**SUPPLEMENTARY MATERIAL**

## *Supplementary material to “Patient safety culture and the ability to improve: a proof of concept study on hand hygiene”*

1. Overview of interventions in the ‘Hand hygiene improvement Toolkit’
2. Dimensions of the interview guide, adaptations and additions
3. Interview guide
4. Distribution of interviewees among hospital units
5. Interview results per hospital unit, per dimension
6. Additional quotes from the interviews
7. Color version figure 1
8. **Overview of interventions in the ‘Hand hygiene improvement Toolkit’**

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| --- | --- | --- | --- |
| Category | Intervention | Target | Description |
| Preparation | Determining goals | Knowledge  Tools&skills  Attitude | Consult with medical and nursing staff to determine specific and realistic goals in improving hand hygiene compliance |
| Strategic placement of dispensers | Tools&skills | Increase number of dispensers in hospital unit. Review dispenser location in consultation with staff |
| Feedback & Reflection | Team training ‘Feedback’ | Knowledge  Attitude | Train healthcare workers to accept feedback on their actions and simultaneously learn to address a co-worker’s behavior |
| Buddy system | Knowledge  Attitude | Pair two healthcare workers to provide each other with feedback on hand hygiene compliance |
| Education & Awareness | E-learning | Knowledge | WHO’s 5 Moments of hand hygiene, technique and its importance |
| SureWash\* | Tools&skills | Mobile training and audit device, using game technology to map and improve hand hygiene techniques |
| Black Box Training | Tools&skills | Point out deficiencies in hand hygiene technique, with the use of a fluorescent alcohol based hand rub and a UV light to show which areas were overlooked. |
|  | Pamphlets for patients and visitors | Knowledge | Create awareness in visitors and patients on importance of hand hygiene |
| Face-to-face education | Knowledge  Attitude | Provide staff education on hand hygiene technique, and the possible consequences of non-compliance for patients and staff |
| Photo- and Video materials | Knowledge  Attitude | Show good examples by only displaying images of health care workers that comply with hospital guidelines |
| Social environment | Champions | Attitude | Encourage hand hygiene behavior by appointing well-performing health care worker as unit champion |
| Reminders | Knowledge | Develop work place reminders for use throughout unit in consultation with staff |

\*SureWash (Glanta Ltd, Dublin, Ireland) is a device that uses video-measurement technology and immediate feedback to teach health care workers the WHO’s 5 moments of hand hygiene.

## Dimensions of the interview guide, adapted from the COMPaZ

|  |  |
| --- | --- |
| Dimensions | Description |
| Teamwork and hierarchy | Collaboration between healthcare workers. Defined as the relationship an individual maintains with colleagues and the way they collaborate. Also includes hierarchical order within the hospital unit. |
| Overall perception of safety | Values and beliefs of a healthcare worker towards patient safety in general. Not specifically focused on but also includes hand hygiene. |
| Communication | The extent to which individuals can freely express ideas and opinions concerning patient safety. This includes the way information is communicated among health care workers within the hospital unit. |
| Reporting | The frequency with which adverse events and incidents are reported. Also includes the severity of reported events. |
| Shift changes | Information transfer during shift changes, including structure, procedures and activities applied. |
| Hospital management support | Measures of hospital administration concerning hand hygiene and interpretation of these measures at the hospital unit level. Assesses whether health care workers are aware of these measures and how they interpret them. |
| Leadership | Commitment towards hand hygiene as expressed by hospital unit management. This includes personal involvement and management style. |
| Adequate staffing | The amount of medical and nursing staff available for the unit. Measures perceived workload and assesses the relationship with hand hygiene compliance. |
| Addressing non-compliance | The extent to which healthcare workers can correct colleagues in case of hand hygiene non-compliance. Also assesses reasons for (not) addressing. |
| Feedback and improvement | How a hospital unit reacts to their hand hygiene compliance scores. Assesses measures that are taken within the hospital unit to increase hand hygiene compliance and the health care worker’s perspectives on these measures. |

**Adaptations and additions to the interview guide**

Three of the COMPaZ dimensions are clustered at the hospital level, rendering them less useful for assessment of safety culture on individual units.38 However, excluding these dimensions would compromise validity of the assessment, therefore a few adaptations were made. In safety culture assessment, collaboration is usually grouped in one dimension,39 we therefore combined ‘Collaboration across hospital’ and ‘Teamwork within hospital unit’ into ‘Teamwork and hierarchy’. We aimed to measure both safety culture in general and hand hygiene culture, specifically. Non-compliance with hand hygiene is usually not registered as an error, ‘Non-punitive response to error’was therefore renamed ‘Addressing non-compliance’. Likewise, ‘Feedback and learning from errors” was renamed ‘Feedback and improvements’, and defined as both the response to error in general and the unit’s plan of action to improve compliance.

