Design Bugs Out – Product Evaluation Report

The Healthcare Associated Infection Technology Innovation Programme



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The Healthcare Associated Infection Technology Innovation Programme

The basic ways of preventing and reducing healthcare associated infections (HCAIs) are largely unchanging. The principal strategies for combating HCAIs are hand hygiene/aseptic techniques, prudent antibiotic prescribing and good clinical practice. However, new technologies and equipment can support these strategies by addressing issues differently, more swiftly or more reliably.

The Department of Health has provided funding for an HCAI Technology Innovation Programme.[1] The Programme aims to:

- speed up the development and adoption of technologies to further help combat HCAIs; and
- identify which new technologies provide the best value and will have the most impact.

Design Bugs Out

In August 2008, as part of the HCAI Technology Innovation Programme, the Department of Health, the NHS Purchasing and Supply Agency[2] and the Design Council launched the Design Bugs Out (DBO) project. Its aim was to bring designers and manufacturers together with clinical specialists, patients and frontline staff to help combat infections by making hospital furniture and equipment easier and quicker to clean.

Based on initial research with users, the Design Council undertook a wide-ranging review of the clinical environment to identify areas that would benefit most from design input. This work identified 51 design opportunities which were considered by a project Expert Reference Group (ERG) and Advisory Board. These were shortlisted to ten opportunities in two streams: five 'quick wins' that were developed by the Helen Hamlyn Centre (Royal College of Art) and five that were advertised via a national design competition. The competition explicitly required bidding manufacturers to partner with a design firm and, through the competition, four teams of designers and manufacturers were successful. These winning teams

1 For further information on the Programme, go to www.hcai.dh.gov.uk
2 The NHS Purchasing and Supply Agency was closed on 31 March 2010

accessed a grant of £25,000 and worked with the Design Council, the ERG and the Advisory Board to develop their product proposals.

By September 2009 the project had led to the development of 11 pieces of furniture and equipment, specifically designed to eliminate dirt traps, make cleaning quicker and easier and, ultimately, reduce the incidence of HCAIs.

Although 11 products were initially developed, this report focuses on the four products – the commode, patient chair, bedside cabinet and overbed table – which went through commercialisation and progressed to the evaluation phase in eight 'showcase' hospitals (Calderdale and Huddersfield NHS Foundation Trust, Central Manchester University Hospitals NHS Foundation Trust, County Durham and Darlington NHS Foundation Trust, Imperial College Healthcare NHS Trust, Mid Essex Hospital Services NHS Trust, Southampton University Hospitals NHS Trust, Lewisham Healthcare NHS Trust and The Royal Wolverhampton Hospitals NHS Trust). These four products were chosen for this evaluation as they received very positive feedback during the consultation phases and were able to be manufactured and placed into the showcase hospitals, enabling multi-site evaluations.

Acknowledgements

We would like to acknowledge the support of each showcase hospital that has assisted in the evaluation of the DBO products, as well as the teams involved at Hospital Metalcraft Ltd (Bristol Maid™), Kirton Healthcare Group Ltd and Knightsbridge Furniture Ltd for their ongoing assistance throughout the project.

We would like to further acknowledge the support of the NHS Technology Adoption Centre, the Hospital Infection Research Laboratory at Queen Elizabeth Hospital, Birmingham, and David Hitchcock Ltd in the compilation of this report.

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Executive summary

Design Bugs Out

Recognising that the design of hospital furniture had not been challenged in many years, the Department of Health's HCAI Technology Innovation Programme, the NHS Purchasing and Supply Agency[3] and the Design Council collaborated in the DBO project with UK designers, the manufacturing community and NHS clinicians to identify ways in which the design of everyday products could assist in reducing HCAIs by making products easier to clean, which in turn should lead to more frequent and more thorough cleaning.

This collaboration has resulted in the development of a range of products that challenge the historic features of hospital furniture and show how its design can enhance effective cleaning and help to tackle HCAIs.

Four newly designed items of furniture have been evaluated – a commode, a bedside cabinet, a patient chair and an overbed table.

Evaluation methods

Three types of evaluation have been undertaken.

