

Occupational sedentary behaviour, physical activity profile and determinants of prolonged sitting among shift workers in the industrial sector of Abidjan: A comparative cross-sectional study

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Abstract

Background: Occupational sedentary behaviour is a major and understudied cardiometabolic risk factor in sub-Saharan Africa, particularly among shift workers in the industrial sector.

Objective: To assess occupational sedentary behaviour and its socio-occupational determinants among shift workers in the Greater Abidjan industrial sector.

Methods: An analytical cross-sectional study was conducted among 480 shift workers from three industrial sectors: food processing (n = 120), construction/maintenance (BTP, n = 90), and services/administration (n = 270). Occupational sitting time was assessed using the OSPAQ, leisure-time physical activity using the short-form IPAQ, sedentary behaviour classification using the ONAPS-PAQ, and determinants were identified by Ridge-penalised logistic regression (L2).

Results: Overall, 71.9% of workers were classified as sitting workers (≥ 6 h/shift). Mean sitting time was 7.22 ± 1.44 h/shift among sitting workers versus 2.09 ± 1.59 h/shift among standing workers ($U = 46,380$; $p < 0.001$; $r = 0.771$). The overall prevalence of occupational sedentary behaviour was 78.1% at the ≥ 4 h/shift threshold, affecting all sitting workers (100%) versus 22.2% of standing workers ($p < 0.001$; $V = 0.846$). Sector-specific prevalence (≥ 6 h/shift) was 94.4% in services, 62.5% in food processing and 50% in construction. No compensatory physical activity was observed (MVPA between sitting and standing workers: $U = 15,750$; $p < 0.001$; $r = 0.254$). Ridge logistic regression identified higher education (aOR = 1.694 [1.410–2.000]), married status (aOR = 5.294 [3.485–8.599]) and the service sector (aOR = 9.724 [5.148–20.663]) as risk factors, and high family burden (aOR = 0.169 [0.125–0.224]), the construction sector (aOR = 0.038 [0.024–0.056]) and shift schedule (aOR = 0.063 [0.032–0.123]) as protective factors.

Conclusions: Occupational sedentary behaviour is highly prevalent in Abidjan's industry, with a double sedentary burden in the service sector. Sector-specific interventions accounting for family structure and work schedules are needed.

Keywords: Occupational Sedentary Behaviour; Shift Work; Physical Activity; Cardiometabolic Risk; Occupational Health; Côte d'Ivoire

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1. Introduction

Sedentary behaviour (SB) — defined as any waking activity characterised by an energy expenditure ≤ 1.5 metabolic equivalents (METs) in a sitting or reclined posture [1] — is now recognised as an independent risk factor for cardiometabolic diseases, type 2 diabetes and all-cause mortality, irrespective of leisure-time physical activity levels [2,3]. Prolonged occupational sitting is specifically associated with a 34% increase in metabolic syndrome risk, a 30% increase in cardiovascular risk and a 13% increase in type 2 diabetes risk [4,5].

Although the epidemiology of sedentary behaviour has been extensively documented in high-income countries [6], data from sub-Saharan Africa remain scarce despite a rapid nutritional and epidemiological transition [7,8]. In Côte d'Ivoire, the rapid growth of the industrial and service sectors has been accompanied by a significant proportion of shift workers [9]. Shift work is independently associated with circadian rhythm disruption, metabolic dysregulation and increased cardiometabolic risk [10,11]. The African occupational context is particularly relevant, where occupational health surveillance is poorly developed and the paradox between high physical demand and prolonged sedentary postures — as observed in manufacturing and construction sectors — has not been systematically studied [12]. The physical activity paradox [13] is potentially highly relevant in this context.

The overall objective of this study was to assess occupational sedentary behaviour and its socio-occupational determinants among shift workers in the Greater Abidjan industrial sector, Côte d'Ivoire. Specific aims were to: (1) characterise and compare occupational sitting time and physical activity profiles of shift workers across three industrial sectors; (2) estimate the prevalence of prolonged sedentary behaviour according to internationally recognised thresholds; and (3) identify socio-occupational determinants of prolonged sitting by multivariate logistic regression.

2. Materials and Methods

2.1. Study design and population

An analytical cross-sectional study was conducted among shift workers from the formal industrial sector of Greater Abidjan, Côte d'Ivoire, from three sectors: (i) food processing; (ii) construction and industrial maintenance (BTP); (iii) services and administration. Inclusion criteria were: salaried employment in a formal industrial enterprise; shift work schedule; ≥ 6 months in the current position; informed consent. Workers on sick leave, maternity leave or in training at the time of the survey were excluded.

2.2. Sampling

The minimum sample size was estimated at $n = 353$ subjects using the Schwarz (2012) formula [$n = Z^2 \times p \times q / i^2$; $Z = 1.96$; $p = 35.7\%$ (proportion of deaths attributable to non-communicable diseases in Côte d'Ivoire, Barry et al., 2025); $i = 5\%$], increased to $n = 393$ after a 10% allowance for non-responses. Participants were recruited using a purposive non-probability quota sampling approach, with quotas defined according to industrial sector and postural work type, with a minimum of 90 subjects per subgroup ensuring statistical power of $1 - \beta \geq 0.80$ ($\alpha = 0.05$). The final sample comprised $N = 480$ workers distributed by sector (food processing $n = 120$; BTP $n = 90$; services $n = 270$) and work type (sitting workers $n = 345$, 71.9%; standing workers $n = 135$, 28.1%), providing an effective precision of $\pm 4.3\%$.

