisible life
- Experience: workshops and lectures
- Initial: traditional methods: books and PowerPoints
- Need for visualization and experiences
  - Practical experiments related to various steps of sterile supply cycle
- Future: New media: e-books and e-learning
- Way forward: need for follow up.



# Lectures and workshops in many locations

















## Lectures and workshops in many locations in 21 countries



# Need for visualization and experience

### Topics are invisible and abstract

- Deal with invisible life that needs to be inactivated
- Abstract concepts of sterility, disinfection and cleanliness
- Processes take place in closed vessels

### Typical questions

- Where are these invisible micro-organisms?
- How can they spread?
- What is most effective for to stop spreading
- Why is surface tension of water impeding adequate cleaning?
- What are those non-condensable gases?
- Why is air in a steam sterilizer a problem?
- How to make steam at an adequate temperature to assure sterilization?
- Why the heck a vacuum is used for drying the load?
- What actually happens in that sterilizer?
- And knowing all these, how to make all this information available to a worldwide audience?
- How to train our technicians?
- Often very limited resources for training





### Need for visualization: Traditional methods: Textbook





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a. An instrument set wrapped in nonwoven b. Individual instruments in sealed pouch

Figure 9.4 - Examples of Sterile Barrier Systems

Examples of sterile barrier systems: two layers of paper, two layers of nonwoven sheets, single or double laminated film pouch, paper bag or a rigid sterilisation container with adequate filter(s).

#### 9.2.2 Preformed Sterile Barrier Systems (PSBS)

Products are on the market that are prepared, or pre-formed, to be used as sterile barrier system. For such products an additional action(s), such as folding, cutting, filling and sealing is still needed to complete the package. Such products are known as Preformed Sterile Barrier Systems (PSBS) Examples: sheets of paper or nonwoven packaging materials, sterilization containers, laminated pouches etc.







containers in storage-syster

Figure 9.5 - Examples of preformed sterile barrier systems: PSBS

#### Packaging of sterile products: SBS 175

Preformed Sterile Barrier System (PSBS) 88 Partially assembled sterile barrier system prior to filling and final closure and sealing.

#### 9.2.3 Protective packaging<sup>89</sup>

An additional layer can be used to facilitate proper storage and safe transportation to the user. It contains the load in its SBS, e.g. an extra plastic wrapper, bag, cardboard box or container. It offers additional protection against dust and liquids and gives extra mechanical protection, making handling easier. Protective packaging may consist of one or more layers. For example disposable items in their SBS may be packed in a box of 24; as stored in a storage area for distribution. For large scale transportation, a number of such boxes may be packed in a larger cardboard box. Such protective packaging is common for single-use90 sterile supplies, but also in case locally sterilized packs need to be transported outside the building where sterilization took place or when to be sent to another facility



Figure 9.6 - a. Single-use sterile b. Single-use items in c. An instrument set in its items in protective packaging their SBS and SBS put inside a plastic transported in a dustcover bag. The cardboard box as dustcover provides an additional protective additional protective layer during storage packaging

88 As defined in EN ISO 11607 <sup>59</sup> In former publications and standards, the protective packaging was also referred to as secondary packaging <sup>90</sup> In this context also the term *disposable* is used. However the term *single-use* preferred as it puts the (a positive) emphasis on its functional use, whereas disposable puts the fact that it is to be thrown away after use as its major (negative) characteristic.

#### Textbook

a. The nonwoven sheets for

wrapping instrument sets

- Traditional backbone for most education •
- First edition 1996. •
- Visualization: Lots of illustrations/photos •
- However: Need for real life demos, experiences •



## Book: Sterilization of Medical Supplies by Steam

- Available in English, French, Polish, Turkish, Japanese, Spanish, Dutch, Norwegian, Russian.
- In total 16000 books in print
- Preparing publication in Chinese and Swedish.



#### STERILIZATION of Medical Supplies by Steam



English



Spanish



Dutch



Norwegian



STÉRILISATION des dispositifs médicaux par la vapeur



French



Polish





Russian



Japanese



Need for visualization: Traditional methods

### PowerPoints

- Presentations adapted to local situation: context, equipment and practices
- Remains abstract/passive









### **Topic:** Microbiology

### Question: Where are these bugs?

- Petri dish with culture medium
- Taking samples: e.g. fingertip, coughing, sputum, table to, free air
- Time. Usually no incubator needed ©











### **Topic: Infection control**

Question: How does disease spread? Why is hand hygiene so important in infection control?

