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ORIGINAL PAPER

Exploring the efficacy of the storage organizational model in the urology suite at a single institution

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Summary

Purpose: The growing use of disposable equipment in operating rooms (ORs) underscores the need for efficient storage systems that ensure reliable access while minimizing waste. Multiple organizational models exist, including open rack storage, Omnicell cabinets, and PAR Excellence weight-based scales. This study evaluated the effectiveness of the current storage model in the urology suite at a single academic institution.
Methods: We first identified the storage systems used in the operating rooms (OR) and Omnicell storage room in the urology suite. We then obtained stored item data from our Supply Chain manager, containing quantities of each item and costs. Using our medical record system, EPIC, we kept track of the frequency of use for each stored item in academic year 2022-2023. Also, during this time, the PI surgeon and OR staff made note of any unavailable or expired equipment.
Results: At our institution, we use a combination of open rack and Omnicell storage. From August-September 2022, there were 3 out-of-stock items noted. In April 2023, there were 7 expired items noted. Of the 237 different disposable items stocked, 117 (49.37%) were unused over the study year, accounting for \$21,812.26 (15.98%) of total on-hand inventory cost.
Conclusions: The current organizational system demonstrated notable inefficiencies, including unavailable equipment, expired items, and substantial cost tied to unused supplies. These challenges highlight the limitations of manual or partially automated storage models and emphasize the need for more reliable, data-driven systems. Institutions may benefit from reevaluating their storage workflows to improve equipment availability, reduce waste, and support more sustainable financial and clinical practices.

KEY WORDS: *Urology suite; Organization; Resource management; Operating room.*

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INTRODUCTION

In recent decades, there has been a substantial rise in disposable equipment use. Reasons for this include improved patient safety due to lower risk of cross contamination and cost efficiency (1). Disposable equipment is also convenient as it eliminates the need for sterilization after use and offers variety and the potential for custom design of a given item (2). The challenge we now face is determining how to best organize, store, and track equipment utilization, especially given the constant turnover of equipment during busy hospital hours when multiple procedures and restocking of equipment are ongoing simultaneously. While many storage options exist, three of the commonly used include open rack storage, Omnicell, and PAR Excellence weight-based scales.

In open rack storage, items are stored on shelves or an equivalent that allows for visible and easy access. Items are typically delivered from a central supply, unpackaged outside the clinical area, and then manually stocked by personnel (3). These individuals are also tasked with keeping track of inventory overall, which can introduce human error into the organizational process and subsequently lead to confusion if items are misplaced (4). Although this introduces organizational challenges, the absence of physical barriers allows staff to quickly identify missing supplies, streamlining troubleshooting when stock discrepancies or workflow disruptions occur. Additionally, open shelving can be easily reconfigured to accommodate variations in product size, temporary increases in demand, or non-standard workflows in specialized clinical settings. Drawbacks include inventory personnel failing to recognize and replace used items, and OR staff failing to put back removed and unused equipment in the appropriate location.

Omnicell storage involves using Omnicell cabinets to manage inventory electronically through user inputs. Supplies and medications can be stocked and stored in a variety of cabinet models by users who have the appropriate privileges as designated in the Omnicell server. Items can then be removed by practitioners after logging in – either through credentials, PIN, fingerprint, ID card – selecting a patient and then choosing the desired item. The Omnicell system and server keep track of inputs over time to monitor inventory (5). Benefits to this storage system include security in the form of locked stationary cabinets with a variety of configurations that can be expanded by purchasing additional units. Drawbacks include needing to rely on user input to track stock and requiring manual audits to confirm stock accuracy. Additionally, erroneous items or more equipment can be removed beyond that which is recorded, causing issues in item availability.

PAR Excellence is an inventory management system that uses calibrated, weight-based supply bins and hangers to provide real-time inventory monitoring. Each PAR Excellence unit functions as a dedicated electronic scale installed beneath an individual supply bin or attached to a supply hanger (Figure 1). The system is designed such that a separate calibrated bin or hanger is typically assigned to each distinct supply item or item category within the operatory. During initial setup, the system records the precise unit weight of each item, allowing subsequent weight fluctuations to be algorithmically translated into changes in item quantity. When supplies are removed or returned, even small variations in weight are detected, prompting automatic recalculation of inventory levels without requiring staff interaction. Each bin/hanger is network-connected to a centralized inventory management platform, where software algorithms continuously process incoming weight data. These algorithms distinguish routine usage from restocking events, reconcile expected versus measured counts, and generate real-time analytics related to consumption trends, inventory turns, and par-level adherence. Based on predefined thresholds, the system can trigger automated alerts for under-stocking, over-stocking, mismatched items, or imminent re-order needs. Clinicians and supply chain personnel interact with the system primarily through dashboards and reports, rather than manual logging, making PAR Excellence a passive, continuously updating inventory solution (6). In addition to this passive use system, another advantage includes versatility with reuse of bins and storage options (e.g., mounted, placed on shelves). The primary disadvantage is possible additional storage costs should further cabinets be desired (7).

