Hospital organisation, management, and structure for prevention of health-care-associated infection: a systematic review and expert consensus

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Despite control efforts, the burden of health-care-associated infections in Europe is high and leads to around 37 000 deaths each year. We did a systematic review to identify crucial elements for the organisation of effective infection-prevention programmes in hospitals and key components for implementation of monitoring. 92 studies published from 1996 to 2012 were assessed and ten key components identified: organisation of infection control at the hospital level; bed occupancy, staffing, workload, and employment of pool or agency nurses; availability of and ease of access to materials and equipment and optimum ergonomics; appropriate use of guidelines; education and training; auditing; surveillance and feedback; multimodal and multidisciplinary prevention programmes that include behavioural change; engagement of champions; and positive organisational culture. These components comprise manageable and widely applicable ways to reduce health-care-associated infections and improve patients' safety.

Introduction

Health-care-associated infections (HAIs) affect millions of patients worldwide every year.[1,2] In the European Union (EU) alone, the estimated number of HAIs is 4 544 100 annually, leading directly to around 37 000 deaths and 16 million extra days of hospital stay.[3] Several evidence-based practice guidelines have been published in the past decade[4–12] but, despite evidence suggesting that good practice strategies are sufficient, hospitals struggle to comply.[13–17] The systematic review and evidence-based guidance on organisation of hospital infection control programmes (SIGHT) was funded by the European Centre for Disease Prevention and Control. Our objective was to provide evidence-based guidance on the organisation of infection-control programmes in hospitals. In particular, the review aimed to identify the most effective and generally applicable elements of acute-care infection-control and prevention programmes and to identify indicators of structure and process for monitoring. In contrast to more procedure-focused recommendations, we address mainly management and organisational features.

Methods

The systematic review was done according to the PRISMA guidelines[18] at three participating institutions (University of Geneva Hospitals, Geneva, Switzerland; Imperial College London, London, UK; and University Hospital of Freiburg, Freiburg, Germany). We separated this project into two work packages: first, a systematic review to identify elements for the organisation of infection-prevention programmes in hospitals and, second, the selection from these of key components, assessment of their implementation and EU-wide applicability, and allocation of process and structure indicators (figure 1).

Search strategy and selection criteria

The search was stratified by five dimensions that we addressed separately: organisational and structural arrangements to implement infection-control programmes, including access to qualified infection-control professionals and the roles of management and advisory committees; targets and methods of HAI surveillance, outbreak management, and the role of feedback; methods and effectiveness of educating and training health-care workers (HCWs); effectiveness of interventions on behavioural change and quality of care, particularly in the context of multimodal prevention strategies; and overview and effectiveness of local policies and resources for standard and transmission-based isolation precautions (figure 1).

We searched Medline, the Cochrane Controlled Trials Register, Embase, the Outbreak Database, PsychINFO, and the Health Management Information Consortium database for reports published between Jan 1, 1996, and Dec 31, 2012. Any landmark papers we found that were published before 1996 were also included. Studies in English, French, German, Italian, Portuguese, and Spanish were eligible when an English title or abstract was available. Studies were eligible for full-text review if they were done in acute-care settings in the context of infection control and were quantitative studies, such as randomised controlled trials, controlled clinical trials, case-control studies, controlled before-and-after studies, interrupted-time series, non-controlled cohort studies, and non-controlled before-and-after studies, or qualitative studies if they were based on in-depth interviews, questionnaires, surveys, focus groups, and direct observations, irrespective of whether they were empirical or grounded in a recognised theory, or used mixed methods to combine quantitative and qualitative investigations. Reviews, letters, notes, and opinion articles that did not report primary data were excluded. Interventions related to community care, primary care, antibiotic prescribing, or a combination of these, were excluded, as were studies done in long-term care settings. Antibiotic stewardship, cost-effectiveness, and occupational health were not addressed because these

topics were elements of other European Centre for Disease Prevention and Control projects at the time of the study. Additional inclusion and exclusion criteria are summarised in the appendix.

Initial assessment was done by screening titles and abstracts against the inclusion and exclusion criteria. Reports without abstracts were read in full. 30% of the titles and abstracts and 100% of the full texts were assessed by a second reviewer. Disagreements were resolved by consensus or by a third reviewer if agreement could not be reached. Reference lists of relevant articles were searched to identify further studies. If the full text could not be obtained by any of the participating academic centres or by the European Centre for Disease Prevention and Control, the study was excluded from further analysis. Study origin was stratified by country income, as defined by the World Bank classification.[19]

We used the integrated quality criteria for systematic review of multiple study designs tool[20] to assess the quality of articles. This approach integrates criteria to evaluate quantitative and qualitative studies. The quality of evidence is graded on the basis of an overall score if the studies meet a set of specific criteria that are designed for each study (appendix).[21,22] Quality assessment was done by two reviewers for all studies (WZ, AH , MD, TG, FS, and LC). Disagreements were resolved by consensus and a third reviewer was consulted if agreement could not be reached. Quality of studies was graded as low (1), medium (2), or high (3).