- Analysis of acceptability in the clinically operational environment was carried out in eight NHS showcase hospitals. Questionnaires were used to obtain the views of staff working with the products, patients who used the products, and visitors. The NHS Technology Adoption Centre assisted the showcase hospitals with the capture and subsequent analysis of this data.
- A human factors expert visited each showcase hospital and viewed first hand how the products were being used. He conducted a range of structured interviews with staff and patients as well as observing ward behaviour.
- Finally, as the key driver behind the DBO concept was cleanability and reduction in HCAIs, the Hospital Infection Research Laboratory at Queen Elizabeth Hospital in Birmingham conducted independent cleanability assessments of each product and of comparable older products in a controlled environment using both ATP[4] and culture methods.

3 The NHS Purchasing and Supply Agency was closed on 31 March 2010

4 Adenosine triphosphate – an indicator of biological contamination

Implementation

It is important to remember that this has been a journey for designers, manufacturers and showcase hospitals alike.

There were, of course, a variety of implementation issues that arose with each of the four DBO products, but these were quickly identified, risk assessed and resolved by the manufacturers at no further expense to the showcase hospitals or the Department of Health. Each manufacturer has been fully engaged and extremely helpful in all aspects of this comprehensive evaluation.

As part of the initial implementation of the products within the clinical operational environment, each manufacturer delivered training sessions to each showcase hospital and these were delivered in accordance with trust requirements. Some of the analysis from the evaluations identified that, although the training was delivered in all trusts, the subsequent training was not disseminated across all staff. This related to both usability and cleaning of each of the products and future implementation of new products within the ward environment should consider this as part of its planning.

Product evaluation summaries

Commode

The commode was designed by PearsonLloyd Design Ltd and manufactured by Kirton Healthcare Group Ltd. It has far fewer detachable elements than existing commodes, and is intended to be much easier to clean.

The new commode was well received by staff. It was seen as easier to clean and able to be cleaned more thoroughly than existing commodes. It was also seen as easy to operate, stable and safe. It was considered easy to transfer patients on and off it. The pulp pan was also well received, as was the overall appearance of the commode. Overall, 78% of staff thought that it was an improvement on the old commode.

Patients were almost unanimous in praising the cleanliness of the commode, and also found it robust, functional and easy to get onto and off. Some 90% of them liked it, as did 84% of visitors.

One issue for some hospitals was that the commode did not fit well with their toilets, and this is something that trusts considering adopting the commode would need to bear in mind.

The work carried out by the human factors expert confirmed that the commode performed well across all the criteria developed by stakeholders; 92% of staff and 87% of patients and visitors considered it an improvement on the old commode.

One issue that arose was that commodes were not cleaned consistently. This did not arise from the design of the commode – indeed, it was seen as being easier to clean than the old commode – but rather is a matter of staff training. As such, it is something that all hospitals may wish to check.

Another issue was storage, a point that also arose from the staff survey, with a significant minority of staff having concerns about this. Observation of a new stacking storage system suggests that this may well help to alleviate these concerns.

There were few other issues arising during the introduction of the commode. A design flaw in the pulp pan was quickly corrected and, as noted above, the new design was very favourably received. One point that trusts considering introducing the new commode will need to bear in mind, however, is that the pan does not fit some toilet units, so other pulp pans may be needed if stool samples are collected from patients by giving them a pulp pan to take into the bathroom to use with the toilet.

The laboratory-based cleaning assessments confirmed that the new commode was easier to clean than the old one.

To sum up, the evaluation strongly suggests that the new commode is a significant improvement on existing designs, which is well received by staff, patients and visitors alike.

Bedside cabinet

The bedside cabinet was designed by Kinneir Dufort and manufactured by Hospital Metalcraft Ltd (Bristol Maid™). It is designed to enhance effective cleaning as well as provide a better patient experience through improved security and ease of access using a radio-frequency identification key locking system.

Staff did consider that the new cabinet would be easier to clean, but opinion was more divided on whether this would actually lead to cabinets being cleaner. They found it strong and sturdy and easy to move and use, but a fifth of them did not agree that the locks worked consistently. Fewer than half the staff thought that the amount of storage space available was adequate, while a significant minority thought that the cabinet was too big. Overall, however, nearly 70% of staff thought that the new cabinet was better than the old one.

Patients thought that the cabinet was clean, strong and sturdy, and 60% thought that it was easy to use. Over half thought that it provided enough storage space, but a quarter did not. Over half thought that it was easy to access, but a fifth did not. Overall, 68% of patients liked the new cabinet.