2.3. Variables and measurement tools

Occupational sitting time was assessed using the OSPAQ (Chau et al., 2012 [14]), measuring the proportion of working time spent in five behaviours: sitting, standing, slow walking, fast walking and vigorous effort. Categorical proportions were converted to midpoint values. Workers were classified as 'sitting workers' (≥ 6 h/shift) or 'standing workers' (< 6 h/shift). Three sedentary behaviour thresholds were applied according to **World Health Organization (2020)** [16] and **Charles et al. (2021)** [17]: moderate (≥ 4 h/shift), high (≥ 6 h/shift) and very high (≥ 7.5 h/shift). Occupational energy expenditure was estimated in MET-min/shift using the Ainsworth Compendium (2011) [18]. Leisure-time physical activity was assessed using the short-form IPAQ [15]: inactive (< 600 MET-min/week), active (600–2,999 MET-min/week) or highly active ($\geq 3,000$ MET-min/week). Total daily sedentary behaviour (total SB = occupational SB + non-occupational SB) was categorised according to ONAPS thresholds: low (< 3 h/day), moderate (3–7 h/day), high (> 7 h/day).

2.4. Statistical analyses

Analyses were performed using SPSS version 25. Continuous variables are presented as mean \pm standard deviation (SD) or median [minimum–maximum] according to distribution, verified by the Shapiro-Wilk test. Categorical variables are

presented as absolute frequencies (n) and percentages (%). Comparisons of continuous variables between two groups used the Mann-Whitney U test and across three sectors the Kruskal-Wallis H test, followed by Dunn's post-hoc tests with Bonferroni correction (adjusted threshold $\alpha/k = 0.017$ for $k = 3$ pairs). Proportion comparisons used the Pearson Chi-square test or Fisher's exact test according to theoretical frequencies. Effect size was estimated by $r = Z/\sqrt{N}$ for Mann-Whitney tests and Cramér's V for contingency tables (Cohen, 1988 [19]: $r < 0.10$ negligible; 0.10–0.30 small; 0.30–0.50 moderate; > 0.50 large). Determinants of prolonged sitting were identified by Ridge-penalised logistic regression (L2, C = 1.0) [20], including variables with $p < 0.25$ in univariate analysis according to the Hosmer & Lemeshow criterion [21]. The statistical significance threshold was $\alpha = 0.05$ (two-tailed) for all analyses.

2.5. Ethical considerations

The study complies with the principles of the Declaration of Helsinki (2013 revision). Written informed consent was obtained from each participant. Participation was voluntary and anonymous.

3. Results

3.1. Sample characteristics

The sociodemographic and professional characteristics of the sample are presented in Table 1. The sample comprised 480 shift workers (435 men, 90.6%; 45 women, 9.4%), with no significant difference in distribution by work type ($\chi^2 = 0.67$; $p = 0.414$; ns). Median age was 39 years [24–60] overall (38 years for sitting workers, 45 years for standing workers), with no significant difference ($U = 22,050$; $p = 0.349$; ns; $r = 0.043$). Educational level differed highly significantly between the two groups ($\chi^2 = 64.15$; $p < 0.001$): no standing worker had attained higher education (bachelor's degree or above), compared with 30.4% of sitting workers. Marital status also differed ($\chi^2 = 59.08$; $p < 0.001$): 82.6% of sitting workers were married or in a civil union compared with 55.6% of standing workers. The number of dependants was significantly lower among sitting workers ($U = 17,438$; $p < 0.001$; $r = 0.206$, small effect). The distribution of professional activities presented the most marked contrast ($\chi^2 = 235.75$; $p < 0.001$): office and driving positions were exclusively in a sitting posture, while handling was exclusively performed standing. Regarding work organisation (Table 2), median shift duration was 8 hours overall, with fixed daytime schedules predominating among sitting workers (82.6% vs. 55.6% among standing workers; $\chi^2 = 99.71$; $p < 0.001$). Seniority in shift schedule differed significantly between the two groups ($U = 26,438$; $p = 0.018$; $r = 0.108$, small effect), unlike seniority within the company ($U = 20,812$; $p = 0.054$; ns).

