Master Thesis

Understanding Variation in Hand Hygiene Practices of Healthcare Workers Through Routines Theory

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Executive Summary

The following study represents the Master Thesis for acquiring the MA in International Business Communication – Multicultural Communication in Organizations at Copenhagen Business School.

Healthcare-acquired infections are a huge burden for patients as well as healthcare systems. Many of them can be prevented through hand hygiene carried out by healthcare workers. However, compliance rates are low.

The goal of this thesis is to explain variance in the hand hygiene practice of healthcare workers by investigating it through the lens of routines theory.

This study builds on routines as conceptualized by Feldman and Pentland (2003), who see them as dualisms of understandings and performances that constrain and enable each other. This way, I expected to get insights on how healthcare workers conceive of the hand hygiene routine and how this consequentially influences their hand hygiene performances.

To better understand the hand hygiene routine, I analyzed various material representations of the routine, such as guidelines, E-learning, posters, and others. I moreover conducted observations at two hospitals in the Danish capital's region to detect differences in hand hygiene performances as well as gain further knowledge on the subject.

I find that health care workers have a strong overall understanding of hand hygiene on the one hand, but a weak and diverging understanding of many of its details, such as correct duration and steps of HH, on the other. A flawed understanding of these aspects results not only in missed hand hygiene actions but also flawed performances.

Furthermore, I find that hand hygiene misses and flawed performance occur for different reasons and should thus be tackled as separate challenges.

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1. Introduction

> *"Infections by multidrug-resistant organisms (MDROs) are increasing worldwide […]. Prevention of spread and control of MDROs in healthcare settings are critical and urgent as the number of antibiotics available to treat these infections is extremely limited and development of new antibiotics is not forthcoming in the foreseeable future.*" - World Health Organization, 2014

In Danish hospitals, one in ten patients contracts an infection (Jensen, 2004; Petersen et al., 2010), while the same happens to only one in sixteen patients in the European average (European Centre for Disease Prevention and Control, 2013). Not all of these infections are due to MDROs, but they all mean costs for the healthcare system and can lead to suffering or even death.

Hand hygiene (HH) as the act of disinfecting one's hands is regarded the most effective measure of controlling healthcare-associated infections (HAIs) (Semmelweis, 1988; Rotter, 1997; Gould et al., 2007). There are other ways to prevent the transmission of pathogens as well, but its simplicity and effectiveness make HH a key measure to tackle HAIs. Its effect however depends on the compliance of healthcare workers (HCWs), which often turns out rather poor (Pittet, 2001).

It might be only one out of a large number of routines in hospitals, but the HH routine is very tangible. It needs to be carried out regularly by all HCWs in contact with patients and their surroundings. This means it can be easily observed, which makes it available for analysis.

While routines traditionally were regarded as means of stability and consistency (March & Simon, 1958; Cyert & March, 1963), Feldman and Pentland (2003) argue that routines are also capable of endogenous change. This view, also known as routine dynamics, conceives of routines as a duality of understandings and performances that enable and constrain each other. It implies that divergent understandings can lead to divergent performances, hence, it might be able to provide an explanation for variation in the practice of the hand hygiene routine. This may pertain not only to variation in the sense of not carrying out HH when required, but also in the sense of carrying it out differently than one is supposed to.

Thus, this master's thesis attempts to answer the following question:
How can variation in the hand hygiene practice of healthcare workers be explained with the concept of routine dynamics?

To provide answers, I will look at HH in theory and practice with the goal of finding ways to increase both compliance as well as correct performances, ultimately hoping to be able to provide insights that can contribute to reducing the number of HAIs.

With this goal in mind, I will first look into theory of organizational routines. More specifically, I will consider Feldman and Pentland's (2003) concept of routines and enrich it with the perspectives and additions from other authors. Afterwards, I will outline what is to be understood by HH as a routine, before I move on to describing the methodological considerations made. I will then analyze the artifacts of the HH routine and subsequently describe the results from my observations. The next section will contain a discussion of the findings, which is accompanied by deliberations on how to tackle the problem of HAIs. Finally, a conclusion will round off the thesis, in which I bring together the key findings.

2. Organizational Routines

Organizational routines are a central element of organizations and a basic mechanism for accomplishing what those do (Feldman & Pentland, 2003; March & Simon, 1958; Cohen et al., 1996). In the past decades, a number of conceptualizations have been established that range from seeing routines as relatively fixed, stable objects (March & Simon, 1958; Cyert & March, 1963) that can be the source of efficiency, but also of inflexibility (Gersick & Hackman, 1990; Weiss & Ilgen, 1985), mindlessness (Ashforth & Fried, 1988), and inertia (Hannan & Freeman, 1984), to ascribing them the ability to generate flexibility (Pentland & Rueter, 1994; Howard-Grenville, 2005) and change (Feldman, 2000; Feldman & Pentland, 2003; Rerup & Feldman, 2011). As pointed out by Geiger and Schröder (2014), the former view focuses on the "organizational elements of routines" (p. 171) and thereby on efficiency, predictability, and reliability, while the latter view sees routines through the performers' lens, since those can enact them in different ways.

2.1 Early Work on Routines

In early understandings, routines were seen as programs or scripts (March & Simon, 1958; Cyert & March, 1963; Ashforth & Fried, 1988) that respond to a need for greater efficiency and reduction of complexity (Simon, 1996). When taking routines as performance programs, all relevant decisions are made in advance. To every recurring task, there is a predefined response which leads to a predetermined result (Geiger & Schröder, 2014). In this view, routines are “repeated patterns of behavior that are bound by rules and customs and that do not change very much from one iteration to another” (Feldman, 2000, p. 611). Accordingly, routines can lead to greater organizational efficiency, legitimacy and stability.

These explanations are rather broad, but overall “suggest that routines arise because they are functional; they minimize cost and increase managerial control” (Feldman & Pentland, 2003, p. 97). Organizational routines are seen as mechanisms or abstractions - key phrase black box -, rather than actions; and the resulting focus on central tendencies and stability underlines their inertial quality (Hannan & Freeman, 1984) whilst diminishing the chance for flexibility and change.

Later on, Nelson and Winter (1982) in their seminal approach to economic evolution characterized routines as “regular and predictable behavior patterns of firms” (p. 14) with three functions:

1) to operate as organizational memory,

2) to establish a truce in intra-organizational conflict as participants may “agree to disagree” (Feldman & Pentland, 2003, p. 98) to reduce conflict, and

3) to function as a target for replication, imitation and control (Weichbrodt & Grote, 2010).

These functions can help establish routines that support individual, team, and organizational performance (Weichbrodt, 2013).

Nelson and Winter assert that "these routines play the role that genes play in biological evolutionary theory" (1982, p. 14). They discern two kinds of routines:

1) operating routines, which are shaped by organizations' overall behavior and which form the basis for efficiency and stability, and

2) high-level review/revision routines, which entail a recurring review of whether the routines still fulfil their function and which thereby foster learning and change through changing routines (Geiger & Schröder, 2014).

Where routines were originally regarded as a tool to deal with and to strengthen stability; in this concept, they also allow for dealing with deviations.

2.2 Organizational Routines as a Source of Flexibility and Change

Ultimately, Feldman and Pentland break with the idea of concepts of routines as fixed patterns of action (Feldman & Pentland, 2003; Feldman, 2000). They rather define organizational routines as "generative systems that produce repetitive, recognizable patterns of interdependent actions carried out by multiple participants" (Pentland & Feldman, 2008, p. 236). They argue that although the concepts of fixed patterns of action provide a convincing explanation for stability in organizations, they do not further our understanding of the dynamics of organizational routines and their relationship to organizational stability and change. This is primarily due to those concepts' inherent limitation of the role of human agency, since "there are no people in these traditional metaphors" (Feldman & Pentland, 2003, p. 99). This and the fact that decisions are made in advance preclude the possibility of choice and variation within the routine itself.

Moreover, Feldman and Pentland point to empirical data as proof of flexibility and change in organizational routines, which cannot be explained with the traditional concepts (Pentland & Rueter, 1994; Feldman, 2000; Edmondson et al., 2001), and which has been observed in various other studies I will refer to later in this chapter.

To tackle these issues and help understand the observed phenomena, they propose a new approach to organizational routines based on the duality between structure and agency respectively action (Bourdieu, 1977; 1990; Giddens, 1984). In doing so, they follow Latour's (1986) notion of power that exists both in principle (ostensive aspect) and in practice

(performative aspect) and transform it into a new theory for organizational routines. They suggest that routines are made up of an ostensive and a performative part as well:

> "The ostensive aspect is the ideal or schematic form of a routine. It is the abstract, generalized idea of the routine, or the routine in principle. The performative aspect […] consists of specific actions, by specific people, in specific places and times. It is the routine in practice".
> (Feldman & Pentland, 2003, p. 101)

Similarly, Winter had earlier distinguished between a "routine in operation at a particular site" and a "routine per se – the abstract activity pattern" (1995, pp. 169-70). Structuration theory assumes that when agents take actions, they produce and reproduce structure, and that structure constrains and enables the actions taken (Giddens, 1984). Thus one can see the ostensive and performative aspect as being recursively related, "with the performances creating and recreating the ostensive aspect and the ostensive aspect constraining and enabling the performances" (Feldman & Pentland, 2003, p. 105).

2.2.1 The Ostensive Aspect

The ostensive aspect forms the abstracted idea of what the routine is (Feldman & Pentland, 2003). It is like the routine's road map (Pentland & Feldman, 2007) that can take the shape of a narrative or a script (Pentland & Feldman, 2005). A mistake easily made is to take artifacts, such as written rules or standard operating procedures (SOPs), to completely form the ostensive aspect. Here, it is important to note that every participant has his or her own subjective understanding of a routine, depending on his or her role and point of view. This means that there is no single objective, commonly shared comprehension of the ostensive aspect. Moreover, the ostensive aspect merely produces an abstract picture of what the routine looks like when it unfolds. Rules enable action, but do not completely determine it due to the lack of sufficient detail: "[t]here are always contextual details that remain open – and that must remain open – for the routine to be carried out" (Feldman & Pentland, 2003, p. 101). Different routine participants may mean different interpretations, different information,

and different goals: “[t]here is no single, objective routine, but a variety of different perspectives on what is involved” (p. 104).

2.2.2 The Performative Aspect

Feldman & Pentland describe performances as “the specific actions taken by specific people at specific times when they are engaged in an organizational routine” (2003, pp. 101-102). Bourdieu (1977; 1990) maintains that practice is inherently improvisational; and so, they argue, is the performance of routines. This is owed to participants’ reflective self-monitoring in trying to make sense of what they are doing, even in highly constrained situations. They may always choose to do things differently when the organizational and institutional context or others’ relevant actions change.

Furthermore, the performative aspect demonstrates individual agency. Agency can be understood as the ability to take action in relation to time, past, present, and future (Emirbayer & Mische, 1998). It is always enacted in relation to the organizational and institutional structures that shape the set of possibilities for the participants (Feldman & Pentland, 2003).

2.2.3 Relationship Between Ostensive and Performative Aspects

The ostensive and performative aspect are inseparable from each other, and both are deemed preconditions for an organizational routine to exist. Change in one aspect does not automatically lead to change in the other (Feldman & Pentland, 2003; Pentland et al., 2012). Both aspects need to be considered. Failing to understand this can lead to negative consequences for organizations: overemphasizing the ostensive aspect may lead to management’s failure to grasp the underlying reasons for which organizational members deviate in their behavior. Vice versa, overemphasizing the performative may result in increased insecurity over what the routine is about, potentially weakening its stability, reducing participants’ understanding of complex action patterns and leading to diminished organizational efficiency.

But what does it mean when divergence between the two parts of a routine occurs? From situation to situation, it may be beneficial or detrimental to an organization's operations: "an organization in search of new ways of operating may wish to create more divergence in key organizational routines. An organization wishing to increase its legitimacy may, by contrast, wish to try to decrease the divergence" (Pentland & Feldman, 2005, p. 804).

When the ostensive and the performative aspects of routines match closely, this could be an indicator for stability or inertia (Pentland & Feldman, 2005); but an increased divergence between the two aspects could also increase the likelihood of flexibility or change (Feldman, 2000). In a study about university housing, Feldman (2000) found that the ostensive aspect can e.g. serve as a goal that people might fall short of or an as ideal that they continuously strive toward and thus alter their performances. Changed performances, on the other hand, can create better understanding and expectations, thereby altering the ostensive aspect. Taken together, a dynamic cycle of endogenous, continuous change is established (Fig. 1).

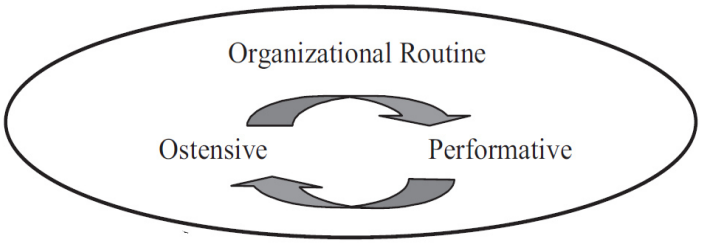

Figure 1: The routine dualism (Pentland & Feldman, 2005)

On the path from the ostensive to the performative aspect, the ostensive aspect of a routine can be used "prospectively, as a guide to what actions ought to be taken, [or] retrospectively, as a guide to accounting for actions already taken" (Feldman & Pentland, 2003, p. 105-106), or to create routines through referring to detected similarities in a set of performances. Feldman and Pentland name the following three ways people can use the ostensive in relation to the performative aspect.

Guiding.

The ostensive aspect can function as a behavioral template or a normative goal. Being only a guide, however, means it cannot denote the details of the performance – those are up to the people performing it.

Accounting.

The ostensive aspect makes it possible to explain our actions and indicates whether it is appropriate to request an accounting: "Connecting one's behavior to a particular routine legitimates the behavior if it is understood to be part of the routine and de-legitimates it if it is not" (Feldman & Pentland, 2003, p. 106). It moreover allows us to demand an account for seemingly unusual actions from others and vice versa to give ourselves sensible accounts in similar situations.

Giving account has big relevance in a hospital setting: nurses, for example, must regularly sign documents asserting they are up-to-date with the newest regulations and guidelines. As noted further above, these artifacts are not to be confused with the ostensive aspect as such which helps the nurses to account for their actions and to have a legitimate basis for every step they take. When they deviate from written rules, they can draw on the ostensive aspect when justifying their actions.

Referring.

With the ostensive aspect of routines one can talk about patterns of activity that otherwise would not be comprehensible. A single individual is not capable of making sense of the vast number of different activities taking place in complex organizations such as hospitals, and even less so of all the details at play. The ostensive aspect allows us to refer to, make sense of, and most importantly, engage in activities embedded in a potentially overwhelming 'sea of activities' (Feldman & Pentland, 2003, p. 107).

On the path from the ostensive to the performative aspect, performances make for the enactment of the ostensive aspect of the routine. According to Feldman and Pentland (2003),

engaging in actions can have the following effects on the ostensive structures that limit and enable further action.

Creation.

In order to become an organizational routine, a written procedure and the idea it establishes must be performed repeatedly. A theoretical plan without subsequent action is not part of the routine.

Maintenance.

"Performing an organizational routine maintains the ostensive aspect by exercising the capability to enact it, that is the idea is being kept alive" (p. 108). If it is not performed over a longer time the capability for doing so disappears, and furthermore the artifact that holds the ostensive definition will sooner or later lose its meaning. Moreover, performing a routine requires certain capabilities which often can be preserved and advanced through said performance.

Modification.

In enacting routines, one can maintain their ostensive aspect or deliberately deviate from it. Doing new things "alters the potential repertoire of activities that creates and recreates the ostensive aspect of the routine" (p. 108). Whether variations in existing practice eventually get accepted as legitimate alternatives and included in the ostensive aspect by members of the organization depends on actors' agency, their time orientation, and the degree of embeddedness of the routine in other organizational structures (Howard-Grenville, 2005).

Further light will be shed on the duality of the ostensive and the performative aspect in chapter 2.3. For a better understanding, however it makes sense to first explore features which play a central role in the study of organizational routines.

2.2.4 Artifacts

Both aspects of organizational routines "may be codified or prescribed, as well as enabled and constrained, by various artifacts" (Pentland & Feldman, 2005, p. 795) (see Fig. 2). Such artifacts, the "physical manifestations of the organizational routine" (p. 797), can assume many different shapes, like formal rules, written procedures, signs and so forth. Routines cannot be considered without artifacts; they are mutually constituted with them (Parmigiani & Howard-Grenville, 2011).

What is more, artifacts are the objectified summaries of routines based on our collective subjective perceptions of them (Feldman & Pentland, 2003). It is for this reason that "[r]outines are both subjective and objective and […] the two are integrally related" (p. 109). Guiding, accounting and referring are subjective acts through which "the ostensive […] enables us to create an apparently objective reality" (ibid.).

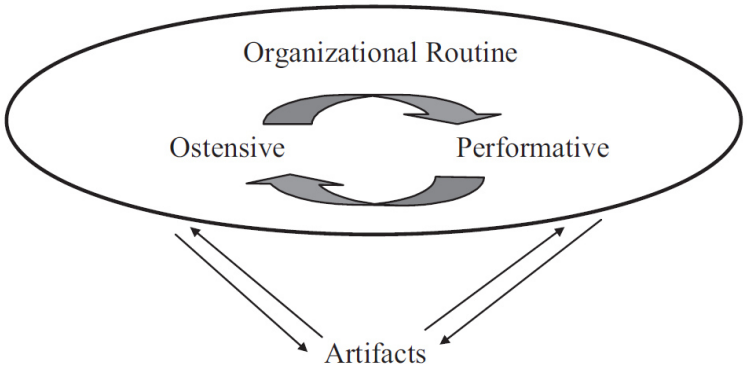

Figure 2: Organizational Routines as conceptualized by Pentland & Feldman (2005, p. 795)

Artifacts of the ostensive aspect may exist in diverse forms, such as written procedures, forms, formal rules, signs and so forth. SOPs or written rules can be regarded as indicators or proxies of the ostensive aspect, but altough they might seem similar, they should not be confused with the ostensive aspect itself.

Scholars' opinions on the exact relation between artifacts and organizational routines diverge, but it can be reasonably assumed that the role of artifacts in routines is important but also ambiguous: "[s]ometimes they matter a great deal; at other times, they only minimally encode a routine and do even less to influence its ongoing use" (Parmigiani & Howard-Grenville, 2011,

p. 439). A precondition for the artifact to exert influence is the ongoing performance of the routine. Without it, the artifact would lose its meaning (Feldman & Pentland, 2003).

