ORIGINAL ARTICLE

# Pedometer-determined physical activity profile of healthcare professionals in a Nigerian tertiary hospital

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## ABSTRACT

**Background:** Healthcare professionals (HCPs) are perceived as statutory advocates for healthy living and promotion of healthy behaviors such as regular participation in physical activity (PA). This study assessed and compared pedometer-determined PA of different urban HCPs in a Nigerian tertiary hospital. **Materials and Methods:** A cross-sectional study involving 180 HCPs from a tertiary hospital in Lagos, Nigeria. PA was measured by daily walking steps using a pedometer. **Results:** The mean step count obtained was 7,396.94 ± 2,714.63 steps/day. Only 20% of the HCPs met a minimum PA of 10,000 steps/day. About one-third (34.4%) of the HCPs were low active and less than a quarter (23.9%) were somewhat active. Further, less than half (43.9%) of the HCPs were found to have PA levels ≥7,500 steps/day. Overall, nurses had the highest step counts (7,980 steps/day) followed by physiotherapists (7,332 steps/day), while pharmacists had the lowest step counts (6,201 steps/day). There was however no significant difference in the mean step counts of the various cadres of the HCPs ($P > 0.05$). Step counts of HCPs were found to significantly negatively correlate with their age ($r = -0.53$; $P < 0.001$), body mass index ($r = -0.39$; $P < 0.001$), and body fat percentage ($r = -0.42$; $P < 0.001$). **Conclusion:** PA profile of the HCPs was mostly characterized by a low active PA level and less than a quarter met the recommended minimum of 10,000 steps/day.

**Key words:** Noncommunicable diseases, physical activity prescription, physical inactivity

## INTRODUCTION

Regular and appropriate physical activity (PA) is a major component in preventing the growing global burden of chronic and noncommunicable diseases (NCDs).[1] According to WHO, recommended level of sufficient PA for adults aged 18–64 years is at least 150 min of moderate-intensity aerobic PA throughout the week, or at least 75 min of vigorous-intensity aerobic PA throughout the week, or an equivalent combination of moderate- and vigorous-intensity activity.[1] This recommendation is equivalent to the widely referred pedometer-based 10,000 steps of walking per day.[2-4] Health gains from PA include reduced risk of NCDs, premature death, obesity, cardiovascular diseases, noninsulin-dependent diabetes, and osteoporosis; resulting in an enhanced mood, improved quality of life and longevity.[1,5,6]

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Physical inactivity is a seriously growing health problem in the world and has been attributed to increase the risk of NCDs globally, including Nigeria and other African countries.[1] The WHO report states that at least 60% of the global population fails to achieve the minimum recommendation for sufficient PA.[1] Physical inactivity has been identified as the fourth leading risk factor for global mortality (6% of deaths globally) and about 2 million deaths per year are attributable to physical inactivity worldwide, with more than 80% of deaths from chronic diseases occurring in developing countries.[1,5] Rapid progress of civilization almost completely eliminates from everyday work, all forms of PA, and simple physical effort, leaving mainly monotonous activities that unevenly load the individual parts and systems of the human body.[7]



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There are divergent reports on the prevalence of PA or physical inactivity in Africa and Nigeria, and different methodologies have been employed in these various reports. The prevalence of physical inactivity in West Africa is 13% with higher prevalence of physical inactivity among females, advancing age and urban residency.[8] In Northern Nigeria, a study reported that 68% of the sample population met the WHO recommended level for sufficient PA.[7] Whereas, another study carried out among urban civil servants in Southwest Nigeria reported a sufficient PA prevalence of 58% and 55% in men and women, respectively.[9] To the best of our knowledge, pedometer-based PA studies are sparse in Nigeria.

