ORIGINAL ARTICLE

Work-Time Distribution of Physicians at a German University Hospital

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SUMMARY

Background: The effective utilization of staff resources is of decisive importance for the adequate, appropriate, and economical delivery of hospital services. The goal of this study was to determine the distribution of working time among doctors in a German university hospital—in particular, in terms of type of activities and time of day.

Methods: The distribution of working time was determined from 14-day samples taken in seven clinical departments of the Medical Center—University of Freiburg. In each 14-day sample, the activities being carried out at multiple, randomly chosen times were recorded.

Results: A total of 250 doctors (participation rate: 83%) took part in the study. A total of 20 715 hours of working time was analyzed, representing twelve years of full-time employment. Overall, 46% of working time in the inpatient sector was spent in direct contact with patients, with relevant differences among the participating clinical departments: for instance, the percentage of time taken up by patient contact was 35% in pediatrics and 60% in oral and maxillofacial surgery. Patient contact was highest (over 50% overall) in the period 8 a.m. to 12 noon.

Conclusion: The amount of working time taken up by activities other than direct patient contact was found to be lower than in previous studies. It remains unclear what distribution of working time is best for patient care and whether it would be possible or desirable to increase the time that doctors spend in direct contact with patients.

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Personnel costs account for around 60% of total expenditure in German hospitals (1). Effective deployment of staff is crucial if a hospital is to function effectively and economically. This becomes particularly relevant in times of shortage of qualified medical personnel (2, 3) and the kind of financial constraints currently prevailing in many institutions (4).

In the setting of industrial production, the importance of studies investigating the time spent working has decreased sharply, owing to the minimization of variance in resource consumption by standardization and automation (5). In contrast, many hospital processes can be neither standardized nor automated, among other reasons because the needs of an individual patient are hard to predict (see [6]).

Organization theory usually describes two methods for investigating work-time:

- In the method of continuous observation, the activities of the staff members concerned are recorded without interruption (7). This almost always means that the staff under investigation are continuously accompanied by another person. An advantage of this technique is that detailed information on the type and duration of the various tasks can be documented (8). Disadvantages are the high cost and the impracticality of surveying the work of a large number of people.
- In the method of work sampling, a sample of activities is used to estimate the overall distribution of work-time (9). The samples are taken at random times to avoid distortions due to temporal patterns. The proportions of total working time taken up by various individual tasks and the statistical confidence levels are calculated from a sample with an assumed random distribution. The technique was developed in the 1930s for use in industrial production processes (9) and has become an acknowledged method for the measurement of working time in the hospital setting (10–16). Reviews of studies on physicians' (17) and nurses' (18) workloads show, however, that this method has not so far been widely used in European hospitals.

Valid data on the distribution of work-time are necessary for assessment of whether highly qualified medical personnel are being deployed effectively and

TABLE 1

Classification of types of activities

Category	Description	Examples
Direct inpatient care	Activities in direct contact with inpatients	Blood sampling, rounds, surgical interventions
Indirect inpatient care	Activities on behalf of particular inpatients without their presence	Documentation, discharge letters
General inpatient activities	Activities not on behalf of particular inpatients but connected with the delivery of care in general	Meetings, team discussions, other activities connected with organization of clinical services
Outpatient care	Activities connected with the care of outpatients	Blood sampling, documentation of treatment
Other activities	Activities not directly serving to deliver hospital care	Research, teaching, moving from place to place, training courses, breaks

in accordance with their competencies. One aspect that has been a focus of public debate is the amount of working time that medical staff spend not in direct contact with patients, e.g., completing obligatory documentation (19).

This article presents the results of a study carried out in various departments of the Medical Center—University of Freiburg from June 2013 to October 2016. The goal of the study was to establish the prevailing work-time distribution of physicians in different disciplines in terms of tasks and times of day. Specifically, we wanted to investigate what proportion of working time was dedicated directly to patients and how much time was spent on other activities. Some of the results from

individual departments have already been published in scientific journals (20–22), but this is the first presentation of the overall findings. No study of this type and size has previously been carried out in the German-speaking countries.

