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The infection control audit: The standardized audit as a tool for change

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Background: Health care workers' compliance with infection control practices and principles is vital in preventing the spread of disease. One tool to assess infection control practice in clinical areas is the infection control audit; however, many institutions do not approach this in a systematic fashion.

Methods: Key features of the infection control audit were identified by the infection control team and developed into a standardized format for review of clinical areas. The audit incorporates a review of the physical layout, protocols and policies, knowledge of basic infection control principles, and workplace practice review.

Results: Over the last 13 years, the infection control unit has completed 17 audits involving 1525 employees. Four-hundred-one staff members have filled out questionnaires that assessed their understanding of standard precautions. A total of 257 recommendations have been made, and 95% of these have been implemented. The majority of recommendations address separation of clean and dirty supplies, hand hygiene compliance, hand hygiene signage, proper use of barriers, and environmental cleaning.

Conclusion: The infection control audit is an opportunity to implement changes and to introduce remedial measures in collaboration with various departments and services. A standardized approach to the audit allows benchmarking of practices across the institution and enhances standards of care. (*Am J Infect Control* 2007;35:271-83.)

Consistent adherence to infection control principles is the means by which health care workers can protect themselves and their patients. The infection control audit is an ideal vehicle to assess consistency of approach to infection prevention, and it has proven to be a useful part of infection control programs.¹ The audit is an organized examination of ward or service practices and procedures that provides an opportunity to simultaneously review safety in the workplace and identify and remedy deficiencies. It is also an ideal time to reinforce and acknowledge those procedures and practices that meet high standards of care. The purpose of this paper is to present our institution's development of a standardized audit form to ensure the consistent and thorough application of key infection control principles.

MATERIALS AND METHODS

Background

Vancouver General Hospital is a 700-bed adult tertiary care facility for British Columbia, Canada, admitting an average of 22,000 patients a year. The hospital is the provincial transplantation center as well as the referral institution for burns, neurosurgery, trauma, and spinal cord injury. The hospital employs, on average, 7000 full-time employees (FTE), and the infection control service is composed of 3.5 FTE medical microbiologists, one of whom is the infection control officer (ICO), and 3.75 FTE infection control professionals (ICP).

The audit structure

The audit tool was designed and developed over a series of meetings with members of the infection control team, consisting of ICPs, ICOs, and medical microbiologists. Audit items were selected based on review of standards and guidelines from the Public Health Agency of Canada (PHAC), the Association for Professionals in Infection Control and Epidemiology, Inc (APIC), and the Hospital Infection Society (HIS) as well as on practical experience. The audit tool was shared with the Community Hospital Infection Control Association-Canada (CHICA-Canada) members, and feedback was requested. Prior to the audit, the patient

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| ITEM | YES | NO | COMMENTS |
|--|-----|----|----------|
| UNIT: | | | |
| Patient/Residents Services Manager: | | | |
| Number of Nurse Clinicians/Supervisory staff: | | | |
| Number of staff: | | | |
| Number of staff per shift: Days: Nights: | | | |
| Number of beds: Single: 2 bed: 3 bed: 4 bed: | | | |
| Number of admissions/month | | | |
| Type of admissions: | | | |
| PHYSICAL ENVIRONMENT | | | |
| Soiled Utility Room: | | | |
| 1. Does the area have a clean orderly appearance? | | | |
| 2. Is there a sink? | | | |
| 3. Are there a washer/disinfector and a hopper in place? | | | |
| 4. If yes to above, are there instructions for its use posted? | | | |
| 5. Are there containers for confining soiled articles prior to pick-up? | | | |
| 6. Is there adequate storage for contaminated supplies/equipment? | | | |
| 7. Are garbage containers covered? | | | |
| 8. Are clean or sterile supplies stored in the room? | | | |
| 9. Are disinfectants or cleaning agents clearly labelled? | | | |
| 10. Is personal protective equipment available? | | | |
| 11. Does traffic move from soiled to clean? | | | |
| Clean Utility Room: | | | |
| 1. Does the area have a clean orderly appearance? | | | |
| 2. Is there a clear separation of clean and soiled storage areas? | | | |
| 3. Are soiled articles brought into the clean area? | | | |
| 4. Are clean supplies stored above the floor? | | | |
| 5. Is there a handwashing sink? | | | |
| 6. Is there a schedule for cleaning the room? | | | |
| 7. Is there evidence of excessive dust or dampness? | | | |
| Medication Room: | | | |
| 1. Does the area have a clean orderly appearance? | | | |
| 2. Is there a dedicated handwashing sink? | | | |
| 3. Is there evidence of inappropriate activities such as food preparation/storage? | | | |
| 4. Are open containers of sterile solutions dated? | | | |
| 5. Are multidose vials used? | | | |
| 6. Is a sharps disposal container readily available? | | | |
| 7. Is the refrigerator clean and free of frost build-up? | | | |
| | | | |
| | | | |
| | | | |

