Literature Review On Relationship between Cleaning and Hospital Acquired Infections

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CLEANING AND INFECTION CONTROL

Hospital-acquired infections are increasing

There is a growing recognition of the relationship between the effective cleaning of hospitals and long-term care facilities and the health and safety of both patients and staff.[1] The national Canadian Nosocomial Infection Surveillance Program (CNISP) "in the past 5years…has documented a significant increase in the number of patients colonized or infected with MRSA."[2] A Welsh study evaluating hospital cleaning regimes and standards argues that there is "no doubt that environmental surfaces can act as a source of pathogens which can give rise to nosocomial [hospital-acquired] infections".[3] This review of the literature focuses on the evidence of infection control nurses and doctors concerned that the trends in cost cutting are contributing to the decline in the provision of cleaning services and the accompanying rise in hospital-acquired infections. The research demonstrates that what we need is rigorous standards for cleaning, versus the steady cutbacks in service that we are observing.

Health impacts of hospital-acquired infections

A report released by Britain's National Audit Office revealed that infections in hospitals affect 100,000 people each year, costing the National Health Service (NHS) approximately £1 billion to treat.[4] More importantly, hospital-acquired infections are primarily responsible for killing 5000 patients per year and are a substantial factor in 3% or 15,000 deaths per year. Additionally, the report found that approximately one-third of hospital-acquired infections may be preventable and concluded that infection control expenditures play an important role in improving patient care and reducing costs.

In the U.S., a Chicago Tribune investigative report alleges that in 2000, an estimated 103,000 patients' deaths were linked to hospital infections and that the causes of 75% of these deadly infections (unsanitary facilities, unwashed hands, and unsanitary instruments) were preventable.[5] The Tribune also cites a US Federal Centers for Disease Control and Prevention report that deaths linked to hospital germs represent the fourth

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[1] Auditor General of Scotland. 2000. A clean bill of health? A review of domestic services in Scottish hospitals. Audit Scotland. April. www.audit-scotland.gov.uk

[2] Kim, T., Oh, P. I., & Simor, A. E. 2001. The economic impact of methicillin-resistant *Staphylococcus aureus* in Canadian hospitals. *Infection Control & Hospital Epidemiology 22*(2): 99-104. p. 99

[3] Griffith, C. J., Cooper, R. A., Gilmore, J., Davies, C., & Lewis, M. 2000. An evaluation of hospital cleaning regimes and standards. *Journal of Hospital Infection 45*: 19-28. p. 25. See also p. 19.

[4] Comptroller & Auditor General. 2000. The management and control of hospital acquired infection in acute NHS trusts in England. *National Audit Office.* London.

Boseley, S. 2001. Ten dirty hospitals get support to clean up. *The Guardian.* April 11.

[5] Berens, M. J. 2002. Infection epidemic carves deadly path: Poor hygiene, overwhelmed workers contribute to thousands of deaths. *Chicago Tribune.* July 21.

Note: In its investigation, the Tribune analysed federal, state agency, court cases, and hospital records. "The result is the first comprehensive analysis of preventable patient deaths linked to infections within 5,810 hospitals nationally." The Tribune also reports that the Center for Disease Control, which "bases its numbers on extrapolations from 315 hospitals", estimated there were 90,000 deaths linked to hospital infections in 2000.

leading cause of mortality among Americans. In addition, Tribune investigators found that hospital cleaning staff were inadequately trained and that cleaning budgets had been steadily cut – 15-20% each year, resulting in overwhelmed and overworked staff.

Cleaning can help stop the spread of super-bugs

Revised hospital infection control guidelines highlight the importance of high standards of ward cleaning to stop the spread of methicillin-resistant *Staphylococcus aureus*.[6] British infection control doctors argue that instead of attempting to apply limited MRSA control measures, which are impossible to achieve, infection control has a duty to press for investment in cleaning.[7]

