

https://dspace.org/

An assessment of the levels of physical activity in an academic anaesthetic department

Belasyse-Smith, Peter

2025
University of the Witwatersrand, Johannesburg
https://hdl.handle.net/10539/48005
Belasyse-Smith, Peter . (2025). An assessment of the levels of physical activity in an academic anaesthetic department [Master`s dissertation, University of the Witwatersrand, Johannesburg]. WIReDSpace. https://hdl.handle.net/10539/48005

Downloaded from a DSpace repository. https://dspace.org/

An assessment of the levels of physical activity in an academic anaesthetic department.

Dr Peter Belasyse-Smith

Student number: 375150

A research report submitted to the Faculty of Health Sciences,

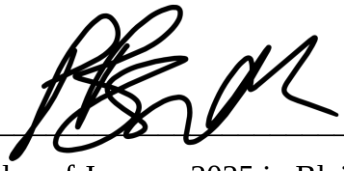
University of the Witwatersrand, in partial fulfilment for the requirements for the degree of

Master of Medicine (Anaesthesia).

Johannesburg, 2025.

DECLARATION

I, Peter Belasyse-Smith, declare that this research report is my own, unaided work. It is being submitted for the degree of Master of Medicine (Anaesthesia) at the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination at this or any other university.

Signed: 

Date: 28th day of January 2025 in Blairgowrie.

Dedication

To my wife and 3 amazing boys for their tireless, unwavering support despite my continual efforts at self-sabotage.

Abstract:

Background:

It has long been known that a positive correlation exists between physical activity, exercise, and health. Individuals who achieve a daily target of 10 000 steps are likely to meet the recommended levels of health-enhancing physical activity to confer long-term benefits.

We aimed to evaluate the physical activity levels of public sector, academic anesthesiologists in Johannesburg, South Africa both on and off duty and determine the proportion meeting recommended guidelines.

Method:

This prospective, cross-sectional observational study was undertaken at three academic hospitals in Johannesburg, South Africa. Ninety-four doctors wore a pedometer on and off duty for a seven-day period. A questionnaire based on the short-form International Physical Activity Questionnaire (IPAQ) was also completed.

Results:

The median (Interquartile Range (IQR)) total daily step count was 6 964 (6 271 - 7 956), the median (IQR) number of steps taken on duty was 5 033 (3 536 – 6 407) and the median (IQR) off-duty daily steps was 3 247 (1 471 - 3 802). Only 5% (5/94) of doctors achieved the recommended target of 10 000 daily steps. The IPAQ data showed that only 3% (3/94) of participants had a high level of physical activity, with 68% (64/94) having an inactive lifestyle. Significant factors influencing the on-duty step count included the duration of the shift, the number of cases performed and being the floor senior.

Conclusion:

Doctors working in the anaesthetic department at the University of the Witwatersrand do not get the recommended level of physical activity either at work or when they are not working. This is placing a large and vital workforce at increased risk for chronic non-communicable disease, mental health issues, and burnout.

Acknowledgements:

The author would like to acknowledge the following for their contribution to this research report:

My supervisor Dr Janine Wagner, for her guidance, advice, and support throughout the process of completing this project.

Ms Moomal Khan BS(Economics), MS(Economics), independent statistician, for her invaluable assistance with data interpretation.

All the keen participants of the study, the medical officers, registrars, and consultants of the Department of Anaesthesiology at the University of the Witwatersrand.

Table of Contents

1. Declaration ii
2. Dedication iii
3. Abstract iv
4. Acknowledgements v
5. Table of contents vi
6. List of abbreviations viii
7. Statement ix
8. Section 1:
    a. Review of the literature 1
    b. References 6
9. Section 2:
    a. Authors guidelines 12
10. Section 3:
    a. Draft article 19
    b. Abstract 20
    c. Introduction 21
    d. Methods 22
    e. Data analysis 24
    f. Results 24
    g. Discussion 28
    h. Limitations 29
    i. Conclusion 29
    j. References 30
11. Section 4:
    a. Proposal 32
    b. Appendix 1 Physical Activity MMED Questionnaire 54
    c. Appendix 2: Permission request for Dr Motshabi 57
    d. Appendix 3: Study information sheet 58
    e. Appendix 4: Written Consent Form for Participants 59
12. Section 5:
    a: Annexure A: Permission from the Head of Department 60
    b: Annexure B: Postgraduate Assessors Group Approval 61

c: Annexure C: Human research ethics committee clearance certificate 62

d: Annexure D: Turnitin report 63

List of abbreviations

CMJAH	Charlotte Maxeke Johannesburg Academic Hospital
CHBAH	Chris Hani Baragwanath Academic Hospital
CPR	Cardio-Pulmonary Resuscitation
FCA(SA)	Fellowship of the College of Anesthetists (South Africa)
HJH/RMMCH	Helen Joseph Hospital/Rahma Moosa Mother and Child Hospital
IQR	Interquartile Range
IPAQ	International Physical Activity Questionnaire.
PA	Physical Activity
WHO	World Health Organisation

Statement:

The Research Report consists of a literature review, draft article, study proposal, and appendices. The literature review and study proposal are included for background reference and are not for examination.

The formatting of this Research Report, but not the draft article, complies with the University of the Witwatersrand's Style Guide for Theses, Dissertations, and Research Reports.

The formatting of the draft article is in keeping with the author guidelines stipulated by the South African Journal of Anaesthesia and Analgesia, the journal to which it is intended to be submitted.

Section 1. Review of the literature.

1. Introduction

A sedentary lifestyle or physical inactivity has been cited by the World Health Organisation (WHO) as one of the top ten causes of morbidity and mortality worldwide.[1] It is estimated that 4-5 million deaths related to chronic non-communicable diseases could be prevented by increasing levels of activity.[2] In 2016 it was found that 27.5% of adults worldwide did not meet WHO recommended levels of physical activity.[2,3]

It has long been recognised that an increase in physical activity correlates with a reduction in the progression of, or risk of developing, chronic non-communicable diseases such as coronary artery disease, type II diabetes, obesity, osteoporosis, and breast and colon cancer.[1] According to Chastin et al. there is a reduction in all-cause mortality associated with increased daily activity of any intensity (in a dose-response relationship), compared to a sedentary lifestyle.[4] Physical activity is also associated with mental health benefits.[1]

In addition to the human cost in morbidity or premature mortality, there are also huge economic implications to the pandemic of inactivity.[5] It has been estimated that physical inactivity costs global healthcare systems a total of $53.8 billion per annum with higher income countries bearing the brunt of the economic burden, and low to middle income countries having a larger burden of disease.[6]

South Africa has a high level of physical inactivity and a high burden of non-communicable disease. [7] Data from the WHO in 2016 showed that 37% of the South African population were classed as physically inactive.[7] In 2009, it was estimated that 51% of all deaths in South Africa were caused by non-communicable diseases.[8]

The current recommendations for adult physical activity from the WHO are that “Adults should do at least 150–300 minutes of moderate-intensity aerobic physical activity; or at least 75–150 minutes of vigorous intensity aerobic physical activity; or an equivalent combination of moderate and vigorous intensity activity throughout the week, for substantial health benefits.”[1] These recommendations also state that “Adults should limit the amount of time spent being sedentary. Replacing sedentary time with physical activity of any intensity (including light intensity) provides health benefits.” [1]

The WHO has also released recommendations for pregnant women and for people with certain chronic diseases.[1] The main difference for pregnant women is that the recommended level of moderate-intensity aerobic activity is reduced to 150 minutes per week.[1] The recommendations for people with chronic diseases, however, are the same as those for adults without chronic disease.

One way that many global health programs have interpreted these guidelines to simplify them for the general population is to recommend a daily target of a minimum of 10 000 steps.[9] This guidance originated in Japan prior to the Tokyo Olympic games in 1964, as a marketing campaign from a pedometer manufacturer.[9] It was not based on any research or evidence at that time. Subsequent research has shown that 10 000 steps a day equates to approximately 300-400 kcal/day of energy expenditure (depending on walking speed and body size).[10–12] Accumulating 10 000 steps on three or more days a week has been shown to be equivalent to 30 minutes of moderate intensity physical activity on most days of the week, which therefore meets the WHO recommendations.[13] There is a proven inverse correlation between the number of steps per day and body mass index, waist circumference, resting heart rate, and diastolic blood pressure.[14,15]

A classification of physical activity as determined by pedometer-assessed step counts was suggested in 2004 by Tudor-Locke et al. This is shown in Table 1 below: [9]

Table 1: Classification of physical activity determined by number of steps per day.

Number of Steps Per Day	Level of Physical Activity
<5000	sedentary lifestyle
5000-7499	low active
7500-9999	somewhat active
≥10000	active
>12500	highly active

Pedometers or step counters are simple electronic or mechanical devices attached to the waistband, wrist, or arm that give the wearer feedback on the number of steps taken, and hence an indication of physical activity.

Pedometers are gradually being replaced by newer technology such as fitness trackers, accelerometers, and smartphone apps, but they have become a popular, validated tool to motivate the population to increase physical activity. [16,17] There is data that suggests that interventions utilising pedometers are effective in producing a short-term increase in physical activity, but only uncertain evidence of any long-lasting effects. [16,17]

One confounder when using pedometers to study physical activity is that of reactivity; the change in behaviour by participants when they know that they are being monitored, also known as a Hawthorne effect.[18] If a participant is using a pedometer on which they can view the numbers of steps accrued and told to measure and record their step counts, their overall physical activity can increase by 15%.[18] Recommended measures to eliminate this bias include blinding the participants to the screen of the pedometer during the study and using a third party to record the accrued steps.[19] One study has shown that the reactivity (increased physical activity) to an unsealed pedometer lasted for seven days, with step counts returning to a baseline level for the following week of the study.[20] Sealed (blinded) pedometers do not elicit the same degree of reactivity.[18]

One other factor that influences the accuracy of step counts recorded by pedometers is the location that they are worn on the body. It has been shown that the most accurate results are obtained when the pedometer is worn on the hip, rather than on the wrist.[21]

An alternative method to assess the physical activity of a study group is to use a self-administered questionnaire. One such tool is the short form International Physical Activity Questionnaire (IPAQ).[22] This is a validated, open access, free to use questionnaire that assesses the type and duration of any physical activity undertaken in the previous seven days. Participants' physical activity levels are then categorized as either low, moderate, or high. [22,23]

Worldwide, there have been many pedometer studies assessing the physical activity levels for physicians of various medical specialties including anaesthetists. [24–33] Most of these studies have only focused on physical activity during working hours. These studies have found that doctors do not achieve the suggested target of 10 000 steps during working hours. [24–33] This leaves them at increased risk for chronic non-communicable disease, mental health issues, and burnout, unless extra effort is made by the individual to do extra physical activity during their own free time outside of work.

There are many reasons that are specific to a career in anaesthesia that make it important for anaesthetists to be aware of their physical activity levels. Anaesthesia is a medical speciality that is often considered to be sedentary. A study by Cuthill et al. [24] has shown that 50% of an anaesthetists' time in theatre is spent standing up, and walking is often limited to short bursts around theatre, or in visiting patients pre-operatively in the wards. The amount walked rarely reaches the 15–20-minute duration recommended by the WHO for a brisk walk. [1,24]

Anaesthetists are also shift workers and a correlation between shift work, long working hours, obesity, and other non-communicable disease has been described. [34]This may be due in part to chronically elevated cortisol levels in shift workers but may also be a result of altered levels of physical activity. [35,36] Roskoden et al. have shown that physical activity for shift workers is higher during working hours compared to non-shift-workers, although no difference in total physical activity was found . [37] Shift work may also affect sleep quality and quality of life for anaesthetists and healthcare workers. [38–40] Poor sleep patterns are independently associated with increased mortality, but if combined with overall poor physical activity, there is a synergistic increase in all-cause mortality. [41] Anaesthetists are also at high risk for burnout, [42] described by Bretland et al. as "the chronic state of job stress, where employer expectations and employee workload exceed the individual's perceived psychological capacity and ability to cope with the work demands expected of them". [43] South African anaesthetists employed in the public sector have been shown to have a 36.5% prevalence of clinical burnout. [44]Programmes designed to target increased physical activity have been shown to reduce rates of burnout. [43]

Speciality trainees in anaesthesia study towards exams, the two-part Fellowship of the College of Anaesthetists of South Africa (FCA (SA)) set by the College of Medicines South Africa.[45] Times of high academic stress and demand are known to affect the level of exercise achieved by examination candidates. [46,47]

There is also evidence that the physical activity levels of American trainee anaesthetists are lower than those of their specialist colleagues.[48,49]

There is a paucity of data with respect to South African anaesthetists' activity levels both on and off duty. This study will investigate the current total physical activity levels of anaesthetists working in an academic department in Johannesburg, South Africa.

Problem Statement

The effect of physical activity on long term health is well established. The WHO has devised a set of guidelines that aim to reduce an individual's risk of developing chronic non-communicable disease. Ideally healthcare professionals should be aware of these recommendations and should ensure that they achieve this desired level of physical activity either during their working day or outside of work. The reality is, however, that many doctors do not fulfil the recommended amount of physical activity.

This leads to the potential risk to doctors of contracting chronic disease over the long-term and increasing their risk of burn-out and deterioration in mental health in the short-term. There is a paucity of data with respect to the physical activity levels of South African anaesthetists during working hours, or outside of work. The results of this study may raise awareness of the current activity levels of anaesthetists, which could result in an improvement in acute and long-term health outcomes for South African anaesthetists and may assist with decreasing the rates of burnout.