2.2.5 Rules and Procedures

The purpose of rules and SOPs is to prescribe behavior. However, their potential to do so is limited, since performances always depend on contextual details (Pentland & Feldman, 2005). While a match between a rule or SOP and performance can be regarded as an indicator for the extent of control of behavior, the relationship between rules or SOPs and the ostensive aspect can reveal an alignment of documents and other objects with our understanding of our actions. The more specific written rules are, the less space is left for rule violation through varying interpretations and performances by different actors. Moreover, management wants staff to understand the reasoning behind their formulated rules.

D'Adderio points out that that rules and procedures in the form of material artifacts "can provide ideal loci for observing abstract understandings and otherwise embodied views of routines" (2008, p. 770) as they "become more stable and visible, which in turn allows them to act as reference points against which variations occurring to performances can be more easily detected" (ibid.).

In the view of Weichbrodt and Grote (2010), the likelihood of alignment of rules and routines increases when rule-followers perceive the rules as supporting. "Rules function as organizational control mechanisms through actors' routine in principle" (Weichbrodt, 2013, p. 92), and diverging ostensive understandings drive rule violations. What is more, the likelihood of identifying and correcting inadequate rules increases when rule-supervisors include rule-followers in evaluating rule violations, also leading to higher rule-routine-alignment.

2.3 Routine Dynamics

Based on Feldman and Pentland's framework, the study of routines as source of both stability and change has come to be called routine dynamics: "[it] refers to research that orients to the internal dynamics of routines and takes as a focal the actions of human and nom-human agents and the patterns created through these actions" (Feldman, 2016, p. 4). This perspective has provided a solid basis for research on organizational routines in various contexts. Numerous papers have adopted this basic conceptualization and advanced our understanding by providing further insights, especially through investigating the ostensive and performative aspects.

In a study about trial-and-error learning used to accomplish routines, Rerup and Feldman (2011) distinguish the two aspects to show how organizational routines and organizational schema can be connected through routines and action. In their view, ostensive patterns are "constituted of actions related to accomplishing a specific task […] and operate at the level of routines" (p. 580). Similarly, Salvato & Rerup (2011) maintain that ostensive designates "abstract patterns of narrative description of how to do a task" (p. 5). Both works relate back to Pentland & Feldman's (2005) view of the ostensive aspect as task specific patterns created and recreated through actions.

The performative aspect, on the other hand, consists of specific actions taken by organizational members at specific times to enact a task, which over time create ostensive patterns (Feldman & Pentland, 2003). For Salvato and Rerup (2011), performative correspondingly denotes "patterns of actual performances by specific people, at specific times, and in specific places" (p. 5).

Feldman and Pentland (2008) understand the ostensive aspects as comprising not only the direct content of the work but also the broader set of associations that relate to the work. They furthermore assert it is possible to express the relationship between ostensive and performative by combining structuration and 'actor-network'-style reasoning. Their angle enables us to understand routine stability and change or flexibility not as counterparts but as different outcomes along a continuum, which result from the same dynamics.

Iannacci and Hatzaras (2012) point toward an imbalance in research towards the performative aspect of organizational routines, which they aim to compensate through a focus on the ostensive. For them, the ostensive is "the result of the activation of systems of constitutive rules, i.e. actual routines in critical realist terminology" (p. 1). They argue it would be a mistake to say the ostensive aspects of routines consist "of the understandings […] of the participants" (Pentland & Feldman, 2008, p. 241) since this allegedly conflates ostensive aspects with performative aspects. Instead, they propose to envision them as "dualities that consist of intersubjective facts when viewed from an ontological angle and objective knowledge" (Iannacci & Hatzaras, 2012, p. 20). What is more, they offer a view of the performative as "patterns of interdependent activities instantiating the ostensive aspects of routines, i.e. empirical routines in critical realist terminology" (p. 1).

2.4 Schemata, Action Dispositions, and the Radial Structure of the Ostensive Aspect

A similar point is made by Dionysiou and Tsoukas (2013). They draw attention to complications that arise when explanations that tend to highlight the multiplicity of individual ostensive understandings try to account for the ostensive aspect's structural, collective level characteristics. They illustrate this in two points: first, they ask how routine participants identify the routine through matching patterns of actions when the ostensive aspect is said to be made up of their diverse, individual understandings: "[i]f 'the ostensive aspect of the routine provides a ready-made justification' when routine participants' actions are challenged […], how is it possible for a participant to use his or her ostensive understanding to justify his or her action to another participant who holds a different understanding" (p. 196)? Second, they point at "elements independent of any particular individual" (p. 196) which the ostensive aspect necessarily needs to include in order to attain structural properties. To account for these issues, Dionysiou and Tsoukas draw on the concepts of shared schemata and coherent action dispositions.

Shared schemata refer to the cognitive content of the ostensive aspect. They can be understood as "knowledge structures that organize past and future experiences" (Rerup &

Feldman, 2011, p. 578). They facilitate coordinating joint activities by “supplying participants with compatible interpretations about what is happening and reciprocal expectations for what is likely to happen next or what actions are appropriate” (Dionysiou & Tsoukas, 2013, p. 196).

Throughout ongoing performance, participants furthermore form action dispositions in the ostensive aspect. A mutually shared, coherent set of such dispositions produces tacit knowledge among participants. Individual behaviors reciprocate each other, which helps routines to persist over time (Hodgson, 2008).

Proceeding with Dionysiou and Tsoukas’ approach, we can now consider how the ostensive aspect is capable of generating both stability and variety. Using Feldman and Pentland (2003), they show that the ostensive aspect contains a “core” or “basic pattern” of actions, but that particular routines at the same time are to be understood as “a category with many instances” (Feldman & Pentland, 2003, p. 103).

Dionysiou and Tsoukas then show how the ostensive aspect’s cognitive content can be seen as a "category with many instances" (Feldman & Pentland, 2003, p. 103) with a “radial structure that is constituted by (1) a stable core consisting of strongly shared schemata and (2) a periphery consisting of loosely shared individual schemata, which represent a potential source of internal variation and conflict” (Dionysiou & Tsoukas, 2013, p. 196).

Accordingly, the core of the ostensive aspect establishes mutual behavioral expectations among routine participants which allows to intertwine individual actions into collective action (Joas, 1997; Miller, 1973). It furthermore helps participants identify specific performances as routine instances and, over time, develop action dispositions. What is more, the presence of a rather stable core gives routine participants a reference point to compare their own experiences with and to help guide their further performances either toward consistency or variation. Schemata of participants from different subgroups who form potentially different understandings from their own perception, however, could be included in the periphery of the ostensive.

In summary, shared schemata and mutually coherent action dispositions in the ostensive aspect can explain stability in routines, whilst the ostensive aspect’s radial structure and

individuals' varying performances can account for flexibility in routines (Dionysiou & Tsoukas, 2013).

2.5 The Role of Connections

A comparable perspective stems from Turner and Rindova (2012). Looking into how participants of a routine balance expectations of consistency with the need for flexibility, they found that organizational members produce and maintain two ostensive patterns at the same time; "one of targeted consistency and another of flexibility in internal coordination […] by leveraging artifacts and connections" (p. 24). This idea is taken up by D'Adderio (2014), who proposes that organizational members create and maintain "patterns of targeted alignment and improvement" (p. 1343), which are in favor of alignment and replication respectively of change and innovation.

Connections can be defined as "interactions between people that enable them to transfer information" (Feldman & Rafaeli, 2002, p. 312). Turner and Rindova (2012) observed that organizational members develop social capital through connections, which plays a central role not only for the collective fusing of routines but also for reconstituting and making sense of them. Participants with limited or no connections, by contrast, apparently formed very different ostensive patterns for the routine; and considerably less connections mean an increased tendency to discard organizational artifacts intended to align behaviors as well as inflexible expectations of consistency (Turner & Rindova, 2012).

This perspective is evocative of Dionysiou and Tsoukas in several aspects: connections, for instance, could be seen analogue to shared schemata. While the latter facilitate coordinating joint activities through interpretations about what is going on and through reciprocal expectations about imminent occurrences or appropriate actions, connections allow the fostering of shared understandings of the routine and team identity (Turner & Rindova, 2012). What is more, they imply that "repetitive interactions in the absence of structural ties foster the development of unintended and divergent understandings" (p. 42) for actors outside the organizational boundary. This could be connected to the periphery of the ostensive aspect, as

participants from different subgroups even within the organizational boundaries may develop different understandings of the routine.

2.6 Criticism

Having shed light on the multiplicity of individual understandings and on collective level characteristics of the ostensive aspect, we will now take a look at some critical voices before moving on to finding out how the actual HH routine looks like.

Geiger and Schröder (2014) propose a framework of routines that stresses their organizational, rather than individual, nature. In this view, routines consist of rules, interpretations and actual performances. Geiger and Schröder prefer a rule-based understanding of organizational routines as collective performance patterns, where rules and their situation-specific interpretation form the basis for enactment. They assume that the relation between following rules and breaking them drives routine dynamics. Routines are not ever-changing but built on stable rules, and organizations can respond variably to rule violations, potentially resulting in change in the routine.

In regard to Feldman and Pentland's approach and to the authors who have adopted it, Geiger and Schröder suggest that first, the influence of rules and structure on the performance of routines is underestimated; that second, the influence of individual actors is overstated, and that third, the routine as practice perspective circumvents the distinction between frame-breaking and small, evolutionary changes as well as between single- and double-loop learning.

Answering to Geiger and Schröder's first point of critique does not seem difficult, since it appears to conflict with reality: if the influence of rules and structure on the performance of routines is underestimated, then how can the low compliance with HH be explained? This is not to say their statement may not be true for other routines in different scenarios, but it does not seem to work well for the case at hand.

The other points of Geiger & Schröder's criticism don't seem relevant in the scope of the present thesis, since they focus on limitations in the ability of practice-based studies to address the influence of organizational phenomena on organizational change. When they

state that the influence of individual actors is overstated, then they refer to the potential of single individuals to change the course of a routine in the long run. The thesis at hand does not concentrate on routine and organizational change, but revolves around variation and flexibility within organizational routines.

Further criticism stems from Wright (2016). In his view, recent research has largely neglected to theorize about how routines are constructed and sustained. He offers an alternative framing based on routines as communicatively constituted performatives; or more precisely, as ”citational patterns of embodied conversation and textual dialectics that performatively co-orient toward an object” (p. 148).

Wright arguments that “present understandings of routines as comprising recursively related ostensive and performative aspects […] have produced inadequate descriptions and explanations of routines as practices leading to recent recognition that extant knowledge of how routines are constituted and reconstituted remain underdeveloped” (2016, p. 159). When it comes to the HH routine, however, the argument becomes quite weak: the processes of guiding, accounting, referring, creation, maintenance, and modification as set forth by Feldman and Pentland provide a solid basis for explaining the very phenomena of routine creation and recreation. I will further elaborate on this in the discussion in chapter 6.1. Nevertheless, like with Geiger and Schröder, Wright’s argument might hold true for more complex and less tangible routines, indeed.

In the next step, we will take a closer look at the hand hygiene routine in focus of this paper, and argue how and why this routine is a valid subject for research.

3. On Hand Hygiene

3.1 Hand Hygiene as a Routine

What do we mean when we talk about HH as performed by HCWs? The World Health Organization (WHO) calls it "a general term referring to any action of hand cleansing" (World Health Organization, 2009b, p. 2). Generally, we distinguish between two methods: hand rubbing with an alcohol-based handrub, and hand washing with soap and water. Different situations require different methods. Unless one's hands aren't visibly soiled with bodily fluids, in special cases of exposure to potential spore-forming pathogens, or after using the toilet, (in which case hand washing should be performed), rubbing one's hands with an alcohol-based fluid disinfectant handrub is the preferred and recommended means for routine antisepsis in all other clinical situations. These situations are described in detail in the WHO guidelines (World Health Organization, 2009b, p. 152).

The empirical part of this study focuses on HH as performed through hand-rubbing with an alcohol-based fluid, since this as the preferred method is prevalent in most situations HH is necessary.

HH fulfils the definition of an organizational routine. It has "repetitive, recognizable patterns of interdependent actions, carried out by multiple actors" (Feldman & Pentland, 2003, p. 93) and thus satisfies each part of the definition:

First, repetition. HH is a fundamental task in the everyday work of HCWs and thus is performed on a regular basis. In observational studies, HCWs cleaned their hands on average from 5 to 42 times per shift, with the frequency fluctuating according to the observation method used and the setting (Word Health Organization, 2009). The number of HH opportunities can vary greatly between hospital wards.

Second, recognizable action patterns. There are countless unique performances, since every HCW is doing HH slightly different in the details, but overall, the patterns of action can be identified as belonging to the same routine.

Third, interdependence of actions. HH can only unfold its full potential when all involved actors are actively engaged. The healthiness of patients and of HCWs depends on all HCWs

performing HH as required. The goal is to allow as few opportunities for pathogen transmission as possible. If one HCW who treats a patient performs the routine but the next HCW does not, this would already increase the risk of transmitting germs and would render almost useless the routine performance of the first HCW. The actual number of interactions between HCWs and patients, naturally, is much higher, which underlines once more the importance of HCWs performing HH.

Fourth, multiple actors. As just pointed out before, the effectiveness of HH depends on all involved actors participating in the routine. This applies to HCWs like nurses and doctors as well as to other hospital staff who work in surroundings where patients are to be found. In the HH routine, all actors are human. There are no non-human actors which could take care of their own “hand hygiene”.

Thus, we can conclude the phenomenon at hand qualifies as an organizational routine.

3.2 Hand Hygiene Artifacts

Like all other routines, the HH routine needs to be considered together with its artifacts. In regard to the ostensive aspect, there are various ones:

There are WHO guidelines on HH, and there are national infection hygiene guidelines, e.g. Danish guidelines published by Statens Serum Institut (SSI; Denmark’s central laboratory for healthcare), which are based on the WHO’s recommendations. They include clear instructions for when and how to perform HH (see Fig. 3).

Figure 3: The hand hygiene technique (WHO, 2009b, p. 155)

Furthermore, signs, posters, stickers, and other forms of reminders for performing HH and for the technique were present in different locations at all wards visited for the purposes of the present thesis. Moreover, training is an essential part of the HH as it serves to form and correct actors' ostensive understanding of the routine. A tangible artifact in this is E-learning, which contains clear examples for when and how to perform HH.

Beyond that, the hand rub dispensers could also be regarded as material artifacts. Without these dispensers, the routine could neither be thought of nor performed the same way. Moreover, Pentland & Feldman (2005) assert that e.g. the physical layout of an office could be considered an artifact. The way the hand rub dispensers are placed in a ward has an influence on the convenience of performing the routine and thus can be considered a subtler

artifact as well. The artifacts of the ostensive aspect will be elaborated on in greater detail in the analysis section.

In view of the performative aspect, where artifacts are the indicators of performances, they are not as easily recognized since HH performances leave few observable traces. Unless one had watched a HCW during his or her HH action, one could only find traces of the performance, such as the amount of hand rub solution taken from and thus missing in the dispenser, surveys among staff, or potentially a subsequent change in the number of HAIs. However, these indicators need to be taken with a pinch of salt, since they are indirect and not completely reliable (Pentland & Feldman, 2005). A more reliable way to assess HH performance would be to use UV light boxes, such as are generally used in HH trainings. Using a light-sensitive solution, they expose whether the routine has been performed correctly. However, the routine can be thought of and constituted without these, so they cannot be considered artifacts of it.

Overall, the HH guidelines, stickers and other visual reminders are strong primary indicators of the routine.

4. Methodology

The research method used for this thesis shall be explained below. This includes the type and number of data collected as well as the method of collecting.

4.1 Study Design

The thesis at hand aims at analyzing how HH compliance connects to the dynamic of organizational routines. This required collecting data on potential variations in the way HCWs practice HH.

Previous studies from a process perspective have used, in large part, qualitative data obtained by looking into the “black box”, and mostly through direct observation (Howard-Grenville & Rerup, 2016). Studying the HH routine “in the wild” (Parmigiani & Howard-Grenville, 2011, p.

415) demands a close-in view of actions and interactions (Howard-Grenville & Rerup, 2016). Investigating a phenomenon in real life also means that insights are gained as one goes through the research process. Therefore, this thesis uses an inductive approach, where data, questions, and theory come together iteratively.

Extant process studies on organizational routines have often used an inductive approach as well, but it is difficult to take them as blueprints to observe the HH routine since no two routines are the same. There will always be different actors and forces that come into play and need to be considered.

In the present thesis, as with Pentland and Feldman, "our concern here is thinking about the match between [these] artifact[s] and performance" (2005, p. 806). Feldman points out that there are two things about routines that can be observed: written or otherwise articulated rules and other materialities, and action (2016). Based on my research objective, I thus gathered empirical data through written documents as well as observation of HCWs during HH performances and related actions.

Firstly, routines are examined by looking at artifacts. This was rather uncomplicated due the ease of identifying artifacts and their relative stability (Pentland & Feldman, 2005). In view of the case at hand, the WHO recommendations for the performance of HH for instance have remained virtually unchanged in the past years.

Guidelines on HH contain clear if-then statements as directives for action. Rules and procedures have been used as proxies for routines in past research (Cyert & March, 1963; Becker, 2004; Miner et al., 2008), but they are static and not able to indicate dynamic performances. As pointed out earlier, they are nevertheless very useful in the form of material artifacts "as reference points against which variations occurring to performances can be more easily detected" (D'Adderio, 2008, p. 770). They are essentially the closest thing discernible to the ostensive understandings of routine participants. In addition to the guidelines, I also looked at the instructions that follow from them as present on posters, stickers, notes, and E-learning.

Secondly, action respectively performances are investigated. A focus on actions allows us to move from explaining routines as based on invisible forces to exploring the "specific actions

by specific people at specific times and places that bring the routine to life" (Feldman & Pentland, 2003, p. 94); and HCWs' performance of HH is an easily observed action. Some action, however, may be more subtle and observing it may thus require greater care: as Feldman points out, "action may be recognized in the breaches and in the gaps […] or in the material traces" (Feldman, 2016, p. 9). This means a missed opportunity for HH – i.e. not performing it although required by the guidelines – is observable as well and qualifies as action.

