Contamination of the Ward Environment: The Importance of Hand Hygiene
Dr. Ginny Moore, Royal Free Hampstead NHS Trust
Teleclass sponsored by GOJO (www.gojo.com)

Contamination of the ward environment: the importance of hand hygiene when leaving the patient zone

Dr. Ginny Moore
UCLH Environmental Research Group
Royal Free Hampstead NHS Trust, London
ginny.moore@uclh.nhs.uk

Hosted by Vanessa Whatley
vanessa@webbertraining.com

Sponsored by GOJO
www.gojo.com

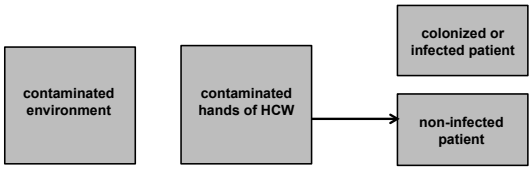
www.webbertraining.com December 11, 2012

Aims

- to illustrate the role of hands in HCAI
- to highlight the role of the environment as a potential source of microorganisms
- to illustrate the most contaminated surfaces in two different types of ward and those surfaces that are most frequently touched
- to demonstrate the importance of hand hygiene when leaving the patient zone
- to discuss a trial of an automated hand hygiene monitoring system with real-time feedback

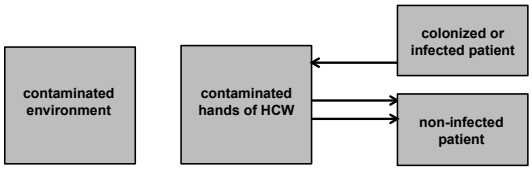
2

The role of hands in HCAI



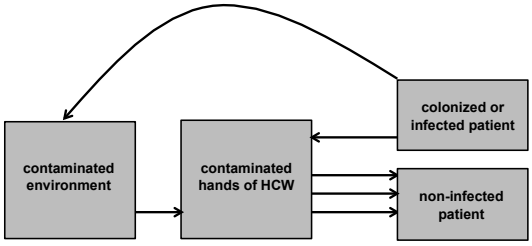
3

The role of hands in HCAI



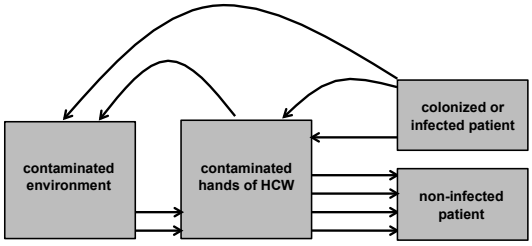
4

The role of hands in HCAI



5

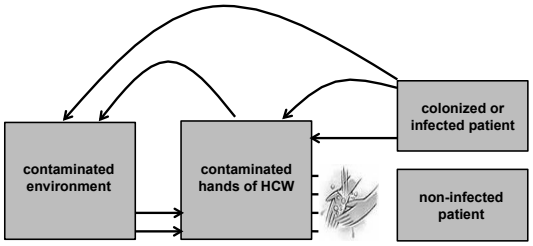
The role of hands in HCAI



6

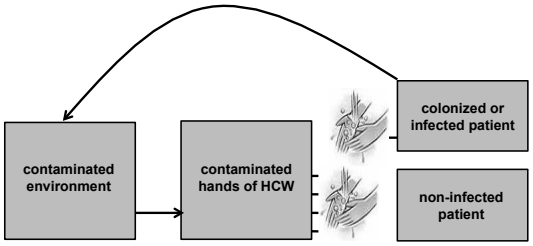
A Webber Training Teleclass
Hosted by Vanessa Whately vanessa@webbertraining.com
www.webbertraining.com

Hand hygiene: when?



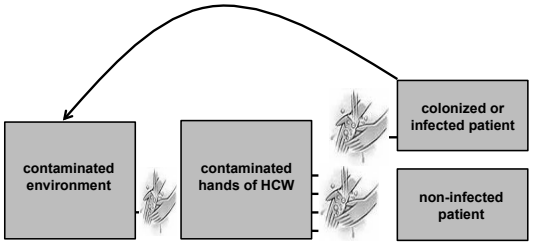
7

Hand hygiene: when?



8

Hand hygiene: when?



9

Hand hygiene: when?