Visitors' views were similar to those of patients on those issues they were asked about (they were not asked about the amount of storage space) but rather more – around three-quarters – liked it.

The work carried out by the human factors expert confirmed these findings. The cabinet generally performed well across the criteria selected by stakeholders, with the amount of storage space emerging as the most significant issue, particularly where patients had large amounts of medication. Bristol Maid™ state, however, that the new cabinet does in fact provide similar if not more space compared with similar cabinets on the market.

The absence of any hanging space led to items such as towels, coats and jackets being hung on the bedside chair. However, it should be noted that the option to provide a hanging space/hook was considered and discounted by the ERG during the design consultations. It was not deemed good practice for the future to have towels and clothes being hung on the side of the cabinet.

One person in five was worried about the stability of the cabinet – this appeared to be because it was light and made of plastic rather than wood.

Some 68% of staff and 66% of patients and visitors considered that the new cabinet was an improvement on the old one, but 24% of staff and 21% of patients rated it poorer.

This work also tended to endorse the finding noted earlier that, just because the cabinet is easy to clean, does not necessarily mean that it will be cleaned. Some 57% of staff and 32% of patients and visitors saw cabinets that could do with cleaning.

On the other hand, contrary to the views of some staff mentioned above, the locks appeared to work reliably. (There had been some problems in the early phase of the project, but these had been resolved.) The main issue here is the allocation, storage and control of cards so as to maintain security while not restricting patients' access to their personal items. Also, confused patients are likely to have difficulty using key cards, or may forget or lose them.

There were some signs of wear and tear on the cabinets, but equivalent comparisons were not made with similar wooden bedside cabinets.

One issue that arose during the observation period was the adequacy of the training provided on how to clean the cabinet and, indeed, more generally on awareness of infection control measures. As part of the preparations for the evaluations, training and support (including hard and electronic copies of a comprehensive manual) were made available to all showcase hospitals to ensure that instructions could be disseminated quickly and easily, but local inconsistencies may have contributed to issues in cleaning the cabinets. Clearly, this is not an issue relating to the design of the cabinet – indeed, staff did not see any great difference between the old and new cabinets in terms of how and how often they should be cleaned – but is one that hospitals generally may wish to check up on.

No further significant issues arose during implementation.

The laboratory-based cleaning assessments showed that the new cabinet was easier or as easy to clean as the old one.

To sum up, overall the new cabinet appears to be an improvement on the old one, although a significant minority of people clearly do not like it. There is a perception that the bedside cabinet may have less storage space than the old one, but the manufacturers state that this is not the case. Individual hospitals will be able to assess how they would make best use of the storage space available depending on the patient group for which the product is being used.

Patient chair

The patient chair was designed by PearsonLloyd Design Ltd and manufactured by Kirton Healthcare Group Ltd. It has a plastic shell with removable cushions (which have advanced pressure-relieving characteristics) to facilitate regular cleaning.

Staff found the new chair easier to clean and easier to clean more thoroughly. This included the cushions. Initially, there were problems with staining of the cushions, but a replacement cover was developed which was well received. Staff also found the chair easy to move and the cushions easy to replace. Adjusting the height of the chair was more of an issue, although 58% of staff did find it easy.

Staff generally found the chair to be sturdy, safe and stable, although a significant minority had concerns about patient safety. A similar minority also thought that the chair was too big, but most staff thought that the size was fine.

Overall, 68% of staff thought that the new chair was better than the old one.

Patients were almost unanimous in considering the chair to be clean and found the chair easy to use and adjustable enough. They found it comfortable, supportive, stable, safe and the right size. Some 91% of them liked it.

Visitors' views were similar to those of patients, with 88% liking it.

The work carried out by the human factors expert generally confirmed these positive assessments. The new chair was an improvement on the old one, which did not meet a significant number of the key criteria, but the armrests were not considered sufficiently comfortable (although they were better than the old chair).

Despite the very positive assessments by staff, patients and visitors referred to earlier, the work did reveal a number of issues, notably that the chair provided less support for smaller patients and that it could wobble and rock (although the vast majority of patients and visitors did consider the chair to be stable). The bucket shape and high armrests also made it difficult for some patients to get out of. Where space was limited, the chair could appear to be 'squashed in'. The manufacturer responded to this by agreeing that some design elements of the chair, such as the enclosed arms and the solid appearance of the shell, could give the impression that the chair is wider than its true dimensions. During development, consideration was given to the design to accommodate the 30-stone weight limit, ensuring that safety and comfort were included in the end product.

