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REVIEW

'Clean Care is Safer Care': the Global Patient Safety Challenge 2005–2006[☆]

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Summary

Background: Each year the treatment and care of hundreds of millions of patients worldwide is complicated by infections acquired during healthcare. The impact of healthcare-associated infection may imply prolonged stays in hospital, long-term disability, massive additional financial burden, and deaths.

Action: Patient safety is a global issue that affects both developed and developing countries. In October 2004, the World Health Organization launched the World Alliance for Patient Safety to coordinate and accelerate improvements in patient safety internationally. A core element of the Alliance is the identification of a topic to be addressed as a Global Patient Safety Challenge over a two-year cycle. The first topic chosen for 2005–2006 is healthcare-associated infection.

Perspectives: The Challenge aims at implementing several actions to tackle healthcare-associated infections worldwide, regardless of the level of development of healthcare systems and the availability of resources. Implementation strategies include the integration in different healthcare settings of multiple interventions in the areas of blood safety, injection safety, and clinical procedure safety, as well as water, sanitation, and waste management, with the promotion of hand hygiene in healthcare as the cornerstone.

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Introduction

Patient safety is a critical component needed to improve the quality of healthcare worldwide. Confronted with this important issue, in 2002 the 55th World Health Assembly adopted a resolution urging countries to pay the closest possible attention to the problem of patient safety and strengthen safety and monitoring systems. The resolution urged the World

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Health Organization (WHO) to lead the process of establishing global norms and standards and supporting country efforts in developing patient safety policies and practices.

In May 2004, the 57th World Health Assembly supported the creation of an international alliance to improve patient safety as a global initiative and the World Alliance for Patient Safety was launched in October 2004. This event represents the first occasion on which senior policy-makers, heads of agencies, technical experts, and clinical and patient groups have joined internationally to pursue the patient safety goal of *'Primum, non nocere'* ('First, do no harm') and to reduce the adverse health and social consequences of unsafe healthcare. A core element of the World Alliance for Patient Safety is the formulation of a Global Patient Safety Challenge. Every two years, a topic that covers a significant aspect of risk to patients receiving healthcare and which is relevant to every WHO Member State will be identified for action.

The topic chosen for the first Global Patient Safety Challenge over the two-year period 2005–2006 is healthcare-associated infection—a major, global issue in patient safety. It occurs in developed, transitional, and developing countries and has implications for hundreds of millions of patients every year.

The burden of disease

Healthcare-associated infection—also referred to as nosocomial infection—is defined as *"An infection occurring in a patient during the process of care in a hospital or other healthcare facility which was not present or incubating at the time of admission. This includes infections acquired in the hospital but appearing after discharge, and also occupational infections among staff of the facility"*.^{1,2} It clearly presents many of the characteristics of a major patient safety problem and has multiple causes, relating both to the systems and processes of care provision as well as to human behavior.

Healthcare-associated infection occurs worldwide and affects both developed and developing countries. It is estimated that in developed countries 5–10% of patients admitted to acute care hospitals acquire an infection; the attack rate for developing countries can exceed 25%.^{3–6} Certain factors increase the risk of infection among hospitalized patients: underlying diseases and decreased immunity; the increasing use of invasive diagnostic and therapeutic techniques; the

transmission of drug-resistant pathogens; and poor infection control measures. However, the available studies indicate that healthcare-associated infections are likely to be more frequent and serious in developing countries where the lack of resources and basic facilities for infection control combine with patients being more susceptible to infection because of malnutrition, multiple comorbidities, immunosuppression, and poor personal hygiene. In contrast, in industrialized countries, this problem is mostly a consequence of sophisticated and invasive healthcare techniques combined with multi-resistant pathogens. In both settings, environmental factors may play a crucial role in causing healthcare-associated infection.