For example, Rampling et al. found that despite aggressively applied infection control measures, a 21-month outbreak of infection/colonization with MRSA on a male surgical ward in Dorchester could not be controlled.[8] Increasing the cleaning hours to almost double the usual level and allocating responsibility for the cleaning of ward medical equipment finally terminated the outbreak. Environmental surveys found that "radiators, medical equipment and furniture were the most frequently contaminated sites".[9] The cleaning time was increased from 66.5 hours to 123.5 hours per week on the 37-bed ward, with an emphasis on dust control and vacuuming. Additionally, radiators and ventilation grills were cleaned every 6 months. The study concludes that a dusty ward is an important source of MRSA infection for surgical patients and that "a high standard of hygiene should be an absolute requirement in hospitals. In the long term, cost-cutting on cleaning services is neither cost-effective nor common sense."[10]

Similarly, an outbreak of MRSA in a Scottish surgical unit was attributed to sub-optimal cleaning (one cleaner for two hours daily). "The outbreak, involving fourteen patients was halted by the institution of a major cleaning programme in all areas of the unit and improvements in the ward fabric."[11] Scottish Drs. Corcoran and Kirkwood argue that resources should be more effectively directed on "areas of more fundamental importance, including education, cleaning and the improvement and maintenance of ward fabric", rather than being diverted to controlling MRSA outbreaks.[12]

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[6] Auditor General of Scotland. 2000. A clean bill of health? A review of domestic services in Scottish hospitals. Audit Scotland. April. www.audit-scotland.gov.uk p. 13.

[7] Barrett, S. P., Mummery, R. V., & Chattopadhyay, B. 1998. Trying to control MRSA causes more problems than it solves. *Journal of Hospital Infection 39*: 85-93. p. 85

Case, M. 1998. Back to basics. *Nursing Times* 94(37):65

[8] Rampling, A., Wiseman, S., Davis, L., Hyett, P., Walbridge, A. N., Payne, G. C., & Cornaby, A. J. (2001). Evidence that hospital hygiene is important in the control of methicillin-resistant *Staphylococcus aureus*. *Journal of Hospital Infection, 49:* 109-116.

[9] Ibid. p. 114.

[10] Ibid. p. 115.

[11] As cited in Dancer, S. J. 1999. "Mopping up hospital infection". *Journal of Hospital Infection 43:* 85-100. p. 91.

[12] Corcoran, G. D., & Kirkwood, E.M. 1999. Revised guidelines for the control of methicillin-resistant *Staphylococcus aureus* infection in hospitals. Letter. *Journal of Hospital Infection*; *41*: 72-74. p. 73

Correspondingly, researchers in France found that "environmental objects [water taps, dry surfaces, patients' mattresses] have been a major risk factor for A. baumannii acquisition".[13] The A. baumannii outbreak was controlled "by application of hygienic measures (handwashing, isolment, meticulous cleaning of the ICU and environmental controls)."[14] Researchers from the National Institute of Infectious Disease (Spain) also found that understaffing increases the risk of patients becoming infected in hospital with the hepatitis C virus.[15]

Also arguing in support of the value of generalized cleaning, Dancer cites a seven-year study by Zafar et al. that examined the incidence of hospital-acquired infections in an American hospital. Dancer reports "there was a sustained decrease in nosocomial C. *difficile*, when cleaning was included as a major part of an aggressive infection control programme."[16]

Health Canada states, "the transmission of viral and other infections can be reduced by effective cleaning of environmental surfaces".[17] In particular "careful attention should be paid to the regular cleaning of environmental surfaces that are frequently touched" such as knobs, handles, and call bells.[18] Health Canada argues that good cleaning procedures need to be defined and consistently applied. Moreover, adequate staff is required to ensure that not only patient care equipment and environments are appropriately cleaned and disinfected, but also that the heating, ventilation, and air-conditioning systems are kept clean and maintained.

Other risk factors for the spread of hospital-acquired infections such as MRSA are staff shortages, patient over-crowding, inadequately trained and supervised staff, and frequent transfers of patients and staff between wards and hospitals.[19]

Added costs of trying to control MRSA:

Hospital efforts to control MRSA are very expensive. Moreover, attempts to identity and treat carriers of MRSA leads to additional costs due to:

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[13] Pina, P., Guezenec, P., Grosbuis, S., Guyot, L., Ghnassia, J. C., & Allouch, P. Y. 1998. An Acinetobacter baumannii outbreak at Versailles Hospital Center. *Pathologie Biologie 16* (6): 385-94, June. p. 385. "A. Baumannii is a multiresistant bacteria which is recognised as [being] responsible for nosocomial infections and hospital outbreaks" (p. 385).