Some cushions were stained, and more bases were scuffed than not. The base appeared to be less easy to clean than the shell and cushions.

Inconsistent cleaning practices were observed. This issue does not arise from the design of the chair, but rather suggests a need for improved staff training at a local level and/or cleaning protocols and, as such, is something that all hospitals may wish to check.

A number of issues arose during implementation relating to the cushions, the stability of the chairs and the height adjustment lever, all of which were addressed through redesign, although there remains a need to ensure that staff and patients are aware that the height adjustment lever should be operated by hand and not by foot.

It also seems that, however stable the chair may actually be, the degree of movement does cause concern to some patients when they are pushing themselves forward in order to stand up.

The laboratory-based cleaning assessment showed that the new chair was easier or as easy to clean as the old one. There are some concerns about liquids from the cleaning procedure (and hence also possibly body fluids) getting into the cushion if the flap covering the zip is not positioned correctly. Jet washing should not be used on the cushions as it causes damage.

In summary, the new chair appears to be a significant improvement on the old one, although there may be some patients for whom the stability of four legs provided by the old chair is sufficiently important to outweigh the significant advantages of the new one. Some smaller patients may also prefer a smaller chair. Further adjustments to the design in the light of experience in use could enhance the advantages that the new chair provides.

Overbed table

The overbed table was designed by Geoff Hollington and manufactured by Knightsbridge Furniture Ltd. It is moulded from SMC[5] to facilitate easy cleaning and it is height adjustable for overbed and over-chair use.

Staff agreed that the new table was easier to clean, could be cleaned more thoroughly and was easy to move. They thought it was safe, stable and an appropriate size (even if, as some thought, it was bigger than the old one). Adjusting the height, however, was more of an issue with only just over half agreeing that this was easy and 17% disagreeing. Nonetheless, 72% thought it was better than the old table.

Patients' and visitors' views were similar to those of staff but, despite the issues around height adjustment, 91% of patients and 87% of visitors liked the new table.

The work carried out by the human factors expert confirmed these views. A particularly useful feature was the design of the table feet which enabled it to be easily moved into position around a seated patient's legs. Adjusting the height up was easy, while adjusting it down was a problem. Additionally, the lower position of the table surface was higher than quoted by the manufacturers and would be on the high side for smaller, seated users.

It was also observed that almost all tables had rubbish bags taped or bulldog clipped onto them. Tape leaves a sticky residue and clips can mark the table, so this is an issue that needs to be addressed. The manufacturer is looking to develop a clip-on solution following this feedback.

Tables showed signs of staining and scuffing; however, the manufacturer is arranging for a protective stain-resistant coating to be incorporated into the table-top material and this is still under development.

A further issue that arose during implementation related to the collar connecting to the upright which led to some tables failing to lock into the desired height

5 Sheet moulding compound/composite

or becoming stuck at a given height. A retrofit has been arranged but not yet evaluated.

The laboratory-based cleaning assessment showed little difference between the old and the new tables, although the new one may be marginally easier to clean. Jet washing should not be used as it damages the seal between the upper and lower surfaces of the tray.

In summary, the new table has some significant advantages compared with the old one, but improvements to the height adjustment mechanism and assurance that the issue of staining has been resolved would further enhance the product.

Introduction

This report sets out the findings from an evaluation in NHS showcase hospitals of the furniture developed through the DBO project in conjunction with the Design Council.

The objective of this document is to help directors of infection prevention and control and other staff to decide whether they should consider furniture developed through the DBO project as part of their trust's strategy to reduce HCAIs.

Patients rightly expect hospitals to be clean and to deliver safe care. The *Code of Practice on the prevention and control of infections*,[6] under the Health and Social Care Act 2008, applies to registered providers of all healthcare and adult social care in England. The Code of Practice (Part 2) sets out the ten criteria against which the Care Quality Commission will judge a registered provider on how it complies with the cleanliness and infection control requirement, which is set out in Regulations, and which includes the maintenance of appropriate standards of cleanliness and hygiene.[7] Compliance criterion 2 of the Code states that the registered provider needs to demonstrate that they provide and maintain a clean and appropriate environment in managed premises that facilitates the prevention and control of infections. Guidance under Part 3 of the document sets out the policies and procedures which registered providers would normally be expected to have in place. This includes that all parts of the premises from which the provider provides care are suitable for the purpose, kept clean and maintained in good physical repair and condition.

