An Ergonomic Workstation Analysis on Call Center Agents

Jonathan Edmon Abad
Industrial Engineering Department
De La Salle University, Manila, Philippines
Tel: (+632) 524-46-11 local 220, Email: jed.abad@gmail.com

Ma. Monica Galarido
Industrial Engineering Department
De La Salle University, Manila, Philippines
Tel: (+632) 524-46-11 local 220, Email: monica.galarido@gmail.com

Angelee Faye Tiu
Industrial Engineering Department
De La Salle University, Manila, Philippines
Tel: (+632) 524-46-11 local 220, Email: angeleefayetiu@gmail.com

Jazmin Chong Tangsoc
Industrial Engineering Department
De La Salle University, Manila, Philippines
Tel: (+632) 524-46-11 local 220, Email: jazmin.tangsoc@dlsu.com.ph

Abstract. The Call Center Industry is one of the fastest growing industries in the Philippines. According to Comcare (2012), a high risk of Musculoskeletal Disorder (MSD) in the workplace of call centers is evident because agents are using their computers on the entirety of their work shift. These agents practice different sitting postures while doing their jobs. This study aims to assess and improve the workstations being used by the call center agents of a call center company. The study involves the identification of office workstation components that cause musculoskeletal disorders and the identification of specific body parts that experience pain and discomfort. Among the tools that were used in the study to gather necessary data were the pain & discomfort survey, focused group discussion, rapid upper limb assessment (RULA) and the actual observation of the call center agents. It was found out from the results of the study that the company's workstation does not comply with the OSHA guidelines and standards, resulting to MSD pain, specifically on the lower back, upper back, neck, shoulder and wrists/hands. To address the issue, identification and application of specific ergonomic Pain Intervention materials were done to enhance the workstations which improved the call center's well-being, morale and productivity.

Keywords: workstation analysis, musculoskeletal disorders (MSD), call center, rapid upper limb assessment (RULA)

1. INTRODUCTION

A call center is a "customer-centered" business that handles different types of customer centered functions namely marketing, selling and servicing which are done through the use of different mediums such as electronic mailings, the World Wide Web, electronic messaging, voice messaging, fax messaging and the traditional mailing (Alava, 2005). The front liners of this business are called call center agents, who basically are the ones who makes and receives calls from customers or clients.

In Aileen Alava's (2005) report, "Updates on the Philippine Call Center Industry: The Issue of Sustainability", she regarded the call center industry as becoming known as the newest sunshine industry in the country. In 2005 alone, it has garnered earnings of around US$1 billion. Moreover, the industry is currently providing employment to around 96,000 Filipinos as call center agents. In 2010, it has been reported by the Board of Investments - Philippines (2011) that the Philippines overtook India as the world's back office for voice-based customer support and sales. Employment for this sector has

more than doubled every year, starting with 1,500 seats in 2000 and finishing with around 60,000 seats.

The Industry has shown great potential in its continuous growth in the Philippines and so, strengthening its stability can lead to a great advantage for the country. According to Herman Miller (2008), in order to know how to improve and maximize call center agents' full potential, there should be an understanding of the roles call center agents take.

Furthermore, in order to improve the performance of an agent, it is necessary to improve their workstation. According to the study conducted by Johnson Controls (2011), a comfortable, well-ventilated, well-lit, safe workplace increase productivity inasmuch as 16 percent while job satisfaction with 24 percent increase, with a reduction on absenteeism. The nature of the work of a call center agent, which is associated with prolonged sitting and repetitive tasks can result to pain and discomfort. Dr. Hedge, professor of ergonomics in Cornwell University, mentioned in his journal entitled "Ergonomics: Rx for Call Center", that compared to other office occupation, such as secretarial, call center agents does not have the liberty to stand up and grab a cup of coffee or walk around, stretch and relax (Read, 2001).

Humans cannot hold a certain position and sitting for long hours can lead to certain complications. In fact, according to Tina Cross (2009), no posture is good and ideal if it is maintained for long hours. Now, aside from the problem of call center agents having to sit in static position for long hours, there is also the issue of people working in awkward positions, such as slouching and arching (Smith & Tayyari, 1997). According to Smith & Tayyari (1997), most cases of postural problems in the office are also caused by awkward posture. Among the things that contributed to this problem includes the poor design of workstations or poor habitual postures. Also, some of the causes why people tend to allow awkward posture is because they do not have appropriate back supports, the seat and desk that they are using have improper heights, the things that they need are situated outside their reach and sitting for long hours.