1. **Interview guide**

## I. Introduction

1. Let’s start by having you briefly describe what you do here.
2. How long have you held this position? How long have you been working on this unit?

## II. Hand hygiene

1. How would you describe your unit’s view on hand hygiene?
2. Have there been efforts to improve hand hygiene?
   1. Are you aware of the ‘Hand hygiene improvement Toolkit’?
   2. If so, has the Toolkit been used? And if so, which interventions have been implemented?
   3. Do you feel improvements have been made in compliance?
3. On your unit, what do you think contributes to (not) being able to improve?
4. Does your unit have a designated ‘Hand hygiene improvement team’? If so, does the team comprise both doctors and nurses?
5. Do you know who your designated infection control nurse(s) is/are?

## III. Safety culture and hand hygiene

1. In your opinion, in what way does the hospital administration show their involvement in hand hygiene?
2. In your opinion, in what way does unit management express the need to improve hand hygiene?
3. To what extent is it customary in your unit to address co-workers on non-compliance? Do you, personally, address non-compliance? Why (not)?
4. Are results of hand hygiene compliance measurements communicated with staff? If so, how? How is this information handled?
5. How would you describe your unit’s workload?
   1. To what extent does workload influence hand hygiene compliance?

## IV. General safety culture

1. How would you describe your unit’s general view on patient safety?
   1. Are measures taken to improve patient safety?
   2. What happens if someone expresses ideas or opinions on patient safety issues?
   3. Do you consider hand hygiene part of patient safety?
2. How would you describe collaboration and communication on your unit?
   1. Among nurses/doctors?
   2. Between nurses and doctors?
3. How would you describe hierarchy on your unit?
4. Can you describe how reporting of patient safety issues is handled on your unit?
   1. Is it customary to report incidents?
   2. Are ‘near-incidents’ reported (error is discovered and corrected without harm to the patient)?
5. How are shift changes organized on your unit?
6. **Distribution of interviewees among hospital units**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Medical director | Nurse manager | Doctor | Nurse | Total |
| Unit 1 | 1 | 1 | 1 | 2 | 5 |
| Unit 2 | 0 | 1 | 1 | 3 | 5 |
| Unit 3 | 1 | 1 | 1 | 1 | 4 |
| Unit 4 | 1 | 1 | 1 | 2 | 5 |
| Unit 6 | 0 | 1 | 1 | 3 | 5 |
| Total | 3 | 5 | 5 | 11 | 24 |

