

# Educational innovation for infection control in Tanzania: bridging the policy to practice gap

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## Abstract

**T**he incidence of hospital acquired infection in developing countries is between two to 20 times higher than in developed countries and is attributable to multiple causes. Evidence-based international policies and guidelines developed to improve infection prevention and control are often not used in practice in these countries. To combat this challenge, this article presents an innovative educational framework used to bridge the gap between policy written by global health agencies and the realities of practice in Tanzania.

## Introduction

Hospital acquired infection is a problem confronting all healthcare settings globally, leading to extended hospital stay and increased patient morbidity and mortality (Hambraeus, 2006). Furthermore, it is estimated that over 1.4 million people are suffering from hospital acquired infections at any one time (Allegranzi et al, 2007). In developing countries the infection rates are approximately two to 20 times higher than those in developed countries and are attributed to multiple causes such as inadequate infrastructure, understaffing, poor hygiene and underlying disease (Pittet et al, 2008; Nejad et al, 2011; World Health Organization, 2011). In response to this challenge, following a specific request from the Tanzanian Chief Nursing Officer (C. Mpandana, personal communication, 25 July 2009) to assist with the introduction of continuing professional development models, Western Australian infection control nurse experts were deployed by Global Health Alliance Western Australia (GHAWA) to Tanzania. They provided a novel educational framework that bridged the gap between internationally informed policy and the realities of practice in Tanzania. This article describes the educational and transcultural strategies they employed to achieve a positive outcome.

In reviewing the literature there was a dearth of studies conducted on infection control in Tanzania. Those that exist, however, indicate a

prevalence of surgical site infections (SSIs) occurring in up to 25% of all in-patients throughout the country (Eriksen et al, 2003; Gosling et al, 2003; Fehr et al, 2006). This was in comparison with findings from other sub-Saharan countries that indicated a prevalence of between 6.8% and 23.6% (Ameah et al, 2009; Mwachaka et al, 2010; Wood et al, 2012). It must be noted that direct comparison between studies should be treated with caution due to the differing methods of data collection, settings, samples, types of surgery and socioeconomic status in each country.

To combat the prevalence of infection in developing countries, a number of global activities have been launched, including the *WHO First Global Patient Safety Challenge, Clean Care is Safer Care* recommendations and guidelines (World Health Organization, 2009a,b). These guidelines, along with the Tanzanian National Infection Prevention Guidelines 2007 (Tanzanian Government, 2007), were used in the development of an Infection Prevention and Management Course (IPMC) delivered to health professionals in Tanzania by GHAWA educators. However, when delivering the course, it was found that despite the availability of high quality policies and guidelines, frontline health professionals were unaware of their existence or were unable to practise within their recommendations. This was one of a number of challenges encountered by the educators. By sharing the strategies used to promote the relevance of the course to local circumstances, and the recommendations, it is intended to provide information on educational strategies used in implementing an evidence-based infection control education course in a developing country.

## Global Health Alliance Western Australia (GHAWA)

GHAWA was established in 2009 to build capacity in the nursing and midwifery workforces of developing countries around the Indian Ocean Rim utilising the resources of Western Australian expert nurses, midwives and academics. GHAWA is a partnership of all five Western Australian universities working in collaboration with the Department of Health (DOH), Western Australia.

## Infection Prevention and Management Course (IPMC)

In 2011 an 'in country' needs analysis was conducted by GHAWA, which identified infection prevention and management as a specific area in which Western Australia educational and clinical expertise could contribute to improving patient care outcomes (Keyes et al, 2011). The IPMC was subsequently developed in 2012 by specialist nurse educators working in this area within WA Health. In embarking on the delivery of this course, the educators were aware of the comprehensive World Health Organization (WHO) Multimodal Hand Hygiene Strategy, which addresses not only education and knowledge of infection control, but infrastructure needs, evaluation and monitoring, reminders for staff in the workplace and the culture of safety in the institution (World Health Organization, 2009a). However, the GHAWA needs analysis had not identified problems such as an unreliable water supply or a lack of resources such as hand wash. As such, the IPMC was never intended to be a wide-ranging strategy such as that proposed by WHO. However, a range of subjects drawn from local and international guidelines were to be covered. It was not until educators viewed the hospitals for themselves that the resource-poor environment became evident. As it transpired, the eventual focus was on hand hygiene, as a result of adaptation to suit participants' expressed need.

