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A Study of the Utilization of Outpatient Department in a Saudi General Public Hospital

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Abstract. Riyadh Armed Forces Hospital (RAFH), one of the largest in Saudi Arabia, has to cope with an increasing number of patients in a country where the resources are no longer as abundant as they used to be. The nearest available appointment for most specialties in Outpatient Department (OPD) exceeds thirty weeks and even one year in some of them. It is commonly believed that expansion is not only indispensable but also overdue. This paper, which is concerned with the study of the "overload problem" of outpatient department, came to the interesting conclusion that the capacity is indeed significantly under-utilized. An average of about 30% of the time allocated to clinics is being wasted by doctors arriving late and/or checking out early. Further inquiry revealed that the appointment system is actually booking "too few" patients to keep the doctors busy.

Introduction

Riyadh Armed Forces Hospital (RAFH) is one of thirteen military hospitals established by the Medical Services Department of the Ministry of Defence and Aviation, in the Kingdom of Saudi Arabia, to provide a high standard of health and medical care for military personnel, the Ministry of Defence and Aviation staff, and medically selected referrals. The hospital is being provided with the latest technology to support the operations of numerous associated departments. It accommodates Primary Care for more than 600,000 patients per year, Secondary Care with a workload exceeding 300,000 visits per year, and Tertiary Care with a capacity of 1000 beds and an occupancy rate of 92% [1].

Over the last two years, the hospital eligible population has exceeded 630,000 patients with an ever-increasing demand rate resulting in extended waiting lists and continuous insisting calls for urgent expansion. However, the current economic circumstances may not be favorable for costly expenses unless they prove to be really inevitable. The Saudi economy is struggling in difficulty due to the slump in oil prices,

which is not expected to recover any time soon [2,3]. This has impacted severely causing a budget deficit in a country mainly dependent on oil revenue (accounting for 75% of the budget), thus forcing the government to restructure operations and increase privatization [2,4,5]. The effect on health care has induced the approval of a mandatory health insurance law by the Council of Governance [6] and has pressurized many health care providers to control spending and efficiently utilize their services.

The objective of the current study, which is concerned only with secondary care, is to investigate the necessity of expansion for Outpatient Department (OPD), knowing that such an expansion is necessary only if the current capacity is being efficiently and maximally utilized. OPD is one of the largest departments in the hospital serving nearly 70 clinical specialities with a total number of more than 500 clinical sessions per week (Appendix 1). It is also one of the busiest departments, as appointment waiting times may exceed 60 weeks.

The rest of the paper is divided into five sections. The first one is devoted to a review of related literature. The second section lays out the research hypotheses on the current utilization of the OPD capacity; such a utilization was approached from two different perspectives: the time initially allocated to the clinics was first compared to the time actually utilized, and second, to the scheduled time as per the booking rule (which we will refer to as the booked time). The third section describes the research methods while the fourth section discusses the results. We conclude the paper with some comments and suggestions.

Literature Review

Utilization, or utilization review, is one of the terms commonly used in health care management. It has been defined as "the examination and evaluation of the efficiency and appropriateness of any health care service" [7 p.535 and p.607]. Efficiency is referred to as a "ratio between resources allocated to accomplish a given task or activity and the total task or activity to be accomplished" [8 p.31]. It is also expressed as a ratio of units of output per one unit of input, or a comparison of productivity with capital resources invested [9 p.581]. Concern about utilization has been triggered by the ever-increase of health care services. This has been stimulated by several factors including technology advances, aging population, physician education and operation inefficiency [10 pp.8-9].

A number of concepts on efficient utilization of resources have been developed and adjusted in accordance with the service set up. Many of these concepts have been directed towards OPD services, including its operation and patient workload management. Reducing workload within the OPD has been investigated through means of accelerating patient discharge from the system. One study recommended that new and follow-up patients be seen by consultants instead of junior physicians [11] while another study concluded that saving resources could be achieved if new patients were seen by

junior doctors and follow-ups by consultants [12]. The latter study reported a reduction of the ratio of the new to follow-up patients from 1:1.6 to 1:1.2 in a six year period [12]. The same conclusion was supported by a study of urology outpatient conducted over a 28-year period [13] and by a study of general medicine clinic workload management [14].

Patient circulation within the OPD and its impact on supporting and tertiary service utilization could present a comprehensive view of critical factors and solutions to many operation inefficiencies. In this context, [15] reported the impact of 100 OPD referred urology patients on the supporting services and within the system leading to the establishment of patient workload measurement at various stages of their treatment. The study yielded a significant contribution to planning patient flow against resources requirement.

Some studies support follow-up monitoring of patients applied by the general practitioners instead of keeping patients at OPD system[16]. Others suggest that improvement of efficiency be achieved by opting general practitioners to refer patients to minor operations directly rather than through the surgery clinics [17]. Other works were concerned with efficient patient referral into the OPD system. One study revealed that inappropriate referrals by the general practitioners to an orthopedic clinic accounted for a total of 42.7% of the total workload [18], whereas another study reported a percentage of 27% among referral to urology clinic [19].

