ORIGINAL PAPER PSYCHOLOGICAL ISSUE

International Journal of Occupational Medicine and Environmental Health 2023;36(4):526–540
https://doi.org/10.13075/ijomeh.1896.02105

PERCEPTION OF THE ACTIVITY-BASED WORKING CONCEPT BY BANK'S EMPLOYEES AS A WORKING CONDITION

MAGDALENA JUSTYNA JASIŃSKA-SŁOWIK, BARTŁOMIEJ TARKOWSKI, and ANNA ZALEWSKA-JANOWSKA

Medical University of Lodz, Łódź, Poland

Psychodermatology Department, Chair of Pulmonology, Rheumatology and Clinical Immunology

Abstract

Objectives: The aim of the research was to explore the potential of the concept of work in the activity-based working (ABW) environment, including its impact on stress, back pain and psychomedical parameters of employees subjected to and not subject to relocation. **Material and Methods:** The data of 396 employees of both sexes were analyzed. The study used standardized psychological questionnaires to measure the level of perceived stress (*Perceived Stress Scale*), the level of readiness for change (*Readiness for Change Questionnaire*), the severity of health behaviors (*Health Behavior Inventory*) and the level of general self-efficacy (*General Self-Efficacy Scale*). The set included questionnaires measuring the level of knowledge of occupational health and safety rules and the frequency of back pain. **Results:** In the group of people whose workplace was moved to another building (in accordance with the concept), the relationship between the level of stress and selected variables: age, sense of generalized self-efficacy was checked. A significant negative correlation between the level of stress and age was confirmed ($\rho = -0.16$, $p = 0.023$), meaning a decrease in the level of stress with age. The level of stress correlated positively with the sense of efficacy ($\rho = 0.21$, $p = 0.003$), which means, the higher the sense of effectiveness, the higher the level of stress. In addition, it was confirmed that the level of stress in the group of people changing their location differed significantly from the general population. **Conclusions:** Work in the ABW concept can contribute to the improvement of interpersonal communication and facilitate the social integration of employees and better evaluation of work in this model. Work in concept has not been shown to be a protective factor against back pain in people with obesity. It was confirmed that in people relocated from traditional office to office in the concept, relocation was associated with stress, but also with a greater sense of self-efficacy. Int J Occup Med Environ Health. 2023;36(4):526–40

Key words:
stress, activity based working, change work environment, bank employees, ergonomics, new working concept

INTRODUCTION

Over the past few decades, technological development, work with numerous screens, and ongoing organizational changes in many corporations have triggered new requirements concerning the work environment [1]. In response to these, the concept of activity-based working (ABW) was established. This model involves adjusting the office to various activities performed by employees throughout the day. As a concept and architectural style, ABW is aimed at fostering productivity through flexibility in choosing the workspace. Employees are expected to transit between workstations depending on the task they are performing and their individual preferences. Office facilities usually include, *inter alia*, soundproofed telephone booths to enable maximum concentration while performing a task, or smaller and larger meeting rooms for various forms of collaboration which require making numerous telephone conference calls [2,3]. Notably, it is employees who share their desks and space, depending on the complexity of the tasks performed. The overarch-

Received: November 24, 2022. Accepted: August 3, 2023.
Corresponding author: Magdalena Justyna Jasińska-Słowik, Medical University of Lodz, Psychodermatology Department, Chair of Pulmonology, Rheumatology and Clinical Immunology, Pomorska 251 (building C-5), 92-213 Łódź, Poland (e-mail: jasinska.slowik@gmail.com).

ing objective of ABW is to explore the nature of work (both current and planned) and to identify its most essential elements. This model does not deprive employees of their desks but allows them to use their working time in the most efficient manner and to tap their full potential. In line with the ABW concept, offices are primarily intended to support collaboration as well as creative and valuable interactions [1–3].

Research has shown that working conditions – especially physical ones, regulated by the specific arrangement of desks – have a significant impact on employees' performance and job satisfaction [1,2]. Seeking to further improve the aforementioned parameters, the office concept is always linked to modern interior design and attention is paid to maintaining a high level of its aesthetic qualities [4,5]. In fact, ABW is also a working style and philosophy which assumes that it is employees who decide how, when and where they want to perform their duties. In consequence, when starting to function in spaces designed in line with the ABW concept, employees face a major change in their working pattern [6].

Sedentary work with a screen for >4 h/day falls within the category of light work with some burdensome elements, in accordance with Polish labour law [7]. Regardless of the nature of work performed, the position assumed by employees is mainly sedentary. Prolonged sitting leads to the development of numerous disorders caused by the forced and abnormal position of the body. Other risk factors triggered by such working conditions include the lack of movement, visual strain, stress and inappropriate dietary habits. Pain has been most commonly reported in the musculoskeletal system [8,9]. In their study, Norman et al. [10] analysed 1183 individuals, approx. 75% of whom declared experiencing some musculoskeletal pain, particularly in the neck and shoulder regions. Ricco et al. [11], on the other hand, indicated a significant relationship between the frequency of musculoskeletal disorders and the time spent in the sitting position. In the study involving 1032 people, about 53% of employees reported pain, and this percentage increased with workers' age [12]. Sedentary work also has a negative impact on the cardiovascular system, contributing to obesity and the occurrence of other civilisation diseases (e.g., cardiovascular diseases) [13]. Research has also shown a strong relationship between time spent in the sitting position and a low level of physical activity among office employees, which translates into a higher likelihood of obesity in this occupational group [14].