Previous studies have revealed that healthcare professionals (HCPs) are a high-risk group for NCDs, sedentary lifestyle, overweight, obesity, work-related musculoskeletal disorders, and working conditions that lead to physical inactivity.[10,11] HCPs are perceived to be pioneers and statutory advocates of healthy living and promotion of healthy behaviors. They are expected to be PA advocates through leadership in order for their patients or clients and the general public to follow. Therefore, communities expect them lead by example and presume that such behaviors should be prevalent among them. However, this perception remains speculative as literature to ascertain empirically or disprove this are generally lacking. Moreover, countrywide and local studies on PA surveillance in Nigeria remain sparse.[7,9,12,13] The objective of this study was therefore to provide a pedometer-determined PA profile of HCPs–physiotherapists, medical doctors, medical laboratory scientists, nurses, pharmacists, and radiographers and compare their pedometer-measured step counts.

## MATERIALS AND METHODS

This was a cross sectional prospective study of A cross-sectional study of physical activity profile of 192 Health Care Professionals at the National Orthopaedic Hospital, Igbobi, Lagos, Nigeria, using a probability sampling technique14, after an informed consent and ethical approval from the Health Research and Ethics Committee.

An Omron HJ-321 tri-axis pedometer was used to measure PA. This was carried out by measuring the number of steps an individual takes in a continuous manner. The pedometer has tri-axis accelerometer type of sensors which are small microelectromechanical systems. It consists of a cantilever beam with a piezoelectric crystal and deflection circuitry. This enables it to count steps accurately when placed in any direction and sense the force as the person strides.[15] The Omron HJ-321 pedometer also has 7 days memory and automatically resets to zero at 12 midnight.

Each pedometer was calibrated for each participant by imputing the participant's height, weight, stride length, and accurate time of the day before distribution. Participants' height, weight, body mass index (BMI), and body fat percentage (BF%) were measured on the first day, and they were given adequate instructions for using the pedometers. Participants were instructed to wear the pedometer attached to a clip or belt strap around the waist from when they wake up in the morning until bedtime at night for 7 consecutive days. This measurement period was to ensure at least 10 h of wear time per day and at least 1 weekend day.[4] The participants were instructed to remove the pedometer any time they were to perform activities that involved the use of water such as bathing or swimming and when going to bed. Participants were reminded via text messages and phone calls daily to remember to wear their pedometers. Meetings were also arranged with participants on the 3rd and 5th day to view the distance accumulated by the participants that day, to ensure compliance with its use. On the 7th day, the pedometer was collected and the step scores for the last 7 days were recorded. The pedometer readings of the 1st and 7th day were not used for the study since they were not complete days. An average of the remaining 5 days step score was calculated to arrive at the average steps per day for each participant.

PA classification was primarily done based on the minimum number of steps - 10,000 steps/day required for sufficient PA as presently widely referred and recommended in literature.[16-19] Hence, participants with <10,000 steps/day were considered "not meeting the recommendation for sufficient PA" and ≥10,000 steps/day were considered as "meeting recommendation for sufficient PA." Furthermore, the average step counts per day were used to categorize participants into PA levels. Pedometer readings of <5,000 steps/day were considered a sedentary lifestyle, 5,000–7,499 steps/day was considered low active, 7,500–10,000 steps/day was considered somewhat active, 10,000–12,499 steps/day was considered active, and individuals walking >12,500 steps/day was classified as highly active.[2,4]

### Data analysis

All the data were analyzed using SPSS (Statistical Package for Social Sciences) Version 20.0 (SPSS Inc., Chicago, IL, USA). The level of significance was set at $\alpha$-level of $P < 0.05$.

Descriptive statistics of mean and standard deviation, frequency, and percentages was used to summarize

**Table 1: Distribution of healthcare professionals by cadre**

| HCPs | Total sample *n* (%) | Male *n* (%) | Female *n* (%) |
|---|---|---|---|
| Medical doctors | 37 (29.6) | 25 (13.90) | 12 (6.70) |
| Physiotherapists | 27 (15.0) | 13 (7.20) | 14 (7.80) |
| Nurses | 69 (38.3) | 2 (1.1) | 67 (37.2) |
| Pharmacists | 20 (11.1) | 4 (2.2) | 16 (8.9) |
| Radiographers | 13 (7.2) | 5 (2.8) | 8 (4.4) |
| Medical laboratory scientist | 14 (7.8) | 5 (2.8) | 9 (5.0) |

HCPs – Healthcare professionals

parametric data from study outcome variables. Independent *t*-test was used to examine gender differences in step scores while one-way analysis of variance (ANOVA) was used to determine the difference among the step scores of the various professional cadres. Pearson moment correlation coefficient test was used to determine any relationships between HCPs step scores, age, BMI, and BF%.