Lastly, in a study conducted by Advicunla, Mayoralgo, & Sysunbin (2011), they discovered that incidence of neck pain among call center operators does not affect their job control. Furthermore, they also recommended that problems regarding neck pain should be addressed by analyzing their computer workstation design. This fortifies that workstation design must be addressed.

2. METHODOLOGY

2.2 Review of Related Literature

One of the mediums that were used to validate the need for the research are past studies that are related to the suggested topic. Case studies, journals, books, research papers and dissertations about ergonomics and occupational ergonomics were examined. Essential data were also gathered and used in the study.

2.3 Needs Analysis

The needs analysis covers the investigation process of the data that were gathered from the surveys, which were organized onto the quality function deployment. The main objective of conducting a needs analysis was to be able to determine the main components of the workstation that contributed to the pain and discomfort experienced by the users.

2.4 Identification of the Problem Statement

An identification of a problem statement is essential in any study for this is where the research will circulate. The results from the related literature and the survey were used to see the specific areas the study focused on. To better formulate a problem statement, the gap analysis result was used. Objectives were then formulated to provide a clearer direction on what path the study will focus on.

2.5 Design Considerations

2.5.1 Generate Alternative Designs

The understanding of the RULA results and the standards of workstation design brought about the generation of the alternative designs for the workstation. After generating designs, these were then evaluated according to their advantages and disadvantages and cost-benefit analysis.

2.5.2 Pain Intervention

The adding of various components to the current workstation of the agents to increase comfortability and efficiency was called the "Pain Intervention". These specifically addressed the top rated body parts that contributed to the pain and discomfort felt by the agents.

2.6 Pain Intervention Results and Comparative Analysis of Agent's Key Performance

The results of the Rapid Upper Limb Assessment (RULA) for the workstation without the Pain Intervention were compared to that of the workstation with the Pain Intervention. The scores that were gathered from this determined whether there is a significant improvement with the participant's posture upon installing the Pain Intervention. Aside from that, another indicator that was considered was the percentage decrease of pain felt by the participants. This would solidify whether the pain and discomfort felt by the participants were reduced because of the Pain Intervention. Lastly, the most important indicator considered was the significant increase of the agents' key

performance indicator after applying the Pain Intervention.

2.7 Final Proposed Guidelines and Implementation Plan

After discussing and analyzing the results of the Pain Intervention and RULA and combining it with the anthropometric data of the agents, these were then translated into the final guideline of the company. After which, the implementation plan was arranged.

2.8 Conclusion and Recommendation

Lastly, this part will discuss whether the problems being addressed in the study has been resolved. This section aims to answer the objectives of the study. The relationship between the significant factors affecting the call center agents as well as the occupational ergonomic chairs they are using, were connected with each other to testify the results of the product's performance.

3. DESIGN PROCESS

3.1 Design Considerations (Response Variables)

The variables that affect the pain and discomfort experienced by the call center agents must be measured to further enhance the recommendations that will be made by the study. Measuring the results gathered by conducting the study would be based on response variables, or commonly known as the dependent variables (Oxfordjournals.org, 2011).One of the response variables in the study is the difference between the initial pain and discomfort ratings of the participants to that after conducting the Pain Interventions. Another would be the comparison of the productivity of the treated and untreated group before and after the study.

3.2 Pain Interventions

A Pain Intervention was conducted for all the participants. Its main purpose was to attempt to relieve the pain being felt by the participants. To identify which specific Pain Intervention should be adapted to the current workstations, the specific body parts on where the pain arise for the agents were assessed as well as the exact time when the pain occurs. Providing specific products to help relieve the pain is the methodology used by the researcher in conducting the Pain Intervention.

It was said that a person would start experiencing discomfort or pain after 3 hours. This was when the product intervention would be put into the system. After that time, the agents will be studied in 1-hour intervals. According to the findings of the pain and discomfort survey conducted earlier in the study, the body parts that experience most pains are the 1) shoulder, 2) lower back, 3) upper back, 4) neck, and 5) wrists/hands.

All the Pain Interventions were derived from the OSHA standard. The backrest will help maintain the natural curvature of the spine; the footrest will help minimize awkward posture; and the mouse pad with wrist rest will help promote natural wrist posture.

3.2.1 Alternative Materials

There are different products that actually fit into the criteria of the study in choosing for the appropriate interventions to be used for the workstation of the call center agents but one of the main issues considered in choosing was the overall cost of acquiring the products. A lot of the said researched products come from different countries or from different online shopping websites while some come from local shops available almost on any mall in the country. In choosing for the Product Interventions, it is important that they are easily accessible and that there are a lot of stocks available in case the company's employee population grows. Because of these, the local products were chosen for its low price, accessibility and stock availability.

