

## Quantifying Ergonomic Risk: A Multi-Faceted Case Study of a University Administrative Office

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### Abstract

In the modern academic office, a significant disconnect exists between standardized workstation design and the diverse physical needs of employees, creating a hidden matrix of health risks. This study provides a comprehensive ergonomic audit of a university registrar's office to quantify these hazards. We conducted a cross-sectional analysis of 20 employees, integrating (1) anthropometric measurements against furniture dimensions, (2) environmental assessments of illumination and noise, and (3) clinical screenings for vision and hearing. The analysis revealed critical design failures. For instance, fixed-height seating created a

postural mismatch for over 60% of staff, and inadequate seat depth prevented proper back support for 43% of female employees. Environmentally, lighting at key workstations fell to 218 lux, less than half the recommended 500 lux, posing a risk for significant visual strain. Most alarmingly, audiometric screening identified that 42% of employees exhibited mild to severe hearing loss. Our findings demonstrate that a "one-size-fits-all" approach to office design is not merely suboptimal but actively detrimental to employee health. This data-driven case study provides a clear mandate for the adoption of adjustable, user-centered workstations and environmental

standards to mitigate occupational health risks.

**Keywords:** Office Ergonomics, Anthropometry, Mismatch Analysis, Illumination, Occupational Safety, Musculoskeletal Disorders.

### \* Introduction

The most common causes of musculoskeletal problems are long working hours in static or uncomfortable positions, in addition to improper seat design, incorrect keyboard and mouse positioning, and lack of a footrest<sup>24</sup>. The contemporary office has transformed into an environment of prolonged sedentary activity, placing administrative workers at the forefront of risk for work-related musculoskeletal disorders (WMSDs) affecting the neck, back, and upper limbs. It was found out that musculoskeletal disorders were common among office workers in Iran<sup>3,5</sup>, Thailand<sup>6,7</sup>, Estonia<sup>8</sup>, India<sup>9</sup>, Turkey<sup>1,10,12</sup>, Malaysia<sup>13,14</sup>, and the United States<sup>2</sup>. The etiology of these disorders is often a fundamental mismatch between the static dimensions of the workstation and the dynamic anthropometry of the user. While the principles of office ergonomics are well-documented, the existing literature often examines these factors in isolation. There remains a gap in

holistic, multi-faceted case studies that simultaneously quantify anthropometric mismatches, evaluate environmental hazards like lighting and noise, and correlate these with direct physiological screenings in a single, high-demand setting. Office workers were generally satisfied with lighting and internal office environment, as the offices were open offices with centrally air conditioned<sup>24</sup>.

It was found that the total weighted score for women was significantly higher compared to men<sup>17</sup>. These are the most affected factors workers, tasks, construction characteristics, workplace components and Physical Environment<sup>25</sup>. Growing computers are known the basic parts of our daily lives provoke support device symptoms<sup>26</sup>. Office employees often spend over 40 hours per week, workstation; therefore, office the environment plays an important role everyday life is a lot of people. Desk the main focus is furniture and office environment. Physical states that you should get more note<sup>27</sup>.

The modern office environment, characterized by prolonged sedentary work, is a known contributor to a range of occupational health issues, most notably work-related

musculoskeletal disorders (WMSDs) affecting the neck, back, and upper limbs<sup>20,21</sup>. The root cause of these issues often lies in a fundamental mismatch between the physical requirements of the job and the physical characteristics of the worker<sup>22</sup>. This disconnect is frequently manifested in poorly designed furniture and suboptimal environmental conditions.

While extensive research exists on general office ergonomics, there is a persistent gap in detailed, multi-faceted case studies that simultaneously quantify anthropometric mismatches alongside environmental hazards like inadequate lighting and excessive noise in specific work settings<sup>28</sup>. University administrative offices represent a unique and under-studied environment where employees face high demands for both computer-based work and face-to-face interaction, often in open-plan spaces<sup>29</sup>.