References:

1. Bull FC, Al-Ansari SS, Biddle S, Borodulin K, Buman MP, Cardon G, et al. World Health Organization 2020 guidelines on physical activity and sedentary behaviour. Br J Sports Med. 2020 Dec;54(24):1451–62. https://doi.org/10.1136/bjsports-2020-102955

2. Lee I-M, Shiroma EJ, Lobelo F, Puska P, Blair SN, Katzmarzyk PT. Effect of physical inactivity on major non-communicable diseases worldwide: an analysis of burden of disease and life expectancy. The Lancet. 2012 Jul;380(9838):219–29. https://doi.org/10.1016/S0140-6736(12)61031-9

3. Strain T, Brage S, Sharp SJ, Richards J, Tainio M, Ding D, et al. Use of the prevented fraction for the population to determine deaths averted by existing prevalence of physical activity: a descriptive study. Lancet Glob Health. 2020 Jul;8(7):E920–30. https://doi.org/10.1016/S2214-109X(20)30211-4

4. Chastin S, McGregor D, Palarea-Albaladejo J, Diaz KM, Hagströmer M, Hallal PC, et al. Joint association between accelerometry-measured daily combination of time spent in physical activity, sedentary behaviour and sleep and all-cause mortality: a pooled analysis of six prospective cohorts using compositional analysis. Br J Sports Med. 2021 Jun;0:1–10. https://doi.org/10.1136/bjsports-2020-102345

5. Ding D, Kolbe-Alexander T, Nguyen B, Katzmarzyk PT, Pratt M, Lawson KD. The economic burden of physical inactivity: a systematic review and critical appraisal. Br J Sports Med. 2017 Jun;51(19):1392–409. https://doi.org/10.1136/bjsports-2016-097385

6. Ding D, Lawson KD, Kolbe-Alexander TL, Finkelstein EA, Katzmarzyk PT, van Mechelen W, et al. The economic burden of physical inactivity: a global analysis of major non-communicable diseases. The Lancet. 2016 Sep;388(10051):1311–24. https://doi.org/10.1016/S0140-6736(16)30383-X

7. World Health Organisation. South Africa risk of Premature death from NCDs [Internet]. World Health Organization - Noncommunicable Diseases (NCD) Country Profiles, 2018. 2018 [cited 2021 Jun 22]. Available from: https://www.who.int/nmh/countries/zaf_en.pdf

8. Mayosi BM, Flisher AJ, Lalloo UG, Sitas F, Tollman SM, Bradshaw D. The burden of non-communicable diseases in South Africa. Vol. 374, The Lancet. 2009. p. 934–47. https://doi.org/10.1016/S0140-6736(09)61087-4

9. Tudor-Locke C, Bassett DR. How Many Steps/Day Are Enough? Sports Medicine. 2004;34(1):1–8. https://doi.org/10.2165/00007256-200434010-00001

10. Wattanapisit A, Wattanapisit ST, Thanamee S. Evidence behind 10,000 steps walking [Internet]. Vol. 31, Journal of Health Research. 2017 [cited 2021 Jun 22]. p. 241–8. Available from: https://he01.tci-thaijo.org/index.php/jhealthres/article/view/89095

11. Le-Masurier GC, Sidman CL, Corbin CB. Accumulating 10,000 Steps: Does this Meet Current Physical Activity Guidelines? Res Q Exerc Sport. 2003 Dec;74(4):389–94. https://doi.org/10.1080/02701367.2003.10609109

12. Booth M. Assessment of Physical Activity: An International Perspective. Res Q Exerc Sport. 2000 Jun 13;71(sup2):114–20. https://doi.org/10.1080/02701367.2000.11082794

13. Warburton DER, Charlesworth S, Ivey A, Nettlefold L, Bredin SSD. A systematic review of the evidence for Canada's Physical Activity Guidelines for Adults. International Journal of Behavioral Nutrition and Physical Activity. 2010;7(1):1–220. https://doi.org/10.1186/1479-5868-7-39

14. Tudor-Locke C, Ainsworth B, Whitt M, Thompson R, Addy C, Jones D. The relationship between pedometer-determined ambulatory activity and body composition variables. Int J Obes. 2001 Nov 30;25(11):1571–8. https://doi.org/10.1038/sj.ijo.0801783

15. Chan CB, Spangler E, Valcour J, Tudor-Locke C. Cross-sectional Relationship of Pedometer-Determined Ambulatory Activity to Indicators of Health. Obes Res. 2003 Dec;11(12):1563–70. https://doi.org/10.1038/oby.2003.208

16. Bravata DM, Smith-Spangler C, Sundaram V, Gienger AL, Lin N, Lewis R, et al. Using Pedometers to Increase Physical Activity and Improve Health. JAMA. 2007 Nov 21;298(19):2296–304. https://doi.org/10.1001/jama.298.19.2296

17. Freak-Poli R LA, Cumpston M, Albarqouni L, Clemes SA, Peeters A. Workplace pedometer interventions for increasing physical activity. Cochrane Database of

Systematic Reviews. 2020 Jul 21;(7). https://doi.org/10.1002/14651858.CD009209.pub3

18. Tudor-Locke C, Bassett DR, Shipe MF, McClain JJ. Pedometry methods for assessing free-living adults. J Phys Act Health. 2011;8(3):445–53. https://doi.org/10.1123/jpah.8.3.445

19. Clemes SA, Parker RAA. Increasing Our Understanding of Reactivity to Pedometers in Adults. Med Sci Sports Exerc. 2009;41(3):674–80. https://doi.org/10.1249/MSS.0b013e31818cae32

20. Clemes, Deans. Presence and Duration of Reactivity to Pedometers in Adults. Med Sci Sports Exerc. 2012 Jun;44(6):1097–101. https://doi.org/10.1249/MSS.0b013e318242a377

21. Husted HM, Llewellyn TL. The Accuracy of Pedometers in Measuring Walking Steps on a Treadmill in College Students. Int J Exerc Sci. 2017;10(1):146–53.

22. IPAQ. The International Physical Activity Questionnaire [Internet]. 2002 [cited 2021 Jul 16]. Available from: https://sites.google.com/site/theipaq/home

23. Craig, Marshall, Bauman, Booth, Ainsworth, Pratt, et al. International Physical Activity Questionnaire: 12-Country Reliability and Validity. Med Sci Sports Exerc. 2003 Aug;35(8):1381–95. https://doi.org/10.1249/01.MSS.0000078924.61453.FB

24. Cuthill JA, Fitzpatrick K, Glen J. Anaesthesia - a sedentary specialty? Accelerometer assessment of the activity level of anaesthetists while at work. Anaesthesia. 2008 Jun;63(3):279–83. https://doi.org/10.1111/j.1365-2044.2007.05352.x

25. Tanaka H, Kawamata T, Gen-No H, Nose H, Kawamata M. Evaluation of the Physical Activity of Anesthesiologists in the Operating Room During Daily Work Using a Triaxial Accelerometer. Arch Environ Occup Health. 2015 Jun;70(2):77–80. https://doi.org/10.1080/19338244.2013.778809

26. Murphy IG, Murphy CG, Heffernan EJ. A comparative analysis of the occupational energy expenditure of radiologists versus clinicians. Ir J Med Sci. 2015 Jun;184(4):889–92. https://doi.org/10.1007/s11845-014-1215-z

27. Atkinson J, Goody RB, Walker CA. Walking at Work: A Pedometer Study Assessing the Activity Levels of Doctors. Scott Med J. 2005 Jun;50(2):73–5. https://doi.org/10.1177/003693300505000210

28. Kovacheva VP, Tsen LC. Predictors of Achieving Recommended Daily Physical Activity Among Anesthesiologists at a Large Tertiary Care Academic Center. J Clin Med Res. 2018;10(1):50–5. https://doi.org/10.14740/jocmr3208w

29. Soh M, Deam RK, Kluger R. 10,000 Reasons to Step Out—Exercise Patterns and Pedometer Evaluation of Consultant Anaesthetists. Anaesth Intensive Care. 2006 Jun;34(3):347–52. https://doi.org/10.1177/0310057X0603400315

30. Abd TT, Kobylivker A, Perry A, III JM, Sperling L. Work-Related Physical Activity Among Cardiovascular Specialists. Clin Cardiol. 2012 Jun;35(2):78–82. https://doi.org/10.1002/clc.21954

31. Beringer CB, Wells M, Goldstein LN. Let's get physical: A prospective pedometer study of doctors working in a South African emergency department. South African Medical Journal. 2020 Jun;110(11):1124–7. https://doi.org/10.7196/SAMJ.2020.v110i11.14828

32. Jun S, Kim J, Choi H, Kim J, Lim S, Sul B, et al. Physical Activity of Workers in a Hospital. Int J Environ Res Public Health. 2019;16(4):532. https://doi.org/10.3390/ijerph16040532

33. Kwiecień-Jaguś K, Mędrzycka-Dąbrowska W, Czyż-Szypenbeil K, Lewandowska K, Ozga D. The use of a pedometer to measure the physical activity during 12-hour shift of ICU and nurse anaesthetists in Poland. Intensive Crit Care Nurs. 2019 Jun;55:1–7. https://doi.org/10.1016/j.iccn.2019.07.009

34. Solovieva S, Lallukka T, Virtanen M, Viikari-Juntura E. Psychosocial factors at work, long work hours, and obesity: a systematic review. Scand J Work Environ Health. 2013 May;39(3):241–58. https://doi.org/10.5271/sjweh.3364

35. Manenschijn L, van Kruysbergen RGPM, de Jong FH, Koper JW, van Rossum EFC. Shift Work at Young Age Is Associated with Elevated Long-Term Cortisol Levels and Body Mass Index. J Clin Endocrinol Metab. 2011 Nov;96(11):E1862–5. https://doi.org/10.1210/jc.2011-1551

36. Li J, Bidlingmaier M, Petru R, Pedrosa Gil F, Loerbroks A, Angerer P. Impact of shift work on the diurnal cortisol rhythm: a one-year longitudinal study in junior physicians. Journal of Occupational Medicine and Toxicology. 2018 Dec 14;13(1):23. https://doi.org/10.1186/s12995-018-0204-y

37. Roskoden FC, Krüger J, Vogt LJ, Gärtner S, Hannich HJ, Steveling A, et al. Physical Activity, Energy Expenditure, Nutritional Habits, Quality of Sleep and Stress Levels in Shift-Working Health Care Personnel. Zhang H, editor. PLoS One. 2017 Jan 12;12(1):e0169983. https://doi.org/10.1371/journal.pone.0169983

38. Valente F, Batista C, Simões V, Tomé I, Carrilho A. Quality of Sleep among Portuguese Anaesthesiologists: A Cross-Sectional Study. Acta Med Port. 2019 Oct 1;32(10):641. https://doi.org/10.20344/amp.11468

39. Nena E, Katsaouni M, Steiropoulos P, Theodorou E, Constantinidis T, Tripsianis G. Effect of shift work on sleep, health, and quality of life of health-care workers. Indian J Occup Environ Med. 2018;22(1):29. https://doi.org/10.4103/ijoem.IJOEM_4_18

40. Krzych ŁJ, Piekiełko P, Baca A, Długosz A, Liberski P, Jaworski T, et al. Sleep quality and daytime sleepiness among Polish anaesthesiologists and intensivists. J Crit Care. 2019 Oct;53:87–90. https://doi.org/10.1016/j.jcrc.2019.06.005

41. Huang B-H, Duncan MJ, Cistulli PA, Nassar N, Hamer M, Stamatakis E. Sleep and physical activity in relation to all-cause, cardiovascular disease and cancer mortality risk. Br J Sports Med. 2021 Jun 29; https://doi.org/10.1136/bjsports-2021-104046

42. van der Walt N, Scribante J, Perrie H. Burnout among anaesthetists in South Africa. Southern African Journal of Anaesthesia and Analgesia. 2015 Nov 2;21(6):169–72. https://doi.org/10.1080/22201181.2015.1102798

43. Bretland RJ, Thorsteinsson EB. Reducing workplace burnout: the relative benefits of cardiovascular and resistance exercise. PeerJ. 2015 Apr 9;3:e891. https://doi.org/10.7717/peerj.891

44. Coetzee J, Kluyts H. Burnout and areas of work-life among anaesthetists in South Africa Part 1 : Burnout. Southern African Journal of Anaesthesia and Analgesia. 2020 Mar 31;26(2):73–82. https://doi.org/10.36303/SAJAA.2020.26.2.2358

45. Fellowship of the College of Anaesthetists of South Africa [Internet]. The Colleges of Medicine South Africa. [cited 2022 Apr 12]. Available from: https://www.cmsa.co.za/view_exam.aspx?QualificationID=1

46. Weidner G, Kohlmann C-W, Dotzauer E, Burns LR. The effects of academic stress on health behaviors in young adults. Anxiety Stress Coping. 1996 Jan;9(2):123–33. https://doi.org/10.1080/10615809608249396

47. Jung ME, Brawley LR. Concurrent self-regulatory efficacy as a mediator of the goal: Exercise behaviour relationship. J Health Psychol. 2013 May 26;18(5):601–11. https://doi.org/10.1177/1359105313479238

48. Williams AS, Williams CD, Cronk NJ, Kruse RL, Ringdahl EN, Koopman RJ. Understanding the exercise habits of residents and attending physicians: a mixed methodology study. Fam Med. 2015 Feb;47(2):118–23.

49. Stanford FC, Durkin MW, Blair SN, Powell CK, Poston MB, Stallworth JR. Determining levels of physical activity in attending physicians, resident and fellow physicians and medical students in the USA. Br J Sports Med. 2012 Apr;46(5):360–4. https://doi.org/10.1136/bjsports-2011-090299

50. Schneider, Crouter, Bassett. Pedometer Measures of Free-Living Physical Activity: Comparison of 13 Models. Med Sci Sports Exerc [Internet]. 2004 Feb;36(2):331–5. Available from: http://journals.lww.com/00005768-200402000-00024 https://doi.org/10.1249/01.MSS.0000113486.60548.E9

51. Schneider, Crouter, Lukajic, Bassett. Accuracy and Reliability of 10 Pedometers for Measuring Steps over a 400-m Walk. Med Sci Sports Exerc [Internet]. 2003 Oct;35(10):1779–84. Available from: http://journals.lww.com/00005768-200310000-00025 https://doi.org/10.1249/01.MSS.0000089342.96098.C4

52. Husted HM, Llewellyn TL. The Accuracy of Pedometers in Measuring Walking Steps on a Treadmill in College Students. Int J Exerc Sci. 2017;10(1):146–53.

53. Beringer CB, Wells M, Goldstein LN. Let's get physical: A prospective pedometer study of doctors working in a South African emergency department. South African Medical Journal. 2020 Jun;110(11):1124–7. https://doi.org/10.7196/SAMJ.2020.v110i11.14828

Section 2: Author's guidelines

South African Journal of Anaesthesia and Analgesia

Guidelines available from: http://www.sajaa.co.za/index.php/sajaa/about/submissions.

Submitted manuscripts that are not in the correct format and without the required supporting documentation specified in these guidelines will be returned to the author(s) for correction and will delay publication.

AUTHORSHIP

Named authors must consent to publication **by signing a covering letter** which should be submitted as a supplementary file. Authorship should be based on substantial contribution to:

(i) conception, design, analysis and interpretation of data;

(ii) drafting or critical revision for important intellectual content; and

(iii) approval of the version to be published. These conditions must all be met (uniform requirements for manuscripts submitted to biomedical journals; refer to **www.icmje.org**); and

(iv) exact contribution of each author must be stated.

DECLARATION OF CONFLICT OF INTEREST

Authors must declare all sources of support for the research and any association with a product or subject that may constitute a conflict of interest. If there is no conflict of interest to declare please include the following statement: The authors declare no conflict of interest.

FUNDING SOURCE

All sources of funding should be declared. Also define the involvement of study sponsors in the study design, collection, analysis and interpretation of data; the writing of the manuscript; the decision to submit the manuscript for publication. If the study sponsors had no such involvement, this should be stated as follows: No funding source to be declared.

RESEARCH ETHICS COMMITTEE APPROVAL

The submitting author must provide written confirmation of Research Ethics Committee approval for all studies including case reports. The ethics committee as well as the approval number should be included.

STATISTICAL ANALYSIS

Authors are advised to involve medical statisticians at the protocol stage of their research project: to plan sample size, and the selection of appropriate statistical tests for analysis and presentation.

PROTECTION OF PATIENT'S RIGHTS TO PRIVACY

Identifying information should not be published in written descriptions, photographs, and pedigrees unless the information is essential for scientific purposes and the patient (or parent or guardian) gives informed written consent for publication. The patient should be shown the manuscript to be published. Refer to **www.icmje.org**.

