World Health Organization

Patient Safety

A World Alliance for Safer Health Care

WHO Guidelines on Hand Hygiene in Health Care: a Summary

First Global Patient Safety Challenge
Clean Care is Safer Care

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Foreword

Health care-associated infections affect hundreds of millions of patients worldwide every year. Infections lead to more serious illness, prolong hospital stays, induce long-term disabilities, add high costs to patients and their families, contribute to a massive, additional financial burden on the health-care system and, critically, often result in tragic loss of life.

By their very nature, infections are caused by many different factors related to systems and processes of care provision as well as to human behaviour that is conditioned by education, political and economic constraints on systems and countries, and often on societal norms and beliefs. Most infections, however, are preventable.

Hand hygiene is the primary measure to reduce infections. A simple action, perhaps, but the lack of compliance among health-care providers is problematic worldwide. On the basis of research into the aspects influencing hand hygiene compliance and best promotional strategies, new approaches have proven effective. A range of strategies for hand hygiene promotion and improvement have been proposed, and the WHO First Global Patient Safety Challenge, "Clean Care is Safer Care", is focusing part of its attention on improving hand hygiene standards and practices in health care along with implementing successful interventions.

New global *Guidelines on Hand Hygiene in Health Care*, developed with assistance from more than 100 renowned international experts, have been tested and given trials in different parts of the world and were launched in 2009. Testing sites ranged from modern, high-technology hospitals in developed countries to remote dispensaries in poor-resource villages.

Encouraging hospitals and health-care facilities to adopt these *Guidelines*, including the "My 5 Moments for Hand Hygiene" approach, will contribute to a greater awareness and understanding of the importance of hand hygiene. Our vision for the next decade is to encourage this awareness and to advocate the need for improved compliance and sustainability in all countries of the world.

Countries are invited to adopt the Challenge in their own health-care systems to involve and engage patients and service users as well as health-care providers in improvement strategies. Together we can work towards ensuring the sustainability of all actions for the long term benefit of everyone. While system change is a requirement in most places, sustained change in human behaviour is even more important and relies on essential peer and political support.

"Clean Care is Safer Care" is not a choice but a basic right. Clean hands prevent patient suffering and save lives. Thank you for committing to the Challenge and thereby contributing to safer patient care.

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INTRODUCTION

Confronted with the important issue of patient safety, in 2002 the Fifty-fifth World Health Assembly adopted a resolution urging countries to pay the closest possible attention to the problem and to strengthen safety and monitoring systems. In May 2004, the Fifty-seventh World Health Assembly approved the creation of an international alliance as a global initiative to improve patient safety. The World Alliance for Patient Safety was launched in October 2004 and currently has its place in the WHO Patient Safety programme included in the Information, Evidence and Research Cluster.

WHO Patient Safety aims to create an environment that ensures the safety of patient care globally by bringing together experts, heads of agencies, policy-makers and patient groups and matching experiences, expertise and evidence on various aspects of patient safety. The goal of this effort is to catalyse discussion and action and to formulate recommendations and facilitate their implementation.

WHO Patient Safety has developed multiple streams of work and focused actions on the various problem areas (http://www.who.int/patientsafety/en/). One specific approach has been to focus on specific themes (challenges) that deserve priority in the field of patient safety.

"Clean Care is Safer Care" was launched in October 2005 as the first Global Patient Safety Challenge (1st GPSC), aimed at reducing health care-associated infection (HCAI) worldwide. These infections occur both in developed and in transitional and developing countries and are among the major causes of death and increased morbidity for hospitalized patients.

A key action within "Clean Care is Safer Care" is to promote hand hygiene globally and at all levels of health care. Hand hygiene, a very simple action, is well accepted to be one of the primary modes of reducing HCAI and of enhancing patient safety.

Throughout four years of activity the technical work of the 1st GPSC has been focused on the development of recommendations and implementation strategies to improve hand hygiene practices in any situation in which health care is delivered and in all settings where health care is permanently or occasionally performed, such as home care by birth attendants. This process led to the preparation of the *WHO Guidelines on Hand Hygiene in Health Care.*

The aim of these *Guidelines* is to provide health-care workers (HCWs), hospital administrators and health authorities with a thorough review of evidence on hand hygiene in health care and specific recommendations for improving practices and reducing the transmission of pathogenic microorganisms to patients and HCWs. They have been developed with a global perspective, not addressing developed nor developing countries but rather all countries, while encouraging adaptation to the local situation according to the resources available.

The *WHO Guidelines on Hand Hygiene in Health Care 2009* (http://whqlibdoc.who.int/publications/2009/9789241597906_eng.pdf) are the result of the update and finalization of the *Advanced Draft,* issued in April 2006 according to a literature review up to June 2008 and to data and lessons learned from pilot testing. The 1st GPSC team was supported by a Core Group of experts in coordinating the process of reviewing the available scientific evidence, writing the document and fostering discussion among authors. More than 100 international experts, technical contributors, external reviewers and professionals offered their input in preparing the document. Task forces were also established to examine different aspects in depth and to provide recommendations in specific areas. In addition to systematic literature search for evidence, other international and national infection control guidelines and textbooks were consulted. Recommendations were formulated based on evidence and expert consensus and were graded using the system developed by the Healthcare Infection Control Practices Advisory Committee (HICPAC) of the Centers for Disease Control and Prevention (CDC) in Atlanta, Georgia, USA.

In parallel with the *Advanced Draft*, an implementation strategy (*WHO Multimodal Hand Hygiene Improvement Strategy*) was developed together with a wide range of tools (at that time called the "Pilot Implementation Pack") to help health-care settings translate the guidelines into practice at the bedside. According to the WHO recommendations for guideline preparation, a testing phase was undertaken to provide local data on the resources required to carry out the recommendations; to generate information on feasibility, validity, reliability, and cost–effectiveness of the interventions; and to adapt and refine proposed implementation strategies. Analysis of data and evaluation of the lessons learned from

pilot sites were of the utmost importance in order to finalize the *Guidelines*, the implementation strategy and the tools currently included in the *Implementation Toolkit* (see Appendix 3; available at http://www.who.int/gpsc/5may/tools/en/index.html).

The final *Guidelines* are based on updated evidence, data from field testing and experiences during the past few years of global promotion of hand hygiene. Special attention has been paid to documenting all these experiences, including various barriers to implementation faced in different settings and suggestions for overcoming them. For example, there is a subsection on lessons learnt from local production of the WHO-recommended hand rub formulations in different settings worldwide (see Part I.12 of the *Guidelines*).

As compared to the *Advanced Draft*, in the final *Guidelines* (see Table of Contents in Appendix 2) there are no major changes in the existing consensus recommendations but nonetheless the evidence grades for some recommendations are different. A few additional recommendations were added and some others were reordered or reworded.

Several new chapters on key innovative topics were added to the final *Guidelines,* for example the burden of HCAI worldwide; a national approach to hand hygiene improvement; patient involvement in hand hygiene promotion; and comparison of hand hygiene national and sub-national guidelines.

Successful dissemination and implementation strategies are required in order to achieve the objectives of these *Guidelines* and this forms the basis of another new chapter related to the *WHO Multimodal Hand Hygiene Improvement Strategy*. Key messages from this chapter are also summarized in Part III of this document.

For rational decision making it is necessary to have reliable information on costs and consequences. The chapter on assessing the economic impact of hand hygiene promotion has been extensively revised, with a considerable amount of new information added to facilitate better assessments of these aspects, both in low- and high-income settings.

All other chapters and appendices have also undergone revision and additions based on evolving concepts. *The WHO Guidelines on Hand Hygiene in Health Care 2009* table of contents is included in Appendix 2.

The present Summary focuses on the most relevant parts of the *Guidelines* and refers to the *Guide to Implementation* and some tools particularly important for their translation into practice. It provides a synthesis of the key concepts in order to facilitate the understanding of the scientific evidence on which hand hygiene promotion is founded and the implementation of the *Guidelines'* core recommendations.

In contrast to the *Guidelines*, presently available only in English, this Summary has been translated into all WHO official languages.

It is anticipated that the recommendations (Part II) will remain valid until at least 2011. WHO Patient Safety is committed to ensuring that the *WHO Guidelines on Hand Hygiene in Health Care* are updated every two-to-three years.

PART I.

HEALTH CARE-ASSOCIATED INFECTION AND EVIDENCE OF THE IMPORTANCE OF HAND HYGIENE

1.

The problem: health care-associated infection (HCAI) is a major cause of death and disability worldwide

1.1 Magnitude of HCAI burden

HCAI is a major problem for patient safety and its prevention must be a first priority for settings and institutions committed to making health care safer.

The impact of HCAI implies prolonged hospital stay, long-term disability, increased resistance of microorganisms to antimicrobials, massive additional financial burdens, an excess of deaths, high costs for the health systems and emotional stress for patients and their families. Risk of acquiring HCAI depends on factors related to the infectious agent (e.g. virulence, capacity to survive in the environment, antimicrobial resistance), the host (e.g. advanced age, low birth weight, underlying diseases, state of debilitation, immunosuppression, malnutrition) and the environment (e.g. ICU admission, prolonged hospitalization, invasive devices and procedures, antimicrobial therapy). Although the risk of acquiring HCAI is universal and pervades every health-care facility and system around the world, the global burden is unknown because of the difficulty of gathering reliable diagnostic data. This is mainly due to the complexity and lack of uniformity of criteria used in diagnosing HCAI and to the fact that surveillance systems for HCAI are virtually nonexistent in most countries.

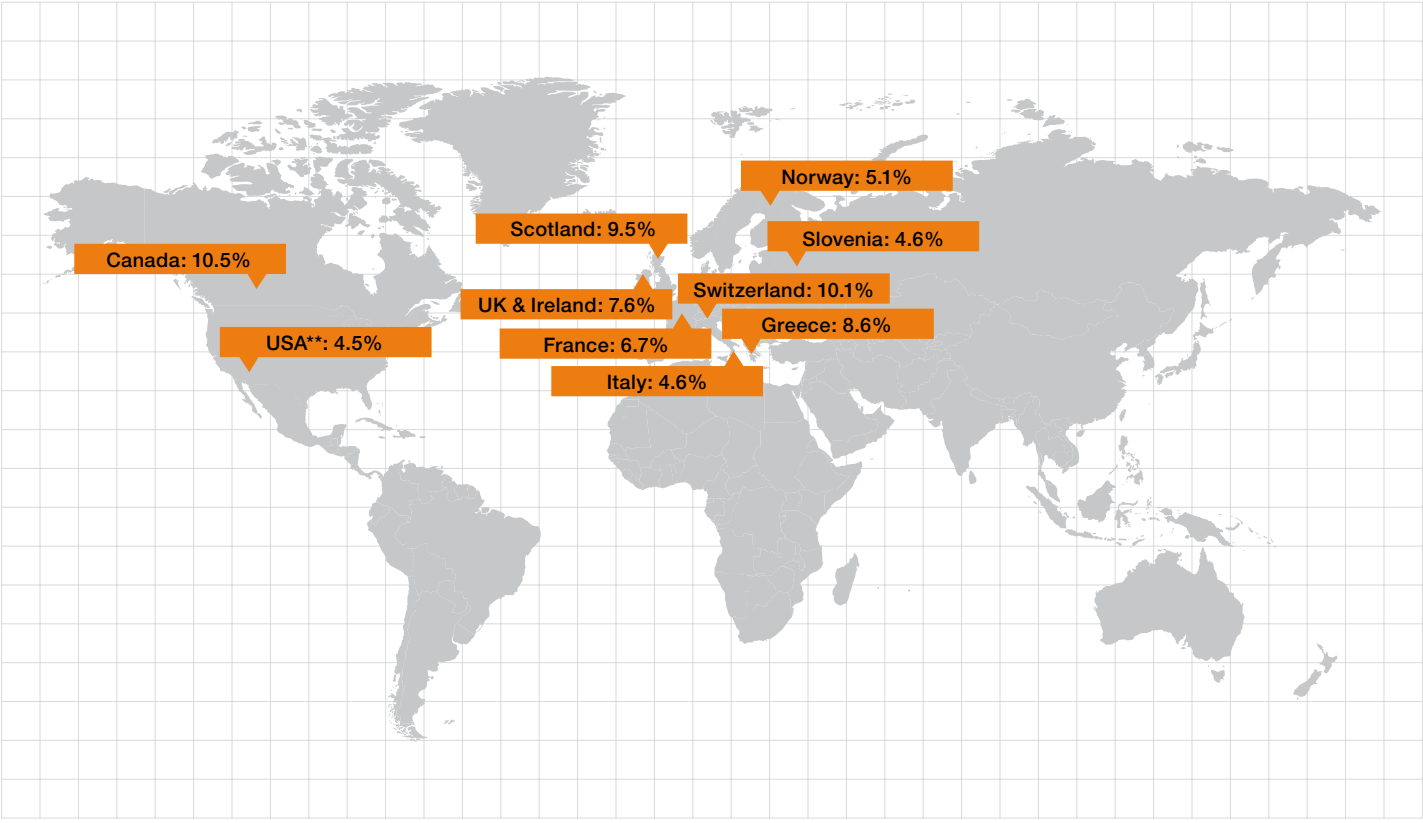
Therefore, HCAI remains a hidden, cross-cutting concern that no institution or country can claim to have solved as yet.