Fig 1. Continued.

| ITEM | YES | NO | COMMENTS |
|--|-----|----|----------|
| Tub/Shower Room(s): | | | |
| 1. Does the area have a clean orderly appearance? | | | |
| 2. Is there a policy that designates who cleans the tub between patients? | | | |
| 3. Is there a protocol posted for cleaning tubs and showers? | | | |
| 4. Is there a regular cleaning schedule? | | | |
| 5. Is there a laundry hamper for used towels and shelving for supplies? | | | |
| Patient/Resident Rooms: | | | |
| 1. Do the rooms have a clean orderly appearance? | | | |
| 2. Are isolation or private rooms for isolation available? | | | |
| 3. Is negative pressure available in these rooms? | | | |
| 4. Are there handwashing sinks accessible in these rooms? | | | |
| 5. If no to the above, are there waterless hand agents available? | | | |
| 6. Can a nurse pass between the beds without touching the adjacent bed? | | | |
| 7. Are sharps containers accessible? | | | |
| 8. Is there a policy on sharing and cleaning of commodes? | | | |
| 9. Is there a urine measuring/discard container for each patient/resident? | | | |
| 10. Is there appropriate storage for urine containers? | | | |
| SPECIAL EQUIPMENT | | | |
| 1. List any special equipment used in the area: | | | |
| 2. Mechanical lifts: Patient Wheelchairs | | | |
| 3. Oximeters Endoscopes | | | |
| 4. Laryngoscopes: Ambubags: | | | |
| 5. Glucometers: | | | |
| 6. Other: | | | |
| 7. Is there a regular cleaning schedule for this equipment? | | | |
| 8. Is the cleaning of equipment clearly designated? | | | |
| 9. Is there compliance with the cleaning schedule? | | | |
| HAND HYGIENE | | | |
| 1. Are health care workers (HCWs) knowledgeable as to how and when to clean their hands? | | | |
| 2. Are HCWs observed to clean hands appropriately? | | | |
| 3. Is antimicrobial soap used on the unit? | | | |
| 4. Are alcohol hand rubs used on the unit? | | | |
| 5. Are alcohol hand rubs readily accessible to HCWs? | | | |
| 6. Are sinks accessible and in adequate number on the unit? | | | |
| 7. Are there dedicated handwashing sinks? | | | |
| 8. Are paper towels and hand cream readily accessible? | | | |
| 9. Are there hand hygiene posters in appropriate areas? | | | |
| 10. Is there an ongoing education on hand hygiene for all HCWs? | | | |

Fig 1. Continued.

| ITEM | YES | NO | COMMENTS |
|---|-----|----|----------|
| BARRIER PROTECTION | | | |
| 1. Is the Infection Control Manual readily available? | | | |
| 2. Do all HCWs know where and how to access Infection Control policies? | | | |
| 3. Are HCWs knowledgeable as to appropriate use of barriers? | | | |
| 4. Is there a protocol on appropriate glove use available? | | | |
| 5. Are gloves being worn for appropriate tasks? | | | |
| 6. Are gloves worn between patient contacts? | | | |
| 7. Are gloves changed as appropriate if they become soiled during a procedure? | | | |
| 8. Are gowns available? | | | |
| 9. Are gowns worn for the appropriate tasks? | | | |
| 10. Is facial barrier protection available? | | | |
| 11. Is facial barrier protection observed to be used when there is a risk of aerosolization of body fluids? | | | |
| 12. Are HCWs knowledgeable about TB precautions/Respiratory isolation? | | | |
| 13. Are particulate respirator masks available? | | | |
| 14. Are HCWs knowledgeable as to the appropriate use of these masks? | | | |
| 15. Are particulate respirator masks observed to be used correctly? | | | |
| ROUTINE PRECAUTIONS | | | |
| 1. Do HCWs know what to do in the event of a sharps injury? | | | |
| 2. Is a sharps exposure protocol posted in the patient care area? | | | |
| 3. Are provisions in place for immediate reporting and assessment of a sharps injury? | | | |
| 4. Is there a policy designating responsibility for sharps disposal? | | | |
| 5. Are sharps containers sealed for disposal when approximately 3/4 full? | | | |
| 6. Are sharps containers point-of-use? | | | |
| 7. Are needles used on patients recapped? | | | |
| 8. If multidose vials are used, is a separate needle and syringe used for each re-entry? | | | |
| 9. Is there a protocol prescribing or prohibiting food consumption in patient/resident care areas? | | | |
| 10. Do HCWs know the difference between biomedical, radioactive, and regular waste? | | | |
| 11. Is waste segregated appropriately? | | | |
| 12. Is biomedical waste disposed of appropriately? | | | |
| | | | |
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| | | | |
| | | | |