Data extraction

An expert group was established, with independent and author members selected according to their area of expertise (infection control, patients' safety, public health, quality improvement, health policy, organisational theory, psychology, and sociology). Elements emerging from the systematic review were categorised under key components of infection control by the study group and presented to the experts, who checked each one for the validity of classification, assessed EU-wide applicability and ease of implementation, and defined structural and process indicators (figure 1). Evidence was graded as low (1), intermediate (2), or high (3) on the basis of the median value for the studies contributing to the component.

To score implementation and EU-wide applicability, the expert group considered potential barriers. For instance, implementation might be affected by budget and financial constraints, work cultural issues, work ethics, leadership, communication, educational background, personal experience, relative priority in the institution, and hospital-wide applicability. Potential barriers to EU-wide applicability might be a financial crisis, cultural issues, specifics of the health-care system, training opportunities for infection control, national safety programmes, and emigration of specialty professionals. Ease of implementation and EU-wide applicability were graded as low (1), intermediate (2), or high (3). Consensus about grading was reached with the Delphi method.[23]

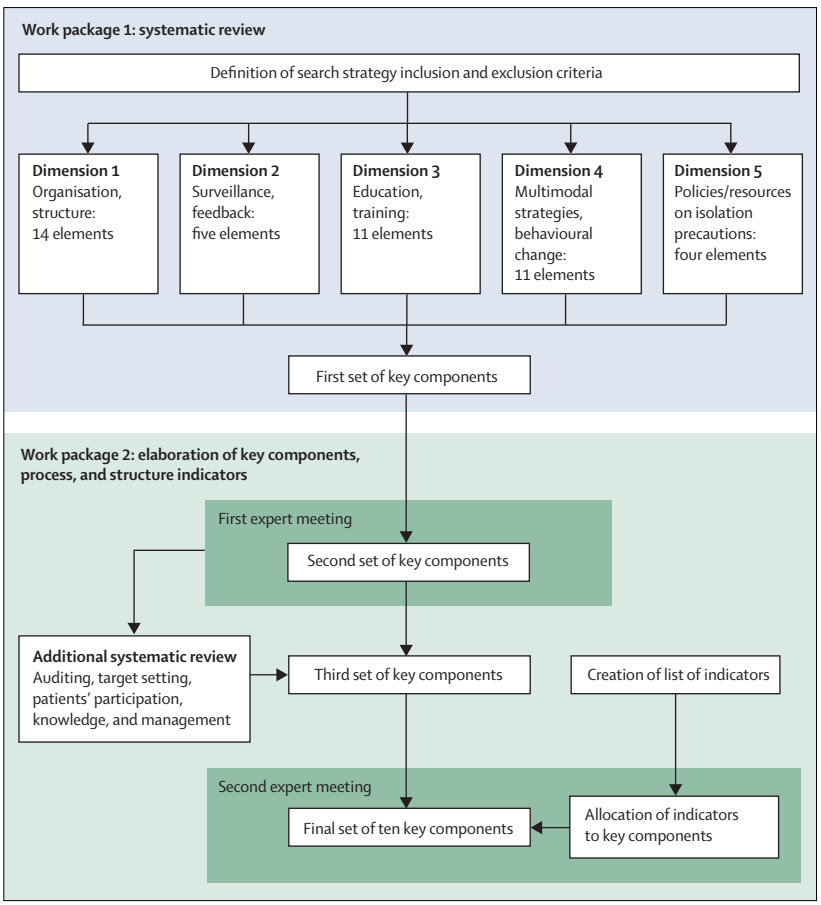

Figure 1: **Outline of the systematic review and component assessment**

See Online for appendix

Role of the funding source

The funder of the study had no role in study design, data collection, data analysis, data interpretation, or writing of the report. The corresponding author had full access to all the data in the study and had final responsibility for the decision to submit for publication.

Results

Our search yielded 47 948 titles and abstracts and an additional 131 were added through cross-referencing. 92 articles were eligible for data extraction and analysis (figure 2, table 1, appendix).[15–17,24–112] Most evidence was from high-income countries, with only eight (8·7%) studies being from upper-middle-income or lower-middle-income countries.[28,29,42,58–60,71,107] 41 (44·6 %) studies had been done in Europe.

Ten components were identified as being crucial to effective infection control in hospitals: organisation of infection control at the hospital level; bed occupancy, staffing, workload, and employment of pool or agency