Direct observation is regarded "the gold standard of HH [behavior] measurement" (McAteer et al., 2008, p. 223), but even though there have been various studies examining HCWs' HH compliance, to the best of my knowledge none of them is centered on routine dynamics theory. On my first visit to one of the observation sites, my goal was thus to first take a look at the situation at hand, and to then figure out the best approach to observing the HH routine in action.

When observing HCWs in this study, different kinds of information were turned to as potential candidates for collection in view of HH, such as: whether the HH has been performed or not, the duration of the procedure, the action that was taken before and the one after the HH action, the location of the hand rub dispenser, the type of HCW in action, whether they wore short- or long-sleeved clothes and watches or wristbands, and so forth.

Observing quality and the exact technique used turned out to be very difficult, however, since most HCWs appeared to perform HH on the go. It was impossible to observe their hands throughout the whole procedure without my vision being obstructed. Furthermore, quality assessment would have meant measuring the cleanliness of the HCWs' hands afterwards - something beyond the scope of this thesis. Thus, like most other studies on observational HH measures (Gould et al., 2007; Haas & Larson, 2007; McAteer et al., 2008), this study does not evaluate quality of HH in the sense of cleanliness.

To attain a picture of the routine which is as comprehensive as possible of the routine, the WHO's five moments for HH (see Appendix) were selected as the basis of my observations. More precisely, use is made of a simplified codification of situations which distinguishes between "before clean tasks", "after dirty tasks", and "after glove use" – a distinction derived

from the HH recommendations in the Danish national infection hygiene guidelines (Statens Serum Institut, 2013, p. 15). Clean tasks are those where there is a chance of transmitting potentially harmful microorganisms to patients or their surroundings. Dirty tasks are those where there is a chance of transmitting potentially harmful microorganisms to HCWs' hands, wrists, or arms, to their surroundings, or to equipment. "After glove use" means the immediate moment after a HCW removes his or her gloves.

The choice of this simplified codification had to be made as I could not undergo specific training, unlike other observers who observed the HH routine based on the five moments for HH. Recognizing those moments reliably without training seemed unfeasible. In addition, within the limits of the present thesis it was deemed less important to recognize the specific moments for HH than recognizing whether there was a situation requiring HH at all.

As data, type of HCW, the duration of the procedure and the approximate amount of hand rub were collected. The latter could not be quantified, was felt to provide an indication of quality of performing the routine. Similar considerations hold for the details of HH technique the HCWs were using, which could not be quantified either. Lastly, I took notes on anything that appeared interesting in terms of the HH routine, especially in moments where I detected deviations or differences in the way the HCWs were practicing it.

4.2 Data Collection

There were two different sequences of observations, most of which were planned with the WHO recommendations for direct observation of HH as blueprint (World Health Organization, 2009b, pp. 159-161). Adjustments were made where this study required them – aspects regarding the preparation and validation of observers, for instance, were not relevant in this scope, and thus excluded. In the first sequence, I sought to gather a lot of data by observing many isolated, different HH performances by different actors in different situations. In the second sequence, I would follow single HCWs over a certain period of time to get a better understanding of their performances in the context of longer sequences of actions.

The following steps were carried out:

4.2.1 Understanding the Moments for Hand Hygiene

I acquainted myself with the different situations that require HH performances through WHO material. The greatest insight stemmed from the ”Hand Hygiene Technical Reference Manual”, which did not only depict and explain in detail the five moments for HH, but also in general offered very useful input and tips for HH observers (see World Health Organization, 2009a, pp. 17-25). In addition, taking the E-learning course the HCWs regularly need to run through furthered my understanding. In view of this thesis, a HH opportunity “determines the need to perform the hand hygiene action, whether the reason […] be single or multiple. [It] exists whenever one of the indications for hand hygiene occurs and is observed” (World Health Organization, 2009b, p. 160). I looked at opportunities instead of individuals to get a comprehensive picture of how the routine looks like with many different actors.

It shall be noted I was unable to register hand hygiene opportunities related to patient contacts that occurred behind closed curtains, owing to ethical reasons. Nevertheless, it seemed reasonable to infer that an opportunity was taking place.

4.2.2 Creating the Observation Forms

For the first sequence of observations, I constructed an observation form that was inspired by the WHO tool (see Appendix), and which would record information on the kind of HH situation as described above, i.e. “before clean task”, “after dirty task”, or “after glove use”. It furthermore logged the type of HCW, the perceived amount of hand rub used, the approximate duration of the performance, as well as contingent notes for each situation (see Appendix).

4.2.3 Determining the Scope of an Observation Period

Location

Firstly, Rigshospitalet in Copenhagen was contacted. However, I was informed that unless there was a specific reason for doing my research at this hospital, they would be too busy to be able to cooperate. Thus, I conducted the observations at Nordsjaellands Hospital in Hillerød

and at Gentofte Hospital in Hellerup. Interestingly, these two hospitals differed in several ways: at Gentofte Hospital, for instance, there were no hand rub dispensers in most of the hallways, but only in the rooms. Moreover, Nordsjaellands Hospital has been employing a HH improvement program for the past three years. The program includes 20 HH observations per month in each ward, and which led to the hospital winning an award for reducing HAI rates this year (Hand Hygiene Excellence Award, 2017). Gentofte Hospital is measuring HH compliance through observations as well, but the wards can choose to do as many or few observations as they want. Thus, it could be expected to spot not only differences between single HCWs' HH practices, but also between the more general HH practices at both hospitals.

With permission of, and in agreement with the clinics' leads for infection prevention, I decided to visit some wards that would offer many HH opportunities to observe, i.e. where I could walk and observe how HCWs were handling equipment, dealing with patients, or were involved in other HH-related situations. Prior to the observations, permission was moreover secured from the head nurses of the respective wards.

I conducted the first sequence of observations in the cardiologic and endocrinological ward at Nordsjaellands Hospital and the second sequence at the orthopedic ward and the infection disease ward at Gentofte Hospital. In the first sequence, I walked along and stood at all possible parts of the ward to capture a picture of many different people working in many different situations. In the second sequence, I followed a few singular HCWs over a period of time to get a better understanding of HH performances in a bigger context of actions as something that is repeated over and over again in different situations. I chose Gentofte Hospital for most of the second sequence, since the lack of hand rub dispensers in many of its hallways would have made it more difficult to observe many singular HH opportunities in isolation in the first sequence. Hence, it made more sense to follow single HCWs with their agreement, as this would cause no or less irritation when following them e.g. into patients' rooms to observe their actions.

Time

In the first sequence, I conducted one session of 90 and another one of 70 minutes. In the second sequence, I first conducted two short sessions of 10-15 minutes to pilot this method of observation, and four longer ones of 20, 40, 45, and 60 minutes. I found these time-periods sufficient to observe different kinds of HCWs performing different actions in different situations. Although using random observational time-periods for HH data collection has been criticized since under such circumstances no well-validated method is available (Gould et al., 2007), this carried no weight for this study since my goal has not been to accurately measure compliance but to detect variations and flexibility in performances - a purpose which random time-periods served well. Moreover, I chose to conduct the observations on four different days between 10 am and 2 pm. I intended to look into the HH practices during "normal" work circumstances; and HCW work activity during these hours tends to be rather average.

Type of HCWs

I observed all kinds of HCWs usually present in hospital wards: nurses, doctors, and other types of healthcare workers, which could be laboratory technicians, therapists, radiologists, and others. During the first sequence of observations, I chose at random which HCW I observed in each situation. The WHO recommends this to minimize selection bias, i.e. to prevent primarily observing those HCWs with extreme behavior (World Health Organization, 2009b). Identifying the respective kind of HCW at hand was easy thanks to ID badges in different colors for different types of HCW.

In the second set of observations, I chose to primarily follow nurses, since following doctors as the only other big group of HCWs would have meant far less observable HH opportunities per session due to the nature of their work.

4.3 Additional Information

During all observation sessions, I did not only fill out the observation forms but also took handwritten notes of all sorts. My main goal in this was to get as much insight as possible

whenever deviations between HH recommendations and performances occurred or when I noticed differences between the ways different HCWs performed the routine.

The data was collected anonymously and in hand writing. Furthermore, I carried WHO material with me, depicting the five moments for HH as well as the correct HH technique, so I could always compare the artifacts with the performances. I did not consider the ways HCWs were talking about the routine to avoid misunderstandings.

Unfortunately, I could not investigate how the HCWs were talking about the routine, owing to my limited understanding of the spoken Danish language.

Moreover, I was given a typical set of HCW clothes to wear. This not only prevented me from carrying bacteria through my personal clothes into the wards but also from causing irritation among both HCWs and patients during the observations. The latter point leads us to the final methodological consideration: the potential biases involved that need to be accounted for.

4.4 Accounting for Biases

Gathering data by participating in the HCWs' natural work setting meant I would be part of the context being observed, so I would both be modifying this context as well as be influenced by it (Schwartz & Schwartz, 1955). There are several biases to consider in view of this:

First, the observation bias, or the potential influence the observer may have on the behavior of HCWs, since participant observation implies that they are aware of being observed. This bias is rooted in the social desirability bias, which "reflects the tendency on behalf of the subjects to deny socially undesirable traits and to claim socially desirable ones" (Nederhof, 1985, p. 264). In our case, this means it reflects the HCWs' tendency to act in a way that places them in favorable light. The presence of me as observer thus could induce "better than usual hand hygiene behavior" (World Health Organization, 2009b, p. 163). While the observed HCWs were aware of my presence, I sought to minimize this bias by not informing them which specific part of their daily work I was interested in. However, I cannot exclude the possibility of the wards' head nurses (who were aware of my focus on HH) telling the local HCWs about my intentions.

Second, the observer bias, or “the impact of the observer’s interpretation of the definitions and the actual situation on the reliability of the data” (World Health Organization, 2009a, p. 17). Like every other observer, I systematically would interpret the observation method and definitions for HH opportunities and actions in my own way (World Health Organization, 2009b), which produces different results than other observers would get. As described earlier, I attempted to minimize the influence of this by acquainting myself with the HH situations and technique as well as possible.

Third, he selection bias, or observers’ tendency to “systematically select certain times, care situations, healthcare sectors, HCWs or opportunities for their observation” (World Health Organization, 2009b, p. 163). This means my results might not reflect the overall HH behavior; plus, I might run the risk of primarily observing those HCWs with extreme behavior. Likewise mentioned above, I chose the observed HCWs at random to counter this bias.

Last, I could still fall victim to the “fundamental attribution error” - the tendency to ignore situational factors when evaluating people. Even when aware of the possible biases and other influential contextual factors, I might “underestimate the impact of [such] situational factors and […] overestimate the role of dispositional factors in controlling behavior" (Ross, 1977, p. 183).

Having accounted for the applied methodology and having pointed out the factors that might influence the results, I will describe my findings and conduct an empirical analysis as well as discuss their implications in the next step.

5. Analysis

In this section, I will account for the results from the gathered data. I will first analyze the artifacts before moving on to describe the results from observing the HH performances. Afterwards, I will discuss the implications of the findings in connection to routines theory as well as limitations.

5.1 Artifacts

Now, a descriptive analysis of the artifacts and of the observed performances will be conducted to show whether there are differences in the way HCWs practice HH.

Starting with the artifacts, the guidelines will be focused that form the physical artifacts on the one hand, and the physical artifacts HCWs are most commonly in contact with on the other hand. For the different types of artifacts, it will particularly be considered how the moments and the technique for HH (time and amount are part of this) are described and depicted. In addition, information regarding gloves, clothing, and jewelry will be looked at.

5.1.1 Guidelines

The main documents analyzed were the WHO guidelines on HH in healthcare (World Health Organization, 2009b) and the SSI national guidelines on hand hygiene (Statens Serum Institut, 2013), which contain extensive information about HH. In the wards analyzed, these guidelines were not visibly present since HCWs are supposed to know them. However, they can access the SSI guidelines on the SSI website and the hospital intranets.

The WHO and SSI guidelines describe the indications for HH in similar detail (see Appendix). The WHO however has broken them down to a tangible “five moments for hand hygiene”: before patient contact, before clean/aseptic procedures, after body fluid exposure risk, after patient contact, and after contact with a patient’s surroundings (see Fig. 4).

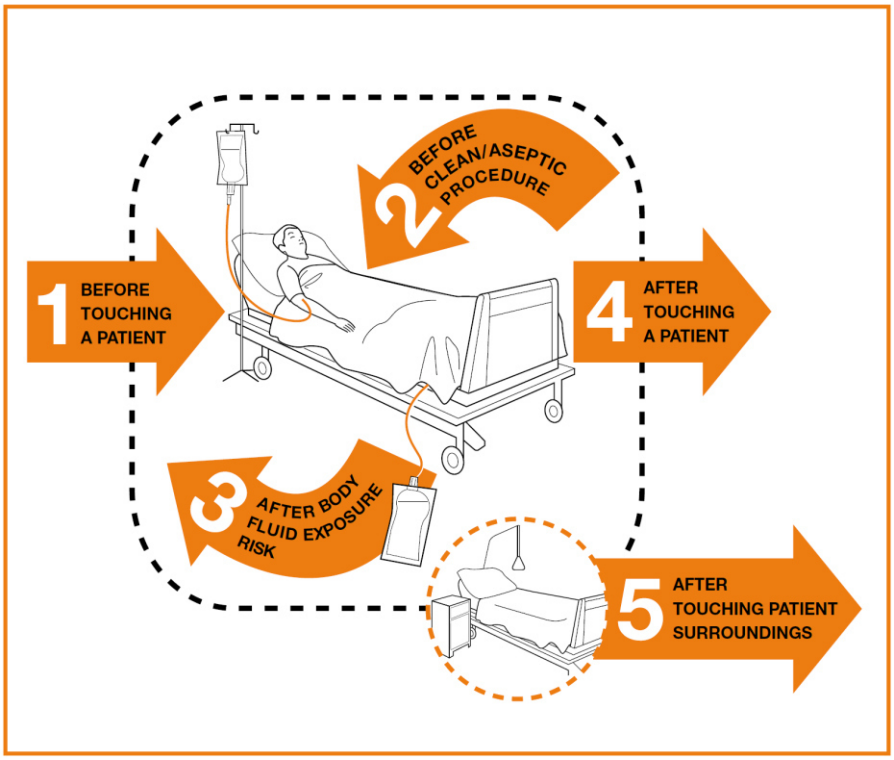

Figure 4: The five moments for hand hygiene (WHO, 2009b, p. 123)

The SSI, on the other hand, differentiates three overall situations: “before clean tasks”, “after dirty tasks”, and “after glove use”. Unlike the five moments in the WHO document, these moments are not depicted in the SSI guidelines, but they link to a training website where they are visualized. The same applies to the HH technique. It is illustrated in the WHO text (see Fig. 3), but not in the SSI guidelines.

Moreover, both guidelines recommend using enough hand rub to keep your hands humid when rubbing for 30 seconds, which corresponds to approximately 3 ml of alcohol-based solution, but there is no exactly prescribed amount.

Lastly, the WHO document recommends to strongly discourage the wearing of rings and artificial fingernails during healthcare. This is taken on in the SSI guidelines, but they moreover also forbid wearing watches, which the WHO guidelines only mention regarding surgical hand preparation. Similarly, the SSI document explicitly recommends HCWs to wear short-sleeved uniforms, which the WHO text only mentions refer to briefly in the lowercase subtitles of some illustrations.

While these guidelines might not be very present in the everyday work of HCWs, they have a big influence on the HH routine since they form the basis for the physical artifacts that I will look at next.

5.1.2 Visual Reminders

There are different kinds of material created by SSI and Region Hovedstaden which the hospitals use. There were signs, posters, and stickers, as depicted in below example of a sink with the typical hand rub and hand wash station (Fig. 5).

Figure 5: Typical hand wash and disinfection station at Gentofte Hospital

There were stickers with information on the correct performance of HH (Fig. 6) and with depictions of the technique (Fig. 7), for instance. The latter is an example of material that the Danish capital region has developed itself, and it contains different steps than the ones in the WHO depiction (Fig. 3). The overall sequence is similar, but the Danish one does not include steps 3 and 7 from the WHO document, and the WHO depiction does not include the step of rubbing wrists, but the Danish one does.

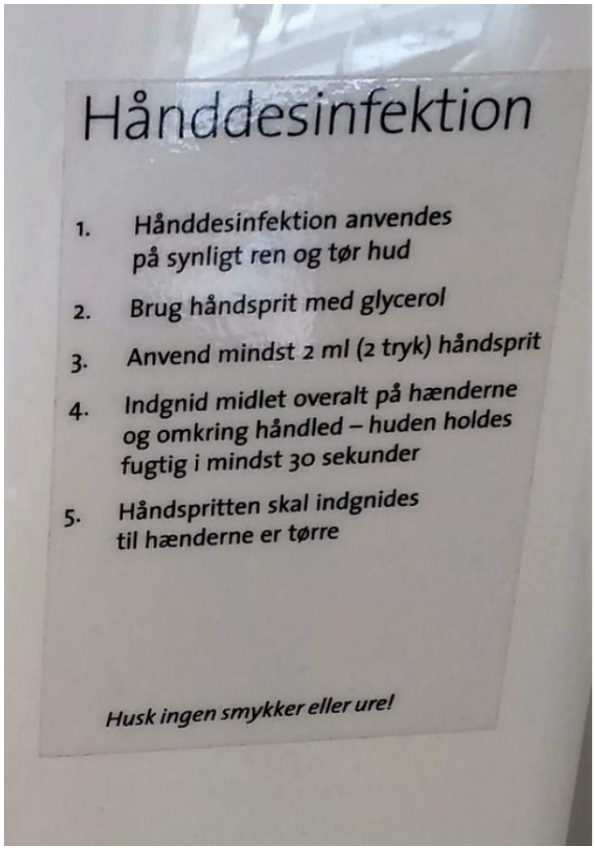

Figure 6: Sticker with information on the correct HH performance

Figure 7: Poster depicting the HH technique

Moreover, there were general reminders for HH (Fig. 8), some of which were rather improvised (Fig. 9). Such reminders could not only be found at various locations in the wards but also at strategic points in hallways, the canteen, entrances, and transition zones between different areas (Fig. 10).

Figure 8: Sticker on the wall: "Clean?"

