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Seamus M. McHugh
Royal College of Surgeons in Ireland

Mark Corrigan
Royal College of Surgeons in Ireland

Borislav D. Dimitrov
Royal College of Surgeons in Ireland, borislav.d.dimitrov@gmail.com

Seamus Cowman
Royal College of Surgeons in Ireland

Sean Tierney
Royal College of Surgeons in Ireland

See next page for additional authors

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Authors
Seamus M. McHugh, Mark Corrigan, Borislav D. Dimitrov, Seamus Cowman, Sean Tierney, Hilary Humphreys, and Arnold DK Hill

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A targeted e-learning programme for surgical trainees to enhance patient safety in preventing surgical infection

McHugh SM[1], Corrigan MA[1], Dimitrov BD[2], Cowman S[3], Tierney S[1], Hill ADK[1], Humphreys H[4,5]

1. Department of Surgery, Royal College of Surgeons in Ireland
2. Department of General Practice, Royal College of Surgeons in Ireland
3. School of Nursing, Royal College of Surgeons in Ireland
4. The Department of Microbiology Beaumont Hospital, Dublin 9, Ireland
5. Department of Clinical Microbiology, the Royal College of Surgeons in Ireland, Dublin, Ireland

Corresponding Author:

Seamus McHugh

Research fellow (General surgery)

Royal College of Surgeons in Ireland

Tel: 014022100

Email. seamusmchugh@rcsi.ie

Abstract

Introduction

Surgical site infection accounts for 20% of all HCAI, however such a programme incorporating the education of surgeons has yet to be established across the specialty.

Methods

An audit of surgical practice in infection prevention was carried out in Beaumont Hospital from July to November 2009. An educational website was developed targeting deficiencies highlighted in the audit. Interactive clinical cases were constructed using PHP coding; a HTML embedded language, and then linked to a MySQL relational database. PowerPoint tutorials were produced as online '*flash'* audiovisual movies. An online repository of streaming videos demonstrating best practice were made available, and weekly podcasts were made available on the '*iTunes ©'* store for free download. Usage of the e-learning programme was assessed quantitatively over 6-weeks in May and June 2010 using the commercial company "Hitslink".

Results

During the 5-month audit, deficiencies in practice were highlighted, including the timing of surgical prophylaxis (33% non-compliance) and intra-vascular catheter care in surgical patients (38% non-compliance regarding necessity). Over the 6-week assessment of the educational material, the SurgInfection.com web-pages were accessed >8,000 times as 77.9% of the visitors were from Ireland. The most commonly accessed modality was the repository

with interactive clinical cases, accounting for 3,463 (43%) of the website visits. The average user spent 57 minutes per visit, with 30% of them visiting the website multiple times.

Conclusions

Interactive virtual cases mirroring real-life clinical scenarios are likely to be successful as an e-learning modality. User-friendly interfaces and 24-hour accessibility will increases uptake by surgical trainees.

Introduction

Approximately 30% of healthcare-associated infections (HCAI) are preventable by infection prevention and control programmes [1, 2]. Surgical site infection (SSI) accounts for 20% of all HCAI [3], and effective education for surgeons is an essential part of any strategy to reduce SSI and other surgical infections. The motivational factors influencing infection prevention and control behaviour are complex[4]. As such, interventions need to be multifaceted to achieve success. Studies have shown that the traditional approach of lecture-based education alone does not result in meaningful behavioral changes [5]. As technology improves, education programmes to change behaviour become more innovative. Novel approaches include high fidelity simulation to improve adherence to best practice in clinical performance [6, 7] as well as e-learning.

E-learning involves the use of internet technology to enhance knowledge, offering students control over learning content and allowing them to tailor their learning sequence individually [8]. The last five years have seen an increasing profile for e-learning in educating medical students and in facilitating the continuing professional development (CPD) of healthcare professionals [9]. Notably with regard to infection prevention is surgical patients, a web based training module incorporating lectures and posters targeting surgical intensive care unit physicians and nurses decreased catheter-related bloodstream infection to zero from 11.3 per 1000 catheter days.

With the importance of such a blended learning approach in mind, the design principles in our study educational initiative which incorporated e-learning focused on provision of a resource which facilitated four core objectives, namely accessibility, time-efficient learning, evidence-based resources, and problem based interactive formative assessment. In this manner we primarily utilized Miller's pyramid model of competence. Guidelines and tutorials

provided the basis for the recall of knowledge assessed in interactive clinical cases. These cases developed in complexity to ensure that the surgical trainee “knows how” in applying knowledge.

By targeting pre-assessed deficiencies in knowledge and awareness amongst surgical trainees relating to the prevention and control of infection in surgical patients identified through audit, this educational initiative seeks to enhance the quality and safety of patient care by minimising HCAI through improving the practice of surgical trainees in antibiotic prophylaxis, operative procedures and the care of vascular catheters. In this study we aimed to report on the design and quantitative uptake of our e-learning programme in the six-weeks following its launch.