3.2.2 Kepner-Tregoe Design Analysis (KTDA)

This tool is used in order to know which of the specified Pain Intervention is the most useful or best fit into the specified musts and wants in the study to address the problems specified. The KTDA will be used to identify the right Pain Intervention materials for the 3 problem categories: upper & lower back, shoulder and neck, wrists/hands and lower legs.

3.3 Cost-Benefit Analysis

3.3.1 Cost

The total cost for the Pain Interventions is presented in Table 1. The total amount of which is Php51,110. This amount is a one-time cost. The useful life of each equipment is indicated below and is based from Gruenwald's (2002) article, *Governmental Accounting: Estimating useful lives for capital assets*.

3.3.2 Benefit

The benefit used in the study is based from the productivity of the agents, which are the total handled calls. The summary of the productivity of the Treated and Untreated Group for the month of October (23 working days) and November (20 working days) is presented in Table 2.

3.3.3 Payback Period

The payback back period is calculated in order to estimate how long the initial investment would be covered. Table 3 below shows the computation for the payback period.

3.3.4 Net Present Value (NPV)

Another tool to be used in conducting a cost-benefit analysis is calculating for the Net Present Value (NPV). This method helps evaluate the proposed solution whether it is worthwhile to invest in or not. In order to determine the annual value of the benefit, the monthly sales gained by the company with the amount of PhP 74,483.20 was multiplied to 12 months. This resulted to an annual sales of Php893,789. This value is considered to be the net value gained by the company on an annual basis. Moreover, referring to the cash flow diagram indicated below, it can be seen that in year 3 the net value decreased because of the cost incurred by replacing the Pain Interventions. The annual value of PhP893,789 is decreased by PhP17,860, which is the cost of replacing the mousepad and backrest, this resulted to a net value of PhP875,938 for year 3.

For the purpose of the study, the rate of return used for the computation of the NPV is 11% based from the annual rate of return of the company. The number of years, t, used in the computation is 5 years. Using the Cost, Php51,110, indicated in Table 1, the NPV is calculated and resulted to PhP3,159,482.85. This shows that the investment on the solution is worthwhile for the company.

Table 1: Monetary Amount (in Peso) for Intervention

Paint Intervention	Useful Life(in years)	Amount	Quantity	A*Q
CD-R King Footrest	5*	PhP350	95	PhP33,250
Mouse Pad	3*	PhP100	95	PhP9,500
Backrest	3*	PhP88	95	PhP8,360
Total Expense		PhP51,110		

*Note – Reference: Gruenwald's (2002), *Governmental Accounting: Estimating useful lives for capital assets*

Table 2:Benefit (Productivity of treated and untreated group for the month of October and November)

	Productivity for the month of October		Productivity for the month of November	
	Treated Group (n=30)	Untreated Group (n=30)	Treated Group (n=30)	Untreated Group (n=30)
Productivity Score (Total handled calls)	20,763	18,258	18,250	16,134
Revenue (in $) (Total Handled Calls * $0.8)	$16,610.40	$14,606.40	$14,600.00	$12,907.20
Difference in Sales between Treated and Untreated Group (in $)	$2,004.00		$1,692.80	

Table 3:Cost-Benefit Analysis

Cost (in Php)	Php51,110.00
Benefit per month (in $)	$1,692.80
Benefit per month (in Php) (Php44=$1)	Php74,483.20.00
Cost/Benefit	0.68
(Cost/Benefit)*(25 working days) = Pay Back Period	17.15
Payback Period (in days)	Approx. 18 days

Table 4:Summary of Cash Flow

Year	Benefit	Cost	Net
0		PhP51,110.00	PhP(51,110.00)
1	PhP893,789.00		PhP893,789.00
2	PhP893,789.00		PhP893,789.00
3	PhP893,789.00	PhP17,860.00	PhP875,929.00
4	PhP893,789.00		PhP893,789.00
5	PhP893,789.00		PhP893,789.00

4. EVALUATION AND ANALYSIS

4.1 Pain and Discomfort Survey Result (with intervention)

Each participant from both the treated and untreated group are asked to answer the pain and discomfort survey questionnaire in order to determine their pain and discomfort rating for each body part during the duration of their shift. The rating for pain and discomfort is presented in Table 5 below and the mean result of each rating for each body part is presented in Table 6 and 7.

