Institution: University of Glasgow

Unit of Assessment: Unit 3, Allied Health Professions, Dentistry, Nursing and Pharmacy

Title of case study: Transforming instrument decontamination in dental practice

1. Summary of the impact

Patients expect and deserve safe health care, but research by the University of Glasgow Dental School in 2000-2005 identified that routine instrument decontamination processes used in UK dental practice were inadequate, with potential for residual body fluid and tissue contamination, leaving patients at risk of infection. These studies led to major changes to decontamination guidance and its implementation, resulting in major improvements to decontamination facilities, procedures and quality assurance in UK dental practice. In Scotland, the government invested £19 million in funding to upgrade equipment and premises, develop updated guidance and to train 7,893 dental staff through NHS Education for Scotland (NES). By December 2012, it was mandatory for all Scottish dental practices to comply with the new standards ('Glennie compliance') to reduce the risk of cross-infection with blood- and tissue-borne diseases such as HIV, hepatitis B, hepatitis C and variant Creutzfeldt-Jakob disease (vCJD).

2. Underpinning research

Blood borne viruses have been a known risk in healthcare-acquired infection for many years, but emergence of the prion disease vCJD in the 1990s – and resistance of the causative agent to heat sterilisation – brought the risk of transmission in healthcare into the public consciousness. Given that four million dental patients receive treatment each year in Scotland, and 180 million instruments are re-processed, even a small risk of infection transmission per procedure could create a significant risk to public health. In response to this infection risk, a University of Glasgow team, led by Prof Andrew Smith, undertook a series of studies on dental instrument decontamination between 2000 and 2005. This research identified widespread insufficiency in infection control practices, using a novel combination of practice-based research and laboratory assays to define risks associated with specific items of dental equipment.

The assessment of dental practices by questionnaire-based surveys can be unreliable, which has been reported elsewhere previously. To address such limitations the Glasgow team developed a new survey approach in 2001, funded by the Scottish Government. In this approach, an infection control specialist and an experienced general dental practitioner visited dental practices and used standardised computer-readable data forms to collect a detailed assessment of practice's compliance with existing guidelines on decontamination.[1] The team surveyed 179 practices, chosen at random from the 837 practices in Scotland, in the first such study involving direct observation ever performed worldwide. The study identified major practice shortcomings in key stages of the decontamination cycle. These included sub-standard cleaning of instruments (41% of practices used only manual cleaning with tap water)[2] – a critical finding in light of the fact that prion protein can adhere to surfaces and is heat resistant; poor separation of clinical areas from decontamination areas (69% of practices did not clearly define dirty and clean areas); inadequate staff training (only 10% of practices had evidence of staff training in decontamination techniques); lack of access to policies and procedures; and inadequate commissioning, testing and maintenance of decontamination equipment.

In parallel, the risks posed by inadequate decontamination were highlighted by laboratory-based studies of residual contamination on commonly used dental instruments. In 2000 a study by the Glasgow team of 327 UK dental practices revealed that 88% of practitioners were routinely re-processing endodontic files – used to shape tooth root canals following removal of the dental pulp.[3] A follow-up study in 2004 showed that 75% of 250 re-processed endodontic files from 25 dental practices in Scotland retained visible debris, and 7% tested positive for residual blood.[4] Similar data were generated for Siqveland matrix bands – a thin metal strip fitted around a tooth, used routinely to place fillings.[5] For both instrument types, updated guidance was subsequently issued by the Scottish Government, stipulating that endodontic instruments and removable matrix bands should be viewed as single use items. More recently, collaborative work involving Prof Smith has identified that transient exposure of the gum tissue of healthy mice to an endodontic file contaminated with prion protein could transmit the disease.[6]

Key researchers (Glasgow): Prof Andrew Smith (Senior Lecturer in Microbiology, 1993-2010; Professor of Clinical Bacteriology, 2010-present) and Prof Jeremy Bagg (Professor of Clinical Microbiology, 1991-present). Key co-investigators: Mr David Hurrell (Health Protection Scotland), Ms Siobhan McHugh, University of Glasgow, Dr David Perrett (University of London) and Professor Philip Marsh (University of Leeds / Porton Down).

