of these 17 people, 8 preferred the feel/scent, 3 cited more convenient access, and 2 said moisturizing products were not available or offered by their facility.

Methods for monitoring for symptoms of ICD are as follows: self-reporting, 28 (65%); visits to employee/occupational health are tracked, 8 (19%); no procedure, 11 (26%); and don't know, 6 (14%).

Half of respondents (22 [51%]) must follow facility guidelines. Professional association guidelines or World Health Organization/Centers for Disease Control guidelines were each cited by 4 people (9%). An additional 4 people (9%) ask colleagues what to do, 3 (7%) do not have guidelines, 2 (5%) don't know, and 1 (2%) makes his or her own decisions.

Policy instructs HCWs with ICD symptoms to do the following: consult employee/occupational health, 28 (65%); use approved lotion, 25 (58%); use approved alternative soap/sanitizer, 19 (44%); moisturize frequently, 14 (33%); use small disposable bottles or packets of approved lotion, 2 (5%); and don't know/not applicable, 5 (12%).

This study embodies the World Health Organization's facets of empowerment: there must be an appropriate foundation of knowledge, development of appropriate skills/behaviors, and a facilitative environment for actions.[1]

Scientific journals as knowledge sources are a solid foundation used by two-thirds of respondents. The influence of peers and websites should be investigated further in order to understand the kind of information retrieved and how it is applied in clinical practice. Formal instruction was cited by only one-third of respondents, whereas informal learning on one's own, from peers, or none at all, each cited by one-fourth of respondents, suggest a lack of standard knowledge foundation.

Approved lotions are the most common solution to treat ICD—their use was determined by employee/occupational health for two-thirds of respondents. Given the level of autonomy for HCWs to monitor their own symptoms before going to employee health professionals (as two-thirds of all HCWs reported this), we do not know what thresholds are established before seeking a change in HH procedure. As with training, a standard for monitoring is needed to ensure best actions at the right times.

The use of nonapproved products by nearly 40% of respondents sounds an alarm. Any product not reviewed by the facility may impact negatively the efficacy of approved antimicrobial soaps and sanitizers. The popular citation "preferred feel/scent" should be applied to future product evaluation efforts. Difficulty of access and lack of availability are problems easily addressed in collaboration with environmental services. HCWs will use products they like or have easy access to.

And finally, more than three-quarters of respondents are expected to follow facility or professional organization policies for addressing ICD. But the responses from other questions of the survey indicate varied levels of training and actions: policies are not specific enough or policies are not consulted frequently. Knowledge and actions are best supported when facilities have explicit guidelines that detail monitoring and actions.

HH saves lives. Support and encouragement for HCW HH compliance leads to better patient care. By addressing ICD on hands, we can avoid one of the common barriers to HH.

ACKNOWLEDGMENTS

Financial support. Georgia-Pacific.

Potential conflicts of interest. Both authors report no conflicts of interest relevant to this article.

Maryanne McGuckin, Dr.ScEd, FSHEA;
John Govednik, MS

Affiliation: McGuckin Methods International, Ardmore, Pennsylvania.

Address correspondence to Maryanne McGuckin, Dr.ScEd, FSHEA, 115 E. Athens Ave, Ardmore, PA 19003 (maryanne@mcguckinmethods.com).

Infect Control Hosp Epidemiol 2016;37:877–878

 0899-823X/2016/3707-0024. DOI: 10.1017/ice.2016.102

REFERENCES

1. World Health Organization. *WHO Guidelines on Hand Hygiene in Health Care*. Geneva, Switzerland: World Health Organization; 2009.
2. Boyce J. Hand hygiene compliance monitoring: current perspectives from the USA. *J Hosp Infect* 2008;70:2–7.
3. Visscher MO, Randal Wickett R. Hand hygiene compliance and irritant dermatitis: a juxtaposition of healthcare issues. *Int J Cosmet Sci* 2012;34:402–415.
4. Larson EL, Aiello AE, Bastyr J, et al. Assessment of two hand hygiene regimens for intensive care unit personnel. *Crit Care Med* 2001;29:944–951.
5. Cimiotti JP, Marmur ES, Nesin M, Hamlin-Cook P, Larson EL. Adverse reactions associated with an alcohol-based hand antiseptic among nurses in a neonatal intensive care unit. *Am J Infect Control* 2003;31:43–48.
6. McGuckin M, Govednik J. Irritant contact dermatitis on hands: literature review and clinical application. *Am J Med Qual* 2015; pii:1062860615611228.

