Steps walked whilst at work, by University of the Free State medical registrars: an exploratory study

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ABSTRACT

Background: Doctors may have physical disabilities affecting their mobility. If they wish to specialise, they need information regarding mobility requirements for various specialities to help them select an appropriate speciality. No research has been published on the differences in physical activity demands in different medical specialities.

Objective: The aim of this study was to compare the physical activity of medical registrars from six specialist departments at a South African academic hospital. The inference was that those specialities where registrars walked the most would be more challenging for those with physical disabilities, thereby limiting mobility.

Methods: The number of steps walked from 07:00 to 16:00 each day was measured, using Yamax CW-701 pedometers. Kruskall-Wallis tests were used to compare the steps taken in different specialities with the level of significance set at 0.05.

Results: Twenty registrars participated in the study. Significant differences in the number of steps walked per day were observed between those from different specialities ($p < 0.001$). Surgery, paediatric and internal medicine registrars walked the most steps per day (median of 5 991, and 5 880, 5 489, respectively). Anaesthesiology and radiology registrars walked a median of 4 521 and 3 926 steps, respectively. Registrars in obstetrics and gynaecology walked the least steps (median of 1 918). There was considerable variation in steps between participants within a department, and for the same participants on different days.

Conclusion: Registrars appeared to be more physically active in some medical specialities than others, in terms of mobility. The wide intra-speciality variation is probably related to differing daily duties. Future studies should include types of work duties (e.g. sedentary vs high physical mobility), cover more specialities, and include more participants.

INTRODUCTION

Newly qualified doctors with physical impairments, who wish to specialise, need information on the motor activity required in various medical specialities, to assist them to choose a career best suited to their disabilities. This information would also be of value to occupational health doctors, to assist in determining if a doctor who sustains a temporary or permanent disability that affects mobility can continue in his or her current speciality.

There are limited studies on this topic and none that differentiate between medical specialities. A study of doctors in the United Kingdom found that the average distance walked per shift ranged from 3.84 to 6.85 km.[1] This could be challenging for some disabled doctors, e.g. lower limb amputees, who may struggle to walk more than 500 steps, particularly if the amputation was proximal or they have phantom limb pain.[2]

The aim of this study was to compare the daily physical activity of registrars in six different specialities, at an academic hospital in Bloemfontein, South Africa, by measuring the number of steps taken during their working day. It was hypothesised that the registrars would walk a similar number of steps per day, regardless of the speciality in which they were training.

METHODS

The study was performed by medical students as part of their curriculum. As the time period for data capturing was limited, the six largest clinical departments located at the academic hospital were included in the study. The study population thus consisted of all registrars (i.e. medical doctors receiving advanced training in a specialist field) from six clinical medicine specialities at Universitas Academic Hospital (UAH) in Bloemfontein, who were registered at the University of the Free State in 2018, and worked from 07:00 to 16:00 on weekdays, viz. anaesthesiology (n = 25), internal medicine (n = 34), obstetrics and gynaecology (n = 19), paediatrics (n = 25), surgery (n = 16), and radiology (n = 14). The study was conducted in October and November 2018.

Walking was chosen to assess physical activity for this study as it is easily measured with a pedometer. A pedometer estimates the distance travelled on foot by recording the number of steps taken but does not capture the intensity or duration of the activity or gradient walked.[3,4] The pedometer needs to be carried in an appropriate place, e.g. the waist, chest or on an armband, as measurements are inaccurate if it is placed in a pocket, purse or backpack.

Registrars with physical disabilities that limited their ability to walk were excluded, as were those who left the closely adjacent, and internally linked, buildings of the University Faculty of Health Sciences and UAH for any reason during their work day.

A pilot study was conducted on two consultants in the Department of Anaesthesiology who found the pedometers easy to use and were not distracted by them during their working day. The pilot study showed that it could be difficult to contact a doctor while he/she was working and that, during the main study, it would be necessary to ensure good communication with the participants.