The objective of the study was to assess psycho-medical parameters in corporate employees, in relation to their work environment – a traditional office vs. an office space designed in line with the ABW concept. The study was designed in such a way as to capture the moment of resignation from 1 of the buildings that do not offer work in the ABW concept. An important factor here is the moment of changing the place of work without ABW to space in this concept. Comparisons were also made with respect to such factors as length of service, susceptibility to diseases related to sedentary work (back pain), as well as employee job satisfaction and motivation. In addition, the impact of working in line with the ABW concept on job quality and employee satisfaction was assessed. The following hypotheses were formulated in the course of the study:

- Familiarity with occupational health and safety (OHS) and ergonomic principles, coupled with working in line with the ABW concept, contribute to reducing the frequency of back pain in obese employees.
- Office relocation was associated with increased stress in relocated employees, while high scores in the *Readiness for Change Questionnaire* (RCQ) and on the *Perceived Stress Scale* (PSS) proved to act as protective factors.
- Good familiarity with OHS principles and a healthy lifestyle contribute to a better assessment of work based on the ABW concept.

It is worth mentioning that the company in which the study was carried out introduced the concept of ABW as applicable in 2016, despite the fact that the office space was not formally adapted. Therefore, the authors examined the compliance with the concept, and not the actual reflection, hence the study should be seen as exploratory.

MATERIAL AND METHODS

The study was conducted as a questionnaire-based survey. It involved 396 people – employees of a multinational corporation having its seat in Poland, and more specifically in the centre of Łódź. The respondents worked in the back office formula. They were contacted through the human resources department. All respondents voluntarily consented to participating in the survey; they did so free of charge and were informed of the anonymisation of their responses. Detailed information was also provided regarding the processing of the respondents' personal data.

The criterion for inclusion in the study was expressing informed consent to complete the questionnaire, and belonging to 1 of the groups, i.e., working in the traditional office model and working in the ABW model. There were no incomplete questionnaires among the collected material. The obtained survey results were sent to those who wished to receive them. Data were collected in December 2018–April 2019.

This article was written as part of a doctoral dissertation developed at the Medical University of Łódź. The project received a positive opinion from the Bioethics Committee, No. RNN/387/18/KE of 13.11.2018. There is no conflict of interest among the authors.

The company where the survey was conducted has 3 buildings. The respondents worked in different work environments – related to the building in which their workstations were arranged. Building A, the oldest building, used to house garment factories. It was revitalised and put in use in 2009. It is characterised by very large office spaces on each floor. Employees have desks assigned to them, which are separated by open space walls, thus creating a separate space for each employee. In addition, each floor has approx. 2 conference rooms, with no smaller project rooms or telephone booth. Overall, 98% of the desks do not have electrical but manual lifting systems. None of the floors feature any relaxation rooms. Buildings D and B were put in use in 2016 and 2018, respectively, and had already been designed in line with the ABW concept. They are characterised by a large number of project rooms of varying dimensions. Each floor features a relaxation room equipped with a sofa and/or a massage bed, as well as a soundproof telephone booth. Desks equipped with electrical lifting systems account for approx. 80% of all desks in these buildings. In addition, each desk has a modern docking station for charging computers, which warrants freedom of movement around the floor. In contrast to building A, there are no open-space walls and the office design has been completely changed to a modern, yet industrial, décor with the addition of plants and an appropriate range of colours. It is worth emphasizing that building A does not meet the formal requirements to be considered a place of work in accordance with the ABW concept.

The respondents – employees of buildings B and D – were divided into 2 groups: the survey group composed of 200 employees who had been relocated from building A to building B or D in the previous month, and the control group composed of 196 employees who had been working in building D or B, based on the ABW concept, from the beginning.

Among the respondents, a division was also made into people identifying or not with work in the ABW concept. As mentioned earlier, the employees of building A did not actually work in the ABW environment due to the lack of space adapted to it. However, some of these employees could identify themselves with working in the ABW concept due to the implementation of this concept and work

model by the management board (communication, management style, personnel and space management, etc.).

The survey has been distributed amongst all of the company employees. Data on 396 employees of both sexes (including 196 women and 200 men) who provided complete responses were analysed. Among the respondents, 184 people (47%) had a master's degree, 136 (34%) had a bachelor's degree, and 76 (19%) had completed secondary education only. The age of the respondents was M±SD 30.30±6.40 years, ranging 22–60 years.

The survey used standardised psychological questionnaires to measure the level of perceived stress (the PSS-10), the level of readiness to change (the RCQ), the severity of health behaviours (the *Health Behaviour Inventory* [HBI]), and the level of general self-efficacy (the *General Self-Efficacy Scale* [GSES]). Self-administered questionnaires were also included in the toolkit to measure the level of familiarity with the OHS principles and the frequency of back pain, and the level of familiarity with the ABW concept.

The PSS-10 contains 10 questions used to assess the intensity of stress experienced in the past month in connection with one's life situation. The intensity of stress is determined not by the number of incidents, but by how they are assessed. Questions relating to the subjective feelings about personal problems and incidents, behaviour and coping were rated on a 5-point scale (0 – never, 1 – hardly ever, 2 – sometimes, 3 – quite often, 4 – very often). The Cronbach's α coefficient for the questionnaire is 0.86 [15].

The RCQ by R. Kriegel and D. Brandt (adapted by A. Paszkowska-Rogacz) contains 35 statements concerning an individual's performance under the conditions of change in 7 areas (ingenuity, drive, self-confidence, optimism, risk-taking, adaptability, and tolerance for uncertainty). Each statement is rated on a 6-point scale, whereby "1" means that the respondent completely disagrees with the statement and "6" that he/she fully agrees with it. The Cronbach's α coefficient for the questionnaire is 0.54 [16].

The GSES, which is used to measure the level of an individual's general belief in the effectiveness of coping with difficult situations and obstacles, contains 10 statements rated on a 4-point scale (1 – no, 2 – rather not, 3 – rather yes, 4 – yes). The Cronbach's α coefficient for the questionnaire is 0.85. The reliability of the scale assessed by the test-retest method (after 5 weeks) is 0.78 [17].

