A New Standardization Model for Physician Staffing at Hospitals

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Abstract

Purpose

The purpose of this study is to develop a model for physician staffing requirements that could be generally applied to any hospital department, taking into account factors such as occupancy level, professional absences, allowances, physician work duties and patient service levels.

Design/methodology/approach

The ability to generalize the model was tested via its implementation to five hospital departments considered to represent a cross-section of all hospital requirements: Internal Medicine, Surgery, Orthopedics Children's (Pediatrics), and Gynecology. The work is based on a combination of a survey, work-sampling and direct time study, conducted by professional observers with a high degree of frequency and over a relatively long period of time.

Findings

The model that we developed is based on the concept of "required work capacity" of physicians. The model makes it possible to account for such factors as yearly capacity, level of desired service, increments for work conditions, roster duties and necessary absences.

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Practical implications

The findings indicate that the departments studied required a significant increase in their physician staffing. In these departments the present manpower situation stands at 80–90% of the necessary staffing based on the average annual occupancy. The new staffing requirements model can be implemented in various departments.

Originality/value

This paper is an original effort to develop a model for physician staffing requirements at hospitals based on a survey, work-study and direct time study. This is a contribution to past research that focused on the development of staffing requirements models, e.g., for nurse or family physicians. The paper presents an original model for physician staffing requirements at hospitals.

Keywords: Work-sampling, Work-study, Staffing model, Physicians, Hospitals

1. BACKGROUND AND INTRODUCTION

The goal of this study was to develop a standardization model for physician staffing requirements for different types of hospital departments, such as Internal Medicine, Surgery, Orthopaedics, Children's (Pediatrics), and Gynecology. The model we propose for standardizing physician staffing requirements makes it possible to assess physician workloads and to quickly update the standard according to gathered data. The model presents the number of physician positions required to implement medical work at different departments. In that perspective, it is similar to the work of Fagersorm et al. (2001) that focused on nurse staffing requirements. Moreover, our model offers the possibility of standardizing physician staffing requirements in relation to different scenarios and parameters: activities in areas outside the department (e.g., in emergency rooms, outpatient clinics and operating rooms); changing patient occupancy rates (e.g., in emergency situations and according to seasonal occupancy such as flu epidemics in winter); and, to some extent, standardization in relation to the level of required service extended to patients. The staffing standard takes into account factors, such as professional absences, work procedures, roster duties and allowances. Despite the new approach of a parameterized "required work capacity", the study is based on generally accepted "work study" standardization principles (Niebel and Freivalds, 2003, Pelletier and Duffield, 2003).

The model is primarily based on the work-sampling study method which is commonly used for analyzing noncyclical work, i.e., when it is not possible to define a clear cycle in the course of the day's work (such as in the present case) as well as in cyclical work in which the cycle is relatively long (usually an order-of-magnitude of an hour or more). It is also customary to use work-sampling when there is the necessity for evaluating the development of a relatively rapid workload as well as work being carried out simultaneously by a team of employees or a number of employees in parallel as in this case (Niebel and Freivalds, 2003, Ampt et al., 2007).

The work-sampling method makes it possible to evaluate the time devoted to different activities in the framework of the work being assessed. The system is based on a statistical estimate of the proportion (the relative part) of the period of time being

studied (the time frame in which the work is being sampled) and which is ascribed to each of the activities defined beforehand. The basic principle of this system is that a large enough sample taken at random from the population (in the case under discussion, the set of activities carried out by the physicians being assessed) will best represent the distribution of the whole range of activities. The accuracy of the results depends, as noted, on the manner in which the sampling is implemented, the number of observations and the length of the study.

A major benefit of work-sampling is that it is possible to derive from the sample's data many parameters which are relevant to the staffing standard such as the distribution of activities in various areas between different types of workers, workload and yield, work times and waiting times, etc. Such parameterization makes it possible to easily adjust the staffing model in accordance with future cases and different settings, as seen below. The main drawback of the system is that the assessment is not continuous. That is, there are periods of time where the worker (physician in this case) is not being watched. This influences the level of detail from the sample: at times it is not possible to define as activities those elements which occur too infrequently and therefore it is necessary to group together the activities sampled (into categories of activities) in order to arrive at the required level of accuracy and significance. The way in which the activities to be quantified is determined (detailed in Table 1 below) makes it possible to evaluate the level of accuracy and significance that are common in the work-study field (Niebel and Freivalds, 2003).

It is important to note that although work sampling and staffing standardization models have been successfully implemented in various industrial and service organizations for more than half a century, including efforts to develop a staffing standardization models in hospitals (mainly for nurses e.g., Fagersorm et. al, 2001, Pelletier and Duffield, 2003, Ampt et al., 2007), their implementation to staffing standardization model for physicians in hospitals remain a challenge, due to the high variety and the complexity of physicians healthcare services (Oddone et al., 1993, 1994). The proposed parameterized model provides in our view a possible tool to reduce the gap and contribute to the applicability of classical methods in industrial engineering to healthcare systems.

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The structure of this paper is as follows: Section 2 presents a literature survey and the main studies regarding the standardization of physician staffing requirements. Section 3 presents the guiding principles of this study; Section 4 describes the proposed standardization model. Section 5 analyzes the main findings of the study and finally Section 6 is devoted to a short discussion and summary of the work.

2. LITERATURE SURVEY

In recent years, a large body of literature addresses issues of data analysis and optimization in healthcare organizations (e.g., Bratt et al., 1999, Barger et al., 2006, Castle and Harvey, 2009, Chatziaslan, 2009, Abu Bakar et al., 2010). Time studies and work-sampling have been used extensively for research on the time that medical staffs require to perform their activities in different work environments. Most of these studies, however, were focused on nurses' activities rather than on physicians' activities, maybe since the former are perceived as more routine and quantifiable, or maybe since it was harder to convince physicians to measure their work. Examples of such studies are discussed in Pelletier and Duffield (2008), Amptet et. al (2007), Bee et al. (2006), Bartholomeyczik and Hunstein (2003) and Rasmussen and Sandman (2000). These studies demonstrate how time studies and work-sampling have been used to define nursing practice patterns; to assess optimal nursing care intensity level; to map nursing activity in acute inpatient mental healthcare settings; to measure time distribution of selected care activities in home care; and to measure time in nursing tasks. For example, Fagersorm et al. (2001) report on their effort to develop a method to estimate the optimal level of nursing care intensity for a ward. Such an optimal level is defined as a balance point between the patients' need for care and the available hospital's staff resources. A discussion is presented on the pros and cons of traditional time studies and the conclusion is that the traditional approach may be a good starting point, yet, that a new method accompanied by proper field study is required to better measure these work activities. The results of a pilot study established that the development of such proposed method, as we try to do in this paper, is worth continuing to create an administrative tool which is more compatible than traditional time studies with the perspectives of caring science.