Fig 1. Continued.

| ITEM | YES | NO | COMMENTS |
|---|-----|----|----------|
| SPECIMEN HANDLING | | | |
| 1. Are HCWs knowledgeable about safe handling of body fluid specimens? | | | |
| 2. Are specimens properly wrapped prior to sending to the laboratory? | | | |
| 3. Are specimens appropriately labelled? | | | |
| 4. Are sharps removed from samples prior to transport? | | | |
| 5. Is there a written policy for specimen collection and transport available? | | | |
| DECONTAMINATION OF BODY FLUID SPILLS | | | |
| 1. Is there a written policy for decontamination of spills of body fluids? | | | |
| 2. Are supplies readily available for decontamination? | | | |
| MRSA/VRE | | | |
| 1. Is there an Antibiotic Resistant Microorganisms Precautions protocol readily available? | | | |
| 2. Are HCWs knowledgeable about precautions for AROs? | | | |
| 3. Are rooms with ARO patient posted if appropriate? | | | |
| 4. Are HCWs observed to comply with ARO precautions? | | | |
| 5. Are cleaning staff knowledgeable about cleaning protocols for MRSA/VRE? | | | |
| 6. Is the appropriate cleaning solution and protocol applied? | | | |
| 7. Is a different mop head used for MRSA/VRE rooms? | | | |
| 8. Are patient/resident rooms cleaned in an acceptable manner? | | | |
| 9. Is there a policy for notifying departments or other institutions when a patient/resident is moved or transferred? | | | |
| RESPIRATORY CARE | | | |
| 1. If applicable, is respiratory protection used when giving respiratory care to ventilated patients? | | | |
| 2. Are oximeters cleaned between patients? | | | |
| 3. Are respiratory care technologists compliant with hand hygiene? | | | |
| REHABILITATION THERAPY | | | |
| 1. Are occupational and physiotherapists observed to be compliant with hand hygiene? | | | |
| 2. Is special equipment cleaned between residents/patients? | | | |
| DRESSING CHANGES | | | |
| 1. Was the HCW observed to clean their hands prior to gathering supplies? | | | |
| 2. Was aseptic technique maintained throughout the equipment set-up? | | | |
| 3. Was "clean to dirty" technique maintained throughout the procedure? | | | |
| | | | |
| | | | |

Fig 1. Continued.

| ITEM | YES | NO | COMMENTS |
|---|-----|----|----------|
| CENTRAL VENOUS CATHETER INSERTION | | | |
| 1. Was set-up of equipment done immediately prior to the procedure? | | | |
| 2. Did HCWs wash their hand prior to set-up? | | | |
| 3. Was the skin clean prior to application of an antiseptic prep agent? | | | |
| 4. Did the physician performing the procedures clean his/her hands appropriately? | | | |
| 5. Were sterile gloves worn for the procedure? | | | |
| 6. Was a sterile gown worn for the procedure? | | | |
| 7. Was a mask worn for the procedure? | | | |
| 8. Was a large sterile drape used? | | | |
| 9. Were any breaks in sterile technique observed? | | | |
| 10. Were hands cleaned after the procedure? | | | |
| GENERAL APPEARANCE | | | |
| 1. Is the hospital dress code adhered to? | | | |
| 2. Do staff consume food and beverages in patient care areas? | | | |
| 3. Are skin lesions covered? | | | |

Fig 1. Infection control audit form.

services coordinator and the medical director are advised in writing that a formal audit of their work area is to be conducted, and a meeting is arranged to review the audit process. It is stressed that confidentiality will be respected and that a standardized audit form (Fig 1) will be used during the inspection and review process to ensure fairness and objectivity.