The HBI contains 24 statements describing different types of health behaviour. It makes it possible to determine the overall health behaviour intensity index, as well as scores relating to specific categories of health behaviour (eating habits, prophylaxis, positive mental attitudes, health practices). The respondents rate these statements on a 5-point scale (1 – never, 2 – rarely, 3 – from time to time, 4 – often, 5 – never). The internal consistency of the HBI determined by Cronbach's α is 0.85 for the whole Inventory, while for its 4 subscales it ranges 0.60–0.65. The reliability assessed by the test-retest method (after 6 weeks) was 0.88 [18].

The test of familiarity with the OHS and ergonomic principles, created by the authors of this study, included questions on the correct positioning of individual elements necessary for office work, and was developed in compliance with the applicable regulation of the Minister of Labour and Social Policy [19]. The result of the questionnaire corresponded to the number of correctly marked answers. The questionnaire contains 10 questions with 1 correct answer. The questions concerned the statutory breaks at work, the setting of computer equipment, as well as the correct body position when working with a screen monitor.

The questionnaire on the frequency of back pain during sedentary work and familiarity with the ABW concept, also created by the authors of this study, contained 31 statements. The respondents rated them on a 5-point scale (1 – definitely does not apply to me, 2 – rather does

not apply to me, 3 – I cannot say that it applies or does not apply to me, 4 – rather applies to me, 5 – definitely applies to me). The results were interpreted as follows: the higher the score obtained in the test, the greater the severity of back pain. The author's questionnaire contained questions about the feeling of back pain. In addition, the questionnaire contained questions about the nature of the pain and its location (Table 1).

Data analysis was performed using statistical software R v. 4.0.5. Responses to individual questions, as well as the results of standardised questionnaires, were presented using basic descriptive statistics. The normality of distributions of the quantitative variables in the subgroups was checked using the Shapiro-Wilk test, on the basis of measures of skewness and kurtosis, and by means of a visual assessment of histograms. A comparative analysis of the survey groups was performed using the χ^2 test (for nominal variables), Student's t-test (for quantitative variables with normal distribution). Comparisons of the levels of stress in the relocated group, in relation to the general population, were conducted using Student's t-test for a single group. Mean differences (MD) between the groups were also determined at the 95% confidence interval (CI). The relationship between quantitative and ordinal variables was verified using Spearman's and Pearson's correlation coefficients, so as to meet the assumptions. A significance level of 0.05 was used in the calculations.

RESULTS

Characteristics of the study group

As part of the study, data on numerous variables relating to the respondents' characteristics were collected. One of these was body weight, which is 1 of the health deterioration risk factors. The body weight was M±SD 82.15±18.50 kg, ranging 40–122 kg, BMI was M±SD 26.66±4.61 kg/m^2, ranging 16.85–38.42 kg/m^2. A normal BMI (18.5–24.9 kg/m^2) was recorded for 158 respondents (40%), while 141 respondents (36%) were overweight (a BMI of 25–29.9 kg/m^2). Obesity (a BMI of 30–40 kg/m^2) concerned 93 respondents (24%), 71 of whom (18%) had grade I obesity (a BMI of 30–34.9 kg/m^2), and 22 respondents (6%) grade II obesity (a BMI of 35–39.9 kg/m^2).

Other analysed factors included the working environment, i.e., the building in which the respondent's workstation was situated, and length of service. As many as 196 respondents (49%) had been relocated to buildings B and D from building A; 103 (26%) had worked in building B, and 97 (25%) in building D, from the beginning. The respondents with a length of service of <1.5 years accounted for 18 (8%) of the group and they had all been employees relocated from building A. The remaining employees in buildings B and D had a length of service of >1.5 years; 103 of them (47%) worked in building B and 97 (45%) in building D.

All respondents with a length of service of >1.5 years had previously worked in building A; they accounted for 178 (100%) and had been relocated.

It was also checked in both groups whether the respondents had ever experienced back pain before. Of the 396 people, 209 (52.8%) provided affirmative answers, while negative answers were given by 187 respondents (47.2%). Of the 330 people who confirmed working in line with the ABW concept, back pain was reported by 17 (51.5%), while other 160 people (48.5%) said they had never experienced such pain. Moreover, 66 out of 396 respondents did not identify with the ABW concept. In that group, pain was reported by 39 people (59.1%), while 27 (40.9%) did not report experiencing any pain. It is worth noting that, in reality, all the respondents worked in line with the ABW concept, but not all of them were aware of it.

Verification of the hypotheses

The hypothesis that familiarity with the OHS and ergonomic principles, coupled with working in line with the ABW concept, are protective factors against back

Table 1. The level of knowledge about work ergonomics in relation to experiencing back pain at work in the study group with obesity, 2018–2019, Medical University of Lodz, Łódź, Poland

Back pain at work	Work ergonomics knowledge		p
	M±SD	MD (95% CI)	
All participants		0.18 (–0.47–0.83)	0.583
no back pain	4.14±1.55		
back pain	4.32±1.60		
Lenght of service			
<1.5 year		–0.65 (–1.58–0.28)	0.164
no back pain	4.50±1.34		
back pain	3.85±1.71		
>1.5 year		0.95 (0.09–1.81)	0.031
no back pain	3.88±1.67		
back pain	4.83±1.31		

MD – mean difference between the 2 groups calculated as the pain group minus the pain-free group with 95% confidence interval (CI).
Comparison of both groups (pain, no pain) using the Student's t-test.

pain in obese people was also verified. First, in the group of obese people (93 people), it was verified whether the level of familiarity with the ergonomic principles differed between those experiencing and those not experiencing back pain. No significant differences were found in the level of familiarity with the ergonomic principles in relation experiencing back pain episodes at work, either in the whole group of obese people or in the group of obese people with a length of service <1.5 years. However, in the group of obese people with a length of service of >1.5 years, the level of familiarity with the ergonomic principles was significantly higher in those who had experienced back pain at work, compared to those without such pain episodes (p = 0.031) (Table 1).