Table 1. Demographic characteristics of registrars, and participation, by department (N = 20)

Characteristic	Department											
	Anaesthesiology		Internal Medicine		Obstetrics and Gynaecology		Paediatrics		Radiology		Surgery	
	n = 5		n = 3		n = 2		n = 2		n = 3		n = 5	
Sex	n	%	n	%	n	%	n	%	n	%	n	%
male	4	80.0	2	66.7	2	100.0	1	50.0	3	100.0	3	75.0
female	1	20.0	1	33.3	0	-	1	50.0	0	-	2	25.0
	median	range	median	range	median	range	median	range	median	range	median	range
Age (years)	34	28–38	31	28–36	32.5	29–36	35	28–42	35	31–45	33	26–37
Height (cm)	182	172–188	175	173–183	176	174–178	169	160–178	176	168–180	167	160–175
Participation (days)	3	2–5	6	3–6	7.5	4–11	8	7–9	5	5–5	3	3–4

The student researchers attended the weekly and/or daily speciality department meetings where the study was explained to the registrars. Registrars who met the inclusion criteria were invited to volunteer to participate. On completion of the consent form, the correct way to wear the pedometer on the hip was demonstrated. The participating registrars were instructed to wear the pedometer from 07:00 until 16:00 throughout the day. The Yamax Digi-Walker CW-701 (Yamax CW-701, Yamasa Tokei Keiki Co. Ltd., Tokyo, Japan) was chosen for this study as it was affordable (R340) and has been shown to be reliable and accurate.[7]

The student researchers met with the registrars at the end of each working day to collect the pedometers, and the number of steps walked was recorded on a log sheet. Data were collected in this manner for 15 working days per department; registrars participated only on the days that they were present at UAH, i.e. not all participants' steps were measured every day.

The protocol was approved by the Health Sciences Research Ethics Committee of the University of the Free State [UFS-HSD2018/0380/2509]. Permission was obtained from the Free State Department of Health and the University of the Free State School of Clinical Medicine. Heads of department for each speciality involved were informed about the study in advance.

Data analysis

Data recorded on log sheets were entered into an Excel spreadsheet. Data analysis was conducted using SAS Version 9.4. Frequencies and percentages (categorical variables) and medians and ranges (numerical variables) were used to summarise the results. Kruskall-Wallis tests were used to compare the steps taken in different specialities with the level of significance set at 0.05.

RESULTS

There were 20 participants (response rate of 15.0%), of which 75% were males (Table 1). The median age ranged from 31 (internal medicine registrars) to 35 years (paediatrics and radiology registrars). Participants from the Anaesthesiology Department were the tallest (median 182 cm); those from the Surgery Department were the shortest (median 167 cm).

Participants from the Surgery Department walked more median steps per day than did those from the Obstetrics and Gynaecology Department ($p < 0.001$).

There was no significant difference between the steps walked per day in participants from the Departments of Surgery, Paediatrics and Internal Medicine ($p = 0.811$). Overall, participants from these three departments walked the most median number of steps during a working day (Table 2) and significantly more than participants from the Anaesthesiology and Radiology Departments ($p = 0.035$ and 0.001, respectively).

Participants from the Anaesthesiology and Radiology Departments walked the second-most number of steps per day. There was no significant difference between these two departments in steps walked per day ($p = 0.114$). Participants from the Obstetrics and Gynaecology Department walked the least median number of steps per day; significantly fewer than walked by participants in the other departments ($p < 0.001$).

The number of steps walked per participant varied from day to day. Figures 1 to 6 illustrate the steps walked per day by participants in each department.

There was considerable variation between the steps walked per day by some participants. For example, participant OG2 walked 5 192 steps on day 2 and 207 steps on day 1 (Figure 3), and participant P1 walked 14 913 steps on day 8, and 1 600 steps on day 9 (Figure 4). There was also variation in the steps walked within departments. For example, although participants P1 and P2 walked a similar number of steps per day for the first five days (varying by approximately 4 000), over the following four days there was much greater variation: 2 038 and 14 913 steps per day (Figure 4).

