

Review Article

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Hand hygiene: Back to the basics of infection control

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Health care associated infections are drawing increasing attention from patients, insurers, governments and regulatory bodies. This is not only because of the magnitude of the problem in terms of the associated morbidity, mortality and cost of treatment, but also due to the growing recognition that most of these are preventable. The medical community is witnessing in tandem unprecedented advancements in the understanding of pathophysiology of infectious diseases and the global spread of multi-drug resistant infections in health care set-ups. These factors, compounded by the paucity of availability of new antimicrobials have necessitated a re-look into the role of basic practices of infection prevention in modern day health care. There is now undisputed evidence that strict adherence to hand hygiene reduces the risk of cross-transmission of infections. With “Clean Care is Safer Care” as a prime agenda of the global initiative of WHO on patient safety programmes, it is time for developing countries to formulate the much-needed policies for implementation of basic infection prevention practices in health care set-ups. This review focuses on one of the simplest, low cost but least accepted from infection prevention: hand hygiene.

Key words Alcohol-based hand rubs - compliance - hand hygiene - hand hygiene agents - hand washing - India

Introduction

Hand hygiene is now regarded as one of the most important element of infection control activities. In the wake of the growing burden of health care associated infections (HCAIs), the increasing severity of illness and complexity of treatment, superimposed by multi-drug resistant (MDR) pathogen infections, health care practitioners (HCPs) are reversing back to the basics of infection preventions by simple measures like hand hygiene. This is because enough scientific evidence supports the observation that if properly implemented, hand hygiene alone can significantly

reduce the risk of cross-transmission of infection in healthcare facilities (HCFs)¹⁻⁵.

Historical background

The significance of hand washing in patient care was conceptualized in the early 19th century⁶⁻⁸. Labarraque⁶ provided the first evidence that hand decontamination can markedly reduce the incidence of puerperal fever and maternal mortality. Semmelweis⁷ worked in the Great hospital in Vienna in the 1840s. There were two maternity clinics in the hospital, with alternate day admission policy. The first clinic was attended by medical students, who moved straight

from autopsy rooms to the delivery suite and had an average maternal mortality rate due to puerperal fever of about 10 per cent. The second clinic, attended by midwives had a maternal mortality of only 2 per cent. The puzzled Semmelweis got a breakthrough in 1847, following the death of colleague Jokob Kolletschka, who had been accidentally got a cut by a student's scalpel while performing an autopsy. His autopsy showed a pathological condition similar to that of women dying from puerperal fever. Semmelweis concluded that some "unknown cadaverous material" caused puerperal fever. He instituted a policy of washing hands with chlorinated lime for those leaving the autopsy room, following which the rate of maternal mortality dropped ten-folds, comparable to the second clinic. Thus, he almost conducted a controlled trial, in an era when microbes were yet to be discovered and the germ theory of disease was not defined⁶⁻⁸. In another landmark study in the wake of Staphylococcal epidemics in 1950s, Mortimer *et al*⁹ showed that direct contact was the main mode of transmission of *S. aureus* in nurseries. They also demonstrated that hand washing by patients' contacts reduced the level of *S. aureus* acquisition by babies.

In 1975 and 1985, the CDC published guidelines on hand washing practices in hospitals, primarily advocating hand washing with non antimicrobial soaps; washing with antimicrobial soap was advised before and after performing invasive procedures or during care for high risk patients. Alcohol-based solutions were recommended only in situations where sinks were not available^{10,11}. In 1995, the Hospital Infection Control Practices Advisory Committee (HICPAC) advocated the use of antimicrobial soap or a waterless antiseptic agent for cleaning hands upon leaving the rooms of patients infected with multidrug-resistant pathogens¹². In 2002, the CDC published revised guidelines for hand hygiene³. A major change in these guidelines was the recommendation to use alcohol based hand rubs for decontamination of hands between each patient contact (of non-soiling type) and the use of liquid soap and water for cleaning visibly contaminated or soiled hands. A systematic review of handwashing by the Thames Valley University as part of the evaluation of processes and indicators in infection control (EPIC) study¹³, concluded that there was a good evidence that direct patient contact resulted in hand contamination by pathogens. The EPIC study also showed the superiority of 70 per cent alcohol/ alcohol based antiseptic hand rubs^{13,14}.

