

A proposal and justification for a parts designated position for the CHEO Clinical Engineering Regional Services

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Abstract (300 words)—Parts and the management of parts is an age-old challenge for clinical engineering (CE) departments. The Children's Hospital of Eastern Ontario (CHEO) is at a critical juncture whereby the demand for parts has increased sufficiently such that it has limited the capacity of the department to function and grow. Herein, the authors provide the basis for a proposal and justification for a permanent full-time parts designated position responsible for protecting the value of the inventory on shelf. Its aim is to develop and maintain a parts nomenclature system, analyze the dynamics of the stocking levels, and evaluate market analysis. This person will also eliminate delays of providing a part for repair/corrective maintenance, and write policies & standards pertaining to parts management.

Keywords— Parts Management, Parts Analysis, Business Case, CMMS, LEAN methodology.

I. INTRODUCTION

Parts and the management of parts used for scheduled maintenance and corrective repairs is an age-old challenge for clinical engineering (CE) departments. The days of component level repair have passed, and board level repair is now common. CE shops have had to adjust from keeping many components used in many devices, to singular parts for specific devices. Not only has this shift in the CE realm changed the storage requirements of the 'parts on hand', but it has also increased the cost of inventory. This, of course, is traded off with modern shipping enhancements such as just-in-time overnight delivery.

At CHEO, there has been little consideration of parts management despite staff growth following an increase of both the volume of equipment and the change in the nature of the work. A department parts management strategy including dynamic processes, delineated roles & responsibilities, and parts inventory guidelines was not adapted to sustain the growth of the department. This has created a known discrepancy between the onsite parts room and the computerized maintenance management system (CMMS) (E-Automate, ECI, Fort Worth, TX, USA). This yielded a lack of confidence in the data, causing disengagement from staff and loss of accountability,

exacerbating any encouragement to improve the parts management system.

The authors herein provide a proposal and justification to create a full-time (1.0 FTE) permanent parts designated position for a regional CE program, which we believe is unique for a large regional program. This position will be responsible for protecting the value of the inventory on shelf, analyzing the dynamics of stocking levels and evaluating market analysis, developing, and maintaining a parts nomenclature system, eliminating delays of providing a part for repair/corrective maintenance, and writing policies & standards pertaining to parts management. It is believed that this vision would create an opportunity to set the standard on parts inventory management for CE departments across the region, provincially, nationally, and internationally.

II. BACKGROUND

The department currently has 40 staff, serving 22 regional hospitals, and 300+ private medical and dental clinics, and several laboratories across a geographical area of ~15,000 square kilometers and supports ~37,000 devices. What is unique about CHEO is that the CE department generates their own purchase orders directly from the CMMS and do not use the in-hospital procurement system. Our department is at a critical juncture whereby the department growth and client satisfaction are stunted by the part management limitations.

III. LITERATURE REVIEW

Inappropriate inventory management results in substantial losses for healthcare organizations and negatively impacts the quality of patient care [1]. Overstock can lead to wasted finances, loss of storage areas, theft, and expired products. The ratio of the annual cost of spare parts to the total cost of acquisition is approximately 10% for high technology devices, 5% for medium technology, and 1.25% for low technology [2] [3]. Understock leads to longer wait-times for repairs and maintenance, negative financial implications, and increases the risk of low-quality care. Inventory management systems are in place to prevent material and financial losses and promoting an efficient and accurate record of items and

supplies [4]. Efficient inventory management helps reduce hospital costs, provides quick services by the hospital, and ensures that patient safety is prioritized.

Investigating similar healthcare settings to CHEO, we can note that parts management consists of a large portion of the financial spending. Approximately 46% of an average hospital's operational budget is related to logistics activities (procurement and supply of goods and services) and more specifically, 15% is for employees assigned to logistics duties [5], [6]. The Ontario Buys & Healthcare Supply Network [6], [7] states that the logistics function represents more than 20% of a hospital's total budget. In Ontario, the total addressable annual spend related to the logistics activities for Ontario healthcare providers is over \$12 billion CAD [8].

Unfortunately, at many healthcare and industry organizations, records of these inventory variations are not available. Healthcare authorities believe healthcare suffers from a shortage of data about supply chain issues [9]. In fact, they state there is no baseline data and no single source of truth to better understand and solve the parts management problem [9]. Organizations are starting to turn to LEAN methodology practices to better manage medical device inventory [4], [10], [11]. Through a Just-In-Time approach, US hospitals record an annual savings of approximately \$3-11 million USD per hospital, or 10-17% in savings [4]. With a parts process set into place within the CE department at CHEO, monitoring the statistics and the quantities of inventory variations will allow us to better analyze and predict changes to the stock and enlighten the healthcare community with these metrics.

