RAISING THE PROFILE OF CLINICAL ENGINEERING THROUGH EFFECTIVE TECHNOLOGY MANAGEMENT

Kim Greenwood[1], Marie-Ange Janvier[1], Y. Rachel Zhang[1], Gaëtanne Heggie[1] and Marjan Yazdanpanah[2]

[1]Children's Hospital of Eastern Ontario, [2]Groupe Vega C.B.I

INTRODUCTION

The growth of Clinical Engineering (CE) departments in the last twenty years has stalled within healthcare facilities despite the fact that the inventory of medical devices within all facilities has grown substantially during this interval even though Ontario hospitals now spend in excess of 300 million dollars per year on medical equipment [1]. One could attribute the phenomena to the increase in reliability of equipment but this factor only signifies part of the cause. For the most part it is the lack of visibility or department reporting structures within an organization that plays into this trend. Even though Clinical Engineering is still most often the first stop for clinicians with equipment problems, many senior healthcare executives do not have a complete grasp of the role of this service within a healthcare organization. The lack of organizational visibility of Clinical Engineering may be in part attributed to the fact that this important support service usually does not hold positions on key operational and strategic executive or advisory committees within many healthcare organizations. In many organizations CE's only role is only to maintain the organization's clinical equipment.

BACKGROUND

The developmental strategy employed by Clinical Engineering at the Children's Hospital of Eastern Ontario (CHEO) has reversed this trend at this facility. This trend reversal was accomplished in this case by taking on the role of management of health technology planning for the institution which has been discussed often in professional community circles but implemented infrequently to date [2]. Clinical Engineering has optimally positioned itself with the distinct role to manage the corporate healthcare assets, provide the technology planning resources to identify future needs and review of emergent health equipment technologies when necessary. Clinical Engineering has since 2001 coordinated the long range planning function for capital equipment at CHEO. Since taking on this role, CE has also been gradually assigned the management of annual corporate capital equipment procurement process and coordination of the ongoing implementation of new clinical equipment.

Prior to 2002 the clinical capital equipment committee was a subcommittee of the hospital's Medical Advisory Committee (MAC). This committee consisted of the medical chiefs and a few members from senior management. It did not include representation from Facilities, Clinical Engineering or Information Services until 2005. Annually, there was a call for new requests and clinicians were asked to rank requests and to submit requirements within the three categories of 1, 2, or 1A. This loosely translated into high priority, moderate priority or a device that may fail and require immediate replacement within the next fiscal year. These requests were compiled into a list which was reviewed by the committee and the submitted requests were either even given approval or refused. There was no clear equipment replacement plan developed for the hospital, many obsolete medical devices remained in service for many years contrary to industry trends [3]. As a result there was no clear overall strategy for medical equipment replacement. More often only the high visibility diagnostic or surgical devices were prioritized and many of the less glamorous common use devices remained in service much longer than recommended by the original equipment manufacturer. Since there was no immediate or long range plan developed the hospital saw a consistent stream of emergency equipment replacements during the course of each fiscal year. This repetitive phenomenon strained the capital equipment budget and on a number of occasions forced the delay of major capital

equipment projects as a result of the unpredictable number of emergency equipment replacements. The clinicians became quite skeptical of the hospital's executive to mitigate this continuing problem.

The overall age of the clinical equipment continued to rise as is shown in Table 3. In 2001, when it was announced that Biomedical Engineering would be working with an external Montreal based consultant, Groupe Vega CBI to develop a new long range clinical equipment plan and an action plan to successfully implement this plan it was met by clear skepticism by a large segment of the Clinical Capital Equipment (CCE) Committee. In spite of the prevailing mood, the Chief Financial Officer chose to proceed with the study.

METHODOLOGY

The fundamental methodology of the equipment plan had been developed and tested in several Quebec hospitals by Groupe Vega in the late 1990s. The first step in this process is to closely examine the corporate long range plan. New programs and services would need to be identified and equipment requirements of these new activities would be defined. Next, a detailed inventory of all of the hospital's clinical capital equipment must be developed. Once these two tasks are completed, enough background information will have been compiled to conduct comprehensive interviews with all clinical stakeholder groups within the organization to solicit their input. Once the stake holder information has been collected work on the equipment plan can commence.

The key components of this long range plan are developed and include (1) A theoretical replacement plan, (2) An emerging technology plan and (3) A fleet equipment plan.

Theoretical Replacement Plan

The theoretical replacement plan takes the existing clinical equipment inventory, classifies the inventory by device type and assigns an estimated life expectancy for each one of these categories based on either established benchmarks or facility past experience. During the last three long range plans completed at CHEO, we used the "Estimated Useful Lives of Depreciable Hospital Assets" published periodically by the American Hospital Association as a starting point and modified the life expectancy data based on our own documented experience [4]. This tactic has worked well in our past plans. Once you are satisfied with your life expectancy table, each single device in the inventory is assigned a life expectancy value based on the category they fell in. The actual age of the device is subtracted from that value to give the remaining theoretical life expectancy. The remaining life expectancy values determined for each device can then be sorted by year of estimated replacement. This then gives you the theoretical replacement list for each of the next five years. These results are summarized and presented to each Clinical Program Directors. Table 1 gives an example of a few items for the Ambulatory Care program for year 4 of the plan.

Table 1: Example of the items in the theoretical replacement plan for Ambulatory Care for Year 4.