With the growing burden of HAIs, limited options of effective antimicrobials evidence supporting the role of hand hygiene in reduction of HAIs, the WHO has launched a global hand hygiene campaign. In 2005, it introduced the first Global Patient Safety Challenge "Clean Care is Safer Care (CCiSC)", as part of its world alliance for patient safety^{15,16}. In 2006, advanced draft guidelines on "Hand Hygiene in Health Care" were published and a suite of implementation tools were developed and tested¹⁷. The first Global Handwashing Day was observed on October 15, 2008. A WHO Patient Safety 2009 initiative has been established to catalyse this progress. This is the next phase of the 'First Challenge's work on CCiSC'¹⁵⁻¹⁸. This initiative has, as of April 2009, seen a total of 3,863 health care facilities registering their commitment, effectively equating to a staff of over 3.6 million people, globally. On May 5, 2009, the WHO highlighted the importance of hand hygiene and launched guidelines and tools on hand hygiene, based on the next phase of patient safety work programme "SAVE LIVES: Clean Your Hands"^{1,2,15-18}.

Normal flora of hands

There are two types of microbes colonizing hands: the resident flora, which consists of microorganisms residing under the superficial cells of the stratum corneum and the transient flora, which colonizes the superficial layers of the skin, and is more amenable to removal by routine hand hygiene. Transient microorganisms survive, but do not usually multiply on the skin. They are often acquired by health care workers (HCWs) during direct contact with patients or their nearby contaminated environmental surfaces and are the organisms most frequently associated with HCAs¹⁻³.

Colonization of hands with pathogens and their role in transmission

The hands of HCWs are commonly colonized with pathogens like methicillin resistant *S. aureus* (MRSA), vancomycin resistant *Enterococcus* (VRE), MDR-Gram Negative bacteria (GNBs), *Candida* spp. and *Clostridium difficile*, which can survive for as long as 150 h. Approximately 10⁶ skin epithelial cells containing viable microorganisms are shed daily from the normal skin^{2,19}, which can contaminate the gowns, bed linen, bedside furniture, and other objects in the patient's immediate environment. Hand carriage of resistant pathogens has repeatedly been shown to be associated with nosocomial infections¹⁻³. The highest

rates of hand contamination are reported from critical care areas, which also report most cases of cross-transmission. The hands may become contaminated by merely touching the patient's intact skin or inanimate objects in patients' rooms or during the "clean" procedures like recording blood pressure¹⁻³.

Importance of hand hygiene

Proper hand hygiene is the single most important, simplest, and least expensive means of reducing the prevalence of HAIs and the spread of antimicrobial resistance^{1-3,20-23}. Several studies have demonstrated that handwashing virtually eradicates the carriage of MRSA which invariably occurs on the hands of HCPs working in ICUs^{24,25}. An increase in handwashing compliance has been found to be accompanied by a fall in MRSA rates²⁶. The hand hygiene liaison group identified nine controlled studies, all of which showed significant reductions in infection related outcomes, even in settings with a high infection rates in critically ill patients^{14,27,28}. Transmission of Health-care-associated *Klebsiella* sp. has also been documented to reduce with improvement in hand hygiene^{2,3,23}. The evidence suggests that adherence to hand hygiene practices has significantly reduced the rates of acquisition of pathogens on hands and has ultimately reduced the rates of HAIs in a hospital^{22,23,26,29-31}.

Indications for hand hygiene during patient care

Wash hands with soap and water when (i) visibly dirty or contaminated with proteinaceous material, blood, or other body fluids and if exposure to *Bacillus anthracis* is suspected or proven (since the physical action of washing and rinsing hands in such circumstances is recommended because alcohols, chlorhexidine, iodophors, and other antiseptic agents have poor activity against spores); (ii) After using a restroom, wash hands with a non-antimicrobial soap and water or with an antimicrobial soap and water; and (iii) before and after having food^{1-3,21-23,32}.

In all other clinical situations described below, when hands are not visibly soiled, an alcohol-based hand rub should be used routinely for decontaminating hands^{1-3,21-23,32}. (i) Before having direct contact with patients. (ii) Before donning sterile gloves when inserting a central intravascular catheter. (iii) Before inserting indwelling urinary catheters, peripheral vascular catheters, or other invasive devices that do not require a surgical procedure. (iv) After contact with a patient's intact skin (e.g., when taking a pulse

or blood pressure or lifting a patient). (v) After contact with body fluids or excretions, mucous membranes, nonintact skin, and wound dressings if hands are not visibly soiled. (vi) After contact with inanimate objects (including medical equipment) in the immediate vicinity of the patient. (vii) After removing gloves. (viii) If moving from a contaminated body site to a clean body site during patient care.