Inefficiency could lend itself to clinic management including poor attendance of patients and the applied appointment system. The amount of time patients have to waste in the consultants' clinics, waiting to be seen, is significantly related to the patients tendency to break appointments [20] and to their late arrival to the clinic [21]. Appointment scheduling on the basis of "first come, first served," entices the clinics to start late while patients are encouraged to arrive early, hence increasing their waiting time. In such a set-up it is common practice to overbook the clinic, assuming non-attendance of some patients, which sometimes results in undermining the clinic finishing time [22]. Efficiency through the consultant's predetermined choice of the time needed for each follow-up patient has reduced clinic waiting time from 39.6 to 9.5 minutes over a six month period [23], with an improvement of the clinic operating time from 187 to 160 minutes. Similar results have been achieved by rheumatology outpatient study [24].

Hypotheses

As there is a consensus on the necessity of expansion of the OPD at RAFH, it is hypothesized that the current capacity of the department is fully utilized.

Our first two hypotheses presume that during clinic operation, the actual time utilized by a clinic is equal to the time allocated in accordance to the predetermined clinic schedule:

Hypothesis 1: Time actually utilized by all OPD clinics is equal to 100% of the total time allocated to these clinics.

Hypothesis 2: Time actually utilized by each of the clinics of the major specialties is equal to 100% of the time allocated to these clinics.

Moreover, booking patients at any of the scheduled clinics is managed through a booking rule that determines the number of patients to be admitted during each clinical session. Our last two hypotheses presume that during clinic operation, the actual time utilized with a booked patient is equal to the time allocated in accordance with the predetermined clinic schedule:

Hypothesis 3: Booked time (for new and follow-up patients) by all OPD clinics is equal to the time allocated for these clinics.

Hypothesis 4: Booked time (for new and follow-up patients) by each of clinics of the major specialties is equal to the time allocated for these clinics.

The first and third hypotheses are concerned with the OPD as one entity while the other two hypotheses (2 and 4) concentrate on each of the major specialties. Major specialties are the ones having the largest numbers of clinics as explained in the study setting subsection.

Methodology

Study setting

The OPD of RAFH serves 69 specialties. However, building on Pereto concept [25 p.28] special attention had to be given to the most important ones. In RAFH (see Appendix 2), about 80% of OPD clinics capacity is being clinically covered by the specialties of surgery (33.08%), medicine (12.72%), dermatology (10.43%), cardiology (9.92%), neuroscience (7.63%), and urology (5.34%). These six specialties/ subspecialties are referred to as the "major specialties".

Specialty clinics at OPD carry out their activities on a session based system; a session refers to the time period allocated for a scheduled clinic. The morning session (Session 1) covers a time duration of 240 minutes (from 8.00 a.m. until noon). The afternoon session (Session 2) is allocated 180 minutes (from 1.00 p.m. to 4.00 p.m.). The less frequent partial morning sessions of a shorter time duration (60, 120, or 180 minutes) are arranged to satisfy the clinical requirement of newly established sub-specialties or to accommodate additional clinic allocation caused by an increased demand. Clinics are weekly scheduled among different specialties following a predetermined time (session type) and room designation (number of rooms utilized per each scheduled clinic), as shown in Appendix 3. The latter provides a detailed description of the schedule of one of the seven locations composing the hospital (Appendix 4). Accordinglye, the clinic activities are carried out by either one physician or a group of two to five physicians (team based). The time allocated

for each clinic scheduled is equal to the session time duration multiplied by the number of rooms utilized.

Study sample

The OPD clinic population is infinite as it consists of all clinic weeks formally conducted from the commencement of the hospital, in addition to those to be conducted in the future. A sample of four weeks (n = 4) of this population was identified for all clinics with the excepetion of obstetrics and gynecology (which were excluded because of data collection problems).

It is important to mention that the OPD clinic room schedule operationally provides a total of 11 clinic sessions per week (two sessions per five working days and one Thursday morning session). However, the majority of the clinics are being scheduled utilizing the sequence of 10 sessions available from Saturday to Wednesday. The Thursday morning sessions are being kept unutilized (with the exceptions of few specialties having scheduled clinic). Unutilized clinic sessions accounted for 16% of the total available sessions at OPD (1 minus 84%, as shown in Appendix 4). The majority of these sessions fall either on Thursday morning (a time undesirable by all specialties to schedule clinics) or are being constrained by the room design (e.g. Ophthalmology and ENT rooms). Those unutilized clinic sessions were excluded as well. Only accomplished clinic sessions data were considered for every week of the study (total of four weeks). Variation among weeks was caused by those clinics either being cancelled or eliminated due to incompleteness.

During the four-week period of the study, 696 clinics were scheduled (Appendix 5). However, only 590 (i.e. 84.79%) clinic data forms were completed and validated for analysis. Because some of OPD clinics were difficult to isolate individually, as they share resources (number of rooms, or one booking list) with other similar clinics, their amalgamation was therefore necessary. Such consideration and action have further reduced the total clinics accepted and considered for analysis from 590 to 522, i.e. another 11.53% reduction (Appendix 5).

Study technique

As the study was intended to focus on the utilization of Outpatient Departments in relation to the number of patients seen or bound to be seen, our unit of analysis combined the relationship between the clinic duration (actual time vs allocated time) and the number of patients seen (new and follow-ups) through scheduled operation. Capacity utilization was measured on two dimensions: the time utilized and the time booked; each as compared to the time allocated, for all OPD and for each of the major specialties. The time allocated for a clinic is the theoretical operating time of the clinic, i.e. the time corresponding to the planned working hours of that clinic as decided by RAFH management. The time utilized is the length of the period elapsing from the opening of the clinic until its closure; it corresponds to the actual working hours (actual operating time) of the clinic. The booked time is the time needed to treat all booked patients.