[14] Ibid. p. 385.

[15] Pestrosillo, N., Gilli, P. Serraino, D., Dentico, P., Mele, A., Ragni, P., Puro, V., Casalino, C., & Ippolito, G.. 2001. Prevalence of infected patients and understaffing have a role in hepatitis C virus transmission in dialysis. *American Journal of Kidney Disease 37*(5): 1004-10. May 1.

[16] Dancer, S. J. 1999. "Mopping up hospital infection". *Journal of Hospital Infection 43:* 85-100. p. 87-88, citing Zafar, Gaydos & Furlong's 1998 study.

[17] Health Canada. 1998. Supplement infection control guidelines: Handwashing, cleaning, disinfecting and sterilization in health care. *Canada communicable disease report 24S8*. Dec. ISSN 1188-4169. p. 30

[18] Health Canada. 1998. Supplement infection control guidelines: Handwashing, cleaning, disinfecting and sterilization in health care. *Canada communicable disease report 24S8*. Dec. ISSN 1188-4169. p. 31.

[19] Ayliffe, G. A. J., Babb, J. R., Taylor, L. J. 1999. *Hospital-acquired infection: Principles and prevention.* (3rd ed). Oxford: Butterworth-Heinemann.

- ward closures
- increased length of stay
- postponed treatments
- psychological impairment of isolated patients
- reduced medical attention to isolated patients
- delayed transfer of patients between hospital and between units
- compromised rehabilitation
- enforced staff absence
- demoralization of staff
- increased expenditure of agency and locum staff
- increased laboratory workload
- increased infection control workload
- increased pharmacy costs (antibiotics)
- stigmatization of hospital and units
- difficulties with purchasing authorities and
- increased likelihood of litigation due to raised patient expectations[20]

The physicians conclude that "the energy, time and money spent on fruitless pursuit of a single organism are resources consumed that could have been directed towards a whole range of activities of benefit to infection control in general"[21]. In a study conducted at Toronto's Sunnybrook and Women's College Health Sciences Centre, researchers found that a conservative estimate of the cost of treating MRSA infections was $14,360 per patient. Assuming an infection rate of 10% to 20%, Kim et al. determined that MRSA costs Canadian hospitals between $42 - $59 million dollars per year.[22]

Cleaning can help stop the rising incidence of gastrointestinal outbreaks in long-term care facilities

The BC Centre for Disease Control reports that between January and July 2002 there was 85 outbreaks of gastroenteritis reported and that over 50% were caused by the Norwalk-like virus.[23] Of all gastrointestinal outbreaks reported to date, 60% occurred in long-term care facilities affecting our most susceptible seniors. Similarly, in a UK study of infectious intestinal diseases, hospitals and long-term care facilities were the most frequently recorded setting for gastrointestinal outbreaks.[24]

Britain's Public Health Laboratory Service Viral Gastro-enteritis Working Group reviewed the causes of outbreaks of infections due to Norwalk-like viruses and makes

[20] Barrett, S. P., Mummery, R. V., & Chattopadhyay, B. 1998. Trying to control MRSA causes more problems than it solves. *Journal of Hospital Infection 39*: 85-93.
[21] Ibid. p. 88
[22] Kim, T., Oh, P. I., & Simor, A. E. 2001. The economic impact of methicillin-resistant *staphylococcus aureus* in Canadian hospitals. *Infection Control & Hospital Epidemiology 22*(2): 99-104.
[23] Petric, M., McIntyre, L., McNabb, A., Trinidad, A., Gamage, B., & Isaac-Renton, J. 2002. *Guidelines for the management of Calicivirus (Norwalk-like virus or Norovirus) gastrointestinal outbreaks*. BCCDC.
[24] Griffith, C. J., Cooper, R. A., Gilmore, J., Davies, C., & Lewis, M. 2000. An evaluation of hospital cleaning regimes and standards. *Journal of Hospital Infection 45*:19-28.