As seen in Table 6 below, most of the agents are not experiencing discomfort even before starting their shift. However, it can be noted that both upper back and lower back pain rating, with a mean of 1.84, is higher than any other body part.

Moving on to the next column which presents the participants state after three hours of working, without a Pain Intervention, the pain and discomfort for the upper and lower back has progressed along with the other body parts. Moreover, it can also be noted that the range of the rating is from 3 to 4, which indicates that the participants are experiencing pain. To add to this, it was also observed that the participants started to occasionally stretch to relieve the pain and discomfort. After three hours of working, the participants went to lunch and are again asked to rate their current state after 2 hours of working until the end of their shift.

Table 5:Discomfort and Pain Rating

Rating:		
1	No Pain	(continue working)
2	Discomfort but tolerable	(continue working)
3	Pain but tolerable	(continue working)
4	Pain and barely tolerable	(stop working and stretch at the workstation)
5	Pain and intolerable	(stop working and walk around the office)

Table 6:Discomfort and Pain Rating of the Untreated Group

	Start	Without Intervention (3 hours)	Without Intervention (5 hours)	Without Intervention (8 hours)
Neck	1.31	3.66	3.56	4.28
Elbows	1.00	3.09	3.00	3.09
Forearms	1.09	3.19	3.28	3.39
Wrist/Hands	1.09	3.56	3.56	4.19
Thighs	1.09	3.28	3.09	3.41
Ankles/Feet	1.51	3.28	3.19	3.87
Shoulders	1.66	4.06	3.04	4.06
Upper Back	1.84	4.78	3.56	4.91
Lower Back	1.84	4.88	3.75	4.91
Hips	1.01	3.19	3.28	3.75
Knees	1.00	3.19	3.09	3.28
Lower Legs	1.81	3.19	3.28	3.09

It can be clearly seen that the participants pain and discomfort rating ranges from 3 to 4 and it can be noted that the upper back and lower back's rating almost reached a pain of 5 until the end of their shift. During this time, the participants are also observed to stretch in their workstation more often (the observation of the participants can be seen in the next section of the paper, the Postural Analysis).

The following Table presents the pain and discomfort rating of the Treated Group from the start of their shift until the end of their shift.

Similar to the untreated group, most of the agents are not experiencing discomfort before starting their shift. However, it can be noted that both upper back and lower back, with a mean of 1.68 and 1.76, respectively, has a higher rating than any other body part. It is followed by the lower legs (1.61), shoulders (1.34) and neck (1.21). Moving on to the next column which presents the participants state after three hours of working, with a Pain Intervention, the pain and discomfort for the upper and lower back has progressed but its rating ranges from 2 to 3 only, which indicates that the participants are experiencing discomfort but can still continue working. Furthermore, these were not only the body parts that had an increase in rating but other body parts as well. Moving on to the next two hours, by this time the agents are working a total of five hours, looking at the third column the ratings remain in the range within 2 to 3 until the end of their shift.

Table 7:Discomfort and Pain Rating of the Treated Group

	Start	With Intervention (3hrs)	With Intervention (5hrs)	With Intervention (8hrs)
Neck	1.21	2.06	2.32	1.28
Elbows	1.00	2.10	2.20	1.09
Forearms	1.19	2.28	2.27	1.00
Wrist/Hands	1.07	2.46	2.69	1.19
Thighs	1.08	2.09	2.36	1.42
Ankles/Feet	1.17	2.19	2.87	1.53
Shoulders	1.34	2.04	2.53	1.06
Upper Back	1.68	2.96	2.80	1.75
Lower Back	1.76	2.75	2.66	1.98
Hips	1.01	2.18	2.28	1.71
Knees	1.00	2.09	2.56	1.21
Lower Legs	1.61	2.24	2.39	1.09