Table 1 Sociodemographic and professional characteristics of shift workers by postural work type (N = 480)

Variables	Total (N=480)	Sitting workers (n=345)	Standing workers (n=135)	Statistic
Sex				
Male	435 (90.6%)	315 (91.3%)	120 (88.9%)	$\chi^2=0.67$; $p=0.414$; ns
Female	45 (9.4%)	30 (8.7%)	15 (11.1%)	
Age				
Median [min–max]	39 [24–60]	38 [24–60]	45 [25–54]	$U=22,050$; $p=0.349$; ns; $r=0.043$
< 30 years	105 (21.9%)	75 (21.7%)	30 (22.2%)	
30–39 years	135 (28.1%)	120 (34.8%)	15 (11.1%)	
40–49 years	135 (28.1%)	60 (17.4%)	75 (55.6%)	
≥ 50 years	105 (21.9%)	90 (26.1%)	15 (11.1%)	
Education level				
None / Primary	45 (9.4%)	30 (8.7%)	15 (11.1%)	$\chi^2=64.15$; $p<0.001$; ***
Lower secondary (BEPC)	90 (18.8%)	45 (13.0%)	45 (33.3%)	
Upper secondary (BAC)	240 (50.0%)	165 (47.8%)	75 (55.6%)	

Higher education (≥ Bachelor's)	105 (21.9%)	105 (30.4%)	0 (0.0%)	
Marital status				
Married / civil union	360 (75.0%)	285 (82.6%)	75 (55.6%)	$\chi^2=59.08; p<0.001; ***$
Single	105 (21.9%)	45 (13.0%)	60 (44.4%)	
Divorced / separated	15 (3.1%)	15 (4.3%)	0 (0.0%)	
Number of dependants				
None	45 (9.4%)	15 (4.3%)	30 (22.2%)	$U=17,438; p<0.001; ***; r=0.206$
1–2 persons	165 (34.4%)	165 (47.8%)	0 (0.0%)	
3–4 persons	180 (37.5%)	120 (34.8%)	60 (44.4%)	
5 or more persons	90 (18.8%)	45 (13.0%)	45 (33.3%)	
Occupation				
Office / administration	165 (34.4%)	165 (47.8%)	0 (0.0%)	$\chi^2=235.75; p<0.001; ***$
Production line operator	120 (25.0%)	75 (21.7%)	45 (33.3%)	
Driver / chauffeur	60 (12.5%)	60 (17.4%)	0 (0.0%)	
Technician / maintenance	60 (12.5%)	15 (4.3%)	45 (33.3%)	
Security / surveillance	45 (9.4%)	30 (8.7%)	15 (11.1%)	
Handling / logistics or other	30 (6.2%)	0 (0.0%)	30 (22.2%)	

Notes: χ^2 = Pearson Chi-square test; U = Two-tailed Mann-Whitney U test. Effect size $r = Z/\sqrt{N}$ (Cohen, 1988). Significance level $\alpha = 0.05$. *** $p<0.001$; ns = not significant.

Table 2 Work organisation, shift time distribution and meal break duration by work type (N = 480)

Variables	Total (N=480)	Sitting workers (n=345)	Standing workers (n=135)	Statistic
Usual shift duration (hours)				
Median (min–max)	8 (6–24)	8 (6–24)	8 (6–8)	
6 hours	30 (6.2%)	15 (4.3%)	15 (11.1%)	$\chi^2=96.62; p<0.001; ***$
7 hours	30 (6.2%)	0 (0.0%)	30 (22.2%)	
8 hours	405 (84.4%)	315 (91.3%)	90 (66.7%)	
24-hour duty	15 (3.1%)	15 (4.3%)	0 (0.0%)	
Work schedule type				
Fixed daytime schedule	360 (75.0%)	285 (82.6%)	75 (55.6%)	$\chi^2=99.71; p<0.001; ***$
Shift schedules (combined)	120 (25.0%)	60 (17.4%)	60 (44.4%)	
Morning shift (5am–1pm)	45 (9.4%)	15 (4.3%)	30 (22.2%)	
Evening shift (1pm–9pm)	15 (3.1%)	0 (0.0%)	15 (11.1%)	
Night shift (9pm–5am)	30 (6.2%)	30 (8.7%)	0 (0.0%)	
Rotating (morning+evening) 2×8	30 (6.2%)	15 (4.3%)	15 (11.1%)	
Seniority in shift schedule				

Not applicable	120 (25.0%)	75 (21.7%)	45 (33.3%)	<i>U=26,438; p=0.018; *; r=0.108</i>
1–3 years	75 (15.6%)	60 (17.4%)	15 (11.1%)	
4–6 years	90 (18.8%)	60 (17.4%)	30 (22.2%)	
7–10 years	120 (25.0%)	90 (26.1%)	30 (22.2%)	
More than 10 years	75 (15.6%)	60 (17.4%)	15 (11.1%)	
Seniority within company				
1–3 years	150 (31.2%)	120 (34.8%)	30 (22.2%)	<i>U=20,812; p=0.054; ns; r=0.088</i>
4–10 years	180 (37.5%)	120 (34.8%)	60 (44.4%)	
More than 10 years	150 (31.2%)	105 (30.4%)	45 (33.3%)	