Methods

The component studies in seven individual departments of the hospital were each carried out over a period of two weeks. A portable device emitted an acoustic and visual signal at random times within 30-minute periods. Every time the signal went off, the participants noted where they were and what they were doing. The study covered the whole work-time of all clinically active staff members. Night shifts were excluded. *Table 1* shows how the different tasks were classified. A more detailed description of the methods can be found in the *eBox*.

Results

Table 2 shows the departments that participated in the study with the numbers of staff, observations, and working hours covered. A total of 41 430 observations were recorded, corresponding to 20 715 hours of work or 12 net work-years. Overall, 83% of the physicians in the seven departments took part in the study. The participating physicians showed almost the same distribution into interns (45%), qualified specialists (24%), and senior physicians/department heads (31%) as all physicians employed in the departments concerned (43%, 26%, and 31% respectively).

Table 3 presents the amount of time spent on the various types of tasks by the doctors in each discipline. The figures include both persons with varying tasks and workplaces and those who, for example, worked only with outpatients. Overall, direct inpatient care took up 24% of the physicians' time. Indirect inpatient care and general tasks related to inpatients together accounted for 28% of the total time. Activities related to outpatients occupied one third of total work-time. This included all

TABLE 2

Numbers of participants, observations, and working hours in each department

	Number of physicians in study	Number of observations	Number of working hours covered
Ophthalmology	39	6422	3211
Dermatology	22	3566	1783
Gynecology	22	3884	1942
Pediatrics	74	11 222	5611
Oral and Maxillofacial Surgery	15	2794	1397
Orthopedics and Trauma Surgery	42	8476	4238
Psychiatry and Psychotherapy	36	5066	2533
Total	250	41 430	20 715

TABLE 3

Distribution of the physicians' total working time (%) with 95% confidence intervals

Category	Ophthalmology	Dermatology	Gynecology	Pediatrics	Oral and Maxillofacial Surgery	Orthopedics and Trauma Surgery	Psychiatry and Psychotherapy	Overall
Direct inpatient care	16.8 [14.5; 19.3]	22.3 [19.4; 25.5]	33 [29.4; 36.9]	19.5 [17.6; 21.5]	27.1 [22.4; 32.5]	31.9 [29.2; 34.9]	25.5 [22.8; 28.3]	24.4 [23.3; 25.5]
Indirect inpatient care	12.9 [11.2; 14.8]	26.6 [23.2; 30.3]	18.7 [16.2; 21.5]	20.2 [18.5; 22.1]	11.1 [8.9; 13.8]	16 [14.3; 17.7]	16.2 [14.4; 18.3]	17.5 [16.7; 18.4]
General inpatient activities	9.4 [7.9; 11.1]	7.7 [6.1; 9.7]	9.4 [7.4; 11.8]	15.3 [13.7; 17.1]	6.8 [5.2; 8.8]	8.8 [7.8; 10]	11.1 [9.6; 12.8]	10.8 [10.1; 11.5]
Outpatient care	44.1 [40.1; 48.2]	26.1 [21.4; 31.3]	21.6 [17.5; 26.2]	31.3 [28.3; 34.5]	44.7 [38.6; 51.1]	36.8 [33.2; 40.5]	32.2 [27.1; 37.7]	34.1 [32.4; 35.7]
Other activities	16.8 [14.7; 19.2]	17.3 [14.3; 20.7]	17.3 [13.7; 21.6]	13.6 [11.9; 15.6]	10.2 [7.5; 13.7]	6.5 [5.3; 7.9]	15 [12.6; 17.7]	13.3 [12.4; 14.2]
Total	100	100	100	100	100	100	100	100

Descriptions of the categories can be found in Table 1

work carried out for the benefit of these patients, i.e., direct care, indirect care, and general clinical tasks. Outpatient work was excluded from the following analyses so as to examine inpatient activity in detail. The remaining 13% of the physicians' working time were spent on "other activities," e.g., research, teaching, moving from place to place, and breaks.