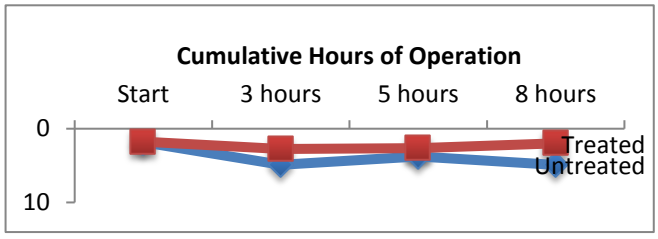

Figure 1 Lower Back Pain Ratings of the Treated and Untreated Group

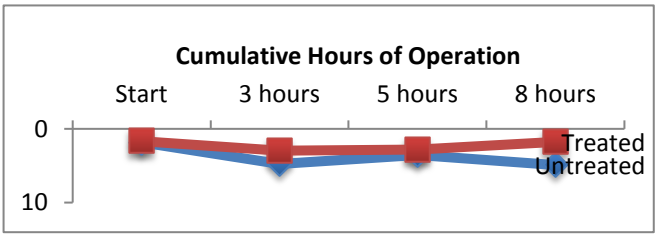

Figure 2 Upper Back Pain Ratings of the Treated and Untreated Group

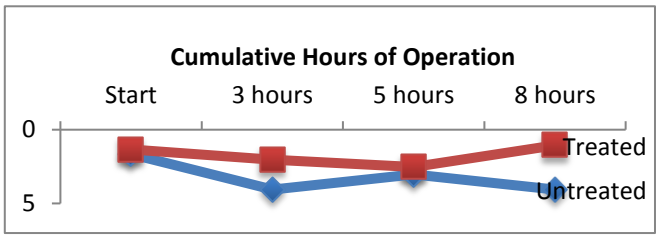

Figure 3 Shoulders Pain Ratings of the Treated and Untreated Group

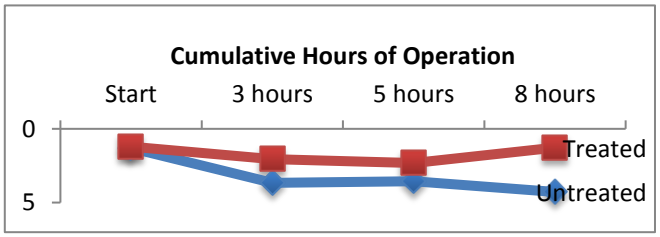

Figure 4 Neck Pain Ratings of the Treated and Untreated Group

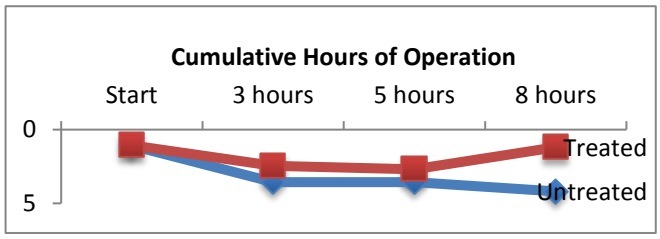

Figure 5 Wrists/Hands Pain Ratings of the Treated and Untreated Group

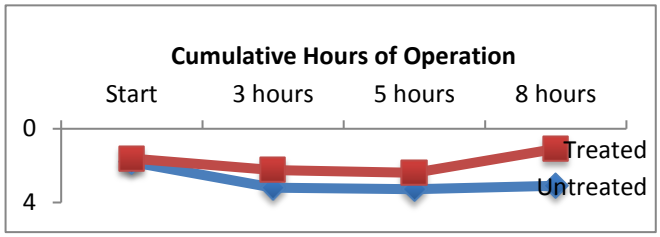

Figure 6 Lower Legs Pain Ratings of the Treated and Untreated Group

4.1.1 RULA Result (with intervention)

The scores of the 30 samples was obtained to have an average final score of 3, which means that there is still a need to further investigate. Although the posture of the agents is better with the use of the Pain Intervention, it was observed to not have a big impact on the overall score. What made a significant increase in the overall score were the static tasks (positions held longer than 10 minutes) and the repeated tasks (positions repeated more than 4 times per minutes).

The percent difference was computed to quantify the impact of the Pain Intervention with respect to the posture of the sample. This was obtained by subtracting the score without Pain Intervention from the score with Pain Intervention and dividing the difference by the score with Pain Intervention and multiplying the quotient by 100.

The study found that there is a difference from the present workstation to the workstation that has Pain Intervention. The score of the posture decreased. If the nature of the work of the agents is not static or if their tasks are not repeated many times per minute, the posture score will greatly decrease.

4.2 Analysis of Results

4.2.1 Analysis of Decrease of Pain and Discomfort Rating

As shown in Figure 7 below, all of the rating for pain and discomfort for each body parts have decreased. However, the top five body parts that have decreased the most are the forearms (22%), wrists/hands (20%), shoulders (22%), upper back (27%) and lower back (35%). It was observed that the pain and discomfort felt by the participants continuously decreased after the succeeding two hours.

