A systematic review of effective features of educational interventions to improve compliance in aseptic central venous catheter use in acute care.

Gemma Cherry, Jeremy Brown, Tim Neal & Nigel Shaw


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Key Words: central venous catheters, educational intervention, infection control, CRBSI (catheter related blood-stream infection), healthcare professional behaviour, behaviour change.

Headline conclusions:

- Educational interventions appear to have the most prolonged and profound effect when used in conjunction with audit, feedback and availability of new clinical supplies consistent with the content of the education provided.
- Educational interventions will have a greater impact if baseline compliance to best-practice is low.
- Repeated sessions, fed into daily practice, using practical participation (such as the use of demonstrations, video education, use of simulator or self study materials) appears to have a small, additional effect on practice change when compared to education alone.
- Active involvement from healthcare staff, in conjunction with provision of formal responsibilities and motivation for change, may change healthcare worker practice.
- Dissemination of information through peers or higher management may have a small effect on practice change.

Background and context: Central venous catheters (CVCs) are the commonest source of hospital-acquired bacteremia (Health Protection Agency), with up to 6000 patients per year in England acquiring a CVC-related bloodstream infection (Shapey et al., 2008). Implementation of Department of Health guidelines has resulted in significant and sustained reductions in CVC-related blood stream infections (Provonost et al., 2002), and cost (Hu et al., 2004). As a result both the Department of Health in the UK and the Institute for Healthcare Improvement in the USA have made the prevention of CRBSI key elements of their Saving Lives and 100,000 Lives campaigns respectively.
This systematic review focuses identify specific areas of educational change, with the aim of identifying the most effective method of changing practice related to the aseptic insertion and maintenance of CV catheters.

**Review objectives:** The objective of this review was to determine individual features of educational interventions that impact on competence in aseptic insertion technique and maintenance of CV catheters by healthcare workers. To evaluate this, we looked at changes in infection control behaviour of healthcare professionals, and considered changes in the clinical welfare of patients involved and in service delivery (where appropriate), provided they could be related directly to the delivery method of the educational intervention. We considered all types of educational intervention involving healthcare professionals responsible for the insertion and maintenance of CV catheters.

**Review methodology:** An educational intervention was defined as a structured educational process intended to increase, improve or enhance the performance of the recipients with regards to the overall health or well being of their patients. Several assessment criteria were used: studies must (a) use a sole participant group of healthcare professionals who had a responsibility as part of their job role to insert and/or maintain intravenous catheters under aseptic conditions, and had already been designated as ‘competent’ to do so by their job-role training, (b) not be general review articles or editorials (c) Use aseptic insertion site catheter maintenance/insertion as an outcome measure for effectiveness of delivery of educational intervention (d) take place within acute care. Assessment of outcomes was based on a modified Kirkpatrick’s 1967 model of hierarchical outcomes at four levels. Kirkpatrick’s hierarchy was selected to provide a more comprehensive evaluation, in order to inform this review’s development.

16 relevant health and educational databases were searched electronically, using piloted search terms. High yield journals and reference lists of included papers were hand searched. 14,413 studies were retrieved, producing 9964 once de-duplicated. Each abstract was doubly screened by two reviewers. Full-text papers were obtained for 270 studies, of which 47 studies were identified as fulfilling all inclusion criteria and were suitable for inclusion in review.

Quality was assessed using a tool based on that by Shaw et al (in press) and adapted from Downs & Black (1998) and Kmet et al (2004) adapted for use in this review. No study was excluded based solely on quality score, although this was considered in the analysis of studies. Each paper was coded by a member of the review team, using a tailored coding sheet.

**Implications for practice:** Following this systematic review, several implications for practice have been proposed:

1. Educational interventions appear to have the most prolonged and profound effect when used in conjunction with audit, feedback and availability of new clinical supplies consistent with the content of the education provided.
2. Educational interventions will have a greater impact if baseline compliance to best-practice is low.
3. Repeated sessions, fed into daily practice, using practical participation (such as the use of demonstrations, video education, use of simulator or self study materials) appears to have a small, additional effect on practice change when compared to education alone.
4. Active involvement from healthcare staff, in conjunction with provision of formal responsibilities and motivation for change, may change healthcare worker practice.
5. Dissemination of information through peers or higher management may have a small effect on practice change.

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