Figure 1 illustrates the distribution of the three types of inpatient-related activities in the various departments. Overall, tasks involving direct contact with patients occupied most time (46%). However, more than half of the total time was occupied with activities not involving the patient, i.e., indirect care and general tasks. The disciplines varied in the proportions of time spent on the three kinds of activities. While direct patient care took up only 35% of the total time in the Center for Pediatrics, the corresponding figure in the Department of Oral and Maxillofacial Surgery was 60%. It should be noted that the overall distributions were calculated as the weighted mean of the values in the individual disciplines on the basis of the number of observations. The overall data thus depended on the size of the individual departments.

Figure 2 shows the distribution of inpatient-related activities over the course of the working day. The time spent on direct care was highest between 08:00 and 12:00, at well over 50%. This fell to around one third between 16:00 and 18:00. The proportion of time devoted to indirect patient care, i.e., tasks such as documentation and writing discharge letters, was about one quarter between 08:00 and 10:00 and increased during the day to about 40% from 16:00 onwards. The amount

of time occupied by general ward activities was usually inversely related to direct patient care, i.e., it went down at times of intensive direct care and rose at less intensive times.

A portion of the multimoment work sampling findings could be validated using a second data source. In the Department of Psychiatry and Psychotherapy, the exact times at which individual and group therapy sessions began and ended were documented in the electronic records, and the definition of one subcategory of direct care corresponded precisely with these sessions.

Analysis of the multimoment data revealed that over a 7-day week the mean daily duration of individual and group therapy measures per patient was 8.11 min/day (95% confidence interval [95% CI] 6.98–9.39 min). This was calculated by dividing the total time per day by the number of patients and included only sessions lasting at least 25 min, as only these were documented in the electronic record for billing purposes. Other treatments by, for example, psychologists or nurses were not included.

The overall treatment times documented in the electronic records came to 8.24 min per patient and day. While the multimoment samples show the time distribution during the 14-day study phase, the electronic records for a whole calendar year were evaluated to establish how accurately the samples reflected the situation over a longer period. The differences between the multimoment findings and the electronic records were neither statistically significant nor substantial in economic terms. It is uncertain, however, to what extent the results might apply to other types of activities or other departments or hospitals.

FIGURE 1

Distribution of inpatient work-time in the participating departments

Discussion

The aim of this study was to ascertain how hospital physicians' work-time is divided among different tasks and different locations. Overall, 46% of inpatient working time was spent in direct contact with patients. More than half of doctors' inpatient work-time was occupied by tasks carried out away from the patients. The amount of time taken up by direct patient care varied from 35 to 60% among the disciplines studied.

Results in comparison with earlier studies

Our results can be compared with those of earlier studies. In 2010, Tipping et al. published a systematic review of the literature on empirical real-time analyses of hospital physicians' work-time distribution (17). They found 11 studies with sometimes inconsistent definitions of tasks in direct contact with the patient, only one of which was carried out in a German-speaking country (Austria [23]). The majority of the studies examined found much lower proportions of time spent on direct patient care than in our data. This discrepancy may result from differences in clinical practices between Germany and the countries in which the studies identified by Tipping et al. were performed. Another possible reason is that eight of the studies were over 20 years old; the most recent was published in 2009. Trends such as consolidation of services, shorter hospital stays, and more diagnostic and therapeutic procedures per unit of time therefore could not be taken into account. Moreover, there were differences in the methods of data acquisition. For example, only three of the studies reviewed used the multimoment work sampling method. In

all others, the physicians' activities were documented continuously.

In a study published in 2002, Blum and Müller (24) investigated the amount of time spent on documentation by 1010 hospital physicians. The data were acquired by means of a questionnaire, rather than empirically in real time. For surgeons, documentation took up an average 162 minutes each day (34% of an 8-h shift), while internists needed 195 min/day (41%). As mentioned by the authors, however, doctors' work shifts are often longer than 8 hours. Also for this reason, Blum and Müller's data are not directly comparable with ours. Furthermore, in our study the time spent on documentation was not recorded specifically; rather, it was subsumed in the category of tasks without the direct presence of the patient.

Limitations

One strength of the study we present here is its wide scope. With 250 participating hospital physicians and a cumulative observation time of 12 net work-years, it has no precedent in the German-speaking countries. A limitation of the study is the relatively restricted depth of detail of the data acquired. For the sake of clarity and ease of handling, it was necessary to aggregate the types of activities in all participating departments into five categories. This enabled the study question to be adequately addressed and meant that the methods could be generically designed and readily explained.