Among obese people, no significant correlation was confirmed between the perception of pain in individual spinal segments and the level of familiarity with the ergonomic principles (either in the whole group of obese people or in any of the groups divided by length of service), p > 0.05 for each comparison (Table 2).

In addition, among obese people, no significant correlation was confirmed between the frequency of experiencing pain and the level of familiarity with the ergonomic principles (either in the whole group of obese people or in any of the groups divided by length of service), p > 0.05 for each comparison (Table 3).

Then, for obese people, the relationship between working in line with the ABW concept (declared yes or no) and experiencing back pain episodes at work was verified. Actually, between these 2 variables no such significant relationship was found (p = 0.728) (Table 4).

Table 2. Correlation between the level of pain in individual sections of the spine and the level of knowledge about work ergonomics in the study group with obesity, 2018–2019, Medical University of Lodz, Łódź, Poland

Spinal segment	Pain vs. work ergonomics knowledge correlation					
	all participants		length of service			
			<1.5 year		>1.5 year	
	ρ	p	ρ	p	ρ	p
Cervical	0.05	0.737	0.16	0.420	–0.13	0.545
Thoracic	–0.15	0.284	–0.23	0.256	0.01	0.954
Lumbar	0.01	0.937	–0.12	0.552	0.16	0.442
Sacral	0.27	0.056	0.32	0.111	0.07	0.729

ρ – Spearman's correlation coefficient.
The p-value <0.05 is statistically significant.

Table 3. Correlation between the frequency of feeling pain at work and the level of knowledge about work ergonomics in the study group with obesity, 2018–2019, Medical University of Lodz, Łódź, Poland

Variable	Frequency of experiencing pain vs. work ergonomics knowledge correlation	
	ρ	p
All participants	–0.24	0.095
Length of service		
<1.5 year	–0.28	0.162
>1.5 year	–0.18	0.389

ρ – Spearman's correlation coefficient.
The p-value <0.05 is statistically significant.

The relationship between the length of service of <1.5 years or >1.5 years and experiencing back pain episodes at work was also verified among people with obesity. Again, no significant relationship was found between these 2 variables (p = 0.406) (Table 4).

For the survey group of obese people, the severity of experienced pain in different spinal segments as well as the nature of spinal pain were also compared between the groups differing in the length of service. There were no statistically significant differences in either the severity of experienced pain in the different spinal segments or the nature of pain in relation to the length of service (p > 0.05 for each comparison) (Table 5).

The severity of experienced pain in individual spinal segments as well as the nature of pain were also compared between the 2 groups of obese people divided by declarations of working in line with the ABW concept (yes/no). There were no statistically significant differences in terms of experienced pain in individual spinal segments in relation to working in line with the ABW concept (p > 0.05 for each comparison). Regarding the nature of pain, those declaring to work in line with the ABW concept were more likely to indicate radiating back pain than those not declaring to do so (p < 0.001). Regarding the other types of pain, no significant differences were confirmed between those declaring and not declaring to work in line with the ABW concept (Table 5).

In a group of people whose workstation had been relocated to another building (in line with the ABW concept), the relationship between the level of stress and selected variables: age, readiness for change and general self-efficacy was tested. A significant negative correlation between the level of stress and age was confirmed (ρ = –0.16, p = 0.023), indicating a decrease in the level of stress with the employees' age. At the same time, the level of stress correlated positively with the sense of efficacy (ρ = 0.21, p = 0.003), meaning that the higher the sense of efficacy, the higher the level of

Table 4. The relationship between work in the activity-based working (ABW) concept and seniority and the occurrence of back pain in the study group with obesity, 2018–2019, Medical University of Lodz, Łódź, Poland

Back pain at work	Participants (N = 93) [n (%)]					
	working in line with the ABW concept		p	length of service		p
	no (N = 9)	yes (N = 84)		<1.5 year (N = 44)	>1.5 year (N = 49)	
All participants			0.728			0.406
No back pain	5 (55.6)	38 (45.2)		18 (40.9)	25 (51.0)	
Back pain	4 (44.4)	46 (54.8)		26 (59.1)	24 (49.0)	

The relationship was checked with the χ^2 test.
The p-value <0.05 is statistically significant.

Table 5. The location and nature of pain vs. the length of service and working in line with the activity-based work (ABW) concept in the survey group of obese people, 2018–2019, Medical University of Lodz, Łódź, Poland

Variable	Length of service				MD (95% CI)	p	Working in line with the ABW concept				MD (95% CI)	p
	<1.5 year		>1.5 year				yes		no			
	M	SD	M	SD			M	SD	M	SD		
In which spinal segment did you experience pain?												
cervical	2.31	1.72	2.42	1.59	0.11 (–0.83–1.05)	0.816	1.75	1.50	2.41	1.65	0.66 (–1.61–2.93)	0.452
thoracic	3.15	1.83	3.21	1.38	0.06 (–0.86–0.97)	0.905	2.50	1.91	3.24	1.59	0.74 (–2.21–3.69)	0.502
lumbar	3.08	1.79	2.88	1.96	–0.20 (–1.27–0.87)	0.706	3.00	2.31	2.98	1.84	–0.02 (–3.59–3.54)	0.986
sacral	2.19	1.60	2.83	1.43	0.64 (–0.22–1.50)	0.142	2.50	1.73	2.50	1.55	0.00 (–2.66–2.66)	>0.999
What was the pain like?												
acute	2.88	1.28	3.00	1.18	0.12 (–0.58–0.81)	0.741	3.00	1.41	2.93	1.22	–0.07 (–2.24–2.11)	0.934
chronic	3.23	1.18	3.26	1.10	0.03 (–0.42–0.88)	0.484	3.00	0.82	3.37	1.16	0.37 (–0.84–1.58)	0.449
mixed	2.77	1.07	2.79	1.10	0.02 (–0.60–0.64)	0.942	2.50	1.00	2.80	1.09	0.30 (–1.21–1.82)	0.596
radiating	3.85	1.05	3.48	1.27	–0.37 (–1.04–0.31)	0.279	3.00	0.00	3.73	1.19	0.73 (0.37–1.09)	<0.001
lancinating	3.44	1.23	3.00	1.06	–0.44 (–1.10–0.22)	0.186	3.67	2.31	3.20	1.09	–0.47 (–6.09–5.15)	0.758
burning sensation	2.65	1.20	2.67	1.27	0.02 (–0.69–0.72)	0.971	2.25	1.50	2.70	1.21	0.65 (–1.87–2.76)	0.600
I don't remember	1.50	0.76	1.75	1.26	0.25 (–0.35–0.85)	0.406	1.75	0.96	1.61	1.04	0.14 (–1.59–1.31)	0.794