1.2 HCAI in developed countries

In developed countries, HCAI concerns 5–15% of hospitalized patients and can affect 9–37% of those admitted to intensive care units (ICUs).[1, 2]

Recent studies conducted in Europe reported hospital-wide prevalence rates of patients affected by HCAI that ranged from 4.6% to 9.3% (Figure I.1).[3-9] An estimated five million HCAI at least occur in acute care hospitals in Europe annually, contributing to 135 000 deaths per year and

Figure I.1
Prevalence of HCAI in developed countries*



* References can be found in Part I.3 of the *WHO Guidelines on Hand Hygiene in Health Care 2009*
**Incidence

representing around 25 million extra days of hospital stay and a corresponding economic burden of €13–24 billion (http://helics.univ-lyon1.fr/helicshome.htm). The estimated HCAI incidence rate in the United States of America (USA) was 4.5% in 2002, corresponding to 9.3 infections per 1000 patient-days and 1.7 million affected patients and an annual economic impact of US$ 6.5 billion in 2004,[10].Approximately 99 000 deaths were attributed to HCAI. [11]

Prevalence rates of infection acquired in ICUs vary from 9 to 37% when assessed in Europe[12] and the USA, with crude mortality rates ranging from 12% to 80%.[2]

In ICU settings particularly, the use of various invasive devices (e.g. central venous catheter, mechanical ventilation or urinary catheter) is one of the most important risk factors for acquiring HCAI. Device-associated infection rates per 1000 device-days detected through the National Healthcare Safety Network (NHSN) in the USA are summarized in Table I.1.[13] Device-associated infections have a great economic impact; for example catheter-related bloodstream infection caused by methicillin-resistant *Staphylococcus aureus* (MRSA) may cost as much as US$ 38 000 per episode.[14]

1.3 HCAI in developing countries

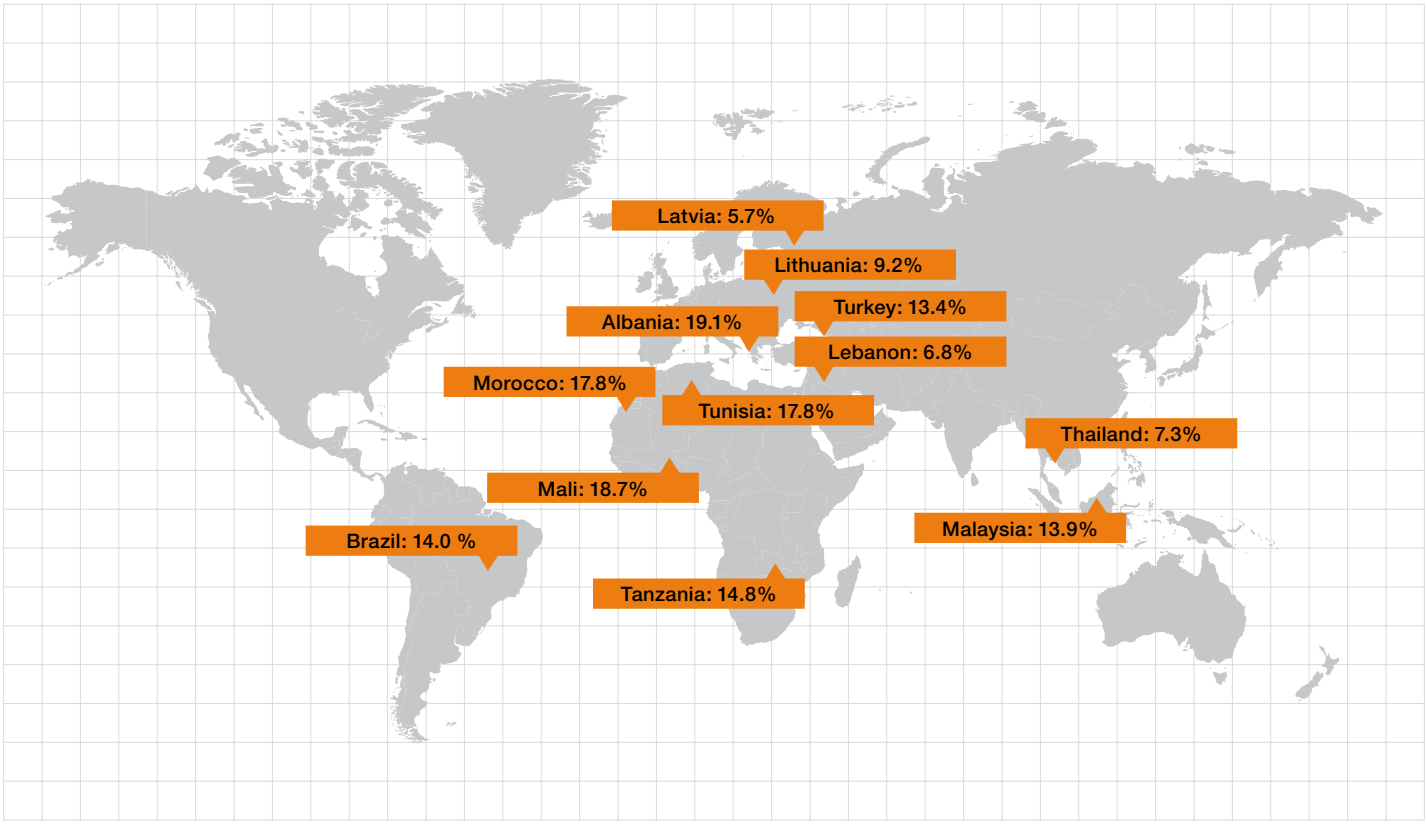
To the usual difficulties of diagnosing HCAI, in developing countries the paucity and unreliability of laboratory data, limited access to diagnostic facilities like radiology and poor medical record keeping must be added as obstacles to reliable HCAI burden estimates. Therefore, limited data on HCAI from these settings are available from the literature.

In addition, basic infection control measures are virtually non-existent in most settings as a result of a combination of numerous unfavourable factors such as understaffing, poor hygiene and sanitation, lack or shortage of basic equipment, inadequate structures and overcrowding, almost all of which can be attributed to limited financial resources. Furthermore, populations largely affected by malnutrition and a variety of diseases increase the risk of HCAI in developing countries.

Under these circumstances, numerous viral and bacterial HCAI are transmitted and the burden due to such infections seems likely to be several times higher than what is observed in developed countries.

For example, in one-day prevalence surveys recently carried out in single hospitals in Albania, Morocco, Tunisia and the United Republic of Tanzania, HCAI prevalence rates varied between 19.1% and 14.8% (Figure I.2).[15-18]

Figure I.2
Prevalence of HCAI in developing countries*



* References can be found in Part I.3 of the *WHO Guidelines on Hand Hygiene in Health Care 2009*

The risk for patients to develop surgical site infection (SSI), the most frequently surveyed type of HCAI in developing countries, is significantly higher than in developed countries (e.g. 30.9% in a paediatric hospital in Nigeria, 23% in general surgery in a hospital in the United Republic of Tanzania and 19% in a maternity unit in Kenya).[15, 19, 20]

Device-associated infection rates reported from multicentre studies conducted in adult and paediatric ICUs are also several times higher in developing countries as compared to the NHSN system (USA) rates (Table I.1).[13, 21, 22] Neonatal infections are reported to be 3–20 times higher among hospital-born babies in developing as compared to developed countries.[23]

In some settings (Brazil and Indonesia), more than half the neonates admitted to neonatal units acquire a HCAI, with reported fatality rates between 12% and 52%.[23] The costs of managing HCAI are likely to represent a higher percentage of the health or hospital budget in low income countries as well.

These concepts are discussed more extensively in Part I.3 of the *WHO Guidelines on Hand Hygiene in Health Care 2009*.

Table I.1.
Device-associated infection rates in ICUs in developing countries compared with NHSN rates

Surveillance network, study period, country	Setting	No. of patients	CLA-BSI*	VAP*	CR-UTI*
INICC, 2002–2007, 18 developing countries†[21]	PICU	1,808	6.9	7.8	4.0
NHSN, 2006–2007, USA[13]	PICU	—	2.9	2.1	5.0
INICC, 2002–2007, 18 developing countries†[21]	Adult ICU#	26,155	8.9	20.0	6.6
NHSN, 2006–2007, USA[13]	Adult ICU#	—	1.5	2.3	3.1

* Overall (pooled mean) infection rates/1000 device-days
INICC = International Nosocomial Infection Control Consortium; NHSN = National Healthcare Safety Network; PICU = paediatric intensive care unit; CLA-BSI = central line-associated bloodstream infection; VAP = ventilator-associated pneumonia; CR-UTI = catheter-related urinary tract infection.
† Argentina, Brazil, Chile, Colombia, Costa Rica, Cuba, El Salvador, India, Kosovo, Lebanon, Macedonia, Mexico, Morocco, Nigeria, Peru, Philippines, Turkey, Uruguay
#Medical/surgical ICUs

1.4 HCAI among HCWs

HCWs can also become infected during patient care. During the Marburg viral hemorrhagic fever event in Angola, transmission within health care settings played a major role on the amplification of the outbreak (WHO unpublished data). Nosocomial clustering, with transmission to HCWs, was a prominent feature of severe acute respiratory syndrome (SARS).[24, 25] Similarly, HCWs were infected during the influenza pandemics.[26]

Transmission occurs mostly via large droplets, direct contact with infectious material or through contact with inanimate objects contaminated by infectious material. Performance of high-risk patient care procedures and inadequate infection control practices contribute to the risk. Transmission of other viral (e.g. human immunodeficiency virus (HIV), hepatitis B) and bacterial illnesses including tuberculosis to HCWs is also well known.[27]

2.

The role of hand hygiene to reduce the burden of health care-associated infection

2.1 Transmission of health care-associated pathogens through hands

Transmission of health care-associated pathogens takes place through direct and indirect contact, droplets, air and a common vehicle. Transmission through contaminated HCWs' hands is the most common pattern in most settings and require five sequential steps: (i) organisms are present on the patient's skin, or have been shed onto inanimate objects immediately surrounding the patient; (ii) organisms must be transferred to the hands of HCWs; (iii) organisms must be capable of surviving for at least several minutes on HCWs' hands; (iv) handwashing or hand antisepsis by the HCWs must be inadequate or omitted entirely, or the agent used for hand hygiene inappropriate; and (v) the contaminated hand or hands of the caregiver must come into direct contact with another patient or with an inanimate object that will come into direct contact with the patient.[28]

Health care-associated pathogens can be recovered not only from infected or draining wounds but also from frequently colonized areas of normal, intact patient skin.[29-43] Because nearly 10^6 skin squames containing viable microorganisms are shed daily from normal skin,[44] it is not surprising that patient gowns, bed linen, bedside furniture and other objects in the immediate environment of the patient become contaminated with patient flora.[40-43, 45-51]

Many studies have documented that HCWs can contaminate their hands or gloves with pathogens such as Gram-negative bacilli, *S. aureus*, enterococci or *C. difficile* by performing "clean procedures" or touching intact areas of skin of hospitalized patients.[35, 36, 42, 47, 48, 52-55]

Following contact with patients and/or a contaminated environment, microorganisms can survive on hands for differing lengths of time (2–60 minutes). HCWs' hands become progressively colonized with commensal flora as well as with potential pathogens during patient care.[52, 53] In the absence of hand hygiene action, the longer the duration of care, the higher the degree of hand contamination.

Defective hand cleansing (e.g. use of an insufficient amount of product and/or an insufficient duration of hand hygiene action) leads to poor hand decontamination. Obviously, when HCWs fail to clean their hands during the sequence of care of a single patient and/or between patients' contact, microbial transfer is likely to occur. Contaminated HCWs' hands have been associated with endemic HCAIs[56, 57] and also with several HCAI outbreaks.[58-60]

These concepts are discussed more extensively in Parts I.5-7 of the *WHO Guidelines on Hand Hygiene in Health Care 2009.*

2.2 Hand hygiene compliance among HCWs

Hand hygiene is the primary measure proven to be effective in preventing HCAI and the spread of antimicrobial resistance. However, it has been shown that HCWs encounter difficulties in complying with hand hygiene indications at different levels.