Historically, items of hospital furniture have primarily been designed for functionality and little attention has been paid to the cleanability of the furniture. The DBO project was initiated through the Department of Health's HCAI Technology Innovation Programme in August 2008 to facilitate the design and development of furniture and equipment that is easy to clean and easy to use within NHS settings.

6 www.dh.gov.uk/prod_consum_dh/groups/dh_digitalassets/documents/digitalasset/dh_123923.pdf

7 The Health and Social Care Act 2008 (Regulated Activities) Regulations 2010 (SI 2010/781), available at: www.legislation.gov.uk/uksi/2010/781/pdfs/uksi_20100781_en.pdf

The brief

HCAIs can affect both patients and healthcare workers. HCAIs may be resistant to antibiotics, making them difficult to treat, can complicate illnesses, cause distress and, in some cases, may even lead to death. They are also a huge financial burden on the NHS.

HCAIs, including MRSA (meticillin-resistant *Staphylococcus aureus*) and *Clostridium difficile* can commonly be spread by the hands of healthcare workers, hospital visitors and patients, or contaminated medical devices. The risk of infection can also be increased where there are variations in the way in which trusts apply infection control processes. A range of measures is needed to tackle HCAIs effectively, although not all can always be prevented.

The DBO project complements the Department of Health's wider approach to addressing the HCAI challenge. The aim was not only to develop well-designed and highly functional equipment and furniture, it was also to improve patient care and enhance quality outcomes.

The aim of the project was to help healthcare staff to manage the hospital environment and improve infection prevention and control. Designs and materials needed to show that they could contribute towards reducing and preventing infection and making cleaning easier, taking into account the behaviour of hospital staff, patients and visitors. All this combined will help to tackle HCAIs, as well as improving patients' experience of care and public confidence in the NHS.

The original brief made it clear that the products needed to work at ward level, as well as demonstrating value for money. It was important to ensure that these new designs were comparable in cost to similar equipment or furniture currently in use across the health system.

The challenge to design and prototype new furniture, equipment or services to meet the specific challenges was initially outlined in one of the five specific briefs below.

1. Hand hygiene

Direct physical contact between hospital staff and patients is a necessary part of hospital life, but it is also one of the most common ways in which HCAIs are transferred. The risk of transferring HCAIs is considerably reduced when hospital staff clean their hands using soap and water and/or hand gel before they come into contact with a patient. Indirect transfer of HCAIs can occur when clinical staff, but also patients, visitors and cleaning staff, touch furniture or pieces of hospital equipment.

Design a new product and/or service or system that improves hand hygiene of hospital staff, patients and visitors. Emphasis should be on how staff can increase appropriate hand hygiene compliance at the point of care, in particular prior to invasive procedures.

2. Bedside environment

The immediate area around a patient's bed has been identified as a key area in fighting infections. Existing bedside furniture and fixtures are often hard to clean due to their shape, materials and surface finish.

2a. Bedside environment (furniture)

Design a specific item of bedside furniture (such as a chair, table, cabinet, personal storage system or isolation furniture). Proposals should consider how new items of furniture will fit with existing and legacy ward furniture and equipment.

2b. Bedside environment (total system)

Design a complete bedside system that is easy to clean and maintain, cost effective and sustainable. These projects should equally provide a comfortable, functional and personal space for the wellbeing of the patient.

3. Commode

Patient care in a hospital includes the use of a commode for defecation and urination. Typically, a commode is shaped like a chair and is wheeled to a patient's bedside, where bedside curtains are then drawn to maintain the patient's privacy and dignity.

One commode may be shared between several patients and therefore needs to be cleaned correctly between each use. Commodes are in constant use, so the time available for cleaning can be limited – as can the space available for cleaning complex and cumbersome commodes.

Design a commode which is easy to clean and enhances usability. Patient experience, comfort and dignity should also be considered a priority.

