

AHEAD: Behavioral Science Framework for Infection Prevention
Prof. Dr. Hugo Sax, and Dr. Lauren Clack, University Hospital Zürich, Switzerland
A Webber Training Teleclass

USZ Universitäts
Spital Zürich


AHEAD: Behavioral science framework for infection prevention



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Hosted by Martin Kiernan
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www.webbertraining.com August 13, 2020

About us



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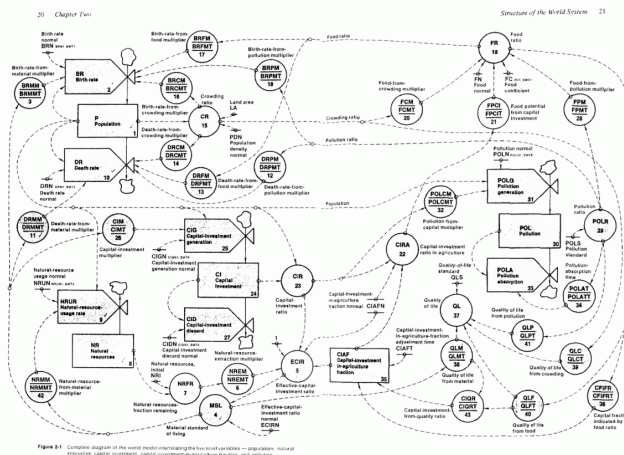
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Healthcare associated infections



Schreiber PW, Sax H, Wolfensberger A, Clack L, Kuster SP. **The preventable proportion of healthcare-associated infections 2005–2016: Systematic review and meta-analysis.** Infection Control & Hospital Epidemiology. 2018 Nov;39(11):1277-95.

Complex systems dynamics



Forrester JW. *World dynamics*. Wright-Allen Press; 1971.

Human factors engineering

Human factors engineering is the scientific discipline concerned with the **understanding of interactions among humans and other elements of a system**, and the profession that applies theory, principles, data and methods to design in order to **optimize human well-being** and overall **system performance**.

- International Ergonomics Association (<https://www.iea.cc>)

Infection Risk Moments (IRM)

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Infection prevention



High risk!

Also infection prevention



Low risk?

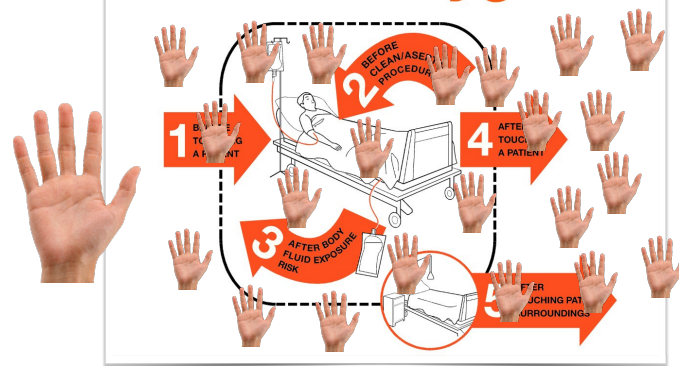
Defining «Risk»

$$\text{likelihood} \times \text{frequency} = \text{overall RISK}$$

(infections per moment) (moments per unit time) (infections per unit time)


Hand hygiene

Your 5 Moments for Hand Hygiene




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Risk



HIGH likelihood x **LOW** frequency = HIGH overall RISK
(of infection/colonization) (on a system level)