This paper presents a case study of the registrar's office at Eastern Mediterranean University. The primary objective was to perform a comprehensive ergonomic evaluation to identify specific mismatches between the anthropometric data of the employees and their workstation furniture. A

secondary objective was to assess critical physical environment factors—illumination and noise—and their potential impact on employee health and safety. We hypothesized that the existing "one-size-fits-all" workstation design would be poorly suited to the majority of staff, leading to measurable risks.

Features of an office such as people, building space, equipment, furniture and the environment must fit together well for workers to feel healthy and comfortable and be able to work efficiently and productively. At least, 50% of the world's population currently works in some form of office<sup>25</sup>.

University administrative offices are a prime example of such an under-studied environment, where employees navigate the dual pressures of intensive computer work and interpersonal communication, often in standardized, open-plan spaces<sup>29</sup>. This "one-size-fits-all" approach to furniture and environment design is rarely interrogated with empirical data. Sufficient resting possibilities, better working conditions and training in physical exercises are required for preventing these disorders<sup>17</sup>

This paper addresses that gap by presenting a comprehensive

ergonomic case study of the registrar's office at Eastern Mediterranean University. Our primary objective was to conduct a data-driven analysis to identify and quantify the specific mismatches between employee anthropometry and their workstations<sup>19</sup>. Concurrently, we aimed to assess critical environmental factors—illumination and noise—and screen for potential impacts on vision and hearing. We hypothesized that the standardized office environment would reveal significant ergonomic deficiencies, posing measurable health risks to the majority of the staff and highlighting the need for evidence-based, user-centered design interventions<sup>19</sup>.

#### **\* Data Collection Tools**

This study utilized a cross-sectional case study design involving 20 employees (7 male, 13 female) at the registrar's office of Eastern Mediterranean University. All participants provided informed consent prior to their inclusion in the study.

**1- Questionnaire:** A questionnaire, approved by the EMU Ethics Committee, was distributed to 20 employees. The questionnaire covered personal information (gender, age, height, weight), working hours, health problems and

physical pain (especially in the neck, shoulders, and upper back), and surrounding physical factors (lighting, noise, rest periods). as shown at tables 2.1 & 2.2 below.

**2- Instrumentation** A suite of calibrated instruments was used for data collection:

#### **\* Anthropometric Measurements**

1- 11 physical measurements were taken from all 20 employees using an anthropometric ruler.

2- Measurements included: height, shoulder height, knee height, hip width, sitting eye height, and others.(figure 1 & 2)

#### **\* Optical Vision Tester**

1- An (OPTICAL INDUSTRIAL VISION TESTER) device was used to conduct **12** precise eye function examinations for 19 employees.

2- Tests included examining both eyes together and each eye individually, as well as testing for depth perception and color discrimination. (figure 3)

#### **\* Illumination Measurements:**

1- The illumination level was measured using a dedicated device in 33 different locations within the registrar's offices. (figure 4)

#### **\* Audiometer Tests**

1- Air conduction tests were conducted for 19 employees to assess the impact of noise on hearing, with

each ear tested independently. (figure 5)

**\* Sound Level Measurements**

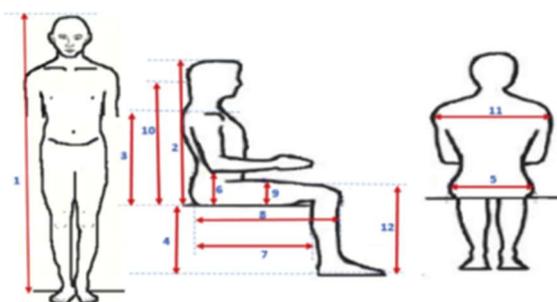
The noise level was measured in 32 different locations using a sound level meter. Measurements were taken three times a day (morning, noon, and afternoon) over three different days to ensure accuracy. (figure 6)

