

# Report on the Burden of Endemic Health Care-Associated Infection Worldwide

Clean Care is Safer Care



WHO Library Cataloguing-in-Publication Data

Report on the burden of endemic health care-associated infection worldwide.

1.Cross infection - epidemiology. 2.Cost of illness. 3.Infection control. 4.Disease susceptibility. 5.Review literature. I.World Health Organization.

ISBN 978 92 4 150150 7

(NLM classification: WX 167)

© World Health Organization 2011

All rights reserved. Publications of the World Health Organization are available on the WHO web site ([www.who.int](http://www.who.int)) or can be purchased from WHO Press, World Health Organization, 20 Avenue Appia, 1211 Geneva 27, Switzerland (tel.: +41 22 791 3264; fax: +41 22 791 4857; e-mail: [bookorders@who.int](mailto:bookorders@who.int)).

Requests for permission to reproduce or translate WHO publications – whether for sale or for noncommercial distribution – should be addressed to WHO Press through the WHO web site ([http://www.who.int/about/licensing/copyright\\_form/en/index.html](http://www.who.int/about/licensing/copyright_form/en/index.html)).

The designations employed and the presentation of the material in this publication do not imply the expression of any opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted lines on maps represent approximate border lines for which there may not yet be full agreement.

The mention of specific companies or of certain manufacturers' products does not imply that they are endorsed or recommended by the World Health Organization in preference to others of a similar nature that are not mentioned. Errors and omissions excepted, the names of proprietary products are distinguished by initial capital letters.

All reasonable precautions have been taken by the World Health Organization to verify the information contained in this publication. However, the published material is being distributed without warranty of any kind, either expressed or implied. The responsibility for the interpretation and use of the material lies with the reader. In no event shall the World Health Organization be liable for damages arising from its use.

The boundaries and names shown and the designations used on the maps do not imply the expression of any opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted lines on maps represent approximate border lines for which there may not yet be full agreement.

Printed by the WHO Document Production Services, Geneva, Switzerland



**World Health  
Organization**

**Patient Safety**

A World Alliance for Safer Health Care

# **Report on the Burden of Endemic Health Care-Associated Infection Worldwide**

A systematic review of the literature

# CONTENTS

|                                                                                                         |    |
|---------------------------------------------------------------------------------------------------------|----|
| Acknowledgements                                                                                        | 1  |
| Abbreviations                                                                                           | 2  |
| Summary                                                                                                 | 3  |
| Introduction                                                                                            | 4  |
| 1. Health care-associated infections in different settings and related risk factors. . . . .            | 6  |
| 2. Methods and challenges of health care-associated infection surveillance . . . . .                    | 8  |
| 3. The burden of endemic health care-associated infection in high-income countries. . . . .             | 12 |
| 4. The burden of endemic health care-associated infection in low- and middle-income countries . . . . . | 16 |
| 5. The impact of health care-associated infection worldwide . . . . .                                   | 20 |
| 6. Lessons learned and the way forward . . . . .                                                        | 22 |
| References                                                                                              | 26 |
| Appendix                                                                                                | 34 |

# ACKNOWLEDGMENTS

**Developed by the Clean Care is Safer Care Team** (Patient Safety Programme - Innovation, Information, Evidence and Research Cluster).

**Clean Care is Safer Care Team:**

Benedetta Allegranzi, Sepideh Bagheri Nejad, Gabriela Garcia Castillejos, Claire Kilpatrick, Edward Kelley, Elizabeth Mathai.  
External lead: Didier Pittet.

**Content contribution**

**Lead author:**

Benedetta Allegranzi  
WHO Patient Safety Programme, Geneva, Switzerland

**Critical technical contribution**

Sepideh Bagheri Nejad  
WHO Patient Safety Programme, Geneva, Switzerland  
Didier Pittet  
WHO Collaborating Centre on Patient Safety  
University of Geneva Hospitals and Faculty of Medicine, Geneva, Switzerland

**Technical contribution**

Marie-Noëlle Chraïti  
WHO Collaborating Centre on Patient Safety  
University of Geneva Hospitals and Faculty of Medicine, Geneva, Switzerland

**Statistical Analysis**

Christophe Combescure  
Division of Clinical Epidemiology  
University of Geneva Hospitals and Faculty of Medicine, Geneva, Switzerland  
Homa Attar  
WHO Collaborating Centre on Patient Safety  
University of Geneva Hospitals and Faculty of Medicine, Geneva, Switzerland

**Reviewers**

Najeeb Al Shorbaji  
WHO Patient Safety Programme, Geneva, Switzerland  
Edward Kelley  
WHO Patient Safety Programme, Geneva, Switzerland  
Colin Mathers  
WHO Mortality and Burden of Disease, Geneva, Switzerland

**Editor**

Rosemary Sudan  
Freelance editor

**Figures**

Laurens Zwakhals  
WHO Public Health Information and Geographic Information Systems, Geneva, Switzerland

