

Maintenance in Hospitals of Saudi Arabia

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ABSTRACT. This paper is an attempt to audit the existing maintenance situation in government and private hospitals in the Kingdom of Saudi Arabia. The results, based on a sample of hospitals from Jeddah and Taif cities, give some insights into the overall working of hospitals and the comparative working between government and private hospitals. On the basis of all hospitals combined it is found that generally maintenance staff have formal vocational qualifications and are provided training facilities. The system of working includes both preventive and breakdown maintenance and is fairly well developed. Maintenance facilities are of standard nature and various maintenance reports are prepared. Most of the hospitals have maintenance planning and control offices. The more serious problems faced are nonavailability of spares, shortage of technical manpower and lack of funds. On a comparative basis, government hospitals employ more maintenance staff, have better training facilities, do more preventive maintenance, have a more organized system of working and prepare more maintenance reports.

1. Introduction

Over the passage of time, maintenance function has continuously gone up in terms of its importance. It is no more considered a necessary evil^[1], but in fact a source of profit^[2]. It is recognized that since poor maintenance practices lead to more frequent breakdowns, which may cause anything from inconvenience to catastrophe, maintenance has to be more reliable, more efficient, and more cost effective^[3-6]. This has led to the application of systems approach to maintenance and the development of the Maintenance Management Systems (MMS)^[7-8]. It is recognized that the heart of such a system is control and, for it to be effective, planning is a pre-requisite^[9].

Maintenance is an important function in the Kingdom of Saudi Arabia because of the fast development of highly capital-intensive infrastructures. In order to get maximum economic life out of these assets it is necessary that they be systematically and properly maintained. The planners of the Kingdom have not been oblivious of this fact and have all along realized the importance of sound maintenance practices^[10].

The above requires occasional audits of existing maintenance practices in different sectors of the Kingdom. This paper reports the results of one such attempt in the hospitals of the Kingdom. Another similar attempt is reported elsewhere^[11].

Like any other service, maintenance is important to the success of any clinical engineering program^[12]. One such comprehensive maintenance program is reported by Ben-Zevi^[13]. Quite often such programs are being computerized^[14, 15]. These programs are generally very elaborately designed and include an effective set of procedures, sound record keeping, efficient reporting, and detailed costing aspects. Thus, maintenance has to be recognized as an important function of hospital management^[16].

In the study reported here a detailed questionnaire was developed to find out the current maintenance practices from various points of view. The questionnaire was circulated amongst different hospitals of Jeddah and Taif. The responses were analyzed through a computer program and are reported here. Section 2 describes the development of the questionnaire and the method adopted for data collection. Section 3 presents the results and discusses them. Section 4 reports the overall conclusions and recommendations.

2. Development of the Questionnaire and Data Collection

A survey is a method of collecting variety of information from people and/or organizations^[17]. This may be done through interviews and/or questionnaires and helps policy makers, researchers, planners, etc.

Development of a proper questionnaire is still more of an art than science and depends on the purpose of survey, type of response desired, characteristics of respondents and the method of distribution. The length and format of the questionnaire affect the return rate, the validity of responses and the overall effectiveness of the questionnaire. The questions may be of open or closed form.

The questionnaire developed for this research consisted of four sections. Those are: General Information, In-house Maintenance, Contracted Maintenance, and Future Needs. The first part comprised ten questions soliciting basic information about the respondents such as the date of establishment, type of employees, ownership, etc. The second part comprised forty eight questions and was subdivided into four sub-sections. Those are: General, Preventive Maintenance (PM), Breakdown Maintenance (BD) and System of Working. Starting with general questions on maintenance, it goes through the PM and BD practices and ends with questions relating to costing system, reporting system, planning system, etc. The third part comprised eleven questions pertaining to contractor's responsibility, kinds of work, problems faced with the contractor, etc. The fourth part comprised seven questions about the problems faced and the future needs as envisioned by the managers in charge.