The WHO "my five moments for hand hygiene"

1. **Before patient contact**
2. **Before performing a clean/aseptic procedure**
3. **After exposure to body fluids**
4. **After patient contact**
5. **After touching a patient's surroundings**

10

Hand hygiene: why not?

Self-reported (by healthcare workers)

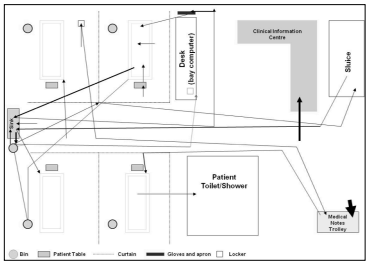
- **lack of facilities; skin irritation**
- **wearing of gloves**
- **not thinking about it (forgetfulness)**

Observed (by researchers)

- **workload → ward type**

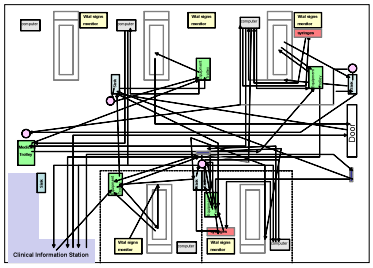
11

Staff movement: Gastrointestinal ward



12

Staff movement: ICU



13

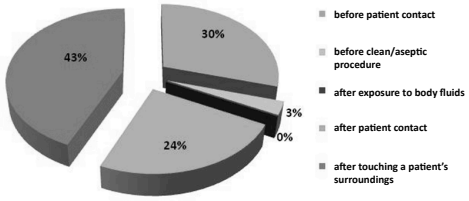
Hand hygiene: why not?

Self-reported (by healthcare workers)
- lack of facilities; skin irritation
- wearing of gloves
- not thinking about it (forgetfulness)

Observed (by researchers)
- workload → ward type
- low personal risk

14

Missed hand hygiene: when?



the majority of hand hygiene opportunities occur after contact with a patient's surroundings

these opportunities are also those most commonly missed (i.e. are associated with the lowest levels of compliance).

15

Contamination of the environment

- Hands
  - patients
  - healthcare workers
- Cleaning materials
- Bioaerosols
  - ward activities (e.g. bed making; floor cleaning)
  - diarrhoea

16

Microbiological ward survey

Aim

To determine how far potential pathogens, and associated risk, can spread from source

Method
- 4 month study conducted in an ICU and a GI ward

17

Microbiological ward survey

Aim

To determine how far potential pathogens, and associated risk, can spread from source

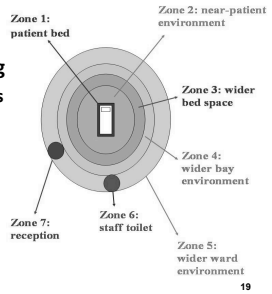
Method
- 4 month study
- 4,000 surfaces sampled

18

Microbiological ward survey

Method

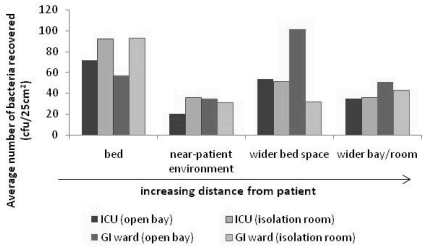
- Environmental sampling
  - Pre-determined surfaces
  - Zones of increasing distance from patient
- Movement analysis



19

Microbiological ward survey

Distribution of bacteria within different ward environments



20

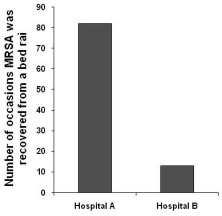
Environmental reservoirs

- The bed rail
  - touched by patients, visitors and carers
  - can become heavily contaminated
  - potential reservoir of pathogenic bacteria
  - MRSA recovered from 2.8% of all bed rails sampled (n=3360)*

*APR Wilson et al. *Critical Care Medicine* 2011; 39:651-658

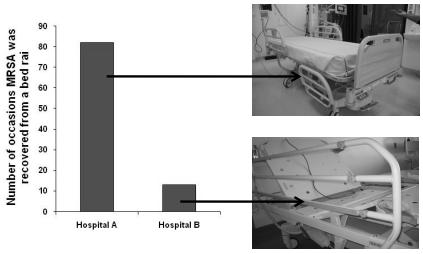
21

Bed Rails: not all the same!



22

Bed Rails: not all the same!