Estimates of the global burden of healthcare-associated infections are hampered by a lack of reliable data. In the USA, the incidence is estimated at around 5–6%, with an attributable mortality of 3.6% (40 000 to 80 000 deaths annually) and excess costs of at least 4.5 billion US dollars every year for the healthcare system.⁵ In Europe, well-established national and international surveillance systems are largely lacking, but studies have shown a prevalence of healthcare-associated infections between 4.4 and 14.8%.^{7–18} Data on infection rates in developing countries are scarce. Even if available, they may not be fully representative because they are collected in hospitals with resources exceeding the standards of the country as a whole. Multi-center studies in Mexico, Thailand, and Brazil reported rates of 9.0%, 11.7%, and 5.1%, respectively;^{19–21} however, rates higher than 20% have been detected in some hospitals.^{22–25}

Four types of infections account for more than 80% of all healthcare-associated infections and are generally linked to specific and well-known risk factors (Table 1). In developed countries, catheter-associated urinary tract infections are the most frequent (accounting for about 35% of healthcare-associated infections), but carry the lowest mortality and cost.³ Surgical site infections are second in frequency and third in estimated cost.^{3,26} Bloodstream infections and pneumonia are less common, but are associated with much higher mortality (up to 50%) and significant attributable mortality.³

In intensive care units (ICU), healthcare-associated infections affect about 30% of patients^{4,27,28} and the attributable mortality may reach 44%.²⁹ The relative proportions of different sites of infection may vary by type of ICU, but ventilator-associated pneumonia is generally the most frequent.^{30,31} The increased risk of infection in these settings

Table 1 Examples of risk factors for the four most common healthcare-associated infections

Urinary tract infections	Surgical site infections	Lung infections	Blood infections
- Urinary catheter	- Inadequate antibiotic prophylaxis	- Mechanical ventilation	- Vascular catheter
- Urinary invasive procedures	- Incorrect surgical skin preparation	- Aspiration	- Neonatal or advanced age
- Advanced age	- Type of wound	- Use of antidepressives	- Severe underlying disease
- Severe underlying disease	- Poor surgical asepsis	- Antibiotics	- Neutropenia
- Urolithiasis	- Diabetes	- Prolonged hospital stay	- Immunodeficiency
- Pregnancy	- Nutritional state	- Malnutrition	- New invasive technologies
- Diabetes	- Immunodeficiency	- Advanced age	- Critical care
	- Lack of training and supervision	- Nasogastric tube	- Lack of training and supervision
	- Suboptimal surgical site care ^a	- Surgery	
		- Immunodeficiency	

^a Failure of staff to cleanse hands before and after taking care of a surgical wound; staff touching an open or fresh wound directly unless wearing sterile gloves or using a non-touch technique; dressings of a closed wound not removed or changed if they are wet or if the patient has signs or symptoms suggestive of infection.²⁶

is linked to a higher proportion of patients with severe and multiple underlying diseases, immunosuppression, advanced age, the widespread use of invasive medical devices, crowding, and emergency situations that increase the workload and prevent optimal implementation of infection control measures.

The solution: to achieve the Global Patient Safety Challenge

Healthcare-associated infections are preventable. Infection control programs can be cost-effective.^{32,33} More sophisticated infection control measures may be required for specific sites of infection, particular devices, or selected pathogens. However, the most effective control measures consist of very simple and widely-recognized precautions, such as hand hygiene.^{34,35} The essential elements of an infection control program include: healthcare worker education; a well-organized surveillance system of healthcare-associated infections; appropriate legislation; and consistent implementation of basic infection control measures.

To tackle this problem, the World Alliance for Patient Safety is implementing a multifaceted strategy and the Global Patient Safety Challenge aims at integrating a number of different actions to reduce healthcare-associated infection. Well-established WHO programs already address some of the risk conditions that lead to healthcare-associated infections in areas such as:

- blood products and their use;
- injection practices and immunization;
- safe water, basic sanitation, and waste management;
- clinical procedures, particularly in first-level, emergency care.

The Global Patient Safety Challenge therefore embraces existing WHO strategies in these areas. These actions are also combined with the new WHO Guidelines on Hand Hygiene in Health Care (Advanced Draft) and related implementation strategies proposed (Figure 1).