To complement the preparation of this course, education providers visited four hospitals in the greater metropolitan area of Dar es Salaam in the week preceding the course, gaining an understanding of hospital design, resources, equipment, hand hygiene facilities, workforce, and patient needs specific to their conditions. This was paramount to develop an understanding of and respect for cultural needs, to ascertain environmental barriers to safe infection prevention, and to identify factors to help bridge the theory and practice gap. This preparation is supported by Pearson and Jordan's (2010) research, which recommended action-orientated programmes be based on evidence-based practice within the local context and be relevant to Tanzanian health professionals and their patients (Pearson and Jordan, 2010).

### Course aim

The course aimed to provide an awareness of the Tanzanian National Infection Prevention Guidelines, and to effect a translation of those national guidelines into practice in Tanzania. It also aimed to build the capacity of participants to identify infection risk and undertake risk reduction activities within the available resources. The four day course, conducted at a hospital campus in Dar es Salaam, involved 40 participants, including medical doctors, nurses, midwives, nursing and midwifery educators, nursing assistants, pharmacy staff and laboratory staff. Participants came from six different healthcare sites comprising acute and community settings.

### Course content

The IPMC contained the following modules:

- Standard and Transmission-based Precautions
- Infection Prevention and Staff Health
- Hand Hygiene including the WHO's 5 Moments of Hand Hygiene, which details specific instances around the care of a patient where hand hygiene has been proven to be most effective at reducing transmissions of organisms (World Health Organization, 2009b)
- Sharp and Injection Safety
- Waste Management
- Quality Improvement
- Instruments and Equipment Decontamination
- Infection Prevention (catheterisation and intravascular devices)
- Outbreak Management
- Spreading Good Practice.

An innovative blended pedagogical approach was adopted using theoretical learning consolidated by group work, quizzes, role play, self-assessment in individual hospital groups, and practical hand hygiene sessions. To add richness, participants were encouraged to provide knowledge related to infection control practices across professions and between sites, as they were in multidisciplinary and multi-site groups. This approach constitutes a departure from the didactic educational style commonly conducted in Tanzania, which generally relies on knowledge retention, with minimal opportunities for experiential learning or critical thinking (Mkony et al, 2012).

### The Tanzanian context

During the hospital visits the educators identified several characteristics of the Tanzanian context that would necessitate modification of the course before it commenced. Firstly, an inadequate water supply was identified. This resulted in significant changes to the teaching of hand hygiene, which is discussed in detail below. In addition, photographs were replaced in the originally prepared PowerPoint presentation with versions from the WHO website. These were more representative of the local situation, for example mobile water containers. Secondly, participant characteristics pertaining to language became evident. Although the English language skills of participants were sufficient, the language used in the presentations was simplified to reduce the complexity of message and facilitate learning.

### Transcultural strategies

On day one of the course, in keeping with educational and cultural practices in Tanzania, time was allowed to facilitate greetings. One innovative greeting technique used by the educators was to display photographs of their families holding welcome signs written in Kiswahili. This recognised the educators as mothers as well as health professionals, a status that was acknowledged culturally by participants, and established mutual respect. The use of albeit limited Kiswahili allowed educators to supersede the limitations of language and facilitated the development of rapport; a concept posited in education research as being critical to engaging participants, with links to cognitive and affective learning (Frisby and Martin, 2010).

Educators also spent time praising what was already working well in Tanzania such as good airflow and ventilation, and identified good sterilisation techniques and inventive use of mobile water containers in lieu of sinks. The combination of these transcultural approaches served to alter the dynamics of the classroom to make it a trusting environment where participants were able to open up and be honest about the reality of their practice. In turn it enabled educators to make realistic practical recommendations for change.

### Challenges in course delivery

On commencement of the course barriers to the implementation of evidence-based practice quickly became apparent. An example of this was hand hygiene; the participants very quickly understood the '5 Moments of Hand Hygiene' but the lack of hand hygiene facilities was identified as being a challenge, with one noting:

*"How can we wash our hands when there is no sink?"*

At the first practical demonstration of the hand hygiene technique this was confirmed when running water was unavailable at the site. To overcome this, bottled water was used, a common practice in the daily reality of Tanzanian hospitals. Other barriers included the lack of clinical and basic equipment, such as clocks, watches, trolleys, specific storage for sterile stock and poor process design in sterilisation pathways.