Insufficient or very low compliance rates have been reported from both developed and developing countries. Adherence of HCWs to recommended hand hygiene procedures has been reported as variable, with mean baseline rates ranging from 5% to 89% and an overall average of 38.7%. Hand hygiene performance varies according to work intensity and several other factors; in observational studies conducted in hospitals, HCWs cleaned their hands on average from 5 to as many as 42 times per shift and 1.7–15.2 times per hour. In addition, the duration of hand cleansing episodes ranged on average from as short as 6.6 seconds to 30 seconds. The main factors that may determine poor hand hygiene include risk factors for non-adherence observed in epidemiological studies as well as reasons given by HCWs themselves for lack of adherence to hand hygiene recommendations (Table I.2.1).

These concepts are discussed more extensively in Part I.16 of the *WHO Guidelines on Hand Hygiene in Health Care 2009.*

Table I.2.1
Factors influencing adherence to recommended hand hygiene practices

A.	**Observed risk factors for poor adherence to recommended hand hygiene practices**
	Doctor status (rather than a nurse) Nursing assistant status (rather than a nurse) Physiotherapist Technician Male gender Working in intensive care Working in surgical care unit Working in emergency care Working in anaesthesiology Working during the week (vs. week-end) Wearing gowns/gloves Before contact with patient environment After contact with patient environment e.g. equipment Caring for patients aged less than 65 years old Caring for patients recovering from clean/clean-contaminated surgery in post-anaesthesia care unit Patient care in non-isolation room Duration of contact with patient (< or equal to 2 minutes) Interruption in patient-care activities Automated sink Activities with high risk of cross-transmission Understaffing/overcrowding High number of opportunities for hand hygiene per hour of patient care
B.	**Self-reported factors for poor adherence with hand hygiene**
	Handwashing agents cause irritations and dryness Sinks are inconveniently located/shortage of sinks Lack of soap, paper, towel Often too busy/insufficient time Patient needs take priority Hand hygiene interferes with HCW-patient relation Low risk of acquiring infection from patients Wearing of gloves/beliefs that glove use obviates the need for hand hygiene Lack of knowledge of guidelines/protocols Lack of knowledge, experience and education Lack of rewards/encouragement Lack of role model from colleagues or superiors Not thinking about it/forgetfulness Scepticism about the value of hand hygiene Disagreement with the recommendations Lack of scientific information of definitive impact of improved hand hygiene on HCAI
C.	**Additional perceived barriers to appropriate hand hygiene**
	Lack of active participation in hand hygiene promotion at individual or institutional level Lack of institutional priority for hand hygiene Lack of administrative sanction of non-compliers/rewarding of compliers Lack of institutional safety climate/culture of personal accountability of HCWs to perform hand hygiene

2.3 Strategies to improve hand hygiene compliance

Over the last 20 years, many studies have demonstrated that effective interventions exist to improve hand hygiene compliance among HCWs (Table I.2.2) although measurement of hand hygiene compliance has varied in terms of the definition of a hand hygiene opportunity and the assessment of hand hygiene by means of direct observation or consumption of hand hygiene products, making comparisons difficult.

Despite different methodologies, most studies used multimodal strategies, which included: HCWs' education, audits of hand hygiene practices and performance feedback, reminders, improvement of water and soap availability, use of automated sinks, and/or introduction of an alcohol-based handrub as well as improvement of the institutional safety climate with participation at the institutional, HCW and patient levels.

These concepts are discussed more extensively in Part I.20 of the *WHO Guidelines on Hand Hygiene in Health Care 2009.*

Table I.2.2
Hand hygiene adherence by HCWs before and after hand hygiene improvement interventions

Reference	Setting	Adherence baseline (%)	Adherence after intervention (%)	Intervention
Preston, Larson & Stamm[78]	ICU	16	30	More convenient sink locations
Mayer et al.[79]	ICU	63	92	Performance feedback
Donowitz[80]	PICU	31	30	Wearing overgown
Conly et al.[81]	MICU	14/28 *	73/81	Feedback, policy reviews, memo, posters
Graham[82]	ICU	32	45	Alcohol-based handrub introduced
Dubbert et al.[83]	ICU	81	92	In-service first, then group feedback
Lohr et al.[84]	Pedi OPDs	49	49	Signs, feedback, verbal reminders to doctors
Raju & Kobler[85]	Nursery & NICU	28	63	Feedback, dissemination of literature, results of environmental cultures
Wurtz, Moye & Jovanovic[86]	SICU	22	38	Automated handwashing machines available
Pelke et al.[87]	NICU	62	60	No gowning required
Berg, Hershow & Ramirez[88]	ICU	5	63	Lectures, feedback, demonstrations
Tibballs[89]	PICU	12/11	13/65	Overt observation, followed by feedback
Slaughter et al.[90]	MICU	41	58	Routine wearing of gowns and gloves
Dorsey, Cydulka Emerman[91]	Emerg Dept	54	64	Signs/distributed review paper
Larson et al.[92]	ICU	56	83	Lectures based on previous questionnaire on HCWs' beliefs, feedback, administrative support, automated handwashing machines
Avila-Aguero et al.[93]	Paediatric wards	52/49	74/69	Feedback, films, posters, brochures

ICU = intensive care unit; SICU = surgical ICU; MICU = medical ICU; MSICU = medical/surgical ICU;
PICU = paediatric ICU; NICU = neonatal ICU; Emerg = emergency; Oncol = oncology; CTICU = cardiothoracic ICU; PACU = post-anaesthesia care unit: OPD = outpatient department; NS = not stated.
* Percentage compliance before/after patient contact

Table I.2.2

Hand hygiene adherence by health-care workers before and after hand hygiene improvement interventions (Cont.)

Reference	Setting	Adherence baseline (%)	Adherence after intervention (%)	Intervention
Pittet et al.[75]	All wards	48	67	Posters, feedback, administrative support, alcohol handrub made available
Maury et al.[94]	MICU	42	61	Alcohol handrub made available
Bischoff et al.[95]	MICU CTICU	10/22 4/13	23/48 7/14	Education, feedback, alcohol gel made available
Muto, Sistrom & Farr[96]	Medical wards	60	52	Education, reminders, alcohol gel made available
Girard, Amazian & Fabry[97]	All wards	62	67	Education, alcohol gel made available
Hugonnet, Perneger & Pittet[98]	MICU/ SICU NICU	38	55	Posters, feedback, administrative support, alcohol rub made available
Harbarth et al.[99]	PICU / NICU	33	37	Posters, feedback, alcohol rub made available
Rosenthal et al.[100]	All wards 3 hospitals	17	58	Education, reminders, more sinks made available
Brown et al.[62]	NICU	44	48	Education, feedback, alcohol gel made available
Ng et al.[101]	NICU	40	53	Education, reminders
Maury et al.[102]	MICU	47.1	55.2	Announcement of observations (compared to covert observation at baseline)
das Neves et al.[103]	NICU	62.2	61.2	Posters, musical parodies on radio, slogans
Hayden et al.[104]	MICU	29	43	Wall dispensers, education, brochures, buttons, posters
Berhe, Edmond & Bearman[105]	MICU, SICU	31.8/50	39 / 50.3	Performance feedback
Eckmanns et al.[106]	ICU	29	45	Announcement of observations (compared to covert observation at baseline)
Santana et al.[107]	MSICU	18.3	20.8	Introduction of alcohol-based handrub dispensers, posters, stickers, education
Swoboda et al.[108]	IMCU	19.1	25.6	Voice prompts if failure to handrub
Trick et al.[64]	3 study hospitals, one control, hospital-wide	23/30/35/ 32	46/50/43/31	Increase in handrub availability, education, poster
Raskind et al.[109]	NICU	89	100	Education
Traore et al.[110]	MICU	32.1	41.2	Gel versus liquid handrub formulation
Pessoa-Silva et al.[111]	NICU	42	55	Posters, focus groups, education, questionnaires, review of care protocols
Rupp et al.[112]	ICU	38/37	69/68	Introduction of alcohol-based handrub gel
Ebnother et al.[113]	All wards	59	79	Multimodal intervention
Haas & Larson[114]	Emerg department	43	62	Introduction of wearable personal handrub dispensers
Venkatesh et al.[115]	Hematology unit	36.3	70.1	Voice prompts if failure to handrub
Duggan et al.[116]	Hospital-wide	84.5	89.4	Announced visit by auditor

ICU = intensive care unit; SICU = surgical ICU; MICU = medical ICU; MSICU = medical/surgical ICU; PICU = paediatric ICU; NICU = neonatal ICU; Emerg = emergency; Oncol = oncology; CTICU = cardiothoracic ICU; PACU = post-anaesthesia care unit: OPD = outpatient department; NS = not stated.

* Percentage compliance before/after patient contact

2.4 Impact of hand hygiene promotion on HCAI

Failure to perform appropriate hand hygiene is considered to be the leading cause of HCAI and the spread of multi-resistant organisms, and has been recognized as a significant contributor to outbreaks.

There is convincing evidence that improved hand hygiene through multimodal implementation strategies can reduce HCAI rates.[61] In addition, although not reporting infection rates several studies showed a sustained decrease of the incidence of multidrug-resistant bacterial isolates and patient colonization following the implementation of hand hygiene improvement strategies.[62-65]

At least 20 hospital-based studies of the impact of hand hygiene on the risk of HCAI have been published between 1977 and June 2008 (Table I.2.3). Despite study limitations, most reports showed a temporal relation between improved hand hygiene practices and reduced infection and cross-transmission rates.

Table I.2.3

Association between improved adherence with hand hygiene practice and health care-associated infection rates (1975– June 2008)

Year	Authors	Hospital setting	Major results	Duration of follow-up
1977	Casewell & Phillips[66]	Adult ICU	Significant reduction in the percentage of patients colonized or infected by Klebsiella spp.	2 years
1989	Conly et al.[81]	Adult ICU	Significant reduction in HCAI rates immediately after hand hygiene promotion (from 33% to 12% and from 33% to 10%, after two intervention periods 4 years apart, respectively)	6 years
1990	Simmons et al.[117]	Adult ICU	No impact on HCAI rates (no statistically significant improvement of hand hygiene adherence)	11 months
1992	Doebbeling et al.[118]	Adult ICUs	Significant difference between rates of HCAI using two different hand hygiene agents	8 months
1994	Webster et al.[74]	NICU	Elimination of MRSA when combined with multiple other infection control measures. Reduction of vancomycin use. Significant reduction of nosocomial bacteremia (from 2.6% to 1.1%) using triclosan compared to chlorhexidine for handwashing	9 months
1995	Zafar et al.[67]	Newborn nursery	Control of a MRSA outbreak using a triclosan preparation for handwashing, in addition to other infection control measures	3.5 years
2000	Larson et al.[119]	MICU/NICU	Significant (85%) relative reduction of the vancomycin-resistant enterococci (VRE) rate in the intervention hospital; statistically insignificant (44%) relative reduction in control hospital; no significant change in MRSA	8 months
2000	Pittet et al.[75,120]	Hospital-wide	Significant reduction in the annual overall prevalence of HCAI (42%) and MRSA cross-transmission rates (87%). Active surveillance cultures and contact precautions were implemented during same time period. A follow-up study showed continuous increase in handrub use, stable HCAI rates and cost savings derived from the strategy.	8 years
2003	Hilburn et al.[121]	Orthopaedic surgical unit	36% decrease of urinary tract infection and SSI rates (from 8.2% to 5.3%)	10 months
2004	MacDonald et al.[77]	Hospital-wide	Significant reduction in hospital-acquired MRSA cases (from 1.9% to 0.9%)	1 year
2004	Swoboda et al.[122]	Adult intermediate care unit	Reduction in HCAI rates (not statistically significant)	2.5 months
2004	Lam et al.[123]	NICU	Reduction (not statistically significant) in HCAI rates (from 11.3/1000 patient-days to 6.2/1000 patient-days)	6 months
2004	Won et al.[124]	NICU	Significant reduction in HCAI rates (from 15.1/1000 patient-days to 10.7/1000 patient-days), in particular of respiratory infections	2 years

Table I.2.3

Association between improved adherence with hand hygiene practice and health care-associated infection rates (1975– June 2008) (Cont.)