Table 2. Steps walked per day by registrars, by department

Department	median	range
Obstetrics and Gynaecology	1 918	207 – 5 578
Radiology	3 926	1 344 – 5 347
Anaesthesiology	4 521	2 318 – 6 519
Internal Medicine	5 489	2 861 – 8 379
Paediatrics	5 880	1 423 – 14 913
Surgery	5 991	2 261 – 9 258

DISCUSSION

The surgery, internal medicine and paediatric registrars who participated in the study walked the most steps, while the obstetrics and gynaecology registrars walked the fewest. However, there was considerable variation in the daily number of steps walked by the registrars within each department. This could be explained by the fact that each department has various subdivisions with different workloads, which require different activity levels. Alternatively, it may be that some participants were inherently more active and walked more steps to perform the same tasks as others.

The findings showed that a registrar might walk a different number of steps on different days. For example, the obstetrics and gynaecology registrar who walked 207 and 5 192 steps on different days explained that he had mostly stood in the operating theatre on the one day, and

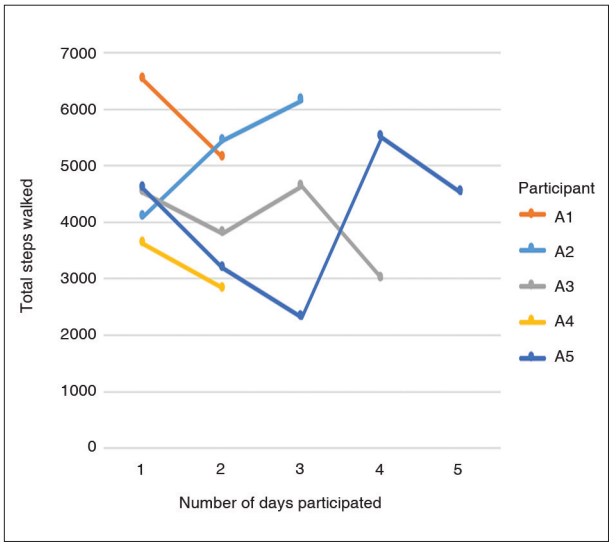

Figure 1. Steps walked per day by participants (A1–A5) in the Anaesthesiology Department

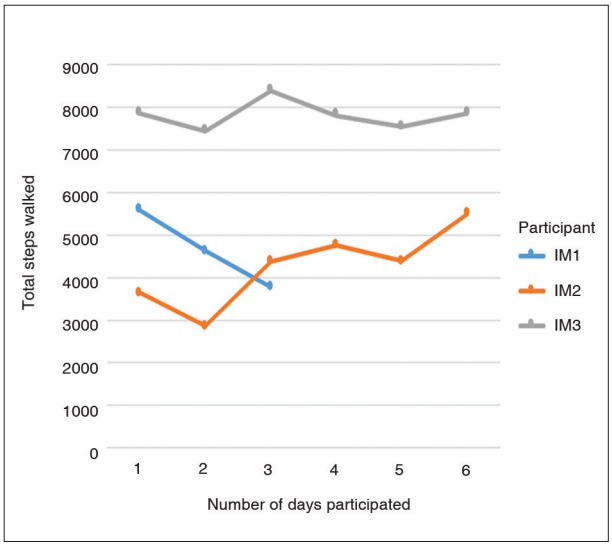

Figure 2. Steps walked per day by participants (IM1–IM3) in the Internal Medicine Department

