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ORIGINAL RESEARCH

One hundred tasks an hour: An observational study of emergency department consultant activities

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Abstract

Objective: To determine work activity patterns undertaken by ED consultants.

Methods: A single observer time-motion study of consultants rostered to clinical shifts: primarily administrative (Duty) or clinical (Resuscitation). Direct observation of 130 h was undertaken using purpose developed time-stamping software. Primary outcome was task number and time spent in predetermined categories of activity. Comparisons occurred by role delineation, sex, weekday and time of day.

Results: For each observed hour consultants performed 101 discrete tasks. A high proportion was spent multitasking; 77 min of overlapping activity in each hour of observation. Consultants spent 42% of each hour on communication, 35% on direct clinical care and 24% on computer use; only 9% was spent on non-clinical tasks. Consultants spent little time (0.6%) accessing e-resources. Duty consultants undertook more tasks than Resuscitation consultants, 111 *versus* 90, and more time was spent on communication (47% *vs* 35%) and computer use (32% *vs* 15%) with less on clinical care (29% *vs* 43%). Female consultants undertook 119 tasks per hour compared with 93 for male consultants; more time was spent on communication (51% *vs* 38%) and computer use (28% *vs* 22%). No difference in activity occurred by time of day or weekday.

Conclusion: ED consultants have very high hourly task rates dominated by communication and clinical activities and frequently multitask. The activity is relatively constant throughout the week but is influenced by sex and role delineation. Appreciation of activity distribution might allow informed interventions to realign the workload or divert tasks to supporting resources.

Key words: *emergency care, emergency medicine, task performance and analysis, workload.*

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Introduction

There were 7.2 million presentations to Australian EDs in 2008–2009, with an average increase of 4.6% for each of the five previous years.[1] Increasing demand is anticipated as a result of population growth and an ageing population.[2–4] EDs are struggling to provide quality and timely care,[5] utilizing older infrastructure not designed to handle current patient loads and acuities.[6,7] EDs are required to manage these increasing demands without substantial increases in overall hospital bed resources.[7]

Central to ED processes and flow are the senior consultants. A study of communication pattern between ED staff has been mapped out and the high degree of centrality of senior doctors showed many staff members require them to solve clinical problems.[8] In addition, ED consultants have essential roles, including administrative work, diagnosis and management of difficult cases, supervision and teaching, and liaison with ambulance, police and family members.[9]

Given the central role of ED consultants in clinical and administrative care, it is essential to describe in detail their workplace activities. Understanding and quantifying doctors' work task and time utilization is important to assess any effects of future interventions in delivery of care.[10] Thus, a study to characterize and breakdown ED consultants' typical on-the-floor activities into quantifiable work-task areas will herald deeper understanding of how they work, and provide a basis of comparison for any future ED technological or workplace environmental change. In addition, it has potential implications for the training of future emergency medicine consultants through both improved role delineation and creating capacity for trainee supervision.

An assessment of UK ED registrars reported 67% of time was spent on seeing patients in the ED, associated short stay wards or clinics, 29% spent on call and 4% on teaching, research or administration.[9]

The time spent by ED physicians has been reported as 67% on patient care (26% bedside and 41% non-bedside) and 41% on documentation.[11] A subsequent study reported ED consultants spent only 32% of time on direct patient care; the remainder includes documentation, communication with other staff members, walking and paperwork.[12] These two studies were echoed by a 2004 study of ED consultants' activities, which reported 65% of total time was spent on indirect patient care.[5]

In the UK, nine ED consultants were asked to keep a work-based diary. An average of 30% of total time was spent on clinical activities, whereas meetings took up 14%.[13] It should be noted that differing methodology, health-care settings and work categorization make direct comparison difficult.

The aim of this study was to add a fine-grained analysis to previous research by quantifying the proportion of time ED consultants spent in different predetermined task categories. A novel aspect is that this study accounts for multitasking, which previous studies have not done. In addition, comparison was made by consultant role and sex, weekday and time of day.

