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The impact of a liner-less reusable clinical waste bin system on costs, waste volumes and infection risk in an Australian acute-care hospital

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Abstract.

***Introduction*:** Regular audits of clinical waste (CW) disposal systems and examination of new technologies can lead to cost and waste reductions and lowering of infection potential. Sydney Adventist hospital a 360 acute bed private facility noted their 240L clinical waste (CW) bin system posed issues with infection and staff-injury risk, aesthetics, logistics, space and cost and evaluated a new liner-less reusable bin system.

***Methods*:** A facility-wide audit was conducted of the current 240L bin system prior to a 3-ward, 3 month staff evaluation of the new liner-less system (Clinismart, SteriHealth Ltd Vic). Clinical waste volume and mass was compared between systems over a 30 month period as was contractor costs, labour, space requirement and general waste (GW) mass. Staff opinion was sought via a 10-point questionnaire and infection and injury risks audited.

Results: Inpatient workloads remained static over the study. Decreases were noted in CW mass (-53.2%); CW volume (-65.2%); CW disposal costs (-30.9%); labour (-69%); and the new system was found to be more space-efficient and logistically superior. Waste segregation was markedly enhanced. Infection and injury risks noted with the 240L system were eliminated. Staff expressed strong preference for the system which was then adopted by the facility.

***Conclusion*:** The study found that the use of a smaller 64-litre, liner-less reusable hospital waste bin system, through its design and operation, has the potential to reduce clinical waste volumes, increase labour efficiencies, decrease costs and minimise infection risk potential, all of which improve the quality of health care.

Additional keywords: medical waste, regulated medical waste, healthcare facility, waste reduction, MGB, wheelie bin, needle stick, infection prevention, savings, foot-pedal.

Implications

- The article assists hospitals in formulating policy on clinical waste disposal procedures.
- The article depicts successful practice in reducing clinical waste cost and volume while minimising infection risk.
- The article presents an example of how clinical waste cost and volume can be reduced by the use of a new liner-less, reusable clinical waste bin system.

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INTRODUCTION

Taking all reasonable steps to minimise the risk of infection transfer among staff patients is an important focus for hospital management.[1] Clinical waste (CW) presents a potential infection risk to staff, patients and publics and an efficient and hygienic CW disposal system is an important part of successfully minimising this risk and providing quality health care.[2]

Examination of a random selection of lined waste carts from nine acute hospitals in the Greater London area revealed that they were unclean and a source of potentially pathogenic material, posing an infection control (IC) risk.[3] Observations included; overfilled bins; external soiling on 100%; internal soiling on 60%; *S. aureus* and enterococci in/on 60%; Gram negative species (including E. *coli, Enterobacter spp* and *P. aeruginosa*) on 60%, and free fluid in 20% of bins. Waste was at times not contained by the liner bags, which may at times collapse or come away from the side-wall. A similar study highlighting IC risk found 25% of poorly cleaned CW bin systems were contaminated with potential pathogens.[4]

Most Australian hospitals use one of two CW bin systems: a bin usually of 50-70L capacity which remains in the patient room and is lined with a removable plastic liner into which clinical staff place CW and which is collected regularly by Hospitality Services (HS) staff and transported to a central waste holding area; or a larger, plastic-bag lined 240L bin sited in dirty utility rooms on each clinical unit. Clinical staff place patient-derived CW in small plastic bags and carry these to the 240L bins. The bins are transported internally by hospital staff to a central waste holding area where they are collected and processed by the CW contractor. Sydney Adventist Hospital (SAH), a 360 bed acute-care private hospital in Sydney, NSW, used the second system.

Regular monitoring of waste handling systems enables evaluation of costs, volumes, IC and occupational, health and safety (OHS) risks and logistic efficiencies.[2] Such quality assurance audits conducted by SAH found the 240L system to be less than ideal. With a view to improving quality of care at SAH, management from HS and Infection Prevention and Control (IPC) departments investigated a new, liner-less, reusable, foot-operated bin system in dirty utility rooms. This paper outlines a comparison of the IC and OHS risks, costs and logistics between the large reusable bin system and the new, smaller, liner-less reusable system.