## RESULTS

Of the 192 HPCs recruited for this study, 12 could not provide valid pedometer readings of at least 5 days. This left 180 valid pedometer readings for data analysis. Distribution of HCPs by professional cadre is shown in Table 1.

The mean age and BMI of the HCPs studied were 36.67 ± 6.52 years (range: 26–55 years) and 24.55 ± 3.83 kg/m$^2$. Table 2 shows the physical characteristics of the various HCPs. There were significant differences in the mean height and weight of the various HCPs ($P$ = 0.04 and $P$ = 0.005, respectively). An ANOVA *post hoc* analysis specifically revealed significant differences in the height and weight of doctors compared to nurses and physiotherapists.

HCPs' mean step count was 7.397 ± 2.715 steps/day. Their step counts ranged from 3,108 to 13,972 steps/day. The mean step counts of the various HCPs are presented in Figure 1. Nurses had the highest step counts (7,980 steps/day) followed by physiotherapists (7,332 steps/day) while pharmacists had the lowest step counts (6,201 steps/day). There was no significant difference in the mean step counts of the various HCPs ($F$ = 1.55; $P$ = 0.18). Male HCPs had higher step counts than females in all professional cadres except among nurses and pharmacists. However, gender differences in step counts were only statistically significant among pharmacists ($P$ = 0.006) [Figure 1].

Overall, only 20% of the HCPs met the recommended minimum of 10,000 steps/day required for optimal PA. Nurses had the highest proportion of professionals meeting this minimum recommendation while radiographers had the lowest proportion of professionals meeting the recommendation [Table 3]. About one-third (34.4%) of the HCPs were found to be low active and less than a quarter (23.9%) somewhat active. In all, 43.9% of the HCPs were found to be at least step counts ≥ 7,500 steps/day; falling within the categories of somewhat active, active, and highly active [Figure 2]. HCPs' step score was found to significantly negatively correlate with their age ($r$ = −0.53; $P$ < 0.001), BMI ($r$ = −0.39; $P$ < 0.001), and BF% ($r$ = −0.42; $P$ < 0.001).

## DISCUSSION

The result of the study showed that the average HCPs took 7,397 steps/day which falls below the minimum 10,000 steps recommended in the present literature and also falls under the low active PA level category as proposed by Tudor-Locke and Bassett.[2] This implies that the HCPs in this study are a "low active" population, with only one out of five (20%) of them, meeting the minimum recommendation of at least 10,000 steps/day for sufficient PA, advised for optimal health. A pedometer-based PA prevalence of 20% recorded in this study is surprisingly low in a population expected to be in the forefront of health and fitness advocacy. The "low active" population represented by the result of this study disagrees with a study conducted among HCPs in Brazil, where a "somewhat active" population was reported.[10]

Direct comparison of results from our study with other studies reporting PA or physical inactivity prevalence for purpose of discussion is not permissible due to differences in study designs and methodologies. Most previous studies assessed PA using questionnaires, which has been known to be prone to over estimation by participants compared to the objective methods of PA assessment such as the use of pedometers and accelerometers.[5,20,21] Using step counts as a measure of PA has a lot of benefits such as its ease of use, easy to remember and provides individuals motivation and concrete goals for increased PA. Although there is presently no direct evidence to support the widely recommended minimum 10,000 steps/day, there is growing evidence daily accumulation of this amount of PA is associated with indicators of good health.[16-19]

An extrapolation of our results to categorical PA levels provides a platform for comparison with some previous studies albeit the methodological differences and limitations. A PA prevalence of 43.9% of the HCPs (≥7,500 steps/day) within the categories of somewhat active, active, and highly active is still slightly lower than those reported among senior civil servants in Lagos, Nigeria, and an urban adult population