Year	Authors	Hospital setting	Major results	Duration of follow-up
2005	Zerr et al.[125]	Hospital-wide	Significant reduction in hospital-associated rotavirus infections	4 years
2005	Rosenthal et al.[126]	Adult ICUs	Significant reduction in HCAI rates (from 47.5/1000 patient-days to 27.9/1000 patient-days)	21 months
2005	Johnson et al.[127]	Hospital-wide	Significant reduction (57%) in MRSA bacteraemia	36 months
2007	Thi Anh Thu et al.[128]	Neurosurgery	Reduction (54%, NS) of overall incidence of SSI. Significant reduction (100%) of superficial SSI; significantly lower SSI incidence in intervention ward compared with control ward	2 years
2007	Pessoa-Silva et al.[111]	Neonatal unit	Reduction of overall HCAI rates (from 11 to 8.2 infections per 1000 patient-days) and 60% decrease of risk of HCAI in very low birth weight neonates (from 15.5 to 8.8 episodes/1000 patient-days)	27 months
2008	Rupp et al.[112]	ICU	No impact on device-associated infection and infections due to multidrug-resistant pathogens	2 years
2008	Grayson et al.[129]	1) 6 pilot hospitals	1) Significant reduction of MRSA bacteraemia (from 0.05/100 patient-discharges to 0.02/100 patient-discharges per month) and of clinical MRSA isolates	1) 2 years
		2) all public hospitals in Victoria (Australia)	2) Significant reduction of MRSA bacteraemia (from 0.03/100 patient-discharges to 0.01/100 patient-discharges per month) and of clinical MRSA isolates	2) 1 year

In addition, reinforcement of hand hygiene practices helps control epidemics in health-care facilities.[66, 67] Outbreak investigations have suggested an association between infection and understaffing or overcrowding that was consistently linked with poor adherence to hand hygiene.[68-70]

The beneficial effects of hand hygiene promotion on the risk of cross-transmission have been shown also in schools, day care centres and in the community setting.[71-73] Hand hygiene promotion improves child health and reduces upper respiratory pulmonary infection, diarrhoea and impetigo among children in the developing world.

These concepts are discussed more extensively in Part I.22 of the *WHO Guidelines on Hand Hygiene in Health Care 2009.*

2.5 Cost-effectiveness of hand hygiene promotion

The costs of hand hygiene promotion programmes include the costs of hand hygiene installations and products plus the costs associated with HCW time and the educational and promotional materials required by the programme.

To assess the cost savings of hand hygiene promotion programmes it is necessary to consider the potential savings that can be achieved by reducing the incidence of HCAIs. Several studies provided some quantitative estimates of the cost savings from hand hygiene promotion programmes.[74,75]

In a study conducted in a Russian neonatal ICU, the authors estimated that the added cost of one health care-associated BSI (US$ 1100) would cover 3265 patient-days of hand antiseptic use (US$ 0.34 per patient-day).[62] In another study it was estimated that cost savings achieved by reducing the incidence of *C. difficile*-associated disease and MRSA infections far exceeded the additional cost of using an alcohol-based handrub.[76] Similarly, MacDonald and colleagues reported that the use of an alcohol-based hand gel combined with education sessions and HCWs performance feedback reduced the incidence of MRSA infections and expenditures for teicoplanin (used to treat such infections).[77] For every UK£1 spent on alcohol-based gel, UK£9–20 were saved on teicoplanin expenditure.

Pittet and colleagues[75] estimated direct and indirect costs associated with a hand hygiene programme to be less than US$ 57 000 per year for a 2600-bed hospital, an average of US$ 1.42 per patient admitted. The authors concluded that the hand hygiene programme was cost-saving if less than 1% of the reduction in HCAIs observed was attributable to improved hand hygiene practices. An economic analysis of the "clean**your**hands" hand hygiene promotional campaign conducted in England and Wales concluded that the programme would be cost beneficial if HCAI rates were decreased by as little as 0.1%.

These concepts are discussed more extensively in Part III.3 of the *WHO Guidelines on Hand Hygiene in Health Care 2009.*

PART II.

CONSENSUS RECOMMENDATIONS

Consensus recommendations and ranking system

Recommendations were formulated based on evidence described in the various sections of the Guidelines and expert consensus. Evidence and recommendations were graded using a system adapted from the one developed by the Healthcare Infection Control Practices Advisory Committee (HICPAC) of the Centers for Disease Control and Prevention (CDC), Atlanta, Georgia, USA (Table II.1).

Table II.1
Ranking system used to grade the Guidelines' recommendations

Category	Criteria
IA	Strongly recommended for implementation and strongly supported by well-designed experimental, clinical or epidemiological studies
IB	Strongly recommended for implementation and supported by some experimental, clinical or epidemiological studies and a strong theoretical rationale
IC	Required for implementation as mandated by federal and/or state regulation or standard
II	Suggested for implementation and supported by suggestive clinical or epidemiological studies or a theoretical rationale or the consensus of a panel of experts

1. 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).[130-140]

B. If exposure to potential spore-forming pathogens is strongly suspected or proven, including outbreaks of *C. difficile*, hand washing with soap and water is the preferred means (IB).[141-144]

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).[75, 82, 94, 95, 145-149] If alcohol-based handrub is not obtainable, wash hands with soap and water (IB).[75, 150, 151]

D. Perform hand hygiene:
   a) before and after touching the patient (IB);[35, 47, 51, 53-55, 66, 152-154]
   b) before handling an invasive device for patient care, regardless of whether or not gloves are used (IB); [155]
   c) after contact with body fluids or excretions, mucous membranes, non-intact skin, or wound dressings (IA);[54, 130, 153, 156]
   d) if moving from a contaminated body site to another body site during care of the same patient (IB);[35, 53-55, 156]
   e) after contact with inanimate surfaces and objects (including medical equipment) in the immediate vicinity of the patient (IB);[48, 49, 51, 53-55, 156-158]
   f) after removing sterile (II) or non-sterile gloves (IB).[53, 159-162]

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).[133-136]

F. Soap and alcohol-based handrub should not be used concomitantly (II).[163, 164]

Figure II.1
How to handrub

Hand Hygiene Technique with Alcohol-Based Formulation

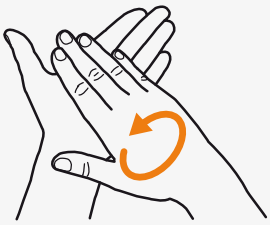
Duration of the entire procedure: 20-30 seconds

1a

1b

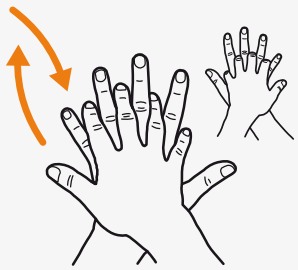
Apply a palmful of the product in a cupped hand, covering all surfaces;

2



Rub hands palm to palm;

3



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

4

Palm to palm with fingers interlaced;

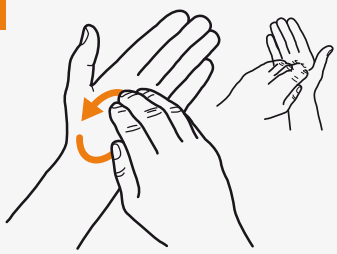
5

Backs of fingers to opposing palms with fingers interlocked;

6

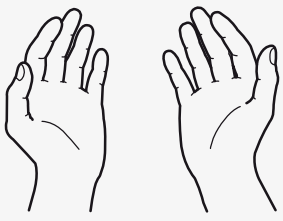
Rotational rubbing of left thumb clasped in right palm and vice versa;

7



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

8



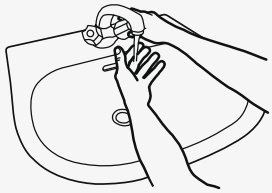
Once dry, your hands are safe.

Figure II.2
How to handwash

Hand Hygiene Technique with Soap and Water

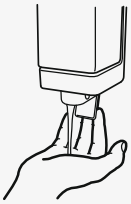
Duration of the entire procedure: 40-60 seconds

0



Wet hands with water;

1

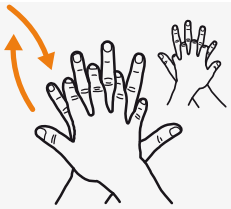


Apply enough soap to cover all hand surfaces;

2

Rub hands palm to palm;

3



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

4

Palm to palm with fingers interlaced;

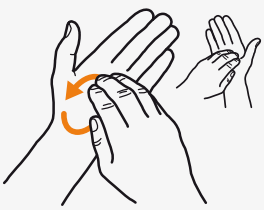
5

Backs of fingers to opposing palms with fingers interlocked;

6

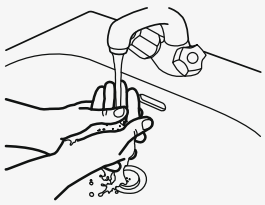
Rotational rubbing of left thumb clasped in right palm and vice versa;

7



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

8

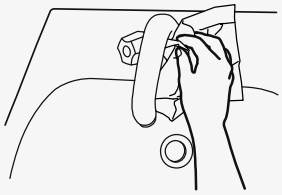


Rinse hands with water;

9

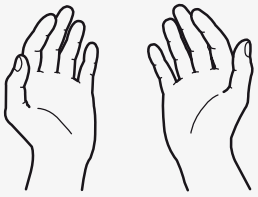
Dry hands thoroughly with a single use towel;

10



Use towel to turn off faucet;

11



Your hands are now safe.

2. Hand hygiene technique

A. Apply a palmful of alcohol-based handrub and cover all surfaces of the hands. Rub hands until dry (IB).[165, 166] The technique for handrubbing is illustrated in Figure II.1.

B. When washing hands with soap and water, wet hands with water and apply the amount of product necessary to cover all surfaces. Rinse hands with water and dry thoroughly with a single-use towel. Use clean, running water whenever possible. Avoid using hot water, as repeated exposure to hot water may increase the risk of dermatitis (IB).[167-169] Use a towel to turn off tap/faucet (IB).[170-174] Dry hands thoroughly using a method that does not recontaminate hands. Make sure towels are not used multiple times or by multiple people (IB).[175-178] The technique for handwashing is illustrated in Figure II.2.

C. Liquid, bar, leaf or powdered forms of soap are acceptable. When bar soap is used, small bars of soap in racks that facilitate drainage should be used to allow the bars to dry (II).[179-185]

3. Recommendations for surgical hand preparation

A. Remove rings, wrist-watch, and bracelets before beginning surgical hand preparation (II).[186-190] Artificial nails are prohibited (IB).[191-195]

B. Sinks should be designed to reduce the risk of splashes (II).[196, 197]

C. If hands are visibly soiled, wash hands with plain soap before surgical hand preparation (II). Remove debris from underneath fingernails using a nail cleaner, preferably under running water (II).[198]

D. Brushes are not recommended for surgical hand preparation (IB).[199-205]

E. Surgical hand antisepsis should be performed using either a suitable antimicrobial soap or suitable alcohol-based handrub, preferably with a product ensuring sustained activity, before donning sterile gloves (IB).[58, 204, 206-211]

F. If quality of water is not assured in the operating theatre, surgical hand antisepsis using an alcohol-based handrub is recommended before donning sterile gloves when performing surgical procedures (II).[204, 206, 208, 212]

G. When performing surgical hand antisepsis using an antimicrobial soap, scrub hands and forearms for the length of time recommended by the manufacturer, typically 2–5 minutes. Long scrub times (e.g. 10 minutes) are not necessary (IB).[200, 211, 213-219]

H. When using an alcohol-based surgical handrub product with sustained activity, follow the manufacturer's instructions for application times. Apply the product to dry hands only (IB).[220, 221] Do not combine surgical hand scrub and surgical handrub with alcohol-based products sequentially (II).[163]

I. When using an alcohol-based handrub, use sufficient product to keep hands and forearms wet with the handrub throughout the surgical hand preparation procedure (IB).[222-224] The technique for surgical hand preparation using alcohol-based handrubs is illustrated in Figure II.3.

J. After application of the alcohol-based handrub as recommended, allow hands and forearms to dry thoroughly before donning sterile gloves (IB).[204, 208]

4.
Selection and handling of hand hygiene agents

A. Provide HCWs with efficacious hand hygiene products that have low irritancy potential (IB).[146, 171, 225-231]

B. To maximize acceptance of hand hygiene products by HCWs, solicit their input regarding the skin tolerance, feel, and fragrance of any products under consideration (IB).[79, 145, 146, 228, 232-236] Comparative evaluations may greatly help in this process.[227, 232, 233, 237]

C. When selecting hand hygiene products:
   a. determine any known interaction between products used to clean hands, skin care products and the types of glove used in the institution (II);[238, 239]
   b. solicit information from manufacturers about the risk of product contamination (IB);[57, 240, 241]
   c. ensure that dispensers are accessible at the point of care (IB);[95, 242]
   d. ensure that dispensers function adequately and reliably and deliver an appropriate volume of the product (II);[75, 243]
   e. ensure that the dispenser system for alcohol-based handrubs is approved for flammable materials (IC);
   f. solicit and evaluate information from manufacturers regarding any effect that hand lotions, creams or alcohol-based handrubs may have on the effects of antimicrobial soaps being used in the institution (IB);[238, 244, 245]
   g. cost comparisons should only be made for products that meet requirements for efficacy, skin tolerance, and acceptability (II).[236, 246]

D. Do not add soap (IA) or alcohol-based formulations (II) to a partially empty soap dispenser. If soap dispensers are reused, follow recommended procedures for cleansing.[247, 248]

5.
Skin care

A. Include information regarding hand-care practices designed to reduce the risk of irritant contact dermatitis and other skin damage in education programmes for HCWs (IB).[249, 250]

B. Provide alternative hand hygiene products for HCWs with confirmed allergies or adverse reactions to standard products used in the health-care setting (II).