The audit includes an inspection of the physical plant, a review of workplace infection control practices, an assessment of health care workers' knowledge and application of infection control principles, and a report documenting deficiencies and required interventions. All documented deficiencies are followed by recommendations that are summarized in a worksheet format with a completion date acceptable to both the audited unit and the infection control team. The review team involves at least 2 ICPs and 1 medical microbiologist.

Physical environment

Inspection of the physical environment consists of a general examination of the layout of the unit with emphasis on the soiled and clean utility rooms, medication room, and patient/resident rooms. Special equipment such as oximeters, endoscopes, and glucometers are checked for the presence of a regular cleaning schedule and for compliance. Design flaws that may inhibit good infection control practice are

noted. The process requires several visits to assess properly the levels of cleanliness and consistency in cleaning practices.

Workplace practice review

The infection control practice of all staff is observed and evaluated using a standardized form to record lapses in accepted practice (Fig 1). The appropriate use of isolation rooms, proper hand hygiene, barrier precautions, and waste disposal are observed and documented on at least 3 occasions, more frequently if deficiencies are initially noted. Policy and procedure manuals are reviewed to determine that all policies conform to current infection control standards. The standard audit form also includes appropriate use of barrier protection, specimen handling, decontamination of body fluid spills, correct use of isolation protocols, and general staff appearance and attire. Other practices assessed when applicable include intravascular line insertion, suctioning, urinary catheter care and insertion, skin and wound care, and unit-related procedures. When practices are unique to a ward/department (eg, the morgue), these are covered with an addendum to the standard form.

Over several visits, a minimum of 75 hand hygiene events are observed by an ICP. Standardized criteria for when hand hygiene is required are used. Episodes are recorded, using personal digital assistant software

Location: _____ Compliance Rate _____ /75 observations = _____ %
 Date: _____ Auditors: _____

Instructions: Auditors should move around a unit as required to document events rather than targeting one specific area of the unit. Please note that no more than three observations for an individual health care worker should be made. Only those situations where hand hygiene is unequivocally required should be documented:

- Before patient care or contact
- During patient care a) when hands are visibly soiled and b) between procedures involving aseptic technique
- After patient contact
- After removal of all barriers
- Before eating or handling food
- After using the toilet
- Whenever hands appear soiled
- After percutaneous injury to hands
- After sneezing or blowing one's nose

| | |
|---------------|--|
| RecordID | <input type="text" value="0"/> |
| UnitID | <input type="text" value="0"/> |
| UserName | <input type="text" value="Infection Control"/> |
| TimeStamp | <input type="text" value="11/21/2002 4:23:30 PM"/> |
| Event Number | <input type="text"/> |
| Profession | <input type="text" value="Doctor"/> |
| HH performed? | <input type="text" value="Y"/> |
| Comments | <input type="text"/> |

| | |
|---------------|---|
| RecordID | <input type="text" value="0"/> |
| UnitID | <input type="text" value="0"/> |
| UserName | <input type="text" value="Infection Control"/> |
| TimeStamp | <input type="text" value="12/2/2002 3:53:14 PM"/> |
| Event Number | <input type="text" value="1"/> |
| Profession | <input type="text" value="Nurse"/> |
| HH performed? | <input type="text" value="Y"/> |
| Comments | <input type="text"/> |

² Pendragon Forms 3.1, Pendragon Software Corporation, Buffalo Grove, Illinois

Fig 2. Hand hygiene survey.

(Pendragon Forms 3.1, Pendragon Software Corporation, Buffalo Grove, IL) onto a hand hygiene audit form (Fig 2). No more than 3 events are recorded for an individual, and only the profession is documented to maintain anonymity. The ICP is discreet during auditing and generally is on the ward as part of their daily rounds. Sampling is opportunistic because not every individual working on the unit is observed. The

intention of the hand hygiene audit is to primarily provide feedback in a positive manner to the unit and is not intended as a research endeavor.