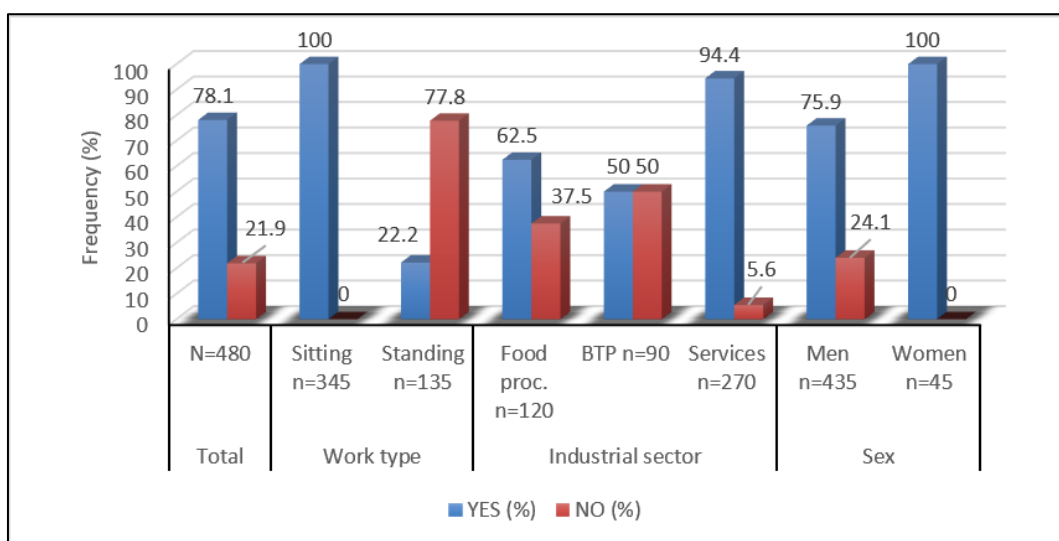
Notes: χ^2 = Pearson Chi-square test; U = Two-tailed Mann-Whitney U test. Effect size $r = Z/\sqrt{N}$ (Cohen, 1988). Significance level $\alpha = 0.05$. *** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$; ns = not significant.

3.2. Postural profile and occupational sitting time

Overall, 71.9% of workers (n = 345/480) were classified as sitting workers (≥ 6 h/shift) and 28.1% (n = 135/480) as standing workers (Table 1). Mean sitting time was 5.78 ± 2.76 h/shift overall, 7.22 ± 1.44 h/shift for sitting workers and 2.09 ± 1.59 h/shift for standing workers ($U = 46,380$; $p < 0.001$; $r = 0.771$). Sitting time differed significantly across industrial sectors ($H = 9.495$; $p = 0.009$): BTP (3.07 ± 2.88 h/shift) < food processing (4.97 ± 2.24 h/shift) < services (7.03 ± 2.20 h/shift; $p_{\text{Bonf}} \text{ BTP-services} = 0.017$) (Table 3).

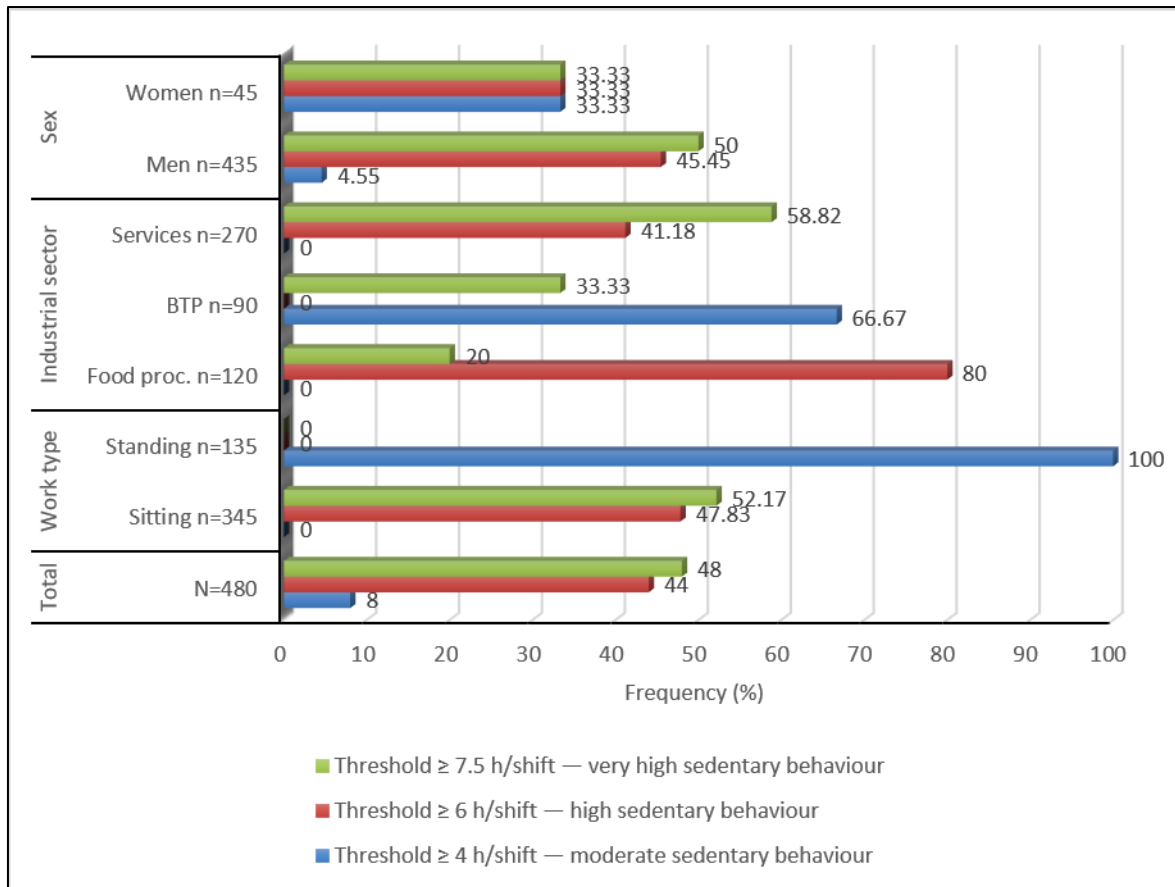
3.3. Prevalence of occupational sedentary behaviour