C. Provide HCWs with hand lotions or creams to minimize the occurrence of irritant contact dermatitis associated with hand antisepsis or handwashing (IA).[228, 229, 250-253]

D. When alcohol-based handrub is available in the health-care facility for hygienic hand antisepsis, the use of antimicrobial soap is not recommended (II).

E. Soap and alcohol-based handrub should not be used concomitantly (II).[163]

6. Use of gloves

A. The use of gloves does not replace the need for hand hygiene by either handrubbing or handwashing (IB).[53, 159-161, 254-256]

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).[257-259]

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).[51, 53, 159-161, 260, 261]

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).[52, 159, 160]

E. The reuse of gloves is not recommended (IB).[262] In the case of glove reuse, implement the safest reprocessing method (II).[263]

The techniques for donning and removing non-sterile and sterile gloves are illustrated in Figures II.4 and II.5

7. Other aspects of hand hygiene

A. Do not wear artificial fingernails or extenders when having direct contact with patients (IA).[56, 191, 195, 264-266]

B. Keep natural nails short (tips less than 0.5 cm long or approximately ¼ inch) (II).[264]

8. Educational and motivational programmes for HCWs

A. In hand hygiene promotion programmes for HCWs, focus specifically on factors currently found to have a significant influence on behaviour and not solely on the type of hand hygiene products. The strategy should be multifaceted and multimodal and include education and senior executive support for implementation (IA).[64, 75, 89, 100, 111, 113, 119, 166, 267-277]

B. Educate HCWs about the type of patient-care activities that can result in hand contamination and about the advantages and disadvantages of various methods used to clean their hands (II).[75, 81, 83, 85, 111, 125, 126, 166, 276-278]

C. Monitor HCWs' adherence to recommended hand hygiene practices and provide them with performance feedback (IA).[62, 75, 79, 81, 83, 85, 89, 99, 100, 111, 125, 276]

D. Encourage partnerships between patients, their families and HCWs to promote hand hygiene in health-care settings (II).[279-281]

9. Governmental and institutional responsibilities

9.1 For health-care administrators

A. It is essential that administrators ensure that conditions are conducive to the promotion of a multifaceted, multimodal hand hygiene strategy and an approach that promotes a patient safety culture by implementation of points B–I below.

B. Provide HCWs with access to a safe, continuous water supply at all outlets and access to the necessary facilities to perform handwashing (IB).[276, 282, 283]

C. Provide HCWs with a readily accessible alcohol-based handrub at the point of patient care (IA).[75, 82, 94, 95, 284-288]

D. Make improved hand hygiene adherence (compliance) an institutional priority and provide appropriate leadership, administrative support, financial resources and support for hand hygiene and other infection prevention and control activities (IB).[75, 111, 113, 119, 289]

E. Ensure that HCWs have dedicated time for infection control training, including sessions on hand hygiene (II).[270, 290]

F. Implement a multidisciplinary, multifaceted and multimodal programme designed to improve adherence of HCWs to recommended hand hygiene practices (IB).[75, 119, 129]

G. With regard to hand hygiene, ensure that the water supply is physically separated from drainage and sewerage within the health-care setting and provide routine system monitoring and management (IB).[291]

H. Provide strong leadership and support for hand hygiene and other infection prevention and control activities (II).[119]

I. Alcohol-based handrub production and storage must adhere to the national safety guidelines and local legal requirements (II).

9.2 For national governments

A. Make improved hand hygiene adherence a national priority and consider provision of a funded, coordinated implementation programme while ensuring monitoring and long-term sustainability (II).[292-295]

B. Support strengthening of infection control capacities within health-care settings (II).[290, 296, 297]

C. Promote hand hygiene at the community level to strengthen both self-protection and the protection of others (II).[71, 138-140, 298-300]

D. Encourage health-care settings to use hand hygiene as a quality indicator (Australia, Belgium, France, Scotland, USA) (II).[278, 301]

Figure II.3

Surgical hand preparation technique with an alcohol-based hand rub formulation

The handrubbing technique for surgical hand preparation must be performed on perfectly clean, dry hands.
On arrival in the operating theatre and after having donned theatre clothing (cap/hat/bonnet and mask), hands must be washed with soap and water.
After the operation when removing gloves, hands must be rubbed with an alcohol-based formulation or washed with soap and water if any residual talc or biological fluids are present (e.g. the glove is punctured).

Surgical procedures may be carried out one after the other without the need for handwashing, provided that the handrubbing technique for surgical hand preparation is followed (Images 1 to 17).

1

Put approximately 5ml (3 doses) of alcohol-based handrub in the palm of your left hand, using the elbow of your other arm to operate the dispenser

2

Dip the fingertips of your right hand in the handrub to decontaminate under the nails (5 seconds)

3

Images 3–7: Smear the handrub on the right forearm up to the elbow. Ensure that the whole skin area is covered by using circular movements around the forearm until the handrub has fully evaporated (10-15 seconds)

4

See legend for Image 3

5

See legend for Image 3

6

See legend for Image 3

7

See legend for Image 3

8

Put approximately 5ml (3 doses) of alcohol-based handrub in the palm of your right hand, using the elbow of your other arm to operate the dispenser

9

Dip the fingertips of your left hand in the handrub to decontaminate under the nails (5 seconds)

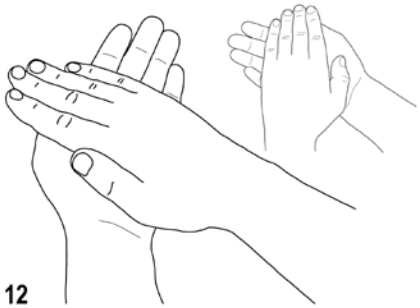
Figure II.3
Surgical hand preparation technique with an alcohol-based hand rub formulation (Cont.)

10

Smear the handrub on the left forearm up to the elbow. Ensure that the whole skin area is covered by using circular movements around the forearm until the handrub has fully evaporated (10-15 seconds)

11

Put approximately 5ml (3 doses) of alcohol-based handrub in the palm of your left hand, using the elbow of your other arm to operate the distributor. Rub both hands at the same time up to the wrists, and ensure that all the steps re-presented in Images 12-17 are followed (20-30 seconds)



12

Cover the whole surface of the hands up to the wrist with alcohol-based han-drub, rubbing palm against palm with a rotating movement

13

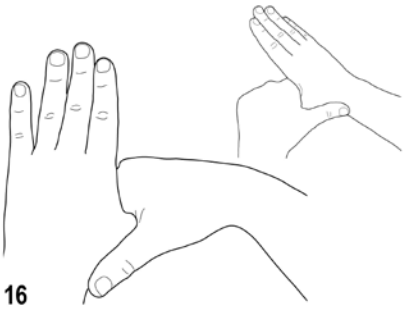
Rub the back of the left hand, including the wrist, moving the right palm back and forth, and vice-versa

14

Rub palm against palm back and forth with fingers interlinked

15

Rub the back of the fingers by holding them in the palm of the other hand with a sideways back and forth movement



16

Rub the thumb of the left hand by rota-ting it in the clasped palm of the right hand and vice versa

17

When the hands are dry, sterile surgical clothing and gloves can be donned

Repeat the above-illustrated sequence (average duration, 60 sec) according to the number of times corresponding to the total duration recommended by the manufacturer for surgical hand preparation with an alcohol-based handrub.

Figure II.4
How to don and remove non-sterile gloves

When the hand hygiene indication occurs before a contact requiring glove use, perform hand hygiene by rubbing with an alcohol-based handrub or by washing with soap and water.

I. HOW TO DON GLOVES:

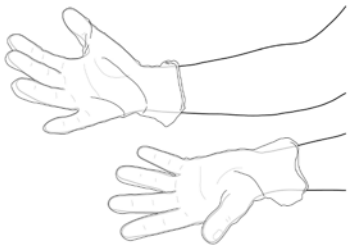
1. Take out a glove from its original box

2. Touch only a restricted surface of the glove corresponding to the wrist (at the top edge of the cuff)

3. Don the first glove

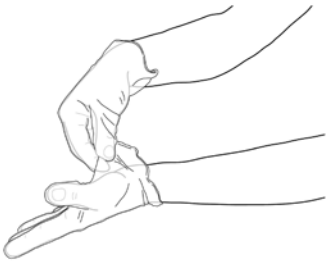
4. Take the second glove with the bare hand and touch only a restricted surface of glove corresponding to the wrist

5. To avoid touching the skin of the forearm with the gloved hand, turn the external surface of the glove to be donned on the folded fingers of the gloved hand, thus permitting to glove the second hand

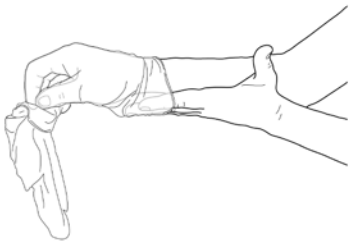


6. Once gloved, hands should not touch anything else that is not defined by indications and conditions for glove use

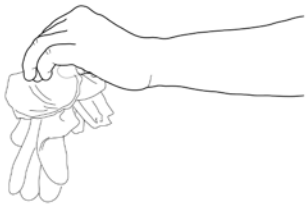
II. HOW TO REMOVE GLOVES:



1. Pinch one glove at the wrist level to remove it, without touching the skin of the forearm, and peel away from the hand, thus allowing the glove to turn inside out



2. Hold the removed glove in the gloved hand and slide the fingers of the unglo-ved hand inside between the glove and the wrist. Remove the second glove by rolling it down the hand and fold into the first glove



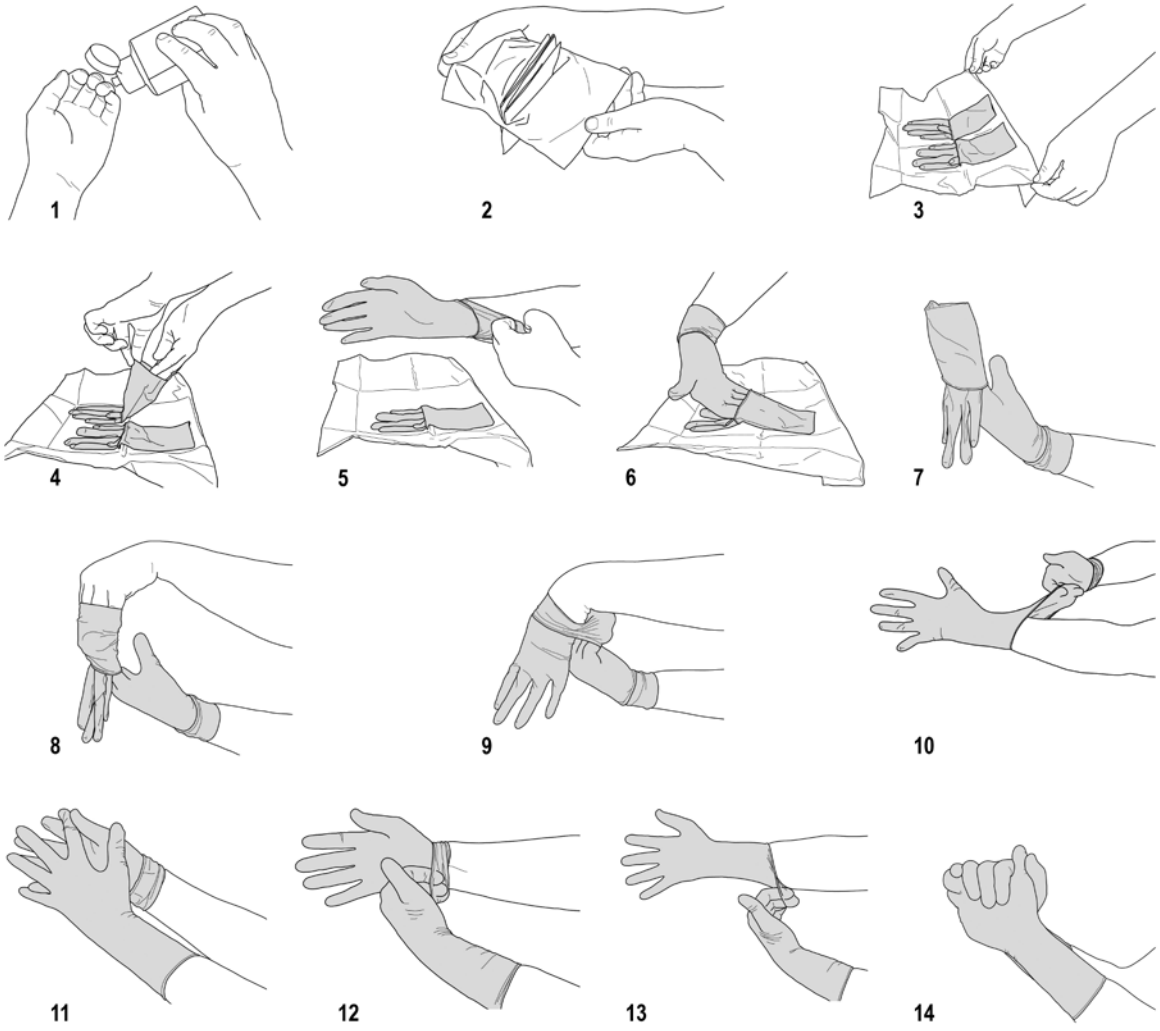
3. Discard the removed gloves

4. Then, perform hand hygiene by rubbing with an alcohol-based handrub or by washing with soap and water

Figure II.5
How to don and remove sterile gloves

The purpose of this technique is to ensure maximum asepsis for the patient and to protect the health-care worker from the patient's body fluid(s). To achieve this goal, the skin of the health-care worker remains exclusively in contact with the inner surface of the glove and has no contact with the outer surface. Any error in the performance of this technique leads to a lack of asepsis requiring a change of gloves.