Hand hygiene

Hand hygiene, a very simple action, remains the primary measure to reduce healthcare-associated infection and the spread of antimicrobial resistance across all settings—from advanced healthcare systems to local dispensaries in developing countries.^{34,35} However, the lack of compliance with hand hygiene among healthcare providers is problematic worldwide. Continuous efforts are being made to identify effective and sustainable promotion strategies. A key action within the Global Challenge is to promote hand hygiene in healthcare globally as well as at country level. To provide healthcare workers, hospital managers, and health authorities with the best scientific evidence and recommendations to improve practices and finally aim at reducing healthcare-associated infections, WHO has developed an Advanced Draft of the Guidelines on Hand Hygiene in Health Care.³⁵

Pilot tests are being conducted in each of the six WHO regions worldwide to help provide local data on the resources required to carry out the recommendations and generate information on feasibility, validity, reliability, and cost-effectiveness of the interventions concerned. This piloting is an essential part of the Global Patient Safety Challenge and the process of finalizing the WHO Guidelines. It provides an opportunity to learn practical lessons for the applicability of the Guidelines in real field situations.

In parallel, this work in progress is accompanied by specific task forces that are addressing critical implementation

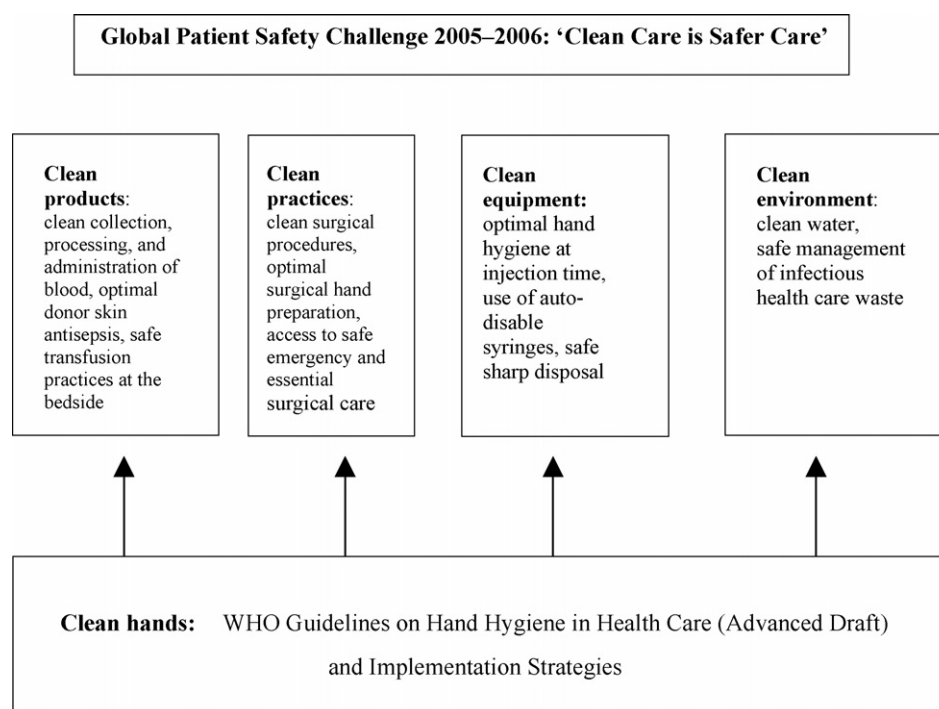


Figure 1 Actions integrated within the Global Patient Safety Challenge.

topics such as: patient involvement; global implementation of a WHO hand hygiene, alcohol-based formulation; glove use and re-use; water quality for handwashing; education, communication, and campaigning; national guidelines on hand hygiene; and religious, cultural, and behavioral aspects of hand hygiene.