Data collection

Study data were collected from all OPD clinics with the exception of obstetrics and gynecology. The exclusion of these two clinics was imposed by the Director of Nursing because of the envisaged difficulty in completing the data collection form by the nurses due to the overcrowdedness and the numerous activities assigned which limit additional engagement (i.e., form completion). Such exclusion accounts for 12% of the total OPD clinics (Appendix 4).

Based on a combination of convenience, judgement and quota, data collection was conducted over a four-week period from Saturday 24th of October 1998 to Thursday 19th of November 1998. The selected period was judged to be most suitable as it does come at a time free from official holidays, periods of school examination or sporting events.

Primary data on clinic utilization includes information on the clinic starting time (referring to the first patient calling time), the clinic ending time (referring to the last patient leaving time), and the number of patients seen during the clinic operating time (new, follow-up and walk-in). In addition, further information was obtained using clinic lists secondary data which included the number of patients that should have been booked as per the booking rule, the number of patients that have actually been booked, the number of non attendees and the number of allocated rooms per such scheduled clinic.

As data have been collected by the OPD Floor Nurses (nurses assigned for each physician), the relevant form was prepared with the assistance of the Clinical Nursing Manager, thus ensuring suitability, responsiveness, and compliance of nurses in completing the information in an accurate manner. A one-week pilot study was conducted to evaluate the friendliness and comprehensiveness of the form. The final version of the form was sent officially to all OPD Charge Nurses under the signature of the Director of Nursing (to ensure compliance).

Statistical analysis

Considering that the OPD clinical sessions study sample was drawn from an infinite number of clinical sessions, the distribution of these clinics time utilization is supposed to follow a normal distribution (Central Limit Theorem). Since the sample size is so small ($n = 4$), and since the population variance is unknown, a two-tailed t-distribution test is considered to be the most relevant for all four hypotheses.

The last two hypotheses are concerned with the time booked as per the booking rule. Patient appointments are being processed on the basis of "first come, first seen" despite the efficiency of the computerized appointment system in handling scheduled appointments. The booking rule assigned for each specialty is determined and decided by the concerned clinic physician, including the number of new and follow-up appointment slots. Such a rule does not give any indication on the time needed for consultation.

Estimation of the average time needed by a booked patient was carried out through the application of multi-regression analysis for all the OPD clinics (to estimate an overall consultation time per patient category), as well as for each major specialty (to estimate consultation time relevant to that specialty). Formulating this mathematically, we can write:

$$Y = a_1X_1 + a_1X_2 + b$$

where Y denotes the total time spent by a clinic in conducting consultations, X_1 denotes the number of new patients that were seen at the clinic, X_2 denotes the number of follow-up patients that were seen at the clinic, a_1 denotes the average consultation time needed by a new patient (slope), a_2 denotes the average consultation time needed by a follow-up patient (slope), and b denotes the setup times (y-intercept).

For each clinic, the time actually utilized (Y) and the numbers of patients seen (X_1, and X_2) were all recorded; but it was not possible to record the average consultation times (a_1 and a_2) and the setup times (b). In other words, we have for each clinic three known values (Y, X_1, and X_2) and three unknown values (a_1, a_2 and b), thus obtaining a system of three unknowns and a number of equations equal to the number of clinics (much higher than three). Normally there is no exact solution to such a system. However, the two slopes and the y-intercept of the obtained multi-regression model are considered to be "close enough" to the exact solution, thereby providing a good estimation for the values of the three unknowns. In our case, the number of unknowns was decreased to two (a_1 and a_2 only) as we decided that setup times should be included in the consultation time rather than considered as overhead (b=0).

Results and Discussion

Time utilized vs time allocated to clinics

Table 1 summarizes the total time allocated (in minutes), the total time utilized (in minutes), and the resulting utilization rate (the ratio of the two time totals), for each of the four observed weeks and for each of the different departments (all OPD and selected major specialties). The table shows that utilization rate of whole OPD ranged between 68% and 71% over the four-week period.

Table 2 illustrates the average utilization rates of major OPD clinics and the results of tests of significance. The mean and the standard deviation are those of the four utilization rates obtained in Table 1. The student's t-distribution statistic was calculated as a ratio where the numerator is the difference between the average utilization (column 1) and 100% (full utilization), while the denominator is the standard deviation (column 2) divided by square root of 4 (the number of observations). The two-tailed levels of significance were obtained at three degrees of freedom.

Table 1. The utilization as a ratio of time utilized to time allocated

	Week 1		Week 2		Week 3		Week 4	
	Allocated	Utilized	Allocated	Utilized	Allocated	Utilized	Allocated	Utilized
All clinics	71940	48868	64320	44292	72840	51783	72120	51437
	67.93%		68.86%		71.09%		71.32%	
Surgery	16920	11785	17640	12655	17640	13800	17640	12175
	69.65%		71.74%		78.23%		69.02%	
Medicine	10440	7374	2160	1615	10440	7519	9960	7765
	70.63%		74.77%		72.02%		77.96%	
Determa-tology	8640	5066	8700	4156	8700	4772	8700	4707
	58.63%		47.77%		54.85%		54.10%	
Cardiology	7860	5950	7860	6171	7860	6530	7620	6073
	75.70%		78.51%		83.08%		79.70%	
Neuro-science	6300	3760	6300	3945	6300	4015	6300	4345
	59.68%		62.62%		63.73%		68.97%	
Urology	4140	2640	3900	2895	4140	2790	4140	3035
	63.77%		74.23%		67.39%		73.31%	