I. HOW TO DON STERILE GLOVES



1. Perform hand hygiene before an "aseptic procedure" by handrubbing or hand washing.
2. Check the package for integrity. Open the first non-sterile packaging by peeling it completely off the heat seal to expose the second sterile wrapper, but without touching it.
3. Place the second sterile package on a clean, dry surface without touching the surface. Open the package and fold it towards the bottom so as to unfold the paper and keep it open.
4. Using the thumb and index finger of one hand, carefully grasp the folded cuff edge of the glove.
5. Slip the other hand into the glove in a single movement, keeping the folded cuff at the wrist level.

6-7. Pick up the second glove by sliding the fingers of the gloved hand underneath the cuff of the glove.

8-10. In a single movement, slip the second glove on to the ungloved hand while avoiding any contact/resting of the gloved hand on surfaces other than the glove to be donned (contact/resting constitutes a lack of asepsis and requires a change of glove).

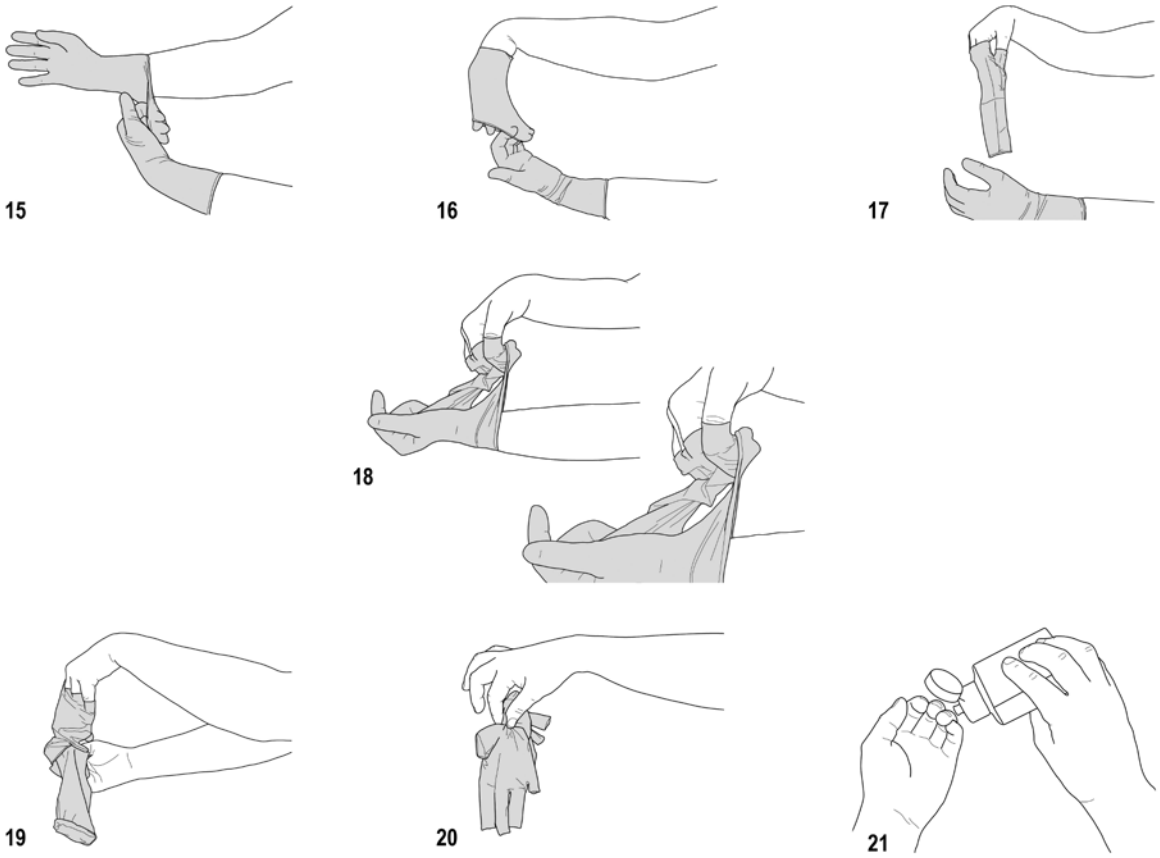
11. If necessary, after donning both gloves, adjust the fingers and interdigital spaces until the gloves fit comfortably.

12-13. Unfold the cuff of the first gloved hand by gently slipping the fingers of the other hand inside the fold, making sure to avoid any contact with a surface other than the outer surface of the glove (lack of asepsis requiring a change of gloves).

14. The hands are gloved and must touch exclusively sterile devices or the previously-disinfected patient's body area.

Figure II.5
How to don and remove sterile gloves (Cont.)

II. HOW TO REMOVE STERILE GLOVES



15-17. Remove the first glove by peeling it back with the fingers of the opposite hand. Remove the glove by rolling it inside out to the second finger joints (do not remove completely).
18. Remove the other glove by turning its outer edge on the fingers of the partially ungloved hand.
19. Remove the glove by turning it inside out entirely to ensure that the skin of the health-care worker is always and exclusively in contact with the inner surface of the glove.
20. Discard gloves.
21. Perform hand hygiene after glove removal according to the recommended indication.

NB: Donning surgical sterile gloves at the time of a surgical intervention follows the same sequences except that:

- it is preceeded by a surgical hand preparation;
- donning gloves is performed after putting on the sterile surgical gown;
- the opening of the first packaging (non-sterile) is done by an assistant;
- the second packaging (sterile) is placed on a sterile surface other than that used for the intervention;
- gloves should cover the wrists of the sterile gown.

PART III.

GUIDELINE IMPLEMENTATION

1.
WHO Implementation strategy and tools

The *WHO Multimodal Hand Hygiene Improvement Strategy* and a wide range of tools were developed in parallel to the *Guidelines* to translate recommendations into practice at the bedside (see Part I.21.1 of the *Guidelines*).

The implementation strategy was informed by the literature on implementation science, behavioural change, spread methodology, diffusion of innovation and impact evaluation. Together with the *Guidelines*, the strategy and tools were tested in eight pilot sites in the six WHO regions in and many other settings worldwide (see Part I.21.5 of the *Guidelines*). The multimodal strategy consists of five components to be implemented in parallel; the implementation strategy itself is designed to be adaptable without jeopardizing its fidelity and is intended therefore for use not only in sites where hand hygiene promotion has to be initiated but also within facilities where there is existing action on hand hygiene.

The five essential elements are (see Part II of the *Guide to Implementation* (http://www.who.int/gpsc/5may/Guide_to_Implementation.pdf):

1. System Change: ensuring that the necessary infrastructure is in place to allow HCWs to practice hand hygiene. This includes two essential elements:
   - access to a safe, continuous water supply as well as to soap and towels;
   - readily-accessible alcohol-based handrub at the point of care.
2. Training / Education: providing regular training on the importance of hand hygiene, based on the "My five moments for hand hygiene" approach and on the correct procedures for handrubbing and handwashing to all HCWs.
3. Evaluation and feedback: monitoring hand hygiene practices and infrastructure, along with related perceptions and knowledge among HCWs, while providing performance and results feedback to the staff.
4. Reminders in the workplace: prompting and reminding HCWs about the importance of hand hygiene and about the appropriate indications and procedures for performing it.
5. Institutional safety climate: creating an environment and the perceptions that facilitate awareness-raising about patient safety issues while guaranteeing consideration of hand hygiene improvement as a high priority at all levels, including:
   - active participation at both the institutional and individual levels;
   - awareness of individual and institutional capacity to change and improve (self-efficacy); and
   - partnership with patients and patient organizations (depending on cultural issues and the resources available; see Part V of the *Guidelines*).

Central to the recommendations' implementation at the point of care is the innovative approach of the "My five moments for hand hygiene" (see Part 21.4 of the *Guidelines* and Part II.1 of the *Hand Hygiene Technical Reference Manual* http://www.who.int/gpsc/5may/tools/training_education/en/index.html)[302] (Figure III.1). Considering the scientific evidence, this concept merges the hand hygiene indications recommended by the *WHO Guidelines on Hand Hygiene in Health Care* (see Part II of the *Guidelines*) into five moments when hand hygiene is required. This approach proposes a unified vision for HCWs, trainers and observers to minimize inter-individual variation and enable a global increase in adherence to effective hand hygiene practices.

According to this concept, HCWs are requested to clean their hands (1) before touching a patient, (2) before clean/aseptic procedures, (3) after body fluid exposure/risk, (4) after touching a patient and (5) after touching patient surroundings.

This concept has been integrated into the various WHO tools to educate, monitor, summarize, feedback, and promote hand hygiene in health-care settings.

Data and lessons learned from testing have been of paramount importance in revising the content of the *Guidelines Advanced Draft.* A significant increase in hand hygiene compliance was observed across all pilot sites.

In addition, an improvement was observed in HCWs' perception of the importance of HCAI and its prevention, as well as their knowledge about hand transmission and hand hygiene practices. Furthermore, a substantial system change was achieved with an improvement in the facilities and equipment available for hand hygiene, including the local production of the WHO-recommended alcohol-based formulations in settings where these products were not available commercially (see Part I.12.5 and I.21.5 of the *Guidelines*). According to the main results of testing, the strategy and its core components were confirmed as a

very successful model, key to hand hygiene improvement in different settings and suitable to be used also for other infection control interventions. The validity of the *Guidelines* recommendations was also fully confirmed. Furthermore, when appropriate, comments from users and lessons learned enabled modification and improvement of the suite of implementation tools.

The final version of the *WHO Multimodal Hand Hygiene Improvement Strategy* and the *Implementation Toolkit* are now available at http://www.who.int/gpsc/5may/tools/en/index.html.

The *Toolkit* includes a range of tools corresponding to each strategy component, to facilitate its practical implementation (see Appendix 3). A *Guide to Implementation* (http://www.who.int/gpsc/5may/Guide_to_Implementation.pdf) was developed to assist health-care facilities to implement improvements in hand hygiene in accordance with the *WHO Guidelines on Hand Hygiene in Health Care*. In its Part II the *Guide* illustrates the strategy components into details and describes the objectives and utility of each tool; in Part III it indicates the resources necessary to implementation, provides a template action plan, and proposes a step-wise approach for practical implementation at the health-care setting level.