Blood safety

Blood transfusion carries a potential risk of acute or delayed complications and transfusion-transmitted infections. The HIV/AIDS pandemic has focused particular attention on the importance of preventing transfusion-transmitted infections. In 2000–2001 over 70 countries were not able to test all donated blood for HIV, HBV, HCV, and syphilis.

The WHO Blood Transfusion Strategy supports the establishment of sustainable national blood programs in all countries that can ensure the provision of safe, high-quality blood and blood products accessible to all patients, and their safe and appropriate use. Key areas of focus include policies for recruitment, selection and retention of voluntary blood donors, blood screening, and appropriate clinical use of blood in patient care.

The following actions to improve blood safety are integrated within the Global Patient Safety Challenge:

- promotion of optimal hand hygiene associated with procedures for collection, processing, and use of blood products;
- promotion of donor skin antiseptics to prevent blood contamination;
- in-service education and training on safe transfusion practices at the bedside.

Injection practices and immunization

Around 16 billion injections are administered each year in developing and transitional countries.³⁶ One needlestick injury from a needle used on an infected source patient carries an average risk of transmitting HBV, HCV, and HIV of 30%, 1.8%, and 0.3%, respectively. In 2000, contaminated syringes caused 21.7 million hepatitis B virus infections (33% of all new infections), 2 million hepatitis C infections (40% of all new infections), and 260 000 HIV infections (5% of all new infections).³⁶

The WHO Injection Safety strategy works with countries to support the formulation of national policies for the safe and appropriate use of injections and facilitates access to safe, high-quality injection equipment. WHO also promotes the implementation of safe and effective systems for vaccine delivery (i.e., accessibility of auto-disable syringes, a special device that inactivates itself after a single use) and management of immunization-related waste, and the establishment and improvement of mechanisms to monitor and respond to adverse events following immunization.

The following actions to improve injection safety are integrated within the Global Patient Safety Challenge:

- promotion of optimal hand hygiene practices at time of injection and immunization;
- strengthening of high-level commitment within countries to use auto-disable syringes for immunization services;

- actions to ensure the safe disposal of sharps as part of an integrated management of waste within healthcare facilities.

Water, basic sanitation, and waste management

One million eight hundred thousand people die every year from diarrheal diseases, 88% of which are attributed to unsafe water supply and inadequate sanitation and hygiene. Water, basic sanitation, and waste management combine to form the safe environment needed for delivering healthcare. Healthcare facilities require access to safe water to prevent fecal–oral-transmitted infections and some respiratory infections. Water quality and cleanliness are also required to ensure effective handwashing during patient care.

Safe disposal of waste in healthcare, in particular syringe needles or infectious body fluids, protects healthcare workers and the community from infections, toxic effects, and injuries. These apply across a range of facilities from the reference hospital to the village health posts, residential care accommodation, dental facilities, and home-based care. Education and handwashing promotion can lead to more than a 50% reduction of the disease burden and save lives in children under 5 years of age in low-income populations.^{37,38}

The following actions to improve water quality and availability and waste management, are integrated within the Global Patient Safety Challenge:

- ensuring access and water quality to support hygiene, and hand hygiene in particular, at the level of healthcare facilities;
- ensuring sound management of waste, particularly of highly infectious healthcare waste such as syringes and sharps.

Clinical procedures

Each year around one million people lose their lives because of road traffic accidents. More than half a million women die due to pregnancy-related complications. In situations such as these, the capacity to implement correct and timely emergency clinical procedures at the first referral hospital is vital. However, in practice, the quality of surgical care is often constrained by lack of trained staff, poor facilities, inadequate low technology apparatus, and limited supplies of drugs, materials and other essentials. Without essential surgical care, up to 10% of the population dies from injury and 5% of pregnancies result in maternal death. In developed countries, about 25% of healthcare-associated infections are surgical site infections; infection rates are two- to several-fold higher in developing countries.³

The WHO Clinical Procedures strategy is working to support countries to build capacity to reduce death and disability through strengthening the basic skills of healthcare providers to manage essential emergency and surgical procedures at resource-limited healthcare facilities. Major components of the strategy include supporting the development of national policies within countries to provide basic requirements for emergency surgical services, education

and training of healthcare providers in essential procedures for obstetrics, surgery and anesthesia, and development of needs assessment and planning tools.