Depart-ment	Descrip-tion	Qty	Cost/ unit	Total Replace-ment Cost	Fleet?
Clinic 6	Table, Examina-tion	4	2.5k	10k	Yes
Urodyna mics	Scanner, Ultrasonic, Bladder	1	15k	15k	No

Emerging Technology Plan

A review of emerging clinical technologies is taken along with the clinical input collected during the stakeholder interviews. The corporate long range plan of the organization is then reviewed and technology forecast is developed for each clinical program. A technology priority ranking system should be employed to evaluate each of the identified new technologies in a fair and equitable manner. The categories for the criteria that determine the final score ranking each technology request would be predesigned gaining input from the organization's leadership. After each request is ranked and a cost analysis is performed, a five year prioritized list of new clinical technologies can be completed.

Fleet Equipment Plan

Fleet equipment is the classification of like equipment into groups to better manage their use, maintenance, standardization and replacement. This system of classification was originally developed many years ago by the U.S. Forestry Service to manage their large diverse inventory of equipment [5]. Effective fleet equipment management encourages standardization of like equipment which decreases operating, capital acquisition and maintenance costs, and reduces the risk of operator error which in turn improves patient safety indirectly. This strategy is most effective when used on larger groupings of equipment so in the healthcare setting it would be best applied to items such as stretchers, beds, physiological monitors, infusion devices, ventilators and defibrillators to name a few examples. Fleet items are shown in the example of the theoretical replacement plan (Table 1). These fleet items are then grouped and reviewed. The development of a fleet replacement equipment plan can be started prioritizing replacement based on the average age and the diversity of each like fleet equipment grouping.

Long Range Plan

Next, the three components can be integrated into a cohesive long range plan for the organization. The initial plan took about 500 hours over 4 to 5 months to complete. The next two planning exercises required the same resource commitments as the first plan did. This plan must also layout the financial requirements necessary to meet all of the defined objectives. Once this plan is finalized and it receives the endorsement of the organization's leadership next comes the most important step to making this plan successful. Clinical Engineering must become the internal champion of this plan for it to be successful. It is important for the champion to routinely lobby internal stakeholders on the benefits of this plan and its eventual positive effect on patient care. Every year the plan is reviewed by clinical program directors and CE to help in the upcoming fiscal year planning.

To validate this approach that clinical technology management does in fact result in measurable positive outcomes, data from the previous three CHEO five year clinical capital equipment plans were collected and analyzed.

RESULTS

Table 2 compares the average actual spend on clinical equipment with the recommended spend from the 2001, 2006 and 2011 long range plans.

Table 3 shows a summary of the age analysis performed for the previous three 5-year plans.

Table 2: Actual Mean Budget against plan recommendations.

	1997-2001	2002-2006	2007-2011	2012-2016
Avg. Annual CCE Budget	$2.4 M	$3.2 M	$5.0 M	NA
Plan Recommended Spend per year	NA	$3.0 M	$4.0 M	$5.0 M

Table 3: Age Analysis during the past three 5-year plans.

	2001	2006	2011
Avg. Age (StdDev) (yrs)	6.3 (5.39)	8.05 (3.96)	5.05 (5.67)
Avg. Remaining Life Exp. (StdDev) (yrs)	3.5 (5.6)	1.46 (5.69)	5.02 (5.6)

CONCLUSION

Developing in-house CE expertise that will develop, implement and update the facility long range health technology plans with input of clinical stakeholders allows the plan to become a vital tool, enabling the facility to keep its capital equipment current, and keep clinician acceptance high by maintaining a fair and methodical process. More recent informal surveys of key clinical stakeholders such as the Laboratories or Diagnostic Imaging continue to reinforce the high level of acceptance of this planning process to date.

Since CHEO first implemented this strategic approach, the evidence is quite clear. CHEO has made its clinical environment safer through the use of planning tools such as fleet management, equipment standardization and a balanced request scoring system while keeping within its long range capital equipment

budgetary limits. The average age of clinical equipment has dropped substantially to just over five years as of the 2011 plan.

Another outcome that has resulted from the implementation of three successive long range capital equipment plans is that the annual contingency fund expense for clinical capital equipment no longer absorbs between fifteen and twenty-five percent of the overall CE budget. It has now been fixed at the relatively small amount of five percent of the overall budget and this threshold has only been reached in one out of the last five fiscal years. This approach clearly allows more freedom to develop and implement a successful CE plan by freeing more of scarce available funding to utilize in planned equipment acquisitions instead of the emergency replacement of obsolete but essential medical devices. It also allows having a more comprehensive vision and a long term plan for future technological replacement / additions in line with the hospital strategies and the new technological trends.

REFERENCES

[1] "CAHO Capital Equipment Group Purchasing Initiative", The Council of Academic Hospitals of Ontario, 2008.

[2] C.E.McCullough,"Biomedical Engineering Involvement in Equipment Selection and Planning", Journal of Clinical Engineering, July/September 2009, pp.152-154.

[3] A. Dreiss, "When Does Medical Equipment Need to be Replaced", Journal of Clinical Engineering, April/June 2008, pp. 78-81.

[4] AHA Health Data Group,"Estimated Useful Lives of Depreciable Hospital Assets", American Hospital Association, ISBN 13: 978-1-55648-3SB-S, Revised Edition, 2008.

[5] C. W. Hendee, "Organization and Management in the Forest Service", U.S. Government Printing Office, pg. 76, 1962.