Although several studies used similar techniques for studying physician activities, such as Gilchrist et al. (2005) and Oddone et al. (1993, 1994), their effort failed short of answering the basic question: "How many physicians are required in a specific

hospital department in each shift and in each day?" The answer to this question is a key for achieving superior productivity as discussed by Vogel (2004) and a main objective in this paper.

Two comprehensive studies aimed at quantifying the work of physicians by work-sampling were reported by Oddone et al. (1993) and Oddone et al. (1994). These two stdies along with the work of Fagersorm et al. (2001) can be considered as the starting point for our current effort. The work-sampling studies reported by Oddone et al. (1993, 1994) focus on the activities of 36 doctors (18 residents and 18 interns) at Duke University Medical Service. In the first stage, 26 of the 36 physicians (72%) were asked to estimate the amount of time they invested in implementing 20 different activities in their ongoing work and 18 types of interaction. In the second stage, a work-sampling system was used to measure physician activities during the daily shift and roster duty for three months. A total of 193 sampling days were implemented for all physicians (an average of approximately 5.1 days per doctor.) At the time of the study, 12 patients on the average were hospitalized in the department with five patients (urgent or regular) arriving each day. To assess the activities, the doctors carried beepers that sounded every 20 minutes, reminding them to record the activity of the moment.

The study of Oddone et al., like that of Bratt et al. (1999), presents a number of conclusions in regard to work-sampling. First, the researchers believe that work-sampling is the most suitable method for quantifying the activities of hospital physicians. The method, they claim, is empirical, quantitative, objective and less influenced by various diversions compared to subjective evaluation systems in which physicians report on activities they carry out (although the subjective system is less costly and the data is collected more quickly.) Work-sampling was found to be easily assimilated after work procedures for the department were mapped out. Both researchers argue that work-sampling constitutes a standard tool for studying physicians at work and in administering a treatment system for hospital patients.

Finkler et al. (1993) conducted a comparison of work-sampling and time-and-motion techniques in researching health services. In their study, trained observers followed residents during their 24-hour day and recorded the start and end times of each

activity that residents performed. Work-sampling results were then derived from the raw data. The authors felt that the results of the subjectively-oriented work-sampling (e.g., taken by the residents themselves) might differ extensively from those of an objective time-and-motion study. As the authors expected, the standard deviations of the estimated task times decreased as work sampling observations became more frequent. Their work-sampling study did not use observation intervals that were more frequent than every 15 minutes. With these settings, the authors indicate that a self work-sampling may not provide an acceptably precise approximation. For comparison, in our study, the time intervals were three times more frequent than those implemented by Finkler et al. Moreover, the work-sampling results were confirmed by direct time studies that were conducted as well. We applied central guidelines that the abovementioned researchers recommended. In general, the work-sampling system was applied by determining the activities that were partially similar to those in the above study. On average, each physician was measured for at least five days while our measurement rate was four times greater. Also in our work, a comparison was made between the quantifying data and the subjective time evaluations of physicians about their various activities. As Oddone et al. (1993) and Oddone et al. (1994) recommend, preparatory work for our study was carried out in each of the departments prior to implementing the work-sampling. Our study also found that work-sampling is suitable for work study in hospitals and can be well generalized for different hospital departments.

Ghosh and Cruz (2006) propose a computer-based (GUI) physician staffing model for planning hospital manpower requirements. Their model evaluates the work capacity of physicians in different areas (departments, outpatient clinics, emergency rooms etc.) and the factors that influence the number of physicians, such as the annual workload, bed capacity, occupancy figures, absences and work allowances. Based on current practices and the nature of the work in a specific department, an allowance of 15–17 percent was usually added to cover the miscellaneous (mostly non-quantifiable) work components. In this study, we based our model on the "required work capacity" of physicians in different areas in accordance with what Ghosh and Cruz (2006) recommend. Our model takes into account the factors they describe as influencing physician numbers and our allowance estimate was close to what they recommended.

In 1991, a national committee was convened in the United States to determine a methodology for standardizing physician staffing at Veterans Administration hospitals. A summary of the committee's work appears in two publications: Lipscomb et al. (1991) and Lipscomb et al. (1995). The committee was presented with two different methodologies for defining medical personnel requirements: one is based on a statistical model, the second on expert judgment. Data for the committee's work was received from four US hospitals. The statistical models were based on different parameters (variables); the mutual influence between them was unknown. The models included data relating to: workload; patient treatment time; the number of interns, residents, and specialists; the region in which the hospital is located; and the size of the hospital. Lipscomb et al. calculated physician staffing in fourteen different "patient care" areas. In general, the committee found conceptual deficiencies in the parametric model. In particular, it was not possible to use these statistical models to determine standardization or to evaluate if the current staffing situation was sufficient. As a result, the committee recommended integrating the statistical model with expert judgment. The two expert judgment models were: the Detailed Staffing Exercise (DSE), based on the Delphi system, and the Staffing Algorithm Development Instrument (SADI) model. The committee did not determine which methodology should be used and confined itself to recommending further research on this subject.

Barger et al. (2006) studied the impact of extended-duration shifts on medical errors by conducting a Web-based survey. The authors found that extended-duration work shifts adversely affected patient safety. Lurie et al. (1989) conducted a time study of on-call house staff in internal medicine departments. Fontaine et al. (2000) considered a work-sampling tool to measure the effect of electronic medical record implementation on healthcare workers. Other studies of manpower-related issues in hospitals and work studies have been published down through the years. These include: Wirth et al. (1977), Guarisco and Oddone (1994), Urden and Roode (1997), Cardona et al. (1997), Whang et al. (2003), Pelletier and Duffield (2003), Khoury et al. (2004), and Wensing et al. (2006).

In summary, the literature survey indicates that work-sampling is probably the most suitable method for reliably estimating the time that doctors require to perform their

activities in different work environments. Therefore it is a good starting point for an effort to to estimate the optimal staffing level of doctors in a vriety of hospital settings. Moreover, it is found that there is a great advantage in integrating work-sampling with statistical explanatory tools, statistical models, expert judgment and simulations as partially done in this study.

3. METHOD OF IMPLEMENTING THE WORK-SAMPLING STUDY

The primary standardization method that we implemented in different departments was based on work-sampling. Work-sampling was chosen since this method, as the literature survey indicates, is well-suited for quantifying the activities of hospital physicians. In order to verify the work-sample data, direct time studies, in which the physicians were monitored continuously, were also implemented among a small representative number of doctors at later stages of the study. This section presents the standardization method we used along with our basic assumptions. A team of industrial engineers with relevant experience in such projects carried out the measurements. The research stages ere as follows:

Preliminary departmental survey

The research included the following stages for each department:

1. Preliminary analysis of the department, including a review of: the physical layout of the working areas; the main medical processes and procedures; the reciprocal relationships between various officers; data and knowledge-transfer interfaces. This stage included in-depth interviews, careful planning of the work-sampling and an explanation about the work-study method to department physicians and personnel.