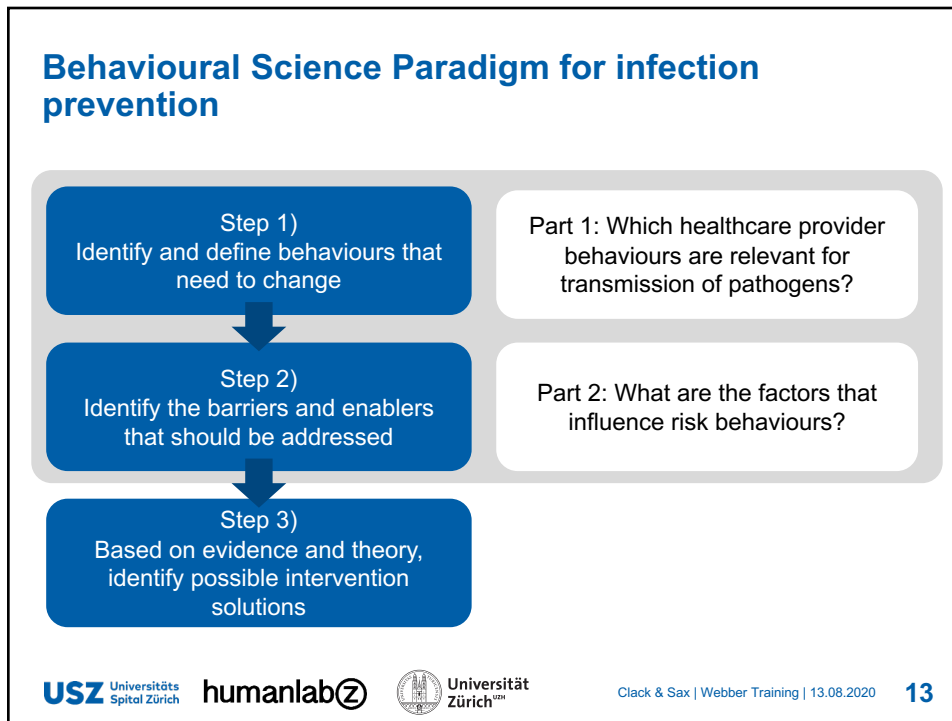
LOW likelihood x **HIGH** frequency = HIGH overall RISK
(of infection/colonization) (on a system level)

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Limitations to current infection prevention approaches

1. Rule-based approach based on compliance with existing guidelines:
 - Does not cover all potential risk behaviours
 - Does not consider many “low likelihood” events
2. Under-utilisation of behavioural theory:
 - Compliance remains low
 - Over-reliance on education and guideline dissemination
 - Fail to consider factors that influence behaviour before designing interventions

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Part 1: Identifying infectious risk behaviours

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In addition to...



HIGH Likelihood X LOW Frequency

We also look at...



LOW likelihood X HIGH frequency

Infectious risk moments (IRM)



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Infectious risk moments (IRM)– refining the concept

IRM Definition: seemingly innocuous, yet frequently occurring care manipulations potentially resulting in transfer of microorganisms to patients

Method: Exploratory observations

- 130 hours exploratory observations
- Established **INFORM** (Infectious Risk Moment Classification Taxonomy)



Clack, L., Schmutz, J., Manser, T., & Sax, H. (2014). **Infectious risk moments: a novel, human factors-informed approach to infection prevention.** *Infect Control Hosp Epidemiol*, 35(8), 1051-1055. doi:10.1086/677166
 Clack, L., Passerini, S., Wolfensberger, A., Sax, H., & Manser, T. (2018). **Frequency and Nature of Infectious Risk Moments During Acute Care Based on the INFORM Structured Classification Taxonomy.** *Infect Control Hosp Epidemiol*, 39(3), 272-279.

