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Mini Review

Prevention and control of nosocomial infections and resistance to antibiotics in Europe – Primum non-nocere: Elements of successful prevention and control of healthcare-associated infections

Martin Mielke*

Robert Koch-Institute, Nordufer 20, 13353 Berlin, Germany

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ABSTRACT

In October 2004, the WHO launched the World Alliance for Patient Safety. In 2006, the Council of Europe adopted a recommendation on the management of patient safety and prevention of adverse events in healthcare to acknowledge that patients can expect each EU health system to secure a systematic approach to ensuring patient safety. This review is a compilation of broadly accepted instruments for the prevention and control of healthcare-associated infections and resistance to antibiotics in Europe.

Antibiotic-resistant bacteria do not stop at the exit of a hospital. The implementation of the various elements of a whole bundle of recommended prevention and control measures in the context of interacting healthcare institutions including long-term care, rehabilitation facilities, ambulatory care practices, and home care, is therefore facilitated by the establishment of regional networks and the integration of prevention and control strategies into disease management programmes.

In order to increase efficiency of prevention and control measures, there is a need for the careful design of interventional studies to figure out the most efficient single or bundle of preventive measures. In addition, methods for the discovery of clusters on the basis of routinely obtained data should be improved.

Introduction

Hospitals were founded in the middle ages to care for poor people afflicted by lepra, pest, and tick typhus. With the beginning of the 19th century, when detailed knowledge in pathology and surgery revolutionized medicine, it became obvious, however, that healthcare interventions in hospitals, although intended to benefit patients, may in some cases cause unintended harm such as surgical site infections and post partum septicaemia. Infections that occur in the context of medical treatment and patients did not have before, so-called nosocomial or healthcare-associated infections (HCAI), still are among the most frequent infections in Europe and other industrialized regions. In fact, they are the most prominent reason for failure of advanced medical treatment such as complex surgery, intensive care, or treatment of immunosuppressed patients.

Prevalence surveys show that 4–9% of patients treated in hospitals suffer from a nosocomial infection. However, public awareness arose only recently, mainly because of the occurrence of antibiotic-resistant bacteria that result in infections, which are difficult to treat, like sepsis, pneumonia, wound infections, or infections of the urogenital tract (ECDC, 2008).

While classical transmissible diseases are critically determined by exposure to and the more or less defined virulence factors of the causative agent, the disposition of the host is the most prominent factor in the pathogenesis of nosocomial infections. Typical risk factors are disposing illnesses like diabetes or kidney dysfunction, high age, disruption of physiological barriers by indwelling devices or changes in the composition of the physiological bacterial flora due to the application of antibiotics. Consequently, the increasing number of older people which is paralleled by a greater demand for healthcare may even increase the problem in the future. Major current problems arise from the spread of MRSA, ESBL-producing *E. coli* or Klebsiellae, multiresistant *Pseudomonas* or *Acinetobacter* spp. as well as from *Clostridium difficile* and *Norovirus* (ECDC, 2008).

Surveillance studies show that spectrum and frequency of nosocomial infections differ according to country, region, and healthcare facility and even from department to department, ward to ward or specialty within a hospital. These differences have multiple and frequently not obvious or even so far unknown causes but are most probably due to differences in the case mix, kind and intensity of treatment, but also to differences in healthcare structure and systems such as the availability of ambulatory healthcare, the number and percentage of patients treated in hospitals, staff-to-patient

* Tel.: +49 30 8754 2233; fax: +49 30 8754 3419.
E-mail address: MielkeM@rki.de.

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ratios, the actual compliance with established hygienic measures, and other infection control practices ("best practice"), the availability of microbiological diagnostic facilities as well as the amount and kind of antimicrobial agents used.

Due to the ability of microorganisms to colonise humans for prolonged periods, patients colonized or infected by antibiotic-resistant bacteria may disseminate the causative agents after delivery from hospital within the outpatient healthcare system – a fact that demands preventive strategies to consider the regional and international dimension of the problem (Navarro et al., 2008).

At the latest since the classical studies by Semmelweis (1861), it is evident that using suitable prevention measures aiming at the causative mechanisms of nosocomial infections, it is possible to prevent at least a part of these unintended events. Consequently, the documentation of decreasing or low rates of infection and antibiotic resistance within the isolated bacterial strains helps to objectify the achievement of the aim to prevent this unintended harm – a duty of each healthcare institution.