**Table 2: Physical characteristics of the healthcare professionals**

| HCPs | $\bar{x}$±SD | | | | | | *F*-test | Significant |
|---|---|---|---|---|---|---|---|---|
| | Medical doctors | Physiotherapist | Nurses | Pharmacists | Radiographers | MLS | | |
| Age (years) | 35.05±3.89 | 36.92±5.01 | 36.10±8.04 | 36.8±5.70 | 35.54±5.88 | 36.36±8.39 | 0.34 | 0.888 |
| Height (cm) | 173.43±7.78 | 167.07±6.61 | 167.86±8.86 | 169.3±11.81 | 168.85±9.86 | 170.36±7.85 | 2.431 | 0.037* |
| Weight (kg) | 77.09±13.45 | 68.15±11.87 | 68.65±10.67 | 68.55±8.04 | 69.48±10.44 | 70.71±7.00 | 3.441 | 0.005* |
| BMI (kg/m$^2$) | 25.21±4.00 | 24.18±3.73 | 24.41±3.77 | 24.23±3.86 | 24.59±4.81 | 24.59±3.22 | 0.314 | 0.904 |
| BF (%) | 28.85±7.96 | 27.4±10.96 | 31.70±6.77 | 31.65±8.04 | 31.17±10.65 | 28.648.74 | 1.503 | 0.191 |

HCPs – Healthcare professionals; MLS – Medical laboratory scientists; BMI – Body mass index; BF – Body fat; SD – Standard deviation; *Significant at $P$ < 0.05

in Maiduguri, Nigeria, where 56.7% and 68%, respectively, were reported to have moderate to high PA levels.[7,9]

There was no significant difference in the step scores among the various HCPs. However, nurses had the highest mean step score of 7,980 steps/day while pharmacist had the lowest step scores (6,201 steps/day). This result agrees with a previous study carried out among doctors and other medical personnel in the United Kingdom, where more nurses met the WHO recommendation for sufficient PA compared to other medical personnel.[22] The increased mean step counts seen in nurses compared to doctors could be because nurses partake in more ambulatory activities when carrying out their procedures as compared to pharmacist and doctors who spend longer hours sitting while at work. Physiotherapists were found to have the second-highest step counts. This result closely aligns with a study carried out among Australian physiotherapists, where a high level of PA was reported among them.[23] This may be associated with the fact that physiotherapists carry out a lot of ambulatory activities while performing their duties at work. Physiotherapists are also expected to be at the forefront of PA promotion.

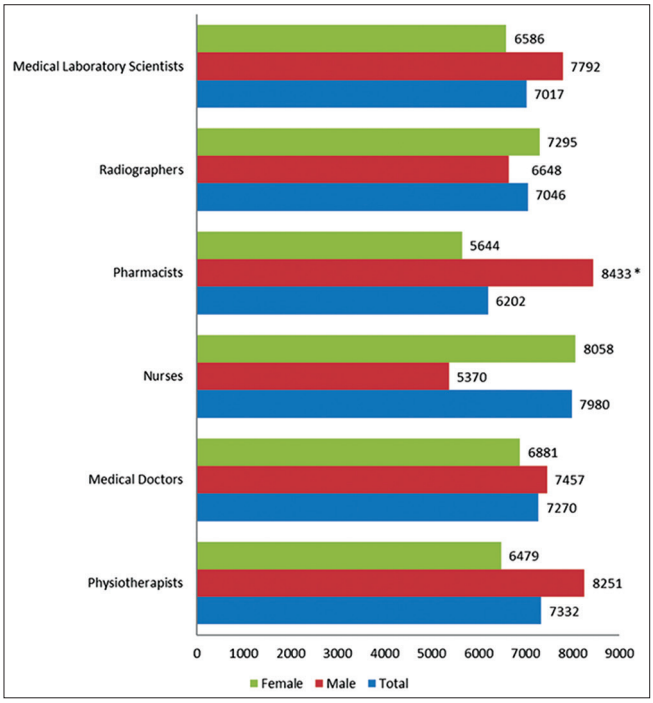


**Figure 1:** The mean step scores of the various healthcare professionals (*$P$ = 0.006)

There was no significant relationship between PA level and gender except among pharmacists. This result does not in consonance with other studies that have reported significantly lower step counts among women compared to men.[24,25] The reason for this disparity could be because Nigerian women are career women and breadwinners, thus they carry out more ambulatory activities in the cause of their duties at work, during household chores and transportation.