1. **Interview results per hospital unit, grouped on the 10 dimensions**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Dimensions | Unit 1 | Unit 2 | Unit 3 | Unit 4 | Unit 6 |
| Teamwork and hierarchy | Pillars rather than hierarchical layers.  Close collaboration between doctors and nurses | Pillars rather than hierarchical layers.  Close collaboration between doctors and nurses | Some hierarchy.  Close collaboration within each hierarchical layer | Some hierarchy,  top-down management.  Acknowledge need for collaboration and take actions to improve. Young and flexible team | Some hierarchy.  Overall friendly collaboration, but verbal aggression occurs among staff. Focus on individual performances |
| Overall perception of safety | Patient safety is priority number one. Aware of consequences of hand hygiene non-compliance. Medical staff can be skeptical of need for improvement | Patient safety is priority number one. Hand hygiene is part of patient safety | Patient safety is very important. Hand hygiene is part of patient safety, but a subordinate part. Medical staff can be skeptical of need for improvement | Improvement in patient safety is important. Hand hygiene is an integral part of work, but a subordinate part of patient safety | Patient safety is an integral part of health care. Varying opinions on whether hand hygiene is part of patient safety |
| Communication | Formal communication.  Bulletin board for important acute topics.  All staff are allowed to express ideas and opinions | Formal communication.  All staff are allowed to express ideas or options, as long as it has been thought out as a plan of action. This is actively stimulated | Formal communication.  On paper, all staff are allowed to express ideas and opinions. In practice, expression is limited to hierarchical layers | Formal and informal communication (i.e. during coffee breaks).  Combined ward; larger specialty actively seeks ideas and opinions, smaller specialty tends to ignore nurses’ opinions. | Formal communication.  Expression of ideas and opinions is limited to hierarchical layers |
| *Hand*  *hygiene*  *results* | Results communicated with staff via email or during rounds.  Hand hygiene subject of work meetings and newsletters | Results communicated with staff via email or unit log.  Hand hygiene subject of work meetings and newsletters | Results irregularly communicated with staff via e-mail and newsletters. Staff try to disseminate results through presentations.  Hand hygiene subject of work meetings | Results irregularly communicated with staff via e-mail, notice of positive results is lacking.  Hand hygiene subject of work meetings | Results irregularly communicated with staff via email.  Hand hygiene not a subject of work meetings |
| Reporting | Most reporting unit of the hospital. Acknowledge that many (near) incidents still go unreported | Everything out of the ordinary is being reported. Acknowledge that reporting could be improved | Incidents concerning patient safety are always reported. Near-incidents are infrequently reported, depending on the situation | A lot is reported, but reporting is limited by increased workload. Reporting remains infrequent | Reporting is good. Acknowledge that many (near) incidents still go unreported |
| Shift changes | Standardized shift changes, includes plenary information transfer, reading patient files, and joint bedside safety checks | Standardized shift changes, includes plenary information transfer, reading patient files, and joint bedside safety checks | Not completely standardized. Generally includes reading patient files and questions for relieving colleague | Standardized shift changes, includes reading patient files and joint bedside safety checks | Standardized shift changes, includes plenary information transfer and reading patient files. Recently added joint bedside safety checks |
| Hospital management support | |  |  |  |  |
| *Perceived investments* | Guidelines could be tightened. If management sets demands, they should facilitate | Investments in department of infection control and purchase of better alcohol based hand rub | Investments in poster campaigns and hand hygiene research | Investments in poster campaigns, tightening guidelines | Investments in posters campaigns |
| *Perceived*  *support* | Hospital management is not responsible, leadership in hospital unit is more important | Staff are divided on perceived hospital management support of hand hygiene | Hospital management sets demands, staff should meet these, hospital unit is responsible | Hospital management sets demands, staff should meet these, hospital unit is responsible | Staff does not perceive hospital management support of hand hygiene |
| *Perceived prioritization* | Hospital management have made hand hygiene a priority. Hand hygiene element of strategic plan, but targets not always feasible | Hospital management have made hand hygiene a priority | Hospital management have made hand hygiene a priority | Hospital management have made hand hygiene a priority, but staff find it frustrating attention is now lowered. Hand hygiene important element of strategic plan, it is made clear that things should change | Hand hygiene element of strategic plan, but only to pass governmental requirements and gain accreditation |
| *Feedback &*  *follow-up* | Too many e-mails from hospital management reminding to comply | Hand hygiene regularly mentioned in plenary meetings,  Indicating management thinks hand hygiene is important | Hospital units are required to explain compliance results in stand-up meetings with hospital management | Hospital units are required to explain compliance results in stand-up meetings with hospital management | No feedback or follow-up perceived |
| Leadership | Closely involved hospital unit management with regular clinical duties. Staff are involved in decision-making, experienced staff are addressed as role models.  Combined top-down and bottom-up approach | Closely involved hospital unit management. Nurse manager actively promotes guideline adherence, presents as role model. Involves staff in decision making.  Combined top-down and bottom-up approach | Medical director addresses non-compliance, but nurse manager is unaware of hand hygiene interventions. Nursing staff responsible for improvement strategy.  Top-down approach in addressing, no clear approach to improvement | Hospital unit management present as role models and address non-compliance. Generally aim at enhancing team spirit but demand hand hygiene compliance.  Top-down approach, zero-tolerance policy | Medical director initiated bed side availability of alcohol based hand rub. Nurse manager was relocated but replacement was delayed. Decision-making among nursing staff.  Currently no clear leadership |
| Adequate staffing | High workload. Hand hygiene priority is lowered in emergency situations (e.g. resuscitation) | High workload. Hand hygiene priority is lowered in emergency situations (e.g. resuscitation) | High absenteeism. Increased workload negatively influences hand hygiene compliance | Self-proclaimed highest workload of the hospital. Hand hygiene is part of routine, slight influence of workload on compliance | High workload. Increased workload not considered legitimate excuse for non-compliance, but can have a negative influence |
| Addressing non-compliance | Staff address each other on non-compliance, but there is room for improvement | Room for improvement according to management. Non-compliance addressed appropriately according to staff | Room for improvement. Medical staff are inconsistent in compliance, hindering addressing by nursing staff | Staff address each other on non-compliance, across hierarchical layers | Staff do not address each other on non-compliance, focus on own performance |
| Feedback and improvement | Aware of own opportunities for improvement. Performs interventions to improve compliance | Sees little opportunities for improvement considering consistently high compliance. Still performs interventions to improve compliance | Little awareness of opportunities for improvement.  Performs little to no interventions to improve compliance  Nurse manager not aware of hand hygiene interventions on unit | Aware of own opportunities for improvement. Performs interventions to improve compliance | Skeptical of opportunities for improvement. Acknowledges possible use of interventions. Performs little to no interventions to improve compliance |
| Safety culture | **Proactive / Generative** | **Proactive / Generative** | **Bureaucratic** | **Proactive** | **Pathological** |

