Hand Hygiene – Reloaded
Prof Dr med Hugo Sax, Bern University Hospital and University of Bern, Switzerland
A Webber Training Teleclass

Hand hygiene – reloaded

Prof Dr med Hugo Sax | Bern University Hospital and University of Bern, Switzerland | sax.health.design.AG

Hosted by Martin Kiernan | martin@webbertraining.com

www.webbertraining.com

October 28, 2021

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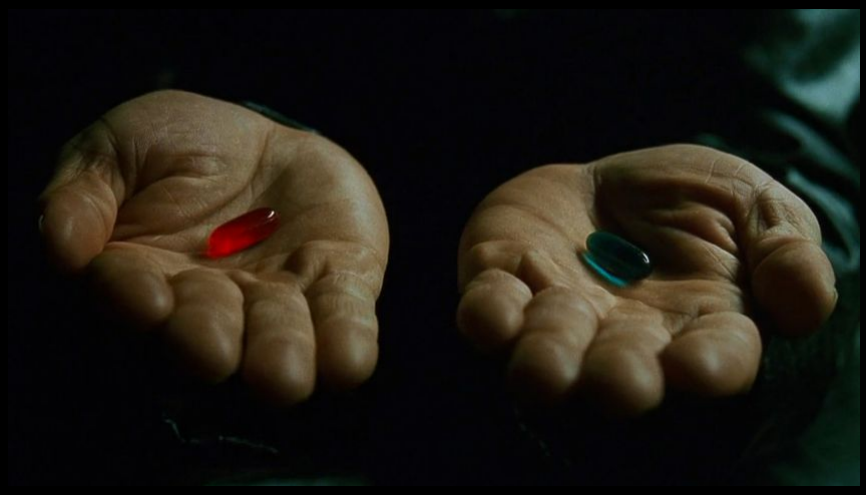

3

Content

- Learn about the **origins** of the 5 moments of hand hygiene
- Critically analysing the (theoretical) **effect** of hand hygiene on **infectious risks**
- Discussing some **unconventional hand hygiene studies**
- Hand hygiene **quo vadis**?

4

The making of the 5 Moments.

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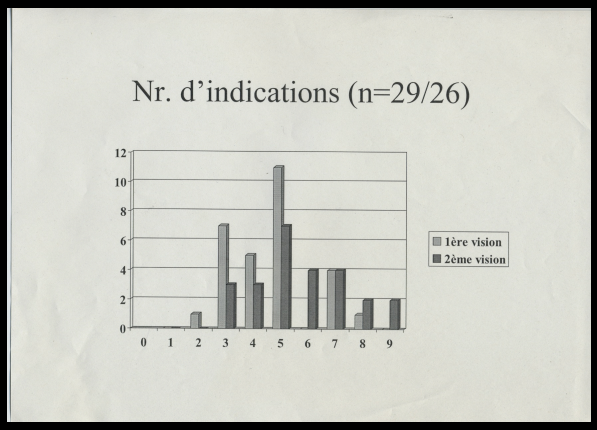

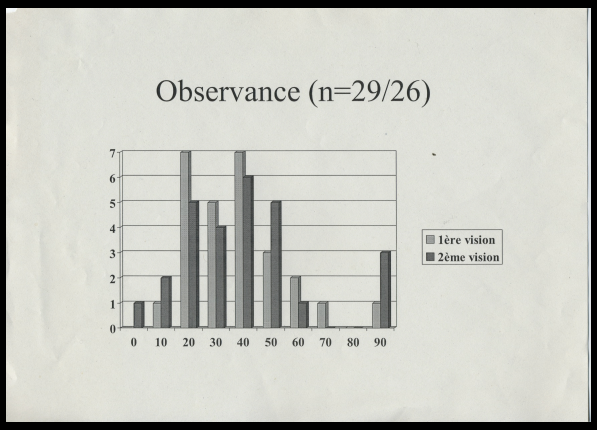

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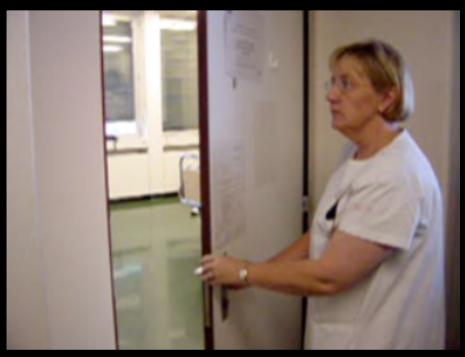