Figure 9: Improvisational reminder on a rubbish bin at Nordsjaellands Hospital: "Smile! This infects"

Figure 10: Reminder on door buzzer (symbolic picture from presentation by Region Hovedstaden)

5.1.3 E-learning

Training is an essential part of routinizing correct HH behavior. E-learning is only a part of the whole process; but as opposed to HCWs' education, presentations and speeches by hygiene nurses, or informal conversations, it is material that I could look at without risking

misunderstandings. Danish HCWs have to do the E-learning course upon starting to work at a hospital and every second year thereafter. The course conveyed extensive information about all important aspects of HH: the situations, the technique, but also correct clothing, rules regarding jewelry, fingernails, and so forth. A big emphasis was put on training the HH moments as they made up a big part of the E-learning (Fig. 11).

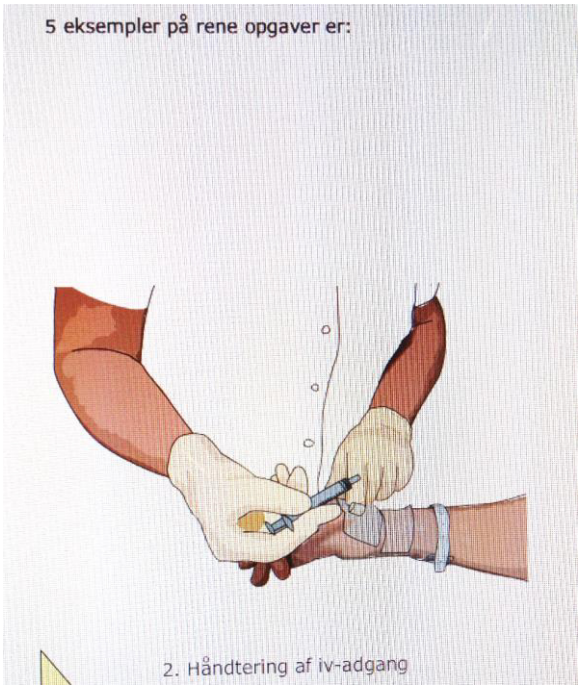

Figure 11: Depiction of a ''clean task'' in the E-learning

5.1.4 Placement of Dispensers

As mentioned earlier, the two hospitals differed in the location of the hand rub dispensers. While at both hospitals' wards such dispensers were placed inside most rooms, they were only allowed in one of the few modern ward hallways at Gentofte Hospital (Fig. 13). In most other wards, they were placed exclusively inside the rooms (Fig. 12). This was due to fire hazard concerns by the fire department. At Nordsjaellands Hospital, which is a more modern building with a different fire protection system, dispensers were present in all hallways.

Figure 12: Hallway without hand rub dispensers

Figure 13: Hallway with hand rub dispensers

Since the bulk of dispensers at Gentofte Hospital were placed inside rooms, they were mostly part of hand hygiene stations which would also include a sink and hand wash dispenser. Hand rub dispensers placed above a sink appeared to be slightly less convenient to use because the sink and the placement in a room confined the space around the dispenser. This meant unlike

with the singular dispensers in hallways (Fig. 13), one could not merely walk past the dispenser, push the lever whilst still in motion and go to one's next destination whilst disinfecting one's hands, but one needed to stand close to the sink to operate it. This means the usual HH action would usually take slightly longer at the HH stations at Gentofte Hospital compared to Nordsjaellands Hospital, due to the lack of singular hand rub dispensers in most hallways. There always was a hand rub dispenser present in the rooms where HH opportunities arose at Gentofte Hospital.

The reason for the prohibition of hand rub dispensers at Gentofte Hospital was the purported risk of fire hazard as estimated by the manager of the fire department. However, although alcohol-based hand rubs are flammable, the risk of fires associated with such products is very low. A study conducted in German hospitals about fire incidents related to alcohol-based hand rub dispensers showed an annual incidence per hospital of only 0.0000475 % (Kramer & Kampf, 2007), and a similar study from the USA found no such incidents (Boyce & Pearson, 2003). The nurses at Gentofte Hospital appeared to regard the risk of fire hazard similarly low, since they put up some dispensers in the hallways despite the prohibition (see Fig. 14).

Figure 14: Temporary hand rub dispenser at Gentofte Hospital

In the next step, I will describe the results from my observations.

5.2 Observations

5.2.1 Results from the Observation Forms

In the first sequence of observations, I observed 50 HH opportunities and 47 in the second sequence. A quantitative analysis of the data does not make sense because the amount of observations is too low to provide for statistical significance (McAteer et al., 2008), because I did not receive professional observation training, and because there were no other observers, in which case inter-observer-reliability could have been measured. Nevertheless, the observations sufficiently satisfied my goal to detect differences in the way specific HCWs perform HH in a specific location at a specific time.

NO.	HH SITUATION	PROFESSIONAL CATEGORY	HR AMOUNT	HH DURATION	NOTES
1	D	D	-	O	
2	D	D	-	-	
3	D	D	+	O	
4	C	N	O	O	
5	C	N	?	-	
6	D	D	+	O	Appears to have remembered to do HH upon seeing dispenser
7	C	N	X	X	
8	G	N	X	X	
9	D	N	X	X	
10	D	Hc	+	+	
11	D	N	X	X	
12	D	N	O	-	
13	D	D	X	X	
14	D	D	O	+	
15	C	D	X	X	
16	D	D	X	X	
17	C	N	O	-	
18	D	N	X	X	Nurse touches medical equipment after patient contact (no HH action)
19	G	D	X	X	
20	D	Hc	O	O	
21	G	D	O	O	
22	D	D	O	-	

Figure 15: Results from an observation session in the first sequence (see Appendix for all and list of abbreviations)

NO.	ACTION(S) BEFORE/AFTER HH OPPORTUNITY	HR AMOUNT	HH DURATION	NOTES
1	Works at computer Patient contact	O	-	Emergency situation: patient in the hallway on the verge of fainting – nurse went to support him
2	Patient contact	O	O	
3	Removes old infusion	O	+	
4	Prepares new infusion Patient contact	O	-	Contact with patient's surroundings during HH performance – hands not properly disinfected
5	Works at computer	X	X	
6	Prepares bed for new patient	+	O	
7	Prepares glass of water in kitchen for patient Puts it into patient's room	X	X	
8	Puts gloves on Disinfects walking frame Removes gloves	X	X	
9	Puts gloves on Removes old infusion Gloves off Takes label off used infusion container	O	O	Keeps infusion bag label stuck to tip of index finger during disinfection – tip not properly disinfected
10	Puts label away	+	+	Potentially noticed not having performed HH properly before
11	Attaches new infusion to patient Removes old infusion container	+	+	
12	Prepares medication Puts gloves on Prepares injection Patient contact Gloves off	X	X	
13	Walking frame contact	X	X	
14	Patient surroundings contact	+	O	
15	Gets injection tip Puts gloves on	X	X	

Figure 16: Results from an observation session in the second sequence (see Appendix for all)

In the first sequence, I recorded 14 opportunities before a "clean task", 33 after a "dirty task", and 3 after glove use. "After glove use" aside, for which I recorded 12 opportunities, this distinction was not possible in the second sequence, as for most patient-related contacts,

“after dirty task” opportunities were “before clean task” moments at the same time. The number of opportunities related to glove use was considerably higher here, since following HCWs into rooms frequently meant observation of tasks that meant contact with bodily fluids, for which glove use was required.

Concerning HCW types in action during the first observation sequence, it was a doctor in 26 cases, a nurse in 19 cases, a different type of HCW in 4 cases, and one that could not be identified since he was not visibly wearing an ID card. In the second sequence, I exclusively followed nurses for observations, with one sole exception in which I followed a doctor.

Out of the observed opportunities, I counted 17 misses in the first sequence and 13 in the second one, six of which were linked to HH action after glove removal. On these occasions, no HH was performed whatsoever. It is however possible that on some occasions, a HH action was performed prior to a “clean task” before I started the observation. Moreover, these numbers do not mean the 33 respective 34 observed performances were conducted the correct way.

To begin with, the HCWs seemed to apply different techniques. Although I could usually not follow the whole procedure with my eyes, the majority appeared to more or less stick to the steps proposed by the WHO and the Danish regional guidelines: they largely started by rubbing their palms, then the back of their hands, then they interlaced their fingers, and so forth - but this was not always the case. Sometimes, they used a different sequence of steps, and they moreover appeared to often leave out some of the steps proposed by WHO or the Danish capital region. What is more, even when they followed all steps, the action did not appear very thorough in many cases.

In large part, shortcomings in the HH technique can be attributed to the inappropriate duration of performances. One cannot go through all steps thoroughly when carrying out HH for mere few seconds. In HH duration, great disparity was observed. The WHO states the HH procedure should take around 20-30 seconds (World Health Organization, 2009b), but only on 13 occasions (19 % of observed occasions) did the observed performance take 20 seconds or longer. On half of the other occasions, the duration was 10-20 seconds, and it was less than 10 seconds on the other half.

The results are slightly better in view of the amount of hand rub consumed per performance. In 41 cases (61 %), the HCWs used the regular amount of hand rub that is dispensed with a one-time push of the dispenser lever, which would be enough to keep the hands humid when performing HH for 30 seconds. In 20 cases (30 %) they used more, e.g. by pressing the lever twice. Only in 5 cases (7 %) did they consume an amount that seemed considerably too little for a performance of 30 seconds. On two occasions during the first sequence, I could not establish the amount consumed.

Furthermore, there is further information that was not captured in the observation forms, such as sex - overall, an estimated 90 % of the observed HCWs were female. Interestingly, not a single HCW observed was wearing watches, jewelry, artificial finger nails, or long-sleeved clothes, which conformed to the recommendations of both WHO and SSI.

5.2.2 Differences in the Details

Concerning the performances, I moreover observed plenty of differences in the details. There were different kinds of rule violations. In one case, a nurse took a phone call during a situation with patient contact without performing HH after or before taking the phone. Unless she disinfected the phone subsequently, she would need to disinfect her hands every time after using her phone after this situation, which is rather unlikely. In another instance, a nurse removed a label from a used patient infusion bag and kept it stuck to the tip of her index finger during the HH procedure; thus, the finger was not properly disinfected. Only upon putting the label away shortly afterwards did she do the HH procedure again.

There were further instances where HCWs seemed to remember to perform HH a few moments after it should have been done – for instance, when one nurse was about to enter a room with medical equipment, she opened the door, stopped, turned to the dispenser next to the entrance, disinfected her hands, and only then entered. It is possible that HCWs' delayed or remembered performances were due to the observation bias, but it may also represent typical incidences that show how correct HH behavior is not routinized by every HCW. Other rule violations included for instance HH misses after glove removal, or a nurse touching the bedsheets of a patient during the HH procedure.

To sum up, even when HCWs ostensibly complied with HH regulations, they often failed to do so in the details.

6. Discussion

Having detected variance in HH performances, I will discuss the implications of the findings in the subsequent section. I will argue for why variation in the way HCWs practice HH occurs through analyzing the observations results in relation to the artifacts in view of routine dynamics and related research discussed in the theory section.

6.1 The Routine Dualism in Hand Hygiene

First, let's take a look at how HCWs used the ostensive aspect of the HH routine in relation to their performances.

6.1.1 Guiding

In general, the ostensive aspect can function as a behavioral template or a normative goal. However, it is only a script that cannot lay out the performance in fine points. The same is true for the HH routine. HCWs can use the descriptions and depictions of the routine for checking up on themselves during routine performance. Nevertheless, although the artifacts provide quite unambiguous information about when and how to perform HH, it is the HCWs who ultimately carry out the action in their individual ways: in below figure, a routine participant would use the ostensive aspect to consider whether action *a* or *b* would align with the rules (see Fig. 17).

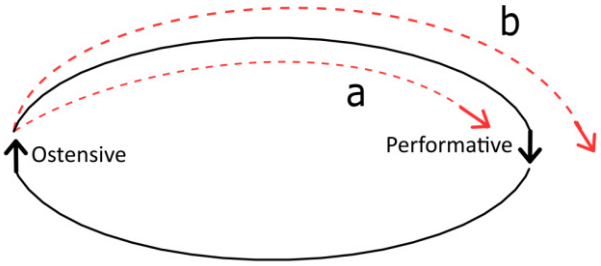

Figure 17: The ostensive aspect guides HH performances

As could be seen during the observations, HH performances varied in several aspects, which often meant deviation from HH rules. It is thus plausible that flawed performances were due to HCWs' ostensive understandings of the routine that diverge with the guidelines.

6.1.2 Accounting

Vice versa, HCWs can use the ostensive aspect to account for HH actions already taken. This applies not only to accounting for their own HH performances but also to checking up on others: If *a* represents the correct procedure, they can inquire why a colleague has chosen to perform the routine way *b* instead, indicating a violation of the written rules (see Fig. 18).

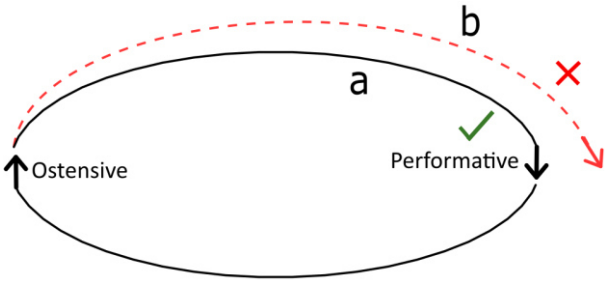

Figure 18: The ostensive aspect can be used to challenge variance in HH actions

The variance could be due to the actor having a different ostensive understanding of HH the routine than the one demanding for an accounting. The understanding that is closer to the artefactual representations respectively rules of the routine would then possess greater legitimacy than the other. HCWs carry a great deal of responsibility for the wellbeing of their patients, thus they need a legitimate basis for every step they take.

Nevertheless, in none of the cases where HH action was missing or done incorrectly did I observe the HCWs speaking up to a fellow HCW about their rule breach. Partially, this can be attributed to the fact that HCWs mostly appeared to perform HH on the go, that means after leaving or before entering a room. On most occasions, they were not accompanied by someone who could have potentially spoken up upon noticing a HH rule violation. However, one of the leads for infection control mentioned too, that sometimes, HCWs inform her about other HCWs' incorrect HH behavior instead of addressing them themselves personally.

Therefore, while HCWs could use their ostensive understandings of the HH routine in theory to question others' actions, they don't appear to be ready to do so. Yet, this implication is not particularly strong owing to the number of situations in which HCWs were present during others' rule violations and could have spoken up during my observations was very small.

6.1.3 Referring

Hospitals are intricate organizations with a wide array of intertwined activities. Every single employee is like a cog wheel in a big clockwork, which means it can be difficult to see how one's actions connect to the greater context. Training and artifacts help the HH routine assume shape in HCWs' understandings – a shape with its specific purpose and place in the organization (see Fig. 19). When HCWs draw on detected similarities in a set of HH performances, they create the routine. It is through their ostensive perceptions that they make sense of how their HH actions help to keep pathogens away from patients and thereby contribute to the overarching purpose of the hospital.

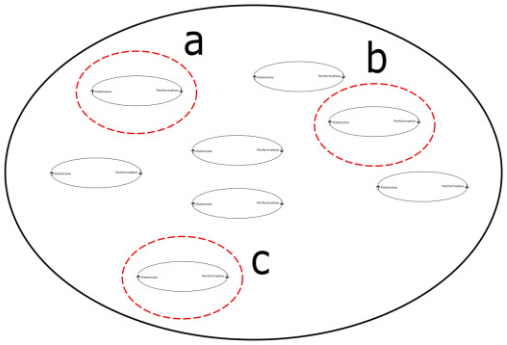

Figure 19: In a sea of healthcare activities, the ostensive aspect helps HCWs make sense of single HH routine performances like a, b, and c

Next, I will look at how HCWs' HH performances affect their ostensive understandings and how this in turn influences subsequent performances.

6.1.4 Creation

The HH routine needs to be performed over and over again to coin the actual routine (see Fig. 20).

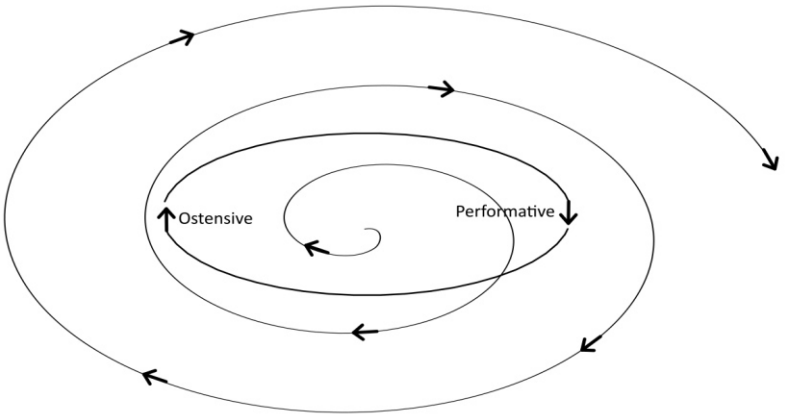

Figure 20: The HH routine is created through ongoing performances

This connects, for example, to instances in which I observed HCWs stopping in their way or going back some footsteps in order to use a hand rub dispenser, from which can be inferred they had not consciously thought about performing the routine a few moments earlier. HH artifacts – as has been described earlier - and trainings represent a starting point for routine creation, but since forming the habit for this routine - according to one of the clinical leads for infection control - takes approximately two years, HCWs need to look at these artifacts time and time again after their performances so as to check up on the congruence of those with the rules. If they don't do this, they could be prone to form ostensive understandings that vary considerably from the HH recommendations; and as a consequence, flawed HH performances follow.

6.1.5 Maintenance

If the HH routine is not performed over a longer time, the capability for doing so disappears. Furthermore, the guidelines, posters, and stickers that hold the ostensive definition will sooner or later lose their meaning. Here, a lack of action would not allude to missed HH opportunities, but to a situation in which the whole routine would gradually fade away. However, the artifacts and observations show that the routine in fact is very much alive. HH performances are carried out repeatedly by all HCWs. The HH routine is formed even when compliance rates or HH actions are deficient. Unlike flawed HH performances, a disappearance of the HH routine as depicted in Fig. 21 appears highly unlikely, given that there were no indications for a break in the loop.