INFORM - Infectious Risk Moment Classification Taxonomy

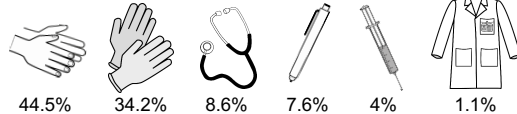
Source	Vector	Endpoint
(Source detail)	(Vector detail)	(Endpoint detail)
Environment Bedside Table, Curtains, Floor, Lamp, Outside Patient Room, Paper Patient Records, Partition Walls, Patient Bed, Trolley, Other	Gloves Don Gloves Without HH, Non-Sterile Gloves, Remove Gloves Without HH, Sterile Gloves	Critical Site Airways, Arterial 3-Way Valve, Arterial Insertion Site, Arterial Lumen Port, Bloodstream, CVC Insertion Site, CVC Line 3-Way Valve, CVC Line-Infusion Connection, CVC Lumen Port, Feeding Tube, Mucous Membrane Face, Mucous Membrane Genitals, Mucous Membrane Rectum, Mucous Membrane Urethra, Open Wound, PVC Insertion Site, PVC Line 3-Way Valve, PVC Line-Infusion Connection, PVC Lumen Port, Urinary Catheter, Other
Gloves HCW Gloves	Healthcare Worker Badge, HCW Private Clothing, HCW White Clothing, Watch	Non-Critical Site Head, Lower Limbs, Trunk, Upper Limbs, Catheter Dressing, Patient Clothing, Wound Dressing, Other
Hands HCW Hands	Invasive Device Arterial Catheter Tip, CVC Tip, Invasive Ventilator, IV Tubes, Needle/Cannula, PVC Tip, Suction Catheter, Thoracic Tube, Uncapped Hub, Urinary Catheter Tip, Ventilation Filter, Other	Patient Bed Bedding, Pillow
Healthcare Worker Body, Clothing, Face, Hair, Other	Medical Device Blood-Pressure Cuff, ECG, Infusion Pump, Non-Invasive Ventilator, Stethoscope, Thermometer, Ultrasound, X-Ray, Other	
Invasive Device IV Tubes, Mechanical Ventilator, Suction Catheter, Other	Mobile Object Bedding, Dressing or Bandage, Flashlight, Medical Tape, Mobile Phone, Pen, Secretions, Tape Dispenser, Tourmiquet, Transfer Board, Transfer Cannula, Washcloth, Wristwatch, Other	
Medical Device Bedside Monitor, Blood-Pressure Cuff, Blood-Pressure Monitor, ECG, Infusion Pump, Non-Invasive Ventilator, Stethoscope, Thermometer, Ultrasound Ventilator Monitor, X-Ray, Other		
Mobile Object Flashlight, Mobile Phone, Pen, Secretions, Tape Dispenser, Toilet Brush, Washcloth, Other		
Other Patient Critical Site, Environment, Intact Skin		
Patient Critical Site Airways, Bloodstream, Mucous Membrane Face, Mucous Membrane Genitals, Mucous Membrane Rectum, Open Wound, Uncapped CVC Hub, Uncapped IV Line, Urethra, Other		
Patient Intact Skin Contaminated Skin, Head, Lower Limbs, Trunk, Upper Limbs		
Unknown Status No Disinfection Observed		

Clack, L., Passerini, S., Wolfensberger, A., Sax, H., & Manser, T. (2018). **Frequency and Nature of Infectious Risk Moments During Acute Care Based on the INFORM Structured Classification Taxonomy.** *Infect Control Hosp Epidemiol*, 39(3), 272-279.

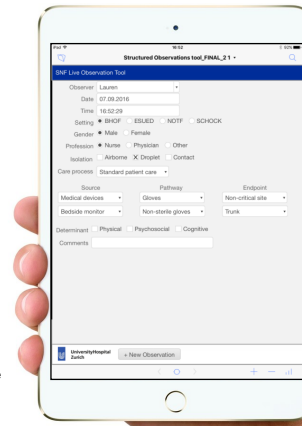
Infectious risk moments (IRM)

Method: Structured direct observations

- 53.77 observation hours (31.25 active care hours)
- 1'338 infectious risk moments (every 1.4 minutes)



- 25.8% concerned transfer to critical sites (higher risk!)
- Comprehensive IRM inventory established



Clack, L., Passerini, S., Wolfensberger, A., Sax, H., & Manser, T. (2018). **Frequency and Nature of Infectious Risk Moments During Acute Care Based on the INFORM Structured Classification Taxonomy.** Infect Control Hosp Epidemiol, 39(3), 272-279.

Hand-to-surface exposures (HSE)

HSE definition: contact resulting in bi-directional exchange of microorganisms between hand and the touched surface

Method: Indirect observations of HSE using head-camera

- Filmed and coded 300 minutes of care (8 nurses, 2 physicians) in ICU
- 4,222 hand-to-surface exposures (1 HSE every 4.2 seconds)
- 291 transitions from outside to inside the "patient zone"
 - Microorganisms potentially transmitted via hands from outside to inside the patient's direct environment once every 1.01 minutes



Clack, L., Scotoni, M., Wolfensberger, A., & Sax, H. (2017). "First-person view" of pathogen transmission and hand hygiene - use of a new head-mounted video capture and coding tool. Antimicrob Resist Infect Control, 6, 108

Part 1 – Summary of Results

Study question: Which healthcare provider behaviours are relevant for transmission of pathogens?