The questionnaire was developed both in English and Arabic. It was distributed to twenty three different hospitals of Jeddah and Taif. In a number of cases interviews were conducted with the maintenance supervisors of the hospitals to help them fill up the questionnaire. In all twenty responses were received – eighteen from Jeddah, and two from Taif. Of these, the split between the government and the private hospitals was even.

3. Analysis of the Results and Their Discussion

The data were stored and analyzed using dBASE IV and Lotus 123 software. The analysis and discussion of results is presented in two parts – the first part refers to the combined results of all the hospitals and the second part compares the results of the government vis-a-vis private hospitals. Also, only significant results are being reported here.

3.1 Combined Results

Table 1 shows the date of establishment of the hospitals included in the sample. It reveals that most of the hospitals were set up in the 1975-1984G period, which corresponds to the oil boom period of the development of the Kingdom of Saudi Arabia. The average percentage ratio of the maintenance staff of the total staff is 17.35%, which is considered a high percentage and shows that considerable attention is being given to the maintenance function. However, the average percentage ratio of Saudi maintenance staff to the total maintenance staff is only 18.66%, which shows that there is a good potential for Saudization in this category. On an average, 60% of maintenance work is done in house and only 40% is contracted. These results are interesting because it was expected that due to the specialized nature of work, hospitals would be mostly contracting their maintenance work. However, the observed trend indicates that hospitals are moving towards self reliance in the area of maintenance.

TABLE 1. Date of establishment of the hospitals.

Year (G)	1955-1959	1960-1964	1965-1969	1970-1974	1975-1979	1980-1984	1985-1990
Number of hospitals	2	0	1	0	7	9	1

Maintenance practices of the hospitals show a positive sign. Of the responding hospitals 40% have 80-100% of their maintenance staff with vocational qualifications. Fifty percent of the hospitals provide training to their maintenance staff, mostly in house. Eighty five percent of hospitals carry out PM work, with sixty five percent having time standards and almost all using a PM work order. Seventy five percent of hospitals maintain details of BD times and, again, all use a BD work order. However, the usage of computers is rather limited as only 30% of hospitals are making use of computers in maintenance. Regarding the system of working, the response figures are given in Table 2. These figures are very encouraging and show that the majority of hospitals have a well developed system of working.

The necessary information about the preparation of reports is given in Table 3. This shows that list of equipment awaiting repairs is the most often prepared report. On the other hand, cost reports are not given much significance.

Another good aspect of the system of working is that 85% of hospitals have Maintenance Planning and Control Offices and Maintenance Stores, 95% of hospitals have their own maintenance workshops and 100% of hospitals provide hand tools to their maintenance workers.

TABLE 2. System of working.

Nature of work	Percentage of hospitals responding 'Yes'
Record man-hours spent by maintenance technicians	65
Record material used	90
Have a costing system	75
Have inspection for maintenance work	60
Have a history card for each piece of equipment	65
Carry out regular analysis of maintenance work	75

TABLE 3. Percentage of hospitals preparing maintenance reports.

Kind of report	Percentage of hospitals
List of equipment awaiting repairs	85
List of equipment with high maintenance cost	65
List of equipment repaired in a period	65
List of equipment with frequent breakdowns	60
Actual man-hours spent on maintenance	60
Efficiency reports	60
Reports on BD costs	45
Reports on PM costs	30
Downtime for equipment in a period	15

With respect to the extent of work provided by contractors, the study shows that in 13 cases they provide personnel, in 10 stores and in 9 facilities. Furthermore, the contractors do both PM and BD work. The contractors are hired mainly because of the special nature of work (95%). Even though all the hospitals intend to continue with the contractors, they mostly complained about the delayed response by the contractors.

Regarding the future needs, 95% of the hospitals studied expect the maintenance work to increase, 60% because of the equipment getting old and 40% because of increased work. Sixty five percent expect this increased work to be carried out in house.

Finally, Table 4 shows the percentage of hospitals facing different kinds of maintenance problems. This shows that delays in obtaining spare parts and shortage of technical manpower are the two major problems.