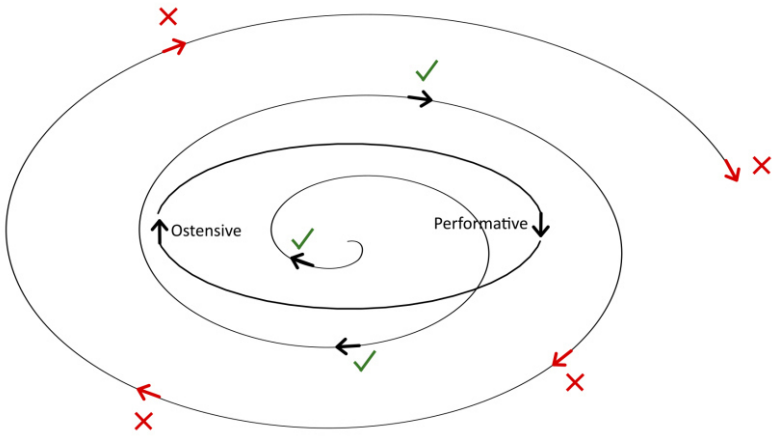

Figure 21: No evidence was found for a potential discontinuation of the HH routine

Instead, I noticed an overall considerably strong connection between the artifacts and HH performances. There were misses and differences in performances, indeed, but these were far away from bringing the routine to a stop. Instead, they were simply diverging actions that stood out when compared to the reference points that are the material artifacts (D'Adderio, 2008). Generally, HCWs continuously performed HH and thereby seemed to maintain the ostensive aspect as well as preserve and advance their capabilities required for this routine performance.

6.1.6 Modification

Clearly, HCWs at times deviated from the HH rules. If they did so deliberately is however highly questionable. I would argue that the bigger part of them believe in the effectivity of HH, since this not only is what they are taught in their education but also is emphasized strongly in internal communication at both hospitals, which means a great deal of awareness. They therefore likely take the artifacts' core message very serious: that their HH actions are paramount for prevention of HAIs. It is reasonable to assume however that despite, or maybe precisely because of the strong core message, the detailed aspects take up a minor role in HCWs' perception.

HCWs likely believe in HH rules and take recommendations serious and therefore match their ostensive understandings closely to them. Deviating from their understandings could thus be interpreted as a rule breach, which would thwart their efforts to keep harmful microorganisms away from patients. In consequence, it would not make sense for them to diverge from their ostensive understandings on purpose. Hence, it is safe to say there was no evidence of deliberate routine modification.

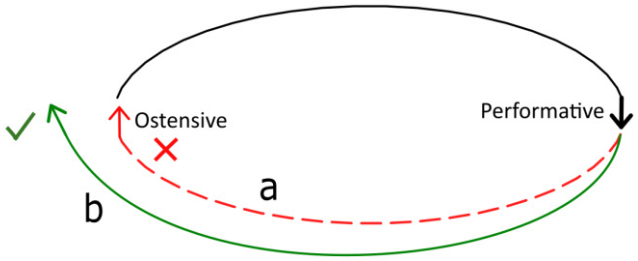

Figure 22: Highly unlikely: HCWs deviating from the ostensive aspect on purpose

6.1.7 Sub-Conclusion

On the way from the ostensive to the performative aspect, the HH artifacts represent a strong basis for HCWs' ostensive understandings, and thus, performances. They theoretically could help people account for their own and others' actions retrospectively, but this did not occur in the few cases where applicable. Moreover, HCWs draw on their ostensive understandings to recognize the importance of every single HH action to reduce HAIs.

On the way from the performative to the ostensive aspect, HH actions influence HCWs' understandings as well as subsequent actions: ongoing HH performance ultimately creates the HH routine, but for a routine that aligns with the rules, an ostensive understanding has to be in place that does the same. Flawed ostensive understandings likely have led to some of the faulty HH actions observed. Last, but not least, I could not find evidence of purposeful routine modification. Diverging HH performances do not seem to happen because HCWs want them to happen, but because their ostensive understandings of the HH routine are differing.

6.2 Different Connections – Different Understandings?

Next, I will examine the role of connections, which in past studies "enabled the development of common understandings and agreements about [the routine's] performance in practice" (Turner & Rindova, 2012, p. 35). As put forth in the theory section, organizational members develop shared and mutual understandings of the performative aspect through connections, whereas participants with limited or no connections – such as staff from different subgroups - appear to develop limited and divergent understandings because they rely on minimal cues.

In the case at hand, nurses and doctors made up the bulk of the observed actors. According to theory, they as routine participants with different roles might develop divergent understandings. Studies have shown that doctors are proven to have the highest level of non-compliance among HCWs (Hugonett et al., 2002), that only one-third of doctors believed that HH before patient contact was necessary (Sharir et al., 2001), or that approximately half of the doctors assumed HH was necessary after patient contact (Davies et al., 2000). From this could be inferred that their understandings of the HH moments is weaker than others'. This, in turn, could be attributed to limited and divergent connections, which would mean an increased tendency to discard organizational artifacts meant to align behaviors (Turner & Rindova, 2012).

When it comes to executed HH actions, however, the observations did not produce evidence of a clear difference between the ways the two main groups of HCWs performed HH. In regard to technique, duration, and so forth, it was rather differences between individual HCWs of all

types that could be observed differing in the details of their performances. Applying Turner and Rindova (2012), it could have been expected that doctors not only show increased variance in their understandings of the HH moments as compared to nurses, but also in their understandings of the mentioned aspects. It thus seems that variance in HH performances of different HCW groups cannot be explained properly through Turner and Rindova's notion of connections.

The only other explanation for the lack of observed differences in the different HCW groups' technique and so forth would be that the main unit was not large enough to provide a reliable picture. It thus may be that if one were to conduct a study like the one at hand, but with a main unit of observations large enough to be representative and statistically significant, and using professionally trained observers of HH performances, one might find differences in the HH performances of different HCW groups.

6.3 From Core to Periphery

Next to correct HH performances, the observations have shown there were also HH misses as well as flawed HH performances differing in duration, technique, and so forth. This brings up the question of how these misses and variations come into being as well as whether they can be corrected, and if so, how.

Although one cannot observe the ostensive aspect, it can be inferred from the deviations in HH performances that there is deviation between the ostensive aspects and the material artifacts, since the relationship between rules or SOPs and ostensive can reveal the alignment of documents and other objects with HCWs' understanding of their actions (Pentland & Feldman, 2005). The alignment increases when rule-followers perceive the rules as supporting (Weichbrodt & Grote, 2010). This once more indicates there is no conscious mismatch between HCWs' ostensive understandings and HH rules.

As pointed out earlier, some aspects - like the importance of performing HH for 30 seconds, or the fact that glove use is *not* a substitute for HH - take a minor position in HCWs' perception of the HH routine, whereas the overall purpose of HH is at the center of their understanding.

Awareness of the situations for HH is in a position in between. This supports Dionysiou and Tsoukas' notion that people have a stable, consistent core in the ostensive, and a periphery of loosely shared schemata as source of internal variation and conflict (2013).

Some relatively detailed aspects of HH such as the guidelines' instructions not to wear watches, bracelets, artificial finger nails, or long sleeves, were followed strictly, even though they were not present in the material artifacts found in the wards. This could partially be attributed to the different nature of these aspects. HCWs only need to consider these once at the beginning of their shift, instead of having to think about them during every HH action. Nevertheless, they appear to have commonly internalized this information, which places it at the core of their ostensive understandings. Moreover, I could observe that many HCWs performed HH in situations which did clearly not require HH action. This suggests they have internalized the overall importance of HH in their shared understandings.

Then again, performing HH when not necessary at the same time implies that the understandings of the moments for HH are necessarily outside the core. Still, the majority of HCWs performed HH in the right moments, which shows the ostensive understanding of those to a certain extent aligns with the artifacts and is shared by various people - and thus is neither in the ostensive core nor the periphery.

The large amount of variance found in HH duration, HH technique, and HH action after glove use, lastly, suggests these aspects are located in the periphery of HCWs' ostensive understandings. This pertains to the better part of HCWs, because there is rather little shared common understanding of these aspects - rule violations as observed are driven by diverging routines in principle (Weichbrodt, 2013). Reasons for this divergence could be a weak emphasis on aforementioned aspects during HCWs' education or trainings on the one hand, or in HH artifacts provided the hospitals on the other. Drawing once more on the example of HH duration, it is however noteworthy that many artifacts in the wards indeed did contain information about the timing (see Fig. 23 and 24).

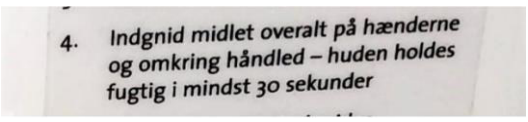

Figure 23: "[...] Keep the hands humid for at least 30 seconds"

Figure 24: ''30 seconds''

This begs the question how the influence of artifacts and training on ostensive understandings of routine participants is constituted in different kinds settings. This could represent an interesting question for future research to answer.

6.3.1 Sub-Conclusion

While exclusively representative for the HCWs observed in this study, it can be safe to say the clear majority of them are aware of the HH routine and believe in its effect as well as in the necessity of removing their jewelry and so forth. Moreover, it is reasonable to assume they are somewhat well-established in HCWs' ostensive understandings, for most HH opportunities were perceived and realized through HH action. Lastly, there is significant variance in HCWs' ostensive comprehension of the technique, duration and glove use. In short: overall awareness of the routine is great; but in spite of a strong shared core understanding of, several detailed aspects take up a minor role in HCWs' perception.

6.4 Addressing Quantity and Quality

Now that we know some aspects of the HH routine are commonly shared and located at the very core of HCWs' ostensive understandings, whilst others are in the periphery and subject

to great variance, I will discuss how the ostensive understandings and thus performances of HCWs could be further aligned with the artifacts.

While it is reasonably easy for HCWs remind themselves to carry out HH in most opportunities, it may also be somewhat easy to become negligent in the details throughout continuous HH performances over time. To tackle this, it may be beneficial to shift their understandings of the technique, timing, and so forth in principle from the periphery toward a more central and commonly shared comprehension. In practice, this would mean an attempt to make HCWs' understanding of the HH moments, technique and so forth as strong as their grasp of the effect of not wearing watches, jewelry, artificial nails, and long sleeves.

This could be done in two ways: by improving compliance (or HH quantity) and HH quality. Improving compliance implies improving HCWs' awareness of HH opportunities; improving quality implies improving the overall technique, duration, thoroughness, and meticulousness of performances.

Those aspects need to be engrained more deeply not only by a bigger emphasis on them in trainings but also artifacts. Training provides ways for routine participants in routines to recognize patterns cognitively and embody them (Danner-Schröder & Geiger, 2016). In those, improvements may be achieved, for instance, through an added E-learning module, or by creating a strategy to encourage HCWs' interpersonal talks.

Both Gentofte and Nordsjaellands Hospital already are going ahead and seeking to foster a culture of open communication, where HCWs are encouraged to address their colleagues in cases of HH rule violations, not with sanctions, but in a spirit of discourse and teaching. Still, speaking up does not yet appear to be widespread. It cannot be safely said to what extent HCWs already are encouraged to speak up in informal conversations, since this was impossible to examine reliably in the scope of this study.

6.4.1 Improving Quantity

Increased speaking up could prove beneficial especially for the moments for HH in HCWs' ostensive understanding. Misses and strongly flawed performances can be recognized and

corrected by more experienced coworkers with a better comprehension of the HH opportunities, for instance. The core of the ostensive aspect establishes mutual behavioral expectations among routine participants which allows to intertwine individual actions into collective action (Joas, 1997; Miller, 1973). The more HCWs have an ostensive understanding that aligns with the HH recommendations, the more they should be able to speak up about HH misses.

This equally applies to HH action after glove removal. Wearing gloves can give HCWs a false sense of security (Pittet et al., 1999), and since many rule breaks in this regard were observed, this aspect likewise requires a considerably greater emphasis in HH artifacts and training. Overall, stressing grasp of HH opportunities – including after glove use - is therefore likely to increase HH compliance.

6.4.2 Improving Quality

Some other aspects of HH performances like technique, duration, and thoroughness cannot be as easily observed and addressed the same way as the moments of HH. It is not HCWs' duty to pedantically observe their colleagues during their work. Therefore, speaking up because they observed a colleague perform HH for a too short time or because they used an incorrect technique seems unlikely.

Instead, the most effective way for them to change their ostensive understanding is through contact with HH artifacts. The presence of effective artifacts gives HCWs a reference point to compare their own actions with and to help guide their further performances toward consistency. Therefore, the correct understanding of these aspects needs to be supported especially through a bigger emphasis in HH artifacts and training.

To achieve this, it may be beneficial to create specific artifacts that contain solely information on one of those aspects on the one hand. Similar to the "Ren?" ("Clean?") stickers found in many places in the observed wards, for instance, one could design a small sticker merely reading "30 seconds" in signal colors that could be put onto or next to every hand rub dispenser, so as to easily catch one's eye every time one is using the dispenser.

On the subject of the correct HH technique, there already are posters and stickers specifically designed to illustrate it step by step. Still, it could prove useful to further look into possibilities of communicating them even more comprehensibly - ideally, something as tangible as the WHO's five moments for HH. In addition, the extant posters that have been hanging on the walls for a longer amount of time are probably not looked at very much - HCWs already know them. It might thus be beneficial to create a new design for them regularly to better catch HCWs' attention.

Similarly, trainings could point out the fact that HH is mostly carried out with a much too short duration, and clearly communicate how much the effect of HH depends on the right duration. Also, one could add specific modules on HH performance duration or emphasize the technique further in the E-learning course.

Furthermore, the hospitals' extant HH compliance observation forms – which focus on the act of HH in the right situation - could furthermore record its duration. The form in use at Nordsjaellands Hospital, for instance, only records whether HH action was carried out in which of the WHO's five moments as well as the type of HCW and potential comments. Duration of a HH action can only be accounted for by ticking off the boxes "no" regarding whether a HH action was carried out, and to write a comment (see Appendix). This is unprecise, since it does not record that HH action *did* take place but was flawed in the performance itself. Thus, it may be beneficial to include a box designated to record whether the duration of the performance was satisfactory, since one then could differentiate between HH misses and flawed HH performances. As a consequence, if either of both show exceptionally bad numbers, they could subsequently be targeted specifically with interventions.

It shall be noted that these recommendations cannot stand by themselves. The WHO points out that altering HH behavior is "a complex task" and "the consequence of multiple influences from our biology, environment, education, and culture (World Health Organization, 2009b, p. 86). When creating behavioral interventions, one needs thus to consider the complexity of individual, institutional and community factors (Kretzer & Larson, 1998; Pittet, 2004).

6.4.3 Sub-conclusion

The effect of the HH routine might be much greater when compliance not only means doing it in the right moment but also in the right manner. Tackling both aspects separately, encouraging speaking up even more, creating new artifacts or altering extant ones, and altering training is likely to not only improve HH compliance but also to reduce transmission of pathogens even when HH *was* performed, and thus, number of HAIs.

6.5 Additional Aspects

The last aspect worthy of discussion is the placement of hand rub dispensers. While the exclusive placement of dispensers in the rooms at most wards in Gentofte Hospital might be less convenient, it did not seem to result in reduced compliance or bigger variance in HH performances. However, the WHO points out that dispensers "in rooms with patient on contact precautions are used significantly less often than those located in other rooms on the ward" (World Health Organization, 2009b, p. 162). This means that HCWs dealing with patients in isolation may benefit from hand rub dispensers located in the hallway. Not only would they serve as visual reminders for performing HH but also may make carrying out HH to some extent easier, since it usually is done "on the go".

This impression is backed by instances in which HCWs were observed resorting to using a portable hand rub dispenser on a table with drinks meant for waiting visitors, since there was no hand rub dispenser in the hallway. When HCWs forget to carry out HH in the room they just left, they would therefore have to go into a room to make up for their missed action, losing time in the process.

As noted earlier, the lack of dispensers in most wards at Gentofte Hospital is due to prohibition by the fire department as for risk of fire hazed. It would be interesting to look at the reasons for which Gentofte Hospital does not have the same fire protection system as Nordsjaellands Hospital or other hospitals that allow dispensers in the hallway. Having pointed to the extremely low occurrence of hand rub dispenser-related fires earlier, it may be that their estimation of risk is inconsistent with reality. If the argument is that switching to a different

fire protection system would be too costly, one should contrast the costs with the costs that accrue with every single HAI. The annual economic impact of HAIs in Denmark is estimated DKK 1 billion (ca. € 134 million) (Jepsen, 2000) or higher (Pedersen & Kolmos, 2007).

It is out of question that upgrading the fire protection system would likely be a very costly and elaborate task. Gentofte Hospital should thus compare the probability of fire hazard including the estimated additional damage caused by hand rub dispensers in hallways with the probability of improved HH compliance and usability of dispensers, and subsequently consider the estimated savings through minimizing the risk of HAIs.

The overall outcome may show that Gentofte Hospital would gain more through increasing HH compliance with hand rub dispenser in hallways than it would lose through the risk of fire hazard.

6.6 Limitations

Before bringing this study to a conclusion, I will discuss some of its methodological as well as more general limitations that need to be considered.

First, language. The fact that this study was conducted in Danish hospitals brought language issues along. While analyzing written texts in the guidelines, on posters, notes, stickers, and in the E-learning could be done without risking major mistranslations, the same was not possible for the spoken language. Potential inaccuracies meant this would not have been possible to do in a scientifically sound manner. It would have been very interesting to investigate the ways that HCWs talk about HH as well, since one could have looked into informal conversations and trainings, for instance. This might be an interesting aspect for future studies to examine.

Second, recognizing the HH opportunities. As mentioned earlier, other researchers studying HH through observation usually receive professional training on the WHO's five moments for HH to ensure they can record HH opportunities correctly. I was not subject to such training. Professionally trained observers might therefore have gotten different results. However, compliance was not the sole focus of this thesis, and, as equally noted in the methodology

section, I acquainted myself with the HH moments as much as I could through different kinds of material. Hence, I am confident that I recognized most HH opportunities correctly.

Third, creating behavioral interventions. Jumaa points out that "[w]hile the techniques involved in hand hygiene are simple, the complex interdependence of factors which determine [HH behavior] makes the study of hand hygiene complex" (Jumaa, 2005, p. 3). When designing interventions to alter human behavior one needs to consider behavioral and social sciences so as to account for different social and cultural needs.