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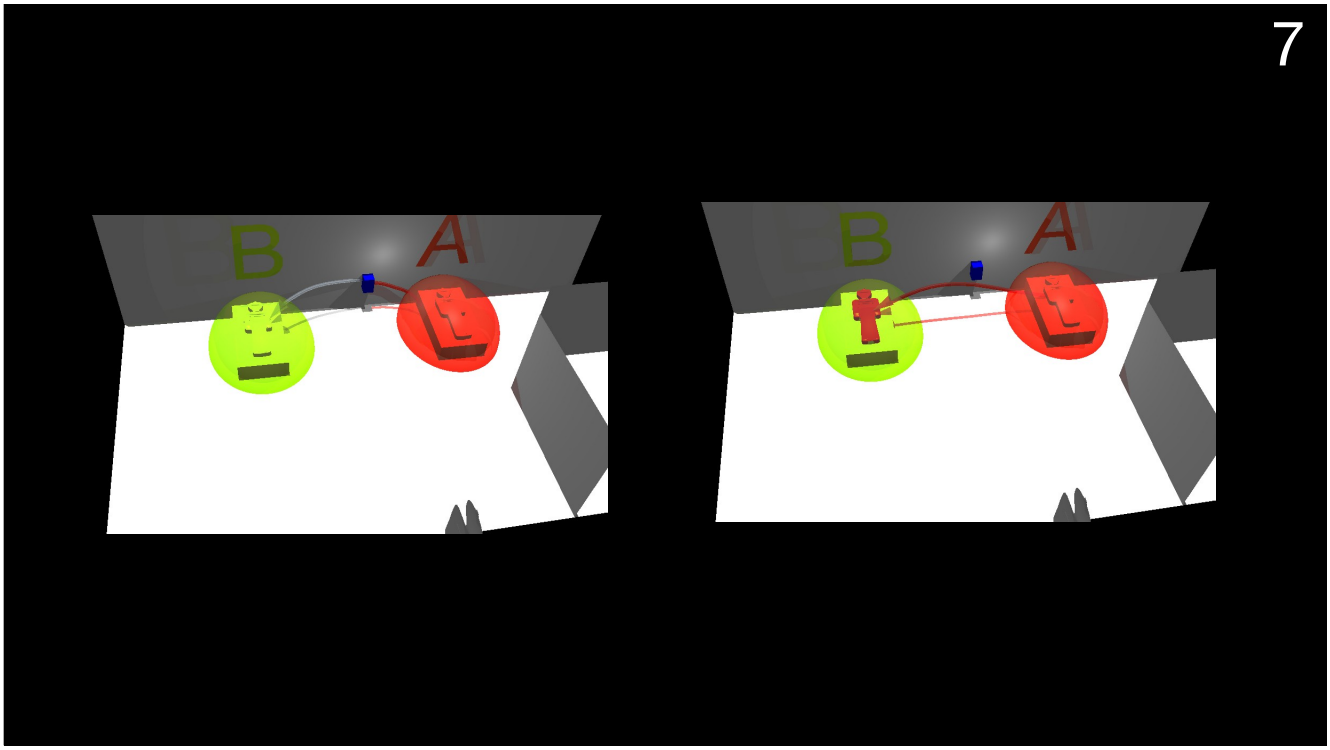
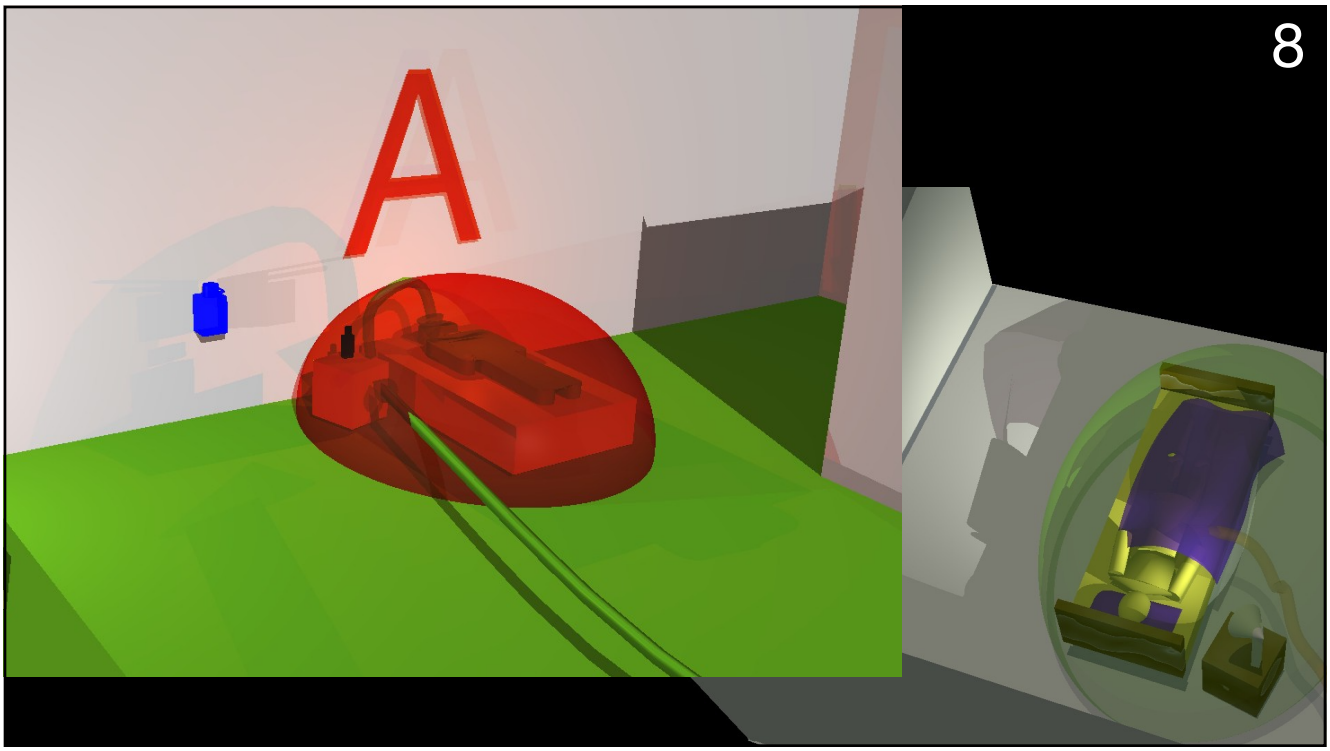