4. Patient transport

Patients are moved around hospitals on a variety of devices including stretchers, wheelchairs and porters' trolleys. This equipment can sometimes be used to transport patients into hospitals from outside, meaning there is the risk of bringing bacteria from outside into the heart of the hospital.

Design a means of patient transport (such as a trolley/stretcher or porter's chair) that is easy to clean and will reduce the potential for the spread of HCAIs. Comfort and functionality – for both patient and member(s) of staff – should remain key design principles.

5. Open brief

Design a piece of equipment, furniture or system which directly or indirectly reduces the spread of common HCAIs in the healthcare environment.

Outcome

Designers and manufacturers worked in conjunction with NHS users to identify the best ideas, and five new products were developed into prototypes for evaluation in eight showcase hospitals which were already working with the Department of Health in the context of the HCAI Technology Innovation Programme. The products comprised a commode, bedside cabinet, overbed table, patient chair and porter's chair, encompassing three of the five briefs.

Following advice from the ERG, nationwide road shows and user feedback sessions with the prototypes, product designs were finalised and limited manufacture commenced in order to conduct evaluations. Sixty commodes, 60 patient chairs, 60 bedside cabinets and 49 overbed tables were placed into the eight showcase hospitals for evaluation in the clinical operational environment.

The porter's chair was not able to be evaluated along with the other products in the timeframe available due to ongoing development.

The evaluation

How the evaluation was done

The four newly designed items of furniture were introduced for three to 12 months in selected NHS hospitals with the aim of evaluating their in-use features and adoption characteristics. The objectives were:

- to assess the acceptability of the products for hospital staff, patients and visitors;
- to obtain further insights into the performance of the products in the hospital setting through observation of practice and structured interviews; and
- to undertake a laboratory-based cleaning assessment.

To ensure that a wide range of clinical settings were accommodated within the operational environment, each showcase hospital was asked to identify a care of the elderly ward and one other ward of their own choice. This ensured that a wide range of patient demographic participated within the evaluation.

Showcase hospital user acceptability

As part of the normal evaluation processes conducted within the HCAI Technology Innovation Programme, questionnaires were developed. These questionnaires sought the views of the people who were using the products in the operational environment, including hospital staff, patients and visitors, to ensure as wide a range of feedback as possible.

The objective of the questionnaires was to understand the acceptability of the products in the clinical environment and, where possible, to compare them with other similar products in use at the hospital.

Surveys were carried out using ViewPoint tablet PCs, allowing staff, visitors and patients to give their opinion on the ward close to the furniture. The data could be collected automatically, increasing impact, accessibility and simplicity, which in turn would generate higher patient feedback response rates.

Observation of practice and structured interviews

To ensure that the DBO products were fully reviewed in the operational setting, observation of practice and structured interviews with staff using the products were undertaken by David Hitchcock Ltd, a registered consultancy of the Institute of Ergonomics and Human Factors, specialising in identifying, developing and evaluating designs and solutions which are fit for purpose – accessible, cost effective, desirable, safe and usable. This evaluation combined three elements, which were:

- observation of the furniture in use through visiting the wards on which the products were used;
- staff and visitor feedback regarding the use and suitability of the products through on-site discussion and a questionnaire-based survey; and
- expert ergonomics appraisal of the products considering the issues raised through the observation and feedback elements.

The showcase hospital lead nurses, their colleagues, the Programme team and those involved at senior level were invited to suggest and prioritise usability criteria for each of the products. Along with the human factors expert, ten staff provided criteria for some or all of the four items of furniture. The analysis for each product is led by the criteria and these were used to steer the factors considered in the observations and discussions, the content of the questionnaire survey and the subsequent appraisals.

Due to a variety of implementation difficulties, not all the hospitals had all four items of furniture in place during the period of evaluation. This resulted in smaller survey samples for the patient chair and the overbed table. This evaluation also occurred towards the end of the trials programme, by which time ward staff had encountered implementation difficulties and the removal and reintroduction of the products following improvement measures. They had also participated in other data collection exercises for earlier evaluations; consequently, many admitted to being somewhat ‘jaded’ about providing ‘yet more feedback’.

Laboratory-based cleanability assessments

The Hospital Infection Research Laboratory, Queen Elizabeth Hospital, Birmingham (part of the University Hospitals Birmingham NHS Foundation Trust) was commissioned by the Department of Health and the Design Council to assess the removal of soil and micro-organisms from artificially contaminated items of newly designed and existing patient furniture (i.e. commode, bedside cabinet, patient chair and overbed table). Comparisons were made between the different types of furniture and the three cleaning methods used. Furniture currently used in the Trust was used for comparison.