What is more, HH interventions cannot be planned as an isolated measure. This as a single measure to reduce HAIs is "unlikely to be successful when other factors in infection control, such as environmental hygiene, crowding, staffing levels and education are inadequate. Hand hygiene must be part of an integrated approach to infection control" (Jumaa, 2005, p. 3). This view is shared by Pittet, who points out that "[b]ecause of the complexity of the process of change, single interventions often fail, [and that] a multimodal, multidisciplinary strategy is necessary" (Pittet, 2001, p. 237). Hence, the improvement of HH as set forth in the discussion needs to be part of a comprehensive, multimodal approach in order to reap maximum effects.

Fourth, the HH routine itself. Although HH is a quite simple and tangible routine, one needs to remember that while the ostensive aspects of routines are multiple and distributed, I described it through a particular ostensive aspect and its formation. HCWs as well as researchers may construct different views on it. For them, the "HH routine" may thus represent something different.

Finally, it shall be stressed once more that this study is not representative for HCWs and HH in general. The numbers collected through observation only captured a fraction of the entire HH routine as understood and carried out by HCWs in the hospitals at hand. This thesis merely gives insight into the specific actions of specific people which I observed in a specific place at a specific time. Nevertheless, it may serve as inspiration for further research in the area of both routines theory as well as infection control in healthcare environments.

7. Conclusion

This thesis started in mind with the question: how can variation in the hand hygiene practice of healthcare workers be explained with the concept of routine dynamics? This question was addressed by using Feldman & Pentland's concept of routine as constituted by a dualism of an ostensive and a performative aspect.

The HH routine is a cornerstone of HAI prevention, but low compliance rates and flawed performances undermine efforts to effectively tackle the transmission of pathogens. This has particularly grave consequences for the ongoing fight against MDROs, whose hazard potential is only increasing with time.

To be able observe the HH routine at the two hospitals, I relied strongly on HH artifacts from the WHO, the SSI as well as the hospitals themselves. First, in the sense that they enabled me to distinguish the HH opportunities, and second, in the sense that they provided me with knowledge of all sorts that helped me select theory and modes of observation. These observations provided some interesting insight.

While the recorded missed HH opportunities are not quantifiable, the ones that were carried out hold different kinds of information. First example, the HH technique of most HCWs differed – for some, only in light details, but for others, by not performing all steps that were required. What is more, the bulk of HCWs carried out HH for a much too short time. For maximum effect, the performance should take around 30 seconds, but in most cases, it took less than ten.

I found out that the extant HH artifacts represent a strong basis for HCWs' overall understanding of the importance of HH. They know why they need to do it, and it is reasonable to assume that most of them are familiar with most HH moments. Ongoing HH performances keep the routine going, but they do not prevent the development of ostensive understandings that are misaligned with the rules. I discovered that flawed ostensive understandings most likely led to flawed HH performances. Thus, hospitals need to ensure that HCWs are taught the routine in a way that clearly conveys all important aspects of HH and at the same time sufficiently stresses the importance of the correct duration of performances as well as of

carrying out every step as required, for instance. In addition, I found that HCWs are probably not purposefully modifying their HH actions, since they are aware of the potential consequences for their patients.

What is more, I found that there is a strong shared understanding among HCWs that they may not wear jewelry, watches, artificial fingernails, or long sleeves. Moreover, there were no indications that doctors and nurses as have different levels of variance in their ostensive understandings.

Overall, I discovered there is a strong core in HCWs' understanding of HH in principle, but also, that many more detailed aspects only take up a minor position in their perception, which consequentially leads to variance in performances.

Last, but not least, I found that in order to effectively fight HAIs, it would make sense to tackle HH quantity – i.e. compliance – and HH quality as separate challenges, for variance in each of these is caused by different kinds of routine dualisms.

If one now wants to go forward and design new HH interventions, one needs to consider that in line with routines theory, these findings only hold true for the specific HH performances of the specific HCWs that were observed for this study in a specific place at a specific time, and that HH interventions are only likely to be successful when part of a bigger, multimodal strategy.

Healthcare-acquires infections are not just a problem of the now. A continuous increase in infections caused by multidrug-resistant organisms means the importance of infection control will only grow in the foreseeable future – and so will the importance of healthcare workers carrying out hand hygiene in the right moment in the right manner.

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Observation Results

List of abbreviations

HR	Hand rub
HH situation	
D	After dirty task
C	Before clean task
G	After glove use
Professional category	
N	Nurse
D	Doctor
Hc	Other healthcare worker/auxiliary
HR amount (The approx. amount of HR used)	
+	More than the "regular" amount
O	The amount of HR dispensed with a "regular" push of the dispenser lever
-	Considerably less than the "regular" amount
X	Missed opportunity
HH duration (The approx. duration of the HH performance)	
+	20 seconds or more
O	~10-20 seconds
-	Less than 10 seconds
X	Missed opportunity

First Sequence

02.08.2017

Nordsjaellands Hospital, DK-3400 Hillerød
Cardiologic & Endocrinological Ward

Observation time: 10:50-12:20

NO.	HH SITUATION	PROFESSIONAL CATEGORY	HR AMOUNT	HH DURATION	NOTES
1	D	D	-	O	
2	D	D	-	-	
3	D	D	+	O	
4	C	N	O	O	
5	C	N	?	-	
6	D	D	+	O	Appears to have remembered to do HH upon seeing dispenser
7	C	N	X	X	
8	G	N	X	X	
9	D	N	X	X	
10	D	Hc	+	+	
11	D	N	X	X	
12	D	N	O	-	
13	D	D	X	X	
14	D	D	O	+	
15	C	D	X	X	
16	D	D	X	X	
17	C	N	O	-	
18	D	N	X	X	
19	G	D	X	X	
20	D	Hc	O	O	
21	G	D	O	O	
22	D	D	O	-	

09.08.2017

Nordsjaellands Hospital, DK-3400 Hillerød
Cardiologic & Endocrinological Ward

Observation period: 11:00-12:10

NO.	HH SITUATION	PROFESSIONAL CATEGORY	HR AMOUNT	HH DURATION	NOTES
1	D	N	+	O	
2	D	D	X	X	
3	D	N	X	X	Answered her work mobile phone (during patient contact) without HH action
4	C	D	O	O	
5	D	D	X	X	No dispenser outside the entrance (heart patients' room)
6	D	D	O	O	No dispenser outside the entrance (heart patients' room)
7	D	D	X	X	
8	C	D	X	X	
9	C	D	X	X	
10	D	Hc	O	O	
11	D	D	O	-	
12	C	D	+	O	Went to door, stopped, went back to dispenser for HH (maybe due to social desirability/observation bias?)
13	C	D	-	-	
14	C	N	+	+	
15	D	D	O	-	
16	D	D	O	-	
17	D	D	?	+	
18	C	N	X	X	
19	D	N	O	O	
20	D	D	O	-	
21	D	Hc	O	O	
22	D	D	O	-	
23	C	N	O	-	
24	D	?	O	O	No visible ID card
25	D	N	O	O	
26	D	N	O	-	
27	C	N	X	X	
28	D	N	O	O	

Second Sequence

09.08.2017

Nordsjaellands Hospital, DK-3400 Hillerød
Cardiologic & Endocrinological Ward

Observation period: 12:45-12:55
Observed HCW: Nurse

NO.	ACTION(S) BEFORE/AFTER HH OPPORTUNITY	HR AMOUNT	HH DURATION	NOTES
1		O	O	
2	Patient contact	O	O	
3	Staff contact	O	-	
4	Prepares equipment	O	-	
	Staff contact			

09.08.2017

Nordsjaellands Hospital, DK-3400 Hillerød
Cardiologic & Endocrinological Ward

Observation period: 13:00-13:15
Observed HCW: Doctor

NO.	ACTION(S) BEFORE/AFTER HH OPPORTUNITY	HR AMOUNT	HH DURATION	NOTES
1		+	O	
2	Patient contact Changes catheter	+	+	Hand wash and hand rub action
3	Staff contact	O	O	
4	Prepares equipment	+	+	
5	Staff contact Works at computer	O	-	
	Staff contact			

16.08.2017

Gentofte Hospital, DK-2900 Hellerup
Orthopedic Ward

Observation period: 13:10-14:10
Observed HCW: Nurse

NO.	ACTION(S) BEFORE/AFTER HH OPPORTUNITY	HR AMOUNT	HH DURATION	NOTES
1	Works at computer Patient contact	O	-	Emergency situation: patient in the hallway on the verge of fainting – nurse went to support him
2	Patient contact	O	O	
3	Removes old infusion	O	+	
4	Prepares new infusion Patient contact	O	-	Contact with patient's surroundings during HH performance – hands not properly disinfected
5	Works at computer	X	X	
6	Prepares bed for new patient	+	O	
7	Prepares glass of water in kitchen for patient Puts it into patient's room	X	X	
8	Puts gloves on Disinfects walking frame Removes gloves	X	X	
9	Puts gloves on Removes old infusion Gloves off Takes label off used infusion container	O	O	Keeps infusion bag label stuck to tip of index finger during disinfection – tip not properly disinfected
10	Puts label away	+	+	Maybe noticed not having performed HH properly before
11	Attaches new infusion to patient Removes old infusion container	+	+	
12	Prepares medication Puts gloves on Prepares injection	X	X	

NO.	ACTION(S) BEFORE/AFTER HH OPPORTUNITY	HR AMOUNT	HH DURATION	NOTES
	Patient contact Gloves off			
13	Walking frame contact	X	X	
14	Patient surroundings contact	+	O	
15	Gets injection tip Puts gloves on Patient contact Gloves off	X	X	
16	Takes old infusion container Takes used clothes	+	+	Hand wash and hand rub action
	Works at computer			

16.08.2017

Gentofte Hospital, DK-2900 Hellerup
Orthopedic Ward

Observation period 14:30-14:50
Observed HCW: Nurse

NO.	ACTION(S) BEFORE/AFTER HH OPPORTUNITY	HR AMOUNT	HH DURATION	NOTES
1		+	-	
2	Prepares water for patient Patient contact Patient surroundings contact Measures blood pressure	X	X	
3	Puts gloves on Cleans equipment Gloves off	O	O	Uses non-stationary HR dispenser at drinks table meant for patients – probably due to lack of dispenser in hallway
4	Brings food to patient	O	O	Uses HR dispenser at drinks table again
	Works at computer			

19.08.2017

Gentofte Hospital, DK-2900 Hellerup
Infection Disease Ward

Observation period: 10:10-10:50
Observed HCW: Nurse

NO.	ACTION(S) BEFORE/AFTER HH OPPORTUNITY	HR AMOUNT	HH DURATION	NOTES
1	Patient contact	O	+	
2	Fetches new patient clothes Puts gloves on Patient contact Removes gloves	X	X	
3	Patient contact	X	X	
4	Fetches tissues Patient contact	+	O	
5	Patient contact	-	O	
6	Fetches new patient clothes Puts gloves on Patient contact Removes gloves	+	+	
7	Patient clothes contact	O	O	
8	Puts gloves on Patient contact Patient clothes contact Removes gloves	O	O	
9	Fetches new patient clothes Patient contact	+	O	
10	Fetches new towel Puts gloves on Patient clothes contact Brings clothes to washing room	X	X	Gloves off and HH required
11	Prepares new waste and clothing bin Removes gloves	X	X	

19.08.2017

Gentofte Hospital, DK-2900 Hellerup
Infection Disease Ward

10:55-11:40
Observed HCW: Nurse

NO.	ACTION(S) BEFORE/AFTER HH OPPORTUNITY	HR AMOUNT	HH DURATION	NOTES
1	Works in staff room Fetches new sheets Fetches new plaster	O	-	
2	Puts gloves on Patient contact Removes gloves	+	O	
3	Puts gloves on Removes old diaper Cleans patient's wound Takes probe Puts new diaper on Gloves off	X	X	
4	Cleans patient w/ tissue	O	O	
5	Puts gloves on Applies lotion on patient Gloves off	-	-	
6	Combs patient	X	X	
7	Puts gloves on Cleans patient surroundings Puts new sheet on patient Removes gloves	+	+	Hand wash and hand rub action
	Drinks water			

2. Extracts from Hand Hygiene Guidelines

A) World Health Organization Guidelines

Indications for hand hygiene

A. Wash hands with soap and water when visibly dirty or visibly soiled with blood or other body fluids (IB) or after using the toilet (II).[179,248,249,287,339,899,1001-1005]

B. If exposure to potential spore-forming pathogens is strongly suspected or proven, including outbreaks of *Clostridium difficile,* hand washing with soap and water is the preferred means (IB).[419-421,432]

C. Use an alcohol-based handrub as the preferred means for routine hand antisepsis in all other clinical situations described in items D(a) to D(f) listed below, if hands are not visibly soiled (IA).[60,221,329,333,484-487,665]If alcohol-based handrub is not obtainable, wash hands with soap and water (IB).[60,195,196]

D. Perform hand hygiene:

   a. before and after touching the patient (IB);[50,52,73,88,110,114, 121,125,126,1006]
   b. before handling an invasive device for patient care, regardless of whether or not gloves are used (IB); [1007]
   c. after contact with body fluids or excretions, mucous membranes, non-intact skin, or wound dressings (IA);[50,125,127,179]
   d. if moving from a contaminated body site to another body site during care of the same patient (IB);[73,88,125-127]
   e. after contact with inanimate surfaces and objects (including medical equipment) in the immediate vicinity of the patient (IB);[73,111,112,114,125-127,129,130]
   f. after removing sterile (II) or non-sterile gloves (IB).[73,123,139,520,1008]

E. Before handling medication or preparing food perform hand hygiene using an alcohol-based handrub or wash hands with either plain or antimicrobial soap and water (IB).[1001-1004]

F. Soap and alcohol-based handrub should not be used concomitantly (II).[617,1009]

World Health Organization, 2009b, p. 152

"My five moments for hand hygiene" explained

The geographical representation of the zones and the critical sites (Figure I.21.5a) is useful to introduce "My five moments for hand hygiene". The correlation between these moments and the indications for hand hygiene according to the present guidelines is given in Table I.21.4. To further facilitate ease of recall and expand the ergonomic dimension, the five moments for hand hygiene are numbered according to the habitual care workflow (Figure I.21.5b).

Moment 1. Before touching a patient

From the two-zone concept, a major moment for hand hygiene is naturally deduced. It occurs between the last hand-to-surface contact with an object belonging to the *health-care area* and the first within the *patient zone* – best visualized by crossing the virtual line constituted by the patient zone (Figure I.21.5a). Hand hygiene at this moment will mainly prevent colonization of the patient with health care-associated microorganisms, resulting from the transfer of organisms from the environment to the patient through unclean hands, and exogenous infections in some cases. A clear example would be the temporal period between touching the door handle and shaking the patient's hand: the door handle belongs to the health-care area outside the patient zone, and the patient's hand belongs to the patient zone. Therefore hand hygiene must take place after touching the door handle and before shaking the patient's hand. If any objects are touched within the patient zone after opening the door handle, hand hygiene might take place either before or after touching these objects, because the necessity for hand hygiene before touching objects within the patient zone is not supported by evidence; in this case the important point is that hand hygiene must take place before touching the patient.

Moment 2. Before a clean/aseptic procedure

Once within the patient zone, very frequently after a hand exposure to the patient's intact skin, clothes or other objects, the HCW may engage in a *clean/aseptic procedure on a critical site with infectious risk for the patient,* such as opening a venous access line, giving an injection, or performing wound care. Importantly, hand hygiene required at this moment aims at preventing HCAI. In line with the predominantly endogenous origin of these infections, hand hygiene is taking place between the last exposure to a surface, even within the patient zone and immediately before access to a critical site with infectious risk for the patient or a critical site with combined infectious risk. This is important because HCWs customarily touch another surface within the patient zone before contact with a critical site with infectious risk for the patient or a critical site with combined infectious risk.

For some tasks on *clean sites* (lumbar puncture, surgical procedures, tracheal suctioning, etc.), the use of gloves is standard procedure. In this case, hand hygiene is required before donning gloves because gloves alone may not entirely prevent contamination (see Part I, Section 23.1).[73,884]

Moment 3. After body fluid exposure risk
After a care task associated with a risk to expose hands to body fluids, e.g. after accessing a critical site with body fluid exposure risk or a critical site with combined infectious risk (*body fluid site)*, hand hygiene is required instantly and must take place before any next hand-to-surface exposure, even within the same patient zone. This hand hygiene action has a double objective. First and most importantly, it reduces the risk of colonization or infection of HCWs with infectious agents that may occur even without visible soiling. Second, it reduces the risk of a transmission of microorganisms from a "colonized" to a "clean" body site within the same patient.[885] This routine moment for hand hygiene concerns all care actions associated with a risk of body fluid exposure and is not identical to the – hopefully very rare – case of accidental visible soiling calling for immediate handwashing.

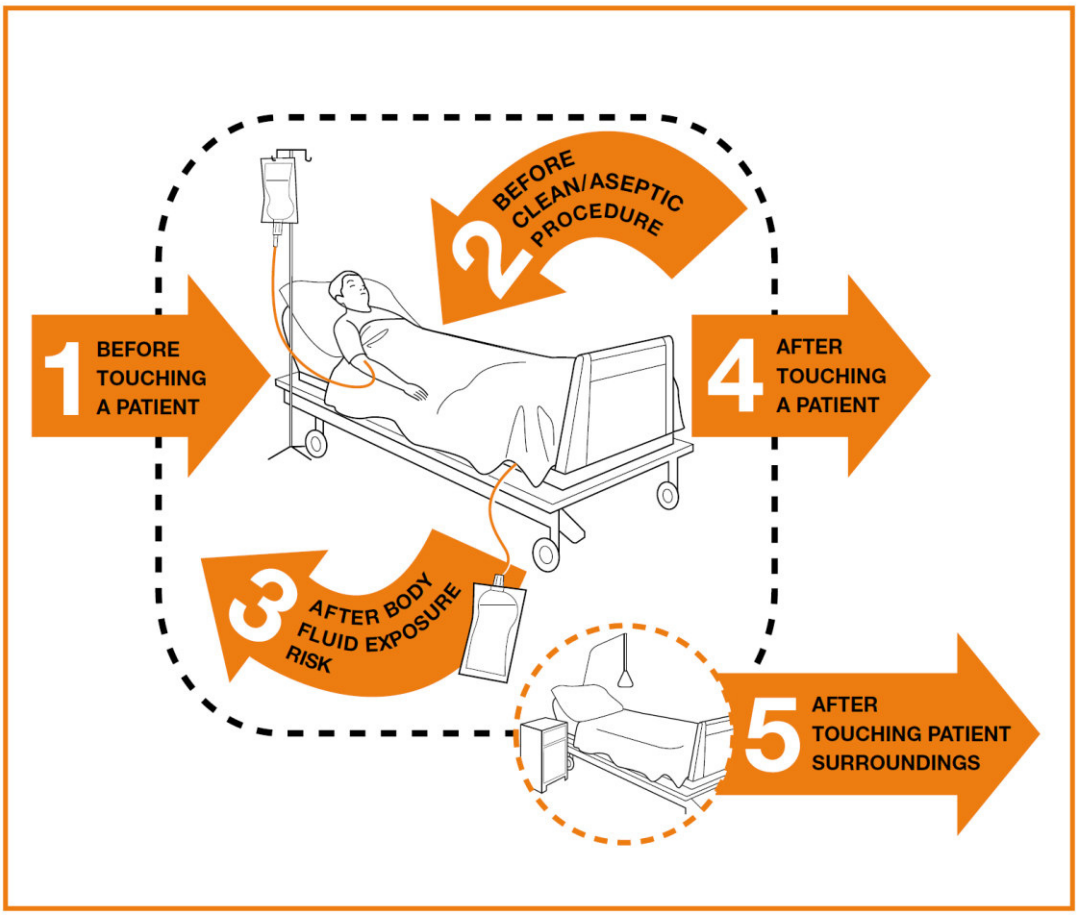
Disposable gloves are meant to be used as a "second skin" to prevent exposure of hands to body fluids. However, hands are not sufficiently protected by gloves, and hand hygiene is

strongly recommended after glove removal (see Part I, Section 23.1). Hence, to comply with the hand hygiene indication in Moment 3, gloves must be removed and subsequently cleansed.

