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“The management cost of Medical Devices and Clinical Engineering
Services”

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Scope

The subject of a thesis for Master of Health Administration (MHA) at University of Oslo in 2010 is «Management of medical devices. An analysis of capital depreciation costs and management costs of medical devices» (in Norwegian) (1). The aim of the thesis is to find the answers to two research questions: 1. To which extent does the national governmental owner's financing of the capital depreciation costs, and the regional health enterprises' division of this cash flow between real estate and medical equipment allow investment/reinvestment in medical devices? 2. What are the management costs of medical devices and clinical engineering services measured in the period 2002 – 2008? The subject of *this* paper is the answer to research question 2.

Background

As clinical medicine has become increasingly dependent on more sophisticated technologies and the complex equipment associated with it, the discipline of clinical engineering (CE) has evolved within hospitals as CE activities or CE Departments (general term). The equipment used in the diagnosis and treatment of patients in a hospital is denominated as «medical devices» (MD), in Norwegian «medisinsk-teknisk utstyr» (MTU). The European union has decided a Medical devices directive (MDD, active since June 14, 1998 (2), which governs and regulates the activities concerning sales of medical devices (equipment), testing and validation and a reporting system for accidents and incidents in connection to the medical devices (a vigilance system). Norwegian authorities have made amendments to the MDD, requiring that all service activities and safety checks on medical devices used on patients shall be recorded and documented in an inventory system, and that sufficient education in the use of the equipment is provided. The Norwegian authorities on security and electrical safety perform regular audits on the Norwegian hospitals CEDs and management systems, demanding

updated inventory systems. Thus, the data provided by the Norwegian MD inventory systems is considered to be a generally valid representation of the equipment situation.

A basic question in the management of a population of medical devices: is it a general correlation between the MD population and the cost of managing and running all necessary activities (Clinical engineering services) – what are the estimated costs of managing a population of for instance an accumulated procurement cost of 1 billion NOK?

Method

The data sets studied are the MD population of Rikshospitalet university hospital and the Regional health enterprise Helse Sør (South of Norway). Approx. 40.000 registered MD units with an accumulated procurement cost of approximately 3.4 billion NOK is included, as well as data on service provisions from the 7 CEDs in the same region. The CEDs within the region operate as separate entities, but work within a network group environment. The data represents a substantial part of the total Norwegian installed base of medical devices (25 % of an estimated total accumulated procurement cost of 13 billion NOK). The historic data sets were obtained when the group (Region South) performed repeated benchmarks for the cost of running the clinical engineering services.

The method for studying the management cost of medical devices and clinical engineering services, is to measure («benchmark») all service, engineering and running costs (including education, running the inventory system, and necessary basic research and development activities) expressed as a percentage of the accumulated equipment cost (accumulated historic cost). The result is presented as a simple management index – MI. The actual lifespan of medical devices are typically 4 – 12 years, and individual members of the equipment population will represent different procurement cost along the time axis. The index selected is as basic as possible, with no manipulation or price indexing on historic cost, capital depreciation etc. None individual costs or analyses were provided, and only groups were analysed.

The costs of running the CED services comprise wages for the employees involved in all processes incl. R&D, spareparts, service contracts with vendors, on-call service from vendors etc, i.e. all costs associated with owning, running, and keeping the MD population in a proper working order, and safe condition according to regulatory definitions.

The interest in the search for expression of a general management index is that it will provide a fast and simple tool for establishing a cost analysis of providing the Clinical Engineering Services (CES) within a hospital environment.

Results

Accumulated procurement cost is accumulated historic cost for the equipment (MD) population, with no kind of adjustment to inflation or other mathematical operations. CES is the sum of all internal and external (vendors) cost of all maintenance, service contracts, spare parts and internal wages to employees. When data is not available in the 2002-dataset, is this indicated with «-». (*). In the 2008-dataset approx. 70 % of total MD-population in Region South is included (Vestfold og Telemark lacking). Applying a linear correction for that 70 % of the population is reported, the estimated data is presented in the table below, marked with an *. Based on a total accumulated procurement (historic) cost of 3.5 billion NOK, every 0,1 % – point is equivalent to 3,5 million NOK.