Assessing knowledge and its application

Prior to any documented observations in the workplace, a questionnaire assessing routine precautions

Date:**Location:**

The Infection Control Service is conducting a review of your clinical area. It would be greatly appreciated if you could take a few minutes to fill out this questionnaire. Results are anonymous, confidential, and for audit purposes only. Please return your reply to the box in the nursing station or mail it to the Infection Control Unit, LSP 1.

A. Demographic Information (please circle one response for each question)

- 1) Position: a) Radiologist b) Radiographer c) Nurse d) Resident /MSI
e) clerical (f) Other _____
- 2) Age: a) less than 20 years b) 20-29 yrs c) 30-39 yrs d) 40-49 yrs e) 50-59 years f) 60 yrs or older
- 3) Sex: a) male b) female
- 4) Years at Vancouver General Hospital:
- 5) Total years working in health care:

B. Routine Precautions (RP) Education Session (circle best response)

- | | | | |
|--|----------------|------------|--------|
| 1) Have you attended an education session on RP at VGH? | Yes | No | Unsure |
| 2) Have you attended an education session on RP? | Yes | No | Unsure |
| 3) When was your last education session on RP? | Yes | No | Unsure |
| a) < 6 mos | b) 6 mos-2 yrs | c) > 2 yrs | |
| 4) Do you feel you received sufficient information on this subject? | Yes | No | Unsure |
| 5) Was the session(s) clear and understandable? | Yes | No | Unsure |
| 6) Do you feel you understand the principles of RP? | Yes | No | Unsure |
| 7) Are you aware of a hospital policy on sharps (e.g., needle stick) injuries? | Yes | No | Unsure |
| 8) Do you know what to do immediately in the event of a sharps injury? | Yes | No | Unsure |
| 9) Do you understand the appropriate use of gloves, masks, and gowns? | Yes | No | Unsure |

C. Knowledge Assessment (circle best response)

- | | | |
|--|------|-------|
| 1) RP advocates the use of gloves for blood or potentially bloody fluids only. | True | False |
| 2) Invasive procedures require hand washing with neutral (non-antiseptic) soap. | True | False |
| 3) Private rooms are still used for potential airborne disease such as TB. | True | False |
| 4) Sharps injuries should be assessed by the Employee Health Unit. | True | False |
| 5) Surgical masks should be used for airborne disease, e.g., Tuberculosis | True | False |
| 6) Hepatitis B immunoglobulin can be given up to one week after an exposure with protection of the individual. | True | False |
| 7) Capped needles may be put into the garbage. | True | False |
| 8) Buffered bleach should be used to clean up blood spills. | True | False |
| 9) The environment is the major source of spread of infections in hospitals. | True | False |
| 10) RP advocates labelling of laboratory requisitions as to risk of bloodborne diseases. | True | False |

D. Practical knowledge of RP (circle best response)

- | | | |
|--|------|-------|
| 1) The use of more than one pair of gloves during an invasive procedure with blood spill has been shown to reduce the risk of cutaneous exposure to blood. | True | False |
| 2) Vaccination of staff for influenza is more effective in preventing outbreaks than vaccination of patients. | True | False |
| 3) Passing of sharps in basins during a procedure has been shown to reduce the risk of sharps injuries. | True | False |

- 4) The terminal cleaning procedure differs in cases of patients with known bloodborne disease. True False
- 5) Caring for patients with MRSA requires the routine use of gowns, gloves, and masks. True False

E. *RP in practice (Please circle best response to what you currently practice. Please leave the answer blank if questions does not pertain to you).*

- 1) Do you wear protective eyewear (other than prescription glasses) during procedures where there is the potential for blood splatter?
 a) always b) sometimes c) never
 - 2) Do you double glove when performing invasive procedures with potential for blood spill?
 a) always b) sometimes c) never
 - 3) When your gloves come in contact with body fluids, do you discard them when the specific task is complete?
 a) always b) sometimes c) never
 - 4) Do you change your personal protection habits if you know the patient has hepatitis B or C?
 a) always b) sometimes c) never
 - 5) Do you wash your hands after removing gloves?
 a) always b) sometimes c) never
 - 6) Do you wear a respirator when there is a potential to be exposed to respiratory aerosols?
 a) always b) sometimes c) never
 - 7) Have you had a sharps injury in the last two years? Yes No
 - 8) Did you report the injury? Yes No
- If no to question 8: Why not?