Table 2. t - Test analysis for time utilization (as a ratio of time utilized to time allocated)

	Average utilization rate	Standard deviation of utilization rate	Test statistic for time utilization hypotheses	Corresponding two-tailed level of significance	Estimation interval for average utilization rate at 95% level of confidence	
					Lowest	Highest
All clinics	69.80%	1.67%	(36.17)	0.005%	67.14%	72.46%
Surgery	72.16%	4.21%	(13.22)	0.093%	65.46%	78.86%
Medicine	73.85%	3.24%	(16.16)	0.052%	68.69%	79.00%
Dermatology	53.84%	4.51%	(20.49)	0.025%	46.67%	61.01%
Cardiology	79.25%	3.06%	(13.58)	0.086%	74.38%	84.11%
Neuroscience	63.75%	3.88%	(18.71)	0.033%	57.58%	69.92%
Urology	69.67%	4.97%	(12.21)	0.118%	61.77%	77.58%

Results of t-tests indicate that the first null hypothesis (the clinics time for the whole OPD is fully utilized) can be rejected at a level of significance as low as 0.005%. Similarly, the second null hypothesis (clinis' time for major specialties is fully uilized) can also be at a level of significance not reaching even 0.2% for all specialties.

As there is strong statistical evidence that the time allocated for clinics is not being fully utilized, it is important to see how close these clinics are from full utilization. The last column in Table 2 provides a 95% level of confidence interval estimate for the average utilization rate for OPD and major specialties. We are 95% confident that the time utilized, in any random sample, is no more than 72.5% for OPD, 61% for

Dermatology and 70% for Neuroscience. Dermatology (the fourth important specialty) has the lowest utilization rate (estimated between 46.7% and 61%), while Cardiology (the fifth important specialty) has the highest utilization rate (estimated between 74.4% and 84.1%).

It is clear that variations do exist between the different specialties. It is beyond the scope of this research to trace the relevant factors explaining such variation (e.g., number of sessions, or appointment waiting lists, etc). However, it is very likely that this variation is attributed to the arrival time of physicians, which could be relevant to a general practice applied by each specialty in their commencement or conclusion time to the clinics operation.

Time booked vs time allocated to clinics

Table 3 illustrates the results of the multi-regression analysis used to estimate the time needed by new and follow-up patients for all the OPD as well as for each major specialty. Values of R, for all the OPD and for major specialties, indicate a moderate to high correlation between the consultation time (dependant variable) and the numbers of new patients and follow-up patients (the two independent variables). The F-tests indicate that at the .05 level, the Rs are significantly different from zero.

Table 3. Results of multi-regression analysis for consultation times estimation

	R	R^2	Adjusted R^2	F-Test		New patient consultation time	Follow-up patient consultation Time
				Calculated F	Significance F		
All clinics	0.648	0.419	0.416	187.76	0.0000	23.157	12.742
Surgery	0.652	0.426	0.409	34.469	0.0000	13.110	15.648
Medicine	0.907	0.824	0.806	158.645	0.0000	21.652	18.168
Dermatology	0.790	0.624	0.583	28.193	0.0000	20.118	17.056
Cardiology	0.771	0.594	0.577	59.243	0.0000	18.893	18.528
Neuro-Science	0.905	0.818	0.796	121.508	0.0000	16.097	14.632
Urology	0.921	0.848	0.781	47.580	0.0000	27.423	13.046

The time estimate gives an indication of the actual time needed by each patient per treatment/consultation visit. Such an estimate, as proved to be statistically significant, was used to estimate the clinic time needed by all patients scheduled per the Booking Rule. By multiplying the number of booked patients by the estimated consultation time for each patient, we obtain the estimated booked time needed for testing the last two hypotheses.

Tables 4 and 5 provide exactly the same information as Tables 1 and 2, respectively, except that the estimated booked time (in Tables 4 and 5) is replacing the utilized time (in Tables 1 and 2). Table 5 illustrates that the null hypothesis (stating that the clinics time for the whole OPD is fully booked) can be rejected at a level of

significance almost equal to zero. Similar results were obtained for all departments with the exception of urology clinics.

Table 4. Time utilization as a ratio of time booked to time allocated

	Week 1		Week 2		Week 3		Week 4	
	Allocated	Utilized	Allocated	Utilized	Allocated	Utilized	Allocated	Utilized
All clinics	71940	46527	64320	42174	72840	47011	72120	46627
	64.67%		65.57%		64.54%		64.65%	
Surgery	16920	10054	17640	10436	17640	10436	17640	10436
	59.42%		59.16%		59.16%		59.16%	
Medicine	10440	7813	2160	1813	10440	7813	9960	7523
	74.83%		83.94%		74.83%		75.53%	
Determa-tology	8640	6083	8700	6083	8700	6083	8700	6083
	70.40%		69.92%		69.92%		69.92%	
Cardiology	7860	5228	7860	5228	7860	5228	7620	5079
	66.51%		66.51%		66.51%		66.51%	
Neuro-science	6300	4333	6300	4333	6300	4333	6300	4333
	68.77%		68.77%		68.77%		68.77%	
Urology	4140	3155	3900	3074	4140	3155	4140	3155
	76.20%		78.82%		76.20%		76.20%	