IV. JUSTIFICATION

A. LEAN Methodology

In 2018, a LEAN report to find waste in the parts inventory system was written coupled with a physical parts room inventory count and reconciliation with the CMMS (publication in progress). The report followed the Define, Measure, Analyze, Improve and, Control (DMAIC) principles. Tools used in this study included: interviews, a survey, detailed process map, and Gemba walk to prioritize problems and guide the scope of each problem and solution. The report identified pinch points in our parts ordering workflow; it became a snapshot in time for historical reference. However, a need was identified to justify creating a parts designated position to address the issues outlined in the report. Again, in 2022 & 2023, a physical inventory count was performed to reconcile the CMMS data with the physical count.

The proposal and justification used LEAN methodology to identify *waste* in the parts ordering system and mitigate or

eliminate it to find justification to fund the parts designated person from the savings.

B. Risk Financial Impact

The carrying capacity of a CE parts inventory is both an asset and a liability. Carrying parts requires operation expense to purchase parts in advance of them being discounted on a repair or planned service. High turn-over parts could be put on a min/max reordering system. However, low turn-over parts require a decision to carry for other reasons such as: potential backorders, ordering/shipping delays, international boundaries, supply chain disruptions, etc. Parts carried in inventory can also become obsolete when medical equipment fleets are replaced, or in the event there is a best before date (e.g., batteries). This results in parts being wasted and becoming a liability on the balance sheet.

A CE CMMS will incorporate the functionality of parts inventory management, which is linked to the work order (WO) entry. A technologist who requires a part that is in physical inventory simply adds the part to the WO, walks to the part room, finds the part, and completes the repair. The inventory is debited; however, this process is not that simple when amplified by 40 people. Without a gate keeper, the parts inventory becomes a 'free for all', coupled with hiccups on the ordering system, which create delays updating the parts inventory.

To study the ebbs and flows of the part inventory the CE team mapped the relative value of the CMMS parts inventory, which is shown in Fig. 1.

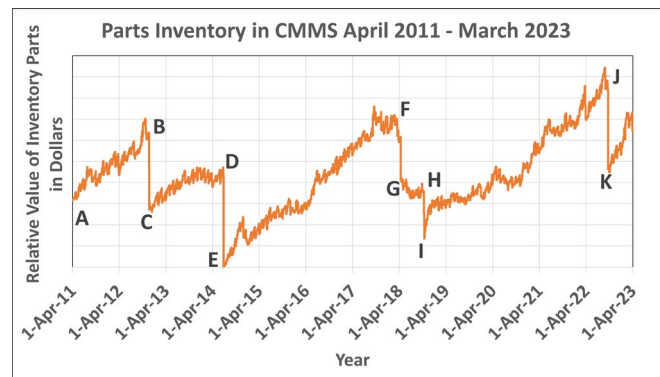


Fig. 1 CHEO Part Inventory in CMMS April 2011 to October 2022

This graph is a novel pictogram of the relative value of CE departments inventory of parts in dollars. Fig.1 was labelled A to K to help interpret the graph. The drops, for example B to C, are distinct points that represent when a physical inventory count was performed. Table 1 is the calculated variance between each label point.

Table 1- Legend % Variance on the Graph

% variance between B & C	31.78%
% variance between D & E	49.09%
% variance between F & G	24.18%
% variance between H & I	25.99%
% variance between J & K	34.41%

Each drop represents a parts write-off that were used and not in inventory, obsolete/expired, or a loss due to an absence of the part at the time of reconciliation. The authors believe if a parts designated position was in place, these drops would be less pronounced and the relative value of inventory between inventory counts would be lower.

C. Wasted Hours per Tech Searching for Parts

Wasted hours per tech searching for parts is difficult to obtain as the CMMS doesn't track this and departments chalk it up to overhead. A tick sheet was created to log time searching for parts for a few technologists for a week. WOs with parts were recorded including time to source, order, and receive the parts.