- 9) Do you ever recap a needle?
 a) always b) sometimes c) never
- Describe the circumstances where you might recap a needle

- 10) What is the significance of a respirator having an N-95 rating?

Thank you for your time and cooperation in answering this questionnaire.

Additional comments (or concerns):

¹ Example of questionnaire form from a current Radiology infection control audit

Fig 3. Infection control standard precautions survey.

Table 1. Demographic information*

| Demographic | Result |
|-------------------------|-----------------------------|
| Age range | 20-65 yr |
| Years in health care | <5 to >30 yr (average 14.5) |
| Sex | |
| Female | 234 (60%) |
| Male | 89 (23%) |
| Unknown | 67 (17%) |
| Occupation | |
| Nurse | 187 (48%) |
| Physician | 34 (9%) |
| Technologist/therapist | 89 (23%) |
| Emergency support staff | 43 (11%) |
| Other | 37 (9%) |

*N = 390.

(Fig 3), frequency of education sessions and health care worker comprehension, and application of infection control procedures in the workplace is filled in anonymously by staff. The questionnaire contains standard questions as well as questions suitable for that specific work environment. After completion of the audit, education sessions are scheduled to discuss the responses to the knowledge and workplace practice assessment questions.

Report and recommendations

The audit report has a structured format consisting of a description of the unit, number of staff, number of beds, and number of monthly admissions. The report follows the same flow as the review process: (1) description of the unit with its activities, (2) physical environment, (3) workplace practices, and (4) infection control knowledge and its application. Findings are summarized as a list of recommendations that are supported with references and guidelines whenever possible. A checklist of responsibilities and action dates are appended, and a meeting with the clinical area's multidisciplinary team is arranged to discuss the findings and the recommendations. Typically, this will include a medical director, patient services manager, nurse representative, unit educator, respiratory therapist, and other ward/department specific staff (eg, morgue attendants). The meeting is an opportunity to discuss any contentious issues prior to the final recommendations. The ICPs then visit the unit at regular intervals (generally 3 and 6 months) to document progress in implementing the various recommendations.

RESULTS

The infection control unit has completed 17 audits at this institution within the last 13 years. The wards and services reviewed included intensive care,

Table 2. Infection control education*

| Parameter | No. and percentage responding affirmatively |
|--|---|
| Attended infection control session | 197 (49%) |
| Sufficient information received | 143 (36%) |
| Personal understanding of infection control principles | 317 (79%) |
| Personal understanding of correct barrier use | 334 (83%) |

*N = 401 respondents.

Table 3. Infection control knowledge assessment*

| Area of assessment | Correct response, n (%) |
|---|-------------------------|
| Sharps injury policy | 321 (85) |
| Sharps exposure management | 302 (80) |
| Sharps handling and disposal | 310 (82) |
| Routine precautions appropriately applied | 177 (47) |
| Personal protection requirements for tuberculosis | 185 (49) |
| Body fluid spill cleanup procedure | 311 (83) |
| Hand hygiene practice | 257 (68) |

*N = 377.

emergency department, orthopedic surgery, solid organ transplantation, outpatient clinics, spinal cord injury unit, pathology and clinical laboratory services, morgue, food and nutrition services, occupational therapy kitchens, respiratory services, operating room, radiology, and hemodialysis. On average, each audit occurs over 3 to 6 months and entails approximately 50 to 100 ICP hours. Approximately, 1525 staff members have been contacted during the audit periods. Questionnaires on routine precautions have been completed by 401 staff.

There were 390 forms available for demographic analysis of which 60% were submitted by nursing staff (Table 1). The age range was 20 to 65 years with an average of 14.5 years in health care. Approximately half of respondents had attended an infection control education session; however, the majority felt that they understood basic principles of infection control, particularly barrier use (Table 2). When formal knowledge was assessed, however, deficiencies were noted in application of routine precautions, barrier use for airborne infections, and hand hygiene practice (Table 3).

A total of 257 recommendations have been made, and 95% have been acted on (Table 4). The most common recommendations focused on proper environmental cleaning (11%), proper equipment cleaning protocols (11%), correct use of personal protective equipment (11%), hand hygiene procedures (8%), and separation of clean and soiled supplies (8%). In

many instances, once a problem or deficiency was identified, it was corrected prior to completion of the audit.