Moment 4. After touching a patient
When leaving the patient zone after a care sequence, before touching an object in the area outside the patient zone and before a subsequent hand exposure to any surface in the health-care area, hand hygiene minimizes the risk of dissemination to the health-care environment, substantially reduces contamination of HCWs' hands with the flora from patient X, and protects the HCWs themselves.

Moment 5. After touching patient surroundings
The fifth moment for hand hygiene is a variant of Moment 4: it occurs after hand exposure to any surface in the patient zone, and before a subsequent hand exposure to any surface in the health-care area, but without touching the patient. This typically extends to objects contaminated by the patient flora that are extracted from the patient zone to be decontaminated or discarded. Because hand exposure to patient objects, but without physical contact with the patients, is associated with hand contamination, hand hygiene is still required.

World Health Organization, 2009b, pp. 101-102



Depiction of the five moments for HH. World Health Organization, 2009b, p. 123

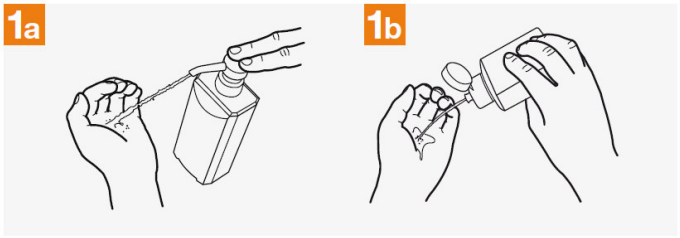
Hand hygiene technique

A. Apply a palmful of alcohol-based handrub and cover all surfaces of the hands. Rub hands until dry (IB).[201,814] (The technique for handrubbing is illustrated in Figure II.1)

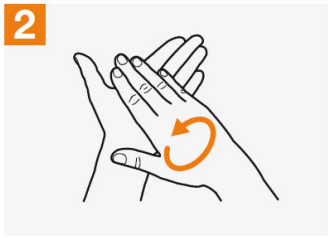
World Health Organization, 2009b, p. 152

Hand Hygiene Technique with Alcohol-Based Formulation

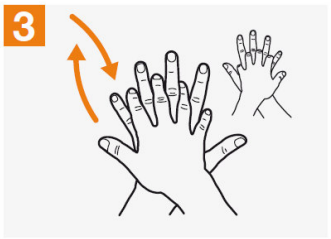
Duration of the entire procedure: 20-30 seconds



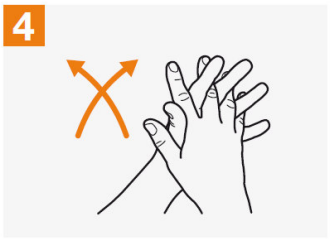
Apply a palmful of the product in a cupped hand, covering all surfaces;



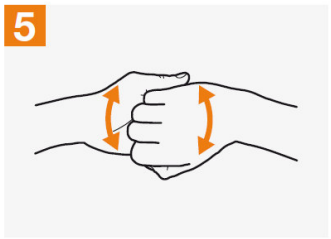
Rub hands palm to palm;



Right palm over left dorsum with interlaced fingers and vice versa;

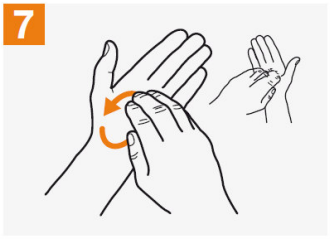


Palm to palm with fingers interlaced;

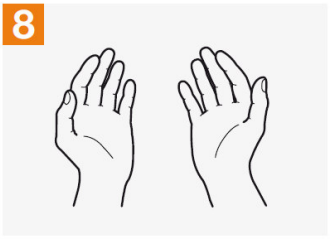


Backs of fingers to opposing palms with fingers interlocked;

Rotational rubbing of left thumb clasped in right palm and vice versa;



Rotational rubbing, backwards and forwards with clasped fingers of right hand in left palm and vice versa;



Once dry, your hands are safe.

Depiction of the HH technique. World Health Organization, 2009b, p. 155

Use of gloves

A. The use of gloves does not replace the need for hand hygiene by either handrubbing or handwashing (IB).[73,123,139,520,913,914,931]

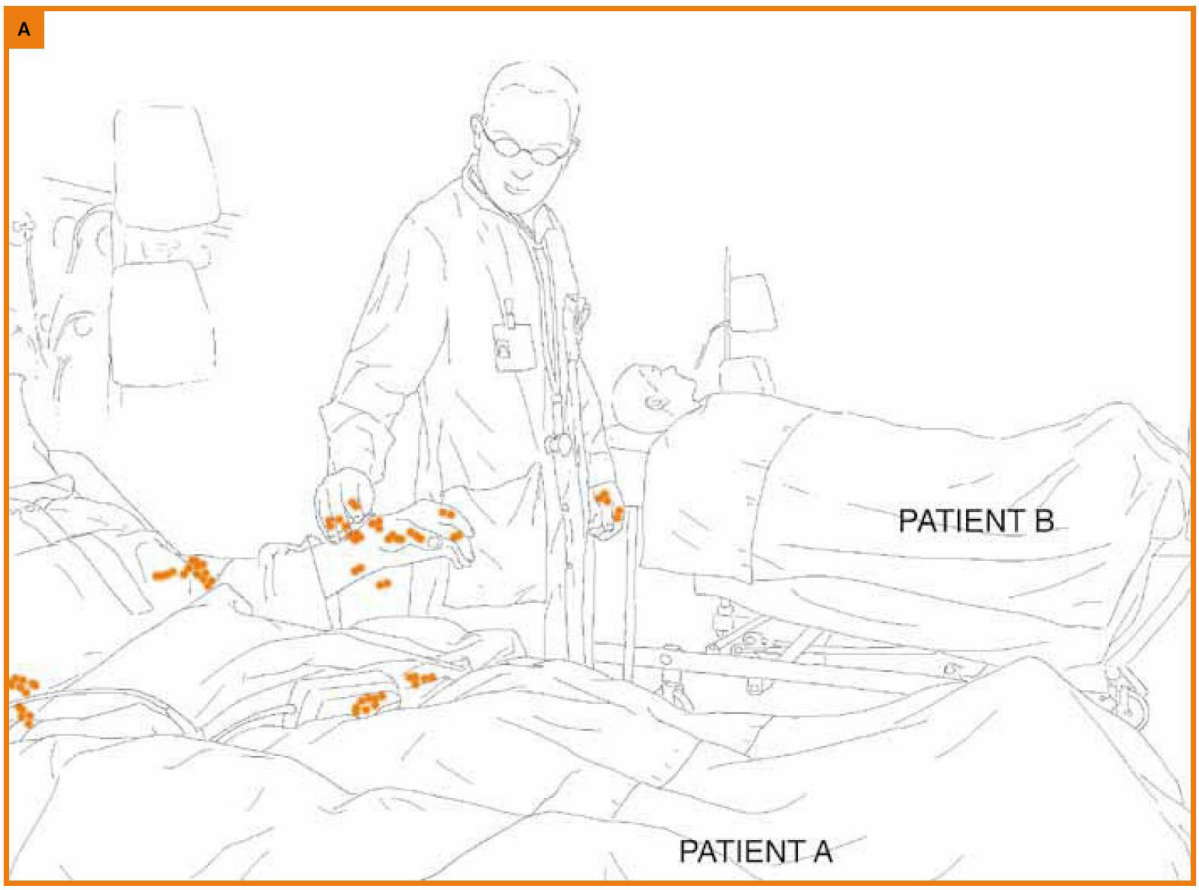
B. Wear gloves when it can be reasonably anticipated that contact with blood or other potentially infectious materials, mucous membranes, or non-intact skin will occur (IC).[906,1019,1020]

C. Remove gloves after caring for a patient. Do not wear the same pair of gloves for the care of more than one patient (IB).[73,114,123,139,520,941,1021]

D. When wearing gloves, change or remove gloves during patient care if moving from a contaminated body site to either another body site (including non-intact skin, mucous membrane or medical device) within the same patient or the environment (II).[72,123,139]

E. The reuse of gloves is not recommended (IB).[956] In the case of glove reuse, implement the safest reprocessing method (II).[952]

World Health Organization, 2009b, p. 153



(A) The doctor had a prolonged contact with patient A colonized with Gram-positive cocci and contaminated his hands. Reprinted from Pittet, 2006[885] with permission from Elsevier.

* The figure intentionally shows that long-sleeved white coats may become contaminated by microorganisms during patient care. Although evidence to formulate it as a recommendation is limited, long sleeves should be avoided.

Hint not to wear long-sleeved clothes in the caption. World Health Organization, 2009b, p. 19 (red marking by author)

B) Statens Serum Institut Guidelines

Bilag 1: Eksempler på situationer, hvor håndhygiejne skal udføres

Håndhygiejne skal udføres

Før rene procedurer/opgaver som fx

- før kontakt med patienten
- før brug af handsker
- før pleje-, behandlings- og undersøgelsesopgaver, som fx
  - før kontakt med udstyr/omgivelser (fx sengeheste, sengeborde)
  - før kontakt med hel og brudt hud og slimhinde
  - før aseptiske og invasive procedurer (fx håndtering eller anlæggelse af katetre, dræn, iv-adgang
  - før håndtering af sterilt og desinficeret udstyr
  - før måltider og håndtering af madvarer
- mellem uren og ren procedure/opgave hos samme patient

(9;10;15-17;46;116)

Efter urene procedurer/opgaver, som fx

- efter kontakt med patienten
- efter brug af handsker
- efter pleje-, behandlings- og undersøgelsesopgaver, som fx
  - efter kontakt med udstyr/omgivelser (fx katetre, dræn, iv adgang, sengeheste, sengeborde)
  - efter kontakt med hel og brudt hud og slimhinde og kontakt til blod, sekreter, ekskreter og andet organisk materiale, der kan indeholde potentielt patogene mikroorganismer
- efter toiletbesøg, hoste, nys og næsepudsning.

(9;10;15-17;46;116)

Detailed description of HH moments. Statens Serum Institut, 2013, p. 42

Anbefaling

Håndhygiejne udføres

- før rene procedurer/opgaver
- efter urene procedurer/opgaver og
- efter brug af handsker.

(9;10)

Med **før** menes umiddelbart, før handlingen foretages.
Med **efter** menes umiddelbart, efter handlingen er afsluttet.

Simplified distinction of HH moments. Statens Serum Institut, 2013, p. 15

Definition af ren og uren procedure

Ren procedure/opgave

- En ren procedure/opgave er en handling, hvor målet er at forebygge, at der via personalets hænder, håndled, underarme og/eller via udstyr/omgivelserne **overføres** potentielt sygdomsfremkaldende mikroorganismer **til patienten, og/eller omgivelser**
- En ren procedure/opgave indebærer en begrænset, men acceptabel risiko for overførsel af potentielt sygdomsfremkaldende mikroorganismer **til personalets hænder, håndled og underarme og/eller udstyr/omgivelserne**.

Efter afslutningen af en ren procedure/opgave er personalets hænder urene – idet de nu er forurenede med mikroorganismer fra patienten (fx hud- og slimhindeflora) og dennes omgivelser.

Uren procedure/opgave

- En uren procedure/opgave er en handling, hvor der er risiko for overførsel af potentielt sygdomsfremkaldende mikroorganismer **til personalets hænder, håndled og underarme og/eller udstyr/omgivelserne**.

Definition of clean and dirty tasks. Statens Serum Institut, 2013, p. 16

Anbefaling

Hånddesinfektion skal foretrækkes som første valg, når hænder, håndled og eventuelt underarme er synligt rene og tørre

- før rene procedurer[12;13;18;109;110;126-130]
- efter urene procedurer, hvor hænder, håndled og evt. underarme ikke er blevet synligt forurenede eller våde[12;41;109;110;116;126;127;129]
- efter håndvask når hænderne er helt tørre[14;18;126;131;132]
- før og efter brug af handsker, når hænder, håndled og evt. underarme er synligt rene og tørre[133-135]
- efter kontakt med patienter med infektiøs diarre skal der udføres håndvask efterfulgt af hånddesinfektion[36;136-138].

Description of moments requiring HH. Statens Serum Institut, 2013, p. 26

Anbefaling

- Hånddesinfektion skal udføres på synligt rene og tørre hænder, håndled og evt underarme[9;10;14;126]
- Der skal tilføres så meget hånddesinfektionsmiddel, at huden kan holdes fugtig af hånddesinfektionsmidlet i 30 sekunder[14;18;36;116;139]
- Producentens anvisning på nødvendig volumen for at opnå det ønskede drab af mikroorganismer skal følges[9;10]
- Hånddesinfektionsmidlet skal fordeles og indgnides overalt på hver finger, mellem fingre, på håndrygge, på håndflader, omkring håndled og evt. underarme[18;139;143-145]
- Underarme skal tages med i indgnidningen, når der kræves samme renhedsgrad som på hænder og håndled
- Hånddesinfektionsmidlet skal gnides ind, indtil hænderne, håndled og evt underarme er helt tørre[18;116;139;143-145]
- Hånddesinfektion udføres efter håndvask på tørre hænder, håndled og evt. underarme[14;18;126;131;132].

Information about duration, amount of hand rub, and other aspects. Statens Serum Institut, SSI 2013, p. 27

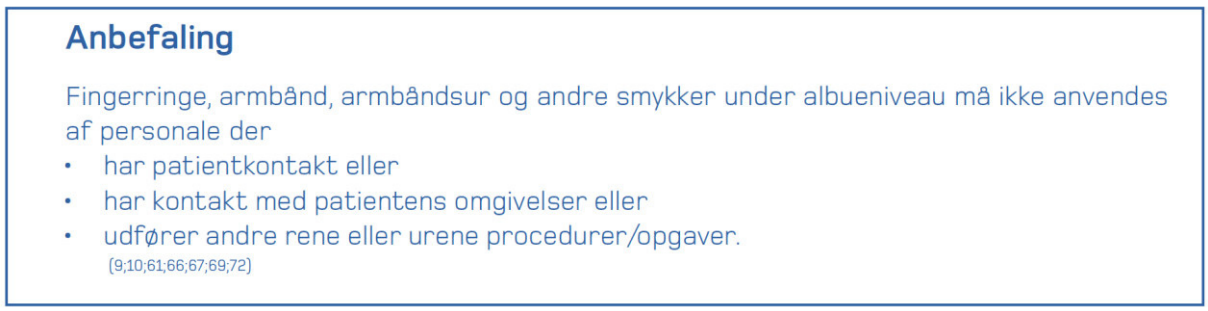
Anbefaling

- Handsker skal anvendes på begge hænder ved pleje- og behandlingsopgaver, hvor der er risiko for kontakt med blod, sekreter, ekskreter eller andet biologisk materiale[9;10;15;16;46;122]
- Handsker skal i særlige tilfælde anvendes ved pleje- og behandlingsopgaver, hvor der er risiko for kontakt med patienten, dennes udskillelser og omgivelser. Se mere i NIR om behandling af patienter med smitsomme sygdomme, herunder isolation[17]
- Handskevalget skal svare til karakteren af den opgave, der skal udføres, og til den forventede varighed af opgaven[10;16;122]
- Handsker skal være CE mærkede[219]
- Pudderfri latex handsker eller handsker med tilsvarende barriere egenskab skal foretrækkes[218]
- Ved dokumenteret allergi mod naturgummilatexproteiner (Allergi type I) anvendes syntetiske handsker (nitril, neopren, polyisopren)[218]
- Handsker er til engangsbrug[9;10;222]

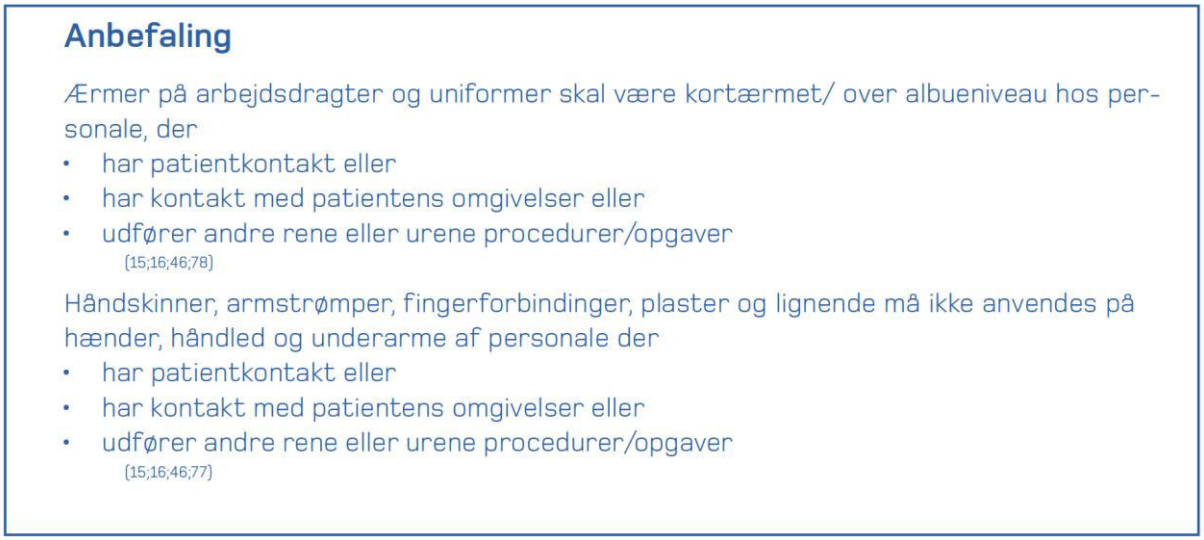
Undersøgelseshandsker skal

- tages fra beholderen med rene og tørre hænder[24;223]
- tages af straks efter endt procedure og kasseres[224]
- skiftes mellem procedurer - også hos den samme patient[9;10;134]
- skiftes hvis de perforeres eller på anden måde beskadiges[16;122]
- Efter brug af handsker skal der foretages håndhygiejne[9;224].