- Fluorescent powder
- UV light





# Making it visible: Teaching aids

### Topic: Cleaning Question: How do I know it is clean?

- UV light
- Fluorescent powder or gel









### **Topic: Cleaning**

- Question: How do I know it is clean?
- USB Microscope/software
- Laptop/computer







### **Topic: Cleaning**

### Question: What is a surfactant? What is its function?

- Syringe with water
- Syringe with fluid soap
- Non-woven sheet or other hydrophobic tissue











Topic: cleaning Question: Stainless steel cannot rust?

- Glass with salty water
- Some surgical instruments; also some hinged











### Making it visible: Teaching aids

### Topic: steam sterilization; physics of steam Question: Why steam for sterilization?

- Steam demonstration kit
  - Flask, stopper with passages, pressure gauge, vacuum pump, thermometer, hot plate, tubing







Topic: steam sterilization; physics of steam Question: What is steam? How is steam made?

• Steam demonstration kit





Topic: steam sterilization; operation of sterilizer: drying Question: Why a vacuum for drying in a steam sterilizer?

• Steam demonstration kit.







### Question: What happens inside a sterilizer? Real time Topic: steam sterilization

- Thermocouple entry for 2 channels; can be with pressure gauge; air inlet
- Thermocouples (K-Type)
- 2 channel digital thermometer
- Bowie and Dick textile pack; with indicator sheets
- Indicator tape









### Making it visible: Teaching aids

### Topic: steam sterilization

Question: What happens inside a sterilizer? Real time. Failing Cycle

- Thermocouple entry for 2 channels; can be with pressure gauge; air inlet
- Thermocouples (K-Type)
- 2 channel digital thermometer
- Bowie and Dick textile pack; with indicator sheets
- Indicator tape







### Topic: steam sterilization

Question: What happens inside a sterilizer? Real time. Successful Cycle

- Thermocouple entry for 2 channels; can be with pressure gauge and air inlet (create fail cycle)
- Thermocouples (K-Type)
- 2 channel digital thermometer
- Bowie and Dick textile pack; with indicator sheets
- Indicator tape









### Making it visible: Teaching aids

Topic: steam sterilization Question: What happens inside a sterilizer? Evaluation after cycle

- Set of dataloggers, for pressure and 2 temperatures
- Computer interface; software
- Bowie and Dick textile pack
- Indicator tape

- No need for thermocouple entry connection
  - No real time readings







## Making it visible: Teaching aids

#### Topic: steam sterilization

### Question: What happens inside a sterilizer? Evaluation after cycle

- Set of dataloggers, for pressure and 2 for temperature (chamber; centre of pack)
- Computer interface; software
- Bowie and Dick textile pack
- Indicator tape
- Easy: No need for connecting thermocouple entry to chamber!





# Making it visible: Process simulations

Topic: steam sterilization

Question: What happens inside a sterilizer as the process passes?

- Technical documentation of sterilizer on site
- Often intimidating complicated!



# Making it visible: Process simulations

#### Topic: steam sterilization

### Question: What happens inside a sterilizer as the process passes?

- Technical documentation of sterilizer on site
- Create piping diagram suitable for animation
- Media in different colours (steam: red; water: blue; vacuum: yellow; active component: green
- Diagram for each step of the process; show subsequently each step





Making it visible: process simulation. Example. Operation of autoclave (Belimed MST-V)





Hospital sterilizer

### Features:

### Belimed MST-V

- Horizontal chamber
- Jaqueted/ double wall
- Double door
- Vertically sliding doors
- Vacuum by water ring pump
- Microprocessor control
- With steam generator







Hospital sterilizer

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### Belimed MST-V

- Horizontal chamber
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### Making it visible: process simulation. Example Sample Process

- Air removal
  - Vacuum followed by 3 pulses:
    -0.9 bar +0.5 bar.
- Sterilisation: 134°C for 3 min
- Drying: 15 min
- Air admission















































# Making it visible: Process simulations for various sterilizers, depending on the site of the training











SCIH Swiss Centre for International Health



Also technicians must know general background on sterilization: Microbiology, infection control, sterile supply cycle