The WHO "SAVE LIVES: Clean Your Hands" programme^{1,2} reinforces the "My 5 Moments for Hand Hygiene" approach as key to protect the patients, HCWs and the health-care environment against the spread of pathogens and thus reduce HAIs. This approach encourages HCWs to clean their hands: before touching a patient, before clean/aseptic procedures, after body fluid exposure/risk, after touching a patient and after touching patient surroundings^{1,2}.

Other precautions in relation to hand sanitation

Avoid unnecessary touching of surfaces in close proximity to the patient. In 2002, the CDC/HICPAC recommended that artificial fingernails and extenders not to be worn by HCPs who have contact with high-risk patients, due to their association with outbreaks of Gram-negative bacillary and candidal infections¹². Although rings harbour a high count of pathogens, they have not been found to be associated with transmission of infections¹².

Method of hand washing^{1,2,21}

For handwashing, remove the jewelry and rinse hands under running water (preferably warm). Lather with soap and using friction, cover all surfaces of hands and fingers. Wash thoroughly under running water. Turn off faucet with wrist/elbow. Dry hands with a single use towel or by using forced air drying. Pat skin rather than rubbing to avoid cracking. If disposable towels are used, throw in trash immediately. Skin excoriation may lead to bacteria colonizing the skin and the possible spread of blood borne viruses as well as other microorganisms. Sore hands may also lead to decreased compliance with hand washing protocols^{1,2,21}. If using antiseptic rub, take an adequate amount and rub on all surfaces for the recommended time. Let the antiseptic dry on its own.

Agents used for hand hygiene

Table I lists the properties, advantages and disadvantages of the commonly used agents for hand hygiene^{1-4,21,33}.

Table I. Properties of hand hygiene products

Agent	Concentration/available products	Activity	Advantages, disadvantages and precautions
Non medicated (plain) soaps	Bars, soaps, tissues, leaflets & liquid preparations	Detergent properties; Non microbicidal; Reduces numbers by mechanical removal of loosely adherent microorganisms from hands.	Advantage: Good for removal of soil and proteinaceous material (e.g., blood) Disadvantage: Do not have any antimicrobial activity; Contamination of hands may occur (e.g., <i>Pseudomonas aeruginosa</i> from sink/ water/ contaminated soap); May result in paradoxical increases in bacterial counts on the skin; causes irritant contact dermatitis and dry skin
Alcohols	60-95% ethanol, isopropanol, n-propanol or a combination of these. Available as rinses, gels, and foams.	<i>Good:</i> GP bacteria, GN bacteria, Env. viruses, Mycobacteria, Fungi <i>Fair:</i> N. Env viruses <i>Nil:</i> Spores	Advantage: Fast action; effectively reduces bacterial counts; addition of low concentrations (0.5-1.0%) of chlorhexidine results in greater residual activity than alcohol alone Advantage: Not appropriate for use when hands are visibly dirty or contaminated with proteinaceous materials; Flammable; Volatile; No appreciable residual activity; Efficacy affected by several factors (type of alcohol, volume, concentration, contact time & wet hands during application); Frequent use can cause drying of the skin (reduced or eliminated by adding 1-3% glycerol/ other skin conditioning agents)
Chlorhexidine	0.5-4%	<i>Good :</i> GP bacteria <i>Fair:</i> GN bacteria , Env. viruses <i>Poor:</i> N. Env viruses, Mycobacteria, Fungi <i>Nil :</i> Spores	Advantage: Safe & relatively non allergic; Activity minimally affected by presence of organic material, including blood; Substantial residual activity Disadvantage: Activity is reduced by natural soaps, inorganic anions, nonionic surfactants and hand creams containing anionic emulsifying agents; Less rapid action than alcohols; Toxic to eye, ears, brain tissue & meninges; Concentration-dependent skin irritation
Chloroxylenol (PCMX)	0.5-4%.	<i>Good:</i> GP bacteria <i>Poor:</i> GN bacteria , Env. viruses, Mycobacteria, Fungi <i>Doubtful efficacy:</i> N. Env viruses <i>Nil:</i> Spores	Advantage: Activity is minimally affected by the presence of organic matter; Allergic reactions uncommon Advantage: Less rapid and less residual activity compared to chlorhexidine; Activity is neutralized by nonionic surfactants; Absorbed through the skin; but is well-tolerated
Hexachlorophene	3%	<i>Good:</i> GP bacteria <i>Poor:</i> GN bacteria, Mycobacteria, Fungi <i>Doubtful efficacy:</i> Viruses, <i>Nil::</i> Spores	Advantage: Residual activity for several hours; Gradually reduces bacterial counts on hands after multiple uses Advantage: With repeated use of 3% hexachlorophene preparations, the drug is cutaneously absorbed; Routine bathing of neonates or burn patients with hexachlorophene is contraindicated because of its potential neurotoxicity.