The Economics of Autoclave-Based Sterilization: Experience from Central Sterile Supply Department of a Cancer Center in Eastern India

To the Editor—The central sterile supply department (CSSD) is an essential component of hospital services. Sterilization of a

TABLE 1. Water and Electricity Consumption Details for Equipment Used for Surgical Sets

Resource Description	Technical Details	Equipment or Procedural Consumption
Water required for manual and automated washing	RO water used for manual cleaning[a]	Soaking: 30 L water in enzymatic tank and changed 2×/d Cleaning: manual washing
	Electro-deionized water or double RO water used by washer disinfector	30 L water used in 3 phases (pre-rinse, intermediate rinse, and final rinse), 8 cycles/d
Electricity required for automated washing	Electricity required by heater of washer disinfector	Phase 1 (pre-rinse): no heater required, water temperature 20°C Phase 2 (intermediate rinse): increase water temperature to 60°C for another 20 mins (heater required), 8 cycles/d Phase 3 (final rinse): increase water temperature to 80°C for another 20 mins, 8 cycles/d
	Electricity required in the pump of washer disinfector	1 HP h = 0.75 kWh for all 3 phases, 8 cycles/d
Electricity for dryer	Electricity required for thermal dryer	1 kW is used in 2 h
Electricity for autoclave	Electricity required in autoclave, steam generator	6 heaters in autoclave, 6 kW each, 3 cycles/d
	Electricity required in autoclave, vacuum pump	2 HP h = 1.5 kWh, 45 min each, 3 cycles/d
Water for autoclave	RO water for vacuum pump of autoclave	390 L/cycle, 3 cycles/d
	Electro-deionized water or double reverse osmosis water for steam generator of autoclave	10 L/cycle, 3 cycles/d

NOTE. RO, reverse osmosis; TDS, total dissolved solids.
[a]For single-RO water, TDS content = 80 ppm; for double-RO water, TDS content <10 ppm.

wide range of materials is required for therapeutic, diagnostic, and infection control applications.[1,2] Depending upon the nature of materials and infrastructure available, these items are sterilized using autoclaves (steam sterilizers), ethylene oxide (ETO) sterilizers, or vaporized hydrogen peroxide (plasma) sterilizers.[1] Our CSSD in the 183-bed oncology center in eastern India is equipped with 3 autoclaves (Tuttnauer, Israel). The actual cost of autoclave-based sterilization is not readily available.[3–7] The purpose of this retrospective study was to document the cost of autoclave-based sterilization by the CSSD at our hospital. The results of this study are useful in cost rationalization, patient billing and the assessment of quality control costs.

Autoclaving cost was calculated by taking into account equipment capital cost, laundry cost, water cost, electricity cost, consumable costs (of sterilization indicators, packaging materials, and instrument cleaning solutions), human resource cost, depreciation cost of equipment, and cost of equipment maintenance contracts. The cost of making 1 L single reverse-osmosis (RO) water was Indian rupees (INR) 0.20 (US$0.003) and the cost of making 1 L double-RO water was INR 0.40 (US$0.006). The cost of electricity included the electricity requirements of the washer disinfector system (heater and pump), the thermal drying cabinet, the autoclave (steam generator and pump), and the electricity used for general purposes such as lighting and air conditioning inside the CSSD. The total electricity cost was calculated using a cost of INR 10 (US$0.17) for 1 kWh (Table 1). The total cost associated with the autoclave was INR 6,077,977 (USD 91,191) plus comprehensive maintenance contract of INR 200,000 (USD 3,000) per year. The cost per cycle of the autoclave was based on a total cycle calculation of 24,000 cycles: 8 cycles per day × 25 days per month × 12 months per year × 10 years. Depreciation cost was calculated using depreciation over 10 years for capital equipment (ie, steam sterilizers, washer disinfector, drying cabinet costs). Human resource cost was calculated for the total CSSD manpower cost per month for 1 scientific officer, 4 technologists, 7 attendants, and 2 housekeepers.

According to our sterilizer load analysis, most of the items in our hospital are steam sterilized: ~75% are steam sterilized; ~20% are ETO sterilized; and ~5% are plasma sterilized.[1] In May 2015, for example, a total of 17,693 items were sterilized: 13,266 items were sterilized by autoclave, 3,674 items were sterilized using ETO, and 753 were sterilized using plasma. The materials sterilized by autoclave included surgical sets, minor procedure sets, linens (ie, surgical gowns and patient drapes) and dressing materials (ie, gauze and cotton). The total cost of sterilizing a surgical set was INR 374.07 (US$6.23) per unit, and the cost of sterilizing a minor procedure set was INR 81 (US$1.35) per unit (see Online Supplementary Table 2 online). Surgical instrument sets included laparotomy sets, gynecological cancer sets, urology general sets, head and neck sets, and plastic surgery sets. Instrument sets for minor procedures included wound-dressing sets, stitch-cutting sets, suturing sets, lumbar puncture sets, bone marrow sets, etc. We also calculated the linen re-sterilization cost for patient drape sets and surgical gown sets, which included the manufacturing cost of 1 sheet (estimated to be used 100 times), laundry cost, and similar cost categories.