recommendations for hospital management of outbreaks. In the event of an outbreak of gastroenteritis, these infection control specialists argue that research demonstrates the need for "a comprehensive and responsive cleaning and disinfection programme during and at the end of an outbreak of gastro-enteritis".[25] Indeed, the researchers found that prompt, thorough and repeated cleaning has prevented subsequent outbreaks of Norwalk-like virus. Specifically, attention should be given to cleaning beds, bathrooms, handles and railings.[26]

Contracting-out cleaning services = increased infection rates

Britain has been plagued with problems with hospitals' cleanliness since the National Health Services (NHS) hired private contractors to clean their hospitals in a misguided attempt to save money and at the cost of reduced standards and services.[27] The NHS found that in addition to reduced staffing levels, "contracting out of hospital cleaning services has further contributed toward falling standards."[28] Contracting-out has not improved the quality of service, rather it has created a two-tier workforce, breaking up the health care team and creating obstacles to the provision of client-focused integrated services. The NHS's audit of cleaning services found that "where services are contracted out they are more likely to have failed. 20 out of 23 of these hospitals which did not pass the cleaning audit are contracted out compared to an estimated 50 per cent of contracts contracted out overall."[29]

Dr. Harvey, a prominent Public Health Specialist in Australia, has spoken out against the dangers of cutting hospital services and contracting-out arguing contracting-out of cleaning services has resulted in a lower standard of infection control, resulting in higher infection rates in hospitals.[30] Similarly, Barrett et al. state that improvement is needed in the quality of cleaning "where direct control has now often been lost to outside organizations."[31] Likewise, Drs. Corcoran and Kirkwood argue that cleaning is a "critical

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[25] Chadwick, P. R., Beards, G., Brown, D., Caul, E. O., Cheesbrough, J., Clarke, I., Curry, A., O'Brien, S., Quigley, K., Sellwood, J., & Westmoreland, D. 2000. Management of hospital outbreaks of gastro-enteritis due to small round structured viruses. *Journal of Hospital Infection 45*:1-10. p. 5.

[26] Ibid.

Ronveaux, O. Vos, D., Bosman, A., Brandwijk, K., Vinje, J., Koopmans, M., & Reintjes, R. 2000. An outbreak of Norwalk-like virus gastroenteritis in a nursing home in Rotterdam. *Eurosurveillance 5*(5):54-57.

[27] Thompson, M., & Hempshall, P. 1998. Dirt Alert. *Nursing Times 94*(28): July 15-21, 63-64.
Butler, P. & Batty, D. 2001. Filthiest NHS hospitals cleaned by private contractors. *Guardian Unlimited.* April 10.

[28] Dancer, S. J. 1999. "Mopping up hospital infection". *Journal of Hospital Infection 43:* 85-100. p. 86.

[29] The United Kingdom Parliament. 2002. *Supplementary memorandum by UNISON (PS 33A).* http://www.parliament.the-stationery-office.co.uk/pa/cm200102/cmselect/cmhealth/308/ p. 1

[30] Marshall, W. 1999. Financial cutbacks have lowered the standard of infection control. *World Socialist Website.* Sept 15. Available on the World Wide Web: http://www.wsws.org/articles/1999/sep1999/harv-s15_prn.shtml.

[31] Barrett, S. P., Mummery, R. V., & Chattopadhyay, B. 1998. Trying to control MRSA causes more problems than it solves. *Journal of Hospital Infection 39*: 85-93. p. 90

area for infection control and yet in many hospitals its management has been lost to outside organizations [resulting in] uncoordinated and inconsistent cleaning protocols".[32]

Similarly, Collins argues that prior to contracting-out of cleaning services, "if additional cleaning was required during an outbreak it was relatively easy to get it done".[33] However, with contracting-out, Collins argues that "frequency, materials and methods are defined in a contract and cannot readily be altered to respond to a change in infection hazard requirements, at least not until the task has been costed and allocated to a particular budget."[34] As a result of contracting-out, the prompt, rapid attention to cleaning infected areas during a gastrointestinal outbreak is impossible, seriously compromising the lives of our seniors as increasing numbers are affected by the outbreak. In addition, Collins found that "disputes between the authority and the contractors are rising".[35] Also, administrative problems are likely to occur if contractors are unaware of health and safety and infection control policies and the importance of cleaning standards.[36] Hence, hospitals are spending additional time and money resolving contract service and cost disagreements.