Contd....

Agent	Concentration/available products	Activity	Advantages, disadvantages and precautions
Iodine & iodophors	0.5-10% povidone-iodine (typical 10% povidone-iodine formulations contain 1% available iodine; free iodine concentrations of 1 ppm)	<i>Good:</i> GP bacteria, GN bacteria <i>Fair:</i> Env. viruses, N. Env viruses, Mycobacteria, Fungi <i>Doubtful efficacy:</i> Spores	Advantage: Iodophors cause less skin irritation/ fewer allergic reactions than iodine, but more irritant contact dermatitis than other antiseptics Advantage: Activity substantially reduced in the presence of organic substances; is affected by pH, temperature, exposure time, concentration of total available iodine, and the amount/ type of organic/ inorganic compounds present (<i>e.g.</i> , alcohols and detergents); May become contaminated with Gram negative bacilli
Quaternary ammonium compounds	Alkyl benzalkonium benzethonium chloride, Cetrimide, and Cetylpyridium chloride	<i>Fair:</i> GP bacteria <i>Poor:</i> GN bacteria, Env. viruses <i>Doubtful efficacy:</i> N. Env viruses, Mycobacteria, Fungi <i>Nil:</i> Spores	Advantage: Usually well tolerated. Advantage: Antimicrobial activity adversely affected by presence of organic material; Not compatible with anionic detergents; Prone to contamination by GNB
Triclosan	2,4,4'-trichloro-2'-hydroxydiphenyl ether: 0.2-2%	<i>Good:</i> GP bacteria <i>Fair:</i> GNB <i>Doubtful efficacy:</i> Viruses, Mycobacteria, Fungi <i>Nil:</i> Spores	Advantage: Persistent activity on the skin; Activity not substantially affected by organic matter; Most formulations are well-tolerated Advantage: Activity affected by pH, presence of surfactants, emollients, or humectants and ionic nature of the formulation; Occasional reports of contamination with GNB. Widespread use in non-medical products like lotions & deodorants may cause resistance in microbes.
Octenidine (activity under evaluation)	Bispyridine 0.1%	<i>Good:</i> Bacteria, Viruses <i>Fair:</i> Fungi, Mycobacteria	Effective & safe antiseptic. Good residual activity Useful antiseptic for mucus membrane of genital tract and oral cavity

Env. viruses, enveloped viruses; N Env viruses, non enveloped viruses; GP, Gram-positive; GN, Gram-negative; GNB, Gram-negative bacteria/bacilli. *Source:* Refs 1-4, 21, 25

Selecting hand hygiene products for health set-ups

The major determinants for product selection are antimicrobial profile, user acceptance, and cost^{2,4,21}. Post-contamination hand hygiene products must have at least bactericidal, fungicidal (yeasts), and virucidal (coated viruses) activity. Since hands of HCWs are frequently contaminated with blood during routine patient care, activity against coated viruses should be included in the minimum spectrum of activity of an agent for hand hygiene⁴. Additional activity against fungi (including molds), mycobacteria, and bacterial spores may be relevant in high risk wards or during outbreaks. Pre-operative hand hygiene should be at least bactericidal and fungicidal (yeasts), since the

hands of most HCWs carry yeasts and surgical-site infections have also been associated with hand carriage of yeasts during an outbreak⁴.

Hospital administrators should also take into account the acceptability of product (smell, feel, skin irritation) by the users and its allergenic potential^{1-4,21}. When comparing the cost of hand hygiene products, it has been found that the excess hospital cost associated with only 4-5 HAIs of average severity may equal the entire annual budget for hand hygiene products used for in-patient care areas^{3,34}.