Table 5. t - Test analysis for time utilization (as a ratio of time utilized to time allocated)

	Average utilization rate	Standard deviation of utilization rate	Test statistic for time utilization hypotheses	Corresponding two-tailed level of significance	Estimation interval for average utilization rate at 95% level of confidence	
					Lowest	Highest
All clinics	64.86%	0.48%	(147.33)	0.000%	64.10%	65.62%
Surgery	59.23%	0.13%	(620.37)	0.000%	59.02%	59.43%
Medicine	77.28%	4.45%	(10.21)	0.200%	70.21%	84.36%
Dermatology	70.04%	0.24%	(246.81)	0.000%	69.65%	70.43%
Cardiology	66.55%	0.07%	(988.56)	0.000%	66.44%	66.66%
Neuroscience	68.77%	0.00%	-	-	68.77%	68.77%
Urology	76.85%	1.31%	(35.42)	0.005%	74.77%	78.93%

These findings clearly indicate a huge waste of resources which could be even worse if the number of patients who did not attend (DNA) were deducted from the number of those booked. Table 6 shows the comparison of the booked patients, the actually seen patients and the resulting attendance rate (the ratio of actually seen to booked). It is quite evident that the number of new patients actually seen always falls short of the number booked, while the opposite is true for follow-up with the exception of dermatology (81.11%). This might be caused by the fact that all walk-in patients (without pre-booked appointments) are marked as follow-up by all clinics.

Table 6. Patients booked as compared to patients actually seen

	Booked Patients		Actually Seen Patients		Attendance Rate	
	New	F-Up	New	F-Up	New	F-Up
All Clinics	3598	7771	2413	8860	67.1%	114.0%
Surgery	1102	1720	967	2281	87.7%	132.6%
Medicine	302	1014	184	1105	60.9%	109.0%
Dermatology	460	884	317	717	68.9%	81.1%
Cardiology	437	675	243	1054	55.6%	156.1%
Neuroscience	364	784	136	909	37.4%	115.9%
Urology	226	486	164	508	72.6%	104.5%

The total attendace rate of all patients (new and follow-up combined) is close to 100% for most specialties. However, this does not mean that the booking rule is matching the capacity of the clinic to the demand. The high rate of the walk-in patients is as undesirable as that of the DNA. Even though when both are equally high, the attendance rate reaches an acceptable level. Table 7, which compares the number of DNA patients and the number of walk-in patients, respectively, to the number of actually booked patients, illustrates the magnitude of the gap between the booked and the actual. Furthermore, the DNA rate always exceeds the walk-in rate for all OPD by almost 12%, which means that the walk-in patients are not fully compensating for the waste caused by the DNA patients.

In other respects, since appointments are being managed on a "first-come, first served" basis, patients are encouraged to arrive long before the actual clinic starting time. Their spot arrival, enhanced by the physicians' late arrival, causes the overcrowdedness of the clinics as well as the tendency of the patients to break their appointments[20]. The difference between the time available for the doctors and the consultation time needed for the patients actually attending the clinic allows the treatment of many walk-in patients. In other words, the under-utilization of the time allocated to the clinics as well as the "first-come first-served" priority rule contributed to the high DNA and walk-in rates shown in Table 7.

Undoubtedly, the problem faced by the OPD clinics signifies inefficiency in resources utilization. Hence, it is a problem of productivity rather than capacity limitation. Under-utilization of the allocated time has been aggravated by the booking rule that is scheduling a number of patients falling short in meeting minimum available resources. As a matter of fact, the under-utilization of the clinic capacity is partly due to the "under-booking" problem as confirmed by the last two hypotheses. Physicians' late arrival and early departure have been encouraged by the current set up of the booking rule; doctors do not attend for four hours of clinical activities if the number of patients booked for them requires no more than two hours.

Table 7. Descriptive analysis of dna patients and walk-in patients

		All clinics	Surgery	Medi-cine	Derma-tology	Car-diology	Neuro-science	Uro-logy
Actually booked patients	New	3743	1539	291	446	349	214	245
	F-Up	9006	2049	1108	1157	847	737	633
	Total	12749	3588	1399	1603	1196	951	878
DNA patients	New	1330	572	107	129	106	78	81
	F-Up	2780	735	249	440	206	226	240
	Total	4110	1307	356	569	312	304	321
DNA rate	New	35.5%	37.2%	36.8%	28.9%	30.4%	36.4%	33.1%
	F-Up	30.9%	35.9%	22.5%	38.0%	24.3%	30.7%	37.9%
	Total	32.2%	36.4%	25.4%	35.5%	26.1%	32.0%	36.6%
Walk-in patients	New	0	0	0	0	0	0	0
	F-Up	2634	967	246	0	413	398	115
	Total	2634	967	246	0	413	398	115
Walk-in rate	New	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	F-Up	29.2%	47.2%	22.2%	0.0%	48.8%	54.0%	18.2%
	Total	20.7%	27.0%	17.6%	0.0%	34.5%	41.9%	13.1%
Variance of DNA rate to walk-in rate	Total	11.6%	9.5%	7.9%	35.5%	-8.4%	-9.9%	23.5%

We can conclude that the most efficent solution is to improve the booking rule so it compiles with the allocated time of clinic operations. In doing so, clinic productivity, in relation to the total number of patients seen, is expected to be significantly improved. This improvement (if achieved), will gradually reduce the appointment waiting list and, most importantly, add capacity for future growth.