Sample sites for the commode were:

- upper arms
- lower arms
- seat
- lid.



Sample sites for the bedside cabinet were:

- top surface
- lower surface
- upper handle
- lower handle.



Sample sites for the patient chair were:

- head area
- seat
- lower arms
- upper arms.



Sample sites for the overbed table were:

- top left
- top right
- under left
- under right.



Test method

Test organism *Bacillus subtilis* National Collection of Type Cultures 10073 spore suspension

This test organism was chosen as it would not be killed by the recommended cleaning methods so physical removal could be assessed.

Test soil Edinburgh soil (Health Technical Memorandum 2030: 1997)

This consists of sheep blood (10ml), egg yolk (100ml) and hog mucin (2g) and simulates the body fluids likely to be found on the test items. It is widely used for assessing the cleaning efficacy of thermal washer disinfectors.

10ml of spore suspension was added to 100ml of the test soil. The mean number of *B. subtilis* spores in the soil before application was 9×10^6. This gives a $\log_{10}$ of 6.95.

The test soil was painted onto the designated sites and allowed to dry for a minimum of 30 minutes before sampling for pre-counts (if applicable – to establish the base count of the sample) followed by cleaning and sampling for post-counts (to establish a count reduction factor).





Cleaning methods

To replicate cleaning that would take place in a clinical setting, domestic staff carried out the following procedures in accordance with the laboratory's local trust guidelines:

- Cleaning with a neutral detergent solution – 1% neutral detergent and single-use cloths. This was designated as cleaning method 1 (CM1).
- Cleaning with a proprietary detergent wipe. This was designated as cleaning method 2 (CM2).

> Jet washing with a pressure washer. This was designated as cleaning method 3 (CM3). Although jet washing may not be common practice in all hospitals, it is used as part of some decontamination area cyclic cleaning regimes and, as such, was included as part of the tests.

Five tests were performed with each method for each test item.

A record was kept of the time taken to clean each test item. However, there were not enough data points for a meaningful analysis of any statistical variation in the time taken to clean individual items of furniture. Looking at all of the items, it seems that old and new furniture take a similar amount of time to clean. Jet washing is generally quicker than cleaning with a detergent solution or wipe (data not shown).

Assessment of cleaning

Test surfaces were swabbed before and after cleaning for the presence of the test micro-organism. An ATP detection method was also used.

Culture method

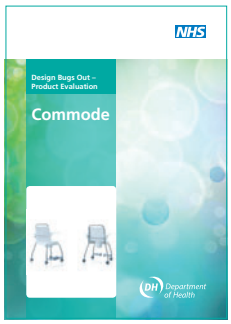
A 25cm^2 area of the pre-defined site was swabbed using a moistened swab and a template. The sample sites were those described above. The swab was placed into 10ml of tryptone soya broth and vortexed for 20 seconds to re-suspend any micro-organisms present. The broth was then ten-fold diluted and the broth and dilutions plated onto tryptone soya agar. After 18 hours' incubation at 37°C, the number of colony-forming units were enumerated and the counts converted to $\log_{10}$ reductions from the pre-counts.

ATP method

Cleaned surfaces were swabbed for the presence of ATP. This was measured using a hygiene monitor (Health Edge Solutions Ltd). The presence of ATP is proportional to the number of relative light units detected by the monitor.

Detailed product evaluation reports

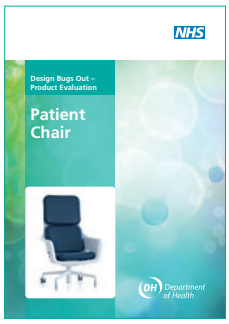
More detailed evaluations are available for each of the four new products (commode, bedside cabinet, patient chair and overbed table). These can be accessed by clicking on the links below.



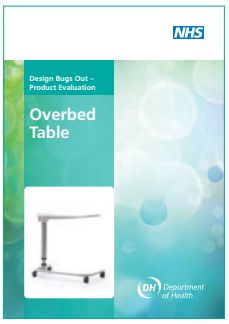
Commode



Bedside cabinet



Patient chair



Overbed table