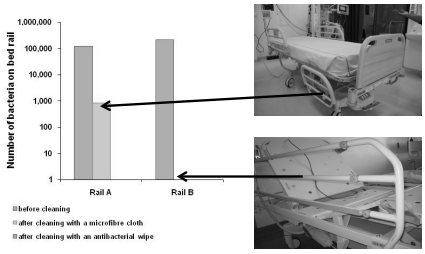


polypropylene + 10% calcium carbonate

nylon painted stainless steel

23

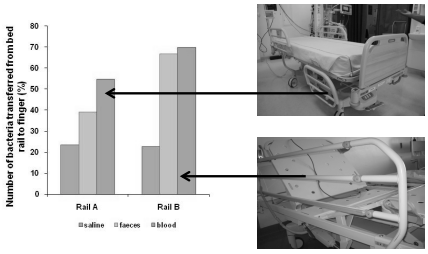
Bed Rails: not all the same!



When using a microfibre cloth, rail A was more difficult to clean (remove bacteria) than rail B

24

Bed Rails: not all the same!



On contact with the bed rail, more bacteria were transferred to the fingertips from rail B than from rail A

25

Environmental reservoirs

- The bed rail
  - bed used to transport patients
  - can also transport bacteria

Clostridium difficile-positive patient

⇓

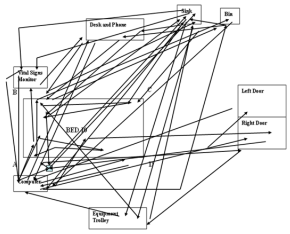
environment (open bay)

⇓ ⇒ environment (reception)

environment (isolation room)

26

The ICU isolation room



Surface	Number of contacts
door handle/panel	291
patient	208
computer	159
equipment trolley	89
bed rail(s)	68

27

The ICU isolation room

Surface	Number of contacts
door handle/panel	291
patient	208
computer	159
equipment trolley	89
bed rail(s)	68

Clostridium difficile **positive sites**

28

The ICU isolation room

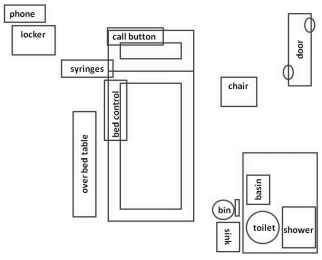
Surface	Number of contacts
door handle/panel	291
patient	208
computer	159
equipment trolley	89
bed rail(s)	68

Enterococcus **spp. positive sites**

Surface	Number of contacts
table/worktop	68
syringe driver	31
telephone	15
chair	4
ventilator	4
stethoscope	-
towel dispenser	-

29

Unrecognised colonisation



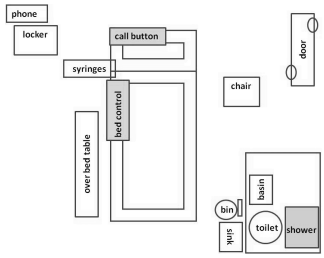
Isolation required for a gentamicin-resistant Gram-negative infection (*Proteus mirabilis*; wound, blood).

Patient had also been infected with MRSA and treated with vancomycin.

30

Contamination of the Ward Environment: The Importance of Hand Hygiene
Dr. Ginny Moore, Royal Free Hampstead NHS Trust
Teleclass sponsored by GOJO (www.gojo.com)

Unrecognised colonisation



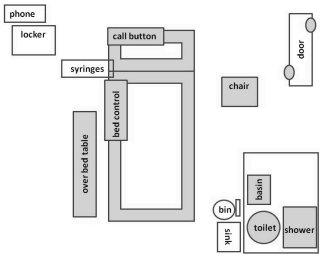
8 week sampling period:

***Proteus mirabilis* isolated from two surfaces**

MRSA isolated from one surface

31

Unrecognised colonisation

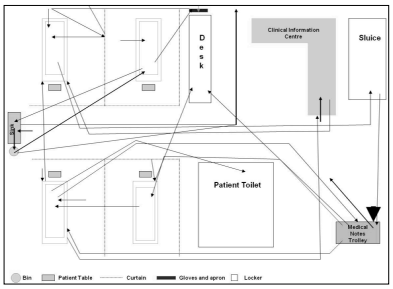


Patient not known to be VRE + But environmental sampling revealed heavy, widespread and persistent VRE contamination.