Methods

Patient care “bundles” were developed to assess peri-operative practice (including antibiotic prophylaxis), peripheral venous catheter maintenance, central venous catheter insertion and maintenance, and post-operative ward-based care, including hand hygiene. Over a five-month period from July to November 2009 a detailed audit was carried out in Beaumont Hospital, Dublin, Ireland. This audit reviewed the infection prevention practices of surgical trainees in the general surgery department.

Both the intra-operative and post-operative stages of a surgical patient journey were assessed as well as care of intra-vascular catheters. Parameters assessed included surgical prophylaxis choice, timing and duration, post-operative wound care and adherence to best practice principle in both the insertion and maintenance of intra-vascular catheters. Through this audit a number of areas for improvement were identified. In targeting these areas, a blended

educational approach was used. This included traditional teaching modules such as posters, lectures and practical demonstrations but also a novel e-learning programme with delivery centred through a website. The domain www.SurgInfection.com was purchased and hosted on the World Wide Web. Best practice guidelines were detailed in a "Guidelines" section. PowerPoint tutorials were produced as online '*flash*' audiovisual movies. Interactive clinical cases were constructed using PHP coding; a HTML embedded language, and then linked to a MySQL relational database. An online repository of streaming videos demonstrating best practice was made available, and weekly podcasts were uploaded on the '*iTunes ©*' store with free access.

Lectures given as part of the educational initiative were also made available as tutorials on the website. Furthermore posters placed at areas of high visibility in surgical wards and operating theatres, while referencing deficiencies noted in the initial audit also directed trainees to the website for further information.

The website went online in April 2010. The first results on the use of the e-learning web-based programme, as assessed recently quantitatively over a period of six weeks (May-June 2010) with the support by the commercial company "Hitslink", have formed the basis of the present report.

Results

During the 5-month audit, specific deficiencies in practice were highlighted, including the timing of surgical prophylaxis (33% non-compliance) and intra-vascular catheter care in surgical patients (38% non-compliance regarding necessity), etc. Over the 6-week online assessment of the educational material, the SurgInfection.com web-pages were accessed

>8,000 times as 77.9% of the visitors were from Ireland. The most commonly accessed e-learning modality was the repository with interactive clinical cases, accounting for 3,463 (43%) of the website visits. This was followed by the "Guidelines" section (11%; n=908), tutorials (4%, n=314) and podcasts (2.6%, n=209). The podcasts however could also be accessed through iTunes©, and this navigation pathway was not measured in our assessment. The online videos received just 123 visits (1.5%). Other web viewings were made up of navigation through the website homepage, as well as "contact us" and "about us" sections. The average user spent 57 minutes per visit, with 30% of them visiting the website multiple times.

Discussion

Our study details the development of a blended learning educational initiative incorporating traditional teaching tools such as lectures and posters with a novel e-learning program. The educational initiative is structured to target deficiencies amongst surgical trainees identified in our initial audit. We report high levels of website usage particularly in the use of online interactive clinical cases.

We acknowledge weaknesses in our study, most notably that we have not yet fully assess the clinical implications of our educational initiative. At present a repeat audit is underway in our institution to determine whether there has been an improvement amongst surgical trainees in adherence to best practice in prevention of infection in surgical patients.

Many studies have shown how hospital costs are significantly reduced with education on infection education [10-12]. In terms of cost effectiveness, the cost of domain name purchase and online hosting of the website is €100 per year. In contrast, the daily cost of a single

catheter related blood stream infection in a surgical patient has been estimated at $12-20,000 [13].

Varying degrees of effectiveness of the e-learning approach have been described, and a recent meta-analysis concluded that internet formats were equivalent to non-internet formats in terms of learner satisfaction as well as changes in knowledge, skills and behaviour [14]. Furthermore, hosting an e-learning programme on the world wide web and combining it with mobile content delivery modules such as podcasts, ensures ease of access to important information for surgical trainees from anywhere in the world. This is borne out in our quantitative assessment of use, with over one fifth of site users resident outside of Ireland. In addition, 24 hour availability also allows for the integration of surgical infection prevention teaching into the busy lives of surgical trainees. Previously, such learning was less structured, consisting of informal "on the job" learning, self driven learning or didactic sessions provided by other healthcare professionals. The development of a programme largely by surgeons for surgeons can assist in changing practice and culture and which we hope to confirm. However, this programme is also available to other healthcare staff, thus integrating the education and practice of all professionals in the prevention and control of infection.

Conclusions

The development of a web-based educational programme targeting specific deficiencies in infection prevention practice amongst surgical trainees is essential. Interactive virtual cases available on-line, which mirror real-life clinical scenarios are a more attractive learning tool. User-friendly interfaces combined with 24-hour accessibility will increase uptake by busy

surgical trainees. A prospective assessment of the clinical effect of this initiative is now underway.

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