1. **Additional quotes from the interviews**

**Teamwork and hierarchy**

*Well-performing units*

“[…] we just have a small team, so doctors and nurses all work together very closely […]. Hierarchy is almost non-existent. There are just differences in responsibilities.” (doctor HU2)

“[we have] a different kind of doctor, they do not have the need to be put on a pedestal. We are in it together.” (nurse manager HU2)

“I have a superior but we are equal. It is more like two pillars than two layers.” (nurse HU1)

“[…] awareness was created from the top-down […}. And I think team spirit has contributed to changing the culture, that you’re in it together [and agree on what to improve].” (medical director HU4)

*Low-performing units*

“We are a unit in which we consult each other easily, across different hierarchical layers.” (medical director HU3)

“There […] is some discontent. […] some projects that were forced through, of which the [nursing] team had a clear opinion, and still does. Which is ignored. And that can be difficult sometimes.” (nurse HU3)

“It’s not that hierarchical, but there is a distinction in who takes the floor and who ultimately makes the decisions.” (doctor HU6)

“If you meet [our boss] in the hallway, he preferably looks up or down. Then it’s almost too hard for him to say hello or something. But is has always been like that with [them].” (nurse HU6)

*Teamwork hospital unit 6*

“We are a family. That is very clear. It is all very homey on our unit.” (nurse HU6)

“[…] sometimes it’s difficult to be critical of one another. Because you’re afraid it might disrupt the relationship.” (nurse HU6)

“[during shift changes] […] there’s cursing and shouting. This is wrong and that is wrong. And then afterwards we talk things over again.” (nurse HU6)

**Overall perception of safety**

*Well-performing units*

“I think that patient safety is definitely taken seriously here, the guidelines on infection control […] are followed pretty strictly”. (nurse HU1)

“[The department manager] has a clear vision on quality and safety. […] On patient safety, we are definitely making an effort to improve things.” (doctor HU4)

*Low-performing units*

“[another unit] has a completely different culture. Their culture is a lot more closed. They all stick to the rules, while we have a tendency to work around them. Or deviate from them.” (nurse HU6)

“Sometimes during night shifts you just deduct one point [of the risk score], so you don’t have to bother the doctor.” (nurse HU6)

**Addressing non-compliance**

*Well-performing units*

“… so nurses mention that to doctors. And the other way around, too, I think. So addressing is part of our culture.” (nurse HU2)

*Low-performing units*

“That is different for every nurse, just as it is very different for every doctor. How someone handles their profession. And if they want to get [personal] or not.” (nurse HU3)

“I don’t really do that. Why not? I don’t think I notice.” (nurse HU6)

“I think I don’t usually pay attention to whether people do that. I guess it’s not a part of how I notice people. So I think I just assume that it’s okay.” (doctor HU6)

**Feedback and improvement**

*Low-performing units*

“I have no clue. And I don’t really care.” (nurse HU6)

“I have no clue.” (doctor HU6)

“Once every so often, you get a message on novelties and results. And God knows what else. [But] there are no measures taken.” (nurse HU6)

**Combining specialties**

“The interaction with the [larger specialty] is very good. They ask us ‘Well, what do you think? Here’s how we feel. What shall we, as a team, do about it?’.” (nurse HU4)

“The [smaller specialty] are not that approachable. […] And if you say something about it […] well, then they won’t listen to you.” (nurse HU4)

“[…] well there are two different types of patients with different supervisors, but we try to align certain protocols as much as possible, so nurses don’t have to do something a certain way with one half of the patients and another way with the other […}.” (medical director HU3)

“There is a huge difference between the doctors of [specialty 1] and [specialty 2]. [1] are more jovial, to be honest. And [2] are more standoffish.” (nurse HU6)

1. **Color version figure 1**

**FIGURE 1.** Hand hygiene compliance per unit, per measurement. First bar represents pooled baseline compliance, other bars represent measurements during the intervention period. OR odds ratio CI confidence interval