Conclusion

The paper investigated the necessity of capacity expansion of an overloaded department (OPD) in a Saudi public hospital (RAFH). The study, which focused on the actual utilized time of the clinics as compared to their allocated time, revealed that about 30% of the time is being un-utilized. One may argue that such a "capacity cushion" may prove to be necessary for the normal operating conditions of the clinics. Unfortunately, this is not the case as this 30% includes only the time wasted by late commencement and/or early closure of the sessions. The unutilized time within the session (which could be inevitable) was not considered.

Furthermore, even though the study was not concerned with the time allocated to the clinics, it is worth mentioning that such a time could be extended if the rooms were scheduled for more working hours. For such a capital intensive hospital as RAFH, it is certainly too costly to allow an average of 35 working hours a week (7 hours a day, 5 days a week) for most of the rooms. Increasing this number to 50 would create an additional 43% of capacity and would decrease the current utilization rate to 52%.

Based on the obtained results, we conclude that the expansion is not indispensable as long as the current capacity is not efficiently utilized. However, we believe that the number of observations we collected is too small to provide accurate estimations of the unutilized capacity. Moreover, if the booking rule is to be changed, more sophisticated techniques should be used to estimate the average consultation time per type of patient (new or follow-up) per specialty. A further research, based on more elaborate data, could contribute significantly to improving the operations and increasing the efficiency not only in RAFH but also in more public hospitals and even in universities and airports.

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Appendix 1. Outpatient department specialized clinics and scheduled sessions

Department	Division	Scheduled clinic	No. of sessions per week
Paediatrics	Paediatrics	1. General Pediatrics	4
		2. Pediatric Neurology	6
		3. Pediatric Nephrology	1.5
		4. Pediatric Hematology	2
		5. Pediatric Endocrinology	1.5
		6. Pediatric Respiratory	3.5
		7. Pediatric Gastroenterology	0.5
		8. Pediatric Genetics	0.5
		9. Pediatric Rheumatology	0.5
		10. Newborn Baby Clinic	1
Medicine	Medicine	1. General Miedicine	15
		2. Diabetics	8
		3. Endocrinology	8
		4. Rheumatology	4
		5. Allergy	2
		6. Cadets' Medicine	1
	Respiratory Medicine	7. Tuberculosis	2
		8. Chest	10
Dermatology	Dermatology	1. Dermatology1	29
		2. Wart	10
		3. Infertility	1
		4. STD	1
Psychiatry	Psychiatry	1. General Psychiatry	18
		2. Depot	2
		3. Social Worker	2
	Psychology	4. Psychology	14
Gastroenterology	Gastroenterology	1. Gastroenterology	8
		2. Hematology	2
Pathology	Pathology	1. Anti-coagulant	6
		2. Hematology	2
Urology	Urology	1. Urology	20
		2. Proscar	1
Nephrology	Nephrology	1. Adult Nephrology	7
Anaesthesia	Anaesthesia	1. Pain	2
Oncology	Oncology	1. Oncology	15
		2. Chemotherapy	20
Surgery	General Surgery	1. General Surgery	18.75
	Paediatrics Surgery	2. Paediatric Surgery	2
	Vascular Surgery	3. Vascular Surgery	2

Appendix 1. (Contd.).

Department	Division	Scheduled clinic	No. of sessions per week
	Plastic Surgery	4. Plastic Surgery and Cleft Palate	8
	Orthopaedic surgery	5. Orthopaedic	34
		6. Fracture	2.25
	Ophtalmology	7. General ENT	14
		8. Head & Neck Oncology	2
		9. Audiology	2
		10. General Ophthalmology	35
		11. Squint	1
		12. Neuro-ophthlmology	1
		13. Occulplastic	1
		14. Retina	1
		15. On-call Ophthalmology	6
		16. Refraction	14
Cardiology	Adult Cardiology	1. Cardiac	19.5
		2. Cardiac Transplant	0.5
		3. Officer Cardiology	1
		4. Prosthetic Valve	2
		5. Cardiac Arrhythmia	1
	Pediatric Cardiology	6. Pediatric Cardiology	12
	Cardiac Surgery	7. Adult Cardiac Surgery	2
		8. Pees Cardiac Surgery	1
Neuroscience	Neurology	1. Neurology	16
	Neurosurgery	2. Neurosurgery	5
		3. Spinal	5
		4. Back	5
	Rehabilitation	5. Rehabilitation	1
Obstetrics & Gynaecology	Obstetrics & Gynaecology	1. Antenatal	39
		2. Gynecology	28
		3. Infertility	3
		4. Antenatal Cardiology (joint with cardiology)	1
	Total	69	525

Appendix 2. Distribution of sessions of OPD clinics among various departments

Department	Number of sessions*	Percentage	Cumulative percentage
Surgery	520	33.08%	33.08%
Medicine	200	12.72%	45.80%
Dermatology	164	10.43%	56.23%
Cardiology	156	9.92%	66.16%
Neuroscience	120	7.63%	73.79%
Urology	84	5.34%	79.13%
Psychiatry	80	5.09%	84.22%
Pediatric	80	5.09%	89.31%
Oncology	60	3.82%	93.13%
Gastroenterology	40	2.54%	95.67%
Pathology	32	2.04%	97.71%
Nephrology	28	1.78%	99.49%
Anesthesia	8	0.51%	100.00%
Total	1572	100%	