Figure 1 illustrates the prevalence of occupational sedentary behaviour by work type, industrial sector and sex. The overall prevalence was 78.1% at the ≥ 4 h/shift threshold. It affected all sitting workers (100%), compared with 22.2% of standing workers, a highly significant difference with a large effect size ($p < 0.001$; $V = 0.846$). Sector-specific prevalence (≥ 6 h/shift) was 94.4% in services, 62.5% in food processing and 50% in construction ($\chi^2 = 100.88$; $p < 0.001$; $V = 0.458$; food processing vs. BTP difference non-significant after Bonferroni correction: $p = 0.284$). By sex, a universal prevalence was observed among women (100%), significantly higher than among men (75.9%; $p < 0.001$; $V = 0.170$). At the ≥ 4 h/shift threshold, 78.1% (n = 375/480) met the moderate sedentary behaviour criterion. At the very high threshold (≥ 7.5 h/shift), 37.5% (n = 180/480) of workers were exposed to maximum cardiometabolic risk, mainly in the service sector (58.8%) and among sitting workers (52.2%) (Figure 2).



Notes: Work type — Sitting (100%) vs. Standing (22.2%); Fisher's exact test, $p < 0.001$; $V = 0.846$ (large effect). Industrial sector — Food (62.5%) vs. BTP (50%) vs. Services (94.4%); $\chi^2 = 100.88$; $p < 0.001$; $V = 0.458$ (Food vs. BTP non-significant after Bonferroni correction: $p = 0.284$). Sex — Men (75.9%) vs. Women (100%); $p < 0.001$; $V = 0.170$ (small effect). YES = sedentary; NO = non-sedentary.

Figure 1 Prevalence of occupational sedentary behaviour (≥ 4 h/shift) by work type, industrial sector and sex (N = 480)



Sedentary behaviour thresholds: ≥ 4 h/shift = moderate sedentary behaviour; ≥ 6 h/shift = high sedentary behaviour; ≥ 7.5 h/shift = very high sedentary behaviour.

Figure 2 Classification of occupational sedentary behaviour level by category (N = 480)

3.4. Occupational energy expenditure

Mean total occupational energy expenditure was 1,045 ± 595 MET-min/shift overall (Table 3). Standing workers (1,326 ± 1,048 MET-min/shift) expended significantly more energy than sitting workers (935 ± 147 MET-min/shift; U = 26,775; p = 0.009; r = 0.120). The construction sector had the highest expenditure, followed by food processing then services (H = 44.30; p < 0.001; post-hoc comparisons: food processing vs. BTP p < 0.001, food processing vs. services p < 0.001, BTP vs. services p = 0.020), with a markedly higher vigorous effort component in construction (821 ± 985 MET-min/shift vs. 159 ± 77 in sitting workers). Men and women showed similar occupational energy expenditure (U = 8,775; p = 0.239; ns).

Table 3 Occupational sitting time and energy expenditure by postural behaviour, industrial sector and sex

Variables (units)	Total N=480	Sitting n=345	Standing n=135	Food n=120	BTP n=90	Services n=270	Men n=435	Women n=45
Sitting time — median (min/day)	302	317	24	302	103	370	302	182
Sitting time — mean ± SD (h/shift)	4.67±2.32	5.92±1.15 ^a	1.48±1.24 ^b	4.12±1.95 ^c	2.39±2.41 ^b	5.68±1.75 ^a	4.77±2.39	3.71±0.95
MET-min/shift sitting (1.5 MET)	420±209	533±103 ^a	133±111 ^d	370±175 ^c	215±217 ^b	511±158 ^a	429±215	334±86

MET-min/shift standing (2.0 MET)	117±165	72±72 ^b	231±256 ^a	162±263 ^a	154±150 ^a	84±89 ^a	102±159	259±151
MET-min/shift slow walking (2.5 MET)	119±195	77±81	229±320	58±3 ^b	318±361 ^a	80±91 ^b	125±204	60±0
MET-min/shift fast walking (4.0 MET)	109±61	95±5	146±107	93±5 ^b	179±118 ^a	93±8 ^b	111±64	96±0
MET-min/shift vigorous effort (6.0 MET)	279±502	159±77	587±868	140±8 ^b	821±985 ^a	161±88 ^b	280±525	269±178
TOTAL MET-min/shift	1,045±595	935±147 ^b	1,326±1,048 ^a	823±201 ^c	1,686±1,107 ^a	930±184 ^b	1,048±621	1,018±219
		U = 26,775; p = 0.009; r = 0.120 **		H = 44.30; p < 0.001 *** (Dunn: Food vs. BTP p<0.001; Food vs. Services p<0.001; BTP vs. Services p=0.020)			U = 8,775; p = 0.239; ns	

^{a, b, c, d}: Different superscripts indicate significant differences after Dunn-Bonferroni post-hoc comparisons (p_Bonf < 0.017). Women (n=45) not shown separately (results similar to total).