3.2 Government vis-a-vis Private Hospitals

As mentioned earlier, amongst the respondents 10 were government hospitals and 10 were private. Some significant similarities and differences between these two groups are mentioned below.

TABLE 4. Percentage of hospitals facing different maintenance problems.

Nature of problem	Percentage of hospitals
Delays in obtaining spare parts	70
Shortage of technical manpower	35
Lack of training facilities	25
Lack of funds	25
Non standard spare parts	15
Not enough Saudi technicians	10
Poor communication amongst staff	10

Both in the government and private sectors, a majority (8 out of 10 each) of the hospitals were established in the '75-'84 decade. Other similarities between the two groups are in terms of pattern of distribution of maintenance staff amongst different categories, percentage of hospitals providing training to their maintenance staff (50% each), and percentage of hospitals maintaining details of BD times (75% each). However, the similarities end here. The differences on the other hand are numerous as described below.

The percentage ratio of maintenance staff to the total staff is far more in government hospitals (26%) than in private hospitals (9%). Also, the percentage ratio of Saudi maintenance work with much less staff and also have a very low level of Saudization. Also, there is more centralization of work in government hospitals (60%) than in private hospitals (30%).

Private hospitals do more in-house maintenance (70%) compared to government hospitals (50%) reflecting the higher level of independence for the private hospitals as well as their higher cost consciousness.

In terms of maintenance practices, government hospitals, surprisingly, seem to be much ahead of their private counterparts. Amongst the government hospitals 50% have 80-100% of their maintenance technicians with vocational qualifications whereas in the private group the percentage is 30. All government hospitals carry out PM while only 70% private hospitals do the same. As indicated in Table 5, the system of working is much better in the government hospitals than in the private hospitals, with only one exception. Also, more of the government hospitals prepare maintenance reports than private hospitals as shown in Table 6.

Finally, government hospitals seem to have more maintenance problems than private hospitals as indicated in Table 7. Government hospitals are more conscious of these problems and more candid in discussing them.

Conclusion

In order to assess the existing maintenance practices, a survey was carried out in twenty hospitals of Jeddah and Taif cities. These hospitals were equally divided be-

tween the government and private sectors. The results were analyzed through computer software. On a combined basis, the results present an encouraging picture of the maintenance practices. The proportion of maintenance staff is high, the workers are provided training facilities, they have vocational qualifications, the system of working includes both PM and BD and is fairly well developed, the facilities are mostly provided, various maintenance reports are prepared, and Maintenance Planning and Control Offices are there in most of the hospitals. The more serious problems faced are regarding non availability of spares, shortages of technical manpower and lack of funds.

Table 5. Comparative system of working.

Nature of work	Percentage of hospitals responding 'Yes'	
	Government	Private
Record man-hours spent by maintenance technicians	80	50
Record material used	100	80
Have a costing system	90	60
Have inspectors for maintenance work	70	50
Carry out regular analysis of maintenance	80	70
Have a history card for each piece of equipment	60	70

TABLE 6. Comparative percentage of hospitals preparing maintenance reports.

Kind of report	Percentage of hospitals	
	Government	Private
List of equipment awaiting repairs	100	70
List of equipment repaired in a period	70	60
List of equipment with frequent BD	80	40
Efficiency reports	80	40
Reports on PM cost	40	20

TABLE 7. Comparative percentage of hospitals facing different maintenance problems.

Nature of problem	Percentage of hospitals	
	Government	Private
Lack of funds	40	10
Shortage of technical manpower	50	20
Lack of training facilities	40	10
Non standard spare parts	20	10

On a comparative basis, it seems that the government hospitals pay more attention to maintenance than the private hospitals. The former have more maintenance staff, they are better trained, they do more PM. Their system of working is more organized, and they prepare more maintenance reports. It seems that, perhaps due to cost saving reasons, private hospitals are cutting corners with maintenance work even though such a policy may prove costly in the long run.

This research has provided an interesting insight into the maintenance practices of one type of service industry. Similar studies for other sectors are recommended to get an overall picture of the maintenance situation in various sectors of the economy.