Further descriptions from the participants included:

*"There are only a few laryngoscopes in the Emergency Department and sometimes we cannot clean them",* and

*"Only one chloride container and over 100–200 instruments going in each day",* with another stating,

*"How do we know 10 minutes when there are no clocks?"*

The gaps between policy recommendations and actual practice were addressed during each session by educators using an infection risk assessment and reduction technique. While still adhering to WHO international standards, educators modified the standards to be achievable within the realities of resource availability. An example of this is seen with practising all five of the WHO 5 Moments of Hand Hygiene. Given the lack of running water, sinks, and liquid soap, it was considered unreasonable by participants. It was subsequently decided that moment 2, 'Before an aseptic procedure', would be the most effective at reducing transmissions, and would be prioritised on return to clinical practice.

Despite the challenges confronted, a variety of successful learning approaches were used in order to deliver the course. One such approach included group work where participants were assembled according to their hospital and asked to work together as an interdisciplinary team. This was very successful, enabling staff to share knowledge, reflect on current practice and problem solve as to how the knowledge gained could be applied to their particular working environment. Alternatively, participants were grouped according to profession and were able to share information about recent upgrades and practices at their hospital.

Role play was another innovative approach used within the IPMC, and is highlighted by Oogarah-Pratap (2006) as an effective strategy, particularly after rapport has been suitably established. In the IPMC educators took the role of patient or nurse and demonstrated the 5 Moments of Hand Hygiene and aseptic technique. Participants repeated the role play, quickly embracing the opportunity to use their own language and use a peer-led teaching technique. The thespian skills displayed in playing 'needy' Western patients were noteworthy. Role play also gave opportunity for individual expressions and dynamic group interaction, such as the spontaneous performance of course participants chanting a song about the 5 Moments of Hand Hygiene.

Another learning activity that proved to be effective in establishing the credibility of the educators and which enthused participants was the use of the GlitterBug® product, a chemical that shines fluorescently when illuminated by a UV lamp (GlitterBug.Com). Participants after washing their hands in their usual manner, applied the GlitterBug® product and then viewed their hands under the UV lamp (Figure 1), demonstrating the effectiveness of the hand hygiene technique. The immediate and visual nature of this learning activity was particularly effective in enhancing an understanding and acceptance of the course content. Moreover, the design of the lamp resembles a bug, and it rapidly gained the nickname of 'Henry', becoming the mascot of the classroom. The introduction of 'Henry' broke the didactic teaching style, livened up the classroom and facilitated effective engagement of the quieter group members, as well as those with poor English. Additionally this approach resulted in laughter and camaraderie, turning a potentially mundane and patronising activity into a humorous learning activity; the use of humour being strongly associated with enhanced learning in nursing education (Ulloth, 2002).

In keeping with the focus on local needs, during the quality improvement (QI) component of the course each participant identified one or more targets for improvement in their clinical area. Specific QI projects were developed for each work area and motivated participants took

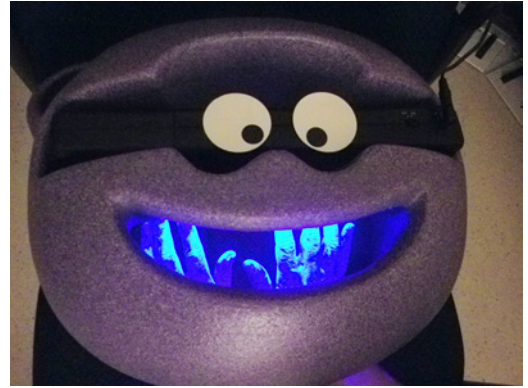


Figure 1. Use of the GlitterBug lamp to highlight poor hand hygiene technique

responsibility for their completion. The aim was for each to action the following in the clinical area:

- Ensure liquid soap was available at the sink,
- Share knowledge of correct hand hygiene using posters and the WHO 5 Moments of Hand Hygiene, and
- Provide education on safe timing in the decontamination process using timers and charts.