2. Constructing a preliminary model of the proposed staffing standardization, as detailed below.

3. Implementing the work-sampling research including measurements and statistically analyzing the samples.

4. Summary of the study's findings.

Determining the activities to be studied

In order to implement the work-sampling, physician activities were divided by a two-level hierarchy into primary and secondary categories that were defined for the study (see Table 1). The activities were defined via consultation with the physicians and

based on past studies (e.g., Oddone et al. 1993, 1994). They were defined in a general manner that can be shared by different types of departments, e.g., Sick rounds; Clarifications and collecting information; Documentation; Research and study; Activities outside the department and Personal. Each activity belonged to a different group, including classification of activities into *direct activities* (i.e., activities directly related to the patient), *indirect activities* (activities that are not related to a particular patient, e.g., research and studying) and allowances (e.g., fatigue, personal and unavoidable delay allowances.) At the same time, areas where the doctors worked were mapped and the main parameters that influenced how doctors spent their time were identified and analyzed. These parameters were established in accordance with the particular activities of each department and such statistics as the number of beds; the number of people being treated during the study relative to the previous year; the number of visits to outpatient clinics; support activities; walking distances between work areas; equipment use; department resources; operating room quotas, etc. In the preliminary survey, a number of parameters were related directly to the standardization and which could be reliably collected from existing databases for later use in refining the parametric model. To the extent possible, these parameters were integrated into the work study, as indicated below.

Measuring the rate of work

Evidently, the average time to fulfil a particular task depends, among other factors, on the rate of work the doctors performed the assignment. Performance rating is used to adjust observed times to those expected from normal performance. In this study, a fixed, normal rate of work was assumed (i.e., a rate of 100% according to the "rate scale", which is commonly used in the US) for all the doctors who were sampled. The reason for determining a fixed, normal rate was to maintain the objectivity of the study independently from the observers. This approach minimized the subjective assessment of the observers who are not doctors by training and who, therefore, had to rely as much as possible on quantified, measurable numerical data. In this regard, it was reasonable to assume that each doctor's rate of work was apt to be different from sampling to sampling so that deviations in the rate of work above and below 100% would be compensated for among the different doctors by the various activities they carried out. The quantification does not refer to the professional capacity of the

doctors performing a particularly activity, to the complexity of the activity or to any professional analysis of the medical work.

Determining the Sample Size, the Significance Level and the Accuracy

In work-sampling studies, the sample size fundamentally affects the accuracy of the portion of time ascribed to each of the performed activities. Calculating the time required for the various activities is based, as noted, on estimating the time distribution of all the actions under observation in the study. To the extent that the proportion of the actions is based on a larger sample, the accuracy is higher, i.e., the standard deviation of the proportion is smaller. In most cases, the level of significance is set at 90% and above while the level of inaccuracy is set at a commonly accepted 5% (Niebald and Freivalds, 2003). Once inaccuracies associated with all the activities are known, one can estimate the weighted average inaccuracy of the whole study. The weights are determined according to the portion of time devoted to each activity (Niebald and Freivalds, 2003).

Performing the Measurements

The observational data was recorded on special handheld terminals (or pocket PCs), commonly used in work-sampling. At first relevant data was defined (such as the lists of doctors, areas, activities and time frames) and transferred to each terminal. During the sampling, it was possible to add activities/personnel/areas to cope with unforeseen matters. Sampling of the doctors in the department took place over five days in the course of the daily shift from 07:00 – 08:00 to 15:00 – 16:00 in accordance with the schedule of the department being studied. Each doctor in the department received an identification number. Each activity was marked and indexed. At the beginning of each measurement day, the form "Place of doctors in the department" was filled out so that the observer knew how many doctors and which ones would be working during the shift in the department as well as in other work areas (such as the emergency room).

The observer carried out a round in the department at a frequency of every five minutes throughout the shift. This frequency is considered high with respect to work-sampling studies. In the literature, rounds were made every 15-20 minutes or less (e.g., see Finkler et al., 1993).

In the course of a round, the observer located all doctors working in the area under his supervision and identified the action being performed at the time of observation. Using the handheld terminal, the observer recorded the following data:

i. Time of observation

ii. Doctor's id number

iii. The performed activity number (activity code)

iv. Specific remarks for further clarification if required

At the end of each work-sampling day, the data from the handheld terminals was integrated with the data that had been hand-registered on forms and all was inputted into a unified database. The results of the quantification refer to a total distribution of the time devoted to all the activities performed by all physicians in the department that was being assessed during the shift.

Quality Assurance of the Working-Sampling results

Quality assurance of the work-sampling findings was implemented in a number of ways:

i. Crosschecking the distribution of physician activities from the work-sampling measurements with the distribution received from direct-study measurements.

ii. Comparing the measured activity rate with subjective evaluations of the doctors in the department being studied (that were indicated by the doctors prior to the study).

iii. Presenting the results to experts in the Israel Medical Association (IMA) to ensure that the working sampling results were reasonable.

4. DESCRIPTION OF THE PROPOSED STANDARDIZATION MODEL

This section describes the proposed standardization model. The methodology we chose served to develop a general model for physician staffing requirements. The model can be adapted for various departments. The physician workload in these departments includes activities that the doctors carry out in the department as well as in other hospital areas, such as the operating rooms, outpatient clinics, emergency room and other departments (consulting). Below we detail the basic concepts, principles and notation according to which the standardization model was determined.

Work Capacity

The model was based on quantifying the *required work capacity*, the average net time that doctors required to perform their activities in the daily shift as observed during the work-sampling study. In order to establish the standardization model independently from patient occupancy in the department at the time of the study, it was also necessary to measure the outputs or the yield in the course of the study – mainly the number of treated patients for the different procedures. For further details see the section below that describes the standardization model.

The overall work capacity for the daily shift was accumulated for all doctor-performed activities in all work areas. The work capacity associated with a specific work area was regarded as the measured *effective presence* of the doctors in this work area after deducting the activities ascribed to the allowances ("personal", "unavoidable delays" and "fatigue"). Overall work capacity, divided by the number of work hours, was estimated to be the *effective number of doctors* required in the daily shift in all work areas.

The following notation and definitions were used to describe the staffing model.

Accumulated activity time

i – the index (type) of activity carried out by department doctors (see Table 1 which details the type of activities)

t_i – the average amount of time required to carry out activities of type (i)

T_i – the average amount of accumulated time (in relation to all the days of the sampling) required to implement all activities of type i in the course of a daily shift by department doctors and in all work areas (department, outpatient clinic and operating room). The summation of the times is indicated by $T_i = \sum t_i$, where the summation is taken with respect to all doctors and all areas in the study.