MD – mean difference between the 2 groups with a 95% CI.
A comparison of the 2 groups using Student's t-test.
* Small group of respondents <5.

stress. In the case of readiness for change, no significant correlation with the level of stress was confirmed on the overall scale, but the scores on the *Ingenuity* and *Optimism* subscales were significantly related to the level of stress ($\rho = 0.15$, $p = 0.034$ for *Ingenuity*, and $\rho = -0.22$, $p = 0.001$ for *Optimism*, respectively). This means that, among the respondents changing the location of the building, those with higher levels of stress were characterised by higher ingenuity and lower levels of optimism (Table 6). At the same time, there was no statistically significant difference in the levels of stress between men and women ($p = 0.312$) (Table 7), among the respondents changing the location of their workstations.

For the group of people who changed the location of their workstation (work building), it was verified whether the level of stress differed significantly from that of healthy members of Polish society (PSS-10 with a mean level of 16.62) (Table 8). It was confirmed that the level of stress in the relocated group indeed differed significantly from that of the general population ($p < 0.001$) (Table 8).

A hypothesis of there being a correlation between the severity of health behaviour (measured by the BHI score) and an assessment of work in line with the ABW concept was also verified. A statistically significant correlation was confirmed between the BHI score and the perception of the ABW "Facilitated commu-

Table 6. The correlation between the level of stress and age, readiness for change and the sense of efficacy in the group of relocated employees, by sex, 2018–2019, Medical University of Lodz, Łódź, Poland

Variable	Level of stress (PSS-10) vs. variable	
	ρ	p
Age	–0.16	**0.023**
Readiness for change	0.07	0.359
Ingenuity	0.15	**0.034**
Drive	0.09	0.184
Self-confidence	0.10	0.178
Optimism	–0.22	**0.001**
Risk-taking	–0.01	0.905
Adaptability	0.07	0.345
Tolerance for uncertainty	0.12	0.097
Sense of efficacy (GSES)	0.21	**0.003**

GSES – General Self-Efficacy Scale; PSS-10 – *Perceived Stress Scale*
ρ – Spearman's correlation coefficient.
The p-value <0.05 is statistically significant.
A comparison using Student's t-test for a single sample.
Bolded are statistically significant values.

Table 7. Readiness for change and the sense of efficacy in the group of relocated employees, by sex, 2018–2019, Medical University of Lodz, Łódź, Poland

Variable	PSS-10		p
	M±SD	MD (95% CI)	
All participants		–0.72 (–2.12–0.68)	0.312
Female	20.61±4.96		
Male	21.33±5.08		

MD – mean difference between the 2 groups with a 95% CI.
PSS-10 – *Perceived Stress Scale*
The p-value <0.05 is statistically significant.

Table 8. The level of stress in the group of relocated employees vs. general society, 2018–2019, Medical University of Lodz, Poland

Variable	Level of stress			p
	M	SD	MD (95% CI)	
All participants			4.35 (3.65–5.05)	<0.001
Healthy society	16.62			
Surveyed group subjected to relocation	20.97	5.02		

MD – mean difference calculated as the group of relocated employees decreased by the mean for general society with a 95% confidence interval (CI).
A comparison using Student's t-test for a single sample.

nication between colleagues" (ρ = 0.13, p = 0.009 for the whole survey group, and ρ = 0.15, p = 0.029 for the group with a length of service of <1.5 years). A statistically significant correlation was also confirmed between the BHI score and the perception of the ABW "Knowledge sharing and integration with colleagues" (ρ = 0.17, p = 0.001 for the whole survey group and ρ = 0.19, p = 0.006 for the group with a length of service of <1.5 years). All of these correlations had a positive direction, which implies that the more the respondents identified with both statements, the higher their BHI score, and thus the higher the intensity of their health behaviour (Table 9).

The relationship between familiarity with the OHS and ergonomic principles, and the intensity of health behaviour was also analysed, but no statistically significant correlation was confirmed between these 2 variables (either in the entire study group or in the 2 groups divided by the length of service), with p > 0.05 for each comparison (Table 10).

The intensity of health behaviour was also compared between those who (if given the choice) would return to their previous work model and those who would prefer to continue with the ABW concept. No statistically significant difference in the intensity of health behaviour was confirmed between the 2 groups of respondents (p = 0.811) (Table 11).