**Table 2.1: Questionnaire at the Registrar's Office**

region/symptoms	Ache	Pain	Cramp	Tingling	Numbness	Swelling
Neck	<input type="checkbox"/>					
Shoulder	<input type="checkbox"/>					
Elbow/forearm	<input type="checkbox"/>					
Hand/wrist	<input type="checkbox"/>					
Finger	<input type="checkbox"/>					
Upper back	<input type="checkbox"/>					
Lower back	<input type="checkbox"/>					

**Table 2.2: Sample Form to Record Employee Measurements**

Table number	
Gender	
Age	
Height (cm)	
Shoulder height (cm)	
Shoulder elbow height (cm)	
Buttock popliteal height (cm)	
Popliteal height (cm)	
Knee height (cm)	
Forearm hand length (cm)	
Hip width (cm)	
Elbow sitting height (cm)	
Sitting height (cm)	
Sitting eye height (cm)	



**Figure 1: Anthropometric Measurements, (Ref; Taifa, I. W., & Desai, D. A. (2017)**



**Figure 2: Tape and anthropometer**



**Figure 3: Optic vision tester**



**Figure 4: Audiometer**



Figure 5: Lux meter



Figure 6: Sound level meter

### 3- Data Analysis and Mismatch Criteria

The core of the analysis involved comparing user anthropometry with workstation dimensions based on established ergonomic principles from Gouvali & Boudolos (2006) and Parcels et al. (1999). A mismatch was identified when a workstation dimension did not accommodate the user's corresponding body dimension according to the formulas detailed below.

**a- Seat Height (SH) Mismatch:**  
Mismatch if  $SH < PH * \cos(30^\circ)$  or  $SH > PH * \cos(5^\circ)$ .

**b- Seat Depth (SD) Mismatch:**  
Mismatch if  $SD < 0.80 * BPL$  or  $SD > 0.95 * BPL$ .

**c- Seat Width (SW) Mismatch:**  
Mismatch if  $SW < HB + 5 \text{ cm}$ .

**d- Armrest Height (AH) Mismatch:**  
Mismatch if  $AH > EH + 5 \text{ cm}$  or  $AH < EH - 5 \text{ cm}$ .

**e- Backrest Height (BH) Mismatch:**  
Mismatch if  $BH < SHH$ .

**f- Desk Height (DH) Mismatch:**  
Mismatch if  $DH < SEH$  or  $DH > SEH + 5 \text{ cm}$ .

**j- Desk Clearance (DC) Mismatch:**  
Mismatch if Vertical  $DC < TT + 2 \text{ cm}$  or Horizontal  $DC < BKL$ .

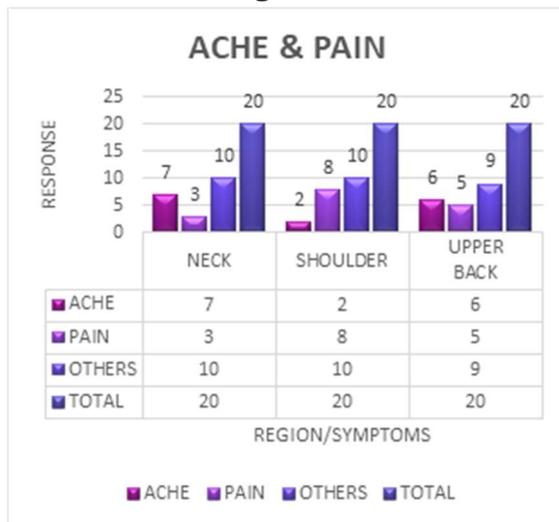
(Where PH=Popliteal Height, BPL=Buttock-Popliteal Length, HB=Hip Breadth, EH=Elbow Height, SHH=Shoulder Height, SEH=Sitting Elbow Height, TT=Thigh Thickness, BKL=Buttock-Knee Length)

#### \* Results

##### 1- Participant and Workstation Characteristics

1- Twenty people answered the questioner. Most of them are women. The survey results show that employees need a more comfortable place due to neck pain, pain, shoulders and restraints are shown in Table 3.1

**Table 3.1: Questionnaire Results at EMU Registrar Office**



2- The anthropometric data for the 20 participants are summarized and analyzed for all of males and females in Table 3.2. The dimensions of the standardized office chairs and desks used by the employees are presented in Table 3.3 below.