Work capacity ("effective presence") in different work areas

The work capacity or the effective required presence of doctors in each work area was calculated as follows:

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$$P_{<area>} = \sum_{i \text{ in } <area>} T_i / t_m$$

where t_m is the number of hours in a daily shift (an average of eight hours in our study) and the summation is taken with respect to all activities performed in a specific work area during the daily shift (except for activities that are ascribed to allowances, e.g., see activities 7 and 11 in Table 1). Thus, the time summation $\sum T_i$ is the average amount of accumulated time to perform all activities required in the course of the daily shift in certain areas. Dividing this summation by t_m results in the effective number of physicians required in that area, denoted, in general, by $P_{<area>}$ or, more specifically, by P_d, P_s, P_c and P_o as seen below.

P_d – the average work capacity for the required activities in the department during the daily shift. That is to say, the average number of doctors required to perform department activities in the course of the daily shift (the subscript d comes from "<u>d</u>epartment").

P_s – the effective presence of physicians required to perform necessary activities in the operating rooms (the subscript s comes from "<u>s</u>urgery")

P_c – the effective presence of physicians required to perform necessary activities in the outpatient clinics (the subscript c comes from "<u>c</u>linic")

P_o – the effective presence of physicians required to perform activities in areas external to the department in other parts of the hospital, such as consulting in other departments and the emergency room (the subscript o comes from "<u>o</u>utside"), and which aren't dependent on patient occupancy in the department (as opposed to other work capacity elements described above).

Normalizing according to the average patient occupancy

A staffing standardization model should reflect required physician work capacity with respect to patient occupancy. Therefore, one has to normalize work capacity according to patient occupancy in the department during the study. It is possible to divide the activities that the doctors perform during the study into two main types: *direct activities* and *indirect activities*. The amount of time devoted to direct activities (such as sick rounds, examinations, treatments, conversations with patients and family, updating, preparing letters of release, etc.) directly depends (usually

proportionately) on the number of patients hospitalized in the department. On the other hand, looking at the matter in a restrictive way, the amount of time devoted to indirect activities does not necessarily depend directly on the number of hospitalizations in the department (for example, administrative activities, studies and research, consulting with other departments, seminars and mentoring students).

The standardization according to average capacity uses the following notation.

f_d – the percentage of measured time for direct (<u>d</u>irect) activities that the doctors perform in the department in the course of the daily shift.

f_i – the percentage of measured time for indirect (<u>i</u>ndirect) activities that the doctors perform in the department in the course of the daily shift.

b_m – the average occupancy rate according to number of hospitalized patients at the time of the study (<u>m</u>ethod time).

b_y – the average <u>y</u>early operation occupancy, as taken from the hospital database.

In order to normalize the measurement "effective presence" in the department and to standardize only the direct activity component according to workload and average yearly occupancy, a *normalization factor* (w_d) was calculated as follows:

$$w_d = f_d \times (b_y / b_m) + f_i \,.$$

Multiplying an average work capacity component (net) by the normalization factor (e.g., $P_d \times w_d$) is equivalent to applying the "rule of three" so as to normalize the work capacity observed at the time of the study according to the average yearly occupancy. Evidently normalization is in relation to direct activities only. That is to say, the effect of this multiplication on the standardization staffing becomes smaller if patient occupancy in the course of the study is closer to the average yearly occupancy and vice versa. Let us note that Standardization of required staffing based on average occupancy is often considered too conservative (in terms of savings in manpower). In many service systems, it is customary to standardize staffing according to the upper percentile of the distribution of the demand for service (in our case according to patients' occupancy). For example, a job standard in a service system according to the 90% percentile ensures a sufficient staffing capacity to serve clients at 90%

occupancy. In the case under discussion, it is possible, by obtaining data regarding occupancy distribution, to standardize according to the desired percentile.

It must be emphasized that not every activity defined as *direct* is carried out frontally vis-à-vis the patients. For example, paperwork in regard to the patient (preparing a document, updating/tracing a document) or consulting and providing guidelines for the medical staff can be performed near the patient as well as in an area farther away.

According to the same principle, it is possible to normalize the "effective presence" in the operating rooms since the work capacity in this work area is a function of department occupancy. Accordingly we define:

$$w_s = f_d^{\,s} \times (b_y^s / b_m^s) + f_i^{\,s} \ , \text{where}$$

$f_d^{\,s}$ – the percentage of measured time for <u>d</u>irect activities that doctors perform in the operating rooms (net operating time).

$f_i^{\,s}$ – the percentage of measured time for <u>i</u>ndirect activities that doctors perform in the operating rooms (preparatory activities, waiting, and personal, in the operating rooms.)

b_m^s – the operations occupancy (number of operations) at the time of the study

b_y^s – the operations average yearly occupancy (number of operations), taken from the hospital database.

Using the same principle, it is possible to normalize "effective presence" in the outpatient clinics. Accordingly,

w_c – the standardization factor associated with the outpatient clinics; w_c was derived from the average number of visits in the daily shift (according to statistics from the hospital's database) with respect to the average number of visits measured at the time of the study in the course of the daily shift.

Absences due to roster duties

R - the average number of doctors in the department who carry out roster duties every day of the week and accordingly are absent the following day after finishing the duty.

Necessary professional absences

e - the percentage of professional absences (necessary absences) of the doctors a year, such as those required for advanced courses abroad, participation in conferences, and professional advancement exams and studying for them. This factor is weighted for every doctor in the department in respect to the relationship between the specialist and residents.

Allowances

$(1+a)$ – indicates the percentage of allowances, such as *personal and fatigue allowances* as well as *unavoidable delays* that are considered in order to arrive at a fair standard. Fatigue allowances are necessary for standardizing work according to specific conditions and the work environment, as is common in work-studies. For example, fatigue allowances are determined by the muscular effort an individual expends, mental strain and the work environment. They are based on known allowance tables (Niebel and Freivalds, 2003). In addition there are commonly accepted allowances for personal needs and unavoidable delays as a result of the nature of the required assignments and the complexity of the system in which the doctors work. The allowance percentages in the current study were set at 17%, which approximates standardization models in other similar work-studies which appear in the literature (e.g., Ghosh, 2006). Let us note that a higher allowance level could have been set in this study (up to about 20%-30% allowance level) relying on existing definitions in the standardization literature, but the approach we follow here is essentially conservative.