Institutions across the nation use different combinations of storage options that best fit their needs. The objective of our study was to characterize the storage methods used in the urology endoscopic suite of a urology department at state university academic medical center and assess the effectiveness of current practices. Through this evaluation, we aimed to identify potential shortcomings and generate opportunities for optimizing storage workflows.

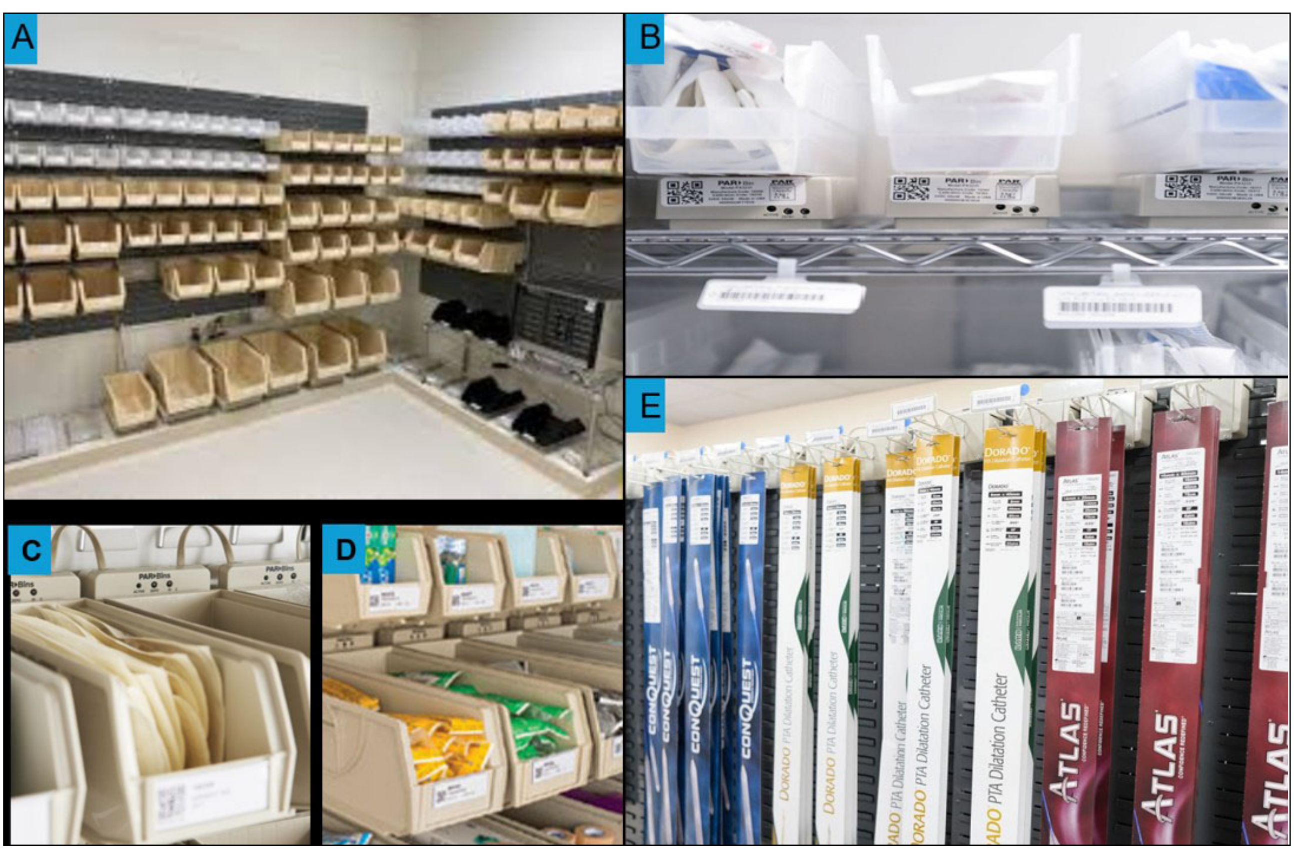
Methods

This was a single-institution study conducted at the University of Iowa based in the urology endoscopic sur-

Figure 1.