**Table 3.2: Overall Anthropometric Measurements (Female & Male, N=20)**

Subjects	Height	Shoulder Height	Shoulder Elbow Height	Buttock Popliteal Height	Popliteal Height	Knee Height	Forearm Hand length	Hip Width	Elbow Sitting Height	Sitting Height	Sitting Eye Height
Mean	167.0050	56.8300	34.5050	44.3250	51.3850	50.5450	41.3300	36.7000	20.7700	78.2550	67.6600
Minimum	154.00	47.30	26.70	35.80	43.60	39.70	30.60	26.80	16.70	63.70	52.90
Maximum	184.00	63.20	42.50	50.70	56.00	55.40	46.70	52.80	25.70	87.40	77.90
Std. Deviation	7.25175	7.19789	4.95426	4.58784	3.82021	3.81624	4.33251	5.54180	2.30699	6.68057	7.46447

**Table 3.3: Equipment Dimensions**

Dimensions	Measurement (cm)
Seat height (Minimum)	38
Seat height (Maximum)	49
Seat depth	44
Seat width	45
Max height of backrest	42
Armrests height	20
Desk height	78.5

**2- Ergonomic Mismatch Analysis** A high prevalence of ergonomic mismatches was identified. The specific mismatches of the seat height, seat depth and seat width for male and female participants are detailed in Tables 3.3, 3.4 and 3.5

respectively. Key findings include a significant mismatch in seat height for both genders and a notable mismatch in seat depth, particularly for female employees.

**Table 3.3: Mismatch of Male and Female Employee of the Seat Height**

Mismatch of	Male	Female	Overall
Optimizing method	42 %	33 %	35 %
Adjustable method	0 %	7 %	5 %

**Table 3.4: Mismatch of Male and Female Employee of the Seat Depth**

Mismatch of	Male	Female	Overall
Old Design	50 %	64 %	60 %
Optimizing method	50 %	36 %	41 %
Extreme method	0 %	0 %	0 %

**Table 3.5: Mismatch of Male and Female Employee of the Seat width**

Mismatch of	Male	Female	Overall
Optimizing method	58 %	57 %	58 %
Extreme method	0 %	0 %	0 %

### 3- Illumination Levels

Illumination across the office was inconsistent and often inadequate. While areas near windows exceeded 1000 lux (often creating glare), interior workstations were poorly lit. The minimum measured illuminance at an active workstation was 218 lux, which is less than half the recommended minimum of 500 lux for general office tasks. This inadequacy can lead to eye strain, headaches, and reduced productivity.

Two types of optic vision tests was done, the first was for far distances and the second is for near and direct distances such as reading and computer use.

Based on the questionnaire, which was distributed at the beginning of the study, some staff pointed to the lack of clarity of vision and lack of light and discomfort.

In figure 7 shows the optec vision test, and table 3.6 was recorded all results of the far visual acuity test.



**Figure 7: Optec Vision Test at EMU Registrar Office**

**Table 3.6: Far Visual Acuity Test**

	Acuity both eyes	Acuity right eye	Acuity left eye
N	19	19	19
Mean	7.95	6.26	6.05
Std. Deviation	3.659	3.984	3.535
Minimum	3	1	2
Maximum	14	14	13
Difficulty in Vision	7	11	10
Normal Vision	12	8	9
Proportion of Vision Issues %	37	58	53

The clarity or sharpness of vision is known visual acuity. By this definition there is 37% of employees haven't clarity of vision with both eyes. Also, the percent of the Acuity is 58% and 53% for right eye And left

eye respectively. It means they can't see clearly for the far distance as the persons with normal vision.