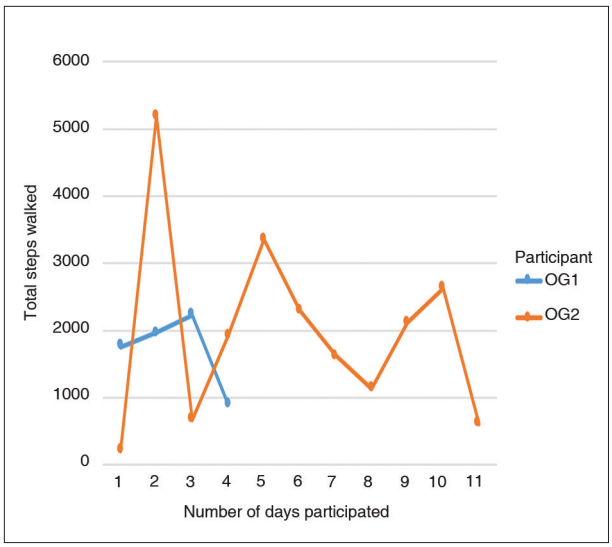

Figure 3. Steps walked per day by participants (OG1 and OG2) in the Obstetrics and Gynaecology Department

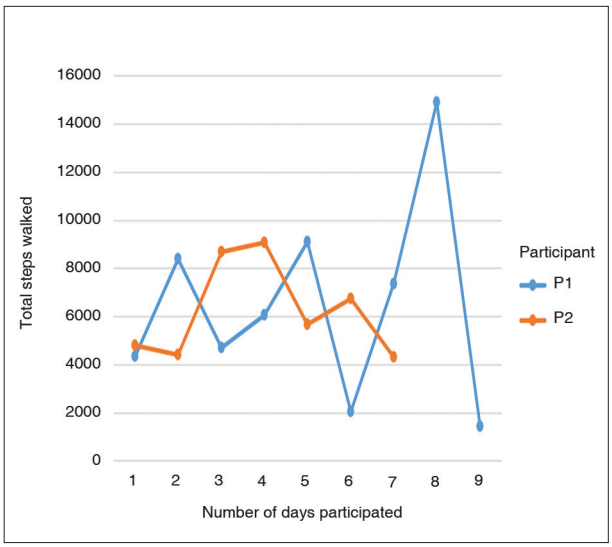

Figure 4. Steps walked per day by participants (P1 and P2) in the Paediatrics Department

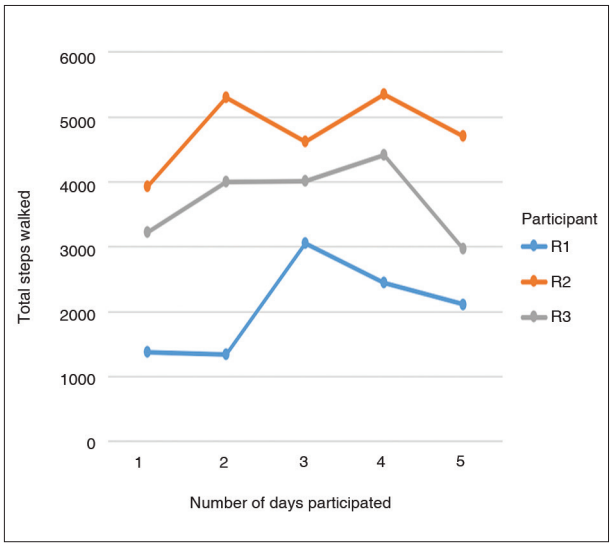

Figure 5. Steps walked per day by participants (R1–R3) in the Radiology Department