PAR Excellence weight-‑based inventory system.

(A) Overview of a storage area equipped with PAR Excellence infrastructure, showing organized wall mounted and shelf based supply bins.
(B) Close up of PAR Excellence calibrated weight based bins positioned beneath transparent supply containers for real time inventory tracking.
(C) Shelf level arrangement of multiple PAR Excellence bins assigned to individual supply items or item categories.
(D) Stocked disposable supplies within labeled bins placed above the weight based scales during routine clinical use.
(E) PAR Excellence hanger-based inventory system enabling real-time supply tracking through calibrated, weight-based technology.



gery suite, which contained *operating rooms* (OR) 1 and 2, and the overflow storage room ("*Omnicell Room*"). No human subjects or identifiable patient information were collected; therefore, institutional review board approval was not required.

Inventory data for all disposable items housed in OR 1, OR 2, and the Omnicell Room were obtained from the institution's Supply Chain manager. The dataset included item names, quantities on hand, and total cost, providing a detailed overview of stored equipment and associated financial burden. To assess actual utilization patterns, electronic medical records from the EPIC system were reviewed to document the frequency of use for each item during the 2022-2023 academic year. Items were categorized based on their annual usage into high-use (≥ 11 uses), low-use (1-10 uses), or unused (0 uses).

During the same academic period, the principal investigator surgeon and operating room nursing staff prospectively documented storage-related incidents encountered during routine workflow. These included instances in which disposable items were unavailable or out of stock during procedures, as well as expired items found during normal clinical activity. All documented instances therefore reflect issues identified during routine clinical workflow rather than through scheduled expiration audits.

All collected data were compiled to evaluate the overall performance of the existing storage systems, quantify inefficiencies, and identify opportunities for optimization. Descriptive statistics were used to summarize utilization frequencies, on-hand cost distribution, and the occurrence of storage-related events. Because this was an observational study focused on system evaluation within a single clinical setting, no inferential statistical analyses were performed.

Results

Within the University of Iowa urology endoscopic suite, supplies were stored using a combination of open rack shelving and Omnicell automated dispensing cabinets. During the initial review period between August and September 2022, the principal investigator surgeon documented three instances in which disposable items were unavailable at the time of surgery (Table 1). These out of stock events required staff to pause the procedure to retrieve the needed items, highlighting gaps in inventory awareness and replenishment.

In April 2023, seven expired disposable items were identified by the PI surgeon during routine clinical use (Table 2). These expired supplies were two types of single use ureteral stone retrieval baskets which required immediate removal/disposal and replacement, demonstrating a lapse in timely inventory rotation and expiration monitoring.

Table 1.
Out of stock items noted.

Out of Stock Items
18-French Council Foley catheter
Dual-Lumen Ureteral Access catheter
200 µm laser fiber

*Noted August-September 2022.

Table 2.
Expired items with model, date, and estimate total cost.

Type	Company	Model	Expiration date	Total cost
Basket				
	Boston Scientific	3.0Fx120cm	11/4/2022	
	Boston Scientific	3.0Fx120cm	1/21/2023	
	Boston Scientific	3.0Fx120cm	1/21/2023	
	Boston Scientific	2.4Fx120cm	7/15/2022	
	Boston Scientific	2.4Fx120cm	1/27/2023	
	Boston Scientific	2.4Fx120cm	11/12/2022	
	Boston Scientific	2.4Fx120cm	1/27/2023	
				$1,254.49

*Noted April 2023.

Comprehensive inventory data were obtained for OR 1, OR 2, and the Omnicell Room, and these items were subsequently categorized by annual utilization (Table 3). Items used ≥ 11 times in the previous year were designated high use, those used 1-10 times were categorized as low use, and items with no recorded use were classified as unused. Among the 237 total disposable items stocked across the three locations, 117 items (49.4%) had no documented use during the 2022-2023 academic year. Despite remaining unused, these items accounted for $21,812.26 in on-hand cost, representing 15.98% of the total inventory value.

The utilization distribution visualized in Table 3 demonstrates that nearly half of the stocked inventory remained idle for an entire year, while a smaller proportion of items accounted for the majority of actual clinical use. This pattern suggests misalignment between stocking practices

Table 3.
On-hand cost data for disposable supplies in OR 1, OR 2, and Omnicell Room. Green indicates 11+ uses, yellow denotes 1-10 uses, and red represents 0 uses in prior year.