Large scale improvements resulting directly from the audit process include the introduction of standardized orders for antimicrobial prophylaxis (arising from the first operating room audit in 1996); the addition of alcohol handrub dispensers throughout the institution beginning in 1995 (to address observed lack of hand hygiene stations); the introduction of a template in 1998 to address additional costs associated with enhanced infection control measures in the tendering process for new construction and renovations (a response to physical plant design constraints observed in the audits); and, more specifically, the addition of 102 negative-pressure rooms in the new acute care tower (20% of all beds). Other improvements arising from audit recommendations include use of the hands-free technique for passing sharps (2000); enhanced personal protective equipment and new safety protocols in the autopsy suites (1999); revised protocols for cleaning of dialysis machines; and introduction of syndromic surveillance for gastrointestinal and respiratory infections in the emergency department (2003).

DISCUSSION

Audits in infection control have received relatively little attention, although the area should be an ideal subject because of its focus on patient and health care worker safety, the availability of standards by which to measure the quality of care, and the ability to document improvement in practice. Unfortunately, most audits involving infection control focus on environmental cleanliness rather than encompassing unit procedures as they apply to the practice of infection prevention.² To be truly effective, an audit must consist of a topic, appropriate practice standards, observation and testing against the selected standards, identification of areas for improvement, and subsequent interventions and demonstration of improvement in practice.³⁻⁵

Following completion of the first 3 infection control audits in the early 1990s, it was apparent that there was a need for a more consistent and organized review process. The audit form had been shared with members of CHICA-Canada and feedback requested, but this was not a formal verification or validation process.⁶ Thus, the audit tool has not been verified, and this is an acknowledged limitation. The infection control services have recently been regionalized, and plans are underway to review the audit document, weight the observations, and develop a scoring system. This will address the urgency of a particular action and the

Table 4. Frequency of infection control recommendations*

| Category of recommendation | Frequency, n (%) |
|---|------------------|
| Environmental cleaning procedures | 29 (11) |
| Cleaning of equipment | 28 (11) |
| Use of protective equipment | 27 (11) |
| Hand hygiene practice | 21 (8) |
| Separation of clean and soiled supplies | 21 (8) |
| Accessible protective equipment | 16 (6) |
| Handling and disposal of sharps | 13 (5) |
| Multidose vial procedures | 7 (3) |
| Prohibition of food and drink in work area | 6 (2) |
| Isolation practices | 5 (2) |
| Other (eg, traffic flow, untidiness, isolation signage) | 84 (33) |

*N = 257.

risk to the patient and/or staff. Construct validity and interrater reliability will also be assessed as part of this process.

It must be emphasized that the infection control audit presents an opportunity to promote infection prevention and control improvement activities in partnership with an organization's multidisciplinary teams. Issues that influence the prioritization of the ward/department to be audited include acuity of patient care, central venous catheter-associated bloodstream infections, surgical wound infection rates and high rates of *Clostridium difficile* or antibiotic-resistant organisms, and date of last audit.

The audit is comprehensive and includes inspection of the physical plant, review of workplace infection control practices, and assessment of health care workers' knowledge and application of infection control principles. The observational period is then followed by identification of areas for improvement, involvement of staff in the report writing process, and recommendations for further intervention. Although initially the process may seem daunting, the prolonged period of time for the audit is designed to account for the busy schedule of the ICP and the need to incorporate the audit as part of their routine for the next several months. It is similar to planning a calendar of educational sessions, but instead, unit or ward visits are scheduled into the ICP's day. In this staged manner, the audit becomes less intimidating, particularly because the ICPs can incorporate some of the observational tasks as part of their daily rounds. The prolonged period of observation likely more accurately reflects true unit practices compared with a set of observations at a single point in time.

An assessment of the physical layout of any unit is necessary to determine the ease or difficulty with which staff can maintain a safe, clean environment

and prevent cross infection. Good or bad design can affect one's ability to maintain a clean environment, and clinical areas must be designed to facilitate good work habits. Recommendations for changes to the physical environment are consistent with The American Institute of Architects Academy of Architecture for Health guidelines and are used to assist with future renovations.⁷ Consultation between facility planning and infection control is now a regular outcome of the audit process.