7
B
A
B
A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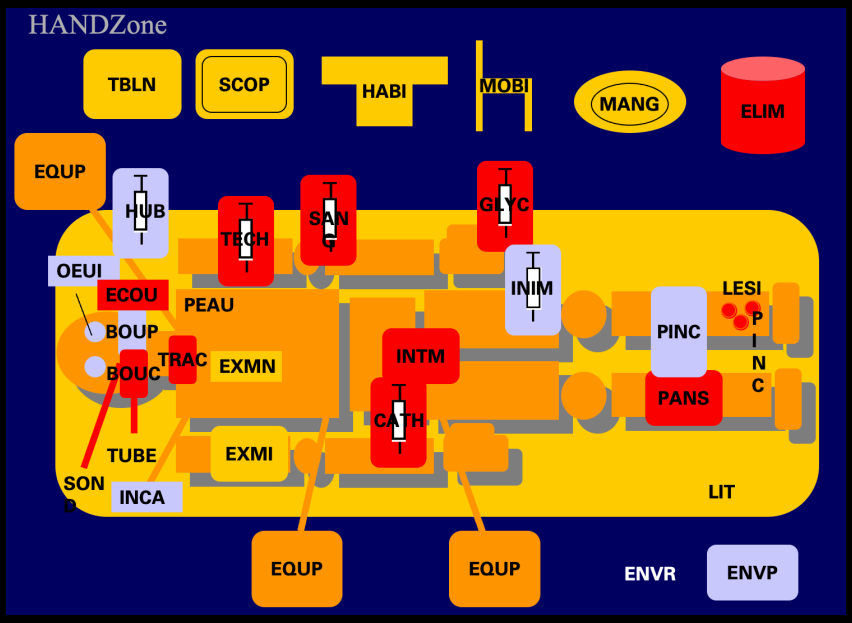
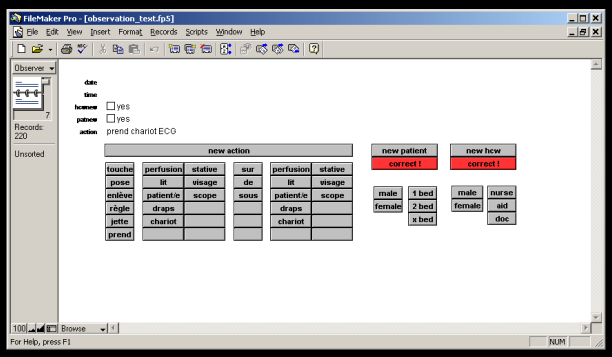
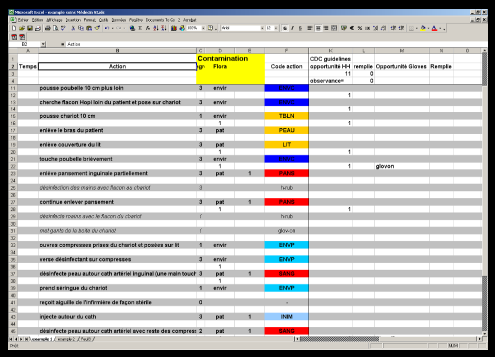


02.02.05		infirmière 1 tournante prise de sang, avec chariot avec plusieurs
02.02.05	08:58	START (PATIENT 1)
02.02.05		**HRUB**
02.02.05		touche chariot prise de sg
02.02.05		touche lit du patient
02.02.05		touche et écrit sur demande d'examen(posée sur chariot)
02.02.05		**HRUB**
02.02.05		ramasse garrot tombé au sol
02.02.05		pose garot sur chariot
02.02.05		reprend garot
02.02.05		pousse table de nuit du patient
02.02.05		met garrot au bras du patient
02.02.05		enfile gants
02.02.05		prend matériel prise de sg sur le chariot
02.02.05		fait prise de sg
02.02.05		jette aiguille et matériel dans poubelle chariot et sharpsafe
02.02.05		prend compresse du plateau sur chariot
02.02.05		pose compresse sur bras patient
02.02.05		jette compresse dans poubelle sans contact
02.02.05		retire gants
02.02.05	09:00	**HRUB**
02.02.05		pousse chariot hors de la chambre
02.02.05		pose ses mains sur ses hanches
02.02.05		pousse chariot dans couloir
02.02.05	09:01	Arrive devant une chambre 2 lits(PATIENTE 2)
02.02.05		**HRUB**
02.02.05		enfile surblouse
02.02.05		touche et écrit sur demande d'examen(posée sur chariot)
02.02.05		trie gobelet sur chariot
02.02.05		enfile gants
02.02.05		prend matériel pour prise de sg
02.02.05		entre dans la chambre
02.02.05		touche TDN patiente
02.02.05		touche patiente
02.02.05		pousse TDN
02.02.05		prend et pose garrot
02.02.05		ouvre sachet butterfly