### **Topic: Sterilizer technology**

- Understanding the processes
- Piping diagram
- Electrical diagram









### **Topic:** Fault finding

- Understanding the symptoms
- Consulting documentation
- Consulting manufacturer/supplier for support
- Assessment/identifying the problem
- Presenting the results to group













#### Topic: Planned preventive PPM

- Identifying components for PPM
- Performing PPM
- Spare parts for PPM
- Spare part management











### **Topic:** Repairs

- Response on break down
- Know your limits
- Adequate tools
- Spare part acquisition/management









### Provide certificate as confirmation of knowledge/skills

- Pre-post test enables assessment of results; stimulates studying
- Certificate stimulates attitude toward training
- Stimulates personal career; CV
- Contributes to recognition of position of CSSD staff in the hospital
- Recognition by health authorities
- Certificate stimulates self confidence







New media: eBooks; e-learning

# Since several years now availability of book in e-form

- Computers/smart phones have become mainstream
- Acceptance of eBooks
- Increasing cost of postage
- Virtually no environmental footprint







#### Huys

#### PDF eBook Esterilizatión de Productos Sanitarios

Autor: Jan Huys En un hospital o centro sanitario, es necesario que todo producto y material usado para el tratamiento de los





#### Huys Esterilización de Productos Sanitarios

Autor: Jan Huys En un hospital o centro sanitario, es necesario que todo producto y material usado para el tratamiento de los

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Remember

Compare



### Since 2016: updating knowledge through eLearning/blended learning

- From any place any time
- E-learning platform; with accounts; evaluation, tests; self assessment



- Combination with contact-evening
- Approved by SVN
- English version soon available



STERILISATIE VERENIGING NEDI



### On-going training: e-Learning/blended learning

#### e-Learning combined with contact evening with participants

- After finalizing e-learning sessions: Evening at school or on site with presentations and demonstrations
  - o Microbiology
  - Cleaning and disinfection
  - o Sterilization







# Results/reactions

- Participants always eager to learn and enthusiastic!
- Reactions of sincere gratitude.
- "First time that I experienced such training in my long career in CSSD"
- "We need more and regular training!"
- "I get to know my sterilizer"
- "Understand my job better"
- "Understand better the importance of my work..."; "I can contribute to better patient safety"
- "The training brought more then just knowledge; it brought me confidence in my work!"
- Enormous gap in resources between locations. Education is crucial. A huge job at hand! Need for follow up!





A tribute to all those participants; and to all CSSD staff and technicians in all health facilities! A sincere thanks for their dedication, enthusiasm, their happiness, the great times we could share! Verse1: Feeling from the experience of the teacher; verse 2 from experience of the participant.

So much to teach on sterile supply, I can't make it anymore! Seeing the smile on the students' face, feels like knockin' on heaven's door!

#### CHORUS:

Knock, knock, knockin' on heaven's door! Knock, knock, knockin' on heaven's door! Knock, knock, knockin' on heaven's door! Knock, knock, knockin' on heaven's door!

So much to learn on sterile supply, I can't grasp it anymore! But when understanding comes to me, feels like knockin' on heaven's door!







- Sheet non-woven: cover for table
- Microbiology

#### Petri dishes with culture medium

- Infection prevention (importance of hand hygiene)
  - UV Light/batteries
  - Glow germ powder
- Cleaning
  - UV Light, Glow germ powder
  - Instruments, glass of water, salt
  - Syringe with water; syringe with fluid soap; sheet non-woven
  - Glass with salty water; surgical instruments also with hinges;
  - microscope, instrument set
- Physics of steam
  - Steam demonstration kit (Erlenmeyer flask, stopper with T-sensor, pressure gauge, vacuum pump, hoses, connectors, digital thermometer, Kidney dish, hot plate
- Operation of steam sterilizer: Real time
  - Steam demonstration kit
  - Thermocouple passage for 2 thermocouples; with pressure gauge, air inlet valve
  - Digital thermometer
  - Timer/watch; paper; clipboard, pen
  - Bowie and Dick textile pack; with A4 test sheet
  - Autoclave tape
- Operation of steam sterilizer after cycle
  - As with real time
  - Datalogger for Pressure and 2x temperature
  - Interface for datalogger
  - Software for downloading data, presenting and assessment of measuring results
- Guitar
  - Guitar, Guitar stand, tuner, plectrum, spare battery, guitar cable
  - Text song
  - Plectrum
  - Music stand

### Materials on the table