resources given to patients' safety in general. Furthermore, to reduce the incidence of potassium related (and other medications) errors—many of which are preventable—effectively, hospitals must go beyond investigating individual incidents and focus more on identifying and implementing effective, systems based improvements that are grounded in evidence of reasonable quality.

Conclusions

This systematic review highlights the lack of strong evidence in support of specific best practice initiatives related to the safe handling of potassium containing products. The quality and quantity of evidence in support of best practices related to other patient safety issues is likely in a similar state. If the aim is to identify and implement the most effective medication safety practices, then systems oriented evaluation research accompanied by implementation of evidence based medication safety practices is essential. The need is especially urgent given our main finding that no valid studies evaluate the effectiveness of any of the practices currently recommended for the safe handling of products containing potassium.

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Additional educational resources

Making health care safer: a critical analysis of patient safety practices

(www.ahrq.gov/clinic/ptsafety/)—The report of an evidence based project, funded by the Agency for Healthcare Research and Quality, that collected and critically reviewed the existing evidence on practices relevant to improving the safety of patients, including medication safety (primarily pertaining to heparin and warfarin)

National Patient Safety Agency (www.npsa.nhs.uk)—This UK agency aims to foster a culture in which errors in the NHS healthcare system can be investigated and innovative solutions developed. In addition to providing resources, the agency collects reports of medical errors and “near misses”

Institute for Safe Medication Practices (United States: www.ismp.org; Canada: www.ismp-canada.org)—This non-profit agency's mission is to understand the causes of medication errors and provide time critical strategies for reducing errors to the healthcare community, policy makers, and the public. The institute runs a voluntary error reporting programme

Australian Council for Safety and Quality in Healthcare (http://www.safetyandquality.org/index.cfm)—Leads national efforts to improve the safety and quality of healthcare provision in Australia. Primary initiatives include medication safety, incident management, and reporting of sentinel events

- 12 Smith J. *Building a safer NHS for patients: improving medication safety*. Department of Health, United Kingdom, 22 January 2004. www.dh.gov.uk/assetRoot/04/07/15/07/04071507.pdf (accessed 5 Jan 2005).
- 13 Wisconsin Patient Safety Institute, Inc. *Maximizing patient safety in the medication use process: practice guidelines and best demonstrated practices*. 2002. www.wpsi.org/media/documents/pdf/Max_Pat_Safty_2002.pdf (accessed 5 Jan 2005).
- 14 Institute for Safe Medication Practices Canada. Concentrated potassium chloride: A recurring danger. *ISMP Canada Safety Bulletin* 2004;4. www.ismp-canada.org/download/ISMPCSB2004-03.pdf (accessed 15 Aug 2004).
- 15 Bates DW. Drugs and adverse drug reactions: how worried should we be? *JAMA* 1998;279:1216-7.
- 16 Bates DW, Teich JM, Lee J, Seger D, Kuperman GJ, Ma'Lu'f N, et al. The impact of computerized physician order entry on medication error prevention. *J Am Med Informatics Assoc* 1999;6:313-21.
- 17 Shojania K, Duncan B, McDonald K, Wachter RM, eds. *Making health care safer: a critical analysis of patient safety practices*. Rockville, MD: Agency for Healthcare Research and Quality, 2001. (Evidence Report/Technology Assessment No. 43; AHRQ publication 01-E058.)
- 18 Leappe LL, Berwick DM, Bates DW. What practices will most improve safety? Evidence-based medicine meets patient safety. *JAMA* 2002;288:501-7.
- 19 The Massachusetts Coalition for the Prevention of Medical Errors. *MHA best practice recommendations to reduce medication errors*. www.macoalition.org/documents/Best_Practice_Medication_Errors.pdf (accessed 15 Aug 2004).

- 1 Health Quality Council of Alberta. *Review of best practices for handling potassium chloride containing products in hospitals, and the preparation of batch amounts of dialysis solutions for continuous renal replacement therapy*. Calgary: HQCA, 2002. http://hqca.ca/pages/news_pages/HQCA_recommendations_040706.pdf (accessed 15 Jun 2005).
- 2 Newman TB. The power of stories over statistics. *BMJ* 2003;327:1424-7.
- 3 Kohn L, Corrigan J, Donaldson M, eds. *To err is human: building a safer health system*. Washington, DC: Committee on Quality of Health Care in America, Institute of Medicine, National Academy Press, 2000.
- 4 Miller LK, Nelson MS, Spurlock BW. *A compendium of suggested practices for prevention and reduction of medication errors*. California Institute for Health Systems Performance. November 2001. www.cihsp.org/cgi-bin/default.asp (accessed 15 Aug 2004).
- 5 Piromohamed M, James S, Meakin S, Green C, Scoot AK, Walley TJ, et al. Adverse drug reactions as cause of admission to hospital: prospective analysis of 18 820 patients. *BMJ* 2004;329:15-19.
- 6 National Patient Safety Agency. *Patient safety alert*. 23 July 2002, Ref: PSA 01. www.npsa.nhs.uk/site/media/documents/486_riskalertpsa01.pdf (accessed 15 Aug 2004).
- 7 Safe use of medicines. *Medication alert: potassium chloride concentrate injection can be fatal!* Alert 1, 5 April 2004. www.safeuseofmedicines.co.nz/wh-qsum-portal/main.asp?ArtID=113&CatType=Name=Publications&CatTypeID=13 (accessed 15 Aug 2004).
- 8 Cohen MR. ISMP medication error report analysis: still more errors with potassium chloride injection concentrate. *Hospital Pharm* 1997;32:998.
- 9 Safety and Quality Council of Australia. *Medication alert! Intravenous potassium chloride can be fatal if given inappropriately*. Alert 1, October 2003. www.safetyandquality.org/articles/ACTION/kcalertfinal1.pdf (accessed 15 Aug 2004).
- 10 Institute for Safe Medication Practices. *Medication safety alert! ISMP quarterly action agenda March-June 2004*. July 2004. www.ismp.org/MSAarticles/A3Q04Action.htm (accessed 15 Aug 2004).
- 11 Patient safety alert. “High-alert” medications and patient safety. *Int J Qual Health Care* 2001;13:339-40.

Endpiece

A scientist's fiancée wants to tidy his desk in 1861

How I shall have to struggle with myself and subdue my natural inclinations before I can become a really useful wife! Do not lose patience with me, Hermann, I am easily discouraged; but I must tell you that your writing table is frightfully untidy. If I were not far too well brought up in regard to learned confusion, I should take the liberty of sorting out all the written papers from the blank sheets, with energetic hand, and putting away all the letters in a drawer—NB unread—and then go over everything with a damp cloth, on Miss Nightingale's principle. But as it is I must leave things as they are and only thankful to have discovered one human failing in you.

Koenigsberger L. *Hermann von Helmholtz* [1905]. New York: Dover Publications, 1965:203

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