Calculating the perceived "level of service" factor

Standardizing the level of service in the study was evaluated by the direct treatment time of the patient in the department (thus, the average amount of time devoted to one patient by the doctors in the course of the daily shift.) Such a measure was selected according to answers to a questionnaire distributed to patients indicating that the perceived "level of service" was primarily affected by the treatment time.

z_d – the standard time coefficient for directly treating the patient in the department (frontal activities vis-à-vis the patient) which is to be determined in principle by

expert judgment. The service coefficient is designed to standardize the number of physician positions in order to arrive at the desired level of service in the department. The value of this coefficient in this study was set at one so as not to affect the proposed standardization yet to include it in the staffing model. Inclusion of such a factor in the model makes it possible to perform theoretical sensitivity analyses associated with the perceived service level with respect to the service level at the time of the study, as seen below.

z_c – represents the standardization coefficient for the perceived level of service at the outpatient clinic. Here again we set the value of this coefficient at one so that it would not influence the proposed staffing standardization, yet would be included in the staffing model. The level of service at the outpatient clinics was generally set according to such factors as the amount of time a patient has to wait for treatment, duration of treatment, attitudes and staff politeness towards the patient and the level of patient satisfaction at the end of the visit.

The staffing standardization model

The proposed standardization model was calculated according to the components presented above. At the core of the model is the *work capacity* or the effective presence physicians required to implement their activities at different work areas. The work capacities are normalized according to the average occupancy in the area and multiplied by the service factor (which is neutralized in this study). Then, the normalized work capacities in relevant areas are multiplied by the allowances factor. Furthermore, the model takes into consideration such factors as "legitimate" absences due to roster duties and other absences due to professional activities performed outside the department.

The staffing standardization model expresses the number of doctors in the department in order to perform the required activities:

$$J = \left[(P_d \times w_d \times z_d + P_s \times w_s + P_c \times w_c \times z_c) \times (1+a) + P_o + R \right] \times (1+e)$$

For the convenience of the readers, we repeat, in brief, the notation used in the model:

J - the required physician staffing in the department

P_d - the effective required presence of physicians in the department area.

P_s - the effective required presence of physicians in the operating rooms

P_c - the effective required presence of physicians in hospital outpatient clinics

P_o - the effective required presence of physicians in external areas

R - the average number of doctors performing roster duties every day of the week and therefore are absent the next day because of leave after roster duty

w_d - the standardization factor to normalize work capacity observed at the time of the study in the department according to average yearly occupancy.

w_s - the standardization factor to normalize work capacity observed at the time of the study in the operating rooms according to average yearly occupancy.

w_c - the standardization factor to normalize work capacity observed at the time of the study in the outpatient clinics according to the average yearly occupancy.

z_d - the standardization factor to reflect the perceived level of service for the patients at the department area. The factor is neutralized in the model by setting its value at one.

z_c - the standardization factor to reflect the perceived level of service for the patients at outpatient clinics. The factor is neutralized in the model by setting its value at one.

a - the percentage of allowance (personal, fatigue, and unavoidable delays).

e - the percentage of necessary professional absences.

5. ANALYZING THE RESULTS OF THE WORK-SAMPLING STUDY

On the basis of the work-sampling data and direct measurements, a detailed report about each department was written. The reports included the following findings:

   i.   Distribution of the doctors' activities according to doctors' rank
   ii.   Distribution of activities according to type (e.g., direct, indirect, personal)
   iii. Workload according to groups of doctors and measurement days
   iv.   Distribution of all activities during job rotations/roster duty
   v.   Distribution of activities according to groups (direct/indirect)
   vi.   Workload during roster duty and daily shifts

vii. Calculation of average treatment time per patient in the course of the study

viii. Calculation of the relationship between the number of patients hospitalized in the department and number of doctors in the department

ix. Calculation of the sample size and inaccuracy level in the study

Proposed Staffing Standardization

The standardization for five departments at three Israeli hospitals was calculated by means of the proposed standardization model, presented above in Section 4. The standardization was calculated in relation to the average annual occupancy and for various occupancy rates. These rates were determined in association with the current standardization of the department. That is to say, when speaking, for example, about "10% above the average occupancy" this means multiplying the average annual occupancy of the department by a factor of 1.1. As seen in the proposed model, a change in the occupancy rate in the department directly influences the occupancy factor and consequently the department's physician staffing requirements. This relation is linear, as seen in the proposed standardization model and in Figure 1 below. As indicated above, another possible approach, which is accepted in service systems, is to standardize the staffing requirements according to a predetermined percentile of the yearly occupancy distribution in order to ensure a minimum level of service during periods when the occupancy is high, such as in winter in the Internal Medicine Department.

Table 2 contain the following columns regarding the various departments that were studied: i) the five department types in this study; ii) the current staffing standard at these departments. In general, according to the collective agreement ("Amorai Committee" agreement, 1976) currently in effect at Israeli hospitals, standardization was set at one doctor per five beds. This is in addition to a department head staffing position for the first thirty beds. For each eight beds another position is added. Further, according to the "Barabash Agreement" (1997) a one-time addition for physician staffing requirements and on-call duties was agreed to. This was in addition to the obligatory standardizations that were calculated as a result of the collective agreements and a ruling by Arbitrator Goldberg (which are relevant to the following departments that were observed in this study: Internal Medicine, Surgery, Orthopaedics and Children's); iii) the current staffing status in terms of effective

positions. That is the number of effective positions that were found in the study. Effective positions were calculated in terms of full-time working physicians. For example, if in practice two physicians are working at a 50% position each it is equivalent to one full time effective position. Let us note that in all the departments the number of effective positions were higher than the standard; and iv) the proposed staffing standard for the department according to average annual occupancy (column 4) and when assuming a higher percentile above the yearly occupancy (columns 5-9). For example, the proposed staffing standard for physicians in the Orthopedics department, assuming an occupancy which is 30% higher than the yearly average is 28.6 doctors.

Table 2. Proposed staffing standardization in various departments in accordance with the occupancy rates and the current staffing.

Department Type	Current Staffing Standard	Current status (effective positions)	Recommend standard calculated according to yearly occupancy in department					
			Average Occupancy	Assuming a certain percentile above the yearly average occupancy				
				10%	20%	30%	40%	50%
Internal Med.	11	16	17.0	18.1	19.2	20.4	21.5	22.6
Orthopaedics	13	23	25.4	26.5	27.6	28.6	29.7	30.8
Surgery	11	14.3	17.2	18.1	18.9	19.8	20.6	21.4
Children's	12	13	14.9	15.8	16.8	17.7	18.6	19.5
Gynecology	27	30	36.2	37.1	38.0	38.9	39.7	40.6

Table 3 presents standardization and occupancy statistics for each of the departments. The way the table's values were calculated is noted in the first row. Column A presents the number of departmental beds according to the current standard; column B presents the yearly occupancy percentage (rate); column C presents the average number of effectively occupied beds per year; column D presents the equivalent occupancy rate in the department, which is appropriate to the number of effective staff positions in the current situation (the equivalent occupancy rate is calculated by using the proposed staffing model); column E presents the equivalent number of occupied beds in the department appropriate to the number of effective staff positions in the current situation (calculated by using the proposed staffing model); column F presents the ratio between the theoretical occupancy in the department beds (column E) and the average number of effectively occupied beds (column C); column G, presents the average accumulated time measured for one patient by all doctors in the department

during the daily shift; and column H presents the value of an equivalent service factor, as explained below.