The second part of the test was checking four measures; color, depth perception vertical phoria, and lateral phoria. The results were recorded in table 3.7

**Table 3.7: Depth and Color Perception, Vertical and Lateral Phoria**

	Depth perception	Color perception	Vertical phoria	Lateral phoria
N	19	19	19	19
Difficulty in Vision	9	4	2	2
Normal Vision	10	15	17	17
Proportion of Vision Issues %	47	21	11	11

The term depth perception refers to our ability to determine distances between objects and see the world in three dimensions. Hyperphoria, or vertical phoria, is the tendency of one eye to deviate vertically. Lateral phoria is the loss of focusing ability. Color perception is the ability to focus on colors. According to the above definitions there are negative results of depth perception and color perception. It was shown in table 3.7 above.

Another examination was done to check the vertical and lateral phoria. This test measures how the eyes work together in the vertical plane and the relative posture of the eyes in the lateral plane. In the vertical phoria test the red line passing through note number 4 is ideal orthophoria. The lateral phoria

shows the arrow above numbered notes, if the subject reads it 8 is ideal or orthophoria, pointing between 3.5 and 12.5 is the accepted norm. 1 to 8 indicates esophoria, 8 to 15 indicates exophoria. The following figure 8 shows the test of vertical and lateral phoria.



**Figure 8: Lateral Phoria Test**

Physiological and Environmental Screening The vision screening results (Table 3.8) indicated that a majority of participants required corrective lenses. The audiometric screening (Table 3.9) revealed a concerning prevalence of mild to severe hearing loss among the staff. Environmental assessments (Table 3.10) showed that illumination levels at several workstations were significantly below the recommended 500 lux, and noise levels were consistently within acceptable, but not optimal, ranges.

There are five levels distributed on the Audiogram in the form of rows, so that there is a

specific range for each level, and each level of properties and controls are as follows: -

1- Normal level: it's range of loudness is from 0 to 20 db. You can understand speech in a noisy environment and no amplification is needed.

2- Mild hearing loss: the range of hearing loss extended between 20 and 40 db. Some difficulty hearing in noisy environments, also, subject needs a higher volume on TV or stereo and his/her family members often notice first.

3- Moderate hearing loss: this level of hearing loss is between 40 and 70 db. You have difficulty understand speech in a noisy environment. Regularly, you ask people to repeat themselves. In general, you miss what people are saying and people say you talk too much.

4- Severe hearing loss: from 70 to 90 db is the range of hearing loss and you have difficulty understand speech in most situations. And you prefer avoiding noisy place.

5- Profound level: it extends between 90 and 120 db and you experience major problems in all communication. And this case requires visual assistance.

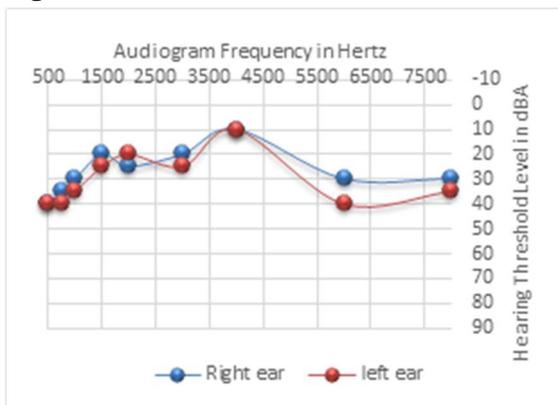
**Table 3.8: Optec Vision Test Statistics**