METHODS

A hospital-wide audit of the 240L bin system (System A) was conducted by IC and HS staff with regard to IC, OHS, space and logistics. The smaller, 64L liner-less, foot-operated system (Clinismart, SteriHealth Ltd, Dandenong Vic) (System B) was introduced to each of the dirty utility rooms in three wards of SAH in August 2010. Staff place patient CW into small bags and carry these manually or on the procedure cart to the dirty utility room for disposal. The lockable, reusable bins, manufactured from scratch-resistant and puncture-resistant ABS polymer are set slightly off the floor on a supporting frame (see Fig 1). The bins are transported in multiples in a vendor-supplied purpose-designed transporter to and from patient rooms by HS staff (see Fig 2) and transported to and from the facility in purpose-built transporters (see Fig 3) The bins are collected, decanted, cleaned and decontaminated offsite by the vendor before being returned for reuse. Staff of SAH were trained in the correct use of System B by the vendor initially and by SAH educators subsequently.

Clinical waste disposal efficiency of System B was monitored by comparing waste volumes produced, number of bins used, correctness of waste segregation, labour required, and costs. Quantitation at 30 months was carried out to ensure consistency of change. Staff opinion on System B was assessed by a 10-point questionnaire completed by HS and clinical staff on the three participating wards. In addition, the contents of bins on each of the 3 wards was monitored for incorrect disposal of sharps.

Data on Inpatient Days (ID) (overnight + day stay) were obtained from SAH. Data on CW weights and volumes and on general waste (GW) weights were obtained from the waste contractor invoices. Data on HS staff hours to transport bins to and from wards ("bin workload") was obtained from SAH HS Manager. Bin fill volumes were assumed to be 80% in both systems. Apart from correct system usage, no change in CW definition or education content was made during the trial. Smaller yellow bags for disposing of individual patient CW were introduced in selected areas.

RESULTS

Adverse issues noted during the audit of System A are listed in Table 1.

Quantitative outcomes

Changes in ID, CW mass, CW volume, bin workload and costs between the System A and System B are shown in Table 2. Although patient workloads and a workforce of approximately 1300 full-time equivalent staff remained fairly constant over the 3 years of the study, CW and GW mass decreased 53.2% and 33.7% respectively and CW volume decreased 65.2% (see Fig 4) and overall CW disposal costs decreased 30.9%. The number of large bags eliminated from lining the 240L bins approximated 5,000 per year. Cost of CW disposal in first quarter 2013 was 27.4% of total SAH waste disposal costs. Available space in soiled utility rooms was reduced markedly, so too in waste storage area where the bins are stacked in a purpose built transporter (figure 3)

Sharps risk

Improperly disposed sharps were an issue in 240L bins and, in the first week of System B adoption, improper sharps disposal was detected daily in one ward (e.g. Vacutainer needle, lancet, micropin). One week after re-education no improperly disposed sharps were detected. In the year previous to the trial one staff member sustained a sharps injury (SI) from a sharp retained in a bin liner. In the 30 months since System B commenced, no SI from CW bin-handling have been reported.

Qualitative outcomes

Three HS staff and 37 clinical staff completed staff-opinion surveys. On ease of use, 98% of staff preferred System B; on ease of changing bins, 100% preferred System B and 89% preferred System B for ease of waste segregation. Overall, 84% of staff preferred System B over System A. All of the concerns noted during audits of System A were resolved with System B.

Infection risk.

System B was deemed to be superior to System A in terms of cleanliness and hygiene due to System B bins: being visually cleaner; their road and ward transport in dedicated transporters eliminated pathogen pick-up on wheels; reduced trips per day minimised potential for wheel-borne pathogens to be transported through patient areas; being liner-less – they did not require staff to lean inside the bin to handle or tie-off liners; a foot pedal eliminated manual lifting of lids.