Methods

Study design and setting

This was a single observer time-motion study conducted in September and October 2008 in Royal Melbourne Hospital (RMH), a tertiary referral hospital in Melbourne, Australia. The ED has 58 000 patient attendances per annum with a 40% admission rate. At that time, the ED used paper ordering for radiology and pathology requests, and relied on a paper medical record, while having digital viewing of radiology and pathology results. The ED Information System (EDIS) at RMH is used to record patient location, specific time points such as arrival and time seen, and the planned disposition of the patient.

Study population

The RMH ED is led by a team of 19 senior doctors (14 ED consultants and 5 senior ED registrars who work on the consultant roster); 6 are female. They vary their responsibilities in departmental administration, research and teaching. ED consultants provide clinical advice, supervise junior doctors undertaking procedures and mentor registrars preparing for Australasian College of Emergency Medicine Fellowship examinations.

Emergency department consultant numbers vary from two to four in shifts of 5–10 h, between 08.00 and 13.00 hours. From 01.00 to 08.00 hours, a registrar provides the senior on-floor responsibilities with a consultant on call. The consultant's role is partly administrative in overseeing flow and access and importantly to provide senior advice and supervision of all other staff. The principle role of the Duty consultant is to act as an ED manager to oversee the entire department, improve patient flow and deal with the flow of information, such as incoming patients and patients being transferred to other departments. At least one other consultant works

in Resuscitation, responsible for the critically ill patients, complex procedures and supervision of junior staff in that area.

Study protocol

Data collection was completed over 23 consecutive days, sampling all days of the week. Five 2 h sessions were sampled commencing at 09.00, 12.00, 15.00, 18.00 and 21.00 hours. These sessions excluded the main handover times, which have been the specific focus of other studies. All senior doctors who were rostered to work as Duty or Resuscitation consultants during the study period were eligible for observation.

A table was created using Microsoft Excel,[14] and randomization of sampling hours undertaken to achieve a representative sample of days, sessions and individual consultants. A total of 65 observation sessions (each 2 h in duration) was carried out, totalling 130 h of observation.

Information describing the study was made known to senior ED doctors before the observation period. During the sessions, subjects were informed that data collection was occurring. Participation was voluntary, and verbal informed consent was sought before observation. Potential study subjects were identified each day from the ED roster. An unbiased coin was thrown to decide which consultant, Duty or Resuscitation was observed for that 2 h session. The observer maintained a discrete distance from the subject to enable an unobstructed view without undue interaction. The observer did not follow the doctor into a cubicle, but continued the observation of doctor's tasks from outside the cubicle. If the doctor could not be observed while managing the patient in a cubicle, the entire time was allocated to 'Clinical Care – In the cubicle'. At the end of the observation session, all current activities were terminated, that is, they were not observed to completion.

Key outcome measures

The primary end-point was to describe the proportion of consultants' time spent on various predetermined task categories and task number in each category. These were direct clinical care, in-transit, documentation, computer use, communication, prescribing or non-clinical tasks. The secondary end-points compared activity by consultant role (Duty has a significant administrative component whereas Resuscitation is mainly clinical), weekday, time of day and sex.

Instrument development

Data were collected using specialized time-stamping software developed for the study.

The software was designed to record total time spent by the observed consultant in the predetermined categories.

One of the key objectives in developing the instrument was to overcome the inherent problem of earlier studies: the inability to accurately record multitasking. To achieve this, customized software was developed for a touch-pad computer with stylus allowing the observer to rapidly capture the start and stop times for multiple tasks running concurrently.

The observer (RK) initially conducted multiple trial observations of doctors using paper and a watch in the ED in July 2008. The main task categories and sub-task categories were identified, and further observations were made to fine-tune the observation categories. The finalized categories list was sent to a software company in Adelaide, Australia.[15] The categories list was loaded into software on a tablet PC (Motion C5 from Intel, Austin, Texas, USA). The customized software allowed simultaneous recording of all activities of the observed doctor, accurate to seconds, thus addressing a major issue in previous studies, the inability to accurately record multitasking when only the principle activity is noted.[16] Data points were recorded for all concurrent tasks by tapping a subcategory to capture start time and repeating to record the stop time, including interruptions. In August 2008, the software was piloted to identify potential software problems, and for the observer to become accustomed to its functionalities. Aside from providing the software, the respective company had no involvement in the study and did not have access to the data, the analysis or to the production of this paper.