The following actions to improve the safety of clinical procedures are integrated within the Global Patient Safety Challenge:

- specific education programs promoting safety in surgical procedures, tailored to the needs of healthcare facilities;
- surgical hand preparation using either antimicrobial soap and water or alcohol-based hand rub to reduce infections associated with surgical procedures;
- access to safe emergency and essential surgical care, including the availability and use of best practice protocols on clinical procedures and equipment.

Implementation strategies of the Global Patient Safety Challenge

The Global Patient Safety Challenge 2005–2006 'Clean Care is Safer Care' means working worldwide to assist countries to reduce the burden of healthcare-associated infection. The challenges are enormous but so are the rewards: saving lives, improving patient safety, and making life better for countless millions of patients and their families.³⁹ The objectives are to:

- raise awareness of the impact of healthcare-associated infections on patient safety and promote preventive strategies within countries;
- build commitment from countries to give priority to reducing healthcare-associated infections;
- test the implementation of the WHO Guidelines on Hand Hygiene in Health Care (Advanced Draft) in specific districts worldwide as part of an integrated package of actions described above in the areas of clean products (blood safety), clean practices (safe clinical procedures), clean equipment (injection and immunization safety), and clean environment (safe water and sanitation in healthcare).

Implementation of the Global Patient Safety Challenge in countries is thus focused on three major strategies: awareness-raising and campaigning, country pledges, and testing implementation in districts.

Building global awareness and understanding of the importance of healthcare-associated infection will help catalyze leadership, political commitment, and action.³⁸ An international awareness-raising campaign has been initiated, focusing primarily on hand hygiene. National health authorities should be at the center of efforts to minimize risks to patients through strengthening systems, environments, processes, and practices in the area of infection control and prevention. WHO Member States have been invited to formally pledge to implement actions to reduce healthcare-associated infection within their countries and to share results and learning internationally.

The procedure to obtain the definitive WHO Guidelines on Hand Hygiene in Health Care includes a last, essential step: the pilot testing phase. The different components of the Global Patient Safety Challenge will be implemented in pilot sites located in each of the six WHO regions worldwide, with a particular emphasis on the Guidelines on Hand Hygiene. The

main goals of this phase are to test the feasibility of the Challenge overall and to learn practical lessons for the applicability of the Guidelines in real field situations.

'Clean Care is Safer Care' currently focuses on short-term objectives and available resources are currently employed to organize regional and national events and workshops, but not to sustain long-term programs in countries. However, human and financial resources will be allocated to support pilot sites where the WHO Guidelines on Hand Hygiene in Health Care are being tested along with the implementation of other interventions related to blood, injection, clinical procedure, and water and environmental safety. The final, recommended strategy will then be tailored according to lessons learned on feasibility and local acceptability. Finally, the aim is also to produce a set of practical, validated tools that are easily available and free of charge to both resource-poor and resource-rich countries or institutions that are interested in promoting hand hygiene in healthcare.

Conclusion

Safety is a fundamental principle of patient care and a critical component of quality management. Its improvement demands a complex system-wide effort involving a broad range of actions related to performance improvement, environmental safety, and risk management, including infection control, safe use of medicines, equipment safety, safe clinical practice, and a safe care environment.

Healthcare-associated infection is of paramount importance worldwide; it affects the quality of care and patient safety and adds tremendous and needless costs to healthcare.

The commitment of the World Alliance for Patient Safety to reduce healthcare-associated infections by selecting this topic as the first Challenge is an unprecedented step. The combined efforts expected under the Global Patient Safety Challenge have the potential to save millions of lives and release major resource savings by improvement of basic procedures and a greater adherence paid to hand hygiene protocols among healthcare providers.