Before the course, participants believed QIs to be the responsibility of hospital managers and had never undertaken quality improvement activities themselves. GHAWA educators emphasised that although Tanzanian hospitals did not have infection control specialists, staff could make a difference in their own area. Participants were keen to put up their created posters and involve the interdisciplinary team. Some also wished to include patients and visitors in their projects. The participants were animated and enthusiastic, with numerous ideas evolving on how improvements could be achieved.

#### Participant feedback

Although it cannot be demonstrated empirically, participant feedback via daily quizzes indicated increased awareness in infection prevention, hand hygiene, quality improvement and aseptic technique. The final course evaluation via questionnaire revealed the sessions were useful and informative, particularly the 5 Moments of Hand Hygiene module. More time was indicated for sessions on decontamination, outbreak investigation/management, community waste management, safety injection procedures, available vaccinations, and the coughing and sneezing technique. The development of a video on infection control practices demonstrating examples of poor and positive practice was requested to enable this to be available at all hospital sites. Post-course discussions held between educators and Curtin University staff, as well as participant evaluations, revealed that time in the clinical area would have enhanced the course, by facilitating quality improvement exercises, risk assessment at nominated sites and the application of learned theories to specific situations. Other suggestions included involving managers of hospitals to raise awareness of the importance of infection prevention and control at executive level.

#### Discussion

The presence of policies and guidelines does not necessarily ensure infection control programmes will be implemented in resource-poor countries. Tanzania, for example, has a national infection control policy document that has been contributed to by several international non-government organisations, yet it has not permeated through to the clinical environment. While efforts are made to follow guidelines by health professionals, they are often jeopardised by poor systems and processes within that country. Bridging the gap between the

guidelines and practice was a priority in the IPMC, which was designed to be culturally and economically appropriate for local conditions (Jayasekara and Schultz, 2006).

Infection control interventions that contain an education programme tailored to the specific needs of local circumstances, such as the IPMC provided through GHAWA, are considered an essential part of any infection control programme (Agarwal et al, 2007; Ider et al, 2012). The delivery of basic infection control education programmes with a particular emphasis on hand hygiene resulted in marked reductions in the neonatal mortality rate in two low-resource hospitals in India and the Philippines (Mantaring et al, 2005; Agarwal et al, 2007). Both of these studies support the implementation of simple interventions, including education to reduce infection rates. An increase in hand hygiene knowledge and compliance was also demonstrated in a low-resource setting in Mali when the WHO multimodal hand hygiene promotion strategies were introduced (Allegranzi et al, 2010).

Some of the strategies promoted in the IPMC have also been replicated elsewhere to positive effect. For example, displaying educational posters was a strategy proposed by GHAWA course participants in their quality improvement projects, and was similarly part of an infection control programme that was introduced to the special care nursery of a tertiary hospital in Bangladesh (Darmstadt et al, 2005). In Bangladesh a significant reduction in suspected sepsis, culture-confirmed sepsis and sepsis-related neonatal death occurred over the study period (Darmstadt et al, 2005).

However, with the exception of these specific examples, larger scale programmes being conducted to assist developing countries to lower their infection rates have to date been unsuccessful (Ider et al, 2012). The literature attributes this to, among other things, the low priority given to infection control by hospital management (Ider et al, 2012). Subsequently, one of the recommendations from the GHAWA educators was to involve hospital management in the education courses. This is supported by Huskins et al (1998), who promote the inclusion of hospital management in the QI process to ensure changes are sustainable.

In accordance with the promotion of sustainability, the importance of having specific individuals or 'change champions' willing to persist in the implementation of practice change is highlighted by Darmstadt et al. (2005). The change champions identified during the IPMC intended to implement QI measures in their own hospitals and encourage colleagues to consider changing practice. Further support of these change champions will be necessary to build capacity and sustainability for change.

In conclusion, the GHAWA Infection Prevention and Management Course is an innovative approach but further work is required to explore the impact of the programme in a measurable way. The adaptations made by the educators helped to enhance the relevance of the course, and its applicability to the realities of practice in Tanzania, thereby bridging the gap between the National Guidelines and daily practice. In essence, this was the key differentiating factor from similar short courses that the educators had run in Australia. Teaching in the Tanzanian context required significant variation of the original course. Communication style and presentation of content that could

potentially be too complex for some of those in attendance had to be modified. As a general theme this involved a reductionist approach from perhaps an overly ambitious course prospectus with a broad focus on infection control to one which focused on 'moment 2'; a concept readily grasped by all participants and seen to have immediate utility in their work. Moving forward from these observations, it is clear to us that devising some means of determining an appropriate combination of education and practical sessions in clinical areas to underpin classroom-based learning warrants attention.