Data analysis

Data from the 65 observation sessions were merged and imported into STATA for analysis.[17] As there were only a small number of individual clinicians, independence for each data point could not be assumed. Descriptive analysis was used to describe outcomes by categories and to compare groups.

A formal sample size was not calculated, but based on the pilot data of 100 separate tasks per hour, a total observation period of more than 100 h was assumed likely to provide enough data to provide a description of ED consultant activities.

The RMH Ethics Committee approved the study.

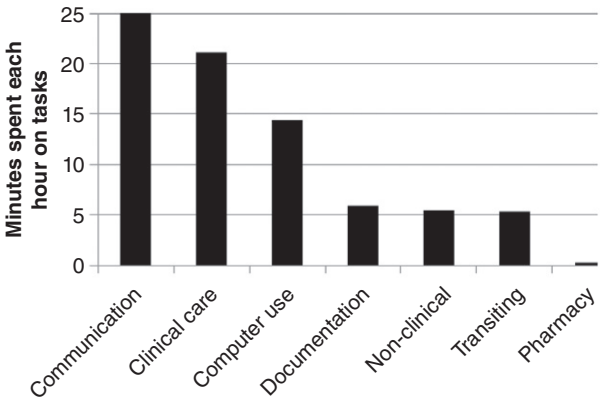

Figure 1. Consultant time spent on various task per hour in the ED.

Results

During the observation period, 17 of the 19 eligible senior medical staff on the consultant roster were included. The remaining two were not undertaking clinical shifts during the study period. There were 65 two-hour study periods, with 35 periods observing Duty consultants and 30 periods observing Resuscitation consultants. Five female consultants were observed for a total of 40 h.

The primary end-point was to determine the proportion of time consultants spent on a number of predefined tasks (Fig. 1). Table 1 provides additional detail of the number of tasks and proportion of time that ED consultants spent on each category. On average, ED consultants spent one-third of an hour's work time on direct patient care. Other management tasks without direct patient contact, such as communication, computer use and documentation, took up 75% of each hour of consultants' time. A quarter of each hour at work was spent using computers for various information needs. For non-clinical tasks, an average consultant used a total of approximately 5 min of every hour on meal breaks, toilet breaks and unspecified time leaving the department.

Considerable variation in the number of tasks recorded by different consultants was noted. Overall, the median hourly task rate was 101.4, but for individual doctors it ranged from 66 to 171.

The consultants spent 17% of each hour accessing EDIS. The remainder of the computer use is for clinical results. Very little time (0.6%) was spent accessing computers to source medical knowledge (e-knowledge).

Table 2 shows the number of tasks per hour and proportion of time for each ED consultant role. There is a considerable increase in the number of discrete tasks undertaken by Duty consultants and additional minutes of activity per hour resulting from multitasking. Duty consultants spent more time using computers and communicating than did Resuscitation consultants. Nearly half of the Duty consultants' time was engaged in various forms of communication activities, and they spent one-third of each hour using the computer. Although the Duty consultants still spent nearly one-third of each hour on direct clinical care, Figure 2 shows this is considerably less than their Resuscitation colleagues reflecting their designated roles.

Female consultants had a higher hourly task rate of nearly 120 compared with 93 for their male colleagues. They did more multitasking, recording nearly 85 min of activity in each hour, compared with 75 min for male consultants. Female consultants spent more time on communication, computer use and documentation but less on transiting and non-clinical tasks (Table 3). Male consultants doubled the time spent by female consultants on meals and breaks off the ED floor, although the total is small. No female consultant was recorded taking a bathroom break during the 40 h of observation of their cohort.

There were no important differences in activity across the week or by time of day.