*Based on 4 weeks total

Appendix 3. Outpatient Department Clinic Schedule – Building 1 – Basement – Oncology Location

	Saturday		Sunday		Monday		Tuesday		Wednesday		Thurs-day
Room No	Session 1	Session 2	Session 1	Session 2	Session 1	Session 2	Session 1	Session 2	Session 1	Session 2	Ses. 1
1	General Medicine	Diabetic	Hema-tology	Gastro-entero-logy*	Oncology Firm 1	Diabetic	General Medicine	Adult Cardiac Surgery	Hema-tology	Gastro-entero-logy*	
2	Oncology Firm 1	Diabetic	Oncology Firm 2	Gastro-entero-Logy*	Oncology Firm 1	Diabetic	Oncology Firm 1	Adult Cardiac Surgery	Oncology Firm 2	Gastro-entero-Logy*	
3	Oncology Firm 1	Diabetic	Oncology Firm 2	Gastroent erology*	Oncology Firm 2	Diabetic	Oncology Firm 1	Pediatric Cardiac Surgery	Oncology Firm 2	Gastro-entero-logy*	
4	Oncology Firm 1	Diabetic	Oncology Firm 2	Gastroent erology*	Oncology Firm 2	Diabetic	General Medi-Cine*** (Cadets Clinic)	Anti-Coagu-Lant**	Oncology Firm 2	Gastro-entero-logy*	
Chemo-therapy 1 (Total 4 patient capacity)	Chemo-therapy	Chemo-therapy	Chemo-therapy	Chemo-therapy	Chemo-therapy	Chemo-therapy	Chemo-therapy	Chemo-therapy	Chemo-therapy	Chemo-therapy	
Chemo-therapy 2 (Total 2 patient capacity)	Chemo-therapy	Chemo-therapy	Chemo-therapy	Chemo-therapy	Chemo-therapy	Chemo-therapy	Chemo-therapy	Chemo-therapy	Chemo-therapy	Chemo-therapy	

* This clinic unofficially operates with an additional two rooms located at the Gastroenterology Department making the total of six clinic sessions instead.

** Due to patient overcrowding, two patients are seen at the same time in this clinic (the room is being utilized as two sessions).

*** This clinic session is allocated to have all military cadets examined as part of the medical examination. Patients seen at this clinic are not booked and thus the workload varies from one week to another.

Appendix 4. Distribution of Outpatient Department clinical set-up at RAFH

OPD location	Designated title	No. of rooms available	No. of weekly sessions available	No. of weekly sessions not utilized	No of weekly sessions utilized	Percentage of sessions utilized
Building 100 Ground Floor	Main	19	209*	15*** + 8** = 23	186	94%****
Building 1 Basement	Oncology	4	44*	0*** + 4** = 4	40	91%
Building 1 Ground Floor	**Ophthalmology**	5	55*	8*** + 2** = 10	45	82%
Building 2 Ground Floor	Neuroscience	6	66*	1*** + 4** = 5	61	92%
Building 2 Basement	Dermatology	5	55*	9*** + 5** = 14	41	75%
Building 119 Ground Floor	Psychiatry	4	44*	18*** + 4** = 22	22	50%
Building 109 First Floor	Obstetrics and Gynecology	6	66*	0*** + 6** = 6	60	91%
Total	**All**	49	539*	84	455	84%

* Number of rooms multiplied by the number of sessions per week (11)
** Unutilized Thursday sessions
*** Unutilized ENT sessions
**** Number of weekly sessions utilized divided by the number of weekly sessions available

Appendix 5. Descriptive list of study clinic sample (Part 1)

Department	Division	No. of clinics scheduled during study period	No. of sessions scheduled during study period	No. of clinics considered	No. of sessions considered	No. of clinics excluded	No. of sessions excluded
Anesthesia	Anesthesia	1x4 = 4	2x4 = 8	4	8	-	-
Cardiology	Adult	15x4 = 60	24x4 = 96	59	95	1	1
	Cardiology	4x4 = 16	12x4 = 48	16	48	-	-
	Peds Cardiology	2x4 = 8	3x4 = 12	8	12	-	-
	Cardiac Surgery						
Subtotal for Cardiology		21x4 = 84	39x4 = 156	83	155	1	1
Dermatology		12x4 = 48	41x4 = 164	44	160	4	4
Gastroentero-logy	Gastro-	3x4 = 12	10x4 = 40	12	40	-	-
Medicine	General	10x4 = 40	16x4 = 64	31	52	9	12
	Medicine	2x4 = 8	8x4 = 32	6	24	2	8
	Diabetic	4x4 = 16	8x4 = 32	12	24	4	8
	Endocrinology	2x4 = 8	4x4 = 16	6	12	2	4
	Rheumatology	2x4 = 8	2x4 = 8	6	6	2	2
	Allergy	3x4 = 12	12x4 = 48	9	36	3	12
	Respiratory						
Subtotal for Medicine		23x4 = 92	50x4 = 200	70	154	22	46
Nephrology	**Nephrology**	4x4 = 16	7x4 = 28	16	28	-	-
Neuroscience	Neurology	15x4 = 60	16x4 = 64	60	64		
	Neuro Surgery	8x4 = 32	13x4 = 52	32	52		
	Rehabilitation	1x4 = 4	1x4 = 4	4	4		
Subtotal for Neuroscience		24x4 = 96	30x4 = 120	96	120	-	-