Previous work highlights the difficulties of translating evidence-based globally developed policies and guidelines into practice by frontline health professionals (Grol and Grimshaw, 2003). From our experience, the impact of internationally funded and informed infection control policy guidance for Tanzania is greatly reduced in clinical practice unless it is mediated through engaging and effective education relevant to the daily reality of nurses, midwives and other healthcare practitioners. Further research is required to determine the barriers and enablers to change practice, as quality improvement does not culturally fit within the duties and structure of the demanding Tanzanian health professional role (S.Thomas and A.Whitfield, personal communication, 15 January 2013). This paper concludes that a creative and engaging education programme could, with further evaluation, be a useful approach to bridging the policy to practice gap in Tanzania.

## Recommendations

Further research:

- Ascertain the extent to which evidence-based globally developed policies and guidelines are being used by front-line health professionals in Tanzania.
- Explore the barriers and enablers for the use of evidence-based globally developed policies and guidelines by front-line health professionals in Tanzania.
- Pedagogies of interactive learning using the GlitterBug lotion and glow lamp, and multi-disciplinary groups allowing for sharing of knowledge and practices, can be useful as one component of a multifaceted approach to engage learners in technique training but they should not be relied on to change practice at the bedside.

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## Declaration of conflicting interest

The authors declare that there are no conflicts of interest.

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## References

- Agarwal R, Agarwal K, Acharya U, Christina P, Sreenivas V, Seetaraman S. (2007) Impact of simple interventions on neonatal mortality in a low-resource teaching hospital in India. *Journal of Perinatology* **27**(1): 44–9.
- Allegranzi B, Sax H, Bengaly L, Richet H, Minta D, Chrait MN, Sokona FM, Ageron AG, Bonnabry P, Pittet D. and on behalf of the World Health Organization "Point G" Project Management C.

(2010) Successful implementation of the World Health Organization hand hygiene improvement strategy in a referral hospital in Mali, Africa. *Infection Control and Hospital Epidemiology* **31**(2): 133–41.

Allegranzi B, Storr J, Dziekan G, Leotsakos A, Donaldson L, Pittet D. (2007) The First Global Patient Safety Challenge "Clean Care is Safer Care": from launch to current progress and achievements. *Journal of Hospital Infection* **65, Supplement 2**(0): 115–23.