		Acuity both eyes	Acuity right eye	Acuity left eye	Depth perception	Color perception	Vertical phoria	Latent phoria	Near Acuity	Far Acuity	Acuity right eye	Acuity left eye	Latent phoria
N	Valid	19	19	19	19	19	19	19	19	19	19	19	19
	Missing	0	0	0	0	0	0	0	0	0	0	0	0
	Mean	7.95	6.26	6.05	5.79	7.47	4.05	9.42	8.42	8.32	6.58	9.61	
	Median	8.00	6.00	5.00	7.00	8.00	4.00	9.50	11.00	9.00	7.00	9.50	
	Std. Deviation	3.659	3.984	3.535	3.293	1.172	.598	1.812	4.936	4.435	4.247	2.826	
	Minimum	3	1	2	0	4	3	6	0	1	0	3	
	Maximum	14	14	13	9	8	5	13	14	14	13	15	

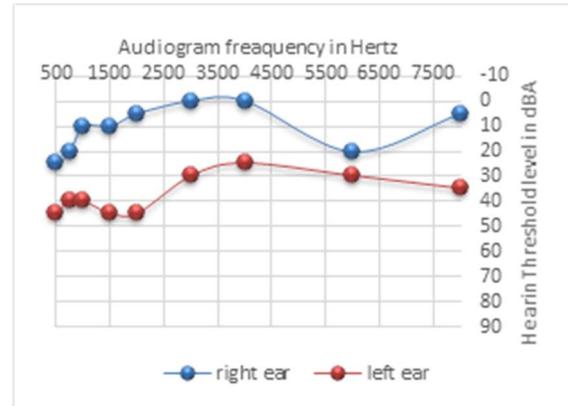
**Table 3.9: Audiometer Test Results**

Subject/Level	Normal	Mild	Moderate	Severel	Profound
Female	6	3	3	1	0
Male	5	1	0	0	0
Total	11	4	3	1	0
Percent %	58	21	16	5	0

There are two types (shapes) of hearing loss depend on the degree and pattern of hearing loss across frequencies (tones): symmetrical and Asymmetrical. Symmetrical means the degree and configuration of hearing loss are the same in each ear. Asymmetrical means the degree and configuration of hearing loss are different in each ear as shown in figures 9 and 10 below.



**Figure 9: Audiogram (Symmetrical)**



**Figure 10: Audiogram (Asymmetrical)**

**\* Discussion**

This study's central finding is that the standardized office environment is fundamentally misaligned with the physical characteristics of its users, creating a cascade of ergonomic risks. The high percentage of mismatches, particularly in seat height and depth, directly correlates with known risk factors for WMSDs, forcing employees into postures that strain the musculoskeletal system. Our findings are consistent with previous research by Ardahan & Simsek (2016) and Akinbinu & Ogidan (2019), who also identified significant ergonomic risks in office environments.

The environmental data adds another layer of concern. Illumination levels below 250 lux at some workstations, far from the 500 lux standard, can lead to eye strain, headaches, and reduced productivity, as highlighted by Aaras et al. (1998). Perhaps most striking is the high rate

of hearing loss identified. While the office noise levels were not excessively high, this finding suggests that the combination of ambient office noise and telephone use may contribute to long-term auditory damage, a factor that is often overlooked in office ergonomic assessments.

A primary limitation of this study is its small sample size, which is characteristic of a case study approach. However, the depth of the multi-faceted analysis provides a strong, data-driven snapshot of the risks inherent in this type of work environment.

The practical implications of these findings are clear. University administrators and facilities managers must move away from a "one-size-fits-all" procurement policy. Investing in fully adjustable chairs and conducting regular, professional audits of lighting and acoustic environments are not luxuries but essential preventative measures.

#### \* **Conclusion**

In conclusion, this case study provides quantitative evidence that the failure to apply ergonomic principles in academic offices is not a trivial oversight but a significant threat to employee health. The high prevalence of musculoskeletal,

visual, and auditory risk factors identified demands a paradigm shift away from standardized, static workstations. Future research should expand this multi-faceted assessment model to other administrative settings, but the immediate implication is clear: investing in adjustable, user-centered environments is a critical and necessary step for protecting the long-term well-being of the workforce.

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