There are three further potential limitations of internal validity that have to be heeded in all empirical realtime

FIGURE 2

Distribution of inpatient work-time at different times of day with 95% confidence intervals

analyses. First, the study period is not necessarily representative for future time points when decisions have to be made. We countered this limitation by selecting study periods in which no unusual circumstances, e.g., vacation time or congresses involving absence of a significant number of medical staff, were anticipated. After the observation period, we asked the participants whether there had been any unusual circumstances during the survey. This questioning revealed an unusually high level of sickness among the staff of the Department of Dermatology and Venereology, prompting us to repeat the study there.

Second, participation in the study was voluntary and not all physicians wanted to or could take part. The work-time distribution of those who took part may have differed from the non-participants. However, with regard to the comparably large number of physicians involved, the participation rate was relatively high (83%). Moreover, we achieved an adequate cross-section of interns, qualified specialists, senior physicians, and department heads.

The third potential limitation of internal validity can be caused by the Hawthorne effect (25, 26). This is the tendency for people to change the way they behave when they know they are participating in a study. To minimize the Hawthorne effect, the data were rendered strictly anonymous, the clinical staff in each department were involved in the planning of the study at an early stage, and all participants were clearly informed about the aims of the study and the methods, specifically the guaranteed anonymity.

Furthermore, the results of our study cannot necessarily be generalized to all hospital services in Germany. Although we succeeded in including a relatively broad spectrum of disciplines the study was restricted to the Medical Center—University of Freiburg, so in particular it is unclear to what extent the findings apply to institutions that are not connected with a university.

Implications

No consensus has yet explicitly been reached, either for specific medical disciplines or in general, on how physicians' time should be divided among various types of tasks to achieve optimal patient care. It has been shown, however, that lack of time for direct patient contact is a major cause of job dissatisfaction for hospital doctors (27, 28). Especially dissatisfaction with the burden of administrative tasks and documentation is an important contributor to work-related stress and emotional exhaustion (29). Furthermore, hospital patients subjectively place a high value on physicians having sufficient time for ward rounds and personal discussions, but are often dissatisfied with the amount of time dedicated to them (30). From the aspect of health care economics, there are signs that if physicians spend insufficient time with individual patients the result may be excessive use of referrals to specialists and of diagnostic and therapeutic procedures, thus leading to an overall increase in health care expenditure (31).

Current social trends mean that doctors' work-time will become a scarcer resource in the foreseeable future. Demographic developments will augment the lack of

KEY MESSAGES

- Inpatient care accounted for 53% of physicians' work-time. A total of 34% was spent on outpatient care and 13% on other activities, e.g., waiting, moving from place to place, and breaks.
- Overall, 46% of working time on the wards in the participating departments was spent in direct contact with patients (e.g., rounds, operations, obtaining blood samples).
- One third of inpatient work-time was occupied by indirect care, i.e., work in connection with particular patients but not in their presence (e.g., treatment documentation, discharge letters).
- The departments of ophthalmology, dermatology, gynecology, pediatrics, oral and maxillofacial surgery, orthopedics and trauma surgery, and psychiatry and psychotherapy of the Medical Center—University of Freiburg took part in the study.
- The knowledge that they were taking part in a study may have altered the physicians' behavior.

physicians (32). A change in patients' attitude will necessitate more involvement of patients and their relatives in medical decision-making (33, 34). At the same time, doctors' own expectations are changing; they are increasingly demanding flexible working hours and a better balance between work and leisure time (35, 36). Furthermore, the amount of medically and legally required documentation has been steadily expanding for some time (37). Against the backdrop of these social developments, effective use of physicians' work-time will become even more important in the future.

Conclusion

The study presented here has shown empirically that only a relatively small proportion of hospital physicians' work-time is available for direct care, confirming the subjective impression of doctors themselves and their patients. More time for direct care can be created only by reducing other duties. Physicians' work activities should correspond to their qualifications. Non-medical tasks should be carried out to a greater extent by appropriate staff, e.g., documentation assistants, medical controllers, and social workers. The constant increase in obligatory documentation by physicians should be halted or restricted to what is absolutely necessary. This would have positive effects for hospital patients, their doctors, and the health care system as a whole.