Location	Total items	# Items green	Total on hand cost -green	# Items yellow	Total on hand cost -yellow	# Items red	Total on hand cost -red	Total on hand cost	% On hand cost red	On hand % items red
OR1	82	44	$54,213.77	23	$31,354.54	15	$5,901.28	$91,469.59	6.45%	18.29%
OR2	123	9	$742.19	18	$4,303.04	96	$12,718.53	$17,763.76	71.60%	78.05%
Omnicell	32	18	$19,590.77	8	$4,518.78	6	$3,192.45	$27,302.00	11.69%	18.75%
Total	237	71	$74,546.73	49	$40,176.36	117	$21,812.26	$136,535.35	15.98%	49.37%

Table 4.
Comparison of Open Rack, Omnicell, and PAR Excellence storage systems.

Feature	Open Rack Storage	Omnicell Storage	PAR Excellence Storage
Storage mechanism	Open shelves providing full visibility and direct access.	Automated, electronically controlled cabinets requiring user authentication.	Calibrated weight based bins that calculate real time item counts.
Stocking process	Supplies delivered from central supply, unpackaged outside clinical area, and manually stocked by staff.	Authorized users stock items into designated cabinet compartments.	Items entered into master database, assigned to weight calibrated bins, and stocked accordingly.
Inventory management	Manual counting and tracking by personnel.	Electronic tracking based on user input and transactions recorded in Omnicell server.	Automated, continuous inventory calculation triggered by weight changes; real time alerts for discrepancies.
Access method	Open access for all staff.	Login required; item selection linked to patient.	No login; passive use, system updates inventory automatically as weight changes.
Advantages	High visibility, easy troubleshooting, flexible	Secure locked storage; configurable cabinets;	Real time automated inventory, reduced need for manual
	configuration for changing workflows or item sizes.	expandable modular units; controlled access.	counts, alerts for under/overstock, reusable bins with flexible mounting options.
Disadvantages	Vulnerable to misplacement and inconsistent stocking practices; limited inventory control.	Dependent on accurate user input; requires periodic manual audits; higher acquisition cost.	May require additional secured cabinetry; initial setup requires calibration; cost of expanding infrastructure.
Best use Scenarios	Settings needing rapid access, high visibility, and flexible workflows.	Environments requiring secure storage, controlled access, and audit trails.	Departments prioritizing automated, real time inventory accuracy with minimal user interaction.

and procedural demand, with implications for both cost efficiency and storage performance.

Discussion

Our analysis revealed several important shortcomings in the current organizational system used in the urology ORs and the Omnicell Room. Even within a single academic year, we identified multiple instances of unavailable and expired equipment. According to the PI, similar issues have continued to occur during the 2024-2025 academic year, although these events were not formally documented. Because of these recurring problems and the PI recommending change to the PAR Excellence weight-based scale system, the organizational system is currently working toward expansion of use of the PAR Excellence system across the institution, including the urology department.
By relying primarily on manually managed open-rack storage, the potential for human error and unintentional oversight in equipment tracking is introduced. This has significant implications for patient care and safety as the lack of readily available equipment causes delays and stress within the operating rooms and is likely associated with worse patient outcomes (8).
Another concern identified was the substantial amount of equipment in storage that went unused, representing a notable financial burden for the department. This issue is almost certainly not unique to our institution. For example, a prior study at a children's hospital reported more than $20,000 in acquisition cost savings over one year after seven surgical services removed minimally used items from their storage (9). These observations raise an important question: how much of the hundreds of billions of dollars in estimated medical waste nationwide may be attributable to the routine stocking of items that ultimately go unused? (10). Furthermore, having unused items in storage inevitably leads to expiration and subsequent disposal, which then generates incredible amounts of medical waste. Indeed, it is estimated that 38,000 metric tons of medical waste are produced annually from endoscopic procedures alone, most of which is due to single-use plastic equipment (11).
To help circumvent the issues we observed at our institution, we proposed the transition to utilizing a predominantly PAR Excellence weight-based scale system. As described previously, PAR Excellence is optimal as it removes potential for human error and can monitor stock real-time using objective metrics – equipment weight (Table 4). Cost estimates for transitioning to a predominantly PAR Excellence system were derived from prior institutional budget proposals and internal pricing information and provided to the department. Based on these data, the projected one-time cost is approximately $128,000, reflecting the purchase of roughly 900 scales priced at $125-225 each. An additional annual service fee of $6,480 ($0.60 per scale per month) would apply. For comparison, our current manual organization model requires approximately $85,000 annually in staffing costs.