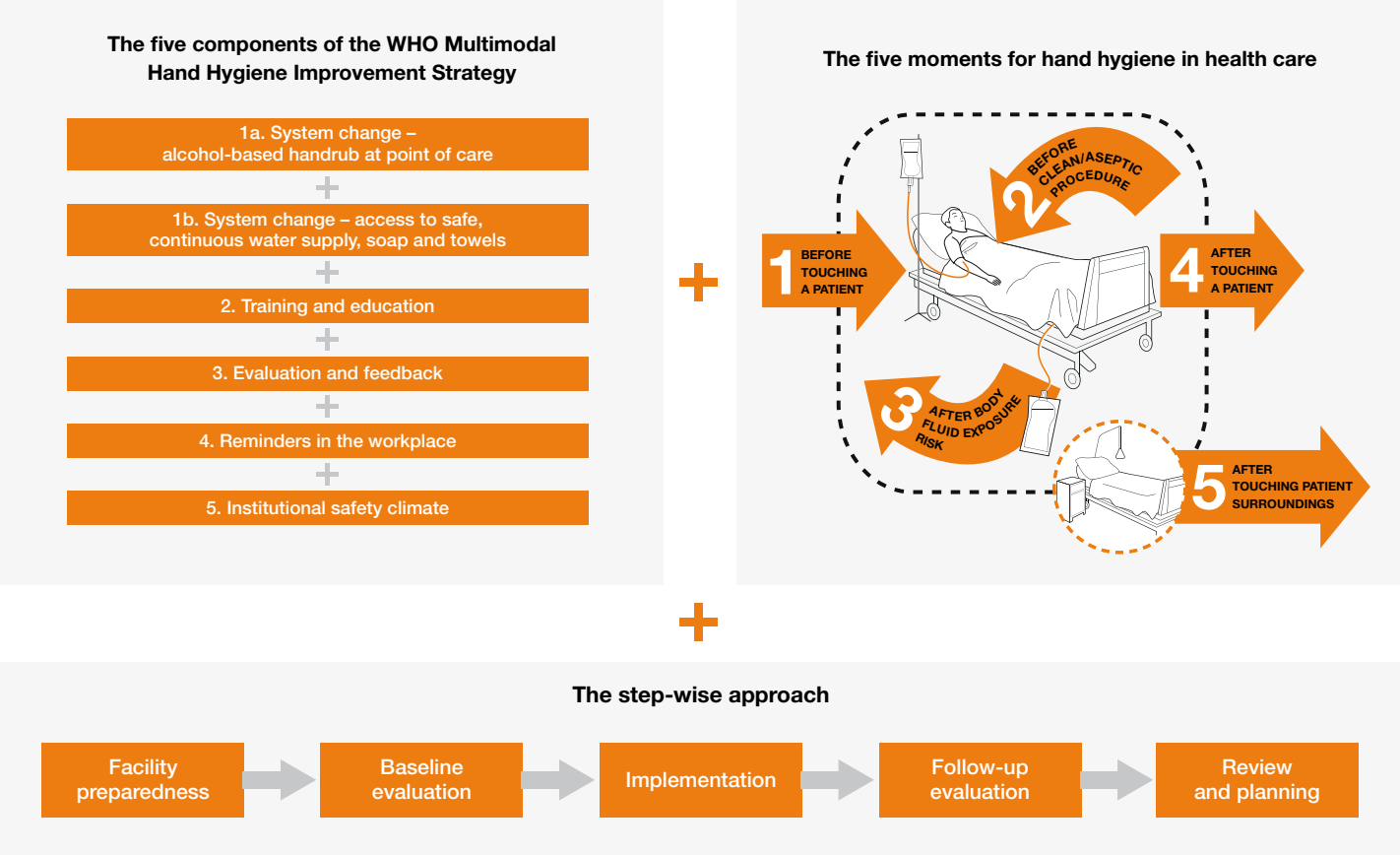
Especially in a facility where a hand hygiene improvement programme has to be initiated from scratch, the following are essential steps (see Part III of the *Guide to Implementation*):

Step 1: Facility preparedness – readiness for action
Step 2: Baseline evaluation – establishing the current situation
Step 3: Implementation – introducing the improvement activities
Step 4: Follow-up evaluation – evaluating the implementation impact
Step 5: Action planning and review cycle – developing a plan for the next 5 years (minimum)

The *WHO Multimodal Hand Hygiene Improvement Strategy*, the "My five moments for hand hygiene" and the five-step approaches are depicted in Figure III.1.

These concepts are discussed more extensively in Part I.21 of the *WHO Guidelines on Hand Hygiene in Health Care 2009.*

Figure III.1



2. Infrastructures required for optimal hand hygiene

An important cause of poor compliance may be the lack of user-friendly hand hygiene equipment as well as poor logistics leading to limited procurement and replenishment of consumables.

While not all settings have a continuous water supply, tap water (ideally drinkable), is preferable for handwashing (see Part I.11.1 of the *Guidelines*). In settings where this is not possible, water "flowing" from a pre-filled container with a tap is preferable to still-standing water in a basin. Where running water is available, the possibility of accessing it without the need to touch the tap with soiled hands is preferable. Sensor-activated manual or elbow- or foot-activated taps could be considered the optimal standard within health-care settings. Their availability is not considered among the highest priorities, however, particularly in settings with limited resources. It should be noted that recommendations for their use are not based on evidence.

Sinks should be located the closest possible to the point of care and, according to the WHO minimum requirements, the overall sink-to-patient bed ratio should be of 1:10.[303]

Placement of hand hygiene products (soap and handrubs) should be aligned with promoting hand hygiene in accordance with the concept of the "My five moments for hand hygiene".

In many settings the different forms of dispensers, such as wall-mounted and those for use at the point of care, should be used in combination to achieve maximum compliance. Wall-mounted soap dispensing systems are recommended to be located at every sink in patient and examination rooms when affordable. Wall-mounted handrub dispensers should be positioned in locations that facilitate hand hygiene at the point of care. Dispersion of the handrub should be possible in a "non-touch" fashion to avoid any touching of the dispenser with contaminated hands, e.g. "elbow-dispensers" or pumps that can be used with the wrist.[304] In general, the design and function of the dispensers that will ultimately be installed in a health-care setting should be evaluated, because some systems were shown to malfunction continuously despite efforts to rectify the problem.[243] A variation of wall-mounted dispensers are holders and frames that allow placement of a container that is equipped with a pump. The pump is screwed onto the container in place of the lid. It is likely that this dispensing system is associated with the lowest cost. Containers with a pump can also be placed easily on any horizontal surface, e.g. cart/trolley or night stand/bedside table.

Individual, portable dispensers (e.g. pocket bottles) are ideal, if combined with wall-mounted dispensing systems, to increase point-of-care access and enable use in units where wall-mounted dispensers should be avoided or cannot be installed.

Because many of these systems are used as disposables, environmental considerations should also be taken into account.

These concepts are discussed more extensively in Part I.23.5 of the *WHO Guidelines on Hand Hygiene in Health Care 2009.*

3. Other issues related to hand hygiene, in particular the use of an alcohol-based handrub

3.1 Methods and selection of products to perform hand hygiene

According to recommendation IB, when an alcohol-based handrub is available it should be used as the preferred means for routine hand hygiene in health care.

Alcohol-based handrubs have the following immediate advantages (see Part I.11.3 of the *Guidelines*):

- elimination of the majority of germs (including viruses);
- the short time required for action (20 to 30 seconds);
- availability of the product at the point of care;
- better skin tolerability (see Part I.14 of the *Guidelines*);
- no need for any particular infrastructure (clean water supply network, washbasin, soap, hand towel).

Hands need to be washed with soap and water when they are visibly dirty or soiled with blood or other body fluids, when exposure to potential spore-forming organisms is strongly suspected or proven or after using the lavatory. (recommendations 1A and 1B)

To comply with routine hand hygiene recommendations, HCWs should ideally perform hand hygiene where and when care is provided, which means at the point of care and at the moments indicated (see Part III.1 of this Summary and Figure III.1), and following the recommended technique and time.

Table III.1

Antimicrobial activity and summary of properties of antiseptics used in hand hygiene

Antiseptics	Gram-positive bacteria	Gram-negative bacteria	Viruses enveloped	Viruses non-enveloped	Myco-bacteria	Fungi	Spores
Alcohols	+++	+++	+++	++	+++	+++	-
Chloroxylenol	+++	+	+	±	+	+	-
Chlorhexidine	+++	++	++	+	+	+	-
Hexachlorophene[a]	+++	+	?	?	+	+	-
Iodophors	+++	+++	++	++	++	++	±[b]
Triclosan[d]	+++	++	?	?	±	±[e]	-
Quaternary ammonium compounds[c]	++	+	+	?	±	±	-

Antiseptics	Typical conc. in %	Speed of action	Residual activity	Use
Alcohols	60-80 %	Fast	No	HR
Chloroxylenol	0.5-4 %	Slow	Contradictory	HW
Chlorhexidine	0.5-4%	Intermediate	Yes	HR,HW
Hexachlorophene[a]	3%	Slow	Yes	HW, but not recommended
Iodophors	0.5-10 %)	Intermediate	Contradictory	HW
Triclosan[d]	(0.1-2%)	Intermediate	Yes	HW; seldom
Quaternary ammonium compounds[c]		Slow	No	HR,HW; Seldom; +alcohols

Good = +++, moderate = ++, poor = +, variable = ±, none = –
HR: handrubbing; HW: handwashing
*Activity varies with concentration.
[a] Bacteriostatic.
[b] In concentrations used in antiseptics, iodophors are not sporicidal.
[c] Bacteriostatic, fungistatic, microbicidal at high concentrations.
[d] Mostly bacteriostatic.
[e] Activity against *Candida* spp., but little activity against filementous fungi.
Source: adapted with permission from Pittet, Allegranzi & Sax, 2007.[362]

This often calls for the use of an alcohol-based product.

Hand hygiene can be performed by using either plain soap or products including antiseptic agents. The latter have the property of inactivating microorganisms or inhibiting their growth with different action spectra; examples include alcohols, chlorhexidine gluconate, chlorine derivatives, iodine, chloroxylenol, quaternary ammonium compounds, and triclosan (Table III.1).

Although comparing the results of laboratory studies dealing with the in vivo efficacy of plain soap, antimicrobial soaps, and alcohol-based handrubs may be problematic for various reasons, it has been shown that alcohol-based rubs are more efficacious than antiseptic detergents and that the latter are usually more efficacious than plain soap. However, various studies conducted in the community setting indicate that medicated and plain soaps are roughly equal in preventing the spread of microorganisms and reducing childhood gastrointestinal and upper respiratory tract infections or impetigo.[72, 139, 305] In health-care settings where alcohol-based handrubs are available, plain soap should be provided to perform hand washing when indicated.

Alcohol solutions containing 60–80% alcohol are usually considered to have efficacious microbicidal activity, with concentrations higher than 90% being less potent.[305,306]

Alcohol-based handrubs with optimal antimicrobial efficacy usually contain 75 to 85% ethanol, isopropanol, or n-propanol, or a combination of these products. The WHO-recommended formulations contain either 75% v/v isopropanol, or 80% v/v ethanol.

These were identified, tested and validated for local production at facility level. According to the available data, local production

is feasible and the products are effective for hand antisepsis, have good skin tolerability along with HCW acceptance, and are low in cost (see Part I.12 of the *Guidelines* and the *Guide to Local Production: WHO-recommended Handrub Formulations* http://www.who.int/gpsc/5may/tools/system_change/en/index.html).

The selection of hand hygiene products available from the market should be based on the following criteria (see Part I.15.2 of the *Guidelines* and the *Alcohol-based Handrub: Planning and Costing Tool* http://www.who.int/gpsc/5may/tools/system_change/en/index.html):

- relative efficacy of antiseptic agents (see Part I.10 of the *Guidelines*) according to ASTM and EN standards and consideration for selection of products for hygienic hand antisepsis and surgical hand preparation;
- dermal tolerance and skin reactions;
- time for drying (consider that different products are associated with different drying times; products that require longer drying times may affect hand hygiene best practice);
- cost issues;
- aesthetic preferences of HCWs and patients such as fragrance, colour, texture, "stickiness", and ease of use;
- practical considerations such as availability, convenience and functioning of dispenser, and ability to prevent contamination;
- freedom of choice by HCWs at an institutional level after consideration of the above-mentioned factors.

Hand hygiene actions are more effective when hand skin is free of cuts, nails are natural, short and unvarnished, and hands and forearms are free of jewellery and left uncovered (see Parts I.23.3-4 of the *Guidelines* and Part IV of the *Hand Hygiene Technical Reference Manual* http://www.who.int/gpsc/5may/tools/training_education/en/index.html).

3.2 Skin reactions related to hand hygiene

Skin reactions may appear on HCWs' hands because of the necessity for frequent hand hygiene during patient care (see Part I.14 of the *Guidelines)*. There are two major types of skin reactions associated with hand hygiene. The first and most common type is irritant contact dermatitis and includes symptoms such as dryness, irritation, itching and in some cases even cracking and bleeding. The second type of skin reaction, allergic contact dermatitis, is rare and represents an allergy to some ingredient in a hand hygiene product. Symptoms of allergic contact dermatitis can also range from mild and localized to severe and generalized. In its most serious form, allergic contact dermatitis may be associated with respiratory distress and other symptoms of anaphylaxis. HCWs with skin reactions or complaints related to hand hygiene should have access to an appropriate referral service.

In general, irritant contact dermatitis is more commonly reported with iodophors.[171] Other antiseptic agents that may cause irritant contact dermatitis, in order of decreasing frequency, include chlorhexidine, chloroxylenol, triclosan and alcohol-based products (see Part I.11 of the *Guidelines)*.

However, numerous reports confirm that alcohol-based formulations are well-tolerated and associated with better acceptability and tolerance than other hand hygiene products.[149, 230, 237, 308-313]

Allergic reactions to antiseptic agents including quaternary ammonium compounds, iodine or iodophors, chlorhexidine, triclosan, chloroxylenol and alcohols[132, 314-323] have been reported, as well as possible toxicity in relation to dermal absorption of products.[233, 324] Allergic contact dermatitis attributable to alcohol-based handrubs is very uncommon.

Damaged, irritated skin is undesirable, not only because it causes discomfort and even lost workdays for the professional but also because hands with damaged skin may in fact increase the risk of transmission of infections to patients.

The selection products that are both efficacious and as safe as possible for the skin is of the utmost importance.