Discussion

This is the first study to provide fine grain detail of ED consultant activities and the first to examine the impact of role delineation and sex. We found that consultants undertook a high number of tasks per hour, predominantly on clinical care, communication and computer use, and that there is high rate of multitasking. Consultants spent only one-third of their time on direct clinical care. The ED consultant's main role as a manager/administrator or clinician, their sex and individual working patterns all influence time utilization and activity.

In this study, consultants undertook over 100 tasks per hour with 77 min of recorded activity per hour as a result of multitasking. This echoes previous studies that ED staff frequently multitask.[18] The rate is much higher than the 33 tasks per hour reported by Hollingsworth *et al.* and 34 reported by France *et al.*[6,12] Both studies were conducted in non-Australian settings, and data for the former study were collected using paper forms, which limited information about multitasking. The

Table 1. Consultants' time spent on specific task categories in ED

Categories	Subcategories	Time on tasks (min)		Task number
		Total	Per hour	Per hour
Communication		3247.0	25.0	37.4
	Other doctors	1348.1	10.4	13.0
	Phone call	675.2	5.2	4.2
	Nurses	637.9	4.9	12.5
	Patients' family	181.1	1.4	1.2
	Clerical staff	85.3	0.7	2.3
	Other staff	105.6	0.8	1.6
	Students	125.8	1.0	1.3
	Paging out	37.0	0.3	0.7
	Ambulance	37.5	0.3	0.5
	Police	7.6	0.1	0.1
	Other	5.9	0.0	0.1
Transiting	Walking between sites	686.7	5.3	19.3
Clinical care		2748.4	21.1	14.9
	In cubicle with patient	1970.5	15.2	5.6
	Reviewing patient file	663.3	5.1	6.4
	Thoughtful contemplation	53.4	0.4	2.1
	Outside cubicle	49.3	0.4	0.5
	Reading textbook	0.3	0.0	0.0
	Other	11.6	0.1	0.1
Computer use		1868.7	14.4	14.8
	ED Information System	1335.8	10.3	9.9
	Radiology	260.2	2.0	1.9
	Pathology results	207.3	1.6	1.9
	Medication reference	14.1	0.1	0.5
	Google	8.1	0.1	0.1
	Medical e-texts	6.8	0.1	0.1
	Other e-knowledge	2.6	0.0	0.1
	Other	33.8	0.3	0.0
Documentation		772.9	5.9	8.3
	Medical record	580.8	4.5	5.8
	Discharge letter	46.0	0.4	0.2
	Sick certificate	1.5	0.0	0.0
	Other	144.6	1.1	2.2
Non-clinical task		708.5	5.5	6.4
	Meals and breaks (off the floor)	400.2	3.1	0.1
	Left ED (unspecified)	87.4	0.7	0.1
	Snacks (on the floor)	21.3	0.2	0.3
	Drinks (on the floor)	20.5	0.2	1.0
	Bathroom	18.7	0.1	0.1
	Other	160.4	1.2	4.9
Pharmacy	Prescribing	29.8	0.2	0.2
Total		10 061.6	77.3†	101.4†

†*Because of parallel multitasking, figures add up to more than 60 min in each hour and 100%.*

Table 2. Comparing number and time in different tasks by Duty and Resuscitation consultant

Task category	Duty (70 h observation)			Resuscitation (60 h observation)		
	Task	Time spent on tasks		Task	Time spent on tasks	
	Per hour	Minutes (per hour)	Proportion (%)	Per hour	Minutes (per hour)	Proportion (%)
Communication	43.2	28.3	47.2	30.7	21.1	35.2
Computer use	18.1	18.9	31.6	10.9	9.0	15.0
Clinical care	15.1	17.1	28.6	14.7	25.8	43.0
Transiting	19.0	5.6	9.3	19.7	4.9	8.2
Documentation	8.5	5.1	8.5	8.0	6.9	11.6
Non-clinical task	6.7	5.2	8.6	6.1	5.8	9.6
Pharmacy	0.3	0.3	0.5	0.2	0.2	0.3
Total	110.8	80.6†	134.4†	90.4	73.7†	122.9†

†*Because of parallel multitasking, figures add up to more than 60 min in each hour and 100%.*