Declarations

Ethical approval and consent for participate: *Not applicable.*

Availability of data and material: *Not applicable.*

Competing interests: *The authors declare that they have no competing interests.*

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Authors' contributions: *JG: Conceptualization, data interpretation, methodology, writing-original draft preparation. RS: Data interpretation, writing-review & editing. MAC: Data interpretation, methodology, writing-review & editing. JAB: Conceptualization, methodology, writing-review & editing, Supervision.*

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Based on these figures, transitioning to PAR Excellence would reduce operating expenses by roughly $78,500 annually ($85,000-$6,480), meaning the system would essentially pay for itself in less than two years.
We would continue to manage several Omnicell units to provide an option for additional security for select items. Ideally, this switch would lead to less errors and associated complications regarding equipment tracking and contribute to significant cost savings in the long term.
Although our study was conducted within a single institution, it highlights the broader need to optimize equipment organization and utilization, particularly in the operating room setting. The United States already allocates a substantial portion of its GDP to healthcare, and medical waste continues to increase annually (12). We acknowledge that our proposed action plan is not a one-size-fits-all solution, as institutional needs and workflows differ. However, the essential message is that all healthcare systems must remain intentional about how equipment is stored, tracked, and used, and take proactive steps to refine these processes. While this work will require persistence and sustained effort, it holds meaningful potential to improve patient outcomes and contribute to a more sustainable economic landscape in healthcare.

Conclusions

This single-institution evaluation of storage practices in a urology endoscopic surgery suite identified meaningful inefficiencies in the current hybrid open-rack and Omnicell organizational model. Unavailable supplies, expired items, and nearly half of stocked materials going unused underscore persistent workflow vulnerabilities and unnecessary financial burden. These findings highlight the need for more reliable and objective inventory systems, such as PAR Excellence weight-based technology, to improve equipment availability, reduce waste, and support sustainable operational and economic performance.

References

1. Eussen MMM, Moossdorff M, Wellens LM, et al. Beyond single-use: a systematic review of environmental, economic, and clinical impacts of endoscopic surgical instrumentation. Int J Surg. 2024; 110:8136-8150.

2. Croffie J, Carpenter S, Chuttani R, et al. ASGE Technology Status Evaluation Report: disposable endoscopic accessories. Gastrointest Endosc. 2005; 62:477-479.

3. Thompson DR, Hamilton DK, Cadenhead CD, et al. Guidelines for intensive care unit design. Crit Care Med. 2012; 40:1586-1600.

4. Wheeler C, Blencowe A, Jacklin A, Franklin BD. Combining research and design: A mixed methods approach aimed at understanding and optimising inpatient medication storage systems. PLoS One. 2021; 16:e0260197.

5. When will getting the right medication to the right patient get easier? Omnicell. Accessed February 27, 2026. https://www.omnicell.me/globalassets/int-blocks--media/uk-website/brochures/uk_xt_adc_brochure.pdf

6. PAR Vision. PAR Vision User Guide. Accessed December 6, 2025. https://www.oit.va.gov/Services/TRM/files/PAR_Vision_User_Guide.pdf

7. Inventory Automation – PAR Excellence. PAR Excellence. Published 2026. Accessed February 27, 2026. https://parexcellence.com/inventory-management/inventory-automation.

8. Efthymiou CA, Cale AR. Implications of equipment failure occurring during surgery. Ann R Coll Surg Engl. 2022; 104:678-684.

9. Cunningham AJ, Krakauer K, Schofield C, Kenron D, Krishnaswami S. Reducing Disposable Surgical Items: Decreasing Environmental Impact and Costs at a Children's Hospital, a Pilot Study. J Surg Res. 2023; 288:309-314.

10. Shrank WH, Rogstad TL, Parekh N. Waste in the US Health Care System: Estimated Costs and Potential for Savings. JAMA. 2019; 322:1501-1509.

11-Namburar S, von Renteln D, Damianos J, et al. Estimating the environmental impact of disposable endoscopic equipment and endoscopes. Gut. 2022; 71:1326-1331.

12. Hartman M, Martin AB, Whittle L, Catlin A; National Health Expenditure Accounts Team. National Health Care Spending In 2022: Growth Similar To Prepandemic Rates. Health Aff (Millwood). 2024; 43:6-17.

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