3.5. Leisure-time physical activity and total sedentary behaviour

Leisure-time physical activity was globally low (840 ± 540 MET-min/week; Table 4). According to ONAPS-PAQ classification, 37.5% of workers (n = 180/480) were inactive (< 600 MET-min/week) and 62.5% (n = 300/480) active (600–2,999 MET-min/week); none reached the highly active category (≥ 3,000 MET-min/week). MVPA differed significantly between sitting and standing workers (U = 15,750; p < 0.001; r = 0.254), with standing workers showing a higher median (105 [40–260] min/week vs. 75 [0–480] min/week). However, 87.0% of sitting workers remained inactive by the MVPA < 150 min/week threshold versus 55.6% of standing workers (χ² = 55.983; p < 0.001), indicating insufficient physical compensation in both groups. MVPA differed significantly across sectors (H = 32.15; p < 0.001), with BTP having the lowest median (70 [0–150] min/week). Total physical activity differed by sex (U = 11,700; p = 0.031; r = 0.099).

Total sedentary behaviour was significantly higher in sitting workers (median 10.5 h/day [4.4–12.6]) than in standing workers (4.4 h/day [3.1–9.0]; U = 40,388; p < 0.001; r = 0.643). Total SB did not differ significantly by sex (U = 9,900; p = 0.597; ns). According to ONAPS thresholds, 73.9% of sitting workers had high sedentary behaviour (SB > 7 h/day) versus 11.1% of standing workers (χ² = 172.23; p < 0.001). For the total sample, 56.2% (n = 270/480) had high total SB and 40.6% (n = 195/480) moderate SB, and none had low sedentary behaviour (Table 6). The inter-sector difference for high sedentary behaviour was highly significant (χ² = 78.93; p < 0.001).

Table 4 Leisure-time physical activity by work type, industrial sector and sex

Variables (units)	Total N=480	Sitting n=345	Standing n=135	Food n=120	BTP n=90	Services n=270	Men n=435	Women n=45
Vigorous PA (VPA) — days/week	0.7±1.0	0.5±0.7	1.2±1.3	1.1±0.8 ^a	0.3±0.7 ^c	0.7±1.1 ^b	0.8±1.0	0.0±0.0
VPA — MET-min/week (8 MET)	198±274	136±188	356±377	370±292 ^a	80±180 ^c	160±257 ^b	218±280	0.0±0.0

Moderate PA (MPA) — MET-min/week (4 MET)	333±322	327±373	349±119	295±124	250±140	378±409	332±338	340±76
Walking — MET-min/week (3.3 MET)	309±341	336±390	242±139	272±193 ^a	162±77 ^b	375±420 ^a	308±356	324±124
Total PA outside work (MET-min/week)	840±540	798±528	946±559	937±432 ^a	492±326 ^b	912±594 ^a	858±564	664±57
		$U=21,038; p=0.099; ns; r=0.075$			$H=68.32; p<0.001; ***$		$U=11,700; p=0.031; *; r=0.099$	
MVPA — mean ± SD (min/week)	108±87	99±91	132±70	120±53 ^a	72±48 ^c	114±105 ^b	110±91	85±19 ^a
MVPA — median [min-max]	90 [0-480]	75 [0-480]	105 [40-260]	110 [50-210] ^a	70 [0-150] ^c	83 [0-480] ^b	90 [0-480]	90 [60-105] ^a
		$U=15,750; p<0.001; ***, r=0.254$			$H=32.15; p<0.001; ***$		$U=10,688; p=0.306; ns; r=0.047$	

^{a, b, c}: Significant difference after Dunn-Bonferroni post-hoc comparisons. PA = Physical Activity; MVPA = Moderate-to-Vigorous Physical Activity.

Table 5 Classification of total physical activity level (PA and MVPA) by work type and industrial sector

Variables	Total N=480	Sitting n=345	Standing n=135	Food n=120	BTP n=90	Services n=270	Men n=435	Women n=45
<i>Total PA classification (MET-min/week)</i>								
Inactive — PA < 600	180 (37.5%)	120 (34.8%)	60 (44.4%)	0 (0.0%)	60 (66.7%)	120 (44.4%)	165(37.9%)	15(33.3%)
Active — PA 600–2,999	300 (62.5%)	225 (65.2%)	75 (55.6%)	120 (100%)	30 (33.3%)	150 (55.6%)	270(62.1%)	30(66.7%)
Highly active — ≥ 3,000	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
		$\chi^2=3.865; p=0.049; *$		$\chi^2=99.56; p<0.001; ***$			$\chi^2=0.368; p=0.544; ns$	
<i>MVPA classification (min/week)</i>								
Inactive MVPA — < 150 min/week	375 (78.1%)	300 (87.0%)	75 (55.6%)	75 (62.5%)	75 (83.3%)	225 (83.3%)	330(75.9%)	45(100%)
Active MVPA — ≥ 150 min/week	105 (21.9%)	45 (13.0%)	60 (44.4%)	45 (37.5%)	15 (16.7%)	45 (16.7%)	105(24.1%)	0(0.0%)
		$\chi^2=55.983; p<0.001; ***$		$\chi^2=22.857; p<0.001; ***$			<i>Fisher; p<0.001; ***</i>	