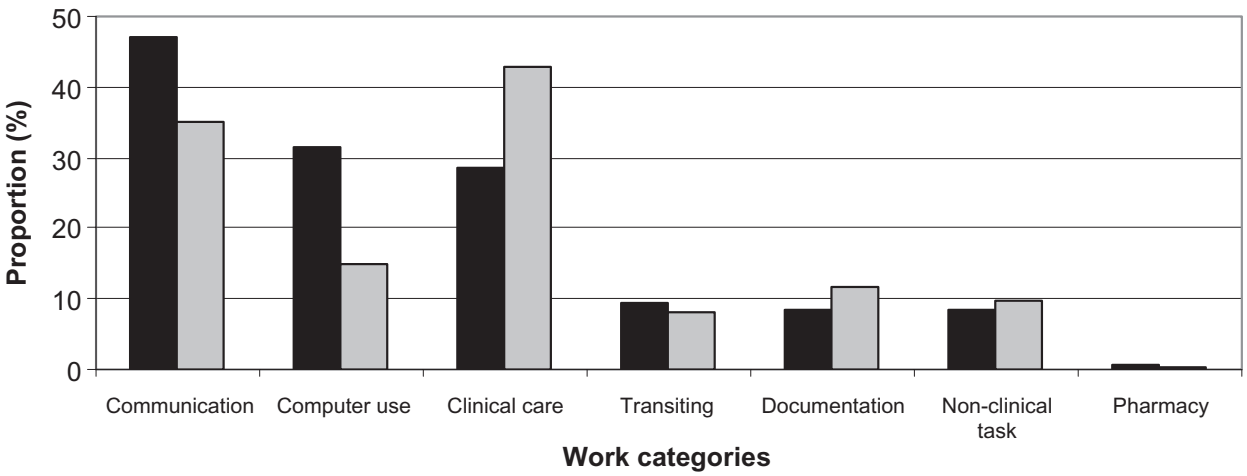

Figure 2. Proportion of each hour spent on task – (■) Duty *versus* (□) Resuscitation consultant.

latter study was conducted using a wireless handheld computer but classified activity into only 13 different categories and subcategories. This might have contributed to the difference in results. Another study focusing on ED interruptions reported emergency physicians completed 23 tasks with seven interruptions per hour.[19] That study had only eight task types and by collecting fine grain detail, it is possible that the true complexity of activity is being revealed in our study. Time spent on direct clinical care is similar to previous US reports of about one-third of consultant time.[6,11,12,20,21]

Communication tasks consumed the biggest proportion of consultant's time (42%), noticeably higher than previous reports by Hollingsworth *et al.* (18%) and Yen *et al.* (29%).[12,22] The difference could also be resulting from different data collection, as this study could record multiple communication events simultaneously. Previous studies have demonstrated that ED clinicians experience high communication loads.[18,23] A recent Australian ED intern study reported 30% of time spent on communication.[16] In this study, face-to-face communication predominated, as did a previous UK study reporting that ED staff members favour synchronous communication channels.[24] Short-duration communication events happened frequently, an occurrence also reported by Fairbanks *et al.*[25] A 2004 Australian study reported a high rate of communication multitasking in the ED and one-third of ED communication time dealt with interruptions.[26]

Friedman *et al.*'s reported Canadian emergency physicians' time on data retrieval and entry was 12%.[27] A US paediatric ED reported only 2.9% of time was computer use by consultants.[22] In contrast, this study found computer use to be one of the major activities undertaken by

Table 3. Comparing male and female consultant time spent and number of task per hour

Task category	Male (90 h total observation)			Female (40 h total observation)		
	Task	Time spent on tasks		Task	Time spent on tasks	
	Per hour (*n*)	Minutes (per hour)	Proportion (%)	Per hour (*n*)	Minutes (per hour)	Proportion (%)
Communication	32.0	22.4	37.3	49.7	30.8	51.3
Clinical care	14.1	20.8	34.7	16.7	21.8	36.3
Computer use	13.2	13.1	21.8	18.3	17.3	28.8
Non-clinical task	6.6	6.3	10.5	6.0	3.6	6.0
Transiting	20.0	5.6	9.3	17.8	4.7	7.8
Documentation	7.1	5.4	9.0	10.8	7.1	11.8
Pharmacy	0.3	0.3	0.5	0.1	0.1	0.2
Total	93.4	73.9†	123.2†	119.4	85.4†	142.3†

†*Because of parallel multitasking, figures add up to more than 60 min in each hour and 100%.*

consultants, mainly to access EDIS. The rate of EDIS usage differed by role, with administrative Duty consultants spending three times that of their clinical colleagues. The apparent increase in utilization of computer programs to manage the ED might provide an opportunity to develop better tools to improve productivity.