ETHNIC CLASSIFICATION

The rationale for analysis based on racio-ethnic-cultural categorisation should be indicated.

CATEGORIES OF SUBMISSIONS

Shorter items are more likely to be accepted for publication, owing to space constraints and reader preferences.

Original articles

Original articles on research relevant to anaesthesia and analgesia should not exceed **3 200** words, no more than **30 references**, with up to **6 tables or figures**. A structured abstract under the following headings, Background, Methods, Results, and Conclusions is a requirement and should not exceed **300 words.**

Clinical Review articles

Review articles relevant to anaesthesia and analgesia should not exceed 2 400 words, with a maximum of 20 references and no more than 6 tables or figures. A summary of 300 words or less is required.

Case reports

Case reports should not exceed 1 800 words with no more than 10 references. Figures are limited to 2 figures and may include images or photographs. The case report should have three headings: Summary (not exceeding 100 words), Case report (with no introduction) and Discussion. Case reports will be published online only. The summary and the URL will appear in the printed version.

Scientific Letters

Scientific Letters should not exceed 2 400 words with a maximum of 10 references. Only one table or illustration is permissible. A structured abstract under the following headings, Background, Methods, Results, and Conclusions, is a requirement and should not exceed 250 words.

Letters to the editor

Letters to the editor should be 800 words or less with only one image or table.

MANUSCRIPT PREPARATION

Refer to articles in recent issues for the presentation of headings and subheadings. If in doubt, refer to 'uniform requirements' - **www.icmje.org**. Manuscripts must be provided in **UK English**.

Qualification, affiliation and contact details

This information must be provided for ALL authors and must be submitted as a supplementary file.

Email addresses of all authors

must be provided.

ORCID number of **ALL** authors must be provided – if authors do not have ORCID, please register at https://orcid.org/

Abbreviations

All abbreviations should be spelt out when first used and thereafter used consistently, e.g. 'intravenous (IV)' or 'Department of Health (DoH)'.

Scientific measurements

Scientific measurements must be expressed in SI units except blood pressure (mmHg) and haemoglobin (g/dl). Litres is denoted with a lowercase 'l' e.g. 'ml' for millilitres). Units should be preceded by a space (except for %), e.g. '40 kg' and '20 cm' but '50%'. Greater/smaller than signs (> and 40 years of age) should also be preceded by a space e.g. > 20 years. No spaces should precede ± and °, i.e. '35±6' and '19°C'.

Numbers should be written as grouped per thousand-units, i.e. 4 000, 22 160...

Quotes should be placed in single quotation marks: i.e. The respondent stated: '...'
Round **brackets** (parentheses) should be used, as opposed to square brackets, which are reserved for denoting concentrations or insertions in direct quotes.

General formatting

The manuscript must be in Microsoft Word or RTF document format. Text must be 1,5-spaced, in 12-point Times New Roman font, and contain no unnecessary formatting (such as text in boxes, except for Tables). *The manuscript must be free of track changes.*

Disclaimers should follow the Conclusion and it should be in the following order: Acknowledgements, Declaration conflict of interest, Funding source, Ethics declaration and ORCID.

ILLUSTRATIONS AND TABLES

If tables or illustrations submitted have been published elsewhere, the author(s) should provide consent to republication obtained from the copyright holder.

Tables may be embedded in the manuscript file **and** provided as **'supplementary files'**. They must be numbered in Arabic numerals (1,2,3...) and referred to consecutively in the text (e.g. 'Table 1'). Tables should be constructed carefully and simply for intelligible data representation. Unnecessarily complicated tables are strongly discouraged. Tables must be cell-based (i.e. not constructed with text boxes, tabs, or enters) and accompanied by a concise title and column headings. Footnotes must be indicated with consecutive use of the following symbols: * † ‡ § ¶ || then ** †† ‡‡ etc.

Figures must be numbered in Arabic numerals and referred to in the text e.g. '(Figure 1)'. Figure legends: Figure 1: 'Title...'. All illustrations/figures/graphs must be of **high resolution/quality**: 300 dpi or more is preferable, but images must not be resized to increase resolution. Unformatted and uncompressed images must be attached as '**supplementary files**' upon submission (not embedded in the accompanying manuscript).

TIFF and PNG formats are preferable; JPEG and PDF formats are accepted, but authors must be wary of image compression. Illustrations and graphs prepared in Microsoft PowerPoint or Excel must be accompanied by the original workbook.

REFERENCES

Authors must verify references from the original sources. *Only complete, correctly formatted reference lists will be accepted.* Reference lists may be generated with the use of reference manager software, but the final document must be delinked from the reference database or otherwise generated manually. Citations should be inserted in the text as superscript, e.g. These regulations are endorsed by the World Health Organization,[2] and others.[3,4-6] The superscript reference number should come after the punctuation mark and should not be in brackets.

All references should be listed at the end of the article in numerical order of appearance in the **Vancouver style** (not alphabetical order). Approved abbreviations of journal titles must be used; see the List of Journals in Index Medicus. Names and initials of all authors should be given; if there are more than six authors, the first four names should be given followed by et al. First and last page, volume and issue numbers should be given. **Wherever possible, references must be accompanied by a digital object identifier (DOI) link and PubMed ID (PMID)/PubMed Central ID (PMCID).** Authors are encouraged to use the DOI lookup service offered by **CrossRef**. Crossref DOIs should always be displayed as a full URL link in the form https://doi.org/10.xxxx/xxxxx\

Journal references:

Jun BC, Song SW, Park CS, Lee DH. The analysis of maxillary sinus aeration according to aging process: volume assessment by 3-dimensional reconstruction by high-resolutional CT scanning. Otolaryngol Head Neck Surg. 2005 Mar;132(3):429-34.

Polgreen PM, Diekema DJ, Vandeberg J, Wiblin RT, et al. Risk factors for groin wound infection after femoral artery catheterization: a case-control study. Infect Control Hosp Epidemiol [Internet]. 2006 Jan [cited 2007 Jan 5];27(1):34-7. Available from: http://www.journals.uchicago.edu/ICHE/journal/issues/v27n1/2004069/2004069.web.pdf.

Book references: Jeffcoate N. Principles of Gynaecology. 4th ed. London: Butterworth, 1975:96-101. *Chapter/section in a book:* Weinstein L, Swartz MN. Pathogenic Properties of Invading Microorganisms. In: Sodeman WA jun, Sodeman WA, eds. Pathologic Physiology: Mechanisms of Disease. Philadelphia: WB Saunders, 1974:457-472.

Internet references: World Health Organization. The World Health Report 2002 - Reducing Risks, Promoting Healthy Life. Geneva: World Health Organization, 2002. http://www.who.int/whr/2002 (accessed 16 January 2010).

Other references (e.g. reports) should follow the same format: Author(s). Title. Publisher place: publisher name, year; pages. Cited manuscripts that have been accepted but not yet published can be included as references followed by '(in press)'. Unpublished observations and personal communications in the text must not appear in the reference list. The full name of the source person must be provided for personal communications e.g. '...(Prof. Michael Jones, personal communication)'.

COVERING LETTER

A covering letter to the editor is mandatory and must include statements that the manuscript has not been published previously and is not under review elsewhere. It should state details of any prior publication of the research in abstract form or in Congress proceedings. The letter must declare if any of the authors have a conflict of interest and that the requirements for submission, including ethics approval and patient permission for case reports have been fulfilled. All authors must sign the covering letter.

REVIEW PROCESS

Manuscripts, after vetting by the editorial team, are assigned for peer-review to 2 reviewers, conversant with the particular field of research. The reviewers and the authors are blinded to each other’s identity. The turn-around time for review and initial editorial decision notification aims to be within 6 weeks of submission.

PROOFS

A PDF proof of an article may be sent to the corresponding author before publication to resolve remaining queries. At that stage, **only** typographical changes are permitted; the corresponding author is required, having conferred with his/her co-authors, to reply within 2 working days in order for the article to be published in the issue for which it has been scheduled.

CHANGES OF ADDRESS

Please notify the editorial department of any contact detail changes, including email, to facilitate communication.

CHARGES

There is no charge for the publication of manuscripts.

LETTERS TO THE EDITOR

(400-800 words) (1 page)

ORIGINAL RESEARCH

(2800-3200 words) (4-5 pages)

SCIENTIFIC LETTERS

(2400 words) (3-4 pages)

CASE STUDIES

(1 800 words) (3 pages)

CLINICAL REVIEWS

(2 400 words) (3-4 pages)

Copyright Notice

By submitting manuscripts to SAJAA, authors of original articles are assigning copyright to the SA Society of Anaesthesiologists. Authors may use their own work after publication without written permission, provided they acknowledge the original source.

Individuals and academic institutions may freely copy and distribute articles published in SAJAA for educational and research purposes without obtaining permission.

The work is licensed under a Creative Commons Attribution-Non-Commercial Works 4.0 South Africa License. The SAJAA does not hold itself responsible for statements made by the authors.

Privacy Statement

The names and email addresses entered in this journal site will be used exclusively for the stated purposes of this journal and will not be made available for any other purpose or to any other party.

Section 3: Draft Article

An assessment of the levels of physical activity in an academic anaesthetic department.

Authors:

Peter Belasyse-Smith BSc (Hons) (KCL, UK), BM (Southampton, UK), DA (SA), FCA (SA)

Janine Wagner, MBBCh (Wits), DA (SA), FCA (SA), MMED (SA), PhD (Wits)

Department of Anaesthesiology, School of Clinical Medicine, Faculty of Health Sciences, University of the Witwatersrand

Peter Belasyse-Smith ORCID ID 0009-0003-7606-4887

Janine Wagner: ORCID ID 0000-0002-8726-9218

Corresponding Author:

Dr Peter Belasyse-Smith

Department of Anaesthesia

Rahima Moosa Mother & Child Hospital

Private Bag X20,

Newclare,

Randburg,

2112,

South Africa

Telephone: +27765991175

Email: drpeterbsmith@gmail.com

Keywords: Physical activity, Anaesthesia, Pedometer, IPAQ, Step count.

Declaration

The authors declare that they have no conflict of interest. This research was done in partial fulfilment of a Master of Medicine degree. No funding source to be declared.

The author/s declare that this submission is in accordance with the principles laid down by the Responsible Research Publication Position Statements as developed at the 2nd World Conference on Research Integrity in Singapore, 2010.

Abstract:

Background:

It has long been known that a positive correlation exists between physical activity, exercise, and health. Individuals who achieve a daily target of 10 000 steps are likely to meet the recommended levels of health-enhancing physical activity to confer long-term benefits.

We aimed to evaluate the physical activity levels of public sector, academic anesthesiologists in Johannesburg, South Africa both on and off duty and determine the proportion meeting recommended guidelines.

Method:

This prospective, cross-sectional observational study was undertaken at three academic hospitals in Johannesburg, South Africa. Ninety-four doctors wore a pedometer on and off duty for a seven-day period. A questionnaire based on the short-form International Physical Activity Questionnaire (IPAQ) was also completed.

Results:

The median (Interquartile Range (IQR)) total daily step count was 6 964 (6 271 - 7 956), the median (IQR) number of steps taken on duty was 5 033 (3 536 – 6 407) and the median (IQR) off-duty daily steps was 3 247 (1 471 - 3 802). Only 5% (5/94) of doctors achieved the recommended target of 10 000 daily steps. The IPAQ data showed that only 3% (3/94) of participants had a high level of physical activity, with 68% (64/94) having an inactive lifestyle. Significant factors influencing the on-duty step count included the duration of the shift, the number of cases performed and being the floor senior.

Conclusion:

Doctors working in the anaesthetic department at the University of the Witwatersrand do not get the recommended level of physical activity either at work or when they are not working. This is placing a large and vital workforce at increased risk for chronic non-communicable disease, mental health issues, and burnout.

Introduction:

Physical inactivity has been cited by the World Health Organisation (WHO) as one of the top ten causes of morbidity and mortality worldwide.[1] Increasing physical activity (PA) has long been known to reduce the risk of developing chronic diseases including coronary artery disease, type II diabetes and hypertension, and is also associated with mental health benefits.[1]

South Africa specifically has a very high level of physical inactivity and a large burden of non-communicable diseases.[2]

Current recommendations for adult PA from the WHO are that 'Adults should do at least 150–300 minutes of moderate-intensity aerobic physical activity; or at least 75–150 minutes of vigorous-intensity aerobic physical activity; or an equivalent combination of moderate and vigorous intensity activity throughout the week, for substantial health benefits.'.[1]

Guidance for the public to achieve recommended PA levels has long revolved around a daily minimum target of 10 000 steps per day. Evidence has shown that this is a reasonable target that correlates with WHO recommendations for adults less than sixty years old.[3–5]

A recent meta-analysis of step counts and all-cause mortality involving 15 studies and 47 471 adults, has suggested that 'taking more steps per day was associated with progressively lower mortality risk, with the risk plateauing for older adults (aged ≥60 years) at approximately 6 000 – 8 000 steps per day and for younger adults (aged <60 years) at approximately 8 000 – 10 000 steps per day.[6]

A classification of physical activity as determined by pedometer-assessed step counts was suggested in 2004 by Tudor-Locke et al. This is shown in Table 1 below.[7]

Table 1: Classification of physical activity determined by number of steps per day[7].

Number of Steps Per Day	Level of Physical Activity
<5 000	sedentary lifestyle
5 000-7 499	low active
7 500-9 999	somewhat active
≥10 000	active
>12 500	highly active

Pedometer studies have been used for many years to provide a simple and affordable means of tracking daily PA levels.[8,9]

Self-administered questionnaires such as the short form International Physical Activity Questionnaire (IPAQ) are an alternative validated tool for the assessment of PA.[10] The IPAQ is a free to use questionnaire that assesses the type of activity, frequency and duration carried out in the previous seven days. From this activity data a calculation of metabolic equivalents (MET) is made, and then combined with duration and frequency to calculate a MET-minutes value. This then enables classification of the assessed PA levels as 'inactive', 'minimally active', and 'health enhancing physical activity (HEPA)'.[10,11]

Pedometer and questionnaire-based studies have been done before to assess PA levels of anaesthetists in other countries, but not in South Africa.[12–14] These studies have found that anaesthetists do not achieve the suggested target of 10 000 steps during their working day.

Anaesthetists as a workforce face many occupational barriers that impact their ability to achieve recommended levels of PA including long hours, shift work, fatigue, and a high burnout risk.[15–17] Rates of burnout can be reduced by programs designed to increase PA.[18]

For this study, the primary objectives were to describe PA levels of anaesthetists working in a public sector, academic department in Johannesburg, South Africa, and determine the proportion that were meeting recommended daily requirements. Secondary objectives were to describe and compare personal and work factors that were associated with meeting daily exercise requirements.