The sample size was small due to time constraints. The average time calculated from the tick sheets for overhead was 45 mins per WO. Equation (1) shows the formula used to determine the total minutes accounted as overtime.

$$\frac{WO}{Year} \times \% \text{ of WO with Parts} \times \frac{45 \text{ mins}}{WO} = \text{Total Mins Overhead (1)}$$

$$CHEO = \frac{5,250}{Year} \times 53.5\% \times \frac{45 \text{ mins}}{WO} = 126,315 \text{ mins}$$

$$Regional = \frac{7,150}{Year} \times 13.7\% \times \frac{45 \text{ mins}}{WO} = 43,020 \text{ mins}$$

Therefore, roughly 169,335 mins/year (2,822 hours/year) can be attributed to overhead. Assuming 1,950 hours/year is equivalent to 1 FTE, this represents 1.44 FTE which would be directly attributed to a full-time parts designated person. This time could be billed to clients as a standard parts fee to cover this position.

D. Ontario Broader Public Sector (BPS) Procurement Directive

Ontario hospitals must follow the BPS Directive, which outlines the responsibilities of organizations throughout each stage of the procurement process. The directive states that organizations must segregate at least 3 of the 5 functional procurement roles: requisition, budgeting, commitment, receipt, and payment [12]. The use of a parts designated

person would ensure that these functional roles are distinctly separated.

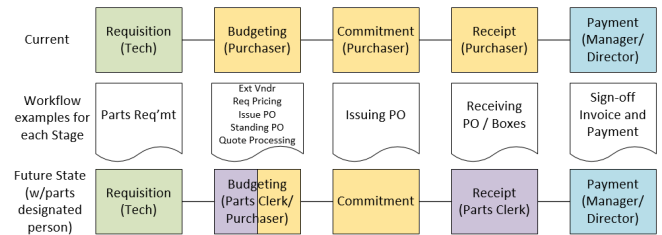


Fig. 2. Typical Parts Order Workflow Current and Future State

V. OPTIONS

The team determined that there were four plausible summary options:

A. Status Quo

Status quo would perpetuate: no ownership for procedure and policies, no nomenclature, no parts analysis, and no key inventory metrics. This option will continue uncoordinated ordering, and organization of the parts inventory system wasting time finding parts. The department growth and client satisfaction will remain unaddressed.

B. Outsource Parts Inventory to Procurement Department

Use existing procurement staff to order and receive parts only. In this option, there is no inventory control or management. The procurement group are unwilling to adapt a dynamic process for the CE program or warehouse the numerous parts required. To function effectively, the parts inventory must reside in the CMMS linked to WOs. Additional costs would be incurred to link the Purchasing system and the CMMS. This option would not save time or money for CE. Lastly, the procurement system does not operate outside of CHEO, rendering difficulties for our regional program.

C. Provide a Parts and Assets Designated Position

A parts designated position recognizes a CE specific role within a regional program responsible for parts nomenclature, policies, and procedures, organizing, ordering, and sourcing CE parts. Creation of the role will remove waste, such as: limiting parts variance, reducing inventory, reducing idle time waiting for parts, and defects to reprocess incorrect parts orders. Parts oversight will provide enhanced metrics particularly for inventory control, throughput and, decision making. In addition, this position could assume additional responsibilities, such as managing testing

equipment, which is generally an often-overlooked area of CE departments.

D. 3-year Pilot Study

A 3-year pilot study could prove the concept and track the metrics to substantiate the business case with more data. This option would require at minimum a 1 year “start-up” period to develop benchmarks, write procedures and provide a 2 year ‘steady state’ trial period. *Option D* would enable fine tuning of the job responsibility and any clerical support requirements for the department.

VI. RECOMMENDATIONS

The final recommendation from the authors after rigorous analyses is to proceed with Option C. A parts designated position will allow the CE department and the regional hospitals to manage their parts and protect the value of the inventory on shelf, analyze the system of stocking levels, and perform market analysis. This role is not limited to parts management only, as the person will have a technical background requirement where test equipment will be managed, and the control of repairs and recertification of test equipment will be completed. Most importantly, the job experience for this position will allow the development and maintenance of a parts nomenclature system. Also, the elimination of wasted hours searching for parts for repair/corrective maintenance would suffice to support this position as discussed previously. Lastly, analysis of profits made on parts could be used to cover a portion of the salary of this position.

VII. CONCLUSIONS

Parts management status quo is insufficient for the current CE department at CHEO. As hospital medical equipment increases, so does the demand for eligible inventoried parts. Also, with the increase of CE staff comes a volume increase of WO and hence spare parts ordering. Our current model of technologists self-regulating the parts inventory is problematic and not sustainable. If the department is to continue to grow and flourish a parts designated person must be hired to alleviate the parts management challenges, coordinate test equipment, and perform market analysis, and reduce downtime to enhance patient care. We believe this would be a gold standard for the regional, national, and international CE community.

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CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

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