Infectious Risk Moments (IRM)

- Occur every 1.4 minutes
- Involved the following vectors:
 - hands
 - gloves
 - medical devices
 - mobile objects
 - invasive devices
 - healthcare provider clothing and accessories

Hand-to-surface exposures (HSE)

- 1 HSE every 4.2 seconds
- Colonising HSE occur every 1.01 minutes
- The patient's direct surroundings are likely contaminated with foreign microorganisms

Part 2: Understanding the factors that influence infectious risk behaviours

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Part 2 – Three Methods

Study question: What are the factors that influence risk behaviours?

Method one: Concept mapping

- Card-sorting activity to reveal mental models

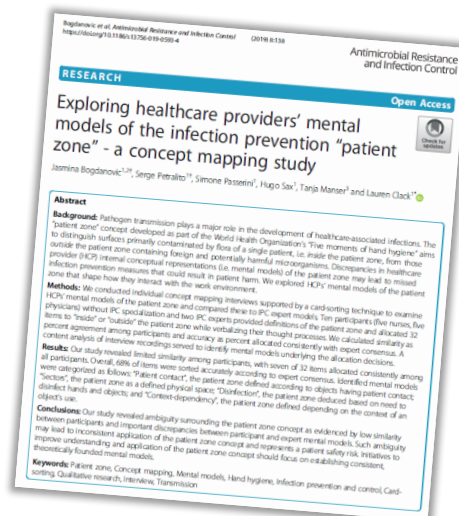
Method two: Video-reflexive ethnography

- Filming active patient care
- Reviewing care-film during a reflexive interview

Method three: Systematic Literature Review

- Reviewed published literature to identify barriers and enablers with established infection prevention guidelines

Concept mapping



Bogdanovic J, Petratto S, Passerini S, Sax H, Manser T, Clack L. Exploring healthcare providers' mental models of the infection prevention "patient zone"-a concept mapping study. Antimicrobial Resistance & Infection Control. 2019 Dec 1;8(1):138.

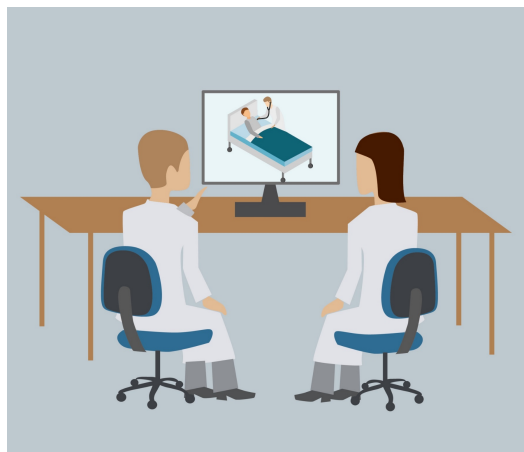
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Video reflexive ethnography - methods

- **Data collection: video-reflexive ethnography**
 - 10' active patient care filming
 - 30' reflexive interview
- **Guiding frameworks**
 - Consolidated Framework for Implementation Research (CFIR)
 - Theoretical Domains Framework (TDF)
 - › incorporates constructs from 138 theories into 12 theoretical domains
- **Analysis**
 - Reflexive interviews recorded and transcribed verbatim
 - Interviews coded *deductively* using TDF as coding framework
 - *Inductive* thematic analysis to identify emerging themes



Video reflexive ethnography - results



- 40 reflexive interviews (5 nurses and 5 physicians each, from four care settings)
- 2'431 Utterances coded according to TDF
- TDF Domains of greatest relevant importance:
 - Environmental context and resources
 - Knowledge
 - Beliefs about consequences

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Video reflexive ethnography – results

Domain: Environmental context and resources

Theme 1: Lack of space

- Barrier: Lack of space, and narrow work result in unintentional contact with people and surfaces

Theme 2: Availability and placement of materials

- Facilitator: Convenient placement of materials (e.g. handrub, glove dispensers)
- Barrier: lack of – or inconvenient placement of materials

Theme 3: Lack of time

- Barrier: insufficient time to adhere to infection prevention
- *“You try to disinfect your hands but of course, it is always the time factor. It is additional work you have to carry out.” (Nurse, intensive care)*