One of the key elements in improving hand hygiene practice is the use of an alcohol based hand rub instead

Table II. Factors affecting compliance to hand hygiene

Health care staff related factors	Clinical factors	Environmental/institutional/behavioral/ other factors
Physician status (rather than a nurse)	Working in an intensive-care unit	Wearing gowns/gloves (beliefs that glove use obviates the need for hand hygiene)
Nursing assistant status (rather than a nurse)	Working during the week (versus the weekend)	Hand washing agents causing irritation and dryness
Male sex	If involved in activities with high risk of cross-transmission	Sinks are inconveniently located/shortage of sinks Lack of soap and paper towels
Lack of role models among colleagues or superiors	Understaffing, patient overcrowding, insufficient time	Belief of low risk of acquiring infection from patients
Not thinking about it/ forgetfulness	Patient needs take priority	Lack of knowledge of guidelines/protocols
	Hand hygiene interferes with health-care worker relationships with patients	Skepticism regarding the value of hand hygiene Disagreement with the recommendations Lack of institutional priority Lack of active participation in hand-hygiene promotion at individual or institutional level Lack of administrative sanction of non-compliers/rewarding compliers

Source: Refs 2,3,38-41

of washing with soap and water. An alcohol-based hand rub requires less time, is microbiologically more effective and is less irritating to skin than traditional hand washing with soap and water^{2,3,35}. In the ICUs, switching to alcohol hand disinfection would decrease the time necessary for hand hygiene from 1.3 h (or 17% of total nursing time) to 0.3 h (or 4% of total nursing time)^{35,36}.

Reasons for poor hand hygiene practices

In most health care institutions, adherence to recommended hand-washing practices remains unacceptably low, rarely exceeding 40 per cent of situations in which hand hygiene is indicated^{35,37}. Hand hygiene reflects attitudes, behaviours and beliefs. Some of the observed/self reported factors found to be affecting hand hygiene behaviours are enlisted in Table II^{2,3,38-41}.

Methods used to improve hand hygiene compliance

Multimodal strategies have been shown to be more successful in improving rates of adherence with hand hygiene in HCWs than single interventions¹⁶. Targeted, multi-faceted approaches focusing on system change, administrative support, motivation, availability of alcohol-based hand rubs, training and intensive education of HCWs and reminders in the workplace

have been recommended for improvement in hand hygiene¹⁶.

Recent studies support the fact that interactive educational programmes combined with free availability of hand disinfectants significantly increased the hand hygiene compliance^{42,43}. A single lecture on basic hand hygiene protocols had a significant and sustained effect in enhancing hand hygiene compliance in a Swedish hospital⁴². The four member States of the European Union, which implemented National Hand Hygiene Campaigns found the following strategies to be extremely useful in their countries: Governmental support, the use of indicators for hand hygiene benchmarking, developing national surveillance systems for auditing alcohol based hand rub consumption and auditing hand hygiene compliance⁴⁴. Trampuz *et al*³⁵ advocated simple training sessions for HCWs to be held in each ward to introduce the advantage of alcohol hand rubs over hand washing.

Other factors like positive role modeling (hand hygiene behaviour of senior practitioners) and the use of performance indicators also remarkably improve adherence to hand hygiene^{40,41}. There should be adequate supply of hand hygiene products, lotions and creams, disposable towels and facilities for hand

washing, where necessary^{2-4,35,40,41}. Alcohol hand rubs should be available at the point of care in sufficient quantities. It needs to be emphasized that wearing gloves does not replace the need for hand hygiene and that contamination may occur during glove removal. Studies by Pitet^{26,45} showed a remarkable and long lasting improvement in hand hygiene compliance using a multimodal strategy, which has been adopted by the first Global Patient Safety Challenge of WHO to develop hand hygiene strategies. The availability of individual, pocket carried bottles also increased compliance^{38-40,46-48}.

Apart from this, all hospitals should have a dynamic infection control team, robust surveillance system, adequate staff to disseminate evidence-based knowledge in an easily comprehensible way to all cadres of staff. At a more local or regional level, there is a need for institutional frameworks or programmes to deal with HAIs⁴⁹. The Institute for Healthcare Improvement (www.ihl.org) offers elaborate training modules on various aspects of patient care. The guide for implementation of WHO's CCiSC and a range of tools to facilitate hand hygiene is available⁵⁰.