Methods:

This prospective cross-sectional observational study utilised a pedometer and questionnaire to assess PA levels. Twenty Decathlon Onwalk100 pedometers were self-financed for the study.[19]

Consent was obtained from participants on the morning of the first day of the study period, and an information sheet was given to the participants with the pedometer and details of how to wear it. Participants were encouraged to wear the pedometer both on and off duty. Step count values on the pedometer were shielded from the view of the participants and data was collected covertly to ensure blinding. Step counts were recorded twice daily by the researcher or an independent third-party giving data for all on and off-duty periods. Pedometer readings were taken as usual on weekends from those participants on duty. For those off duty over the

weekend, a reading was taken on Friday at 16:00, and a final reading taken on Monday at 07:00, covering the 63-hour weekend off-duty period. Pedometers were collected from all participants on Monday at 07:00 at the time of obtaining the final reading.

The self-administered questionnaire collected data on age, rank, work location, chronic diseases, anthropometrics, upcoming examinations, and daily clinical workload details. Data allowing for completion of the short-form IPAQ was also included. This was added to the study design to document any activities undertaken whilst wearing a pedometer was not possible. The questionnaire was returned to the researcher at the end of the seven-day study period.

Permission to distribute the questionnaires was obtained from the Academic Head of the Department of Anaesthesiology at The University of The Witwatersrand.

The sample population was drawn from 227 full time members of the Department of Anaesthesiology of the University of the Witwatersrand. Exclusions for the study were refusal, ICU rotations, rotations at satellite locations, annual leave during study period, injury that would limit physical activity and being on call on the first night of the study period.

Consecutive convenience sampling was utilized for doctors rostered to three chosen hospital sites (CMJAH, CHBAH, HJH/RMMCH) over multiple seven-day periods.

After consultation with a biostatistician, a minimum sample size of 92 participants was sought, (providing a 5% margin of error, and 95% confidence level), based on the findings of similar studies[20].

Potential biases in the study were addressed by blinding the pedometers to the study participants and incorporating potential confounders such as CPR events into the questionnaire design. An independent biostatistician was used for the analysis of the data and negative findings were also reported in this report.

The study was approved by the postgraduate assessors' group from the University of the Witwatersrand and was registered on The National Research Database NHRED ref: GP_202205_073. Ethical clearance was obtained from The Human Research Ethics Committee (Medical) at the University of the Witwatersrand (M211066).

Data Analysis:

Study data was entered into a Microsoft Excel spreadsheet and then analysed using SPSS 28. Descriptive statistics summarised the demographic data and key variables used in the study. Categorical data was presented visually using bar charts. Correlation analysis was performed to reveal associations and dependencies within the dataset. Independent t-tests and one-way ANOVA assessed differences in step counts across groups. Regression analysis was conducted to identify factors influencing daily step counts. A 5% significance level was used throughout.

Results

Of the 102 participants initially enrolled, 8 met exclusion criteria during the study period and were excluded from data analysis, leaving a sample size of 94 doctors.

Table 2 shows the step count data for the study. N = number of shifts, IQR = Interquartile Range.

	N	Minimum	Maximum	Median	IQR	25th %ile	75th %ile
Daily on duty steps	440	691	13 560	5 033	2 871	3 536	6 408
Daily off duty steps	444	108	50 949	3 247	2 332	1 471	3 803
Total weekly steps	94	27 818	84 998	48 823	12 790	43 521	5 6311
Daily total steps (averaged)	94	3 974	12 143	6 964	1 739	6 217	7 957

Step count data (Table 2) was obtained for n=440 on-duty shifts. Daily steps on duty ranged from 691 to 13 560 steps with a median (Interquartile Range (IQR)) of 5 033 (IQR: 3 536 - 6 408). Off-duty steps (from n=444 off-duty periods) ranged from 108 to 50 949 steps with a median step count of 3 247 (IQR: 1 471-3802). From the total weekly step counts, an average total daily step count was calculated, with a range of 3 974 to 12 143 steps, and a mean of 7 134 (95%CI: 6 760-7 484) steps.

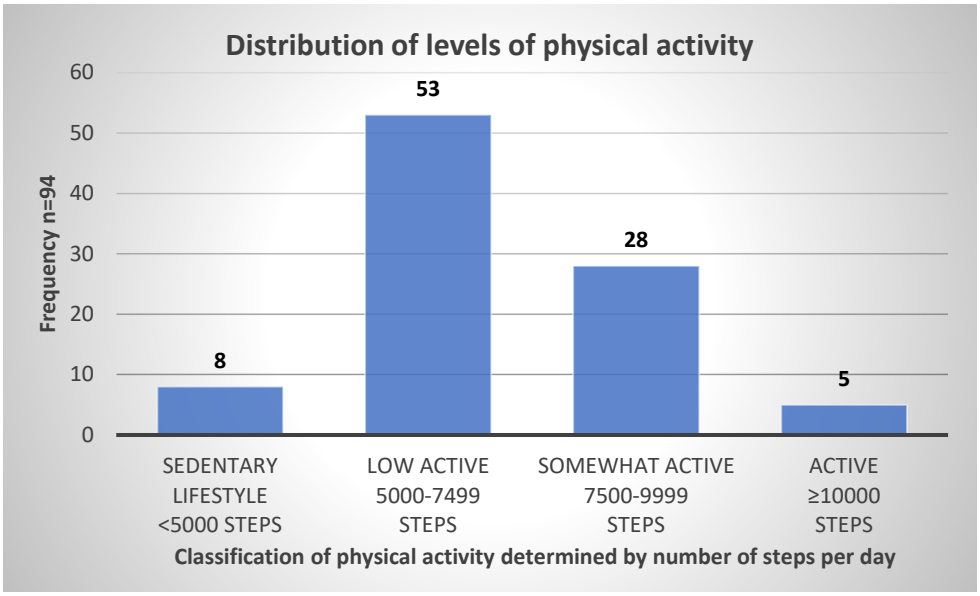


Figure 1. The numbers of participants classified by physical activity ranges according to average daily step counts.[7]

Figure 1 classifies the physical activity by step count according to Tudor-Locke et al.[7] It was found that 65% (n=61) of the study sample fell below the level of a 'somewhat active' average daily step count of 7 500 steps, and five (5%) of the doctors in the study achieved the recommended number of total average daily steps (10,000 steps) as per WHO standard.[1]

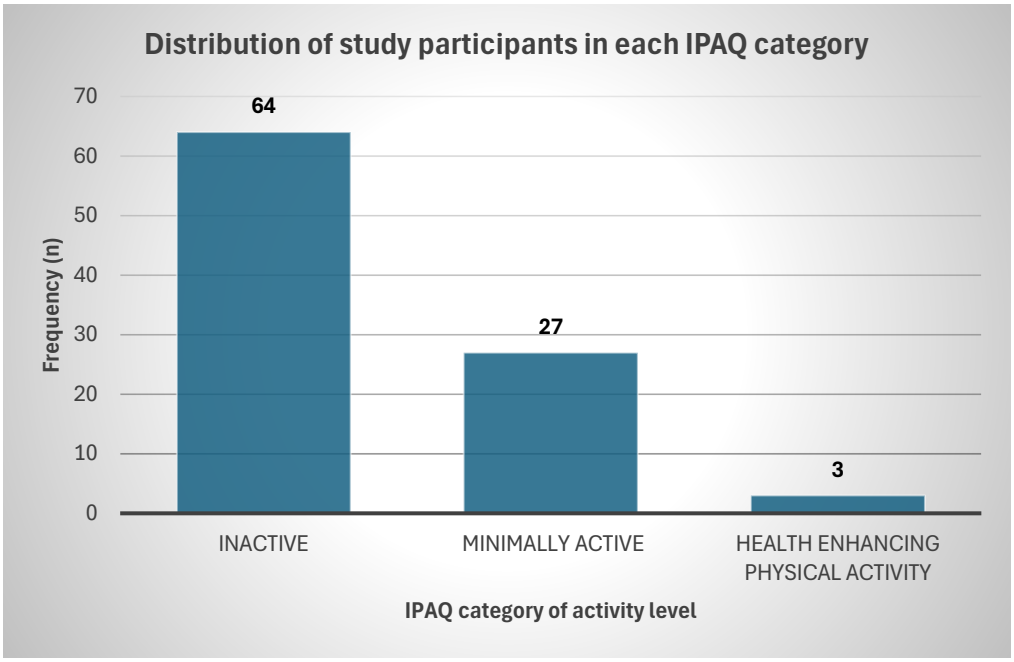


Figure 2. The distribution of study participants categorised according to IPAQ classification.[10,11]

Figure 2 categorises participants' PA level as obtained from the study questionnaire according to the IPAQ guidance.[10,11] It shows that 64 individuals (68%) were classified as being 'inactive', 27 (29%) were minimally active and only 3 (3%) of participants had health enhancing physical activity levels.

The total number of hours on duty for the participants ranged from 33 to 69 hours per week, with a mean of 46 (95%CI: 44-47) hours. Total off-duty hours ranged from 99 to 135 hours over the 7-day study periods, with a mean of 122 (95%CI: 120-123) hours. There was a positive significant association between the total number of hours spent on duty and the on-duty step count (r=0.513; p=0.041) and (albeit weakly) the total weekly step counts (r=0.01; p=0.02).

A significant negative association was observed between the total number of off-duty hours in a week and the total weekly step count (r=-0.17; p=0.03).

Sixty participants (64%) belonged to the age group 25-34, 28% (n=26) were in the age group 35-44, 7% (n=7) were within the age group 45-54, and there was one participant above 54 years (1%). Steps on duty significantly differed by age groups (p=0.03), with those between 25-34 years of age having the highest mean on duty step count of 26 769 (95%CI: 24 703-28 836).

Doctors were from different ranks within the department; 18 medical officers (19%), 37 junior registrars (39%), 15 senior registrars (16%) and 24 consultants (26%). Results showed that consultants had a statistically significant higher mean off-duty step count compared to other ranks 7 437 (95%CI: 6 864-8 209; p=0.01). Differences in mean on-duty and total daily step counts between ranks were not statistically significant.

Body Mass Index (BMI) values for the participants ranged from a minimum value of 18 to a maximum value of 38, with a mean value of 25.4 (95%CI: 24.5-26.3). 41% (n=39) had a normal weight, 29% (n=27) were overweight and 24% (n=23) were obese. 5% (n=5) were classified as underweight. No correlation was found between BMI class and total daily average steps attained (r=0.561, p=0.061).

Eleven of the 94 participants (11.7%) disclosed that they suffered from a chronic disease; no significant correlation was found between average total daily step counts and this variable (p= > 0.05).

Eleven of the participants (11.7%) were enrolled to write an exam in the next three months. This variable was compared with off-duty steps – but no significant correlation was noted (p= >0.05).

The average number of cases performed daily while on duty was 3 (95%CI: 3.5-3.9), with a range from 0 to 18 cases. A significant association was shown between the number of cases performed and on-duty step counts (r=0.12; p=0.007) but the association between the number of cases performed and off-duty step counts was insignificant at the 5% level (r=0.031; p=0.051).

The role of being the floor senior whilst on duty had a significant correlation with both total on-duty steps taken (r=0.795; p=0.007) and attaining an average daily step count of ≥ 10 000 steps (r=0.652; p=0.01). There were also statistically significant differences found in the values of the means of both on-duty steps and total daily step counts for those who performed senior duties (t-test for equality p= < 0.05 for both variables).

No statistically significant differences were found with on-duty or total daily step counts for those who did administrative work whilst on duty (t-test for equality p= > 0.05). There were also no significant differences found in the step counts of doctors who performed cases in private practice during their off-duty hours. There was only 1 CPR event during the 440 on-duty shifts, this was not included in the analysis.

On duty step counts were compared for the different surgical disciplines but there was no statistically significant relationship found (p= > 0.05 for all disciplines).

Doctors worked at 3 different hospitals during the study period: 56.5% (n=53) of participants were located at CHBAH, 23.5% (n=22) at HJH/RMMCH and 20% (n=19) at CMJAH. Doctors working at CMJAH had significantly higher on duty step counts compared to those based at CHBAH or HJH/RMMCH (p=0.003).

Table 3: Data for daily on duty step counts compared to number of cases (grouped).

	Case numbers (grouped)	N	Mean	SD	95% CI Lower & Upper boundaries		P value
Daily on-duty steps	Cases 0 - 3	239	5 229	149.3	4 935	5 522	0.032
	Cases 4 - 7	183	5 590	170.7	5 255	5 926	
	Cases > 7	18	6 477	544.1	5 407	7 546	

There was a statistically significant relationship between daily on-duty step counts and the number of cases performed on duty (p=0.032).

Regression analysis was performed to identify factors influencing total daily step counts among the study participants. Significant relationships for increasing total daily step counts were found for total daily hours on duty (p=0.03), increased number of daily cases (p=0.04) and being the floor senior on duty (p=0.02). Having a chronic illness, differences in BMI, administrative duties and upcoming exams did not significantly affect average daily step count.

Discussion:

This pedometer study looking at the PA of anaesthetists was the largest of its kind in the literature. The results show that most of the doctors working in the Department of Anaesthesiology at the University of the Witwatersrand are not meeting WHO recommended PA levels. The pedometer data showed that 95% were below recommended levels, and the IPAQ data found 97% did not achieve the WHO targets.[1,7,10,11]

These findings are consistent with previous global research on anaesthetists which found low PA levels among this workforce. However, they does not correlate with the findings of a questionnaire-based study from the same institution, which found 55.4% of the study had a high level of PA.[21] Study designs and differences in questionnaire formats are likely to account for the variance.

A daily on-duty median of 5 033.50 (IQR: 3 537 -6 408) steps compares well with other studies of anaesthetists worldwide, being just below those from Boston, but higher than those found in Melbourne or Glasgow[12–14]. A pedometer-based study from Bloemfontein involving twenty medical registrars included a subgroup of 5 anaesthetists with a daily median step count of 4 521 (range: 2 318-6 519).[22]

Several factors were positively associated with achieving higher daily step counts and PA levels. Having more hours on duty, performing more cases, and being the designated floor senior were all associated with increased step counts. This may all reflect a greater degree of movement required on busier clinical days.

Age was a factor, with the youngest cohort (25-34 years) having the highest on-duty step counts, perhaps due to greater energy levels. BMI category and having chronic diseases did not seem to influence physical activity levels in this study sample.

Consultants had significantly higher off-duty step counts in comparison with other ranks, which could relate to different lifestyle factors in this group.

Doctors at CMJAH had significantly higher on-duty step counts which is most likely just a reflection of the differing physical layout of the hospital sites.

Limitations:

Due to the nature of the working hours of the study sample, and the need for covert data collection, per-person daily step counts were not attainable. We instead relied on weekly and hence daily averages which may underestimate spikes in activity on one or more days.

As recommended for studies of this type, efforts were made to reduce the 'reactivity' of the pedometer study via covert sampling and blinding of the step counts to the participants.[23] Nonetheless, there might still have been some performance bias and increased daily step counts, despite the low overall physical activity levels noted.

Correlation between participant IPAQ data and pedometer step count data was not done, as the purpose of this study was not to further validate the IPAQ, and the reason for inclusion of the IPAQ in the study design was to account for physical activity done off duty when wearing a pedometer was potentially not feasible.