Video reflexive ethnography – results

Domain: Knowledge

Theme 1: Knowledge of rules and guidelines

- *“I do not know exactly when to wear gloves and when not. I mean, I know it is for every patient contact. But what does ‘for every patient contact’ really mean? When do I have to change them?” (Physician, Trauma ward)*

Theme 2: Knowledge/Awareness of contamination status

- Barrier: lack of shared knowledge about what items are clean vs. dirty

Theme 3: Knowledge of evidence underlying guidelines

- Barrier: perceived lack of evidence, or lack of knowledge about evidence
- Facilitator: knowledge of evidence supporting guidelines

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Video reflexive ethnography – results

Domain: Beliefs about consequences

Theme 1: Beliefs about patient consequences based on empiric observation

- *“Not really, to be honest, from all risks of germs [...] these things are a bit overrated. It is more likely, that the patient catches something another way, gets the infection. Especially, a wound infection – I have never seen a wound infection in a patient at least not in our department, that came from the outside.” (Physician, Medical ward)*

Theme 2: Belief in efficacy of preventative measure

- Belief or disbelief in efficacy of measure to prevent infection

Theme 3: Self protection

- Facilitator: when infection prevention behaviour aligned with self-protection measures, else barrier

Summary of part 2 results

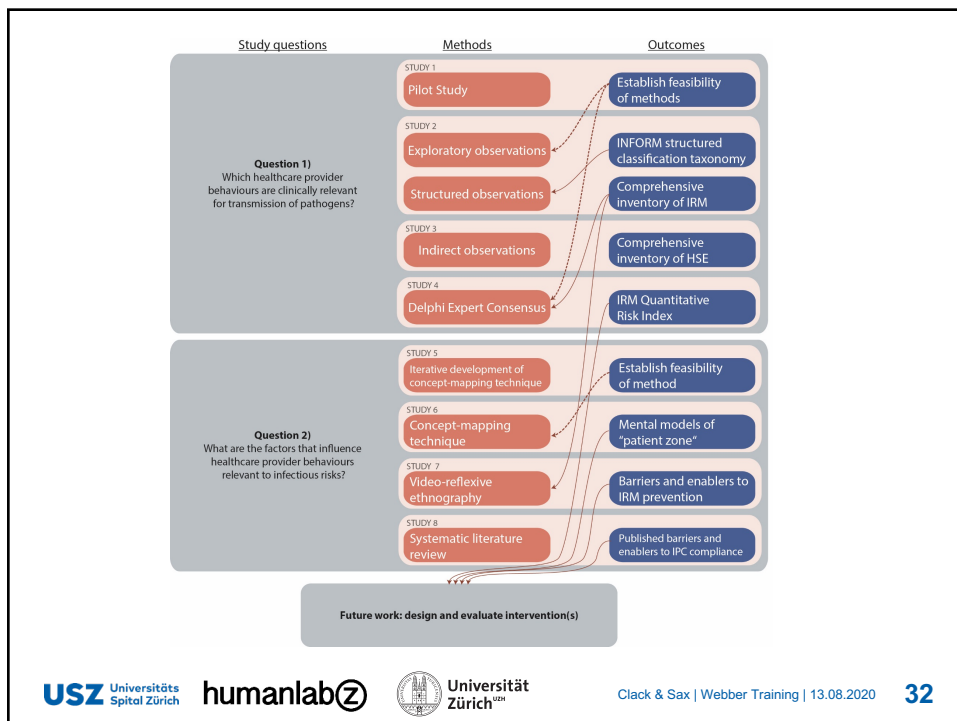
Study question: What are the factors that influence risk behaviours?

<u>Video-reflexive ethnography</u>			<u>Systematic Literature Review</u>		
Domain	Frequency	Themes	Domain	Frequency	Themes
11. Environmental Context and Resources	416	7	11. Environmental Context and Resources	61	16
1. Knowledge	276	5	12. Social influences	48	13
15. Nature of the behaviours	244	5	1. Knowledge	31	7
6. Beliefs about Consequences	243	6	10. Memory, Attention and Decision Processes	30	11
10. Memory, Attention and decision Processes	154	6	3. Social/Professional Role and Identity	29	12
12. Social influences	99	6	6. Beliefs about Consequences	25	8

Legend: domains that did not emerge as highly important in both studies are listed in grey.