Table 3. Staffing standardization and current status at studied departments

Column	A	B	C=A*B	D	E=A*D	F=E/C	G	H
Dept. Type	No. Stand. Beds	Yearly Occup.	Avg. Occup. Beds	Theoretical Occup. by model.	No. effect. beds	Curr. Eff. Occup.	Treat. time per patient	Equiv. Serv. Factor
Internal Medicine	38	118%	44.8	108%	41.0	92%	61 min.	0.93
Orthopedics	38	97%	36.9	75%	28.5	77%	52 min.	0.73
Surgery	33	94%	31.0	61%	20.1	65%	46 min.	0.68
Children's	33	82%	27.1	65%	21.5	79%	102 min.	0.84

The duration of the patient's treatment appears in column G. To calculate these times, all the activities that were defined as direct were taken into account. In actual fact, doctors perform only about 50% of these activities in proximity to the patient. That is to say, in the course of the daily shift, the patient meets doctors frontally only half of the time appearing in the table, which reflects the time directly devoted to him. The time standard for treating a patient in the department (the time devoted to one patient by the doctors in the course of a daily shift) constitutes the basis for standardizing the level of service in the department, which is to be carried out by outside experts (see Lipscomb et al., 1995). It is clear to all the parties in the study that the desired level of service should be higher than the service provided today in all the departments that were studied.

As noted above, the level of the service factor was "neutralized" by setting its value at one. However, in order to demonstrate, even partially, the potential effects of the current staffing situation on the service level, column H presents the value of an equivalent service factor which, if plugged into the proposed staffing model, results in a standard equal to the present staffing situation in accordance with the average patient occupancy in the departments. For example, for the Orthopaedics Department, the equivalent service factor that results in a standard equivalent to the present staffing situation is 0.73 (i.e., 27% lower than the "neutralized" service factor that was somewhat arbitrarily set to one according to the current situation). In other words, a service factor of 0.73 will bring about a situation in which the desired standardization

according to average yearly occupancy is equal to 23. This is the physician staffing situation in terms of effective positions available in the department today. It is clear that setting the desired level of service as the standardizing factor will bring about an additional increase in the number of positions in these departments according to different workloads.

Figure 1 presents the number of required staff positions for each of the five departments as a function of the department occupancy. Additional details regarding each of the above departments appear in a specific report that was prepared separately for each department.

[Insert Figure 1 about here]

6. DISCUSSION

This paper follows previous works, such as Gilchrist et al. (2005), Oddone et al. (1993, 1994), and Fagersorm et al (2001), and claim that professional assessment of optimal physician stuffing level is possible. Ideas and methods of Scientific Management that were developed approximately a hundred years ago for the manufacturing sector can and should be better implemented in healthcare systems. Productivity and service level in the healthcare industry are major issues in our global society. The huge proportion of GDP invested in this sector in the USA and other industrial nations call for a Scientific Management of resources in this sector. As physicians are by no doubt one of the most important and expensive resource in healthcare systems, further development and implementation of the proposed model are well justified.

A glance at the tables and graphs in the previous section reveal that most of the departments require an additional staffing of between 25%–100%. It appears that current physician staffing stands at between 80-90% of the required staffing based on the average yearly occupancy. That is to say, it seems that these departments adapted, in one way or another (sometimes creatively by relying on external resources) their physician staffing requirements to meet professional medical demands deriving from average patient occupancy.

An important point is that the standardization proposed in this paper was determined in a conservative manner (i.e., savings in manpower). There are many factors that could have been set in such a way as to significantly increase the required standard. Below we address a number of factors and parameters that were set in a conservative manner in this study but justify further discussion.

Service time coefficients that are supposed to standardize the number of physician positions to provide a level of desired service are indeed included in the standardization model but have been neutralized by setting their value at one. That is to say, these coefficients were not used to increase the required standardization even though the direct service level for the patient (which depends very much on the extent of frontal time with the patient) is of decisive importance to the patient's "perception of service" and despite the fact that direct service time vis-à-vis the patient was lower than required and what was assessed a priori to the study by the physicians themselves. As noted above, standardizing the level of service is to be carried out by standardizing patient treatment time in the departments (the time devoted to the patient by the department doctors in the daily shift – see Table 3) and by the coefficient of the patient service standardization to be determined, in principle, by the expert evaluation of other physicians. Ideally, the above service coefficient should standardize physician staffing in order to arrive at the desired level of service in the departments. As the literature survey and questionnaires, handed to a sample of patients, indicate, patient treatment time constitutes one of the main components in the level of service in a department.

Quantifying the activities of the doctors in the departments was carried out in the course of the daily shift, lasting about eight hours a day. On the other hand, after ending a quantification day, several of the department doctors (in addition to those on duty) remained in the hospital area and engaged in various activities. These activities were not measured and the amount of time involved was neither included in the work capacity nor calculated into the standardization.

In this paper, a uniform work rate of 100% was set even though in many cases it seemed that the doctors carried out many activities at a much higher rate. It should be noted that we would expect to see a rate above 100% when the workload on the

personnel is high. This is supported by the literature on the subject (e.g., Niebel and Freivalds, 2003).

The assumption was made that time invested in indirect activities is not directly dependent on the number of hospitalizations in the department even though this assumption is only to a certain extent reasonable. For example, administrative activities ultimately increase with department occupancy.

The assumption was made that the work capacity of department physicians in work areas outside the department will remain identical to the current situation (without multiplying the various coefficients). This range of activities involves providing, for example, medical services to patients who aren't hospitalized in the relevant department, activities in outpatient clinics, consultations in other departments, emergencies and operations.

Normalization of direct work capacity was based on an average yearly occupancy. This sort of normalization is conservative in principle (savings in manpower). As noted above, in many service systems it is customary to standardize staffing requirements based on the upper percentiles of client occupancy distribution. For example, it was possibly to standardize staffing in the system based on the 90th percentile of the occupancy, which ensures sufficient staffing in order to serve clients in scenarios like this as well. In systems in which failure to provide service in a reasonable time leads to a high penalty (in price, in lives, etc.) it is customary to assure as well the provision of fast service in situations in which there is an increase in patient occupancy.

In continuation of the remark above, when standardization is calculated at workloads lower than the yearly average, as in the graphs above (the conservative assessment according to which the standardization was calculated), there is a shift in tendency. That is to say, a situation in which the indirect activities in the model are not dependent on occupancy leads to an increase in required physician staffing.

The percentage of non-continuous additions in the standardization model was set in a balanced, conservative manner. It would have been possible to propose a much higher

addition (up to 20-30%) based on definitions commonly used in other standardization systems.