For example, concern about the drying effects of alcohol was a major cause of poor acceptance of alcohol-based handrubs in hospitals.[325, 326] Although many hospitals have provided HCWs with plain soaps in the hope of minimizing dermatitis, frequent use of such products has been associated with even greater skin damage, dryness and irritation than some antiseptic preparations.[171, 226, 231] One strategy for reducing exposure of HCWs to irritating soaps and detergents is to promote the use of alcohol-based handrubs containing humectants. Several studies have demonstrated that such products are tolerated better by HCWs and are associated with a better skin condition when compared with either plain or antimicrobial soap.[75, 95, 97, 146, 226, 231, 327-329] With rubs, the shorter time required for hand antisepsis may increase acceptability and compliance.[285]

Ways to minimize the possible adverse effects of hand hygiene include selecting less irritating products, using skin moisturizers, and modifying certain hand hygiene behaviours such as unnecessary washing (see recommendations 5A-E and Part IV of the *Hand Hygiene Technical Reference Manual* http://www.who.int/gpsc/5may/tools/training_education/en/index.html).

Certain practices can increase the risk of skin irritation and should be avoided. For example, washing hands regularly with soap and water immediately before or after using an alcohol-based product is not only unnecessary but may lead to dermatitis.[163] The use of very hot water for handwashing should be avoided as it increases the likelihood of skin damage. When clean or disposable towels are used, it is important to pat the skin rather than rub it to avoid cracking. Additionally, donning gloves while hands are still wet from either washing or applying alcohol increases the risk of skin irritation.

3.3 Safety issues related to the use of alcohol-based handrubs

Alcohols are flammable; therefore, alcohol-based handrubs should be stored away from high temperatures or flames in accordance with national and local regulations (see Part B of

the *Guide to Local Production: WHO-recommended Handrub Formulations* http://www.who.int/gpsc/5may/tools/system_change/en/index.html).

Although alcohol-based handrubs are flammable, the risk of fires associated with such products is very low.

For example, none of 798 health-care facilities surveyed in the USA reported a fire related to an alcohol-based handrub dispenser. A total of 766 facilities had accrued an estimated 1430 hospital-years of alcohol-based handrub use without a fire attributed to a handrub dispenser.[330]

In Europe, where alcohol-based handrubs have been used extensively for many years, the incidence of fires related to such products has been extremely low.[147] A recent study[331] conducted in German hospitals found that handrub usage represented an estimated total of 25 038 hospital-years, with an overall usage of 35 million litres for all hospitals. A total of seven non-severe fire incidents was reported (0.9% of hospitals). This is equal to an annual incidence per hospital of 0.0000475%. No reports of fire caused by static electricity or other factors were received, nor were any related to storage areas. Indeed, most reported incidents were associated with deliberate exposure to a naked flame, e.g. lighting a cigarette.

In the summary of incidents related to the use of alcohol handrubs from the start of the "clean**your**hands" campaign until July 2008 (http://www.npsa.nhs.uk/patientsafety/patient-safetyincident-data/quarterly-data-reports/), only two fire events out of 692 incidents were reported in England and Wales.

Accidental and intentional ingestion of alcohol-based preparations used for hand hygiene have been reported and may lead to acute, and in some cases severe, alcohol intoxication.[332-335] In the "clean**your**hands" campaign incidents summary, 189 cases of ingestion were recorded in health-care settings. However, the vast majority was graded as no or low harm, 12 as moderate, two as severe, and one death was reported (but the patient had been admitted already the previous day for severe alcohol intoxication). It is clear that, especially in pediatric and psychiatric wards, security measures are needed. These may involve: placing the preparation in secure wall dispensers; labelling dispensers to make the alcohol content less clear at a casual glance and adding a warning against consumption; and the inclusion of an additive in the product formula to reduce its palatability. In the meantime, medical and nursing staff should be aware of this potential risk.

Alcohols can be absorbed by inhalation and through intact skin, although the latter route (dermal uptake) is very low. Many studies evaluated alcohol dermal absorption and inhalation following its application or spraying on skin.[324, 336-339] In all cases either no or very low (much less than the levels achieved with mild intoxication, i.e. 50 mg/dl) blood concentrations of alcohols were detected and no symptoms were noticed.

Indeed, while there are no data showing that the use of alcohol-based handrub may be harmful because of alcohol absorption, it is well-established that reduced compliance with hand hygiene will lead to preventable HCAIs.

3.4 Alcohol-based handrubs and *C. difficile* and other non-susceptible pathogens

Alcohols have excellent in vitro germicidal activity against Gram-positive and Gram-negative vegetative bacteria (including multidrug-resistant pathogens such as MRSA and VRE), *Mycobacterium tuberculosis*, and a variety of fungi.[131, 306, 307, 340-345] On the contrary, they have virtually no activity against bacterial spores or protozoan oocysts, and reduced activity against some non-enveloped (non-lipophilic) viruses. However alcohols, when used in concentrations present in some alcohol-based handrubs (70–80% v/v), also have in vivo activity against a number of non-enveloped viruses (e.g. rotavirus, adenovirus, rhinovirus, hepatitis A and enteroviruses). [177, 346, 347] Various 70% alcohol solutions (ethanol, n-propanol, isopropanol) were tested against a surrogate of norovirus and ethanol with 30-second exposure and demonstrated virucidal activity superior to the others.[348] In a recent experimental study, ethyl alcohol-based products showed significant reductions of the tested surrogate for a non-enveloped human virus; however, activity was not superior to non-antimicrobial or tap/faucet water controls.[349] In general, ethanol has shown greater activity against viruses than isopropanol.[350]

Following the widespread use of alcohol-based handrubs as the gold standard for hand hygiene in health care, concern has been raised about their lack of efficacy against spore-forming pathogens, in particular *C. difficile*. The widespread use of alcohol-based handrubs in healthcare settings has been blamed by some.[351, 352]

Although alcohol-based handrubs may not be effective against *C. difficile,* it has not been shown that they trigger a rise in *C. difficile*-associated disease.[63, 76, 353, 354]

C. difficile-associated disease rates began to rise in the USA long before the widespread use of alcohol-based handrubs.[355, 356] One outbreak of the epidemic strain REA-group B1 (≅ ribotype 027) was successfully managed while introducing alcohol-based handrub for all patients other than those with *C. difficile*-associated disease.[354]

In addition, several studies recently demonstrated a lack of association between the consumption of alcohol-based handrubs and the incidence of clinical isolates of *C. difficile*.[353, 357, 358]

Contact precautions are highly recommended during *C. difficile*-associated outbreaks, in particular glove use (as part of contact precautions) and handwashing with a plain or antimicrobial soap and water following glove removal after caring for patients with diarrhoea.[359, 360] Alcohol-based handrubs can then be used exceptionally after handwashing in these instances, after making sure that hands are perfectly dry. Moreover, alcohol-based handrubs, now considered the gold standard to protect patients from the multitude of harmful resistant and non-resistant organisms transmitted by HCWs' hands, should be continued to be used in all other instances at the same facility.

Abandoning alcohol-based handrub for patients other than those with *C. difficile*-associated disease would do more harm than good, considering the dramatic impact on overall infection rates observed through the recourse to handrubs at the point of care.[361]

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APPENDICES

1. Definition of terms

Hand hygiene. A general term referring to any action of hand cleansing (see below, "Hand hygiene practices").

Hand hygiene products

Alcohol-based (hand) rub. An alcohol-containing preparation (liquid, gel or foam) designed for application to the hands to inactivate microorganisms and/or temporarily suppress their growth. Such preparations may contain one or more types of alcohol, other active ingredients with excipients and humectants.

Antimicrobial (medicated) soap. Soap (detergent) containing an antiseptic agent at a concentration sufficient to inactivate microorganisms and/or temporarily suppress their growth. The detergent activity of such soaps may also dislodge transient microorganisms or other contaminants from the skin to facilitate their subsequent removal by water.

Antiseptic agent. An antimicrobial substance that inactivates microorganisms or inhibits their growth on living tissues. Examples include alcohols, chlorhexidine gluconate (CHG), chlorine derivatives, iodine, chloroxylenol (PCMX), quaternary ammonium compounds and triclosan.

Detergent (surfactant). Compounds that possess a cleaning action. They are composed of a hydrophilic and a lipophilic part and can be divided into four groups: anionic, cationic, amphoteric and non-ionic. Although products used for handwashing or antiseptic handwash in health care represent various types of detergents, the term "soap" will be used to refer to such detergents in these guidelines.

Plain soap. Detergents that contain no added antimicrobial agents or may contain these solely as preservatives.

Hand hygiene practices

Antiseptic handwashing. Washing hands with soap and water or with other detergents containing an antiseptic agent.

Antiseptic handrubbing (or handrubbing). Applying an antiseptic handrub to reduce or inhibit the growth of microorganisms without the need for an exogenous source of water and requiring no rinsing or drying with towels or other devices.

Hand antisepsis/decontamination/degerming. Reducing or inhibiting the growth of microorganisms by the application of an antiseptic handrub or by performing an antiseptic handwash.

Hand care. Actions to reduce the risk of skin damage or irritation.

Handwashing. Washing hands with plain or antimicrobial soap and water.

Hand cleansing. Action of performing hand hygiene for the purpose of physically or mechanically removing dirt, organic material and/or microorganisms.

Hand disinfection is extensively used as a term in some parts of the world and can refer to antiseptic handwash, antiseptic handrubbing, hand antisepsis/decontamination/degerming, handwashing with an antimicrobial soap and water, hygienic hand antisepsis, or hygienic handrub. Since disinfection refers normally to the decontamination of inanimate surfaces and objects, this term is not used in these *Guidelines*.

Hygienic hand antisepsis. Treatment of hands with either an antiseptic handrub or antiseptic handwash to reduce the transient microbial flora without necessarily affecting the resident skin flora.

Hygienic handrub. Treatment of hands with an antiseptic handrub to reduce the transient flora without necessarily affecting the resident skin flora. These preparations are broad spectrum and fast-acting, and persistent activity is not necessary.

Hygienic handwash. Treatment of hands with an antiseptic handwash and water to reduce the transient flora without necessarily affecting the resident skin flora. It is broad spectrum, but is usually less efficacious and acts more slowly than the hygienic handrub.

Surgical hand antisepsis/surgical hand preparation/ presurgical hand preparation. Antiseptic handwash or antiseptic handrub performed preoperatively by the surgical team to eliminate transient flora and reduce resident skin flora. Such antiseptics often have persistent antimicrobial activity. **Surgical handscrub(bing)/presurgical scrub** refer to surgical hand preparation with antimicrobial soap and water. **Surgical handrub(bing)** refers to surgical hand preparation with a waterless, alcohol-based handrub.

Associated terms

Efficacy/efficacious. The (possible) effect of the application of a hand hygiene formulation when tested in laboratory or in vivo situations.

Effectiveness/effective. The clinical conditions under which a hand hygiene product has been tested for its potential to reduce the spread of pathogens, e.g. field trials.

Health-care area. Concept related to the "geographical" visualization of key moments for hand hygiene. It contains all surfaces in the health-care setting outside the patient zone of patient X, i.e. other patients and their patient zones and the health-care facility environment.

Humectant. Ingredient(s) added to hand hygiene products to moisturize the skin.

Patient zone. Concept related to the "geographical" visualization of key moments for hand hygiene. It contains the patient X and his/her immediate surroundings. This typically includes the intact skin of the patient and all inanimate surfaces that are touched by or in direct physical contact with the patient such as the bed rails, bedside table, bed linen, infusion tubing and other medical equipment. It further contains surfaces frequently touched by HCWs while caring for the patient such as monitors, knobs and buttons as well as other "high frequency" touch surfaces.

Persistent activity. The prolonged or extended antimicrobial activity that prevents the growth or survival of microorganisms after application of a given antiseptic; also called "residual", "sustained" or "remnant" activity. Both substantive and non-substantive active ingredients can show a persistent effect significantly inhibiting the growth of microorganisms after application.

Point of care. The place where three elements come together: the patient, the HCW, and care or treatment involving contact with the patient or his/her surroundings (within the patient zone).[302] The concept embraces the need to perform hand hygiene at recommended moments exactly where care delivery takes place. This requires that a hand hygiene product (e.g. alcohol-based handrub, if available) be easily accessible and as close as possible – within arm's reach of where patient care or treatment is taking place. Point-of-care products should be accessible without HCWs having to leave the patient zone.

Resident flora (resident microbiota). Microorganisms residing under the superficial cells of the *stratum corneum* and also found on the surface of the skin.

Surrogate microorganism. A microorganism used to represent a given type or category of nosocomial pathogen when testing the antimicrobial activity of antiseptics. Surrogates are selected for their safety, ease of handling and relative resistance to antimicrobials.

Transient flora (transient microbiota). Microorganisms that colonize the superficial layers of the skin and are more amenable to removal by routine handwashing.

Visibly soiled hands. Hands on which dirt or body fluids are readily visible.

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Ward Infrastructure Survey	Slides for the Hand Hygiene Co-ordinator	Hand Hygiene Technical Reference Manual	Your 5 Moments for Hand Hygiene Poster	Template Letter to Advocate Hand Hygiene to Managers
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