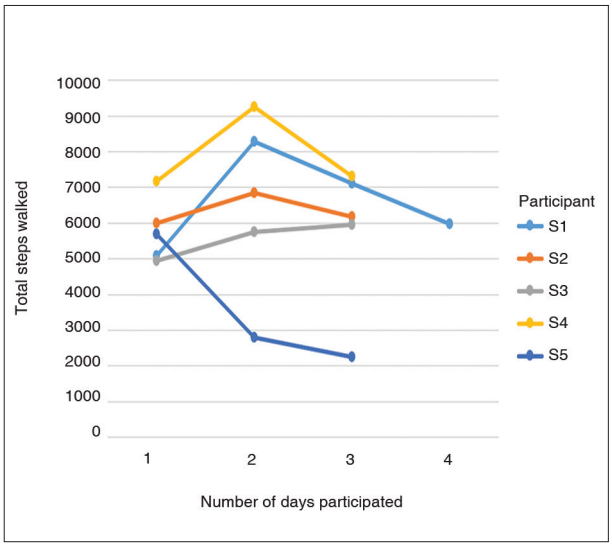

Figure 6. Steps walked per day by participants (S1–S5) in the Surgery Department

spent time in the wards on the other day. In contrast to the variability in steps walked each day seen in the surgical departments, participants from the Internal Medicine Department – a non-surgical department – walked a more consistent number of steps per day.

However, in a working day, not all studies have shown that surgeons walk less than their medical counterparts. A study in the USA, comparing the average daily steps of cardiologists, cardiothoracic surgeons and cardiac anaesthetists, found no statistically significant differences; the average number of steps walked per day was 6 010 (5 553–6 540).[8] The working day over which steps were recorded was, on average, three hours longer for the cardiothoracic surgeons than the anaesthetists, implying that the surgeons walked fewer steps per hour. This could be attributed to the relative physical immobility of surgeons while operating, followed by periods of activity.

Work-related patterns of activity influence the interpretation of studies that only use the number of daily steps as a measure of physical exertion. Other factors, such as prolonged standing time in theatre must be taken into consideration when assessing the strain of physical activity. Musculoskeletal pain has been documented as one of the daily physical hazards that surgeons face, and has been related to long hours in this static posture.[9]

The number of steps walked by the paediatrics registrars in our study illustrates the effect of being on-call for emergencies. One participant walked 14 913 steps on a day when he was on-call for emergencies and had to rush between several areas of the hospital; the following day, he walked only 1 600 steps because he was both tired and not on-call for emergencies.

The wide range of steps walked by the same registrar on different days, or by different registrars from the same department, demonstrates that not only the median daily number of steps, but also the range, should be taken into account when choosing a speciality compatible with a person's physical limitations. A recent South African study that measured the steps walked during a 6–12 hour working day for doctors in an emergency department, also found considerable variation in the level of activity between study participants, with a range of approximately 12 000 steps per day (median 6 328; IQR 4 646–8 409).[10]

In our study, surgery and internal medicine registrars walked a similar number of steps per day. A Dutch study, conducted by Goosen et al.,[11] also found no significant difference in the number of daily steps walked between internal medicine physicians and surgeons. Conversely, a study on the activity of doctors in the UK[1] found that those working in surgical disciplines walked less than their counterparts in internal medicine specialities.

Soh et al.[12] (Australia) and Cuthill et al.[13] (Scotland) reported the median number of steps taken during the working day of anaesthetists as 4 770 (1 667– 9 630) and 3 694 (1 444–7 712), respectively. Similarly, in our study, the registrars from the Anaesthetic Department walked a median of 4 520 steps per day (2 318–6 519).

Doctors may have experienced the events that caused their physical disabilities before they started their medical training, during their student training, or subsequent to qualifying as doctors. Their disabilities may be temporary or permanent. In the USA, there are differing opinions as to whether applicants with certain physical disabilities should be accepted into medical training programmes, and whether every medical graduate should be 'undifferentiated', i.e. able to enter any speciality.[14] Such a requirement would be limiting and potentially discriminatory against applicants with disabilities. Legislation in the USA (e.g. the Americans with Disabilities Act (ADA) of 1991), regarding the admission of applicants with physical disabilities into medical schools, has done little to increase their number, with many medical schools having no graduates with a recorded physical disability.[15] The current (2018) Selection Policy for the School of Clinical Medicine at the University of the Free State requires a medical report from each applicant who wishes to study medicine, which a selection committee uses to determine if the applicant has a disability that would potentially make him/her "unfit for medical studies".[16] Fear of being rejected for medical training at the University, based on this policy, may have led to applicants with disabilities not revealing them, or not applying to study medicine. Some students with physical disabilities may be academically superior to their peers and it would be a loss to society if potential innovators in medicine were turned away from medical school based on their physical disabilities.[17]