DISCUSSION

An audit of the clinical waste disposal system at SAH identified risks and inefficiencies with the existing 240L lined bin system and the system does not comply with NSW Health guidelines that state waste bags should not exceed 55 litres.[2] Moreover, there is evidence of potential pathogens being harboured in large, lined CW disposal bins.[3] The liner-less System B was assessed by IC staff as having minimal infection risk compared to the high potential risk of System A. An important outcome of the implementation of the new 64L waste bin system was a decrease in incorrectly disposed of sharps, which in turn reduced staff sharp injury risk. System B bins are designed to be used in patient rooms or dirty utility rooms and SAH chose to place them in dirty utility rooms in most wards and in selected patient rooms in Endoscopy and ICU.

The smaller liner-less waste bin system, in reducing CW costs, volumes and space, proved to be very acceptable to ward and hospitality staff. Staff appreciated not

Table 1. Adverse issues noted with System A (240L bins)

Concern	Issue
Space	The bins required a large floor space area in: ▪ the dirty utility rooms ▪ the bin store room ▪ waste storage area
Logistics	HS staff on average changed the bins in each ward on a daily basis, and as only one bin should be handled by one person at a time, this task required many return trips to wards. This in turn resulted in: o high HS staff hours to complete o increased traffic of cumbersome bins in public areas
OHS	• To reduce trips to wards, staff wheeled two bins at a time in a push/pull arrangement resulting in: o strain risk to HS staff o potential impact with other staff, visitors and patients. • Staff, in reaching into the bin to compress and tie off the liners, were exposed to potentially infectious material and improperly disposed sharps.
IC	Bins were considered a potential IC risk to patients and staff through: o absence of foot-operated opening mechanism requiring staff to lift lid manually; o arrival of visually scratched and sometimes externally soiled bins o risk of pathogens being brought into, or transported through, the hospital on the wheels of bins. o a liner collapsing into the bin placing staff at risk by: ▪ their attempts to reach inside and pull the liner up and over the rim, or ▪ making it impossible for the liner to be tied off before transport
Segregation	The largeness of the bins: o tempts staff to dispose of waste other than CW into the bin. o in one audit, 80%-85% of contents were general waste
Aesthetics	Transportation to and from wards of unsightly “obviously waste” bins in public areas.

HS Hospitality staff; OHS Occupational health and safety; IC Infection control

Table 2. System comparison of CW mass and volume, bin workloads and costs per month

	System A (Q2 2010)	System B (Q1 2013)	Change %
Inpatient days/month	12,919	13,025	0.8%
CW volume (L/month)	86,784	30,490	
CW L/ID	6.72	2.34	-65.2%
CW mass/month (kg)	7,636	3,603	
CW kg/ID	0.59	0.28	-56.1%
GW mass/month (kg)	7,734	5,173	
GW mass kg/ID	0.60	0.40	-37.7%
Bin transport to wards (bins/day)	11.1	7.0	
Bin transport workload (hrs/day)	3.25	1.00	-69.2%
CW disposal costs/month	$8,094	$5,595	-30.9%

CW clinical waste; ID inpatient day; GW general waste; Q2 quarter 2; Q1 quarter 1.

Fig 1. System B: size and foot-operated mechanism

Fig 2. System B: Internal transport trolley

having to lean inside CW bins, fix liners, tie off liners, move heavy bins or lift lids with their hands. Staff also commented favourably on System B's foot-operated lid, ease of use, inducement to segregate CW, ease of bin exchange and ease of transport. Whereas the 240L bins required many trips per day to and from wards, System B bins were transported in one trip by use of the purpose-designed transporter. Another advantage of System B bins was that they were of the same design "family" as the reusable sharps containers used at SAH and thus both could be transported at the same time on the transporter. Being smaller, System B bins were exchanged and washed more often and this was manifested in their visual cleanliness noted by staff and no doubt by patients and visitors.

The smaller bin and smaller patient CW bags enabled superior CW segregation. Faced with the large 240L bin it was difficult for staff to avoid a mentality of

"*Big bin, everything in*" and with System B the change was evident to a mentality of "*Smaller bag, smaller bin, I'm conscious of what I put in"*. With System B the volume of CW was reduced by two-thirds and mass by just over half – the difference in the two being a reflection of the lighter GW being correctly segregated.