DISCUSSION

This research focused on the impact of the ABW environment on the employees who were relocated from a traditional office model to an office following the ABW con-

Table 9. The correlation between an assessment of working in line with the activity-based working (ABW) concept and the health behaviour score in the survey group, 2018–2019, Medical University of Lodz, Łódź, Poland

Activity-based working concept	Assessment of work in line with the ABW concept vs. *Health Behavior Inventory* correlation					
	all participants		length of service			
			<1.5 year		>1.5 year	
	ρ	p	ρ	p	ρ	p
Ability to choose the workspace according to the activity undertaken	–0.03	0.606	–0.05	0.426	0.02	0.825
Flexible working style	0.07	0.177	0.09	0.194	0.04	0.608
Facilitated communication between colleagues	0.13	**0.009**	0.15	**0.029**	0.10	0.170
Access to areas that support the work performed	0.07	0.154	0.08	0.234	0.06	0.430
Wireless internet access across the building	0.02	0.631	0.02	0.826	0.03	0.706
Ability to change one's surroundings and work with different people	0.04	0.382	0.07	0.337	0.01	0.972
Knowledge sharing and integration with colleagues	0.17	**0.001**	0.19	**0.006**	0.13	0.079
No desk assigned to an employee	–0.02	0.698	0.01	0.914	–0.06	0.464
No personalisation option	–0.03	0.541	0.09	0.189	0.04	0.634
Obligation to work in zones according to the task at hand	–0.03	0.499	-0.03	0.631	–0.03	0.661
Rule of cleaning the desk after finishing work and storing all belongings in a lockable cabinet (lockers)	0.04	0.373	-0.01	0.988	0.09	0.222

ρ – Pearson's correlation coefficient.
A comparison of the 2 groups using Student's t-test.
The p-value <0.05 is statistically significant.
Bolded are statistically significant values.

cept. The authors wanted to verify whether working in line with the ABW concept could be a protective factor against back pain. In addition, the authors aimed to investigate the levels of stress experienced by the respondents and its relationship with other psychological factors. It was also decided to verify whether people with a high intensity of health behaviour assessed the ABW concept better.

The authors found that obese people with episodes of back pain, working in line with the ABW concept and with a length of service of >1.5 years, were significantly better familiarised with the ergonomic principles than those not experiencing pain episodes. The current level of knowledge and the need to conduct further research does not allow a reliable assessment of the usefulness of the ABW concept in this context. Many authors attribute positive effects to ABW in the physical and psychological spheres, but its impact should be considered ambiguous and requiring further research [20].

Previous research has revealed that working in line with the ABW concept can positively influence such areas of employee functioning as interactions, communication, time and space control, and satisfaction with the workplace [20]. Nonetheless, it is worth bearing in mind that changing the workspace and work environment can be a challenging experience and a process which (especially in the initial stages) leads to increased levels of perceived stress [21]. Giorgi et al. show, that work-related stress can not only have a negative impact on psychological and physical functioning of the workers (leading to anxiety, depression, maladaptive behaviours and job burnout), but may also affect the whole organization [22]. The results obtained by the authors (given the manner of data collection – already

after the relocation) do not allow measuring the impact of the relocation itself on the level of stress. At the same time, it should be noted that the level of perceived stress in employees who changed their workspace was significantly higher than in the general population. In addition, among the personality factors, only optimism and self-efficacy significantly correlated with the levels of perceived stress, suggesting that employee characteristics alone (e.g., self-confidence, adaptability or tolerance for uncertainty) are not sufficient to ensure a comfortable relocation. Moreover, employees characterised by a higher sense of self-efficacy experienced more stress, which could be explained by the fact that the change they had to face was of a forced (imposed) nature over which they had little influence.

Previous research on the implementation of the ABW concept has highlighted the need for good communication and process planning in order to ensure that employees are comfortable with the introduced change [1,23,24]. Based on the results described above, the authors suggest that, in the process of workplace modification (including the introduction of the ABW concept), measures aimed at reducing the negative psychological effects, such as education along with supporting the development of soft skills for effective stress management, should also be implemented. Ravalier et al. [25] also show, that initiatives co-developed with employees can bring positive impact, thus consultations with employees and their engagement in the decision-making process should be considered when a change in working environment is being planned. Furthermore, when measuring the benefits of a change in the working environment, it is worth paying attention to the selection of appropriate indicators – relevant to the change being implemented – in order to avoid distortions in the measurement resulting from other variables accompanying the modification of the working environment [26].

The results also indicate that there is a correlation between the intensity of health behaviour and satisfaction with interpersonal relationships (e.g., communication with colleagues). The perception of ABW and the intensity of health behaviour was found to correlate. The respondents indicated that ABW facilitated communication, the exchange of knowledge and integration among colleagues. Similar results were obtained by Haapkangas et al. [27] who reported significant "satisfaction with communication" [25], as well as by Rolfo et. al. [24] who indicated, however, that this effect only occurred when the team was relocated in whole. Many sources point to some factors that can have an adverse impact on communication when working in line with the ABW concept [20–27]. These include the inconvenience of finding a desk to work at, noise in the office space, and the inconvenience of finding new colleagues if the team has not been relocated

Table 10. Familiarity with the principles of health and safety at work vs. *Health Behaviour Inventory* (HBI) correlation, 2018–2019, Medical University of Lodz, Łódź, Poland

Variable	Familiarity with the principles of health and safety at work vs. HBI correlation	
	ρ	p
All participants	–0.09	0.091
Length of service		
<1.5 year	–0.09	0.187
>1.5 year	–0.07	0.368

ρ – Pearson's correlation coefficient.
The p-value <0.05 is statistically significant.

Table 11. The health behaviour score vs. the preference to return to the previous work model in the survey group, 2018–2019, Medical University of Lodz, Łódź, Poland

Return to previous office	*Health Behaviour Inventory*			p
	M	SD	MD (95% CI)	
All participants			–0.42 (–4.07–3.22)	0.811
No return	73.16	8.58		
Return	72.74	7.19		

The p-value <0.05 is statistically significant.

in whole [23–25]. The authors recognise the importance of these factors and the need for future research in this area.

According to the results obtained in the study, employees characterised by a higher intensity of health behaviour assessed their work in line with the ABW concept better. In the study by Arundell et al. [28], those with a higher score in the eating habits category appreciated more the opportunity to eat with colleagues, which also increased integration between them. Mutual motivation for regular and healthy meals reduced the amount of junk food consumed and casual eating [28]. It is noteworthy that an increase in health-promoting behaviours may not only have an impact on the appreciation of positive changes in the working environment introduced by the employer, but is linked to the employee leading a healthier lifestyle. Studies by Gil-Beltrán et al. [29] and Jeong et al. [30] show a significant association between practices such as intensive and regular exercise and taking up activities on days off – and multiple health and psychological factors. Organizations that put an effort in promotion of physical exercise and health related behaviours achieve general grater well-being, better work satisfaction and lower stress of their employees [29–31].