# ABBREVIATIONS

|                |                                                        |
|----------------|--------------------------------------------------------|
| <b>BSI</b>     | bloodstream infection                                  |
| <b>CDC</b>     | Centers for Disease Control and Prevention             |
| <b>CL</b>      | central line                                           |
| <b>CR-BSI*</b> | catheter-related bloodstream infection                 |
| <b>CR-UTI</b>  | catheter-related urinary tract infection               |
| <b>ECDC</b>    | European Centre for Disease Prevention and Control     |
| <b>EPIC</b>    | European Prevalence of Infection in Intensive Care     |
| <b>HAP</b>     | health care-associated pneumonia                       |
| <b>HCAI</b>    | health care-associated infection                       |
| <b>HELICS</b>  | Europe Link for Infection Control through Surveillance |
| <b>HIV</b>     | human immunodeficiency virus                           |
| <b>ICU</b>     | intensive care unit                                    |
| <b>INICC</b>   | International Nosocomial Infection Control Consortium  |
| <b>SSI</b>     | surgical site infection                                |
| <b>NNIS</b>    | National Nosocomial Infection Surveillance System      |
| <b>NHSN</b>    | National Healthcare Safety Network                     |
| <b>USA</b>     | United States of America                               |
| <b>UTI</b>     | urinary tract infection                                |
| <b>VAP</b>     | ventilator-associated pneumonia                        |
| <b>WHO</b>     | World Health Organization                              |

\* CR-BSI is used as a generic term throughout the report when referring to different categories included in the retrieved articles, e.g. “central venous catheter-associated”, “central venous catheter-related”, “central line-associated”, or “catheter-related bloodstream infection”.

# SUMMARY

Health care-associated infection (HCAI) is acquired by patients while receiving care and represents the most frequent adverse event. However, the global burden remains unknown because of the difficulty to gather reliable data. In many settings, from hospitals to ambulatory and long-term care, HCAI appears to be a hidden, cross-cutting problem that no institution or country can claim to have solved yet. HCAI surveillance is complex and requires the use of standardized criteria, availability of diagnostic facilities and expertise to conduct it and interpret the results. Surveillance systems for HCAI exist in several high-income countries but are virtually nonexistent in most low- and middle-income countries.

Data included in this report are the results of systematic reviews of the literature on endemic HCAI from 1995 to 2010 in high- and low/middle-income countries. According to published national or multicentre studies, pooled HCAI prevalence in mixed patient populations was 7.6% in high-income countries. The European Centre for Disease Prevention and Control (ECDC) estimated that 4 131 000 patients are affected by approximately 4 544 100 episodes of HCAI every year in Europe. The estimated HCAI incidence rate in the USA was 4.5% in 2002, corresponding to 9.3 infections per 1000 patient-days and 1.7 million affected patients.

The systematic review of the literature revealed clearly an extremely fragmented picture of the endemic burden of HCAI in the developing world. Only very scanty information was available from some regions and no data at all for several countries (66%). Many studies conducted in health-care settings with limited resources reported HCAI rates higher than in developed countries. Hospital-wide prevalence of HCAI varied from 5.7% to 19.1% with a pooled prevalence of 10.1%. Of note, the pooled HCAI prevalence was significantly higher in high- than in low-quality studies (15.5% vs 8.5%, respectively). Surgical site infection (SSI) is the most surveyed and most frequent type of infection in low- and middle-income countries with incidence rates ranging from 1.2 to 23.6 per 100 surgical procedures and a pooled incidence of 11.8%. By contrast, SSI rates vary between 1.2% and 5.2% in developed countries.

The risk of acquiring HCAI is significantly higher in intensive care units (ICUs), with approximately 30% of patients affected by at least one episode of HCAI with substantial associated morbidity and mortality. Pooled cumulative incidence density was 17.0 episodes per 1000 patient-days in adult high-risk patients in industrialized countries. By contrast, the incidence of ICU-acquired infection among adult patients in low- and middle-income countries ranged from 4.4% up to 88.9% and pooled cumulative incidence density was 42.7 episodes per 1000 patient-days.

High frequency of infection is associated with the use of invasive devices, in particular central lines, urinary catheters, and ventilators.

Among adult ICU patients in high-income countries, pooled cumulative incidence densities of catheter-related BSI (CR-BSI), urinary catheter-related UTI (CR-UTI), and ventilator-associated pneumonia (VAP) were 3.5 per 1000 CL-days, 4.1 per 1000 urinary catheter-days, and 7.9 per 1000 ventilator-days, respectively. In low- and middle-income countries, pooled cumulative incidence densities of CR-BSI, CR-UTI, and VAP were 12.2 per 1000 CL-days, 8.8 per 1000 urinary catheter-days, and 23.9 per 1000 ventilator-days, respectively. Newborns are also a high-risk population in developing countries and neonatal infection rates are three to 20 times higher than in industrialized countries.