43 positive sites
bed control → 7 occasions
tap (ensuite) → 9 occasions
door handles → 3 occasions

32

Staff movement: GI ward



Nurse:patient ratio 1:8

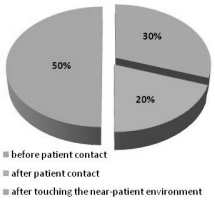
staff movement between patients and/or bed spaces common

33

Staff movement: GI ward

Routes most travelled		Hand hygiene compliance*
Origin	**Destination**	
patient	patient	33%
record folder	desk	14%
bed	bed	25%
patient	sluice room	50%

*** compliance based upon observed outcomes**



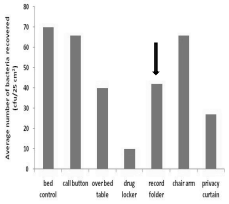
34

Contamination of the near-patient environment (GI surgical ward)

Routes most travelled		Hand hygiene compliance*
Origin	**Destination**	
patient	patient	33%
record folder	desk	14%
bed	bed	25%
patient	sluice room	50%

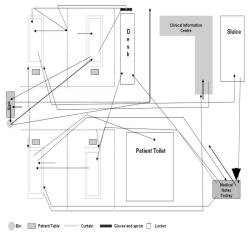
*** compliance based upon observed outcomes**

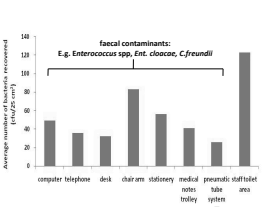
MRSA, MSSA, *Enterococcus* spp, *E. Coli*
Stenotrophomonas maltophilia,
Acinetobacter baumannii



35

Contamination of the wider ward environment (GI surgical ward)



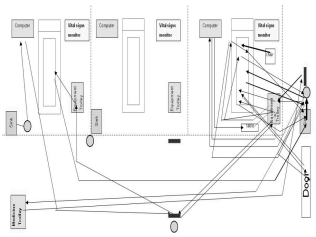


VRE
MRSA

36

A Webber Training Teleclass
Hosted by Vanessa Whately vanessa@webbertraining.com
www.webbertraining.com

Staff movement: ICU



Nurse:patient ratio 1:1

staff movement focussed around a single bed area

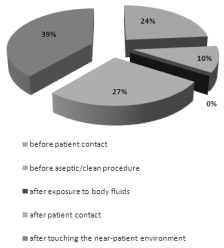
Surface	Number of contacts
equipment trolley	211
patient	178
computer	170
door panel	69
bed rail(s)	68

37

Staff movement: ICU

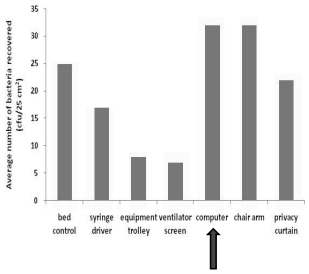
Routes most travelled		Hand hygiene compliance*
Origin	Destination	
equipment trolley	patient	43%
patient	equipment trolley	11%
patient	computer	14%
bed	door (exit bay)	70%

* compliance based upon observed outcomes



38

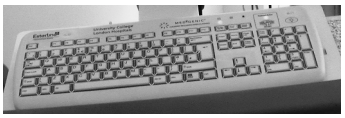
Contamination of the near-patient environment (ICU)



39

Environmental reservoirs

- The computer keyboard
  - difficult to clean → heavy contamination
  - flat, sealed keyboards facilitate cleaning
  - visual prompt to promote cleaning compliance



- flashing light easy to ignore!

40

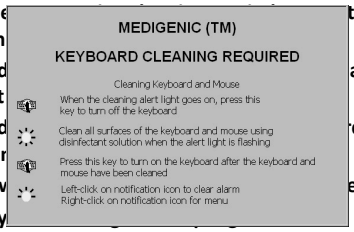
Software to improve cleaning compliance

- "Moving window" software
  - projects a moving cleaning reminder onto the monitor screen
  - window appears at the same time as the flashing light alarm
  - window disappears as soon as the keyboard is cleaned
  - software installed on 9 of 20 ward computers
  - daily microbiological sampling

41

Software to improve cleaning compliance

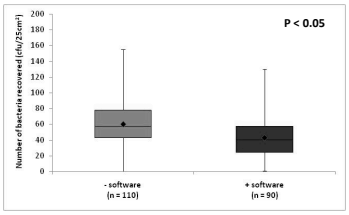
- "Moving window" software
  - proj… …the mon…
  - wind… …lashing light…
  - wind… …d is clean…
  - softw… …ers
  - daily…



UCL HOSPITALS
University College London Hospitals NHS Foundation Trust

Software to improve cleaning compliance

Effect of installing additional software upon the median, IQR, range and mean (♦) number of bacteria recovered from computer keyboards



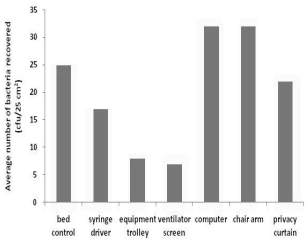
Significantly fewer bacteria were recovered from test keyboards (+ software) than from control (- software).