3. References to the research

1. Smith AJ, *et al*. A method for surveying instrument decontamination procedures in general dental practice. *Br. Dent. J.* **202**, E20-E23 (2007); doi: 10.1038/bdj.2007.125
2. Bagg J, *et al.* Pre-sterilisation cleaning of re-usable instruments in general dental practice. *Br. Dent. J*. **202**, E22 (2007); doi: 10.1038/bdj.2007.124
3. Bagg J, *et al.* Cross infection control measures and the treatment of patients at risk of Creutzfeldt Jakob Disease in UK general dental practice. *Br. Dent. J.* **191**, 87-90 (2000); doi: 10.1038/sj.bdj.4801104
4. Letters S *et al.* A study of visual and blood contamination on reprocessed endodontic files from general dental practice. *Br. Dent. J*. **199,** 522-525 (2005); doi: 10.1038/sj/bdj/4812811
5. Lowe AH, *et al*. A study of blood contamination of Sigveland matrix bands. *Br Dent J* (2002); 192(1): 43-45. doi: 10.1038/sj.bdj.4801287
6. Kirby E, *et al.* Bioassay Studies Support the Potential for Iatrogenic Transmission of Variant Creutzfeldt Jakob Disease through Dental Procedures. *PLoS ONE* **7**, e49850 (2012); doi: 10.1371/journal.pone.0049850

Grant funding

Decontamination review services: review of general dental practitioners in Scotland (Nov 2001 – Nov 2002) Scottish Executive Health Department to Smith A.J., Bagg J., Henry M. and Mathewson H. (£213,125)

4. Details of the impact

Professional guidance on infection control procedures, including instrument decontamination, has evolved over the years in response to emerging challenges. HIV prompted major changes that resulted in adoption of standard precautions, and the more recent emergence of the prion disease vCJD forced a re-assessment of instrument decontamination processes across health care.

University of Glasgow research provided evidence of sub-standard compliance with existing instrument decontamination guidance in a high proportion of general dental practices in Scotland, and identified instrument decontamination procedures that required updated guidance to ensure patient safety from prions and other infectious agents, particularly blood-borne viruses. Profs Andrew Smith and Jeremy Bagg provided these findings in a report to the Scottish Executive Health Department (SEHD) that was published by the Glennie Group in November 2004.[a] Immediately, instrument decontamination in the 837 general dental practices across Scotland became a priority issue for the Scottish Executive, and resulted in a large-scale coordinated response across Health Protection Scotland, NHS Education for Scotland (NES), Healthcare Facilities Scotland, National Procurement and NHS Boards.

The result was significant government funding to upgrade dental practice decontamination facilities and to provide additional training for dental personnel in Scotland. Full compliance with the 'Glennie requirements' (see below) has been mandatory in Scotland since December 2012, ensuring that general dental practices have implemented decontamination processes that are validated and significantly more robust, consistent and evidence-driven than previously. This initiative, driven by the research undertaken at Glasgow Dental School, has led to a reduced risk of cross-infection for the four million patients receiving dental treatment every year in Scotland and a greater number elsewhere in the UK.

The key requirements for Glennie compliance, identified by the Glasgow research, included the need for a local decontamination unit (LDU) that was physically separated from the clinical treatment area; enhanced instrument cleaning procedures with a strong recommendation for installation of automated washer disinfectors; all decontamination equipment to be installed, validated and maintained by an accredited test engineer, with the recommended routines of daily

and weekly testing undertaken by fully trained staff; and for the implementation of a documented decontamination process, a quality management system and documented staff training. In 2008, the Scottish Health Planning Note (SHPN) 13, Part 2 was published, setting out the technical requirements for establishment of LDUs with which dental practices must legally comply.

Implementing decontamination training

Following their 2004 report, the Glasgow team remained involved in the development of guidance to help general dental practitioners comply with the updated decontamination requirements. Part of this role was delivered through involvement with the Scottish Dental Clinical Effectiveness Programme (SDCEP), a government-backed initiative (managed through NES), to develop user-friendly, evidence-based guidance for the dental profession in Scotland. As part of SDCEP, Bagg participated in the group of expert practitioners that developed the 'Decontamination into Practice' guidance documents[b] ('Cleaning of dental instruments', 2007; 'Sterilization of dental instruments', 2011). A new section of the SDCEP 'Practice Support Manual entitled 'Health and Safety – Infection Control) was launched in December 2012), which provides detailed guidance on the management procedures necessary for effective infection control in dental practice.[c]

The SDCEP documents now form core elements of an on-going training and support service delivered to Scottish dental practice staff by a NES decontamination training team, established by the Chief Dental Officer and the NES Dean for Postgraduate Dental Education in collaboration with Bagg in 2005. Building on the effective visitation model used in the Glasgow research, the team is led by a highly experienced dental practitioner with specific infection control skills and comprises an infection-control nurse and a group of highly trained specialist dental nurses. The teams visit practices to evaluate their existing decontamination and infection control processes, working in partnership with the practice staff, and later revisit the practice to assess the implementation of any changes. Since 2008, this in-practice training and support has been delivered to 7,893 dental care professionals (including 3,811 dentists)[d], at a total cost to NES of approximately £2.2 million.[e]

Capital investment in improved decontamination infrastructure in Scotland

Widespread Glennie compliance has required a significant financial commitment from both dental practices and the Scottish Executive via the territorial NHS boards. In total, the boards have invested £16.8 million in capital funding towards LDUs and practice improvements (including physical alterations) targeted to decontamination between 1st January 2008 - 31st July 2013.[f] The Scottish Executive provisions to support this investment included:

- *February 2008* – The Scottish Executive and NHS National Procurements began a national contract (MEK005, 2008 to 2009 and NP143, 2010 to 2013) to provide cost-effective purchase, installation and maintenance of validated and compliant washer-disinfectors (WDs), which were recommended within SHPN 13 Part 2 as the most effective means of instrument cleaning.[g,k]
- *March 2008* – Funding was subsequently made available by the Scottish Executive as part of an on-going Scottish Executive Primary and Community Care Premises Modernisation Programme with a total of £75 million allocated between 2008 and 2011 to dental services, training and decontamination.[h]
- *September 2008* – £5 million provided towards further improvements specifically aimed at decontamination between 2008 and 2009.[i]
- In October 2012, an additional £2 million in funding was made available to support purchase of WDs.[j]

In 2009, a survey indicated that whilst many dental practices had been able to establish an LDU, 17% of them would struggle to be Glennie-compliant without moving premises or building extensions. The original deadline of December 2009 was subsequently changed to December 2012 for practices that could develop a feasible action plan.[k] The Scottish Chief Dental Officer, who described administering the adoption of dental decontamination reforms as having been one of the more challenging aspects of her role, commented in the Scottish Dental Magazine that, "*it would be nice to think that decontamination has helped a few practices and given them the opportunity to move into better accommodation".* [l]

Broader influence on decontamination UK-wide

The reach of the University of Glasgow research extends beyond Scotland, where it has directly influenced the guidance documents of other UK health administrations. In October 2008, the Chief Dental Officer (England) issued the 'Decontamination Health Technical Memorandum 01-05: Decontamination in primary care dental practices' (HTM 01-05), which included information already released in Scotland through the SDCEP and SHPN 13 Part 2, and acknowledged the 2004 Scottish dental survey report as highlighting the issue of decontamination standards ('The need for guidance', p.8, section 1.7).[m] These guidelines were released along with a local self-assessment audit tool, the data from which identified decontamination issues comparable to those reported previously by the Glasgow group in Scotland. HTM 01-05 was subsequently adopted in Northern Ireland in November 2009 and Wales in March 2011.

Unlike Scotland, there was no central funding in England or Wales to make provisions to meet the HTM 01-05 requirements of decontamination, instead opting for a more gradual path towards full compliance. Funding was provided by Primary Care Trusts, for example, in NHS East Sussex Downs & Weald and NHS Hastings & Rother grants of £874,000 and £574,000, respectively, were awarded between 2008-2010 towards the purchase of WDs and structural changes to practice buildings.[n] In NHS Shropshire grants totalling £100,000 were issued to 13 practices in 2010-2011 for the purchase of decontamination equipment.[o] By April 2010, all general dental practices in England were expected to have become compliant with essential requirements (have a validated decontamination process) and to have registered with the Care and Quality Commission, who are responsible for ensuring compliance with HTM 01-05. No timescale was set for achieving best practice (including a separate room for LDU and WDs).

5. Sources to corroborate the impact

a. NHS Scotland: Survey of Decontamination in General Dental Practice (2004)
b. 'Decontamination into Practice' dental clinical guidance on cleaning and sterilization, Scottish Dental Clinical Effectiveness Programme (2011)
c. Practice Support Manual: 'Health and Safety – Infection Control', Scottish Dental Clinical Effectiveness Programme (Dec 2012)
d. Training figures were provided by the Assistant Director of Postgraduate Education (Decontamination), NHS Education for Scotland; available on request.
e. Funding data provided by Programme Development Manager, SDCEP; available on request.
f. FOI Act survey of all 14 Scottish NHS boards requesting data on spending towards LDUs and practice improvements; data available on request.
g. SEHD Letter from CDO, Decontamination of instruments in dental primary care – national contract for sterilisers (Feb 2008)
h. Letter from Dr J. Pryce, Deputy Directory – Primary Care Division, Scottish Executive: Primary and community care premises modernisation programme 2008-9 & 2009-10 – invitation to submit proposals; available on request. (Summarised on Scottish Government website)
i. SEHD Letter from CDO, Decontamination funding – practice improvements: general dental services (Sept 2008)
j. SEHD Letter from CDO, Washer-Disinfector (WD) [grants] (Oct 2012)
k. SEHD Letter from CDO, Decontamination of dental instruments in primary care – timescales for compliance (Nov 2009)
l. Scottish Chief Dental Officer quote from Scottish Dental Magazine.
m. Department of Health, Health technical memorandum 01-05: Decontamination in Primary care dental practices (Oct 2008, latest edition March 2013); Glasgow report referenced on p.85.
n. FOI Act request for funding info NHS Hastings Sussex (June 2010); available on request.
o. NHS Shropshire County Primary Care Trust, annual report of infection prevention and control (April 2010 to March 2011), p.14; available on request.