Conclusion:

Doctors working in the anaesthetic department at the University of the Witwatersrand do not get the recommended level of physical activity either at work or when they are not working. This is placing a large and vital workforce at increased risk for chronic non-communicable disease, mental health issues, and burnout. Interventions from workplace management to promote physical activity may play a role in improving this situation.

Balancing the stressors of long hours, a high-stress occupation, fatigue, and trying to increase levels of PA outside of work isn't an easy task – but it is one that we must be better at.

References:

1. Bull FC, Al-Ansari SS, Biddle S, Borodulin K, Buman MP, Cardon G, et al. World Health Organization 2020 guidelines on physical activity and sedentary behaviour. Br J Sports Med. 2020 Dec;54(24):1451–62. https://doi.org/10.1136/bjsports-2020-102955
2. World Health Organisation. South Africa risk of Premature death from NCDs [Internet]. World Health Organization - Noncommunicable Diseases (NCD) Country Profiles, 2018. 2018 [cited 2021 Jun 22]. Available from: https://www.who.int/nmh/countries/zaf_en.pdf
3. Tudor-Locke C, Bassett DR. How Many Steps/Day Are Enough? Sports Medicine. 2004;34(1):1–8. https://doi.org/10.2165/00007256-200434010-00001
4. Le-Masurier GC, Sidman CL, Corbin CB. Accumulating 10,000 Steps: Does this Meet Current Physical Activity Guidelines? Res Q Exerc Sport [Internet]. 2003 Dec;74(4):389–94. Available from: http://www.tandfonline.com/doi/abs/10.1080/02701367.2003.10609109 https://doi.org/10.1080/02701367.2003.10609109
5. Wattanapisit A, Wattanapisit S. Evidence behind 10,000 steps walking [Internet]. J Health Res [Internet]. 2017 Jun [cited 2021 Jun 22];31:241–8. Available from: https://www.researchgate.net/publication/317400141_Evidence_behind_10000_steps_walking
6. Paluch AE, Bajpai S, Bassett DR, Carnethon MR, Ekelund U, Evenson KR, et al. Daily steps and all-cause mortality: a meta-analysis of 15 international cohorts [Internet]. The Lancet Public Health, 2022;7(3), e219-e228 https://doi.org/https://doi.org/10.1016/s2468-2667(21)00302-9
7. Tudor-Locke C, Bassett DR. How Many Steps/Day Are Enough? Sports Medicine. 2004;34(1):1–8. https://doi.org/10.2165/00007256-200434010-00001
8. Freak-Poli R LA, Cumpston M, Albarqouni L, Clemes SA, Peeters A. Workplace pedometer interventions for increasing physical activity. Cochrane Database of Systematic Reviews. 2020 Jul 21;(7). https://doi.org/10.1002/14651858.CD009209.pub3
9. Tudor-Locke C, Bassett DR, Shipe MF, McClain JJ. Pedometry methods for assessing free-living adults. J Phys Act Health. 2011;8(3):445–53. https://doi.org/10.1123/jpah.8.3.445
10. IPAQ. The International Physical Activity Questionnaire [Internet]. 2002 [cited 2021 Jul 16]. Available from: https://sites.google.com/site/theipaq/home
11. Craig, Marshall, Bauman, Booth, Ainsworth, Pratt, et al. International Physical Activity Questionnaire: 12-Country Reliability and Validity. Med Sci Sports Exerc [Internet]. 2003 Aug;35(8):1381–95. Available from: http://journals.lww.com/00005768-200308000-00020 https://doi.org/10.1249/01.MSS.0000078924.61453.FB
12. Cuthill JA, Fitzpatrick K, Glen J. Anaesthesia - a sedentary specialty? Accelerometer assessment of the activity level of anaesthetists while at work. Anaesthesia. 2008 Jun;63(3):279–83. https://doi.org/10.1111/j.1365-2044.2007.05352.x

13. Kovacheva VP, Tsen LC. Predictors of Achieving Recommended Daily Physical Activity Among Anesthesiologists at a Large Tertiary Care Academic Center. J Clin Med Res. 2018;10(1):50–5. https://doi.org/10.14740/jocmr3208w

14. Soh M, Deam RK, Kluger R. 10,000 Reasons to Step Out—Exercise Patterns and Pedometer Evaluation of Consultant Anaesthetists. Anaesth Intensive Care. 2006 Jun;34(3):347–52. https://doi.org/10.1177/0310057X0603400315

15. Solovieva S, Lallukka T, Virtanen M, Viikari-Juntura E. Psychosocial factors at work, long work hours, and obesity: a systematic review. Scand J Work Environ Health. 2013 May;39(3):241–58. https://doi.org/10.5271/sjweh.3364

16. Cook MA, Gazmararian J. The association between long work hours and leisure-time physical activity and obesity. Prev Med Rep. 2018 Jun;10. https://doi.org/10.1016/j.pmedr.2018.04.006

17. Balatoni I, Szépné HV, Kiss T, Adamu UG, Szulc AM, Csernoch L. The Importance of Physical Activity in Preventing Fatigue and Burnout in Healthcare Workers. Healthcare (Switzerland). 2023 Jul 1;11(13). https://doi.org/10.3390/healthcare11131915

18. Bretland RJ, Thorsteinsson EB. Reducing workplace burnout: the relative benefits of cardiovascular and resistance exercise. PeerJ. 2015 Apr 9;3:e891. https://doi.org/10.7717/peerj.891

19. Decathlon Geonaute Onwalk 100 [Internet]. [cited 2024 May 5]. Available from: https://www.decathlon.co.za/trackers-pedometers-or-scales/119526-69535-onwalk-100-pedometer-and-accelerometer-black.html

20. Beringer CB, Wells M, Goldstein LN. Let's get physical: A prospective pedometer study of doctors working in a South African emergency department. South African Medical Journal. 2020 Jun;110(11):1124–7. https://doi.org/10.7196/SAMJ.2020.v110i11.14828

21. Mampana NM. Health habits and physical activity level of anaesthetists in an academic department - affiliated to the University of the Witwatersrand [Internet]. 2019 [cited 2024 May 5]. Available from: https://wiredspace.wits.ac.za/items/184a9fbf-9777-4389-b7f8-06900e746056

22. Lamacraft G, Claasen C, Coetzee R, Du Toit J, Kritzinger S, Staats D, Van Niekerk A, Joubert G. Steps walked whilst at work, by University of the Free State medical registrars: an exploratory study. Occup Health Southern Afr. 2021; 27(2):46-50. Available from: https://indexmedicus.afro.who.int/iah/fulltext/Steps%20walked%20whilst%20at%20work,%20by%20University%20of%20the%20Free%20State%20medical%20registrars%20an%20exploratory%20study_Lamacraft%20G.pdf

23. Clemes, Deans. Presence and Duration of Reactivity to Pedometers in Adults. Med Sci Sports Exerc [Internet]. 2012 Jun;44(6):1097–101. Available from: https://journals.lww.com/00005768-201206000-00016 https://doi.org/10.1249/MSS.0b013e318242a377

Proposal

An assessment of the levels of physical activity in an academic anaesthetic department.

Dr Peter Belasyse-Smith

Student number: 375150

drpeterbsmith@gmail.com

Supervisor: Dr Janine Wagner

Department of Anaesthesiology, University of the Witwatersrand.

1. Introduction

A sedentary lifestyle or physical inactivity has been cited by the World Health Organisation (WHO) as one of the top ten causes of morbidity and mortality worldwide [1]. It is estimated that 4-5 million deaths related to chronic non-communicable diseases could be prevented by increasing levels of activity [2]. In 2016 it was found that 27.5% of adults worldwide did not meet WHO recommended levels of physical activity [2,3].

It has long been recognised that an increase in physical activity correlates with a reduction in the progression of, or risk of developing, chronic non-communicable diseases such as coronary artery disease, type II diabetes, obesity, osteoporosis, and breast and colon cancer [1]. According to Chastin et al. there is a reduction in all-cause mortality associated with increased daily activity of any intensity (in a dose-response relationship), compared to a sedentary lifestyle [4]. Physical activity is also associated with mental health benefits [1].

In addition to the human cost in morbidity or premature mortality, there are also huge economic implications to the pandemic of inactivity [5]. It has been estimated that physical inactivity costs global healthcare systems a total of $53.8 billion per annum with higher income countries bearing the brunt of the economic burden, and low to middle income countries having a larger burden of disease [6].

South Africa has a high level of physical inactivity and a high burden of non-communicable disease [7]. Data from the WHO in 2016 showed that 37% of the South African population were classed as physically inactive [7]. In 2009, it was estimated that 51% of all deaths in South Africa were caused by non-communicable diseases [8].

The current recommendations for adult physical activity from the WHO are that “Adults should do at least 150–300 minutes of moderate-intensity aerobic physical activity; or at least 75–150 minutes of vigorous intensity aerobic physical activity; or an equivalent combination of moderate and vigorous intensity activity throughout the week, for substantial health benefits.” [1]. These recommendations also state that “Adults should limit the amount of time spent being sedentary. Replacing sedentary time with physical activity of any intensity (including light intensity) provides health benefits.” [1].

The WHO has also released recommendations for pregnant women and for people with certain chronic diseases [1]. The main difference for pregnant women is that the recommended level of moderate-intensity aerobic activity is reduced to 150 minutes per week [1]. The recommendations for people with chronic diseases, however, are the same as those for adults without chronic disease.

One way that many global health programs have interpreted these guidelines to simplify them for the general population is to recommend a daily target of a minimum of 10 000 steps [9]. This guidance originated in Japan prior to the Tokyo Olympic games in 1964, as a marketing campaign from a pedometer manufacturer [9]. It was not based on any research or evidence at that time. Subsequent research has shown that 10 000 steps a day equates to approximately 300-400 kcal/day of energy expenditure (depending on walking speed and body size) [10–12]. Accumulating 10 000 steps on three or more days a week has been shown to be equivalent to 30 minutes of moderate intensity physical activity on most days of the week, which therefore meets the WHO recommendations [13]. There is a proven inverse correlation between the number of steps per day and body mass index, waist circumference, resting heart rate, and diastolic blood pressure [14,15].

A classification of physical activity as determined by pedometer-assessed step counts was suggested in 2004 by Tudor-Locke et al. This is shown in Table 1 below [9].

Table 1: Classification of physical activity determined by number of steps per day.

Number of Steps Per Day	**Level of Physical Activity**
<5000	sedentary lifestyle
5000-7499	low active
7500-9999	somewhat active
≥10000	active
>12500	highly active

Pedometers or step counters are simple electronic or mechanical devices attached to the waistband, wrist, or arm that give the wearer feedback on the number of steps taken, and hence an indication of physical activity.

Pedometers are gradually being replaced by newer technology such as fitness trackers, accelerometers, and smartphone apps, but they have become a popular, validated tool to motivate the population to increase physical activity [16,17]. There is data that suggests that interventions utilising pedometers are effective in producing a short-term increase in physical activity, but only uncertain evidence of any long-lasting effects [16,17].

One confounder when using pedometers to study physical activity is that of reactivity; the change in behaviour by participants when they know that they are being monitored, also known as a Hawthorne effect [18]. If a participant is using a pedometer on which they can view the numbers of steps accrued and told to measure and record their step counts, their overall physical activity can increase by 15% [18]. Recommended measures to eliminate this bias include blinding the participants to the screen of the pedometer during the study and using a third party to record the accrued steps [19]. One study has shown that the reactivity (increased physical activity) to an unsealed pedometer lasted for seven days, with step counts returning to a baseline level for the following week of the study [20]. Sealed (blinded) pedometers do not elicit the same degree of reactivity [18].

One other factor that influences the accuracy of step counts recorded by pedometers is the location that they are worn on the body. It has been shown that the most accurate results are obtained when the pedometer is worn on the hip, rather than on the wrist [21].

An alternative method to assess the physical activity of a study group is to use a self-administered questionnaire. One such tool is the short form International Physical Activity Questionnaire (IPAQ) [22]. This is a validated, open access, free to use questionnaire that assesses the type and duration of any physical activity undertaken in the previous seven days. Participants' physical activity levels are then categorized as either low, moderate, or high [22,23].

Worldwide, there have been many pedometer studies assessing the physical activity levels for physicians of various medical specialties including anaesthetists [24–33]. Most of these studies have only focused on physical activity during working hours. These studies have found that doctors do not achieve the suggested target of 10 000 steps during working hours [24–33]. This leaves them at increased risk for chronic non-communicable disease, mental health issues, and burnout, unless extra effort is made by the individual to do extra physical activity during their own free time outside of work.

There are many reasons that are specific to a career in anaesthesia that make it important for anaesthetists to be aware of their physical activity levels. Anaesthesia is a medical speciality that is often considered to be sedentary. A study by Cuthill et al. [24] has shown that 50% of an anaesthetists' time in theatre is spent standing up, and walking is often limited to short bursts around theatre, or in visiting patients pre-operatively in the wards. The amount walked rarely reaches the 15–20-minute duration recommended by the WHO for a brisk walk [1,24].

Anaesthetists are also shift workers and a correlation between shift work, long working hours, obesity, and other non-communicable disease has been described [34]. This may be due in part to chronically elevated cortisol levels in shift workers but may also be a result of altered levels of physical activity [35,36]. Roskoden et al. have shown that physical activity for shift workers is higher during working hours compared to non-shift-workers, although no difference in total physical activity was found [37]. Shift work may also affect sleep quality and quality of life for anaesthetists and healthcare workers [38–40]. Poor sleep patterns are independently associated with increased mortality, but if combined with overall poor physical activity, there is a synergistic increase in all-cause mortality [41]. Anaesthetists are also at high risk for burnout [42], described by Bretland et al. as "the chronic state of job stress, where employer expectations and employee workload exceed the individual's perceived psychological capacity and ability to cope with the work demands expected of them"[43]. South African anaesthetists employed in the public sector have been shown to have a 36.5% prevalence of clinical burnout [44]. Programmes designed to target increased physical activity have been shown to reduce rates of burnout [43].

Anaesthetic speciality trainees study towards exams, the two part Fellowship of the College of Anaesthetists of South Africa (FCA (SA)) set by the College of Medicines South Africa[45]. Times of high academic stress and demand are known to affect the level of exercise achieved by examination candidates [46,47].

There is also evidence that physical activity levels of American trainee anaesthetists are lower than those of their specialist colleagues [48,49].

There is a paucity of data with respect to South African anaesthetists' activity levels both on and off duty. This study will investigate the current total physical activity levels of anaesthetists working in an academic department in Johannesburg, South Africa.

2. Problem Statement

The effect of physical activity on long term health is well established. The WHO has devised a set of guidelines that aim to reduce an individual's risk of developing chronic non-communicable disease. Ideally healthcare professionals should be aware of these recommendations and should ensure that they achieve this desired level of physical activity either during their working day or outside of work. The reality is, however, that many doctors do not fulfil the recommended amount of physical activity.

This leads to the potential risk to doctors of contracting chronic disease over the long-term and increasing their risk of burn-out and deterioration in mental health in the short-term. There is a paucity of data with respect to the physical activity levels of South African anaesthetists during working hours, or outside of work. The results of this study may raise awareness of the current activity levels of anaesthetists, which could result in an improvement in acute and long-term health outcomes for South African anaesthetists and may assist with decreasing the rates of burnout.