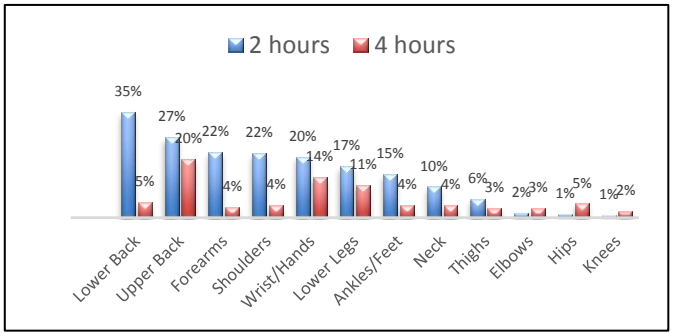

Figure 7 Percentage Decrease of Pain and Discomfort Per Body Part

4.2.2 Comparative Analysis of the KPI

4.2.2.1 Test for Normality

The call center company, BPO Premier, recorded the performance of their agents after the study. This is to determine if their agents are improving. Three factors were considered for this which are the following: average handled call times, employee attendance, quality of handled calls. The average handled call time was recorded by the supervisors every day for each agent while the quality of the handled call is determined thrice a week.

To determine if the performance of the agents is normally distributed, the normality test was conducted. Figure 8 below shows the graphical representation of the performance of the agents.

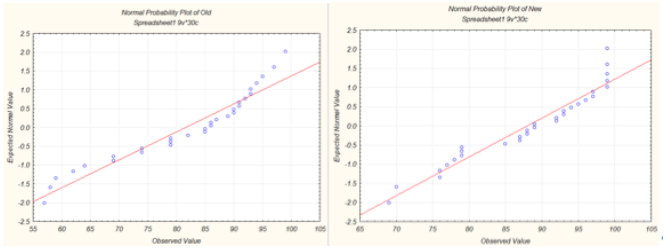

Figure 8 Performance of the agents 5th week of October (left) and1st week of November (right)

The old performance is the performance of the agents without the Pain Intervention and this was taken from the 1st week of October to the 1st week of September while the new performance, where the agents made use of the Pain Intervention, is gathered from the 2nd week of September to the 2nd week of November.

4.2.2.2 t-Test

Since the performances of the treated and untreated group are normally distributed, the t-Test was used to determine if they are statistically different from each other.

Factors that were included in the equation were the value of the mean and variance of the performances of the agents (see Table 8). The result would be significant if the computed t-value is more than the critical value at the 0.05 level. The critical value of the study is at 2.042, while the computed t-value is at 31.7312. Since the critical value has a higher value than the t-value, the researchers succeeded to reject the hypothesis that there is no significant difference between the workstation with the Pain Intervention and the workstation without the Pain Intervention. This means that the two performances have a significant difference and that the performances of the agents are better while they are working in the workstation with the Pain Intervention.

Table 8:Values from the t -test

	Untreated Group (n=30)	Treated Goup (n=30)
Productivity (Total Handled calls)	18,250	16,134
Average number of calls made per agent (X bar)	608.33	537.80
Standard Deviation	123.63	89.60
Variance	15,285.13	8,028.79

5. CONCLUSION

The Call Center Industry has become one of the fastest growing industries in the Philippines and it has been reported that many workplace injuries are accounted for in this specific industry. Previous studies such as that of Advicunla et al. (2011) has already proven that the workstation and various psychological factors contribute to neck pain among other pains. Specifically in the call center environment, the factors that contribute to the pain and discomfort felt by call center agents are determined to be the following: keyboard position, mouse and ergonomic chair. However, none have studied the effects of different workstation designs to the body parts of a person. This study explores the different components of the workstation that affects the different body parts of a person.

This study was conducted in a call center company and among the tools that were used for the analysis of the data gathered were the Pain and Discomfort survey, Rapid Upper Limb Assessment (RULA) and the Gap Analysis. This study also made use of the measuring tape and ErgoIntelligence to determine the anthropometric data and the RULA scores of the working positions of the participants. The call center agents were categorized per classification according to their specific anthropometry. Results that were gathered showed the different workstation components that affect the different body parts of the participants. Different alternatives to be used in intervening with the current workstation design were then studied. Combining the information from the classification and the alternatives gathered, the Pain Intervention was identified. Significance of these Pain Intervention was tested in the study and based from the data collected through the survey and RULA, the results were found to be significant.

The Pain Intervention, along with the guidelines for the correct positioning of each workstation component per specific anthropometric classification of the call center agents, were used and implemented for in the call center company, which significantly improved the performances of the agents.

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