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References

- World Health Organization. *World Alliance for Patient Safety: forward programme 2005*. Geneva: WHO; 2005. Available at: http://www.who.int/patientsafety/en/brochure_final.pdf (accessed 1 March 2006).
- Benenson AS. *Control of communicable diseases manual*. 16th ed. Washington: American Public Health Association; 1995.
- World Health Organization. *The Global Patient Safety Challenge 2005-2006 "Clean Care is Safer Care"*. Geneva: World Health Organization; 2005. Available at: http://www.who.int/patient-safety/events/05/GPSC_Launch_ENGLISH_FINAL.pdf (accessed 1 June 2006).
- Pittet D, Harbarth S. The intensive care unit. In: Bennett JV, Brachman PS, editors. *Hospital infections*. 4th ed. Boston, MA: Little, Brown & Company; 1998. p. 381–402.
- Weinstein RA. Nosocomial infection update. *Emerg Infect Dis* 1998;4:416–20.
- Lazzari S, Allegranzi B, Concia E. Making hospitals safer: the need for a global strategy for infection control in healthcare settings. *World Hosp Health Serv* 2004;40: 32, 34, 36–42.
- Bernander S, Hambraeus A, Myrback KE, Nystrom B, Sundelof B. Prevalence of hospital-associated infections in five Swedish hospitals in November 1975. *Scand J Infect Contr* 1978; 10:66–70.
- Mertens R, Kegels G, Stroobant A, Reybrouck G, Lamotte JM, Potvlieghe C, et al. The national prevalence survey of nosocomial infections in Belgium, 1984. *J Hosp Infect* 1987;9:219–29.
- Šrámová H, Bartonová A, Bolek S, Krečmerová M, Šubertová V. National prevalence survey of hospital-acquired infections in Czechoslovakia. *J Hosp Infect* 1988;11:328–34.
- Emmerson AM, Enstone JE, Griffin M, Kelsey MC, Smyth ET. The second national prevalence survey of infections in hospitals—overview of the results. *J Hosp Infect* 1996;32:175–90.
- Ruden H, Gastmeier P, Daschner FD, Schumacher M. Nosocomial and community-acquired infections in Germany. Summary of the results of the First National Prevalence Study (NIDEP). *Infection* 1997;25:203–5.
- Pittet D, Harbarth S, Ruef C, Francioli P, Sudre P, Pétignat C, et al. Prevalence and risk factors for nosocomial infections in four university hospitals in Switzerland. *Infect Control Hosp Epidemiol* 1999;20:37–42.
- Gikas A, Padiaditis I, Roubelaki M, Troulakis G, Romanos J, Tselentis Y, the CICNet. Repeated multi-centre prevalence surveys of hospital-acquired infection in Greek hospitals. *J Hosp Infect* 1999;41:11–8.
- Vaqué J, Rosselló J, Arribas L, the EPINE Working Group. Prevalence of nosocomial infections in Spain: EPINE study 1990–1997. *J Hosp Infect* 1999;43:S105–11.
- Scheel O, Stormark M. National prevalence survey on hospital infections in Norway. *J Hosp Infect* 1999;41:331–5.
- The French Prevalence Survey Study Group. Prevalence of nosocomial infections in France: results of the nationwide survey in 1996. *J Hosp Infect* 2000;46:186–93.
- Klavs I, Bufon Luznik T, Skerl M, Grgic-Vitek M, Lejko Zupanc T, Dolinsek M, et al. Prevalence and risk factors for hospital-acquired infection in Slovenia—results of the first national survey, 2001. *J Hosp Infect* 2003;54:149–57.
- Nicastri E, Petrosillo N, Martini L, Larosa M, Gesu GP, Ippolito G, the INF-NOS Study Group. Prevalence of nosocomial infections in 15 Italian hospitals: first point prevalence study for the INF-NOS Project. *Infection* 2003;31:10–5.
- Ponce-de-Léon RS, Garcia GL, Volkow FP. Resultados iniciales de un programa de infecciones nosocomiales en los Institutos Nacionales de Salud. *Salud Publica Mex* 1986;28:586–92.