3. Aim

The aim of this study is to assess whether anaesthetists in the Department of Anaesthesia at the University of the Witwatersrand are meeting recommended levels of daily physical activity.

4. Objectives

Primary Objectives:

- To describe the level of physical activity taken by anaesthetists over a seven-day period.
- To determine the proportion of anaesthetists that are meeting their recommended daily exercise requirements over a seven-day period.

Secondary Objectives:

- To describe and compare personal and work factors that are associated with meeting daily exercise requirements over a seven-day period.

5. Research Assumptions

Level of physical activity: A numerical expression of an individual's daily physical activity used as an estimate of a person's total energy expenditure [1,9,22,23].

Recommended daily exercise requirements over a seven-day period: The levels of exercise and physical activity recommended by the World Health Organisation for various population groups to mitigate health risks and achieve health benefits [1]

Working hours: Day shifts (from 07:00 to 16:00) and night shifts (from 16:00 to 07:00 the following morning).

After hours: Any other time outside of working hours.

Pedometer: Pedometers are simple electronic or mechanical devices attached to the waistband, wrist or arm that give the wearer feedback on the number of steps taken, and hence an indication of physical activity [17].

Non-Communicable Disease: "A non-communicable disease, or NCD, is a medical condition or disease which … is non-infectious and cannot be passed from person to person" [50]. Examples include most cancers, most heart diseases, diabetes, stroke, and hypertension.

Anaesthetist: Any qualified doctor performing anaesthesia who works in the University of the Witwatersrand Department of Anaesthesiology including medical officers, registrars, and consultants**.**

Medical officer: A qualified doctor practicing in the University of the Witwatersrand Department of Anaesthesiology under specialist supervision.

Career medical officer: A medical officer with more than 10 years of experience and is regarded as a consultant.

Registrar: A qualified doctor who is registered with the Health Professions Council of South Africa (HPCSA) as a trainee specialist anaesthetist.

Junior Registrar: A registrar in their first or second year.

Senior Registrar: A registrar in their third, fourth or subsequent years.

Consultant: A qualified doctor who is registered with the HPCSA as a specialist anaesthetist capable of independent practice, or a career medical officer.

6. Demarcation of Study Field

The study will be conducted in the Department of Anaesthesiology of the University of the Witwatersrand. The department comprises 234 Anaesthetists: 75 consultants (68 full time, seven part-time), 12 career medical officers, 108 registrars, and 39 medical officers [email

from Prof. E Oosthuisen. CMJAH. Received 19.07.2021, email from Dr B Gardner. HJH received 16.07.2021. email from Dr T Kleyenstuber RMMCH received 16.07.2021. Email from Dr P Mogane CHBAH received 16.07.2021].

The following hospitals are affiliated with the department:

- Charlotte Maxeke Johannesburg Academic Hospital (CMJAH)
- Chris Hani Baragwanath Academic Hospital (CHBAH)
- Helen Joseph Hospital (HJH)
- Rahima Moosa Mother and Child Hospital (RMMCH)
- Wits Donald Gordon Medical Centre (WDGC)
- Thelle Mogoerane Hospital
- Klerksdorp-Tshepong Hospital

Of the 108 registrars on the circuit, at any one time there are 14 who are rotating through either Intensive Care Units at CHBAH/HJH/CMJAH/WDGMC or at outreach satellite sites (Thelle Mogoerane Hospital or Klerksdorp-Tshepong Hospital).

7. Ethical Considerations

An application for ethics clearance will be submitted to the Human Research Ethics Committee (HREC) of the University of the Witwatersrand. The study will not and is not intended to assess anyone, and not be used as part of any disciplinary undertaking against any of the participants.

The study will only commence once after obtaining ethical clearance from the HREC.

A self-administered questionnaire will be utilised in this study (Appendix 1). Questionnaires will be completed anonymously, and no identifying information will be collected on the questionnaire. Confidentiality will be ensured as only the researcher and supervisor will have access to the raw data.

Permission to distribute the questionnaires will be obtained from the Academic Head of the Department of Anaesthesiology at The University of The Witwatersrand (Appendix 2).

The data collected will be stored on a password protected computer for six years once the study is completed as per the HREC regulations.

The study will be conducted according to the principles of the Declaration of Helsinki [51] and the South African Guidelines for Good Clinical Practice [52].

8. Data Collection

8.1 Research Design

The study will be conducted as a prospective cross sectional observational study with the use of a pedometer and a researcher completed questionnaire.

A prospective study is one in which the data for the study is not yet in existence when the study is being planned. A population is chosen by the researcher and followed over the duration of the study to determine outcomes [53]. This study will be prospective as currently there is no information on the physical activity of anaesthetists in the study group.

A cross-sectional study is one which collects data at one time from many participants, rather than from a small group of participants over multiple time periods. This study is choosing a cross-sectional design as these are best for assessing for population-based surveys [53].

An observational study is one which descriptive data is collected as it occurs. It requires that the data be collected under strictly defined conditions and in a precise, controlled manner. This study is observational as there is no experimental arm [53].

All participants will use a commercially available, standardized, pre-tested pedometer (Sportline® Pedometer 340, EB Brands, Yonkers, NY). Sportline® pedometers have been validated in several previous studies [21,54,55]. Twenty Sportline® pedometers have been kindly lent to the researcher, by Dr Craig Berringer a consultant emergency physician at Chris Hani Baragwanath Hospital, who conducted a similar study among emergency care physicians [31].

Participants will be assisted in completing a questionnaire detailing demographic characteristics, daily theatre activities, and details of any daily out of-hours activities. Participants' activity levels will be charted twice daily by the researcher over the course of the seven-day study period.

8.2 Study Population

The study population consists of all full-time anaesthetists employed by the Wits Department of Anaesthesiology rostered to non-ICU and non-satellite locations.

8.3 Study sample method

The sample population will be drawn from doctors rostered for a seven-day period to one of the four chosen hospital sites (CMJAH, CHBAH, HJH, RMMCH). Consecutive convenience sampling will be utilized.

8.4 Inclusion criteria

- Full time Anaesthetists working in the Department of Anaesthesiology of the University of the Witwatersrand.

8.5 Exclusion criteria

- Anaesthetists declining participation in the study.
- Non-full-time consultants.
- Interns rotating though the department of anesthesiology.
- Registrars allocated to ICU rotations.
- Registrars allocated to satellite outreach hospitals.
- Members of staff injured at the time of study such that their ability to walk is hindered.
- Members of the department who are on leave or not present at work for seven consecutive days during the study duration.
- Participants on night call on the first Monday evening during the week of data collection.

8.6 Sample size

The department comprises 234 Anaesthetists: 75 consultants (68 full time, seven part -time), 12 career medical officers, 108 registrars, and 39 medical officers. After non-full-time consultants, and those allocated to satellite sites and ICU were excluded; there were 213 eligible members of staff who could be considered.

In consultation with a biostatistician, it was determined that a minimum sample size of 92 participants is required to ensure a 5% margin of error, and 95% confidence level [email from Dr Zvifadzo Matsena-Zingoni, University of the Witwatersrand, received 29.09.2021]. The sample size was determined based on the findings of similar studies, assuming that 11.7% of participants will achieve the recommended step target [31]

8.7 Collection of Data

A questionnaire was developed to provide extra information over and above a daily step count (Appendix 1). Questions regarding physical activity during off duty hours were adapted from the short form International Physical Activity Questionnaire (IPAQ) [22,23].
Other details included in the questionnaire are:

- Demographics (age, presence of chronic disease, height, weight, anaesthetic rank, hospital, and whether writing exams in the next 3 months)
- Pedometer step counts – recorded twice daily (at the onset or end of shifts)
- On or off duty
- If on duty, nature of shift performed (day/night).
- Surgical speciality assigned to, and number of cases performed.
- Details of work done whilst on duty e.g., clinical duties, administrative duties, floor senior.
- Details of daily physical activity performed during off duty hours.
- Details of off duty work activities e.g., performance clinical work in private healthcare facilities.

Data collection will take place at four hospital sites (CHBAH, CMJAH, RMMCH, HJH) over consecutive weeks. The researcher will request to be placed at the relevant hospitals via leave replacement for the duration of the study periods at each hospital.
Participants will be approached consecutively for inclusion upon release of the relevant weekly roster for the following week. On arrival at work on Monday morning, the participants will be given an information sheet and will be asked to sign informed consent for participation [Appendices 3 &4]. A numbered pedometer (correlating to the participants' study number) will then be affixed to their waistband.
The screen of the pedometer will be covered in a way to blind the participant from the number of steps achieved. Step counts will be recorded twice a day by the researcher (or trained research assistant); on the participants' arrival into work at 07:00 and on their departure at 16:00 either in the anaesthetic tea-room or in the theatre where the participant is working. The 07:00 recording will include any out of hours activity from the previous night and morning prior to 07:00, thus giving a total for the 24-hour period. The step count will then be reset and read again at 16:00 to record physical activity during working hours.

Pedometer readings will be taken twice daily by the researcher or trained research assistant, on Saturday and Sunday to capture data from participants on call over the weekend. If the participants did not have any on call shifts over the weekend, a reading will be taken on Friday at 16:00, and the next (and final) reading will be on Monday at 07:00. This will be a 48-hour reading captured as weekend off-hours activity. The pedometers will be collected on the following Monday at 07:00 and then re-allocated to the next cohort of participants.
With 20 pedometers available, the data collection is expected to be completed in a minimum of five weeks.
A questionnaire will also be completed by the researcher daily, upon consultation with the participant recording the daily levels of physical activity.

9: Data Analysis

Data captured from the participants will be entered into a Microsoft Excel® spreadsheet and analysed in conjunction with a biostatistician using the statistics programme STATA® version 16.1.
Descriptive and inferential statistics will be used to analyse the data. Categorical data will be described using frequency and percentage.
Continuous variables that are normally distributed will be summarised using means and standard deviations, and those not normally distributed will be summarised using medians and interquartile ranges. Comparison between groups will be done using Chi-squared tests, Mann-Whitney, and Kruskal-Wallis tests.
Associations between categorical variables will be determined by performing chi-squared tests, and odds ratios will be calculated. Logistic regression analysis will be performed to determine factors predictive of achieving the recommended number-of daily steps over a seven-day period.

10: Significance of the study

This study is significant as it will investigate the physical activity of a group of South African anaesthetists for the first time. The data obtained will be useful in educating the department on the risks of a sedentary lifestyle, and the importance of incorporating minimum recommended daily physical activity levels into their daily routines.

This will help to reduce the staff members' risk of developing future chronic diseases, improve their overall mental health and reduce burnout. This will also hopefully reduce absenteeism and sick leave in the department.

11: Validity and reliability of the study

Methods to ensure validity and reliability include:

- Use of a representative sample population.
- Use of a validated pedometer.
- Blinding of the pedometer.
- Use of a questionnaire based on the International Physical Activity Questionnaire.
- Analysing data in conjunction with a biostatistician.

12: Potential Limitations of the study

The study is contextual in nature and will only include anaesthetists working in the CMJAH, CHBAH, RMMCH, and HJH theatres. It will only represent the physical activity of individuals working in those locations and will not be applicable to other institutions, or individuals in the department working outside of these theatres.

Should doctors not be willing to participate due to concerns of poor fitness, there may be a selection bias leaving behind a pool of more active, fitter participants.

It is known that just the act of wearing a pedometer can introduce an awareness of the participant's physical activity and cause the wearer to increase their number of steps [18]. To counter this bias, the screens of the pedometers will be covered, and pedometers taped shut so the participants will not be able to monitor their progress.

It is possible that certain activities performed during the working day could cause 'pseudo steps' which would falsely elevate the step count recorded.

One such activity is Cardio-pulmonary resuscitation (CPR) hence its inclusion in the self-administered questionnaire. It is possible that there would be other such events which would increase the recorded physical activity. A hip mounted pedometer was chosen for this study to increase accuracy of the readings and to try to reduce the likelihood of pseudo-steps being a confounder.

13: Project Outline

Year	2021									
Month	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	April
Proposal	X	X								
Ethics approval				X						
Postgraduate approval			X							
Data collection					X	X	X	X		
Data analysis									X	
Submission										X

14: Financial Plan

Document	Price per unit	Number of Pages/ hours	Total
Proposal	R1/page	90	R90
Questionnaire	R1/page	260	R360
Final report	R1/page	200	R200
Research assistant	R50/hour	56	R2800
Total			R3450

The Department of Anaesthesiology will incur the costs of paper and printing for the post graduate application. The researcher will incur the remaining costs.

References

1. Bull, Al-Ansari, Biddle, Borodulin, Buman, Cardon, et al. World Health Organization 2020 guidelines on physical activity and sedentary behaviour. Br J Sports Med 2020;54:p.1451–62. doi:10.1136/bjsports-2020-102955.

2. Lee, Shiroma, Lobelo, Puska, Blair, Katzmarzyk. Effect of physical inactivity on major non-communicable diseases worldwide: an analysis of burden of disease and life expectancy. The Lancet 2012;380:p.219–29. doi:10.1016/S0140-6736(12)61031-9.

3. Strain, Brage, Sharp, Richards, Tainio, Ding, et al. Use of the prevented fraction for the population to determine deaths averted by existing prevalence of physical activity: a descriptive study. Lancet Glob Health 2020;8:p.E920–30. doi:10.1016/S2214-109X(20)30211-4.

4. Chastin, McGregor, Palarea-Albaladejo, Diaz, Hagströmer, Hallal, et al. Joint association between accelerometry-measured daily combination of time spent in physical activity, sedentary behaviour and sleep and all-cause mortality: a pooled analysis of six prospective cohorts using compositional analysis. Br J Sports Med 2021;0:p.1–10. doi:10.1136/bjsports-2020-102345.

5. Ding, Kolbe-Alexander, Nguyen, Katzmarzyk, Pratt, Lawson. The economic burden of physical inactivity: a systematic review and critical appraisal. Br J Sports Med 2017;51:p.1392–409. doi:10.1136/bjsports-2016-097385.

6. Ding, Lawson, Kolbe-Alexander, Finkelstein, Katzmarzyk, van Mechelen, et al. The economic burden of physical inactivity: a global analysis of major non-communicable diseases. The Lancet 2016;388:p.1311–24. doi:10.1016/S0140-6736(16)30383-X.

7. World Health Organisation. South Africa risk of Premature death from NCDs. World Health Organization - Noncommunicable Diseases (NCD) Country Profiles, 2018 2018. https://www.who.int/nmh/countries/zaf_en.pdf (accessed 06/22/2021).

8. Mayosi, Flisher, Lalloo, Sitas, Tollman, Bradshaw. The burden of non-communicable diseases in South Africa. The Lancet 2009;374:p.934–47. doi:10.1016/S0140-6736(09)61087-4.

9. Tudor-Locke, Bassett. How Many Steps/Day Are Enough? Sports Medicine 2004;34:p.1–8. doi:10.2165/00007256-200434010-00001.