Several hypotheses that were formulated were not actually confirmed in this publication. The authors hypothesised that familiarity with OHS and ergonomic principles, together with working in line with the ABW concept, might be a protective factor for obese people against back pain. Furthermore, the relationship between the length of service, obesity and a high level of familiarity with the ergonomic principles with the frequency of back pain was not confirmed. The hypothesis that working in line with the ABW concept reduces the frequency of back pain episodes in obese people was not confirmed either. Nor was any association found between the level of experienced back pain and obesity. Based on the obtained results, it was also impossible to determine differences in the location and nature of pain in obese people with different length of service and different declarations of working in line with the ABW concept.

In the groups with different declarations of working in line with the ABW concept, the attempt to verify the location and nature of pain in obese people following the ABW concept did not yield any statistically significant results. It is worth noting that there are no sources to verify the results obtained in the present study regarding the aforementioned variables related to experiencing back pain. Previous research conducted in these areas has focused on describing the impact of working in line with the ABW concept on improving communication, interpersonal relations, productivity and employee performance [20–25].

Limitations

Certain distracting factors that could negatively influence the perception of ABW, including noise, a lack of privacy, and impaired collaboration with employees if the team was not relocated in whole, were not considered in this publication. Due to the applied manner of data collection (after the relocation), the effect of the relocation itself on the level of perceived stress was not measured. It should also be noted that the data collected comes from 1 company that has implemented the ABW concept for its employees. The results achieved in other companies may be different – due to the varying possibilities of implementing the ABW concept. Any generalization of the results obtained in the study to each application of ABW in the work environment should be done with caution. It is worth reminding that data were collected using questionnaire methods based on self-reporting. Although this form should be considered an objective source of data, it is possible that there are some individual differences in the perception of one's own behaviour and also in the assessment of performance or pain intensity. With this method, it is also impossible to verify the accuracy of data such as height or weight of the subject.

In addition to the above-mentioned limitations that could have influenced the results of the study, the specific circumstances of the study should be emphasized, i.e., compliance with the concept (mental identification with the employees' concept), and not a real reflection.

CONCLUSIONS

Activity-based working is a promising concept but it requires good planning and employee awareness. This was also the first Polish study to show how individual psycho-medical characteristics affect the understanding of change (relocation) accompanied by stress, and how these characteristics could play a significant role in change management. In addition, the positive impact of work in the concept of ABW on the health behaviour of employees should be emphasized, which translates into them as a group of people cooperating with each other. Indeed, working in the ABW concept can be useful as an indirect tool to improve aspects such as broadly understood team communication or integration.

Author contributions

Research concept: Magdalena Justyna Jasińska-Słowik, Bartłomiej Tarkowski, Anna Zalewska-Janowska

Research methodology: Magdalena Justyna Jasińska-Słowik, Bartłomiej Tarkowski, Anna Zalewska-Janowska

Collecting material: Magdalena Justyna Jasińska-Słowik

Statistical analysis: Magdalena Justyna Jasińska-Słowik

Interpretation of results: Magdalena Justyna Jasińska-Słowik, Bartłomiej Tarkowski, Anna Zalewska-Janowska

References: Magdalena Justyna Jasińska-Słowik

REFERENCES

1. Babapour Chafi M, Rolfö L. Policies in Activity-based Flexible Offices – "I am sloppy with clean-desking. We don't really know the rules." Ergonomics. 2019; 62:1, 1-20. https://doi.org/10.1080/00140139.2018.1516805.
2. Haapakangasa A, Hallman D, Mathiassen S, Jahncke H. The effects of moving into an activity-based office on communication, social relations and work demands – A controlled intervention with repeated follow-up. Journal of Environmental Psychology. 2019;66, 101341. https://doi.org/10.1016/j.jenvp.2019.101341.
3. Hoendervanger J, Yperen N, Mobach M, Albers C. Perceived fit in activity-based work environments and its impact on satisfaction and performance. Journal of Environmental Psychology. 2019;65, 101339. https://doi.org/10.1016/j.jenvp.2019.101339.
4. Rolfö L. Relocation to an activity-based flexible office – Design processes and outcomes. Applied Ergonomics. 2018; 73, 141–150. https://doi.org/10.1016/j.apergo.2018.05.017.
5. Danielsson, C.B., Bodin, L., 2008. Office type in relation to health, well-being, and job satisfaction among employees. Environ. Behav. 40 (5), 636–668. http://dx.doi.org/10.1177/0013916507307459.
6. Bjerrum, E., Bødker, S., 2003. Learning and living in the "New office". In: Paper Presented at European Conference on Computer-Supported Cooperative Work. ECSCW 2003 – Helsinki, Finland, Varighed: 14.09–18.09. 2003, Conferences number: 8.
7. Tatara T, Dąbrowska-Bender M. Najczęstsze choroby powodowane pracą w warunkach biurowych. Zdr Publ. 2010; 120(2): 101-106. Polish.
8. Ciepłowska A, Waszkowiak K, Jędrusek-Golińska A, Szymandera-Buszka K, Kmiecik D, Kobus-Cisowska J. Nutritional status and behaviors of corporate office workers in Poznan – a pilot study. Probl Hig Epidemiol. 2017;98(4): 387-392. https://doi.org/10.2478/s13382-014-0315-3.
9. Kayihan G. Relationship between daily physical activity level and low back pain in young, female desk-job workers. Int J Occup Med Environ Health. 2014;27(5):863–70. https://doi.org/10.2478/s13382-014-0315-3.
10. Kowalska M, Bugajska J. Problemy zdrowotne osób pracujących z komputerem. Med Pr. 2009;60(4):321–5. Polish.
11. Norman K, Floderus B, Hagman M, et al. Musculoskeletal symptoms in relations to work exposures at call centre companies in Sweden. Work. 2008; 30(2): 201-214.

