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Preventing healthcare-associated infection through education: have surgeons been overlooked?

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Introduction

Healthcare associated infection (HCAI) is associated with considerable morbidity and mortality to patients. The recent Hospital Infection Society Prevalence Survey (HISPS) of HCAI, which was carried out in England, Wales, Northern Ireland and the Republic of Ireland and which involved 75, 694 patients, noted a prevalence overall of 7.59%, with the figure increasing to 6% in tertiary referral centres[1]. [2]. The Prevalence Survey of Nosocomial Infections in Spain (EPINE) using a common methodology published in 2006 revealed a HCAI rate of 7.90%[3]. The total number

of patients acquiring HCAI in the European Union every year is estimated at 3 million, with 50,000 deaths per year as a consequence[4].

In North America extensive financial assessments calculate the costs of HCAs to be \$4.5-5.7 billion per year[5]. To put this in context, a recent U.S. study ascertained that the HCAI cost per case was a minimum of \$4,644[6] but for blood stream infection, the costs were calculated at \$10-20,000 per patient[7].

Regional collaborations in surgery have previously improved the overall quality of care with a fall in surgical site infection (SSI) rates[8]. The importance of a large-scale safe care initiative in surgery has been recently demonstrated in the “Safe Surgery Saves Lives” proposal from the World Health Organisation[9]. Through the introduction of a quality control checklist peri-operatively, SSI rates decreased significantly, from 6.2% to 3.4%. The implementation of “care bundles” to decrease HCAI has also been previously demonstrated[10]. Significantly, a novel study in a U.K. hospital uniquely targeted surgical teams to implement a “Clean Practice Protocol”. Through audit and education infection prevention practices were significantly improved[11]. Some 20-30% of HCAI are considered to be preventable through an extensive infection prevention and control programme[12, 13]. Consequently, there is much scope within surgery to improve patient care and reduce healthcare costs

Education Programmes

Many studies over the last 10 years have demonstrated success in educating nursing staff[14, 15], critical care healthcare workers [16-18] as well as medical students and

junior doctors[19] in the infection prevention and control of infection. The success of these numerous programmes is striking compared to the paucity of such interventions in the surgical arena. Surgical site infections, which account for 14% of all HCAs can be devastating for the patient and costly to manage[20]. Surgical patients often require central venous catheters (CVCs) which account for 7% of HCAI[20]. Recent National Institute for Clinical Excellence (NICE) guidelines published on the prevention of SSI describe numerous recommendations for pre- intra- and post-operative care[21]. Given that it has been shown that hospitals with a higher trainee-to-bed ratio also have an increased SSI incidence[22], it is surprising that an infection prevention and control programme, incorporating the education of surgeons has yet to be established across the specialty. However, it is instructive to review what has been undertaken and achieved amongst other groups of healthcare workers.

Nursing staff

As front line staff, adherence to infection prevention and control guidelines within the nursing profession is essential to decrease HCAI. There are a number of published studies promoting education programmes. One such study focussed on CVCs in the paediatric population. Here, protocols regarding the cleaning and dressing of the CVC insertion site, as well as CVC access, were promoted through posters and teaching sessions. As a result, infection rates among infants on surgical services fell from 15.46 to 6.67/1,000 catheter days[15]. A U.S. study provided nursing staff with unit-specific urinary tract infection (UTI) rates as an educational intervention combined with a video reviewing catheter care. In the post-intervention phase, a decrease in UTI rates resulted in an estimated cost saving of \$403,000 over 18 months[14]. A recent

Intensive Care Unit (ICU) study displayed posters and storyboards highlighting best practice oral care for ventilated patients[23]. Nurses' competency in oral care was then formally assessed in 30-minute sessions with feedback provided. Through this education programme ventilator associated pneumonia (VAP) rates decreased by 50%.

Critical care healthcare workers

In the current literature, much of the published education programmes have centred on critical care healthcare workers as the risk of infection in critical care areas is great and the consequences, in terms of clinical outcome and costs, are very significant. An Argentinean multi-center trial recently showed a significant decrease in the incidence of VAP through an eight month education programme for ICU personnel[16]. The programme centered on one-hour educational sessions based on the 1997 CDC Nosocomial Pneumonia Prevention Guidelines. These sessions were offered to all physician, nursing, and ancillary staff and these focused on the epidemiology and pathogenesis of nosocomial pneumonia as well as hand hygiene and the proper handling of respiratory secretions and suction catheters. In addition, feedback of VAP rates was provided to ICU personnel on a monthly basis. Rates of VAP dropped from 51.28 episodes of VAP per 1000 mechanical ventilation days to 35.52 episodes. Given the cost of VAP[24, 25], these programmes have shown themselves to be remarkably cost effective.

The use of a self-study module to prevent catheter-related bloodstream infections (CRBSIs) was pioneered in the US[17]. The ten-page module was accompanied by a series of lectures and posters. Infection rates decreased from 4.9 to 2.1 cases per 1,000

catheter days. The effectiveness of a self-study module combined with posters, fact sheets and lectures has since been further demonstrated in the ICU setting, with several studies showing significant decreases in catheter-related bloodstream infection (CRBSI) [17, 26-28], VAP[18, 29] and hand hygiene adherence[30].