10. Wattanapisit, Wattanapisit, Thanamee. Evidence behind 10,000 steps walking. J Health Res 2017;31:p.241–8. https://he01.tci-thaijo.org/index.php/jhealthres/article/view/89095 (accessed 06/22/2021).

11. Le-Masurier, Sidman, Corbin. Accumulating 10,000 Steps: Does this Meet Current Physical Activity Guidelines? Res Q Exerc Sport 2003;74:p.389–94. doi:10.1080/02701367.2003.10609109.

12. Booth. Assessment of Physical Activity: An International Perspective. Res Q Exerc Sport 2000;71:p.114–20. doi:10.1080/02701367.2000.11082794.

13. Warburton, Charlesworth, Ivey, Nettlefold, Bredin. A systematic review of the evidence for Canada's Physical Activity Guidelines for Adults. International Journal of Behavioral Nutrition and Physical Activity 2010;7:p.1–220. doi:10.1186/1479-5868-7-39.

14. Tudor-Locke, Ainsworth, Whitt, Thompson, Addy, Jones. The relationship between pedometer-determined ambulatory activity and body composition variables. Int J Obes 2001;25:p.1571–8. doi:10.1038/sj.ijo.0801783.

15. Chan, Spangler, Valcour, Tudor-Locke. Cross-sectional Relationship of Pedometer-Determined Ambulatory Activity to Indicators of Health. Obes Res 2003;11:p.1563–70. doi:10.1038/oby.2003.208.

16. Bravata, Smith-Spangler, Sundaram, Gienger, Lin, Lewis, et al. Using Pedometers to Increase Physical Activity and Improve Health. JAMA 2007;298:p.2296–304. doi:10.1001/jama.298.19.2296.

17. Freak-Poli, Cumpston, Albarqouni, Clemes, Peeters. Workplace pedometer interventions for increasing physical activity. Cochrane Database of Systematic Reviews 2020. doi:10.1002/14651858.CD009209.pub3.

18. Tudor-Locke, Bassett, Shipe, McClain. Pedometry methods for assessing free-living adults. J Phys Act Health 2011;8:p.445–53. doi:10.1123/jpah.8.3.445.

19. Clemes, Parker. Increasing Our Understanding of Reactivity to Pedometers in Adults. Med Sci Sports Exerc 2009;41:p.674–80. doi:10.1249/MSS.0b013e31818cae32.

20. Clemes, Deans. Presence and Duration of Reactivity to Pedometers in Adults. Med Sci Sports Exerc 2012;44:p.1097–101. doi:10.1249/MSS.0b013e318242a377.

21. Husted, Llewellyn. The Accuracy of Pedometers in Measuring Walking Steps on a Treadmill in College Students. Int J Exerc Sci 2017;10:p.146–53.

22. IPAQ. The International Physical Activity Questionnaire 2002. https://sites.google.com/site/theipaq/home (accessed 07/16/2021).

23. Craig, Marshall, Bauman, Booth, Ainsworth, Pratt, et al. International Physical Activity Questionnaire: 12-Country Reliability and Validity. Med Sci Sports Exerc 2003;35:p.1381–95. doi:10.1249/01.MSS.0000078924.61453.FB.

24. Cuthill, Fitzpatrick, Glen. Anaesthesia - a sedentary specialty? Accelerometer assessment of the activity level of anaesthetists while at work. Anaesthesia 2008;63:p.279–83. doi:10.1111/j.1365-2044.2007.05352.x.

25. Tanaka, Kawamata, Gen-No, Nose, Kawamata. Evaluation of the Physical Activity of Anesthesiologists in the Operating Room During Daily Work Using a Triaxial Accelerometer. Arch Environ Occup Health 2015;70:p.77–80. doi:10.1080/19338244.2013.778809.

26. Murphy, Murphy, Heffernan. A comparative analysis of the occupational energy expenditure of radiologists versus clinicians. Ir J Med Sci 2015;184:p.889–92. doi:10.1007/s11845-014-1215-z.

27. Atkinson, Goody, Walker. Walking at Work: A Pedometer Study Assessing the Activity Levels of Doctors. Scott Med J 2005;50:p.73–5. doi:10.1177/003693300505000210.

28. Kovacheva, Tsen. Predictors of Achieving Recommended Daily Physical Activity Among Anesthesiologists at a Large Tertiary Care Academic Center. J Clin Med Res 2018;10:p.50–5. doi:10.14740/jocmr3208w.

29. Soh, Deam, Kluger. 10,000 Reasons to Step Out—Exercise Patterns and Pedometer Evaluation of Consultant Anaesthetists. Anaesth Intensive Care 2006;34:p.347–52. doi:10.1177/0310057X0603400315.

30. Abd, Kobylivker, Perry, III, Sperling. Work-Related Physical Activity Among Cardiovascular Specialists. Clin Cardiol 2012;35:p.78–82. doi:10.1002/clc.21954.

31. Beringer, Wells, Goldstein. Let's get physical: A prospective pedometer study of doctors working in a South African emergency department. South African Medical Journal 2020;110:p.1124–7. doi:10.7196/SAMJ.2020.v110i11.14828.

32. Jun, Kim, Choi, Kim, Lim, Sul, et al. Physical Activity of Workers in a Hospital. Int J Environ Res Public Health 2019;16:p.532. doi:10.3390/ijerph16040532.

33. Kwiecień-Jaguś, Mędrzycka-Dąbrowska, Czyż-Szypenbeil, Lewandowska, Ozga. The use of a pedometer to measure the physical activity during 12-hour shift of ICU and nurse anaesthetists in Poland. Intensive Crit Care Nurs 2019;55:p.1–7. doi:10.1016/j.iccn.2019.07.009.

34. Solovieva, Lallukka, Virtanen, Viikari-Juntura. Psychosocial factors at work, long work hours, and obesity: a systematic review. Scand J Work Environ Health 2013;39:p.241–58. doi:10.5271/sjweh.3364.

35. Manenschijn, van Kruysbergen, de Jong, Koper, van Rossum. Shift Work at Young Age Is Associated with Elevated Long-Term Cortisol Levels and Body Mass Index. J Clin Endocrinol Metab 2011;96:p.E1862–5. doi:10.1210/jc.2011-1551.

36. Li, Bidlingmaier, Petru, Pedrosa Gil, Loerbroks, Angerer. Impact of shift work on the diurnal cortisol rhythm: a one-year longitudinal study in junior physicians. Journal of Occupational Medicine and Toxicology 2018;13:p.23. doi:10.1186/s12995-018-0204-y.

37. Roskoden, Krüger, Vogt, Gärtner, Hannich, Steveling, et al. Physical Activity, Energy Expenditure, Nutritional Habits, Quality of Sleep and Stress Levels in Shift-Working Health Care Personnel. PLoS One 2017;12:p.e0169983. doi:10.1371/journal.pone.0169983.

38. Valente, Batista, Simões, Tomé, Carrilho. Quality of Sleep among Portuguese Anaesthesiologists: A Cross-Sectional Study. Acta Med Port 2019;32:p.641. doi:10.20344/amp.11468.

39. Nena, Katsaouni, Steiropoulos, Theodorou, Constantinidis, Tripsianis. Effect of shift work on sleep, health, and quality of life of health-care workers. Indian J Occup Environ Med 2018;22:p.29. doi:10.4103/ijoem.IJOEM_4_18.

40. Krzych, Piekiełko, Baca, Długosz, Liberski, Jaworski, et al. Sleep quality and daytime sleepiness among Polish anaesthesiologists and intensivists. J Crit Care 2019;53:p.87–90. doi:10.1016/j.jcrc.2019.06.005.

41. Huang, Duncan, Cistulli, Nassar, Hamer, Stamatakis. Sleep and physical activity in relation to all-cause, cardiovascular disease and cancer mortality risk. Br J Sports Med 2021. doi:10.1136/bjsports-2021-104046.

42. van der Walt, Scribante, Perrie. Burnout among anaesthetists in South Africa. Southern African Journal of Anaesthesia and Analgesia 2015;21:p.169–72. doi:10.1080/22201181.2015.1102798.

43. Bretland, Thorsteinsson. Reducing workplace burnout: the relative benefits of cardiovascular and resistance exercise. PeerJ 2015;3:p.e891. doi:10.7717/peerj.891.

44. Coetzee, Kluyts. Burnout and areas of work-life among anaesthetists in South Africa Part 1 : Burnout. Southern African Journal of Anaesthesia and Analgesia 2020;26:p.73–82. doi:10.36303/SAJAA.2020.26.2.2358.

45. Fellowship of the College of Anaesthetists of South Africa. The Colleges of Medicine South Africa n.d. https://www.cmsa.co.za/view_exam.aspx?QualificationID=1 (accessed 04/12/2022).

46. Weidner, Kohlmann, Dotzauer, Burns. The effects of academic stress on health behaviors in young adults. Anxiety Stress Coping 1996;9:p.123–33. doi:10.1080/10615809608249396.

47. Jung, Brawley. Concurrent self-regulatory efficacy as a mediator of the goal: Exercise behaviour relationship. J Health Psychol 2013;18:p.601–11. doi:10.1177/1359105313479238.

48. Williams, Williams, Cronk, Kruse, Ringdahl, Koopman. Understanding the exercise habits of residents and attending physicians: a mixed methodology study. Fam Med 2015;47:p.118–23.

49. Stanford, Durkin, Blair, Powell, Poston, Stallworth. Determining levels of physical activity in attending physicians, resident and fellow physicians and medical students in the USA. Br J Sports Med 2012;46:p.360–4. doi:10.1136/bjsports-2011-090299.

50. Le-Masurier, Sidman, Corbin. Accumulating 10,000 Steps: Does this Meet Current Physical Activity Guidelines? Res Q Exerc Sport 2003;74:p.389–94. doi:10.1080/02701367.2003.10609109.

51. Wattanapisit, Wattanapisit. Evidence behind 10,000 steps walking [Internet]. J Health Res 2017;31:p.241–8.

52. Paluch, Bajpai, Bassett, Carnethon, Ekelund, Evenson, et al. Articles Daily steps and all-cause mortality: a meta-analysis of 15 international cohorts. 2022. doi:https://doi.org/10.1016/s2468-2667(21)00302-9.

53. Tudor-Locke, Bassett. How Many Steps/Day Are Enough? Sports Medicine 2004;34:p.1–8. doi:10.2165/00007256-200434010-00001.

54. Tudor-Locke, Bassett, Shipe, McClain. Pedometry methods for assessing free-living adults. J Phys Act Health 2011;8:p.445–53. doi:10.1123/jpah.8.3.445.

55. IPAQ. The International Physical Activity Questionnaire 2002. https://sites.google.com/site/theipaq/home (accessed 07/16/2021).

56. Craig, Marshall, Bauman, Booth, Ainsworth, Pratt, et al. International Physical Activity Questionnaire: 12-Country Reliability and Validity. Med Sci Sports Exerc 2003;35:p.1381–95. doi:10.1249/01.MSS.0000078924.61453.FB.

57. Cuthill, Fitzpatrick, Glen. Anaesthesia - a sedentary specialty? Accelerometer assessment of the activity level of anaesthetists while at work. Anaesthesia 2008;63:p.279–83. doi:10.1111/j.1365-2044.2007.05352.x.

58. Kovacheva, Tsen. Predictors of Achieving Recommended Daily Physical Activity Among Anesthesiologists at a Large Tertiary Care Academic Center. J Clin Med Res 2018;10:p.50–5. doi:10.14740/jocmr3208w.

59. Soh, Deam, Kluger. 10,000 Reasons to Step Out—Exercise Patterns and Pedometer Evaluation of Consultant Anaesthetists. Anaesth Intensive Care 2006;34:p.347–52. doi:10.1177/0310057X0603400315.

60. Solovieva, Lallukka, Virtanen, Viikari-Juntura. Psychosocial factors at work, long work hours, and obesity: a systematic review. Scand J Work Environ Health 2013;39:p.241–58. doi:10.5271/sjweh.3364.

61. Cook, Gazmararian. The association between long work hours and leisure-time physical activity and obesity. Prev Med Rep 2018;10. doi:10.1016/j.pmedr.2018.04.006.

62. Balatoni, Szépné, Kiss, Adamu, Szulc, Csernoch. The Importance of Physical Activity in Preventing Fatigue and Burnout in Healthcare Workers. Healthcare (Switzerland) 2023;11. doi:10.3390/healthcare11131915.

63. Decathlon Geonaute Onwalk 100 n.d. https://www.decathlon.co.za/trackers-pedometers-or-scales/119526-69535-onwalk-100-pedometer-and-accelerometer-black.html (accessed 05/05/2024).

64. Beringer, Wells, Goldstein. Let's get physical: A prospective pedometer study of doctors working in a South African emergency department. South African Medical Journal 2020;110:p.1124–7. doi:10.7196/SAMJ.2020.v110i11.14828.

65. Mampana. Health habits and physical activity level of anaesthetists in an academic department - affiliated to the University of the Witwatersrand. 2019.

66. Lamacraft, Claasen, Coetzee, Du Toit, Kritzinger, Staats, et al. PEER REVIEWED ORIGINAL RESEARCH State medical registrars: an exploratory study. vol. 27. 2021.

67. Clemes, Deans. Presence and Duration of Reactivity to Pedometers in Adults. Med Sci Sports Exerc 2012;44:p.1097–101. doi:10.1249/MSS.0b013e318242a377.

68. Government. What is a non-communicable disease? 2021. https://www.gov.za/faq/health-non-communicable-diseases/what-non-communicable-disease (accessed 07/30/2021).

69. World Medical Association. World Medical Association. Declaration of Helsinki – ethical principles for medical research involving human subjects 2013. https://www.wma.net/policies-post/wma-declaration-of-helsinki-ethical-principles-for-medical-research-involving-human-subjects/ (accessed 07/16/2021).

70. South African Department of Health. South African Good Clinical Practice Guidelines 2006:p.96. http://www.kznhealth.gov.za/research/guideline2.pdf (accessed 07/16/2021).

71. Brink, Van der Walt, Van Rensburg. Fundamentals of research methodology for healthcare professionals. 4th ed. Juta; 2017.

72. Schneider, Crouter, Bassett. Pedometer Measures of Free-Living Physical Activity: Comparison of 13 Models. Med Sci Sports Exerc 2004;36:p.331–5. doi:10.1249/01.MSS.0000113486.60548.E9.

73. Schneider, Crouter, Lukajic, Bassett. Accuracy and Reliability of 10 Pedometers for Measuring Steps over a 400-m Walk. Med Sci Sports Exerc 2003;35:p.1779–84. doi:10.1249/01.MSS.0000089342.96098.C4.