12. Riccò M, Cattani S, Gualerzi G, Signorelli C. Work with visual display units and musculoskeletal disorders: a cross-sectional study. Med Pr. 2016;67(6):707-719. https://doi.org/10.13075/mp.5893.00471.
13. Makowiec-Dąbrowska T, Bortkiewicz A, Gadzicka E. Wysiłek fizyczny w pracy zawodowej – czynnik ryzyka, czy ochrona przed chorobami układu krążenia. Med Pr. 2007;58(5): 423–32. Polish.
14. Strauß M, Foshag P, Przybylek B, et al. Occupation and metabolic syndrome: is there correlation? A cross sectional study in different work activity occupations of German firefighters and office workers. Diabetol Metab Syndr. 2016;22, 8(1):57. https://doi.org/10.1186/s13098-016-0174-0.
15. Juczyński Z, Ogińska-Bulik N. Narzędzia pomiaru stresu i radzenia sobie ze stresem, Warszawa, Pracownia Testów Psychologicznych; 2009. p. 11-22. Polish.
16. Kriegel R., Brandt D. (1996), Sacred Cows Make the Best Burgers. Developing Change ready People and Organizations, Warner Books, New York
17. Juczyński Z. Poczucie własnej skuteczności jako wyznacznik zachowań zdrowotnych. Promocja Zdrowia. Nauki Społeczne i Medycyna. 1998; 14: 54–63. Polish.
18. Juczyński Z. Narzędzia pomiaru w promocji i psychologii zdrowia. Pracownia Testów Psychologicznych, Warszawa 2009: 110-116. Polish.
19. W sprawie bezpieczeństwa i higieny pracy na stanowiskach wyposażonych w monitory ekranowe. Rozporządzenie Ministra Pracy i Polityki Socjalnej z dnia 01.12.1988 (Dz. U.98.148.973). Polish.
20. Engelen, L.; Chau, J.; Young, S.; Mackey, M.; Jeyapalan, D.; Bauman, A. Is activity-based working impacting health, work performance and perceptions? A systematic review. Build. Res. Inf. 2019; 47, 468–479. https://doi.org/10.1080/09613218.2018.1440958.
21. Moyle, P. and Parkes, K. The effects of transition stress: a relocation study. J. Organiz. Behav. 1999;20(5):625-646. https://doi.org/10.1002/(SICI)1099-1379(199909)20:5%3C625::AID-JOB898%3E3.0.CO;2-7.
22. Wijk K, Bergsten E, Hallman D. Sense of Coherence, Health, Well-Being, and Work Satisfaction before and after Implementing Activity-Based Workplaces. Int J Environ Res Public Health. 2020; 17(14): 5250. https://doi.org/10.3390/ijerph17145250.
23. Giorgi G, Arcangeli G, Perminiene M, Lorini C, Di Fabio A, Mucci N. Work-Related Stress in the Banking Sector: A Review of Incidence, Correlated Factors, and Major Consequences. Frontiers in Psychology. 2017; 8. https://doi.org/10.3389/fpsyg.2017.02166.
24. Rolfö L, Eklund J, Jahncke H. Perceptions of performance and satisfaction after relocation to an activity-based office. Ergonomics. 2018; 61:5, 644-657. https://doi.org/10.1080/00140139.2017.1398844.
25. Ravalier M, Wainwright E, Smyth N, Clabburn O, Wegrzynek P, Loon M. Co-Creating and Evaluating an App-Based Well-Being Intervention: The HOW (Healthier Outcomes at Work) Social Work Project. International Journal of Environmental Research and Public Health. 2020; 17(23). https://doi.org/10.3390/ijerph17238730.
26. Akerstrom M, Corin L, Severin J, Jonsdottir IH, Björk L. Can Working Conditions and Employees' Mental Health Be Improved via Job Stress Interventions Designed and Implemented by Line Managers and Human Resources on an Operational Level? Int J Environ Res Public Health. 2021; 16;18(4):1916. https://doi.org/10.3390/ijerph18041916.
27. Happakangas A, Hallaman D, Mathiassen S, Jahncke H. Self-rated productivity and employee well-being in activity-based offices: The role of environmental perceptions and workspace use, Building and Environment. 2018;145: 115-124. https://doi.org/10.1016/j.buildenv.2018.09.017.
28. Arrundell L, Sudoholz B, Teychenne M, Salmon J, et.al. The Impact of Activity Based Working (ABW) on Workplace Activity, Eating Behaviours, Productivity, and Satisfaction. Int J Environ Res Public Health. 2018;17;15(5):1005. https://doi.org/10.3390/ijerph15051005.
29. Gil-Beltrán E, Meneghel I, Llorens S, Salanova, M. Get Vigorous with Physical Exercise and Improve Your Well-Being

at Work! International Journal of Environmental Research and Public Health. 2020; 17(17). https://doi.org/10.3390/ijerph17176384.

30. Jeong, G, Kang W, Choi SB. Employees' Weekend Activities and Psychological Well-Being via Job Stress: A Moderated Mediation Role of Recovery Experience. International Journal of Environmental Research and Public Health. 2020; 17(5). https://doi.org/10.3390/ijerph17051642.

31. Getaneh ME, Shetie Workneh B, Seid AM, Fentie Abegaz B, Wassie Alamirew M, Aemro Terefe A. Prevalence of work-related stress and its associated factors among bank workers in Gondar City, Northwest Ethiopia: A multi-center cross-sectional study. International Journal of Africa Nursing Sciences. 2022; 16. https://doi.org/10.1016/j.ijans.2021.100386.