- Ameah EA, Mshelbwala PM, Nasir AA, Lukong CS, Jabo BA, Anumah MA, Nmadu PT. (2009) Surgical site infection in children: prospective analysis of the burden and risk factors in a sub-Saharan African setting. *Surgical Infections* **10**(2): 105–09.
- Darmstadt GL, Nawshad Uddin Ahmed ASM, Saha SK, Azad Chowdhury MAK, Alam MA, Khatun M, Black RE, Santosham M. (2005) Infection control practices reduce nosocomial infections and mortality in preterm infants in Bangladesh. *Journal of Perinatology: Official Journal of the California Perinatal Association* **25**(5): 331–5.
- Eriksen HM, Chugulu S, Kondo S, Lingaas E. (2003) Surgical-site infections at Kilimanjaro Christian Medical Center. *Journal of Hospital Infection* **55**(1): 14–20.
- Fehr J, Hatz C, Soka I, Kibatala P, Urassa H, Smith T, Mshinda H, Frei R, Widmer A. (2006) Risk factors for surgical site infections in a Tanzanian district hospital: a challenge for the traditional national nosocomial infections surveillance system index. *Infection Control and Hospital Epidemiology* **27**(12): 1401–04.
- Frisby BN, Martin MM. (2010) Instructor-student and student-student rapport in the classroom. *Communication Education* **59**(2): 146–64. GlitterBug.Com GlitterBug Handwash Education System.
- Gosling R, Mbatia R, Savage A, Mulligan JA, Reyburn H. (2003) Prevalence of hospital-acquired infections in a tertiary referral hospital in northern Tanzania. *Annals of Tropical Medicine and Parasitology* **97**(1): 69–73.
- Grol R, Grimshaw J. (2003) From best evidence to best practice: effective implementation of change in patients' care. *The Lancet* **362**(9391): 1225–30.
- Hambraeus A. (2006) Lowbury Lecture 2005: infection control from a global perspective. *Journal of Hospital Infection* **64**(3): 217–23.
- Huskins WC, Soule BM, O'Boyle C, Gulácsi L, O'Rourke EJ, Goldmann DA. (1998) Hospital infection prevention and control: a model for improving the quality of hospital care in low- and middle-income countries. *Infection Control and Hospital Epidemiology* **19**(2): 125–35.
- Ider B-E, Adams J, Morton A, Whitby M, Clements A. (2012) Perceptions of healthcare professionals regarding the main challenges and barriers to effective hospital infection control in Mongolia: a qualitative study. *BMC Infectious Diseases* **12**(1): 170.
- Jayasekara R, Schultz T. (2006) The feasibility and appropriateness of introducing nursing curricula from developed countries into developing countries: a comprehensive systematic review [2006]. pp. 1–16. Joanna Briggs Institute: Adelaide, Australia.
- Keyes L, Lane M, O'Nions P, Stanley D. (2011) Tanzania: inception phase. In *Global Health Alliance WA Summary Report* (Department of Health, ed.). Global Health Alliance WA: Perth, Western Australia.
- Mantaring JB, Mandoza M, Estrada GM, Canseco RR, Aduan E, Geraldez A, Mendoza SD, Macleod WB, Huskins WC, Goldmann D, Gill CJ, Hamer DH. (2005) Reduction in neonatal bacteremia and mortality rates using a simple set of interventions in a NICU in the Philippines [abstract]. *International Journal Of Antimicrobial Agents* **26**: S92.
- Mkony CA, O'Sullivan PS, Owibingire SS, Fyfe MV, Omer S, Freeman P, Makubi A, Mloka DA, Portillo CJ, Leyna GH, Tarimo E, Kaaya EE, Macfarlane SB. (2012) Teaching and educational scholarship in Tanzania: Faculty initiative to improve performance of health professionals' students. *Journal of Public Health Policy* **33**(S1): S150–70.
- Mwachaka PM, Obonyo NG, Mutiso BK, Ranketi S, Mwang'ombe N. (2010) Ventriculoperitoneal shunt complications: a three-year retrospective study in a Kenyan national teaching and referral hospital. *Paediatric Neurosurgery* **46**: 1–5.
- Nejad SB, Allegranzi B, Syed SB, Ellis B, Pittet D. (2011) Health-care-associated infection in Africa: a systematic review. *Bulletin of the World Health Organization* **89**: 757–65.
- Oogarah-Pratap B. (2006) The use of role-play as an assessment strategy in health education for trainee primary school teachers – a case study. *Journal of Science Education* **7**(1): 36–9.
- Pearson A, Jordan Z. (2010) Evidence-based healthcare in developing countries. *International Journal of Evidence-based Healthcare* **8**(2): 97–100.
- Pittet D, Allegranzi B, Storr J, Nejad SB, Dziekan G, Leotsakos A, Donaldson L. (2008) Infection control as a major World Health Organization priority for developing countries. *Journal of Hospital Infection* **68**(4): 285–92.
- Tanzanian Government. (2007) National infection prevention and control guidelines for healthcare services in Tanzania. A pocket guide for healthcare providers. (MoHaS Welfare, ed.). Government of Tanzania: Tanzania.
- Ulloth J. (2002) The benefits of humor in nursing education. *Journal of Nursing Education* **41**(11): 476–81.
- Wood J, Nthumba P, Stepita-Poenaru E, Poenaru D. (2012) Pediatric surgical site infection in the developing world: a Kenyan experience. *Pediatric Surgery International* **28**(5): 523–7.
- World Health Organization. (2009a) Guide to implementation: a guide to the implementation of the WHO multimodal hand hygiene improvement strategy. World Health Organization: Geneva, Switzerland.
- World Health Organization. (2009b) WHO guidelines on hand hygiene in health care: first global patient safety challenge clean care is safer care. World Health Organization: Geneva, Switzerland.
- World Health Organization. (2011) Report on the burden of endemic healthcare associated infection worldwide. World Health Organization: Geneva, Switzerland.