Few details or data are available regarding CSSD costs;[3–7] however, costing information is crucial. A previous study published in Brazil showed that the cost for sterilization by autoclave was US$31.37 and that low-temperature steam and gaseous formaldehyde sterilization (LTSF) cost US$255.28.[6] The cost of surgical set sterilization in our center was considerably less than that mentioned in the Brazilian study. In our study, the cost of autoclave-based sterilization of minor procedure set was less than that for a surgical set for several reasons: (1) less receiving time per set, (2) fewer instruments in the minor procedure set, (3) no manual cleaning of the minor procedure set (eg, primary cleaning is done in the procedure area in outpatient departments), (4) less set assembly and packaging time compared with surgical procedure sets, and (5) easier loading and unloading than for surgical procedure sets.

The cost of utilities (water and electricity) was different for each type of sterilized product (eg, surgical set, minor procedure set, surgical gown set, and patient drape set) for several reasons.

https://doi.org/10.1017/ice.2016.94 Published online by Cambridge University Press

(1) Water and electricity consumption for the washer disinfector is 4 times less for minor procedure sets than for surgical procedure sets. (2) No manual cleaning is required for minor procedure sets. (3) Electricity consumption by the thermal drying cabinet is less for minor procedure sets. (4) Water and electricity consumption of steam sterilizer for minor procedure sets is half that needed for surgical procedure sets (Table 1). Depreciation costs of equipment included those of washer disinfectors, dryers, and steam sterilizers. Depreciation was calculated using the initial capital cost of equipment and the cost of comprehensive maintenance contract of equipment divided over 10 years.

For surgical sets and minor procedure sets, the major cost contribution was due to consumables followed by electricity; for surgical gown sets and patient drape sets, the major costs were the manufacturing cost of the gowns and drapes followed by the cost of electricity. Calculating the cost of autoclaved-based sterilization is essential to assessing costs, to making decisions about patient billing, and for monitoring the effect of quality control on cost.

These cost categories demonstrate that there are no shortcuts to sterilization. Optimizing various factors contributing to costs is an ongoing challenge facing quality control managers, CSSD managers, and hospital administrators.

ACKNOWLEDGMENTS

The authors wish to extend their thanks to Mr. Sanjeev Agarwal in the Finance Department and Mr. J.R. Soundaranayagam in the Maintenance Engineering Department.

Financial support: No financial support was provided relevant to this article.

Potential conflicts of interest: All authors report no conflicts of interest relevant to this article.

Debabrata Basu, MSc, DHM;[1]
Sanjay Kishore Dutta, BCom;[1]
Sanjay Bhattacharya, MD, DNB, DipRCPath, FRCPath;[2]
Aseem Yogishwar Mahajan, MBBS, MHA;[2]
Venkata Raman Ramanan, MS;[2]
Mammen Chandy, MD, FRCPA, FRACP, FRCP[2]

Affiliation: 1. Central Sterile Supply Department, Tata Medical Center, Kolkata, India; 2. Tata Medical Center, Kolkata, India.

Address correspondence to Dr. Sanjay Bhattacharya, MD, DNB, DipRCPath, FRCPath, Consultant Microbiologist, Tata Medical Center, 14 Major Arterial Road (E-W), Newtown, Kolkata 700156, India (Sanjay.Bhattacharya@tmckolkata.com).

Infect Control Hosp Epidemiol 2016;37:878–880

 0899-823X/2016/3707-0025. DOI: 10.1017/ice.2016.94

SUPPLEMENTARY MATERIAL

To view supplementary material for this article, please visit http://dx.doi.org/10.1017/ice.2016.94

REFERENCES

1. Basu D, Bhattacharya S, Mahajan A, Ramanan VR, Chandy M. The importance of the central sterile supply department in infection prevention and control. *Infect Control Hosp Epidemiol* 2014;35:1312–1314.
2. Office of the Principal Scientific Adviser to the Government of India. An overview of central sterile supply department of the Tata Medical Center, Kolkata. In: *Scientific Operating Procedures for Sterilization Practices in India*. New Delhi; 2012: 165–183.
3. Sandler RL, Altman RD. Method for calculating costs of steam sterilization devised. *Hospitals* 1979;53:118–119.
4. O'Shaughnessy KL. Steam sterilization costs: a guide for the central service manager. *J Healthc Mater Manage* 1993;11:40, 42–45.
5. Adler S, Scherrer M, Daschner FD. Costs of low-temperature plasma sterilization compared with other sterilization methods. *J Hosp Infect* 1998;40:125–134.
6. Jericó Mde C, Castilho V. Cost management: the implementation of the activity-based costing method in sterile processing department [In Portugese]. *Rev Esc Enferm USP* 2010;44: 745–752.
7. Basu D, Bhattacharya S, Mahajan A, Ramanan VR, Chandy M. sterilization indicators in central sterile supply department: quality assurance and cost implications. *Infect Control Hosp Epidemiol* 2015;36:484–486.