In face of increasing patient mobility, there is current activity in Europe to harmonise **strategies for the prevention of HCAI**, and it is the aim of this report to give an overview about widely accepted elements of successful strategies for prevention and control of HCAI on the basis of recent consensus processes.

In October 2004, the WHO launched the **World Alliance for Patient Safety**. In 2006, the Council of Europe adopted a **recommendation on management of patient safety and prevention of adverse events in healthcare** (s. World Health Assembly Resolution 55.18; Council Conclusions 2006/C 146/01 on common values and principles in European Union Health Systems, OJ C 146/1 of 22.6.2006). The Council acknowledged that patients can expect each EU health system to secure a systematic approach to ensuring patient safety.

The DG SANCO Public consultation on strategies for improving patient safety by prevention and control of healthcare-associated infections and recommendations of the DG R&D-funded ARPAC project, the INCO-MED-funded ARMED project, and IFIC workshop and contributions from the WP2 Expert Group collaborating with the IPSE National Contact Points as well as previous recommendations for the prudent use of antimicrobials in human medicine form the basis for the following compilation of broadly accepted instruments for the prevention and control of healthcare-associated infections (see References: EU Commission and Council, ECDC).

In addition, at the latest SARS demonstrated that healthcare workers are at risk of acquiring healthcare-associated infections. Provisions to protect their health and safety are taken through directives 89/391/EEC on the introduction of measures to encourage improvements in the safety and health of workers, and 2000/54/EC on the **protection of (healthcare) workers from risks related to exposure to biological agents** at work and 89/655/EC concerning the minimum safety and health requirements for the use of work equipment by workers at work.

Widely accepted measures for the prevention and control of nosocomial infections and the spread of antibiotic-resistant bacteria

Awareness is a prerequisite

> "In 1846, mortality in the first department was five times higher then in the second. . . . The negative publicity of the first obstetric clinic resulted in a strong preference of the second department . . ." (Semmelweis, 1861)

A prerequisite for any systematic approach to a **prevention and control strategy** is recognition (awareness) of and knowledge about the problem at all levels of the healthcare system including patients, physicians, nurses, other healthcare staff, and healthcare managers. However, without the presence of a sufficiently high number of well-educated and specially trained staff, continuously implementing infection control measures and able to realize and cope with clusters of infection, success will not be achieved, and **it is a major task for the member states to define adequate staffing in the healthcare system**.

Outcome analysis – surveillance policies

Standardised collection, analysis, and feedback of data about healthcare-associated infections and antibiotic resistance

Since the initial "Study on the Efficiency of Nosocomial Infection Control (SENIC)" in the USA, several other national surveillance systems demonstrated the effect of the standardised collection and analysis of data for constructive action at the local level on the reduction of infection rates (Haley et al., 1985).

According to a broad consensus (IPSE, 2008), rates of

- device-associated infections especially on **Intensive Care Units** (ICU) (Moro and Jepsen, 1996; Beyersmann et al., 2008),
- **surgical site infections** (Bouza et al., 2006; Herwaldt et al., 2006), and
- nosocomial diarrhoea (*C. difficile*; *Norovirus* outbreaks) (Vonberg et al., 2008)

should be part of a surveillance system for HCAI (s. References: ECDC, IPSE).

In addition, **antimicrobial use and antimicrobial resistance,** especially in the following species or genera,

- Methicillin-resistant *Staphylococcus aureus* (MRSA)
- Vancomycin-resistant Enterococci (VRE)
- *E. coli*
- *Klebsiella* spp.
- *Pseudomonas* spp.
- *Acinetobacter* spp.
- other multiresistent species

should be registered by the microbiology laboratory from specimens received that need to be drawn to the attention of the infection control team.

Benchmarking and Zero tolerance

> "For the time being, I think that the number of endogenous infections that cannot be prevented by hygienic measures are those which have been reported before the department of pathology had been established at the clinic in Vienna" (Semmelweis, 1861)

The **interpretation of data obtained by surveillance systems** is complex and should be undertaken with great care in the context of those responsible for the performance (e.g. the infection control committee in hospitals).

The data are primarily important for a self-critical discussion inside the quality circles of the healthcare institution using **nationally available reference data for benchmarking** (Harbarth et al., 2003).

Presently, there is insufficient evidence on the merits and limitations of the HCAI public reporting system. However, there is no doubt, that the collection and analysis of HCAI such as surgical site infections, is an important quality indicator of performance.

In the United States of America, there is currently a strategy of "**zero tolerance**" to HCAI and a strict pay for performance policy (Jarvis, 2007). It will be interesting to follow the effects of this approach.