Review of workplace practices is evaluated against existing standards and current facility-specific infection control policies and procedures. The most commonly found deficiencies in the areas reviewed include incorrect storage of clean and dirty supplies, poor compliance with handwashing, incorrect use of barriers, inadequate cleaning of shared equipment, and consumption of food and beverages in the work area. Ways in which deficiencies are addressed include review of work practice with staff, reorganization of service areas to improve infection control compliance, and revision of protocols or procedures. For example, confusion over cleaning of electronic equipment such as oximeters and glucometers led to changes in cleaning protocols and assignment of housekeeping personnel to the task. Identification of poor aseptic technique when accessing multidose lidocaine vials on certain wards led to the immediate withdrawal of this item from unit stock. Documentation of inappropriate mask use and review of exposure risk to airborne disease in our institution led to increased promotion of respirators for high-risk respiratory care and training in their use (prior to severe acute respiratory syndrome). The latter intervention was felt to be a high priority because the region accounted for 38% of all newly diagnosed tuberculosis cases in the province and our institution admitted an average of 64 cases of active respiratory tuberculosis a year.⁸ These examples of early successes were a direct outcome of the audit process and may have contributed to the facility's successful infection control management of severe acute respiratory syndrome cases.⁹ All of these specific examples were documented as completed on 3- or 6-month follow-up to "close the loop" between observation, recommendation, and implementation.

A recent addition to the audit process is the observation of opportunities for hand hygiene during a 1-hour period on 2 or 3 occasions. Compliance rates for hand hygiene practices vary from 28% to 60% across all professions. Varying compliance rates and hand hygiene practices are highlighted during the postaudit meetings, and staff are invited to provide feedback and suggestions for improving compliance. This component of the audit allows for the opportunity to compare the practice of other units within the same institution

and is excellent material for postaudit education sessions. It is difficult to determine whether the hand hygiene audits and feedback have improved health care worker compliance, partly because of the numerous barriers and facilitators that affect intent to comply with this simple yet effective measure and partly because the intent of the audits was for feedback rather than as independent evaluation of compliance over time.

A major component of infection control is education of the health care worker on routine precautions. Comprehension of infection control principles is vital to the protection of both staff and patients. The purpose of the knowledge and practice survey as part of the audit process is to ascertain the level of infection control knowledge, to determine whether perception of knowledge is genuine, and to evaluate whether knowledge is applied in the workplace setting. The questionnaire has been particularly useful in detecting areas that require further attention. Infection control arranges education sessions to review the correct responses with unit personnel and circulates FAQ sheets for each question following collection of all the survey forms.

In retrospect, the behavioral and knowledge components in the knowledge assessment form would have been better if items had been rated on a scale rather than as a simple yes or no question. This is a limitation of the form from an analytical standpoint; however, it must be emphasized that this particular audit tool serves mainly to inform the infection control team of gaps in knowledge and deficiencies in practice, which then can be communicated back to the ward or unit. Future plans for the knowledge assessment form include a factor analysis to verify construct validity and revision to allow for further assessment of changes in knowledge over time. This then would allow for more focused intervention with detailed observations and research questions.

One illustration of the ability of the knowledge and practice assessment form to identify areas for improvement was the disappointing results regarding attendance at infection control education sessions and comments regarding the subject matter presented in the early audits. It clearly documented a need to revise the infection control unit's approach to content delivery and provided the impetus to create an on-line infection control education module and infection control manual. The latter has recently received funding to assess infection control knowledge retention over time.

Involvement of health care workers from the onset of the audit and review of the audit findings with feedback by staff prior to the final audit draft should be stressed. Participation in the process by the clinical areas facilitates acceptance and completion of recommendations in a timely fashion. The nursing unit

manager, the medical director, the nurse educator, and the infection control designate on the ward are involved at the beginning of the audit process and are key participants in the development of action plans.

The goal of the infection control team is to review each clinical area on a 5- to 7-year cycle, similar to the hospital accreditation process. Documentation and consistency of approach should allow the team to focus on previous deficiencies and to compare infection control practice over time. This then would complete the audit cycle. The concept of regular review hopefully will also emphasize the importance of incorporation of infection control practices as routine.

The infection control audit can be a daunting task. A standardized protocol for the audit process provides a template for an impartial, organized, structured, and thorough review. Uniformity of approach, front-line presence of the ICP on the unit, involvement of the clinical area under review, and documentation of results have been effective in promoting and improving standards of infection control in this institution.

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