10





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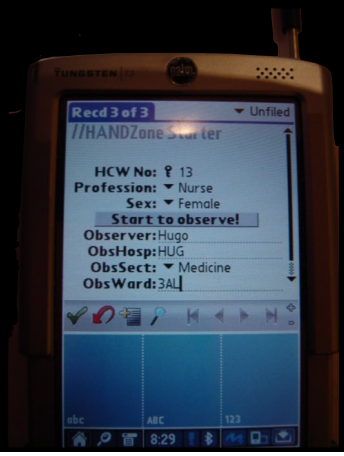
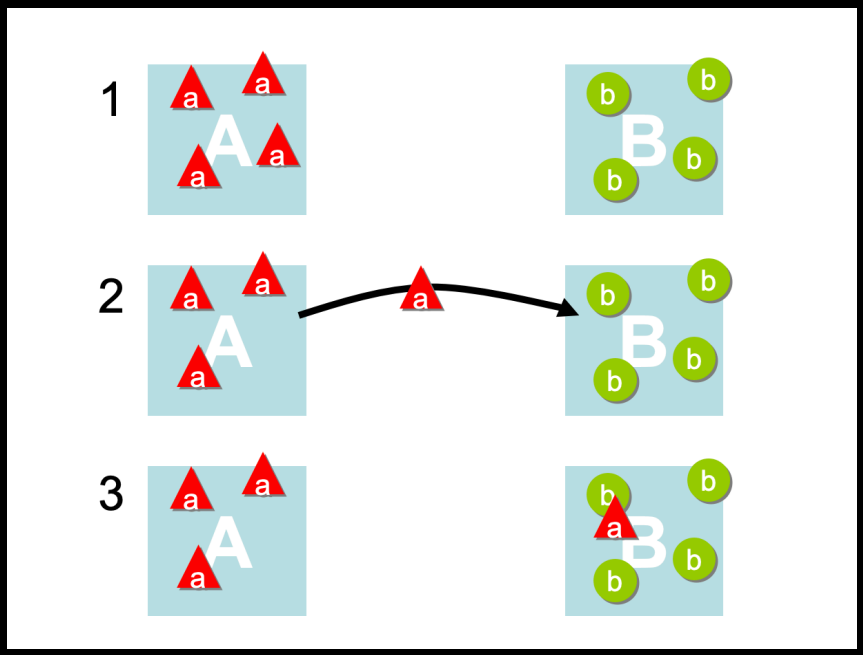
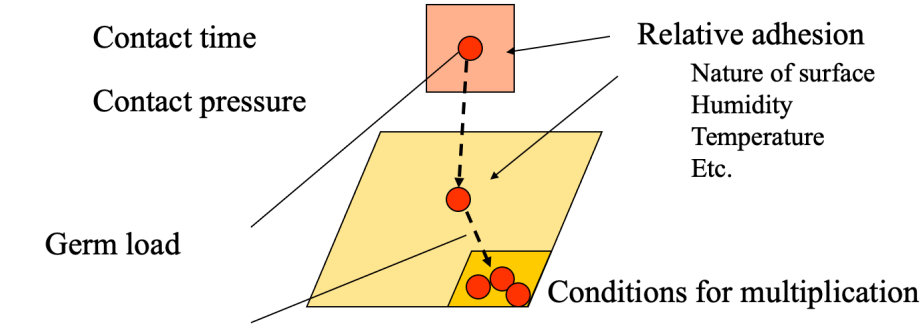

Recd 3 of 3
Unfiled
//HANDZone Starter
HCW No: 13
Profession: Nurse
Sex: Female
Start to observe!
Observer: Hugo
ObsHosp: HUG
ObsSect: Medicine
ObsWard: 3AL
8:29

12


1
2
3
A
B
a
b

13

Analysis of transmission factors : **hands > surface > colonisation**



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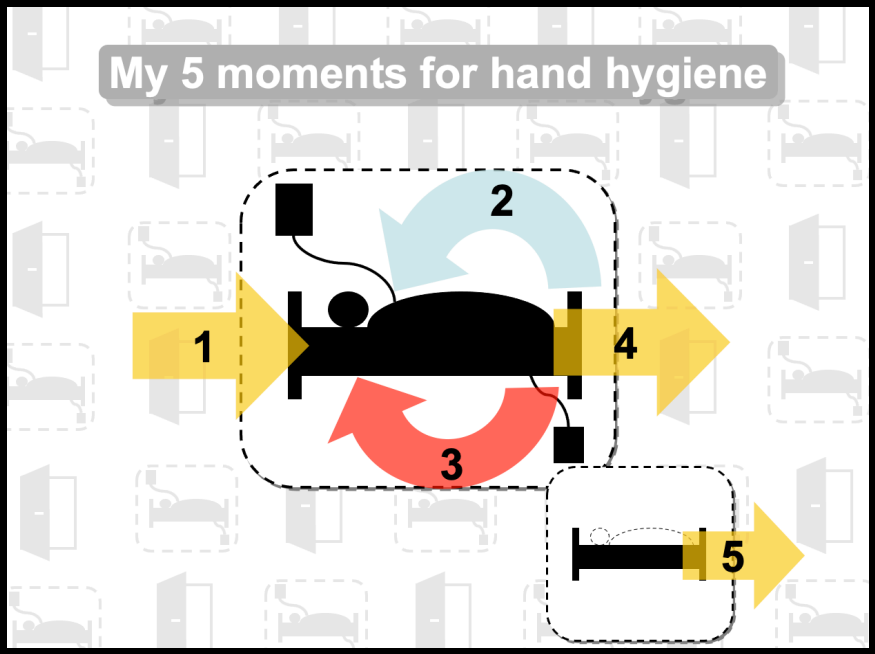

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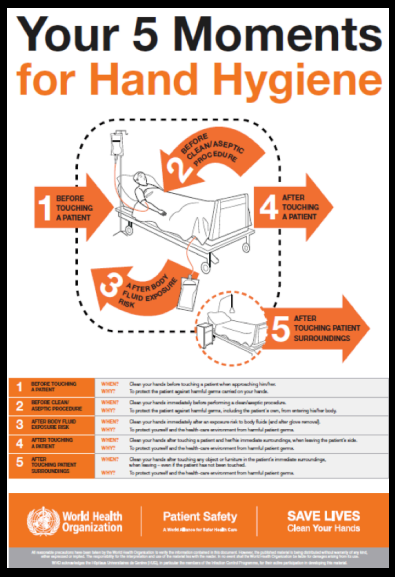


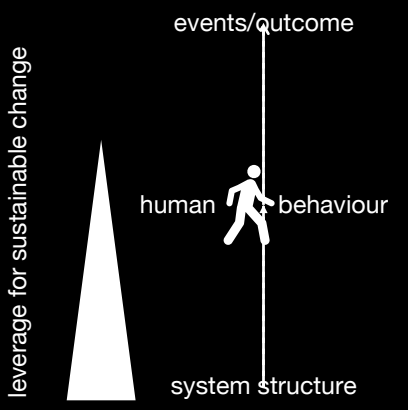
Sax H, Allegranzi B, Uckay I, Larson E, Boyce J, Pittet D. "My five moments for hand hygiene": a user-centred design approach to understand, train, monitor and report hand hygiene. Journal of Hospital Infection 67, 9–21 (2007).