Doctors with disabilities are in a minority; they need to build support networks, and employers need to reduce their biases towards such physicians.[18] Studies are required to investigate the experiences of physicians with disabilities and the patients they treat.[19]

Living with a permanent disability potentially narrows the career choice of a doctor. Studies like this provide information that can help impaired doctors to make career choices, based on the physical activity that is required to practise a particular speciality.[20]

Limitations

The main limitation of the study was the small sample size. We presented p values, with statistical significance set at 0.05, for some differences, although we acknowledge that the power of the study was too low to detect true differences (post hoc pairwise comparisons would need a significance level of 0.008). In addition, the response rate was low and the results cannot be generalised to all registrars in the six departments in the University. Nevertheless, this exploratory study provides some evidence that the physical demands of different medical specialities vary.

The data analysis was mainly descriptive, and we did not compare the numbers of steps walked for males and females, or for registrars of different heights. Both sex and height are potential confounders and should be taken into account in future studies on this topic.

While we relied on the accuracy of the pedometers to measure the activity of the participants, the accuracy of the Yamax CW-701 pedometer, which we used, has been found to be similar or more reliable to that of others used in research.[7,21]

The registrars rarely had a 'normal' or 'average' working day. Their days were dependent on the types of duties required. One would need to study a department for a longer period and collect data about the daily responsibilities of each participant (e.g. theatre duty or on-call for emergencies) to assess activity more reliably.

The number of steps walked in a day is only one indicator of physical exertion. Other activities, such as prolonged standing, can also be strenuous. One surgical registrar stated that he found it more exhausting to stand in theatre all day, than to walk around the wards or clinics.

Recommendations

To improve the accuracy and validity of similar future studies, we recommend that participants from a single department be observed while performing the various activities that require him/her to sit, stand or run. In this manner, intra-departmental variations in physical activity can be ascertained. However, both the sample size and time period over which the measurements are recorded will need to be increased. Time that participants are 'on-call' for emergencies, i.e. outside of normal working hours, should be included, as the physical

activity of registrars may differ when managing emergencies; measuring physical activity from 07:00 to 16:00 may not provide an accurate representation of overall physical mobility requirements.

CONCLUSION

In this small study, a difference was found between the daily physical mobility of registrars in different specialities, as measured by steps walked each day. Surgery, paediatrics and internal medicine registrars walked the most steps per day, followed by radiology and anaesthesiology registrars. Registrars in obstetrics and gynaecology walked the least. There was considerable variability in physical activity for the same participant on different days, and between participants within the same department. These variations need to be taken into consideration when interpreting the results and planning future similar studies. This study highlighted the challenges of conducting such a study and can serve as a basis for further research on this topic.

KEY MESSAGES

1. Pedometers are easy tools to use to measure mobility at work.
2. A doctor training to be a specialist does not have a consistent daily level of work-related physical mobility.
3. Doctors training in the same speciality can have markedly different levels of mobility on the same day, owing to differing allocated duties.

DECLARATION

The authors declare that this is their own work; all the sources used in this paper have been duly acknowledged and there are no conflicts of interest.

AUTHOR CONTRIBUTIONS

Conception and/or design of the study: GL, CC, RC, JdT, SK, DS, AvN, GJ
Data acquisition: CC, RC, JdT, SK, DS, AvN
Data analysis: GJ
Interpretation of the data: GL, CC, RC, JdT, SK, DS, AvN, GJ
Drafting of the paper: CC, RC, JdT, SK, DS, AvN
Critical revisions of the paper: GL, CC, RC, JdT, SK, DS, AvN, GJ
Accountability for all aspects of the work: GL, CC, RC, JdT, SK, DS, AvN, GJ

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