Table 6 Total sedentary behaviour (SB) and global sedentary level by work type, industrial sector and sex

Variables (units)	Total N=480	Sitting n=345	Standing n=135	Food n=120	BTP n=90	Services n=270	Men n=435	Women n=45
<i>Sedentary behaviour by component</i>								
Occupational SB (min/day)	280±139	355±69	89±74	247±117	143±144	341±105	286±144	222±57
Non-occupational SB (min/day)	209±119	207±125	216±105	152±117	250±41	222±129	205±119	248±120
Total SB — mean ± SD (h/day)	8.1±3.0	9.3±2.5	5.1±1.4	6.6±2.9	6.6±2.4	9.3±2.7	8.1±3.0	7.8±2.7
Total SB — median [min-max] (h/day)	8.0 [3.1-12.6]	10.5 [4.4-12.6] ^a	4.4 [3.1-8.0] ^b	5.8 [3.1-11.0] ^c	5.7 [4.4-11.0] ^c	11.0 [4.4-12.6] ^a	8.0 [3.1-12.6]	8.0 [4.4-11.0]
		<i>U=40,388; p<0.001; ***; r=0.643</i>		<i>H=107.59; p<0.001; *** (Dunn: Food vs BTP ns / Food vs Services *** / BTP vs Services ***)</i>		<i>U=9,900; p=0.597; ns; r=0.025</i>		
<i>Global sedentary behaviour classification</i>								
Low SB — SB < 3 h/day	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Moderate SB — SB 3-7 h/day	195 (40.6%)	75 (21.7%)	120 (88.9%)	75 (62.5%)	60 (66.7%)	60 (22.2%)	180(41.4%)	15(33.3%)
High SB — SB > 7 h/day	270 (56.2%)	255 (73.9%)	15 (11.1%)	45 (37.5%)	30 (33.3%)	195 (72.2%)	240(55.2%)	30(66.7%)
		<i>χ²=172.23; p<0.001; ***</i>		<i>χ²=78.93; p<0.001; ***</i>			<i>χ²=1.51; p=0.219; ns</i>	

SB = Sedentary Behaviour. ^{a,b,c}: Different superscripts indicate significant differences after Dunn-Bonferroni post-hoc tests.

3.6. Determinants of prolonged sitting

Among the eleven candidate variables introduced in univariate analysis, six met the $p < 0.25$ threshold for inclusion in the multivariate model (Table 7): high family burden (≥ 3 dependants; OR = 0.405 [0.304–0.532]; $p < 0.001$), belonging to the BTP sector (OR = 0.036 [0.018–0.064]; $p < 0.001$), belonging to the service sector (OR = 22.666 [13.511–45.426]; $p < 0.001$), higher education level (OR = 4,563 [1,391–85,677]; $p < 0.001$), married status (OR = 3.800 [2.492–5.939]; $p < 0.001$) and shift schedule (OR = 0.300 [0.182–0.488]; $p < 0.001$). Male sex ($p = 0.443$), age ($p = 0.101$) and company seniority ($p = 0.041$, but not retained in the multivariate model) did not meet the inclusion threshold or were not retained.

Due to the quasi-perfect separation of data induced by the industrial sector variable, Ridge-penalised logistic regression (L2, C = 1.0) was applied [20]. Six variables were independently associated with prolonged sitting in the multivariate model (Table 8). Independent risk factors were: higher education (aOR = 1.694 [1.410–2.000]; $p < 0.001$), married status (aOR = 5.294 [3.485–8.599]; $p < 0.001$) and belonging to the service sector (aOR = 9.724 [5.148–20.663]; $p < 0.001$). Protective factors were: high family burden (aOR = 0.169 [0.125–0.224]; $p < 0.001$), belonging to the BTP sector (aOR = 0.038 [0.024–0.056]; $p < 0.001$) and shift schedule (aOR = 0.063 [0.032–0.123]; $p < 0.001$). Model performance was excellent: AUC = 0.976; overall accuracy = 96.9%; sensitivity = 100.0%; specificity = 88.9%.