17

Estimation grossière des indications à l'hygiène des mains 'avant patient' manquées; avril-sept 2009 aux HUG

1'379'700

(en moyenne, 7560 par jour)



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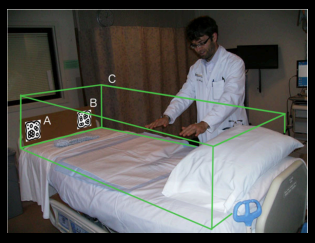
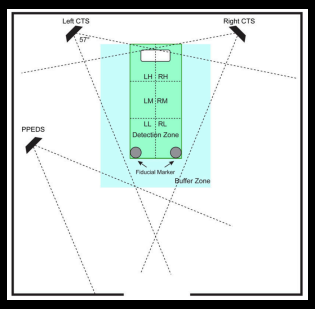
Monitoring hand hygiene.

20

Computer vision and depth sensing can estimate potential HH opportunities and adherence to PPE.





Method

- Microsoft **Kinekt** and inbuilt and additional software:
  - Color **video camera** & **depth sensor**
  - Track 6 **skeleton** representations (2 with 20 points)
  - **Fiducial markers** to 'know' the position of the **bed**
  - **Privacy** protecting millisecond existence of videos

- **Evaluation of touch, gown, mask, glove** against **human observation** in video from an additional video camera

Chen, J., Cremer, J. F., Zarei, K., Segre, A. M. & Polgreen, P. M. Using Computer Vision and Depth Sensing to Measure Healthcare Worker-Patient Contacts and Personal Protective Equipment Adherence Within Hospital Rooms. Open Forum Infect Dis 3, ofv200 (2016).
https://academic.oup.com/ofid/article/3/1/ofv200/2460557

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Computer vision and depth sensing can estimate potential HH opportunities and adherence to PPE.

Results

Average 'contact' was 3 seconds

Touch detection:

Sensitivity: 99.7%

Specificity: 98.7%

Gown detection:

Sensitivity: 100.0%

Specificity: 98.2%

Mask detection:

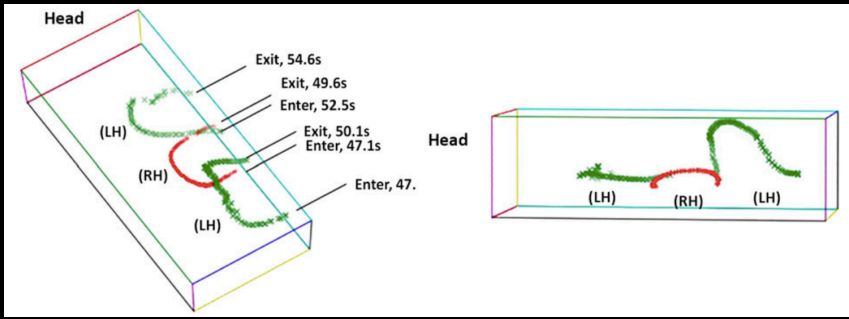
Sensitivity: 100.0%

Specificity: 98.8%

Glove detection:

Sensitivity: 100.0%

Specificity: 98.8%



Chen, J., Cremer, J. F., Zarei, K., Segre, A. M. & Polgreen, P. M. Using Computer Vision and Depth Sensing to Measure Healthcare Worker-Patient Contacts and Personal Protective Equipment Adherence Within Hospital Rooms. Open Forum Infect Dis 3, ofv200 (2016).
https://academic.oup.com/ofid/article/3/1/ofv200/2460557

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Hand hygiene reality check

Filming real ICU care with a head camera

296.5 min, 8 nurses, 2 physicians

4222 hand-to-surface exposures (one per 4.2”; mean duration 7.4”), gloved 21%

	Outside patient zone	Inside patient zone 42%	Overall
Mobile objects	61%	78%	61%
Immobile objects	16%	12%	13%
Patient intactskin	—	10%	4%
Patient critical sites	—	28%	12%
HCP own body	23%	—	10%

Clack, L., Scotoni, M., Wolfensberger, A. & Sax, H. “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 (2017). https://aricjournal.biomedcentral.com/articles/10.1186/s13756-017-0267-z

25

Hand hygiene reality check

Filming real ICU care with a head camera

	Occurrence; n	Hand hygiene action; n (%)
Infectious risk moments	508	17 (3.3%)
Patient colonisation events	291	14 (4.8%)
Patient infection events	217	3 (1.4%)

Clack, L., Scotoni, M., Wolfensberger, A. & Sax, H. "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 (2017). https://doi.org/10.1186/s13756-017-0267-z

26

How do hands … infect?

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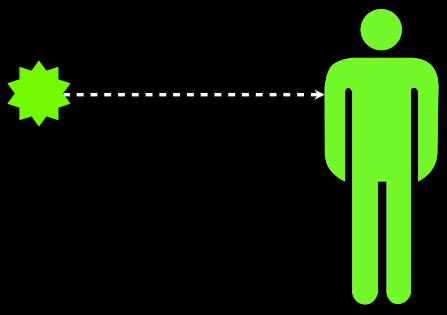

Exogenous infection

28

Endogenous infection

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Are HAI transmissible?