Consultants spent very little time accessing e-knowledge. Asaro reported 0.3% of consultants' time was spent on knowledge acquisition, for example reference books, but did not mention online e-knowledge resources.[5] Although much effort has been invested to provide e-knowledge tools to clinicians, ED consultants do not appear to avail themselves of these resources. A similar study of junior staff or other health-care providers might find a different uptake.

It appears that female consultants are better at multitasking with higher task rates and less time is spent on non-clinical tasks. Although no female consultant was observed to have a toilet break during this study, it is possible that this was due to sampling or to the Hawthorne effect[28] and unlikely to be sustained for a 10 h shift. No previously published study was found on the influence of sex on ED consultant work practice.

The high task rate, complexity of work patterns and minimal time spent on non-clinical tasks indicate that overall productivity might only be improved if diversion of tasks to other staff or better tools to assist consultants can be developed. Productivity improvements will need to assist consultants to work smarter, not harder, and information technology might help to reduce the task burden on clinicians.[29] Systems that push results with meaningful implications or track patient flow and identify bottlenecks might reduce the time spent checking delayed or irrelevant information.

High levels of communication by consultants might necessitate a re-examination of information transmission within the ED and between hospital departments. Diversion of tasks to other staff or intelligent prioritization of communication might reduce the impact on the most senior ED staff. This study was not able to quantify how much workload could be diverted.

The measurably high number of hourly tasks in combination with the frequency of multitasking might provide a framework for assessing clinical risk. The more exact method of measurement presented by this study might make it easier in future to determine the hourly task rate or mix before exceeding a threshold for adverse clinical outcomes.

This research might also point the way toward developing better methods of evaluating doctors' work performance. This might include, for example, some exploration of benchmarked weighting of certain doctor tasks used in this study. It could provide more appropriate measurements than blunt tools, such as patients seen per doctor per shift or per hour.

Limitations

Behaviour of subjects during observation can be altered by a subject's awareness of participating in the study: the Hawthorne effect.[28] However, direct one-on-one time-motion study is still more accurate than work sampling and provides more accurate information on work tasks.[30] Steps were taken to mitigate the effects resulting from observation, such as maintaining a suitable distance from the consultant observed. It was felt unlikely that ED consultants would substantially change work practice from normal.

The observer might not have been able to appreciate what consultants were doing from a distance, but made a best assessment by observation. However, pilot studies were undertaken and the observer sought to

identify all ED staff and to confirm the accuracy of the tasks recorded. Confirmation of accuracy would require direct interaction with consultants that was felt to be an unacceptable impost on usual work practice.

This study was conducted at a single site, and its findings might not be generalizable to other settings. Data were collected in 3 weeks from mid-September to mid-October, and might not be representative of practice for the entire year. A longer period of intermittent sampling would be required to confirm the assumed lack of seasonal variability.

Conclusion

Our results show that ED consultants undertake a large number of hourly tasks, which involves multitasking and utilization of support systems. They spent the majority of their time on tasks that are not direct clinical care. The consultants' main role as a manager/administrator or as resuscitation clinician influenced their activity for that session. Sex and individual work practices also contribute to differences in activities.

Targeted interventions are recommended to free up consultants' time so that they can spend more time on clinical care and supervision of junior staff with decreased overall task loads. This might include diversion to other health-care workers or to support systems, including information technology assistance. Continued efforts to understand the workload and other factors affecting ED consultants will help to improve productivity and deliver better care to patients.

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Competing interests

None declared.

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