Contracting-out = ↑ staff turnover, ↓ service flexibility, and ↓ quality of service

In his hospital review, Scotland's Auditor General found that average staff turnover was found to be higher amongst external contractors than in-house (40% compared to 23% of staff in 1998/1999).[37] In addition, externally contracted cleaning staff were more likely to have traditional, narrowly defined and inflexible cleaning roles, as compared with in-house cleaners with expanded, more flexible job descriptions including other duties such as bed making, plant care, and portering. Furthermore, turnover among cleaning staff with traditionally defined cleaning duties was higher when compared with staff with non-traditional job descriptions.

The Auditor General also notes "our evidence suggests that many hospitals may have trouble achieving the cleaning frequencies or output standards that they have specified because of high levels of absence due to sickness and high turnover. Data collected at one hospital demonstrated that nearly one third of planned cleaning hours were lost due to vacancies, sickness absences and leave. Only 2% of this shortfall was made up by overtime."[38] Similarly, BBC News reports, "high staff turnover and absence can result in skill shortages, reduced quality of service or service disruption, under-cleaning, and

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[32] Corcoran, G. D., & Kirkwood, E.M. 1999 Revised guidelines for the control of methicillin-resistant *Staphylococcus aureus* infection in hospitals. Letter. *Journal of Hospital Infection*; *41*: 72-74. p. 73
[33] Collins, B. J. 1988. The hospital environment: How clean should a hospital be? *Journal of Hospital Infection 11(Supplement A)*: 53-56. p. 55.
[34] Ibid.
[35] Ibid.
[36] Ayliffe, G. A. J., Babb, J. R., Taylor, L. J. 1999. *Hospital-acquired infection: Principles and prevention.* (3rd ed). Oxford: Butterworth-Heinemann.
[37] Auditor General of Scotland. 2000. A clean bill of health? A review of domestic services in Scottish hospitals. Audit Scotland. April. www.audit-scotland.gov.uk
[38] Ibid. p. 2

increased costs. A recent study found that …hospital cleanliness was adversely affect by poor staff retention and problems recruiting staff."[39]

In Britain, strategies to improve hygiene standards have included bringing cleaning staff in-house, employing additional cleaning staff, and increasing frequency of cleaning.[40] Furthermore, in response to deficient cleaning standards in hospitals, Britain's National Health Service makes several recommendations that hospitals and long-term care facilities are required to comply with, including a definitive set of stringent cleaning and infection control standards as well as surveillance and audit guidelines.[41]

Good hospital cleaning reduces risk of hospital-acquired infections

Hospital cleaning services "play a key part in minimising the risk of hospital acquired infections, which have serious consequences for patients and lead to significant costs".[42] Numerous studies have shown that thorough environmental cleaning is essential to containing MRSA, gastrointestinal, and other types of infection outbreaks.[43] The only intervention used to combat a glycopeptide-resistant enterococci (GRE) infection outbreak at a UK hospital "was a very thorough and systematic cleaning of the wards, after which reduction in both the level of environmental contamination and the numbers of [infected patients] were noted".[44]

One of the current priorities set by Britain's National Health Service (NHS) is "strengthening services to prevent and control communicable diseases, especially hospital-acquired infection".[45] Reducing environmental contamination and limiting the spread of infection in hospitals is primarily achieved through good effective cleaning and hygiene.[46] Researchers in France have found that environmental objects have been a major risk for infection and "the meticulous cleaning of the ICU helped control an

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[39] Ibid. p. 18

[40] BBC News. 2002.*Talks offer to striking hospital staff.* July 30. http://news.bbc.co.uk/1/hi/Scotland/2160257.stm

[41] National Health Service. 2001. *The NHS plan – clean hospitals.* Crown Copyright http://www.cleanhospitals.com/downloads/clean_hospitals_report.pdf

[42] Auditor General of Scotland. 2000. A clean bill of health? A review of domestic services in Scottish hospitals. Audit Scotland. April. www.audit-scotland.gov.uk p. 1

[43] Caul, E. O. 1994. Small round structural viruses: Airborne transmission and hospital control. *The Lancet 343*:1240-2. May 21.