- 5 ICUs, 18 months, genetic typing of all strains of 10 pathogens, daily chart review, 9-day time window for same strains between patients = transmission
- 28,498 patient days, 278 (431) infections, **41 (14.5%)** associated with transmission

Table 6. Ascertained transmission episodes and transmission-associated nosocomial infections related to indicator organisms in five intensive care units (Jan 2000 to July 2001)

Intensive Care Unit	Transmissions, n	Transmissions per 1,000 Patient Days (95% CI)	Average Waiting Time Between Transmission in Days (95% CI)	Nosocomial Infections Caused by Indicator Organisms, n	Proportion of Transmission-Associated Nosocomial Infections (%)
A	57	5.9 (4.5–7.7)	9.6 (12.6–7.4)[a]	111	21
B	21	6.8 (4.2–10.4)	26.0 (41.9–16.9)[a]	28	3
C	33	5.0 (2.2–5.3)	16.5 (37.9–15.7)[a]	40	9
D	12	2.8 (1.4–4.9)	45.4 (90.3–25.8)[a]	17	2
E	18	3.7 (2.2–5.8)	30.3 (50.2–19.1)[a]	82	6
Total	141	5.0 (4.2–5.8)	23.2 (27.3–19.8)[b]	278	41 (14.5)

Grundmann H, Bärwolff S, Tami A, et al. How many infections are caused by patient-to-patient transmission in intensive care units? Crit Care Med 2005, 33:946–951. https://journals.lww.com/ccmjournal/fulltext/2005/05000/how_many_infections_are_caused_by.5.aspx

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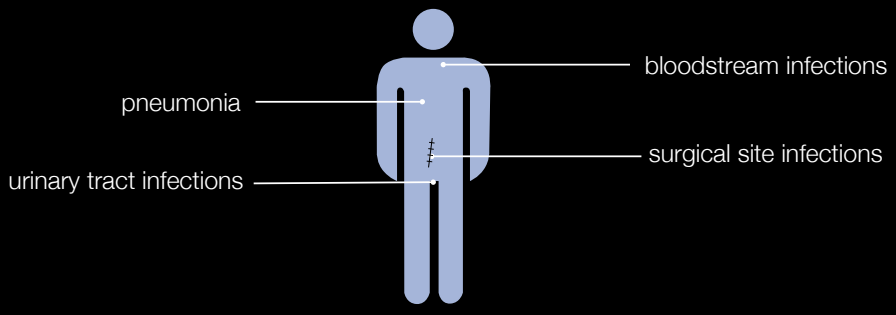

~85% of all healthcare-associated infections

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How and how often do pathogens travel?

A systematic literature review 2018

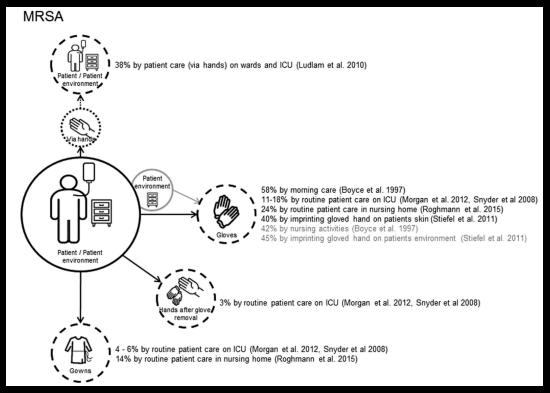
32 of 13,121 articles included

84% examined transfer **from patients**

Transfer frequency to hands 33%, gloves 30%, gowns 10%

Only 2 studies transfer **to patients**

Risk: moist body sites (n=7), longer duration of care (n=5), and care of patients with an invasive device (n=3).



Wolfensberger, A. Clack L, Kuster SP, Passerini S, Mody L Chopra V, Mann J, Sax H. Transfer of pathogens to and from patients, healthcare providers, and medical devices during care activity-a systematic review and meta-analysis. Infect Control Hosp Epidemiology 39, 1–15 (2018). https://doi.org/10.1017/ice.2018.156

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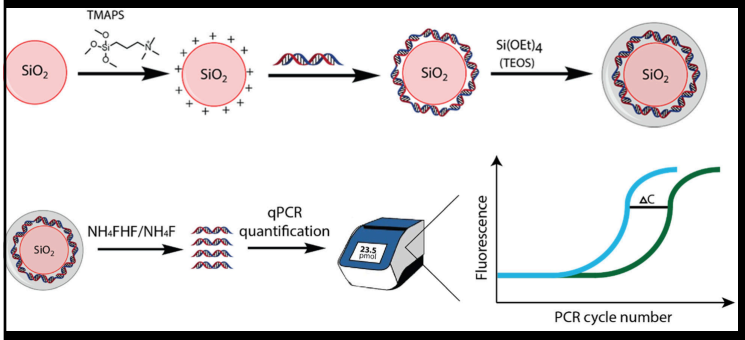
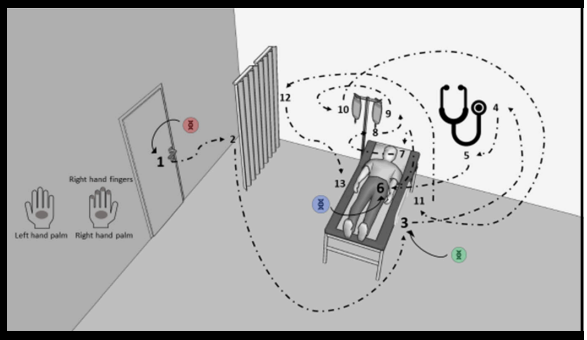
How and how often do pathogens travel?