Pedometer step counts decreased with increasing age among the HCPs. The finding corroborates previous studies in Nigeria and internationally, where objective or subjective PA decreased with increasing age in both genders.[7,9,24-26]

There was a significant negative correlation between step counts and BMI and step count and BF%. This result agrees with previous studies in which participants that were overweight or obese fell into the low active or sedentary PA levels.[27,28] It is expected that increased weight or BF would ordinarily prevent individuals from walking around sufficiently, leading to a sedentary lifestyle and this, in turn, fuelling the vicious cycle of weight gain and physical inactivity.

A major strength of this study is that it employed an objective method to measure PA among HCPs. Although pedometers are slightly more expensive compared to PA questionnaires, they provide a more effective means of estimating PA among individuals.[3,5] They capture intermittent and continuous activities taking into consideration work, household, and leisure time activities which amount to energy expenditure compared

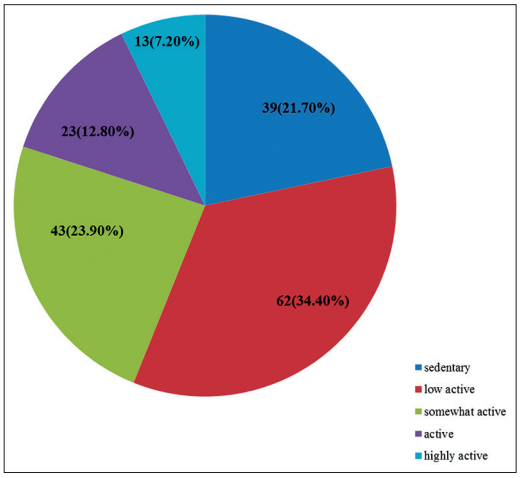


**Figure 2:** The distribution of physical activity level among participants

**Table 3: Distribution of healthcare professionals based on minimum recommended steps per day**

| | Medical doctors | Physiotherapists | Nurses | Pharmacists | Radiographers | MLS | Total |
|---|---|---|---|---|---|---|---|
| Pedometer steps ≥10,000 | 6 (16.2) | 5 (18.5) | 19 (27.5) | 2 (10.0) | 1 (8.3) | 3 (21.4) | 36 (20.0) |
| Pedometer steps ≤10,000 | 31 (83.8) | 22 (81.5) | 50 (72.5) | 18 (90.0) | 12 (92.3) | 11 (78.6) | 144 (80.0) |
| Total | 37 | 27 | 69 | 20 | 13 | 14 | 180 |

MLS – Medical laboratory scientist

to subjective methods of PA assessment. To the best of our knowledge, this study is the first to provide information on a pedometer-determined PA levels among HCPs in Nigeria. Most of the cross-sectional studies in Nigeria to date have measured PA using subjective methods, and none has been conducted among HCPs.[7,9,12,13]

This study however has its limitations. First, this study evaluated a representative sample of HCPs in a single tertiary hospital, hence, cannot be generalized for all HCPs in Nigeria. Factors influencing PA may vary across several hospital environments and different states in the country. Second, pedometers are not programmed to measure some types of PA such as swimming, cycling, and weightlifting.[15] This poses some limitation on the accuracy of the findings from the study. Hence, step counts may have been underestimated. Nevertheless, pedometers can measure walking, running, and most incidental and sporting activities that are seen as a valid measure of ambulatory PA, and these ambulatory PA attributes are the ones mostly exhibited by individuals.

## CONCLUSION

The mean daily step count of HCPs in an urban tertiary hospital in Nigeria was 7,396 which fall under the low active PA category. Less than a quarter of the HCPs met the recommended minimum of 10,000 steps/day suggested for optimal health. This study suggests a need for effective strategies to encourage HCPs to participate in more ambulatory PA at work and off work.

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Nil.

### Conflicts of interest
There are no conflicts of interest.

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