Test keyboards were less likely to have a flashing light than control keyboards.

Activation of the software improved cleaning compliance.

43

Contamination of the near-patient environment (ICU)

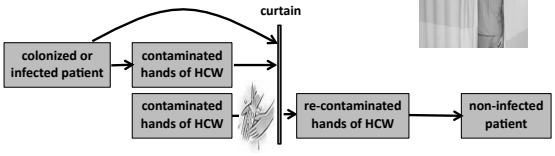


- 977 surfaces sampled
- 6% were contaminated with enterococci
- faecal contamination most likely to be present on:
  - bed control panel
  - privacy curtains
  - bin lids

44

Environmental reservoirs

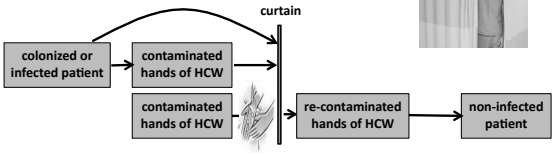
- The privacy curtain
  - hand hygiene often performed before drawing curtains



45

Environmental reservoirs

- The privacy curtain
  - hand hygiene often performed before drawing curtains

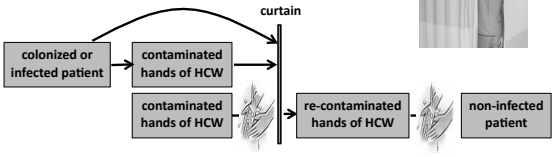


MRSA + day 1 | MRSA + days 1 and 3 | MRSA + day 9

46

Environmental reservoirs

- The privacy curtain
  - hand hygiene often performed before drawing curtains

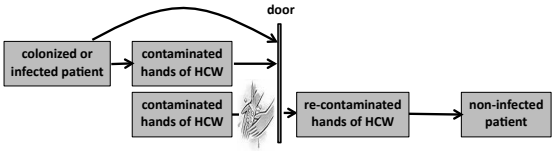


47

Environmental reservoirs

- The door handle
  - Isolation room

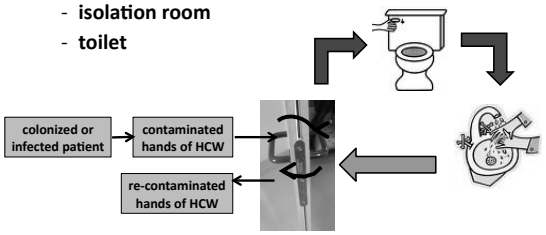
Surface	Number of contacts
door handle/panel	291



48

Environmental reservoirs

- The door handle
  - isolation room
  - toilet



49

Hand hygiene: how?

- Alcohol gel
  - quick and easy
  - in most cases it's all that's needed
- Soap, water and effective hand drying
  - if hands are visibly dirty
  - if exposure to *Clostridium difficile* likely/suspected
  - after using the toilet

50

Hand hygiene: how to improve compliance

- Interventions
  - should provide the cues to perform hand hygiene
  - should provide the ability to perform hand hygiene
    e.g. locating alcohol gel dispensers en route to a task where hand hygiene is required
- Cues
  - should be tied to specific events or tasks
  - may differ with ward type

McLaughlin AC and Walsh F. *Am J Infect Control* 2012; 40:653-658

51

Hand hygiene: how to improve compliance

- General wards
  - movement from bed to bed common
  - bacterial transfer possible even when performing seemingly innocuous tasks
    - illustration of case note folders?
- ICU
  - movement more likely to be centred around one bed
  - common movement routes (patient → computer)
    - visual reminders (e.g. software; screen saver)?
- Conclusions based on visual observations

52

Hand hygiene: compliance

- Problems with visual monitoring
  - provides limited information
    - short (20 min) sessions during working day
  - the "Hawthorne Effect"
    - compliance increases when staff know they are being observed
      - overt surveillance leads to higher rates of compliance than covert surveillance
    - monitoring in single rooms not usually practicable
  - observation obscured by curtains
- Continuous automatic monitoring is required

53

VeraMedico: a solution?