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References

- [1] **Hartman, E.H.** (Ed.), Maintenance Productivity: Why it is low and how to improve it, in: *Maintenance Management*, Industrial Engineering and Management Press, Norcross, Georgia, U.S.A. (1987).
- [2] **Bleuel, W.H.**, Maintenance is not an expense – it is a new source of profit, *Plant Engineering*, Oct. (1981).
- [3] **Morrow, L.C.**, *Maintenance Engineering Handbook*, McGraw Hill Book Co., New York, U.S.A. (1966).
- [4] **Kelly, M.** and **Harris, M.J.**, *Management of Industrial Maintenance*, Newness Buttersworth, London, U.K. (1979).
- [5] **Blanchard, B.S.** and **Lowery, E.D.**, *Maintainability: Principles and Practice*, McGraw Hill Book Co., New York, U.S.A. (1969).
- [6] **Gordon, F.**, *Maintenance Engineering: Organization and Management*, John Wiley and Sons, New York, U.S.A. (1973).
- [7] **Niebel, B.W.**, *Engineering Maintenance Management*, Marcel Dekker Inc., New York, U.S.A. (1985).
- [8] **Finely, H.F.**, *Modern Maintenance Management Systems*, The Howard Finely Corporation, Houston, Texas, U.S.A. (1981).
- [9] **Blanchard, B.S.** and **Febrycky, W.J.**, *Systems Engineering and Analysis*, Prentice-Hall, Englewood Cliffs, N.J., U.S.A. (1981).
- [10] A Watchword for Maintenance, Arab News, 19th October (1986).
- [11] **Ikhwan, M.H.** and **Burney, F.A.**, Maintenance in Saudi Arabia, *International Journal of Production and Operations Management*, **14**(7): 70-80 (1994).
- [12] **Webster, J.G.** and **Cook, A.M.**, *Clinical Engineering: Principles and Practices*, Prentice-Hall, Englewood Cliffs, N.J., U.S.A. (1979).
- [13] **Ben-Zevi, S.**, Preventive Maintenance Program, Final Report, American Society of Hospital Engineering (1975).
- [14] **Barnard, J.Q.**, Computerized Record of Maintenance Activities, *Hospitals TAHA*, **48** 102 (1974).
- [15] **DesRoches, H.B.**, Computer Monitoring of Preventive Maintenance, *Hospitals*, TAHA, **49**: 86-92, (1975).
- [16] **Wieland, G.F.** (Editor), *Improving Health Care Management*, Health Administration Press, Ann Arbor, Michigan (1981).
- [17] **Fink, A.** and **Kosecoff, J.**, *How to Conduct Surveys*, Sage Publications, London, U.K. (1985).

الصيانة في مستشفيات المملكة العربية السعودية

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المستخلص . تقدم هذه الورقة عرضاً لأوضاع الصيانة في المستشفيات بالمملكة العربية السعودية وذلك بدراسة عينة من المستشفيات الخاصة والحكومية في كل من مدينتي جدة والطائف . لقد أظهرت الدراسة أن هذه المستشفيات يتوفر بها فنيون مؤهلون كما توفر لهم تدريباً مناسباً . وتشمل الصيانة كلاً من الصيانة الوقائية وصيانة الأعطال . ويوجد في أغلب المستشفيات مكتب للتخطيط والسيطرة ، وأبرز المشاكل التي تواجه الصيانة في المستشفيات تتمثل في عدم توفر قطع الغيار ونقص الكوادر الفنية ونقص الموارد . وبصدد المقارنة بين المستشفيات الحكومية والأهلية أظهرت الدراسة أن المستشفيات الحكومية توظف عدداً أكبر من الفنيين لقسم الصيانة وهم في الغالب أكثر تدريباً من نظرائهم في القطاع الخاص . كما تقوم المستشفيات الحكومية بقسط أكبر من الصيانة الوقائية ، وتصدر عدداً أكبر من تقارير الأداء .