- Danchaivijitr S, Waitayapichet S, Chokloikaev S. Efficacy of hospital infection control in Thailand 1988–1992. *J Hosp Infect* 1996;32:147–53.
- Starling CAF, Pinheiro SMC, Almeida FF. *CDC/NNIS methodology in Brazilian hospitals: five years of experience*. 6th Annual Meeting of the Society for Health Epidemiology of America, Washington DC, 1996.
- Mayon-White RT, Duce G, Kereselidze T, Tikomirov E. An international survey of the prevalence of hospital-acquired infection. *J Hosp Infect* 1988;11:43–8.
- Ponce-de-Léon S. The needs of developing countries and the resources required. *J Hosp Infect* 1991;18:376–81.
- Western KA, St John R, Shearer LA. Hospital infection control and international perspectives. *Infect Control* 1982;3:453–5.
- Macias AE, Muñoz JM, Bruckner DA, Galvan A, Rodriguez AB, Guerrero FJ, et al. Parenteral infusion contamination in a multi-institutional survey in Mexico: considerations for nosocomial mortality. *Am J Infect Control* 1999;27:285–90.
- Mangram AJ, Horan TC, Pearson ML, Silver LC, Jarvis WR. Guideline for prevention of surgical site infection, 1999. Hospital Infection Control Practices Advisory Committee. *Infect Control Hosp Epidemiol* 1999;20:250–78.
- Vincent JL. Nosocomial infections in adult intensive-care units. *Lancet* 2003;361:2068–77.
- Eggimann P, Pittet D. Infection control in the ICU. *Chest* 2001;120:2059–93.
- Girou E, Stephan F, Novara A, Safar M, Fagon JY. Risk factors and outcome of nosocomial infections: results of a matched case-control study of ICU patients. *Am J Respir Crit Care Med* 1998;157:1151–8.
- National Nosocomial Infections Surveillance (NNIS) System Report, data summary from January 1992 to June 2002. issued August 2002. *Am J Infect Control* 2002; 30:458–75.
- Pittet D, Uckay I, Eggimann P, Sax H. Non-antimicrobial measures to prevent infections in critical care. In: Torres, A., editor. *Critical Care Medicine*. Des Plaines, IL: Society for Critical Care Medicine; 2006. (in press).
- Haley RW, Culver DH, White JW, Morgan WM, Emori TG, Munn VP, et al. The efficacy of infection surveillance and control programs in preventing nosocomial infections in US hospitals. *Am J Epidemiol* 1985;121:182–205.
- Haley RW, Morgan WM, Culver DH, White JW, Emori TG, Mosser J, et al. Update from the SENIC project. Hospital infection control: recent progress and opportunities under prospective payment. *Am J Infect Control* 1985;13:97–108.
- Pittet D, Hugonnet S, Harbarth S, Mourouga P, Sauvan V, Touveneau S, et al. Effectiveness of a hospital-wide programme to improve compliance with hand hygiene. Infection Control Programme. *Lancet* 2000;356:1307–12.
- World Health Organization. *World Alliance for Patient Safety: Global Patient Safety Challenge 2005-2006*. Geneva: World Health Organization; 2005. Available at: http://www.who.int/patientsafety/events/05/HH_en.pdf (accessed 23 June 2006).
- World Health Organization. *Injection safety*. Fact sheet No. 231, revised April 2002. Available at <http://www.who.int/mediacentre/factsheets/fs231/en/index.html> (accessed 1 June 2006).
- Luby SP, Agboatwala M, Feikin DR, Painter J, Billhimer W, Altamirano A, et al. Effect of handwashing on child health: a randomised controlled trial. *Lancet* 2005;366:225–33.
- Pittet D. Clean hands reduce the burden of disease. *Lancet* 2005;366:185–7.
- Pittet D, Donaldson L. Clean Care is Safer Care: a worldwide priority. *Lancet* 2005;366:1246–7.