Abstract

The experiences gleaned from new and suddenly emergent infectious diseases (e.g. SARS, avian influenza or diarrhea caused by Clostridium difficile) have highlighted how important it is, also for infection prophylaxis, to be able to find instruments for rapid and effective communication. Since 1990 online (E) learning has been used to train nursing staff and offers the advantage of being able to study at an individual pace as well as cut down on the time and financial resources needed. It serves to overcome geographic distances in respect of the teaching institution, can be used at any time of day according to individual needs and has proved suitable for presenting learning modules in infection prevention.

No doubt, traditional didactic learning continues to be the most important approach, but new technologies such as “problem based learning” (PBL) are becoming more popular, and allow students to acquire knowledge in concrete situations. Translating knowledge into behavior calls for an ability to convert scientific theoretic knowledge quickly, efficiently and clearly into practical behavior. Hence E learning is an ideal way to ensure that the latter requirements are met. While it is obvious that knowledge can be easily imparted by this method, further research is needed to establish whether and to what extent it is possible to use this method to translate the acquired knowledge into altered behavior too. Experts believe that novel media technologies hold out several new prospects for accomplishing this.

Zusammenfassung

Erfahrungen mit neuen und plötzlich auftauchenden Infektionskrankheiten (e.g. SARS und Avian Influenza oder durch Clostridium difficile verursachte Diarrhöe) haben unterstrichen, wie wichtig es ist, auch in der Infektionsprophylaxe Instrumente zu finden für eine schnelle und effektive Kommunikation. On-line (E-) learning wird in der Ausbildung des Pflegepersonals seit 1990 eingesetzt und bietet die Vorteile, nach eigenem Tempo lernen zu können, sowie Zeit und Kosten zu sparen. Es überwindet geographische Distanzen zum Vortragenden, kann im Lauf des Tages nach individuellen Bedürfnissen angewandt werden und hat sich als gut geeignet erwiesen, Lernmodule der Infektionsprävention zu präsentieren.

Traditionelles, didaktisches Lernen ist sicher immer noch die Basis, andererseits beginnen sich auch neue Techniken wie z.B. das “Problem-based Learning (PBL)” durchzusetzen, die es dem Lernenden erlauben, sein Wissen in konkreten Situationen anzuwenden. Die Übersetzung von Wissen in Verhalten braucht die Fähigkeit, wissenschaftliche Theorie schnell, effizient und leicht zugänglich in praktikables Verhalten zu konvertieren. E-Learning bietet sich dafür an, letztere Anforderungen optimal zu erfüllen. Während klar ist, dass sich Wissen über diesen Weg gut transportieren lässt, ist weitere Forschung notwendig, um herauszufinden, ob und in welchem Ausmaß es gelingt, auch über diesen Weg aus dem erworbenen Wissen verändertes Verhalten zu machen. Exper-
Background

Recent experiences with new (e.g., SARS and Avian Influenza) and emerging infectious diseases (e.g., Clostridium difficile associated diarrhea) has reinforced the importance of effectively communicating and applying fundamental infection control principles across the healthcare spectrum. Developing better tools for teaching these principles is essential, and this includes determining which new tools are, in fact, most effective. Innovative avenues of content delivery are available to infection control educators with electronic media such as interactive television, web-based learning, CDROMs and satellite broadcasts allowing faster, more economic and less labor-intensive information sharing with larger audiences. Newer instructional methods such as team based or problem-based learning break down the traditional roles of teacher–student and potentially allow for direct application of knowledge to a clinical situation. These are exciting times for infection control practitioners, however, it is important to understand the advantages and limitations of the different modalities and learning tools in order to use them effectively.

On-line education

On-line learning, also known as E-learning, web-based training or distance-distributed learning has various definitions but can globally be described as “anything delivered, enabled or mediated by electronic technology for the explicit purpose of learning” [1]. Information technology such as personal computers, CDROMS and the internet are used along with tools such as email, discussion forums, whiteboards, video-streaming, electronic pictures and hyperlinks to enhance the learning process. Software for training content can be developed in-house or purchased and content can be delivered via the Web or can simply be computer-based, depending on facility and organizational needs and resources. On-line learning is cost-effective by potentially allowing access to information on the students’ own time and by reducing the expenses associated with time-off for attendance at educational sessions, printing educational material and instructional time. On-line learning allows health care workers (HCWs) to readily access infection control educational modules at their own pace and encourages the consistent application of infection control precautions to protect the healthcare workforce as well as their patients and the public. On-line learning is of particular advantage in under-serviced or remote areas and enables the learner direct access to expert opinion and content. Most information technology contains assessment tools, allowing educators to critically evaluate content in a timely manner. Educators may also have the option of monitoring the progress of learners as they proceed through the course and quickly address any key learning issues or problems [2].