Summary and implications

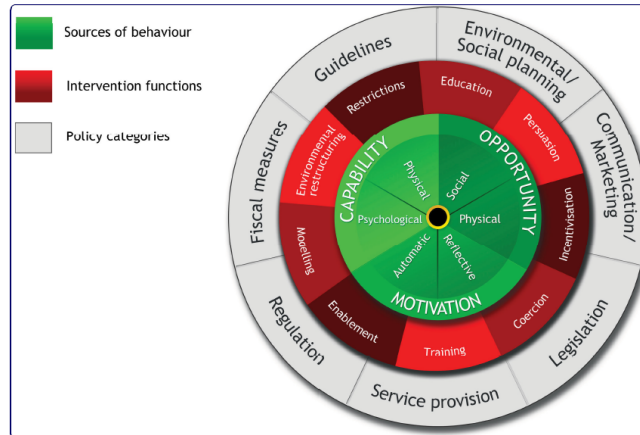
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Intervention design

Mapping identified barriers and facilitators to intervention functions



Michie, S., van Stralen, M. M., & West, R. (2011). The behaviour change wheel: a new method for characterising and designing behaviour change interventions. *Implement Sci*, 6, 42. doi:10.1186/1748-5908-6-42

Intervention design

TDF Domain	Intervention functions
Environmental Context and Resources	Training Restriction Environmental restructuring Enablement
Knowledge	Education
Beliefs about Consequences	Education Persuasion Modelling

Hierarchy of intervention effectiveness

The Hierarchy of Intervention Effectiveness

Cafazzo, J., & St-Cyr, O. (2012). From Discovery to Design: The Evolution of Human Factors in Healthcare. *Healthcare Quarterly*, 15, 24-29.

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Conclusions

Part 1: Identifying infectious risk behaviours

- Several low/medium-risk, high frequency behaviours identified
- These include, but go beyond existing indications for hand hygiene

Part 2: Understanding behavioural determinants

- Environmental context and factors beyond individual knowledge appear to be important influencers of behaviour
- Social influences of

Part 3: Intervention design

- INFORM observational taxonomy to identify most relevant local risks
- Interventions should be designed with consideration of barriers and facilitators
- Prioritise “theoretically coherent” intervention functions
 - Environmental restructuring

Step 1)
Identify and define behaviours that need to change

Step 2)
Identify the barriers and enablers that should be addressed

Step 3)
Based on evidence and theory, identify possible intervention solutions

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www.webbertraining.com/schedulep1.php	
August 18, 2020	<p><i>(FREE Teleclass)</i></p> <p>POLIO ERADICATION IN INDIA AND TAKEAWAYS FOR OTHERS Speaker: Dr. Ranga Reddy, Infection Control Academy of India</p>
August 26, 2020	<p><i>(FREE Teleclass)</i></p> <p>HOSPITAL LAUNDRY AND C. DIFFICILE SPORE INACTIVATION Speaker: Kevin P. McLaren, American Reuseable Textile Association</p>
September 10, 2020	<p>LOOK AT WHAT THE CAT SCRATCHED IN - PET ASSOCIATED ZOOSES, WHAT'S NEW AND RELEVANT FOR INFECTION PREVENTION AND CONTROL Speaker: Prof. Jason Stull, University of Prince Edward Island, and Ohio State University</p>
September 17, 2020	<p>REPROCESSING OF CRITICAL FOOT CARE DEVICES Speaker: Clare Barry, Infection Control Consultant, Canada, and Merlee Steele-Rodway, Canadian Association of Medical Device Reprocessing</p>
September 24, 2020	<p>WATERBORNE PATHOGENS: WHY IS THEIR PROFILE CHANGING? Speaker: Prof. Syed A Sattar, Professor Emeritus of Microbiology, University of Ottawa</p>
October 15, 2020	<p><i>(FREE Teleclass)</i></p> <p>THE VALUE OF CERTIFICATION - "WHAT'S IN IT FOR ME?" Speaker: Sandra Callery, Certification Board of Infection Control</p>

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