	2002		2005		2008*	
Accumulated procurement cost of MD	2,62 bill NOK		3,134 bill NOK		2,543 bill NOK (*3,63 bill NOK)	
No MD in inventory system	-		39 536		32 138 (* 45 911)	
CED total servicecost	104,3 mill NOK		130,4 mill NOK		112,1 mill NOK (*160,4 mill)	
	Mean (%)	Deviation (%)	Mean (%)	Deviation (%)	Mean (%)	Deviation (%)
Management index (MI) ¹	<u>4,0</u>	3,5 – 4,9	<u>4,2</u>	3,3 – 4,7	<u>4,4</u>	4,1 – 5,5
MI Rikshospitalet	4,2		4,1		4,1	
MI <u>only maintenacne</u>	3,5	3,0 – 4,3	3,5	2,9 – 4,3	3,7	3,3 – 5,2
MI <u>only maintenance</u> Rikshospitalet	3,3		3,2		3,5	
Cost ratio internal maintenance CED of total servicecost (spareparts and employees involved in maintenance) %	-	-	37	-	42	-
Cost ratio vendor on call of total servicecost %	76	-	26	-	22	-
Cost ratio vendor servicecontract of total servicecost %		-	37	-	36	-

Discussion

Nationally and internationally there are many benchmark-references for the cost of general service providers. Several consulting and audit companies have databases for best practice or typical practice, which are used in their analysis of companies or processes. These are typically simple service activities or products, like answered telephone calls per time unit or cost per invoice. On the other hand, there are few reasonable benchmarks of complex service provisions, like clinical engineering services. The main issue is to find robust and logical definitions of which services or activities are contained within the cost. The inclusion and exclusion criteria have to be precise and adequately defined.

In the analysis prior to the fusion of the two hospitals Rikshospitalet og Det norske Radiumhospital (both former parts of recently merged Oslo university hospital) in 2004, performed by the international consulting company McKinsey, the company was not able to present international benchmark data on clinical engineering services. McKinsey company decided in the final report to use the same dataset as referred here from 2002 as the mean management index for clinical engineering services.

There are a few international studies and reports on establishing a management index of clinical engineering services which are commented here.

The Canadian researcher Monique Frize made a multicenter international survey published in 1990 on the cost of running CED services (in both «teaching hospitals» og «non-teaching hospitals») (3), also analyzed by Bronzino (4). The study was performed in cooperation with IFMBE, International Federation of Medical and Biological Engineering. The main conclusion of analysis of data sets from 122 responding hospitals around the world, was that the majority were spending 3 – 5 % of equipment cost on annual total services in connection with the equipment. There are some uncertainties in this report concerning costs, since it is referred to the equipments «replacement value», and there are no indications on how this is defined or calculated. Specifically, it is stated that in Nordic countries there are no university hospitals spending more than 3% and only 17 % spending less than 3 % (MI).

In 1999 the British NAO, National Audit Office, published a detailed analysis of procurement and management of medical devices in all British Trusts, based on datasets from 1996 – 97 (5). They concluded that the typical (mean value) of all maintenance processes with an MI-index of 4.0 %.

In 2004 the Scotch Audit Scotland published a similar survey as the British from 1999 (6). It was demonstrated a spreading MI between hospitals. Median Management index were 5.6 % with deviations from 2.7 % to 12.5 %.

The different results in the referred international data sets correlate very well to the result in the present study from Region South of Norway. Since the data sets were collected in different countries and time-lines, it is very probable that that the MI referred is a general expression of the cost of running clinical engineering services in a developed specialist health care. An effect of establishing this general MI, is that an increase of equipment population of 100 mill NOK causes a calculated mean increase of 4.4 mill NOK to run all the processes associated with the new equipment.

Conclusion

The results from this study in Region South of Norway – comprising approx. 25 % of all Norwegian medical equipment show that the management cost of medical devices and clinical engineering services, expressed as a percentage of the accumulated equipment cost, have increased in two steps of 0.2 % to 0.4 % in the period 2002 – 2008, to a mean index of 4.4 %. The measuring method and the results correlates well with the internationally published data referred.

Definitions

MD – Medical devices, according to EUs MDD – Medical Devices Directive – all specialized equipment used in the diagnosis and treatment of patients (excluding ICT and general building equipment)

CED – Clinical Engineering Department, the administrative and organizational unit responsible for managing the hospitals medical devices.

CES – Clinical Engineering Services

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