The learning process

In company with novel technologies for delivery of content are newer instructional methodologies. Traditional didactic learning still has its place, however, techniques such as problem-based learning (PBL) may be used to permit the student to apply their knowledge to a relevant situation. An example of this instructional methodology that focuses on experiential learning and adult learning theory is the University of British Columbia’s Basic Infection Control course [3]. Briefly described, PBL involves the presentation of a scenario (the problem) designed to guide the student to acquire the knowledge needed to understand, and hopefully solve, the problem. Scenarios developed to cover the basic knowledge areas essential to a beginning practitioner are coupled with guiding questions to direct their learning. Student–student and student–instructor interactions are integrated into the course and students work in small groups in which they are expected to have on-line interaction. This may be at their convenience either individually (asynchronous) (Figure 1 and Figure 2) or in real time in course chat rooms (synchronous) [4]. Recommended text and internet-based references as hyperlinks provide resource material. The instructor’s role is to ensure that relevant topics have been discussed, that all points have been heard and that closure is brought to each scenario. A set of objectives to ensure that relevant material has been covered is given at the end of the scenario.

In our experience at the University of British Columbia Infection Control Certificate Program, the PBL process works well for those interested in enhancing their existing knowledge in infection control (e.g. practitioners in infection control, public or occupational health and physicians) and lends itself well to smaller groups of students who are self-motivated to take the course. It mimics the way in which infection control is practiced, which requires a large degree of problem solving and consultation, and requires that learners not only acquire a certain knowledge base, but also know how to seek new information and apply it in a practical situation. PBL allows students to immediately apply the knowledge they acquire and instills confidence in their ability to support an opinion. Geographical limitations are overcome with students from across Canada taking the course and participating in asynchronous group discussions. Instructors have also mentored the learning sessions from a variety of countries through the course of an academic session. Other tutors have also recognized the value of this learning format with a recent survey of 1,286 faculty at 22 US and Canadian medical schools rating PBL more positively than...
Students are put in Groups where they discuss their replies for each question in week one prior to posting the “group” answer under the Case bulletin section. Class discussion follows in week two.

Figure 1: Asynchronous learning in the Pathology 427 Course: basic principles of infection control

Figure 2: Asynchronous learning in the Pathology 427 Course: basic principles of infection control. Discussion occurring over time, with each reply as a “thread” under the original query.

traditional methods [5]. The asynchronous learner to learner interaction has been rated as one of the most important types of knowledge acquisition in an on-line environment as it permits bidirectional learning with time for consideration and research on issues raised during the course of discussion [6].

PBL is, however, more labor-intensive for the instructor, requiring regular monitoring of student progress and involvement in the discussions and may not be the optimal method of delivering basic content to large groups quickly and efficiently. Virtual classrooms that deliver material twenty-four hours a day, seven days a week and are self-directed may better address the needs of large organiza-
tions where issues such as shift work and geographic separation impede traditional learning activities. This has been the format employed in our health authority to teach healthcare workers basic principles of infection control. The workers are provided with an infection control module that can be distributed via the intranet or on CDROM. Basic demographic information is collected to allow senior educators to assess who is using the material and when. Software has been written to allow HCWs to return to the section of the module they were working on when they re-renter the course material. A particular advantage is that course material can be updated quickly in response to new information or changes in policy or procedure. Instructional methodologies that include didactic learning, illustrational and resource material and a self-assessment component have been the most effective means of content delivery.

Key to selecting the appropriate instructional methodology is ascertaining the target audience, the material that must be covered and the resources available to your institution. A successful program must have the support of senior administration, meet the needs of the learners as well as satisfy and involve the content developers.

Assessment of on-line learning

The potential impact of on-line learning is great; by providing access to educational material from an internet-connected computer any time and anywhere, healthcare workers have increased accessibility to infection control material. Educators and content experts are able to evaluate deficient areas in a timely fashion. Infection control, occupational health and public health experts benefit by being able to post and widely disseminate new information expeditiously. Providing a consistent message across the continuum of care on basic infection control precautions should offer an important contribution to improving healthcare quality. Attractive as its potential may be, it is imperative that the effectiveness of on-line learning as an educational strategy is assessed. Rigorous research and investigation regarding the performance of on-line learning including the understanding of both barriers and strategies to ensure its effectiveness are required to understand the scope of the potential for this learning technology in the field of infection control. User evaluation of computer-assisted learning packages is required as are assessments of the ability of students to actually learn and retain the content. The ability of this mode of learning to transfer knowledge to health care workers can be assessed fairly readily through the use of self-assessment quizzes, particularly if they are administered before and after completion of the on-line material. Weakness in specific subject areas can be ascertained, vague questions and/or content can be identified and addressed and workers can be monitored for their ability to gain knowledge over time. This type of assessment has been readily implemented and evaluated [7]. Desai et al evaluated a computer-assisted interactive infection control program and found that nursing staff and medical students found the program effective and enjoyable. On-line learning improved infection control understanding at least as effectively as the traditional infection control lecture. Higher level of use by night shift and weekend staff was noted and a demonstrable increase in infection control knowledge was found [8]. Evaluations of on-line learning have generally rated the courses favorably, although admittedly the results are biased towards those already more accepting of technology and newer forms of learning [7], [8], [9].