As technology improves, education programmes to change behaviour become more innovative. A web-based training module to decrease CRBSI between 1999 and 2002, also incorporating lectures and posters, was recently promoted effectively[31]. Surgical ICU physicians and nurses participated, with CRBSIs decreasing to zero from 11.3 per 1000 catheter days [31].

Medical students/junior doctors

A study from 2000 showed the effectiveness of one-day teaching course in infection prevention and control[19]. This study targeted medical students and doctors in their first postgraduate year. The course focused on the insertion and maintenance of CVCs and was in the form of a “hands-on” approach, where students/doctors rotated through a series of one-hour stations. As well as CVC insertion, these stations addressed arterial blood gas puncture, venepuncture through vascular lines, urinary catheter insertion, and lumbar puncture. The incidence of catheter-associated bloodstream infections was 4.9 cases per 1000 catheter-days compared with 2.1 cases in the post-intervention period [19].

Table 1 Summary of education -based interventions in infection prevention and control amongst different categories of healthcare workers

Staff targeted	Area targeted	Intervention	Result [ref]
Nursing staff	CRBSI	Posters, teaching sessions	Decrease in infection rates 15.46 – 6.67/1,000 catheter days [15]
	Urinary catheter-associated infection	Feedback of infection rates, Educational video sessions	Decrease in urinary-catheter-associated infection rates from 32 – 17.4/1,000 catheter days. Saving of \$403,000 over 18 months through decreased UTI rates [14]
	VAP	Formal 30 minute assessments with feedback	Decrease in VAP rates by 50% [23]
Critical care healthcare workers	VAP	Information sessions on pathogenesis of VAP. Feedback of monthly VAP rates	Decrease in VAP rates from 51.28 – 35.52/100 MV-days [16]
	VAP	Self-study module. Series of lectures and posters	Decrease in VAP rates from 12.6 – 5.7/1,000 MV-days [18]
	CRBSI	Self-study module. Series of lectures and posters	Decrease in catheter-related bloodstream infections from 4.9 – 2.1/1,000 catheter days [17]
	CRBSI	Self-study module. Series of lectures and posters	Decrease in catheter-related bloodstream infections from 3.4 – 2.8/1,000 catheter days [27]
	CRBSI	Self-study module. Factsheets, posters and staff meetings	Decrease in catheter-related bloodstream infections from 10.8 – 3.7/1,000 catheter days [26]
	CRBSI	Self-study module. Factsheets and posters	Decrease in catheter-related bloodstream infections from 9.4 – 5.5/1,000 catheter days [28]
	CRBSI	Web-based training module. Series of lectures and posters	Decrease in catheter-related bloodstream infections from 11.3 – 0/1,000 catheter days [31]
Medical students/ junior doctors	CRBSI, Urinary catheter-associated infections	1 day practical teaching session	Decrease in catheter-related bloodstream infections from 4.9 – 2.1/1,000 catheter days [19]

Discussion

The motivational factors influencing infection prevention and control behaviour are complex[32]. As such, interventions need to be multifaceted to achieve success. A recent study suggests that the local appointment of infection prevention and control coordinators, with the ongoing measurement of infection rates as well as feedback and accountability contribute greatly to the success of such initiatives[33]. When focusing on the educational aspect, it is difficult to determine which approach is the most effective. Previous studies have shown that the traditional approach of lecture-based education alone does not result in meaningful behavioural changes[34]. Rather it is thought that a blended learning approach, with particular focus on the small group format is important. The positive effect of good mentor practices on students has been demonstrated in improving hand hygiene compliance[35]. Similarly, direct

supervision by an instructor providing positive and negative feedback in a hands-on learning environment is particularly effective[19]. New interventions involving web-based learning in combination with these established education formats are also proving successful in changing infection prevention and control behaviour[31].

Many studies have shown how hospital costs are significantly reduced with education on infection education[19, 26, 31, 36-39]. The costs of these educational interventions are small in comparison with the estimated savings[17-19, 36]. In these times of constrained financial resources, infection prevention and control measures become even more critical given the association between inadequate staffing in the ICU setting and increased rates of HCAI[36, 40-42]. There is evidence in the literature to suggest that the most important factor in determining infection rates in surgical practice is the competence and conscientiousness of the individual surgeon[43, 44]. Given the recent success of a unique education programme in educating surgeons[11], it is apparent that further such programmes would be effective in reducing morbidity and mortality for surgical patients. If such education programmes were developed and were readily exportable across hospitals, regions, and countries, this would have positive financial implications for health services.

Conclusions

The development of an educational strategy on infection prevention and control, focusing on surgical trainees, is overdue. Such an initiative should be multifaceted and incorporate technological advances such as web-based education. This would facilitate the delivery at a time of convenience for trainees and others, and assist in its

exportation to multiple sites and health services. This would also fulfil the existing need for standardization of education programmes for all health care workers.

Overall, such a programme would have far reaching benefits for individual patients, contribute to significant economic savings within health services and enhance the quality and safety of patient care.

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