Fig 3. System B: dedicated road transporter

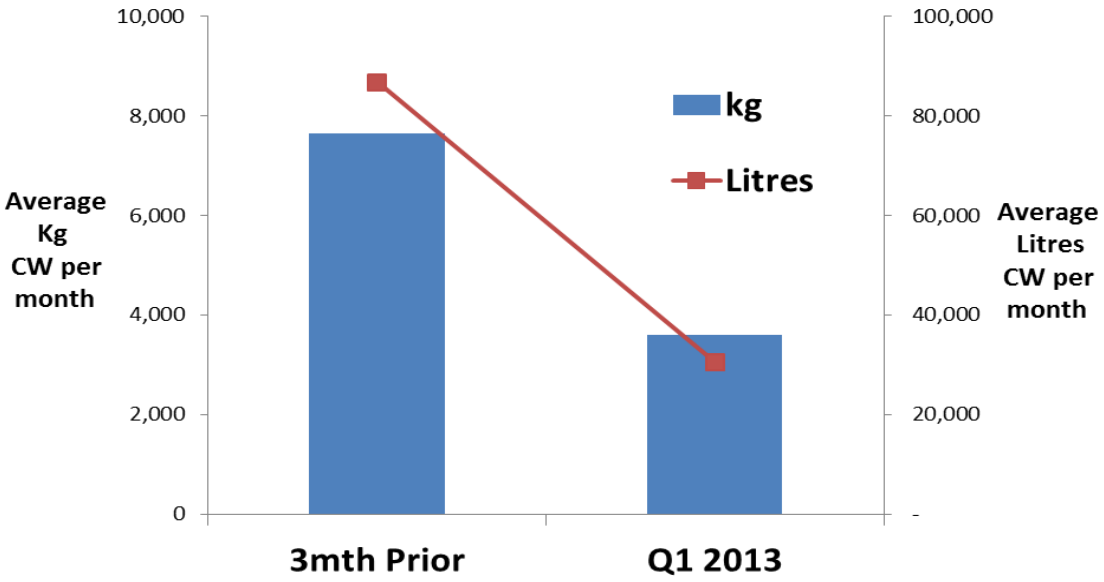

Fig 4. Average monthly clinical waste mass and volume prior to and 30 months after adoption of System B

Of note was that the marked decrease in CW volumes was not reflected in a GW volume increase. GW decreased over the 3 years (due to SAH recycling strategies). There are few recent papers on CW management in the Australian literature however data in a NSW Auditor-General's report of 2002[5] shows that SAH 2013 CW weights per FTE were half of a similar sized government hospital in the report. Although the cost per litre of CW removed was higher with System B, the system's efficiencies resulted in an overall CW disposal cost reduction of 30.9% These CW volume reductions and associated cost reductions brought CW costs down to 27.4% of SAH total waste disposal costs, markedly less than the 60%- 68% stated in other studies. [3,5] Not included in SAH CW costs were the savings in HS staff hours transporting the bins to and from wards. There was a pride among SAH staff knowing that CW volumes and costs had been reduced, that handling efficiencies were increased and that 5,000 less large plastic liner-bags were being landfilled.

Following the review process, System B was deemed superior to the existing system and was progressively introduced to all clinical areas of SAH. With the continued waste disposal improvements resulting from this initiative, the use of the new bin system has diversified into cytotoxic waste, and this application is also seeing promising results.

Strengths of the study were: time-frame over which it was conducted; accuracy and completeness of monthly weight and cost data; and involvement of frontline staff. Limitations of the study were: bin volume calculations were based on an assumed 80% fill level; the impact of smaller patient CW bags could not be separated from the impact of smaller CW bins; improper sharps disposal was ascertained on one ward only; and infection control risks were visually assessed (microbiological monitoring was not conducted).

CONCLUSION

The study found that the use of a smaller 64-litre, liner-less reusable hospital waste bin system, through its design and operation, has the potential to reduce waste volumes, increase labour efficiencies, decrease costs and minimise infection risk potential, all of which improve the quality of health care.

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