Prior to implementing the infection control module at our health authority, a pilot evaluation of the on-line learning method was conducted with staff from a variety of clinical areas. Five facilities were chosen to participate; each site provided HCWs who were randomly assigned to the infection control module or a control module containing workplace material hazards information. A nurse was hired from the casual pool to replace participating staff to ensure that all HCWs (including those who might not normally use on-line learning) assessed the module. Pre and post-tests of infection control knowledge and a user satisfaction survey were conducted. Of the 114 individuals participating in the evaluation (85% nursing staff), a significant increase in the pre to post quiz scores was noted for the online modules compared to the control material, indicating that the course was successful in transferring knowledge. Interestingly, the user satisfaction survey revealed that, although 79% of the participants indicated they would recommend the online course to coworkers, 28% preferred classroom-based education when given a choice of learning modalities [10].

More difficult to assess is the ability of on-line learning to assist in effecting a sustained change in behaviour i.e. knowledge translation [11]. Knowledge translation involves the ability to make evidence-based research available to frontline workers in a timely, efficient and accessible manner; as such, on-line platforms certainly have the potential to fulfill this one aspect of translating knowledge into practice, however, it is unclear whether they facilitate the final process of altering behaviour. On-line learning, by predisposing to behavioral change through knowledge acquisition, is simply an aid to the final goal of knowledge translation. This is a relatively unexplored field and further research is needed to test the effectiveness of on-line education as a successful tool for change.

Conclusion

On-line learning has been an educational tool in nursing since the early 1990s and offers the advantages of self-paced learning, time and cost savings. It breaks down the barriers of geographical location and time-of-day and has already been used successfully in presenting infection control training modules [3], [12]. Both traditional and
newer instructional methodologies adapt readily to this method of content delivery and this venue is generally seen to be user friendly, accessible and relevant to professional practice. While knowledge has been demonstrated to be effectively transferred, future research needs to be conducted to assess the ability of the knowledge gained to be translated into a behavioral change as well. Exciting opportunities abound in this field and infection control practitioners, as well recognized players in healthcare worker education, are encouraged to take advantage of these newer technologies.

Curriculum Vitae

Dr. Elizabeth Ann Bryce, MD, FRCPC

Regional Medical Director for Infection Control at Vancouver Coastal Health, co-chair of the British Columbia Provincial Infection Control Network. Elizabeth Bryce is dually qualified in Internal Medicine and Medical Microbiology. She is the Regional Medical Director for Infection Control at Vancouver Coastal Health and is co-chair of the British Columbia Provincial Infection Control Network. Dr. Bryce is the former Director of Standards and Guidelines for the Community Hospital Infection Control Association – Canada, and is a member of the Canadian Nosocomial Infection Surveillance Program. She is the co-developer of the only Canadian University accredited Infection Control Certificate Program which has been developed for on-line learning. Dr. Bryce has been the recipient of grants to develop on-line courses and to evaluate the impact of on-line educational modules for health care workers.

References

1. Hicks S. Evaluating e-learning. Training & Development. 2000;54(12):75.
2. Kirk J. E-Learning: an executive summary. Information Analyses. 2002.
3. Roscoe DL, Bryce EA, McManus K. Teaching infection control through WebCT, across Canada and beyond. Can J of Infect Control. 2003:18:12.
4. Schmidt HG. Foundations of problem-based learning: some explanatory notes. Medical Education. 1993;27:422-32.
5. Vernon DTA. Attitudes and opinions of faculty tutors about problem-based learning. Academic Medicine. 1995;70:216.
6. Soo KS, Bonk CJ. Interaction: what does it mean in online distance education. ERIC Document Reproduction Service No. ED 428-724, 1998.
7. Strazzo D, Wentling TL. A study of e-learning practices in selected Fortune 100 companies. http://learning.ncsa.uiuc.edu/?display-page.cfm?Page=Publications.
8. Desal N, Philpott-Howard J, Wade J, Casewell M. Infection control training: evaluation of a computer-assisted learning package. J Hosp Infect. 2000;44:193-9.
9. Burgess LP, Garshnek V, Birkmire-Peters D, Seifried SE. Distance learning on the Internet: web-based archived curriculum. Hawaii Med J. 2004;63:297-90.
10. Canadian Nursing Advisory Council Report. Enhancing infection control education to nurses in rural and community practice. (Bryce EA, Choi P, Landstrom M, Lo Chang J, Smailes E, Yassi A), May 2005.
11. Knowledge Translation and Learning Technologies: perspectives, considerations and essential approaches. Michael Smith Foundation for Health Research, University of British Columbia Continuing Medical Education. www.msfhr.org/sub-whats-resource.htm.
12. www.apicelearn.org

Corresponding author:
Elizabeth Ann Bryce
Division of Medical Microbiology And Infection Control, JPN 1111 - 899 West 12th Avenue Vancouver, General Hospital Vancouver, British Columbia, Canada VSZ 1M9, Phone: 604-875-4759, Fax: 604-875-4359 elizabeth.bryce@vch.ca

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