It should be pointed out that standardization in the case under discussion was set using only average times in a deterministic closed-form equation. That is say, this proposed model equation does not include terms that take into account the variations that exist in a system with random times (i.e., in a stochastic service system). It should be noted that failure to consider the variation factors significantly reduces standardization values in this case. This basic result is widely known and cited in the professional literature and appears in most of the textbooks about queuing theory and simulations about queuing systems (for example, one may be found in Law and Kelton, 1991). It is possible to validate this by using various simulations (static Monte Carlo simulations or discrete event systems simulations). The phenomena described in this section is of considerable importance since in our opinion, simulation would show that a level of service is actually lower than what is presented in the figures that summarize the level of service as a function of workload in the current standardization and the present staffing situation.

7. CONCLUSIONS

The goal of this study was to develop a standardization model for physician staffing requirements for different types of hospital departments, such as Internal Medicine, Surgery, Orthopedics, Children's (Pediatrics), and Gynecology.

Our most important conclusion is that it is possible to standardize the number of physician positions to provide a desired level of care.

The model we proposed for standardizing physician staffing requirements makes it possible to assess physician workloads and to quickly update the standard according to factors such as occupancy level, professional absences, allowances, physicians' work duties and to some extent the obtained service level.

It appears that this study is to some extent one of the largest work studies for physician staffing in modern hospitals. It is reasonable to assume that other work studies were carried out but were not published for various reasons.

REFERENCES

"Amorai Committee Agreement" (1976), appears (Hebrew) in TEKEN HAROF'IM, ESKEM KIBUTZI (part D), The Israeli Ministry of Health Publication, 29 November, 1976.

"Barabash Agreement" (1997), (Hebrew) An Agreement for standardization issues, Letter of the General Manager, Israeli Ministry of Health, 18 March, 1997.

Abu Bakar A.H., Hakim I.L., Chong S.C., Lin B. (2010), Measuring Supply Chain Performance Among Public Hospital Laboratories, *International Journal of Productivity and Performance Management*, Vol. 59 (1), 75-97.

Ampt, A., Westbrook, J., Creswick, N., Mallock N., (2007), A comparison of self-reported and observational work sampling techniques for measuring time in nursing tasks, Journal of Health Services Research Policy, Vol. 12, 18–24.

Barger L. K., Ayas N. T., Cade1 B. E., Cronin J. W., Rosner B., Speizer F. E., Czeisler C. A. (2006), Impact of Extended-Duration Shifts on Medical Errors, Adverse Events, and Attentional Failures, *PLoS Medicine*, Vol. 3(12), 1–9.

Bartholomeyczik S., Hunstein D. ,(2003), Time Distribution of Selected Care Activities in Home Care in Germany, *Journal of Clinical Nursing*, Vol. 13(1), 97–104.

Bee E. P, Richards A. D., Loftus J. S.,1, Baker A. J., Lorna Bailey L., Lovell K., Phil Woods P., and Cox D., (2006) Mapping Nursing Activity in Acute Inpatient Mental Healthcare Settings, *Journal of Mental Health*, Vol. 15(2), 217–226.

Bratt, J., Foreit, W., Chen, P., West, C., Janowitzi, B., De Varagas, T. A (1999), Comparison of Four Approaches for Measuring Clinician Time Use, *Health Policy and Planning*, Oxford University Press, 14(4), 374-381.

Cardona P., Tappen R.M., Terrill M., Acosta M., Eusebe M.I. (1997), Nursing Staff Time Allocation in Long-Term Care: A Work Sampling Study, *Journal of Nursing Administration*, Vol. 27(2), 28–36.

Castle A., Harvey R. (2009), Lean Information Management: The Use of Observational Data in Health Care, *International Journal of Productivity and Performance Management*, Vol. 58 (3), 280–299.

Chatziaslan B.E., (2009), Healthcare Capacity Measurement, *International Journal of Productivity and Performance Management*, Vol. 58 (8), 748-766.

Fagersorm A., Gersorom L. , Rainio A.K., (2001), Professional Assessment Of Optimal Nursing Care Intensity Level: A New Method of Assessing Personnel Resources For Nursing Care, *Journal of Clinical Nursing,* Vol. 8 (4), 369 – 379.

Finkler, S. A., Knickman, J. R., Hendrickson, G., Lipkin, M., and Thompson, W. G. (1993), A Comparison of Work Sampling and Time-and-Motion Techniques for Studies in Health Services Research, Health Services Research 28:5, 577-597.

Fontaine, B.R., Speedie, S.M., Abelson, D., Wold, C. (2000), A Work-Sampling Tool to Measure the Effect of Electronic Medical Record Implementation on Health Care Workers, *The Journal of Ambulatory Care Management*, 23(1), 71-85.

Ghosh B. and Cruz G. (2006), Computer Assisted Physician Requirements Planning, *Journal of Health Management,* 8, 157.

Gilchrist V., McCord G., Labuda S. S., King D. B., McCormick F. K., Oprandi M. A., Selius A. B., Cowher M., Maheshwary R., Patel F. , Shah A., Tsai B., Zaharna M. (2005), Physician Activities During Time Out of the Examination Room, *Annals of family Medicine*, Vol. 3, (6), 494- 499.

Guarisco S. and Oddone E. (1994), Time Analysis of a General Medicine Service: Results From a Random Work Sampling Study, *Journal of General Internal Medicine*, Vol 9, 272-277.

Khoury, S.A., and Mawajdeh, S. (2004), Performance of Health Providers in Primary Care Services in Jordan. *Eastern Mediterranean Health Journal*. Vol. 10(3), 372-381.

Law A.M., Kelton W.D. (1991) *Simulation modeling & analysis*, McGraw-Hill, New-York.

Lipscomb J. (1991), Physician Staffing for the VA: Volume I, *Committee to Develop Methods Useful to the Department of Veterans Affairs in Estimating its Physician Requirements, Institute of Medicine*, National Academy Press.

Lipscomb J., Kilpatrick E.K., Kerry L. and Pieper K. (1995), Determining VA Physician Requirements Through Empirically Based Models, *Health Services Research* 29; 6, p.697–716.

Lurie N., Rank B., Parenti C., Woolley T., and Snoke W. (1989) , How Do House Officers Spend Their Nights? A Time Study of Internal Medicine House Staff On Call" *New England Journal of Medicine*, 320, no. 25, 1673-1677.

Niebel B. and Freivalds A. (2003), *Methods, Standards, & Work Design*, McGraw Hill, New-York.

Oddone E., Guarisco S., Simel D. (1993), Comparison of House staff's Estimates of their Workday Activities with Results of a Random Work-Sampling Study, *Journal of Association of American Medical Colleges*, Volume 68, No. 11, 859-861.

Oddone E., Guarisco S., Simel D. (1994). Time Analysis of a General Medicine Service: Results from a Random Work Sampling Study, *Journal of General Internal Medicine*, Volume 9, May 1994, 272-277.