Conflict of interest statement

The authors declare that no conflict of interest exists.

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Supplementary material

eBox:
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CLINICAL SNAPSHOT

Skeletal Hyperostosis as a Cause of Aspiration

An otherwise healthy 78-year-old man was admitted for the surgical treatment of a right-sided pleural empyema in an advanced stage. His wife related that he had been suffering for months from unclear speech, a stubborn cough, and food and drink “going down the wrong pipe.” The empyema was treated by decortication via thoracotomy, and a PEG tube was placed for nutrition. A cervical spine x-ray revealed, as the probable cause of repeated aspiration and pleural empyema, diffuse idiopathic skeletal hyperostosis (DISH) of the cervical spine, also known as Forestier's disease. DISH is a non-inflammatory skeletal disease of the spine, of unknown cause, that arises at the bony insertions of tendons, ligaments, and joint capsules. Pleural empyema secondary to aspiration is certainly a rare initial presentation of DISH; patients more commonly come to medical attention because of dysphagia or, occasionally, sleep apnea syndrome. In this patient's further course, the osteophytic changes were resected through an anterior cervical approach, whereupon his dysphagia and dysarthria markedly improved.

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eBOX

Methods

The study was carried out for 2 weeks in each of seven departments: Ophthalmology (62 beds), Dermatology (48 beds), Gynecology (77 beds), Pediatrics (111 beds), Oral and Maxillofacial Surgery (30 beds), Orthopedics and Trauma Surgery (107 beds), and Psychiatry and Psychotherapy (120 beds). Each participating physician had a portable device that emitted an acoustic and visual signal at random time points within 30-minute intervals. When the signal went off, the participants noted where they were and what they were doing at that moment. The study covered the entire working time of the clinically active participants, with the exception of night shifts.

The surveyed activities were selected so that they reflected the special characteristics of the department concerned but could also be grouped into categories for overall analysis. The category of direct inpatient care embraced all activities that took place in direct contact with one or more inpatients, e.g., blood sampling, ward rounds, or surgical interventions. Indirect inpatient care covered all activities on behalf of certain inpatients but not in their direct presence, e.g., updating treatment documentation or writing discharge letters. The category of general inpatient activities included all activities that were not performed on behalf of particular patients but served to deliver inpatient hospital services in general, such as meetings, team discussions, and other activities connected with organization of clinical services. Outpatient care comprised all activities connected with caring for outpatients: direct care, indirect care, and general clinical tasks. The category of other activities embraced all activities that did not directly serve to deliver hospital care, such as training, waiting, research, teaching, moving from place to place, and breaks. The detailed results of the individual studies in the Department of Ophthalmology and the Department of Psychiatry and Psychotherapy can be found elsewhere (21, 22).

The specific methods and the terminology of the study were tested in short pilot studies (one or two physicians for 1 to 2 days) in each department to ensure that they were well understood and practicable. Participation was voluntary and anonymous. The participating members of the medical staff were informed in advance of the aims of the study and given detailed advice on the use of the signalling devices and the definitions of the categories. In addition, detailed written instructions were provided together with the signalling devices and a telephone hotline was offered for real-time assistance. The methods were approved in advance by the staff council of the Medical Center—University of Freiburg and the internal review board of the University of Freiburg.

The maximum-likelihood estimator for the proportion of work-time accounted for by each category resulted from the total number of multimoment observations. Because observations close to each other showed serial correlation, the samples per department, physician, and working day were compiled into a cluster and cluster-robust standard errors were calculated. This calculation of standard errors avoided systematic underestimation of the size of the confidence intervals due to serial correlation.

In the Department of Psychiatry and Psychotherapy, the internal validity and the temporal generalizability of the acquired data were checked by comparison of the times calculated for individual and group therapy sessions on the basis of the multimoment samples with a whole calendar year's worth of precisely documented times entered in the electronic records for billing purposes.