Silica nanoparticles with encapsulated DNA (SPED)





Scotoni M, Koch J, Clack, L, PItal AK, Wolfensberger A, Grass R, Sax H. Silica nanoparticles with encapsulated DNA (SPED) – a novel surrogate tracer for microbial transmission in healthcare. Antimicrob Resist Infect Control 9, 152 (2020). https://doi.org/10.1186/s13756-020-00813-7

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How and how often do pathogens travel?

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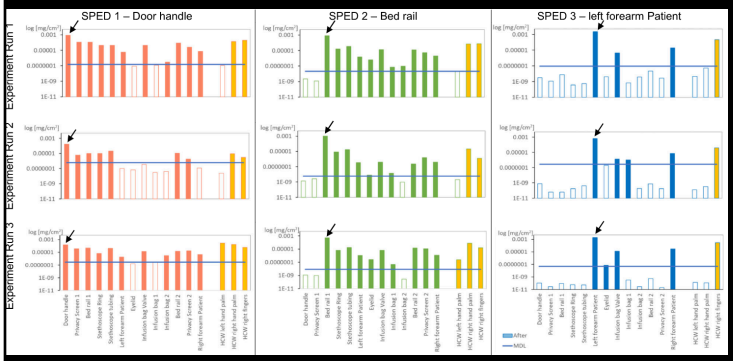

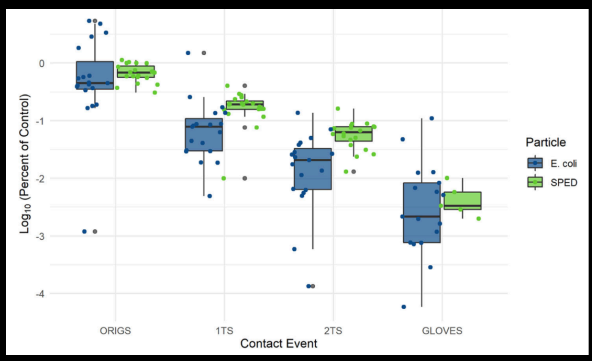

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Quo vadis?

Panel 1: Hand hygiene research agenda: 2021 and beyond—55 proposals*

Hand hygiene substances and laboratory research

1 Assessing the possible effect of emollients and gelling agents on the efficacy of alcohol-based hand rubs and formulating new products using in-vitro followed by in-use studies
2 Assessing and validating alcohol-based hand rubs produced in low-resource countries
3 Assessing the efficacy of alcohol-based hand rubs on emergent microorganisms
4 Identifying the best methods to recover microbial pathogens from hands and doing comparative studies close to clinical contexts
5 Developing new innovative methods to measure microbial pathogens on hands, either directly or indirectly, that could be used at the point of care during care delivery and ideally allow immediate feedback to health-care workers
6 Producing evidence-based, high-quality data comparing different formulations of alcohol-based hand rubs (ie, rinse, gel, spray, and foam) from the laboratory (eg, antimicrobial efficacy) to the point of care (eg, acceptability, tolerability, frequency of use, and compliance)
7 Monitoring the effect of alcohol-based hand rubs on skin using realistic, pragmatic clinical trials and further clarifying their effect on the human microbiome among high-frequency and low-frequency users in different populations
8 Assessing the minimal level of reduction of microbial pathogens on hands needed to be reached by alcohol-based hand rub use to ensure patient safety
9 Studying interactions between alcohol-based hand rub and glove use according to acceptability, tolerability, frequency of use, and observed compliance
10 Evaluating the added value of antiseptics, such as chlorhexidine, to alcohol-based hand rubs in real-life conditions using randomised controlled studies
11 Developing new norms for the validation and accreditation of alcohol-based hand rubs, closer to clinical practices requirements and recommendations

Simplification of the hand hygiene concept

12 Identifying the contribution of each of the WHO My Five Moments for Hand Hygiene to specific infectious outcomes and causes
13 Understanding whether a simplification of the My Five Moments concept would be appropriate and safe
14 Proposing alternative hand hygiene concepts to improve the overall effectiveness on patient outcomes
15 Studying the best technique to clean hands compared with the current standard WHO six-step How to handrub technique, using validated microbiological and clinical performance indicators
16 Testing alternative simplified steps to improve both hand hygiene techniques and compliance

17 Determining the correlation between different monitoring techniques with infectious outcomes to assess the best prediction fit
34 Determining the relationship between different levels of hand hygiene performance and their preventive effect
35 Identifying the best strategies to implement hand hygiene in non-hospital settings

Implementation of hand hygiene improvement strategies

36 Identifying the best mechanisms to achieve widespread access to alcohol-based hand rubs worldwide, including at time of crises in which demand increases resulting in shortage
37 Determining the best approaches to facilitate system change implementation and long-term maintenance at institutional, regional, national, and worldwide levels
38 Determining the cost-effectiveness of alcohol-based hand rub introduction in different settings
39 Evaluating the benefits and possible consequences of using alcohol-based hand rubs among patients and their families
40 Producing individual health-care worker-level hand hygiene performance data to investigate the effect of individual performance feedback on infectious outcomes
41 Performing effectiveness studies on the preventive effect of performance feedback and developing an overall system for monitoring and feedback
42 Determining best strategies and parameters to apply performance feedback and their cost-effectiveness
43 Evaluating the incorporation and cost-effectiveness of automated systems into hand hygiene feedback approaches
44 Evaluating the effect of message framing, language, and digital communication technologies within social marketing strategies across different culture and contexts
45 Conducting controlled studies on improving patient participation by proposing best methods of providing information, the benefit of including user feedback during the design, and implementation stages of initiatives