The impact of HCAI implies prolonged hospital stay, long-term disability, increased resistance of microorganisms to antimicrobials, a massive additional financial burden for health systems, high costs for patients and their families, and excess deaths. In Europe, HCAs cause 16 million extra-days of hospital stay, 37 000 attributable deaths, and contribute to an additional 110 000 every year. Annual financial losses are estimated at approximately € 7 billion, including direct costs only. In the USA, approximately 99 000 deaths were attributed to HCAI in 2002 and the annual economic impact was estimated at approximately US\$ 6.5 billion in 2004. Information is again very scanty from low- and middle-income countries and no data are available at national or regional levels. According to a report on device-associated infections in 173 ICUs from 25 countries in Latin America, Asia, Africa, and Europe, crude excess mortality in adult patients was 18.5%, 23.6%, and 29.3% for CR-UTI, CR-BSI, and VAP, respectively. A review of several studies showed that increased length of stay associated with HCAI varied between 5 and 29.5 days.

Although HCAI global estimates are not yet available, by integrating data from published studies, there is clear evidence that hundreds of millions of patients are affected every year worldwide, with the burden of disease much higher in low- and middle-income countries. There is an urgent need to establish reliable systems for HCAI surveillance and to gather data on the actual burden on a regular basis. Evaluation of the key determinants of HCAI is an essential step to identify strategies and measures for improvement. Robust evidence exists that HCAI can be prevented and the burden reduced by as much as 50% or more. Solid recommendations have been issued by national and international organizations, but their application needs to be strengthened and accompanied by performance monitoring both in high-income and low- and middle-income countries. HCAI must be treated as a priority patient safety issue within comprehensive approaches to be tackled effectively. The WHO Patient Safety programme integrates efforts with other WHO programmes to reduce HCAI by assisting with the assessment, planning, and implementation of infection prevention and control policies, including timely actions at national and institutional levels.

# INTRODUCTION

Health care-associated infections (HCAIs) are infections that patients acquire while receiving treatment for medical or surgical conditions and are the most frequent adverse event during care delivery.<sup>1</sup> HCAI is a major problem for patient safety and its impact can result in prolonged hospital stay, long-term disability, increased resistance of microorganisms to antimicrobial agents, a massive additional financial burden for the health system, high costs for patients and their families, and excess deaths.<sup>2,3</sup> The risk to acquire HCAI is universal and pervades every health-care facility and system worldwide, but the true burden remains unknown in many nations, particularly in developing countries.

Data on the burden of diseases worldwide are regularly published by the World Health Organization (WHO) to inform health-care workers, policy-makers, and the public of the most important diseases in terms of morbidity and mortality.<sup>4</sup> HCAI does not appear on the list of over 100 diseases evaluated. The most likely reason is that the diagnosis of HCAI is complex and relies on multiple criteria and not on a single laboratory test. In addition, national systems of continuous surveillance are seldom in place. In many settings, from hospitals to ambulatory and long-term care, HCAI appears to be a hidden, cross-cutting problem that no institution or country can claim to have solved yet.

This report presents the evidence available from the scientific literature on the endemic burden of the most frequent types of HCAI and provides an assessment of epidemiological differences among countries according to income levels. The report aims also to identify major obstacles and gaps to assess the magnitude of the HCAI burden worldwide and to identify solutions and future perspectives for improvement. All data presented were compiled from systematic reviews of studies published in the scientific literature from 1995 to 2010. Methods and key definitions used are described in Boxes 1 and 2.

## Box 1

### Methodology used for systematic reviews and analysis included in this report

#### Type of infection

Overall HCAI, health care-associated urinary tract infection (UTI), surgical site infection (SSI), hospital-acquired pneumonia (HAP), ventilator-associated infection (VAP), and health care-associated bloodstream infection (BSI).

#### Sources

PubMed, Cochrane Library, World Health Organization (WHO) regional medical databases (Appendix). A comprehensive list of search terms (Appendix) including MeSH terms “cross infection”, “infection control”, “developing countries” and “developed countries” was used, together with the individual names of high-, middle- and low-income countries.

#### Inclusion criteria

All studies reporting full or partial data related to infection rates, risk factors, mortality, excess length of stay, costs, HCAI aetiology in general, and health care-associated UTI, BSI, SSI, and HAP/VAP. For high-income countries, only national or multicentre studies were included.

#### Exclusion criteria

Duplicate references and publications reporting the same data; studies reporting outbreaks; studies including community-acquired infections.

#### Time limits

January 1995 to December 2010.

#### Language

No language restrictions.

#### Criteria to define high-quality studies

prospective design; use of standardized definitions (i.e. accord-

预览已结束，完整报告链接和二维码如下：

[https://www.yunbaogao.cn/report/index/report?reportId=5\\_28850](https://www.yunbaogao.cn/report/index/report?reportId=5_28850)