Griffith, C. J., Cooper, R. A., Gilmore, J., Davies, C., & Lewis, M. 2000. An evaluation of hospital cleaning regimes and standards. *Journal of Hospital Infection 45*:19-28.

Wilcox, M. H., & Dave, J. 2000. The cost of hospital-acquired infection and the value of infection control. *Journal of Hospital Infection 45*:81-84. p. 81.

Dancer, S. J. 1999. "Mopping up hospital infection". *Journal of Hospital Infection 43:* 85-100.

[44] Chadwick, C., & Oppenheim, B.A. 1996. Cleaning as a cost effective method of infection control. *The Lancet 347*:1776. June 22.

[45] Wilcox, M. H., & Dave, J. 2000. The cost of hospital-acquired infection and the value of infection control. *Journal of Hospital Infection 45*:81-84. p. 81.

[46] Case, M. 1998. Back to basics. *Nursing Times 94*(37):65

Noone, P., & Griffiths, R. J. 1971. The effect on sepsis rates of closing and cleaning hospital wards. *Journal of Clinical Pathology 24*:721-5.

outbreak of Acinetobacter baumanii".[47] O'Connel similarly found that "appropriate cleaning and disinfection programmes are essential to render the ICU relatively pathogen free".[48]

Researchers in Norway did a 3-year survey of hospital-acquired infections and antibiotic treatment of 4,500 residents in nursing and residential homes and found that infection is usually the most frequent reason for patients to be transferred from nursing homes to a hospital. Anderson and Rasch argue that there is a "substantial cost-benefit in effective preventative measures against hospital-acquired infections in long-term care".[49] Furthermore, Britain's General Auditor reported that about 30% of hospital acquired infections might be preventable.[50]

Conclusion

Failure to meet required cleaning standards can seriously increase risks for hospital-acquired infections and reduce patients' confidence in the ability of the hospital to provide safe and effective medical care. In B.C., there is considerable anecdotal evidence that over the past 10 years hospitals have been cutting back cleaning staff, not replacing staff when they are off on sick leave, and therefore compromising the health and well being of patients and residents. This requires further investigation. In addition, the plans to contract-out housekeeping could further compromise infection control standards and patient health. The concerns related to contracting-out highlighted in this review focus on the following:

- loss of control of specialized training required for the use of effective procedures, equipment and materials[51]
- loss of control of staffing levels
- higher staff turnover, increased sick time and absences from work[52]
- loss in service delivery flexibility and a corresponding lack of ability of cleaning staff to respond to emergencies such as infectious disease outbreaks.

In conclusion, the research suggests that the focus should be on increased staffing levels and cleaning standards – not on contracting-out.

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[47] Pina, P., Guezenec, P., Grosbuis, S., Guyot, L., Ghnassia, J. C., & Allouch, P. Y. 1998. An Acinetobacter baumanii outbreak at the Versailles Hospital Centre. *Pathol Biol* (Paris) *46*(6): 385-94. June.
[48] O'Connel, N. H. 2000. Intensive care unit design and environmental factors in the acquisition of infection. *Journal of Hospital Infection 45*(4):255-62.
[49] Anderson, B.M., & Rasch, M. 2000. Hospital-acquired infections in Norwegian long-term care institutions. *Journal of Hospital Infection 46*: 288-296. p. 288.
[50] Comptroller & Auditor General. 2000. The management and control of hospital acquired infection in acute NHS trusts in England. *National Audit Office.* London.
[51] Ayliffe, G. A. J., Babb, J. R., Taylor, L. J. 1999. *Hospital-acquired infection: Principles and prevention.* (3rd ed). Oxford: Butterworth-Heinemann.
[52] Auditor General of Scotland. 2000. A clean bill of health? A review of domestic services in Scottish hospitals. Audit Scotland. April. www.audit-scotland.gov.uk

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