Compliance with hand hygiene

17 Identifying the determinants of health-care workers' compliance in different socio-economic and cultural backgrounds and suggesting strategies to improve compliance
18 Assessing the effect of measuring hand hygiene compliance on improvement in action
19 Identifying the specific determinants of physicians' hand hygiene behaviour and the best approaches to improve it
20 Identifying the most effective educational strategies in the short-term and long-term through clinical trials and studying variations among different settings and health-care professional categories
21 Determining whether education during training is more effective or sustainable and what would be the ideal repeated frequency among health-care workers
22 Developing games and studying the effect of innovative approaches to teach and ensure sustainability of hand hygiene knowledge and best practices among health-care workers
23 Determining the effect of glove use on hand hygiene practices, HAIs, and antimicrobial resistance cross-transmission
24 Determining whether the benefit of appropriate hand hygiene behaviour could be better than using gloves when contact precautions are indicated
25 Comparing glove changing with glove disinfection using alcohol-based hand rubs in randomised controlled studies
26 Assessing the potential added value and risks of gloves containing antimicrobial materials
27 Identifying the minimum or ideal target for hand hygiene compliance percentage improvement to have an impact on outcomes

Hand hygiene promotion strategies

28 Assessing the effect of hand hygiene promotion on different types of HAIs
29 Evaluating the importance of specific components of the multimodal strategy to induce health-care workers' sustained behavioural change and reduce HAIs and antimicrobial resistance cross-transmission
30 Evaluating the effectiveness of hand hygiene improvement in reducing HAIs and antimicrobial resistance cross-transmission using randomised and controlled studies, interrupted time series analyses, and cluster-randomised, and stepped wedge studies
31 Determining how institutions succeed at implementing complex multimodal improvement strategies and barriers and facilitators to implementation, using qualitative studies
32 Assessing the cost-effectiveness of hand hygiene promotion strategies in different settings

(Continues on next page)

46 Describing the perceptions of service users and patients about a given safety climate, in both high-income and low-income and middle-income countries
47 Identifying and explaining factors associated with successful local adaptations of the multimodal hand hygiene improvement strategy
48 Identifying the best approaches to ensure the sustainability of the multimodal hand hygiene improvement strategy and its positive results
49 Determining the best methodological approaches for comparing the WHO Hand Hygiene Self-Assessment Framework results from health-care facilities in different countries
50 Developing semi-automated and electronic tools to facilitate regular and easy completion of the WHO Hand Hygiene Self-Assessment Framework
51 Determining the time span between the implementation of the hand hygiene improvement intervention and the detection of a demonstrable effect on HAI reduction using time series analyses, in high-income and low-income countries

Hand hygiene campaigning

52 Conducting outcome research on national campaigning, preferably versus local action
53 Evaluating the effect of hand hygiene campaign integration versus promotion in isolation
54 Determining the optimum approach and outcome measure for a global health-care campaign focused on hand hygiene and its cost-effectiveness
55 Evaluating the effects of engaging consumers and the public in global campaigning

HAI=health-care-associated infection.

4 Identifying the **best methods** to **recover microbial pathogens** from hands and doing comparative studies **close to clinical contexts**

5 Developing new innovative methods to **measure microbial pathogens on hands**, either directly or indirectly, that could be used **at the point of care** during care delivery and ideally allow immediate feedback to health-care workers

…

12 Identifying the **contribution** of each of the WHO My Five Moments for Hand Hygiene **to specific infectious outcomes** and causes

13 Understanding whether a **simplification of the My Five Moments** concept would be appropriate and safe

14 Proposing **alternative hand hygiene concepts** to improve the overall effectiveness on patient outcomes

Lotfinejad N, Peters A, Tartari E, Fankhauser-Rodrigez C, Pires D, Pittet D. Hand hygiene in health care: 20 years of ongoing advances and perspectives. Lancet Infect Dis 21, e209–e221 (2021).

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In conclusion…

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The idea behind the 'Five Moments' was to create a **simple and robust mental model** - it clearly needs **systems design** for a successful implementation.

The exact **contribution** and **pathway** of **hand transmission** to **infection** needs more investigation.

Detailed accounts of **hand-to-surface exposures** could help to better understand transmission.

Utopia: ***precision infection prevention*** would tell healthcare providers when a transmission is (very likely) going to happen, which would decrease need for general hand hygiene and increase adherence.

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Credits

Benedetta Allegranzi
Lauren Clack
Robert Grass
Pascale Herrault
Claire Kilpatrick
Julian Koch
Stefan Kuster
Lona Modi
Simone Passerini
Didier Pittet
Manuela Scotoni
Jules Storr
Ilker Uckay
Cinzia Ullrich
Aline Wolfensberger

Hand Hygiene – Reloaded
Prof Dr med Hugo Sax, Bern University Hospital and University of Bern, Switzerland
A Webber Training Teleclass

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November 4, 2021	DISCOVERING AND TRANSFORMING THE INNER ICP EDUCATOR: EXPLORING CORE ELEMENTS OF AN INNOVATIVE PROFESSIONAL'S EXPERIENCE Speaker: **Dr. Gwyneth Meyers**, Alberta Health Services
November 18, 2021	*(FREE Teleclass)* THE SANITATION ECONOMY & PUBLIC HEALTH Speaker: **Alexandra Knezovich**, Toilet Board Coalition, Switzerland
December 2, 2021	EMERGING FUNGAL INFECTIONS AND INFECTION PREVENTION AND CONTROL Speaker: **Prof. Andreas Voss**, Radboud University, The Netherlands
December 16, 2021	*(FREE Teleclass)* COVID-19 AS DRESS REHERSAL: THE RISE OF DISEASE X Speaker: **Prof. Stephen S. Morse**, Mailman School of Public Health, Columbia University

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