Table 7 Factors associated with high occupational sedentary behaviour: univariate and multivariate analyses

Variable (reference category)	Crude OR	95% CI	p	aOR	95% CI	p	Sig.
<i>A. Sociodemographic factors (controlled confounders)</i>							
Male sex (ref. = Female)	1.311	[0.620–2.435]	0.443 ns	—	—	—	ns
Age (per additional year)	0.984	[0.964–1.003]	0.101 ns	—	—	—	ns
Higher education (ref. = non-higher)	4,563	[1,391–85,677]	<0.001 ***	1.694	[1.410–2.000]	<0.001	***
Married / civil union (ref. = single)	3.800	[2.492–5.939]	<0.001 ***	5.294	[3.485–8.599]	<0.001	***
Dependants (per additional unit)	0.405	[0.304–0.532]	<0.001 ***	0.169	[0.125–0.224]	<0.001	***
<i>B. Occupational factors (main explanatory factors)</i>							
BTP/maintenance sector (ref. = Food processing)	0.036	[0.018–0.064]	<0.001 ***	0.038	[0.024–0.056]	<0.001	***
Service/administration sector (ref. = Food processing)	22.666	[13.511–45.426]	<0.001 ***	9.724	[5.148–20.663]	<0.001	***
Shift schedule (ref. = fixed daytime)	0.300	[0.182–0.488]	<0.001 ***	0.063	[0.032–0.123]	<0.001	***
Company seniority (ordinal 1–3)	0.780	[0.610–0.991]	0.041 *	—	—	—	ns

AUC = 0.976; overall accuracy = 96.9%; sensitivity = 100.0%; specificity = 88.9%. Ridge-penalised logistic regression (L2, C=1.0). *** p<0.001; ** p<0.01; * p<0.05; ns = not significant. — = variable not retained in the multivariate model. OR = Odds Ratio; aOR = adjusted Odds Ratio; CI = Confidence Interval.

4. Discussion

This study provides the first systematic characterisation of occupational sedentary behaviour among shift workers in the Abidjan industrial sector, using validated tools (OSPAQ, IPAQ). Its main contributions are: (i) a very high prevalence of prolonged occupational sitting (71.9% at the ≥ 6 h/shift threshold), with a marked inter-sector gradient; (ii) the identification of a double sedentary burden in the service sector; and (iii) the identification of six independent determinants, including three risk factors (higher education, married status, service sector) and three protective factors (high family burden, construction sector, shift schedule).

The overall prevalence of prolonged sitting (71.9% at ≥ 6 h/shift) exceeds comparable African estimates: Aryeetey et al. (2022) [22] reported 52.3% among urban Ghanaian office workers, and Diouf et al. (2021) [23] observed a mean occupational sitting time of 5.8 h/day in an urban Senegalese sample. In comparison, European shift workers in administrative sectors show similar levels (70–80% of working time sitting; Hallman et al., 2015 [24]). The inter-sector gradient — services (94.4%) > food processing (62.5%) > construction (50%) — is consistent with the structural requirements of each professional sector. The very high prevalence in services warrants particular attention, as these workers accumulate both occupational sedentary behaviour and high sedentary time during leisure, creating a 'double sedentary burden' that substantially increases cardiometabolic risk [25].

In contrast to our initial hypotheses, MVPA differed significantly between the two postural groups ($U = 15,750$; $p < 0.001$; $r = 0.254$), with standing workers showing higher activity levels. However, 87.0% of sitting workers remained inactive according to WHO recommendations (MVPA < 150 min/week), indicating insufficient physical compensation in this group. This result is consistent with Biswas et al. (2015) [3], who demonstrated that prolonged sedentary behaviour constitutes an independent risk factor, not neutralised by leisure-time physical activity. The physical activity paradox [13] is illustrated by the construction sector, which has the highest occupational energy expenditure but the lowest leisure-time physical activity (median APTot: 492 MET-min/week), suggesting a professional fatigue effect.

The multivariate analysis reveals a more complex picture than previously suggested. The service sector is the most powerful risk factor (aOR = 9.724 [5.148–20.663]), consistent with the international literature [28]. Married status (aOR = 5.294) and higher education (aOR = 1.694) emerge as independent risk factors, reflecting the over-representation of more educated and married workers in sedentary administrative positions in the service sector. Conversely, high family burden (aOR = 0.169) constitutes a protective factor, consistent with data from low-income countries where domestic responsibilities represent a source of incidental physical activity [27]. Shift schedule (aOR = 0.063) is also protective, reflecting the greater physical mobility associated with rotating shifts. These results reinforce the need for sector-specific, family-sensitive and schedule-aware occupational health strategies.

5. Conclusion

This study documents a high prevalence of occupational sedentary behaviour among shift workers in Abidjan's industry, with the service/administrative sector bearing the heaviest burden (94.4%) alongside a dual accumulation of occupational and leisure sedentary behaviour. Six independent determinants were identified, with industrial sector and family burden being the most influential. These findings advocate for evidence-based sedentary behaviour reduction programmes, differentiated by sector, integrating height-adjustable workstations, structured movement breaks and systematic assessment of sedentary behaviour in occupational health evaluations.

Compliance with ethical standards

Disclosure of conflict of interest

The authors declare no conflicts of interest.

Limitations

Measurements relied on self-report (OSPAQ, IPAQ, ONAPS), which may introduce recall and social desirability biases. The cross-sectional design does not allow causal relationships to be established. The disproportionate male representation (90.6%) limits generalisability to the female industrial workforce. Finally, the use of Ridge regression on prorated data requires confirmation through individually collected large-scale data.

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Author contributions

KFN: data collection, formal analysis, original draft writing and revision. AHY: conceptualisation, analysis verification and revision. GAC: analysis, reading and revision. ALAA: conceptualisation, supervision and validation. All authors approved the final version of the manuscript.

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