Research and education

To develop successful interventions, more research into behavioural determinants is needed, in particular, how these determinants can be applied to improve hand hygiene^{51,52}. Process indicators are vital and an understanding of why some interventions succeed and others fail is needed. Since hand hygiene is more of a behavioural practice, the first step towards the development of interventions should be to identify the prevalence of risk behaviours (*i.e.* non compliance) and the difference in risk behaviours. Since the reasons for non-compliance vary among countries, large scale systematic studies are needed to identify the reasons thereof and plan remedial strategies.

An expert panel has recommended that measuring hand hygiene compliance is essential to understand the current situation, facilitate change and to measure the impact of interventions⁵³. This can be done by direct observation, automated electronic monitoring, product consumption and self reporting by HCW⁵⁴.

The important aspect of role models for students, whose adherence is strongly influenced by their mentor's attitude at bed side should be exploited in moulding the behaviour of young medical students. A few lectures in the undergraduate curriculum may prime the medical students to this basic necessity. The Hand

Hygiene Liason Group strongly advocates teaching of elementary hygiene practices at medical schools⁵⁵. In an elaborate study focusing on MBBS students, it was noted that assessing the knowledge, attitude and practices of final year MBBS students and providing a positive role modeling at undergraduate level is a good initiative⁵⁶.

Indian scenario

In India, the quality of healthcare is governed by various factors, the principal amongst these being whether the health care organization is government or private-sector run. There is also an economic and regional disparity throughout the country. About 75 per cent of health infrastructure, medical manpower and other health resources are concentrated in urban areas, where 27 per cent of the population lives⁵⁷. There is a lack of availability of clean water for drinking and washing. Like in other developing countries, the priority given to prevention and control of HCAI is minimal. This is primarily due to lack of infrastructure, trained manpower, surveillance systems, poor sanitation, overcrowding and understaffing of hospitals, unfavourable social background of population, lack of legislations mandating accreditation of hospitals and a general attitude of non-compliance amongst health care providers towards even basic procedures of infection control. In India, although hand hygiene is imbibed as a custom and promoted at school and community levels to reduce the burden of diarrhoea, there is a paucity of information on activities to promote hand hygiene in HCFs. Sporadic reports document the role of hands in spreading infection and isolated efforts at improving hand hygiene across the country^{54,58-60}.

The practice of compulsory training on standard precautions, safe hospital practices and infection control for all postgraduates upon course-induction, as is being done in a few Delhi medical colleges seems very promising for our country. Such an exercise may be made mandatory across all medical and nursing colleges of India, especially since the "patient safety" is increasingly being prioritized by the Government of India and the country being one of the 120 signatories pledging support to the WHO launched world alliance (available at http://www.who.int/patientsafety/events/06/statememts/India_pledge.pdf).

Challenges ahead

Although evidence based guidelines are increasingly being implemented in the developed countries, the developing countries still lack basic health care facilities, surveillance networks and resources to

curtail HAIs⁶¹⁻⁶³. Lack of hand washing facilities (e.g., sinks, running water and sewage systems) are major deterrents for implementation of hand hygiene⁶¹. The use of WHO advocated alcohol based hand rubs is a practical solution to overcome these constraints, because these can be distributed individually to staff for pocket carriage and placed at the point of care. The major advantage is that its use is well applicable to situations typical of developing countries, such as two patients sharing the same bed, or patient's relatives being requested to help in care provision. Several hospitals are now reporting increased compliance after implementation of CCI⁶⁴. Several countries have also initiated nationally co-ordinated activities (<http://www.who.int/gpsc/national-campaigns/en/>) to promote hand hygiene⁵⁴. However, global Healthcare Infection Prevention programmes can only be successful, if these populous developing nations are able to control the menace by formulation of national or local policies and strictly implementing the guidelines.

Conclusion

Hand washing should become an educational priority. Educational interventions for medical students should provide clear evidence that HCWs hands become grossly contaminated with pathogens upon patient contact and that alcohol hand rubs are the easiest and most effective means of decontaminating hands and thereby reducing the rates of HAIs. Increasing the emphasis on infection control, giving the charge of infection control to senior organizational members, changing the paradigm of surveillance to continuous monitoring and effective data feedback are some of the important measures which need to be initiated in Indian hospitals.

One of the reasons microbes have survived in nature is probably their simplicity: a simple genomic framework with genetic encryption of basic survival strategies. To tackle these microbes, human beings will have to follow basic and simple protocols of infection prevention. The health care practitioners in our country need to brace themselves to inculcate the simple, basic and effective practice of hand hygiene in their daily patient care activities and serve as a role model for future generations of doctors, nurses and paramedical personnels.

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