Pelletier D. and Duffield C. (2003), Work sampling: Valuable Methodology to Define Nursing Practice Patterns, *Nursing and Health Sciences*, 5, 31–38

Rasmussen B. H., Sandman P. O., (2000), Nurses' Work in a Hospice and In An Oncological Unit in Sweden. *Hospice Journal.*; Vol. 15(1), 53–75.

Stevenson J., Caverly S., Srebnik D., and Hendryx M. (1999), Using Work Sampling to Investigate Staff Time Allocation in Community Mental Health Centers, Administration and Policy in Mental Health, Vol. 26, No. 4, 291-295.

Urden L. and Roode J. L. (1997), Work Sampling: A Decision-Making Tool for Determining Resources and Work Redesign, *Journal of Nursing Administration*, Vol. 27(9), 34-41.

Vogel P., (2004) *Superior Productivity in Health Care Organizations,* Baltimore: Health Professional Press, Inc.

Wensing M., Van Den Hombergha P., Akkermansa R., Van Doremalena J., and Grola R. (2006), Physician Workload in Primary Care: What is the Optimal Size of Practices? A cross-sectional study. *Health Policy*, 77, 260-267.

Whang E.E., Perez A., Ito H., Mello M.M., Ashley S.W., Zinner M.J. (2003) Work Hours Reform: Perceptions and Desires of Contemporary Surgical Students, J*ournal of the American College of Surgeons*, 197(4) ,624-630.

Wirth P., Kahn L., Perkoff G.T. (1977), Comparability of two methods of time and motion study used in a clinical setting: work sampling and continuous observation. *Med Care*. 15(11), 953–960.
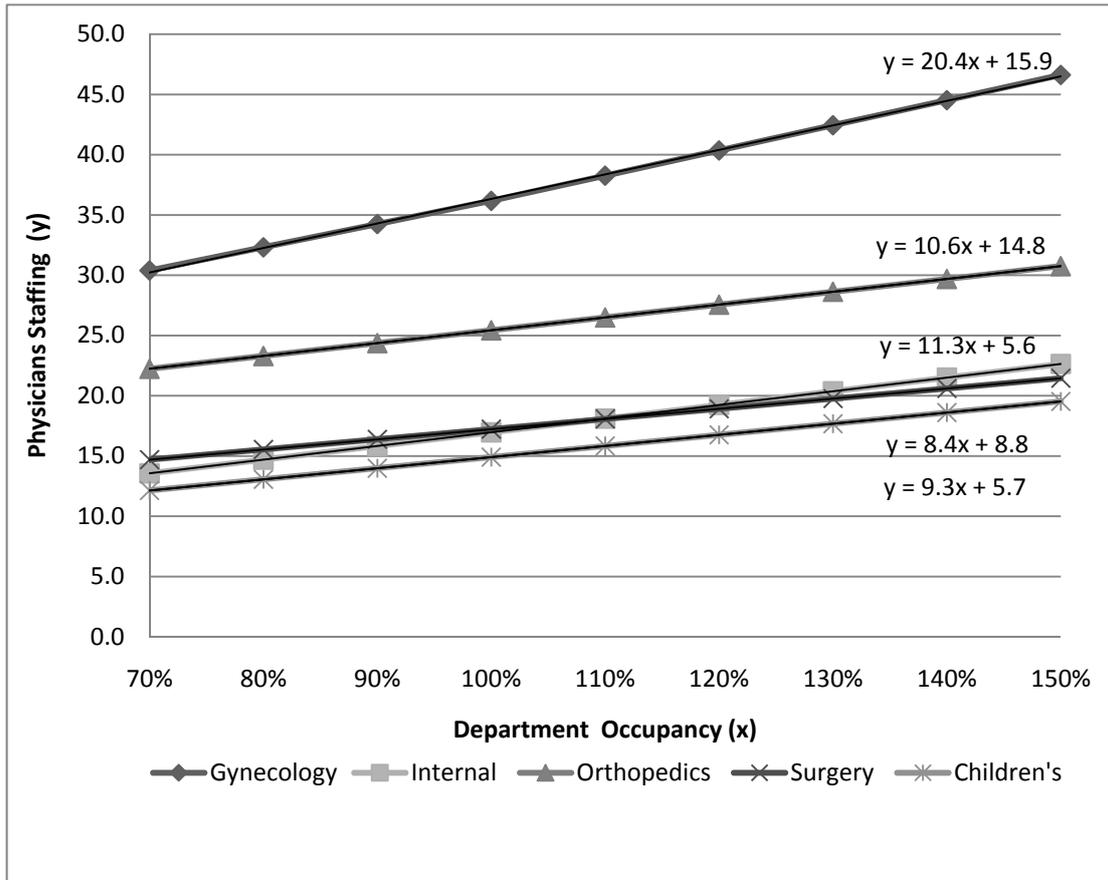
Figure 1: Physicians' staffing requirement for each department as a function of its occupancy, based on the proposed model. The linear strandline between the physicians' staffing (Y) and the yearly occupancy (x) is shown. The intercept represents the required physicians' staffing for seventy percents occupancy of average yearly occupancy.

Table 1. List of Performed Activities

No.	Category/Groups of Activities	Activities	Type of Activity
1	Updating activities	1.1 morning meeting	Direct
		1.2 X-ray meeting	
		.1 Doctors meeting (other)	
2	Sick rounds	2.1 Morning round	Direct
		2.2 Sick round (other)	
3	Clarifications and collecting information	3.1 Computer clarifications	Direct
		3.2 Telephone clarifications	
		3.3 Frontal clarifications	
		3.4 Receiving reports	
		3.5 Literature clarifications	
4	Interacting with patient	4.1 Speaking with patient or family	Direct
		4.2 Physical examination	
		4.3 Treatments	
		4.4 Taking blood	
5	Conferring and consultations	5.1 Conferring/consultations	Direct
		5.2 Staff briefing	
		5.3 Accompanying external consultants	
6	Documentation	6.1 Preparing letter of release	Direct
		6.2 Preparing interim report	
		6.3 Ordering examinations and x-rays	
		6.4 Approving letters of release	
		6.5 Examining patient documents	
		6.6 Follow-up/preparing documents (other)	
7	Waiting	7.1 Waiting (enforced)	Indirect
8	Administrative activities	8.1 Preparing work plan	Indirect
		(8.2 Administrative, other	
9	Research and study	9.1 Lectures and seminars	Indirect
		9.2 Accompanying students	
		9.3 Research	
10	Activities outside the department	10.1 Transitions	Indirect
		10.2 Consulting other departments	
		10.3 Outpatient clinics	
		10.4 Operations	Direct
11	Personal	11.1 Food	Personal additions
		11.2 Bathroom	
		11.3 Miscellaneous	