Appendix 5. (Contd Part 2)

Department	Division	No. of clinics scheduled during study period	No. of sessions scheduled during study period	No. of clinics considered	No. of sessions considered	No. of clinics excluded	No. of sessions excluded
Oncology	Oncology	6x4 = 24	15x4 = 60	24	60	-	-
Pediatrics	General	(1x4)+(1x4)+(0.5x4)+(0.5x4) = 12	16	12	16	-	-
	Neurology	4x4 = 16	6x4 = 24	16	24	-	-
	Nephrology	1 .5x 4 = 6	1.5x4 = 6	6	6	-	-
	Hematology	2x4 = 8	2x4 = 8	8	8	-	-
	Endocrinology	(1x4)+(0.5x4) = 6	1.5x4 = 6	6	6	-	-
	Respiratory	2.5x4 = 10	3.5x4 = 14	10	14	-	-
	Gastroenterology	(0.5x4) = 2	0.5x4 = 2	2	2	-	-
	Rheumatology	(1x4) = 4	0.5x4 =2	-	-	4	2
	Genetics	(1x4) = 4	0.5x4 = 2	3	1.5	1	0.5
Subtotal for Pediatrics	68	20x4 = 80	63	77.5	5	2.5	
Pathology	Pathology	(1x4)+(1x4)+(0.5x4)+(0.5x4)+(1x4) = 16	8x4 = 32	16	32	-	-
Psychiatry	Psychiatry	7x4 = 28	20x4 = 80	28	80	-	-

Appendix 5. (Contd Part 3).

Department	Division	No. of clinics scheduled during study period	No. of sessions scheduled during study period	No. of clinics considered	No. of sessions considered	No. of clinics excluded	No. of sessions excluded
Surgery	General	4x4 = 16	18.75x4 = 75	16	75	-	-
	Pediatrics Surgery	1x4 = 4	2x4 = 8	4	8	-	-
	Vascular Surgery	1x4 = 4	2x4 = 8	4	8	-	-
	Plastic Surgery	2x4 = 8	8x4 = 32	7	28	1	4
	Orthopedic	13x4 = 52	36.25x4 = 145	48	141	4*	4*
	ENT	9x4 = 36	18x4 = 72	36	72	-	-
	Ophthalmology	17x4 = 68	45x4 = 180	-	-	68	180
Subtotal for Surgery		47x4 = 188	130x4 = 520	115	332	73	188
Urology	Urology	5x4 = 20	21x4 = 84	19	83	1	1
Total		696	1572	590	1329.5	106	242.5
		100%	100%	84.77%	84.57%	15.23%	15.43%
Total (after clinical amalgamation) **		628	1572	522	1329.5	106	242.5
		100%	100%	83.12%	84.57%	16.88%	15.43%

* The four excluded orthopedic clinics refer to Thursday morning Fracture Clinics – exclusion was made (through records were received) because his clinic does not apply pre-appointment booking rules.

** Clinic amalgamation was necessary because

1. Tthere was difficulty in distinguishing the number of rooms occupied by each scheduled clinic (i.e., 16 Dermatology Clinics were amalgamated into 8 clinics)
2. Only one form was completed for a number of similar scheduled clinics (time and specialties were the same), i.e. 60 Neurology Clinics being amalgamated into 20 clinics.
3. Some clinics do not apply any booking rule though they form a subspecialty of a major one, i.e., all weekdays Fracture Clinics (total of 20 clinics) being amalgamated among orthopedic and general surgery clinics.

دراسة لمدى استغلال الطاقة الاستيعابية لقسم العيادات الخارجية في مستشفى حكومي عام بالمملكة العربية السعودية

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**رئيس قسم التخطيط والتطوير بمستشفى القوات المسلحة بالرياض

(قدم للنشر في ١٤٢١/١/٤هـ ؛ وقُبل للنشر في ١٤٢٢/١/١٦هـ)

ملخص البحث. يواجه حاليا مستشفى القوات المسلحة بالرياض الذي يعتبر أحد أكبر المستشفيات بالمملكة مشكلة تضاعف عدد المراجعين بشكل يفوق ارتفاع موارد المستشفى. فبالنسبة لأكثر العيادات الخارجية لا يمكن للمراجع الحصول على موعد قبل ثلاثين أسبوعا وقد تكون مدة الانتظار أكثر من سنة بالنسبة لبعض العيادات. في كل يوم يزداد الاقتناع بأن الحل الوحيد للمشكلة هو التوسيع. وقد حاول الباحثان من خلال هذه الدراسة التحقيق في مدى ضرورة مثل هذا الحل ومدى توافر حلول أخرى أقل تكلفة وأكثر كفاءة. وقد كشفت الدراسة فعلا أن نسبة استغلال الطاقة الاستيعابية الحالية لقسم العيادات الخارجية - كما تحددها أوقات الدوام الحالي - لا تتعدى الـ ٧٠٪ مما لا يتناسب البتة مع الاكتظاظ الذي يعاني منه المستشفى. وتوضح الدراسة أهمية تحسين أداء العمليات كبديل عن الحلول الاستثمارية الباهضة، فتطوير نظام المواعيد مثلا يمكن أن يلعب دورا مهما في تخفيض نسبة الوقت المعطل للأطباء الذي غالبا ما يكون المراجعون في أشد الحاجة إليه.