Information on glove use. Statens Serum Institut, 2013, p. 40



Information on wearing jewelry, watches, etc. Statens Serum Institut, 2013, p. 19



Information on appropriate sleeve length and other aspects. Statens Serum Institut, 2013, p. 20

3. WHO Observation Form

Source:

World Health Organization. (2009). *Observation Form*.
retrieved from who.int/gpsc/5may/Observation_Form.doc

World Health Organization | Patient Safety — A World Alliance for Safer Health Care | SAVE LIVES Clean Your Hands

Observation Form

Facility:		**Period Number*:**		**Session Number*:**	
Service:		**Date:** (dd/mm/yy)	/ /	**Observer:** (initials)	
Ward:		**Start/End time:** (hh:mm)	: / :	**Page N°:**	
Department:		**Session duration:** (mm)		**City**:**	
Country:**					

Prof.cat		Prof.cat		Prof.cat		Prof.cat	
Code		Code		Code		Code	
N°		N°		N°		N°	

Opp.	Indication	HH Action	Opp.	Indication	HH Action	Opp.	Indication	HH Action	Opp.	Indication	HH Action
1	☐ bef-pat. ☐ bef-asept. ☐ aft-b.f. ☐ aft-pat. ☐ aft.p.surr.	☐ HR ☐ HW ○ missed ○ gloves	1	☐ bef-pat. ☐ bef-asept. ☐ aft-b.f. ☐ aft-pat. ☐ aft.p.surr.	☐ HR ☐ HW ○ missed ○ gloves	1	☐ bef-pat. ☐ bef-asept. ☐ aft-b.f. ☐ aft-pat. ☐ aft.p.surr.	☐ HR ☐ HW ○ missed ○ gloves	1	☐ bef-pat. ☐ bef-asept. ☐ aft-b.f. ☐ aft-pat. ☐ aft.p.surr.	☐ HR ☐ HW ○ missed ○ gloves
2	☐ bef-pat. ☐ bef-asept. ☐ aft-b.f. ☐ aft-pat. ☐ aft.p.surr.	☐ HR ☐ HW ○ missed ○ gloves	2	☐ bef-pat. ☐ bef-asept. ☐ aft-b.f. ☐ aft-pat. ☐ aft.p.surr.	☐ HR ☐ HW ○ missed ○ gloves	2	☐ bef-pat. ☐ bef-asept. ☐ aft-b.f. ☐ aft-pat. ☐ aft.p.surr.	☐ HR ☐ HW ○ missed ○ gloves	2	☐ bef-pat. ☐ bef-asept. ☐ aft-b.f. ☐ aft-pat. ☐ aft.p.surr.	☐ HR ☐ HW ○ missed ○ gloves
3	☐ bef-pat. ☐ bef-asept. ☐ aft-b.f. ☐ aft-pat. ☐ aft.p.surr.	☐ HR ☐ HW ○ missed ○ gloves	3	☐ bef-pat. ☐ bef-asept. ☐ aft-b.f. ☐ aft-pat. ☐ aft.p.surr.	☐ HR ☐ HW ○ missed ○ gloves	3	☐ bef-pat. ☐ bef-asept. ☐ aft-b.f. ☐ aft-pat. ☐ aft.p.surr.	☐ HR ☐ HW ○ missed ○ gloves	3	☐ bef-pat. ☐ bef-asept. ☐ aft-b.f. ☐ aft-pat. ☐ aft.p.surr.	☐ HR ☐ HW ○ missed ○ gloves
4	☐ bef-pat. ☐ bef-asept. ☐ aft-b.f. ☐ aft-pat. ☐ aft.p.surr.	☐ HR ☐ HW ○ missed ○ gloves	4	☐ bef-pat. ☐ bef-asept. ☐ aft-b.f. ☐ aft-pat. ☐ aft.p.surr.	☐ HR ☐ HW ○ missed ○ gloves	4	☐ bef-pat. ☐ bef-asept. ☐ aft-b.f. ☐ aft-pat. ☐ aft.p.surr.	☐ HR ☐ HW ○ missed ○ gloves	4	☐ bef-pat. ☐ bef-asept. ☐ aft-b.f. ☐ aft-pat. ☐ aft.p.surr.	☐ HR ☐ HW ○ missed ○ gloves
5	☐ bef-pat. ☐ bef-asept. ☐ aft-b.f. ☐ aft-pat. ☐ aft.p.surr.	☐ HR ☐ HW ○ missed ○ gloves	5	☐ bef-pat. ☐ bef-asept. ☐ aft-b.f. ☐ aft-pat. ☐ aft.p.surr.	☐ HR ☐ HW ○ missed ○ gloves	5	☐ bef-pat. ☐ bef-asept. ☐ aft-b.f. ☐ aft-pat. ☐ aft.p.surr.	☐ HR ☐ HW ○ missed ○ gloves	5	☐ bef-pat. ☐ bef-asept. ☐ aft-b.f. ☐ aft-pat. ☐ aft.p.surr.	☐ HR ☐ HW ○ missed ○ gloves
6	☐ bef-pat. ☐ bef-asept. ☐ aft-b.f. ☐ aft-pat. ☐ aft.p.surr.	☐ HR ☐ HW ○ missed ○ gloves	6	☐ bef-pat. ☐ bef-asept. ☐ aft-b.f. ☐ aft-pat. ☐ aft.p.surr.	☐ HR ☐ HW ○ missed ○ gloves	6	☐ bef-pat. ☐ bef-asept. ☐ aft-b.f. ☐ aft-pat. ☐ aft.p.surr.	☐ HR ☐ HW ○ missed ○ gloves	6	☐ bef-pat. ☐ bef-asept. ☐ aft-b.f. ☐ aft-pat. ☐ aft.p.surr.	☐ HR ☐ HW ○ missed ○ gloves
7	☐ bef-pat. ☐ bef-asept. ☐ aft-b.f. ☐ aft-pat. ☐ aft.p.surr.	☐ HR ☐ HW ○ missed ○ gloves	7	☐ bef-pat. ☐ bef-asept. ☐ aft-b.f. ☐ aft-pat. ☐ aft.p.surr.	☐ HR ☐ HW ○ missed ○ gloves	7	☐ bef-pat. ☐ bef-asept. ☐ aft-b.f. ☐ aft-pat. ☐ aft.p.surr.	☐ HR ☐ HW ○ missed ○ gloves	7	☐ bef-pat. ☐ bef-asept. ☐ aft-b.f. ☐ aft-pat. ☐ aft.p.surr.	☐ HR ☐ HW ○ missed ○ gloves
8	☐ bef-pat. ☐ bef-asept. ☐ aft-b.f. ☐ aft-pat. ☐ aft.p.surr.	☐ HR ☐ HW ○ missed ○ gloves	8	☐ bef-pat. ☐ bef-asept. ☐ aft-b.f. ☐ aft-pat. ☐ aft.p.surr.	☐ HR ☐ HW ○ missed ○ gloves	8	☐ bef-pat. ☐ bef-asept. ☐ aft-b.f. ☐ aft-pat. ☐ aft.p.surr.	☐ HR ☐ HW ○ missed ○ gloves	8	☐ bef-pat. ☐ bef-asept. ☐ aft-b.f. ☐ aft-pat. ☐ aft.p.surr.	☐ HR ☐ HW ○ missed ○ gloves

* To be completed by the data manager.
** **Optional**, to be used if appropriate, according to the local needs and regulations.

WHO acknowledges the Hôpitaux Universitaires de Genève (HUG), in particular the members of the Infection Control Programme, for their active participation in developing this material.
Revised August 2009

General Recommendations

(refer to the Hand Hygiene Technical Reference Manual)

1. In the context of open and direct observations, the observer introduces him/herself to the health-care worker and to the patient when appropriate, explains his/her task and proposes immediate informal feed back.
2. The health-care worker, belonging to one of the main four following professional categories (see below), is observed during the delivery of health-care activities to patients.
3. Detected and observed data should be recorded with a pencil in order to be immediately corrected if needed.
4. The top of the form (header) is completed before starting data collection (excepted end time and session duration).
5. The session should last no more than 20 minutes (± 10 minutes according to the observed activity); the end time and the session duration are to be completed at the end of the observation session.
6. The observer may observe up to three health-care workers simultaneously, if the density of hand hygiene opportunities permits.
7. Each column of the grid to record hand hygiene practices is intended to be dedicated to a specific professional category. Therefore numerous health-care workers may be sequentially included during one session in the column dedicated to their category. Alternatively each column may be dedicated to a single health-care worker only of whom the professional category should be indicated.
8. As soon as you detect an indication for hand hygiene, count an opportunity in the appropriate column and cross the square corresponding to the indication(s) you detected. Then complete all the indications that apply and the related hand hygiene actions observed or missed.
9. Each opportunity refers to one line in each column; each line is independent from one column to another.
10. Cross items in squares (several may apply for one opportunity) or circles (only a single item may apply at one moment).
11. When several indications fall in one opportunity, each one must be recorded by crossing the squares.
12. Performed or missed actions must always be registered within the context of an opportunity.
13. Glove use may be recorded only when the hand hygiene action is missed while the health-care worker is wearing gloves.

Short description of items

Facility:	to complete according to the local nomenclature	
Service:	to complete according to the local nomenclature	
Ward:	to complete according to the local nomenclature	
Department:	to complete according to the following standardized nomenclature:	
	medical, including dermatology, neurology, haematology, oncology, etc.	surgery, including neurosurgery, urology, EENT, ophthalmology, etc.
	mixed (medical & surgical), including gynaecology	obstetrics, including related surgery
	paediatrics, including related surgery	intensive care & resuscitation
	emergency unit	long term care & rehabilitation
	ambulatory care, including related surgery	other (to specify)
Period N°:	1) pre- / 2) post-intervention; and then according to the institutional counter.	
Date:	day (dd) / month (mm) / year (yy)	
Start/end time:	hour (hh) / minute (mm).	
Session duration:	difference between start and end time, resulting in minutes of observation.	
Session N°:	attributed at the moment of data entry for analysis.	
Observer:	observer's initials (the observer is responsible for the data collection and for checking their accuracy before submitting the form for analysis.	
Page N°:	to write only when more than one form is used for one session.	
Prof.cat:	according to the following classification:	
	1. nurse / midwife	1.1 nurse, 1.2 midwife, 1.3 student.
	2. auxiliary	
	3. medical doctor	3.1 in internal medicine, 3.2 surgeon, 3.3 anaesthetist / resuscitator / emergency physician, 3.4 paediatrician, 3.5 gynaecologist, 3.6 consultant, 3.7 medical student.
	4. other health-care worker	4.1 therapist (physiotherapist, occupational therapist, audiologist, speech therapist), 4.2 technician (radiologist, cardiology technician, operating room technician, laboratory technician, etc), 4.3 other (dietician, dentist, social worker and any other health-related professional involved in patient care), 4.4 student.
Number:	number of observed health-care workers belonging to the same professional category (same code) as they enter the field of observation and you detect opportunities.	
Opp(ortunity):	defined by one indication at least	
Indication:	reason(s) that motivate(s) hand hygiene action; all indications that apply at one moment must be recorded	
	bef.pat: before touching a patient	aft.b.f: after body fluid exposure risk
	bef.asept: before clean/aseptic procedure	aft.pat: after touching a patient
		aft.p.surr: after touching patient surroundings
HH action:	response to the hand hygiene indication(s); it can be either a positive action by performing handrub or handwash, or a negative action by missing handrub or handwash	
	HR: hand hygiene action by handrubbing with an alcohol-based formula HW: hand hygiene action by handwashing with soap and water	Missed: no hand hygiene action performed

WHO acknowledges the Hôpitaux Universitaires de Genève (HUG), in particular the members of the Infection Control Programme, for their active participation in developing this material.

Observation Form – Basic Compliance Calculation

	Facility:						Period:			Setting:					
	Prof.cat.			Prof.cat.			Prof.cat.			Prof.cat.			Total per session		
Session N°	Opp (n)	HW (n)	HR (n)	Opp (n)	HW (n)	HR (n)	Opp (n)	HW (n)	HR (n)	Opp (n)	HW (n)	HR (n)	Opp (n)	HW (n)	HR (n)
1															
2															
3															
4															
5															
6															
7															
8															
9															
10															
11															
12															
13															
14															
15															
16															
17															
18															
19															
20															
Total															
Calculation	Act (n) = / Opp (n) =			Act (n) = / Opp (n) =			Act (n) = / Opp (n) =			Act (n) = / Opp (n) =			Act (n) = / Opp (n) =		
Compliance															

Compliance (%) = $\frac{\text{Actions}}{\text{Opportunities}}$ x 100

Instructions for use

1. Define the setting outlining the scope for analysis and report related data according to the chosen setting.
2. Check data in the observation form. Hand hygiene actions not related to an indication should not be taken into account and vice versa.
3. Report the session number and the related observation data in the same line. This attribution of session number validates the fact that data has been taken into count for compliance calculation.
4. Results per professional category and per session (vertical):
   - 4.1 Sum up recorded opportunities (opp) in the case report form per professional category: report the sum in the corresponding cell in the calculation form.
   - 4.2 Sum up the positive hand hygiene actions related to the total of opportunities above, making difference between handwash (HW) and handrub (HR): report the sum in the corresponding cell in the calculation form.
   - 4.3 Proceed in the same way for each session (data record form).
   - 4.4 Add up all sums per each professional category and put the calculation to calculate the compliance rate (given in percent)
5. The addition of results of each line permits to get the global compliance at the end of the last right column.

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World Health Organization | Patient Safety — A World Alliance for Safer Health Care | SAVE LIVES Clean Your Hands

Observation Form – Optional Calculation Form

(Indication-related compliance with hand hygiene)

	Facility:						Period:			Setting:					
	Before touching a patient			Before clean/ aseptic procedure			After body fluid exposure risk			After touching a patient			After touching patient surroundings		
Session N°	Indic (n)	HW (n)	HR (n)	Indic (n)	HW (n)	HR (n)	Indic (n)	HW (n)	HR (n)	Indic (n)	HW (n)	HR (n)	Indic (n)	HW (n)	HR (n)
1															
2															
3															
4															
5															
6															
7															
8															
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11															
12															
13															
14															
15															
16															
17															
18															
19															
20															
Total															
Calculation	Act (n) = Indic1 (n) =			Act (n) = Indic2 (n) =			Act (n) = Indic3 (n) =			Act (n) = Indic4 (n) =			Act (n) = Indic5 (n) =		
Ratio act / indic*															

Instructions for use

1. Define the setting outlining the scope for analysis and report related data according to the chosen setting.
2. Check data in the observation form. Hand hygiene actions not related to an indication should not be taken into account and vice versa.
3. If several indications occur within the same opportunity, each one should be considered separately as well as the related action.
4. Report the session number and the related observation data in the same line. This attribution of session number validates the fact that data has been taken into count for compliance calculation.
5. Results per indication (indic) and per session (vertical):
   - 4.1 Sum up indications per indication in the observation form: report the sum in the corresponding cell in the calculation form.
   - 4.2 Sum up positive hand hygiene actions related to the total of indications above, making the difference between handwash (HW) and handrub (HR): report the sum in the corresponding cell in the calculation form.
   - 4.3 Proceed in the same way for each session (observation form).
   - 4.4 Add up all sums per each indication and put the calculation to calculate the ratio (given in percent)

***Note:** This calculation is not exactly a compliance result, as the denominator of the calculation is an indication instead of an opportunity. Action is artificially overestimated according to each indication. However, the result gives an overall idea of health-care worker's behaviour towards each type of indication.

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4. Nordsjaellands Hospital Observation Form

Source:

Nordsjaellands Hospital. (2009). *Observationsark ved håndhygiejne*. Picture taken by the author.

Observationsark ved håndhygiejne

Hospital
Afdeling
Dato

Ren! Lad os huske hinanden på det

Situation 1: Før pleje- og behandlingsopgaver
Situation 2: Før ren opgave
Situation 3: Efter uren opgave
Situation 4: Efter patientkontakt
Situation 5: Efter kontakt med patientens omgivelser

Læger	Situation (sæt x)	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
	Håndhygiejne	☐ Ja	☐ Nej				☐ Ja	☐ Nej				☐ Ja	☐ Nej				☐ Ja	☐ Nej			
	Bemærkninger																				
Plejepersonale	Situation (sæt x)	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
	Håndhygiejne	☐ Ja	☐ Nej				☐ Ja	☐ Nej				☐ Ja	☐ Nej				☐ Ja	☐ Nej			
	Bemærkninger																				
	Situation (sæt x)	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
	Håndhygiejne	☐ Ja	☐ Nej				☐ Ja	☐ Nej				☐ Ja	☐ Nej				☐ Ja	☐ Nej			
	Bemærkninger																				
~~Andre~~	Situation (sæt x)	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
	Håndhygiejne	☐ Ja	☐ Nej				☐ Ja	☐ Nej				☐ Ja	☐ Nej				☐ Ja	☐ Nej			
	Bemærkninger																				

Forslag til forbedringer:
Hvad er vi gode til?
Hvad skal vi ændre?
Hvilke nye vaner vil vi tillægge os?

Antal ja ☐ / Antal ja + nej ☐ x 100 = Ja% ☐ → Overføres til compliancearket sammen med antal observationer