- An "intelligent" hand hygiene monitoring system
  - device worn by each healthcare worker
  - receives information about hygiene events
    - patient contact
    - hand washes
  - responds to this information
  - transmits and records adherence to hygiene protocols
- Will demonstrate ACTUAL hand hygiene compliance

54

VeraMedico: a solution?

- Information received
  - Staff-patient contact (long term plan)
    - via small device worn by patients
  - Staff-equipment contact
    - via small device fitted to specific equipment
  - Alcohol vapour
    - detects the use of alcohol gel
  - Use of soap and water
    - via device installed within sink waste outlets

55

VeraMedico: a solution?

- Responding to information

Badge displays one of three colours

amber hand hygiene is required
e.g. nurse touches patient

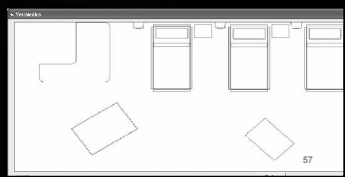
green hand hygiene has been performed
e.g. nurse touches patient then uses alcohol gel

red hand hygiene has not been conducted
e.g. nurse touches equipment then patient

Alerts non-compliance in real time to staff and patients

56

www.veraz.co.uk/files/Demo3Large.wmv



57

The "Green Badge Project"

Aims

1. To determine if a hand hygiene monitoring system with immediate feedback improves hand hygiene compliance in a clinical setting
2. To determine acceptability to staff and patients

58

The "Green Badge Project"

- 5 week study
  7 days a week (10am – 4pm)
- 3 key study phases

Phase 1
- badges set to green
- information received and transmitted by devices
  - actual hand hygiene compliance determined (without prompt)
  - observed hand hygiene compliance determined (visual audit)

59

The "Green Badge Project"

Phase 2
- information received and transmitted by devices
- badges switched on (green → amber → red)
  - hand hygiene compliance determined (automated and visual)
    - staff aware of colour change and need for hand hygiene
- staff and patient questionnaire

Phase 3
- information received and transmitted by devices
- badges set to green
  - hand hygiene compliance determined (without prompt)
    - any permanent effect?

60

The "Green Badge Project"

Results

	VeraMedico		Visual Observation	
	recorded compliance	first contacts (n)	median (range) compliance	audits (n)
Phase 1 inactive phase	**22%**	1665	**43%** (11-75)	38
Phase 2 immediate feedback	**66%**	3672	**58%** (40-87)	9
Phase 3 inactive phase	**62%**	1369	**64%** (18-100)	16

→ **effective means of improving hand hygiene compliance**

61

The "Green Badge Project"

Staff Feedback (n = 23)

96% of respondents agreed that the colours on the badge were easy to see

79% thought that wearing the badge would improve hand hygiene

52% of respondents agreed that the system will reduce infections

22% were unsure as it "would depend upon the individual and use of badge"

91% of respondents agreed that not all staff would wear the badge

doctors were thought to be those least likely to wear the badge

Staff were comfortable with being challenged by patients

56% thought that patients would challenge a red (or absent) badge

62

The "Green Badge Project"

Patient Feedback (n = 30)

In general:

agreed that the colours on the badge are easy to see

agreed that badge system is a good idea

However:

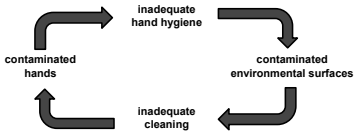
primary concern was their illness

NOT feeling unable to challenge staff

63

Conclusions

- **hands play an important role in HCAI but so too do environmental surfaces**



- **continuous automatic monitoring with immediate feedback can help improve hand hygiene compliance**
- **establishing common contact patterns can help focus hand hygiene training and/or behaviour change**

64

Acknowledgements

Prof Peter Wilson

Staff and patients in all study wards

Ward Survey
Graham FitzGerald
Monika Muzslay

Bed Rail Study
Shanom Ali

Computer Study
Helen Fifer
Paul Ostro
Paul Ganney

Green Badge Project
Sarah Storey
Sarah Atkinson
Veraz Ltd
SURF (England's Healthcare-Associated Infection (HCAI) Service Users Research Forum)

65