A: Demographic data:

1. **Study Number: _____**
2. **Pedometer Number: _____**
3. **Age:**

25-34	
35-44	
45-54	
55-64	
65+	

4.1 Chronic disease: Y/N

4.2 If yes:

Prefer not to disclose	
Cancer	
Hypertension	
Type II Diabetes Mellitus	
HIV	
Other	

If other, please specify_____

5. **Height (cm): _____**
6. **Weight (kg): _____**
7. **Rank:**

MO	
Registrar (junior)	
Registrar (senior)	
Career MO	
Consultant	

8. **Current hospital rotating at:**

CHBAH	
HJH/RMMCH	
CMJAH	
Other	

If other, please specify_____

9. **Enrolled to writing exams in next 3 months: Y/N**

B: Data pertaining to step counts Study number:_____ Pg. 2 of 3

10. Physical activity assessment

	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
12.1 Date							
12.2 Duty							
07:00-16:00 on duty steps							
16:00-07:00 on duty steps							
07:00-16:00 off duty pre-call steps							
07:00-16:00 off duty post-call steps							
07:00-16:00 off duty other steps							
16:00-07:00 off duty other steps							
12.3 Type of surgery							
General surgery							
Trauma							
Orthopaedic							
Obstetrics							
Gynaecology							
ENT							
Paediatrics							
Other (specify)							
12.4 Number of cases performed							
12.5 Floor senior Y/N							
12.6 Administrative work Y/N							
12.7 CPR performed Y/N							

Activities in off duty period: **study number _____ Pg. 3 of 3**

	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
13.1 Performance of anaesthesia in private during off duty period: Y/N							
13.2 Physical Activity in off duty period: Y/N							
13.2a: If yes, Nature of Activity:							
Walking							
Moderate activity (Such as carrying light loads, bicycling at a regular pace, or doubles tennis)							
Vigorous activity (like heavy lifting, digging, aerobics, or fast bicycling) (specify)							
Other (Please specify)							
13.4 If Yes: Duration of Activity (mins)							
0-15							
16-30							
31-60							
60+							

Appendix 2: Permission request for Dr Motshabi

Dear Professor Motshabi,

My name is Dr Peter Belasyse-Smith. I am one of the registrars in Department of Anaesthesiology. I am planning to do my MMed research, titled "An assessment of the levels of physical activity in an academic anaesthetic department".

Please may I have your permission to approach the members of the department to participate in my study? I would be requesting medical officers, registrars, and consultants to wear a pedometer and complete a questionnaire for a seven-day period.

Participation in the study is voluntary and anonymous. Written informed consent will be obtained from all participants prior to entry into the study. Information will remain confidential and only my supervisor and I will have access to the raw data.

The aim of the study is to assess the current physical activity levels of the anaesthetists in our department. With the results of this study, hopefully I can raise awareness of the importance of physical activity in our department.

Yours faithfully,

Dr Peter Belasyse-Smith

0765991175

drpeterbsmith@gmail.com

Appendix 3: Study information sheet

Study title: "An assessment of the levels of physical activity in an academic anaesthetic department."

Dear Colleague,

My name is Dr Peter Belasyse-Smith, and I am a registrar in the Department of Anaesthesiology at the University of the Witwatersrand. I would like to invite you to participate in my MMED research project which seeks to describe the physical activity of full-time anaesthetists within the Department of Anaesthesiology, University of the Witwatersrand.

This will be accomplished with the use of a blinded pedometer, to be worn on the waistband of the participant for a seven-day period during work duties and outside of work with twice-daily recordings of step counts by the researcher, and a short researcher completed questionnaire detailing levels of daily physical activity during the duration of the study period. The pedometer will be given to the participant by the researcher on Monday morning and returned on Monday morning of the following week. Research will take place in theatres at CHBAH, CMJAH, HJH/RMMCH during your normal working week.

The study has been approved by the Human Research Committee (Medical). Ethics approval number: _____.

If you have any concerns, please contact the research administrator of the committee, Mr Rhulani Mkansi on email: Rhulani.Mkansi@wits.ac.za or telephone: 011 717 1252.

Participation in the study is voluntary and anonymous. There are no personal identifiers included within the questionnaire. All information will remain confidential and only my supervisor and I will have access to the raw data. There is no penalty for not participating in the study.

No incentives will be provided for participating in the study or completing the questionnaire. All questionnaires and pedometers must please be returned to the researcher at the end of the study. If there are any questions prior to or during the study, please feel free to ask.

Kind regards

Dr Peter Belasyse-Smith

Researcher (Tel. 0765991175) Date: October 2021

Appendix 4: Written Consent Form for Participants

PARTICIPANT CONSENT SHEET

An assessment of the levels of physical activity in an academic anaesthetic department.

1. I have been given a Participant Information Sheet which explains the nature and processes involved in this study, which is attached hereto.
2. I was given time to read it, or had it read to me, in the language I best understand.
3. I was given time to ask any questions I wanted to and found any answers given to me to be reasonable and satisfactory.
4. I believe I fully understand why the study is being conducted and what the intended outcomes will be.
5. I understand that there will be no immediate benefit to me, should I agree to participate, nor will I receive any payment; conversely, participation will not cost me anything but my time.
6. I understand that, even if I initially consent to take part in the study, I may subsequently withdraw at any time and would not be required to give any reasons; if that happened, any data collected about me for the purposes of the study would immediately be destroyed, unless I give consent for it to be retained
7. I have been given a range of contact details, listed below. If I require further information or become concerned about any aspect of this study, I am free to speak to any of these contacts.

Contact details:

Dr Peter Belasyse-Smith, Principal Investigator, telephone no. 0765991175, or by e-mail at drpeterbsmith@gmail.com,

Dr Janine Wagner, Supervisor, on telephone no. 0829337194, or by e-mail at drjaninewagner@gmail.com

Professor CB Penny, Chairperson of the Human Research Ethics Committee (Medical) at the University of Witwatersrand, on telephone no. 011 717 2301, or by e-mail at Clement.Penny@wits.ac.za.

Ms. Z Ndlovu or Mr Rhulani Mkansi, Committee Secretariat, telephone nos.: 011 717 2700 or 1234, or by e-mail at: Zanele.Ndlovu@wits.ac.za or Rhulani.Mkansi@wits.ac.za

Name of Participant: _____

Date: _____

Place: _____

Signature or mark _____

Section 5:

Annexure A: Permission from the Head of Department

UNIVERSITY OF THE WITWATERSRAND JOHANNESBURG | FACULTY OF HEALTH SCIENCES | WITS SCHOOL OF CLINICAL MEDICINE

DEPARTMENT OF ANAESTHESIOLOGY
Tel.(011)488 4344

20 April 2022

Postgrad Office

School of Clinical Medicine

Faculty of Health Sciences

University of the Witwatersrand

To Whom It May Concern

Permission To Conduct Research: Dr Peter Belasyse-Smith- Student Number: 375150

This is to confirm that I have read and given permission for **Dr Peter Belasyse-Smith** to conduct research at in the Department of Anaesthesiology towards his/her Mmed project titled *"An assessment of the levels of physical activity in an academic anaesthetic department"*

Thank you.

Assoc. Prof. P Motshabi Chakane

Ass Prof P. Motshabi Chakane
HOD Wits Anaesthesia
HOU Cardiac Anaesthesia
Tel: +27 (0)11 488 4344
Cell: 083 432 1994
Email: palesa.motshabi@wits.ac.za
Website: www.wits.ac.za
Charlotte Maxeke Johannesburg Academic Hospital, 6th Floor, Area 301/16, Jubilee Road, Parktown, Johannesburg

WITS UNIVERSITY | WITS SCHOOL OF CLINICAL MEDICINE | FACULTY OF HEALTH SCIENCES

Annexure B: Postgraduate Assessors Group Approval

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

Private Bag 3 Wits, 2050
Fax: 027117172119
Tel: 02711 7172076

Reference: Mrs Sandra Benn
E-mail: sandra.benn@wits.ac.za

05 October 2021
Person No: 375150
PAG

Dr PB Belasyse-Smith
28 Pekin Avenue
Blairgowrie
2194
South Africa

Dear Dr Peter Belasyse-Smith

Master of Medicine in Anaesthesia: Approval of Title

We have pleasure in advising that your proposal entitled *An assessment of the levels of physical activity in an academic anaesthetic department* has been approved. Please note that any amendments to this title have to be endorsed by the Faculty's higher degrees committee and formally approved.

Yours sincerely

Mrs Sandra Benn
Faculty Registrar
Faculty of Health Sciences

Annexure C: Human Research Ethics Committee clearance certificate

UNIVERSITY OF THE WITWATERSRAND JOHANNESBURG	HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)

Office of the Deputy Vice-Chancellor (Research and Innovation)

TO: Dr P Belasyse-Smith
School of Clinical Medicine
Department of Anaesthesia
Medical School
University

E-mail: drpeterbsmith@gmail.com

CC: Supervisor: Dr J Wagner
<drjaninewagner@gmail.com>
and <HREC-Medical Research Office@wits.ac.za>

FROM: Mr Iain Burns
Human Research Ethics Committee (Medical)
Tel: 011 717 1252

E-mail: Iain.Burns@wits.ac.za

DATE:

REF: R14/49

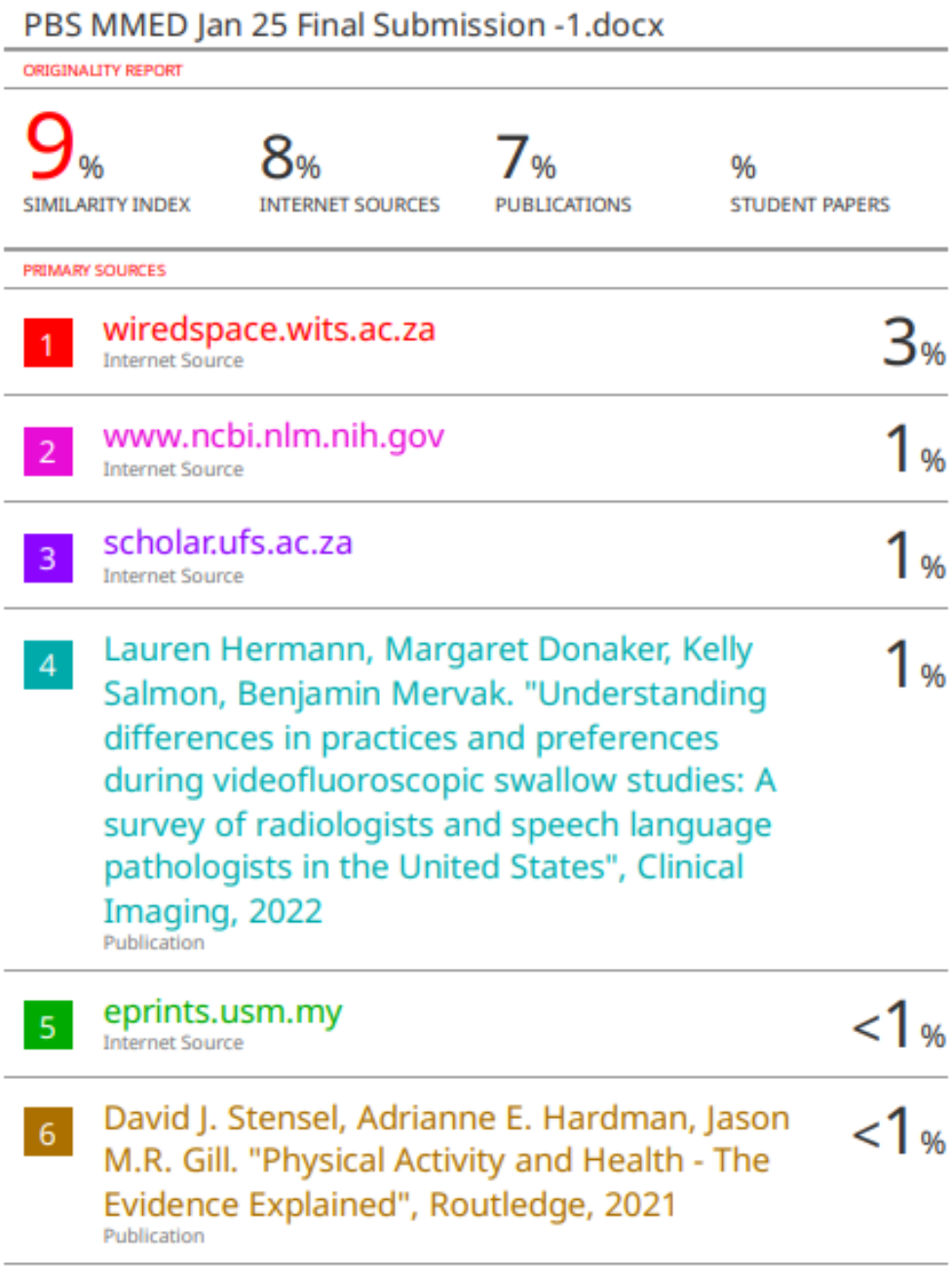
PROTOCOL NO: **M211066** (This is your ethics application reference number. Please quote it in all enquiries, oral or written, relating to this study.)

PROJECT TITLE: *An assessment of the levels of physical activity in an academic anaesthetic department*

Please find attached the Clearance Certificate for the above project. I hope it goes well and that an article in a recognized publication comes out of it. This will reflect well on your professional standing and contribute to Government funding of the University.

MSWorks2000/Iain0007/Clearscan.wps

Annexure D: Turnitin report.



PBS MMED Jan 25 Final Submission -1.docx

ORIGINALITY REPORT

9%	8%	7%	%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	wiredspace.wits.ac.za Internet Source	3%
2	www.ncbi.nlm.nih.gov Internet Source	1%
3	scholar.ufs.ac.za Internet Source	1%
4	Lauren Hermann, Margaret Donaker, Kelly Salmon, Benjamin Mervak. "Understanding differences in practices and preferences during videofluoroscopic swallow studies: A survey of radiologists and speech language pathologists in the United States", Clinical Imaging, 2022 Publication	1%
5	eprints.usm.my Internet Source	<1%
6	David J. Stensel, Adrianne E. Hardman, Jason M.R. Gill. "Physical Activity and Health - The Evidence Explained", Routledge, 2021 Publication	<1%

7	Hardini Ariningrum, Irma Nuryana, Dian Eka Saputri. "Determinant Factors Affecting Compliance MSME Taxpayers (Case Study of Cipadang Village Community)", eCo-Buss, 2024 Publication	<1 %
8	Nicolaas van der Walt, Juan Scribante, Helen Perrie. "Burnout among anaesthetists in South Africa", Southern African Journal of Anaesthesia and Analgesia, 2015 Publication	<1 %
9	4pack.wordpress.com Internet Source	<1 %
10	Renate Strehlau, Leigh Martens, Ashraf Coovadia, Collet Dandara, Jennifer Norman, Julia Maisel, Louise Kuhn, Elaine J. Abrams. "Absence Seizures Associated With Efavirenz Initiation", Pediatric Infectious Disease Journal, 2011 Publication	<1 %
11	strathprints.strath.ac.uk Internet Source	<1 %
12	www.frontiersin.org Internet Source	<1 %
13	www.science.org Internet Source	<1 %
14	www.dovepress.com Internet Source	<1 %
15	apps.who.int Internet Source	<1 %
16	samj.org.za Internet Source	<1 %

Exclude quotes	On	Exclude matches	< 8 words
Exclude bibliography	On		