**Height Adjustable Workstation Assessment**

**Final Design Report**

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Ohio University faculty and staff utilizing height adjustable workstations

# Introduction

 Recent studies conducted by the American Cancer Society have shown that extensive sitting in our daily lives can be very unhealthy, and it has been said that, “Sitting is the new Smoking.” A sedentary lifestyle can lead to health problems such as heart disease, obesity, type 2 diabetes, and muscular issues (American Cancer Society “Leisure Time Spent Sitting in Relation to Total Mortality in a Prospective Cohort of US Adults, 2010). This issue is common in the workplace where people spend long hours seated at their workstations. Height adjustable worktables are in some cases being incorporated across various work fields to get people out of their seat and on their feet to attempt to decrease the health risks associated with a mostly sedentary lifestyle.

 Currently, at Ohio University, some faculty and staff utilize height adjustable worktables in their offices. Figure 1 shows an illustration of what an adjustable table looks like. In order to receive one of these workstations from the university, a faculty or staff member must now have a note from their physician that says they have a medical issue that the physician believes would benefit from utilizing an adjustable workstation. Otherwise, faculty and staff must pay out of pocket to acquire their own height adjustable worktable.



Figure 1: Diagram of an Adjustable Worktable Steelcase Series 7

At this point, no in-depth follow up has been conducted on the impact of these worktables for those who have received them at Ohio University. Our team will measure the effectiveness of these tables in terms of pain reduction and productivity to determine if they are worth the investment. Our findings could encourage the willingness of the university to offer these workstations to its employees, they could help maintain the status quo, or they could encourage the university to explore other options for helping its employees reduce their pain and increase productivity.

# Business Reason

Height adjustable worktables are being used at Ohio University, but no follow up has been done to assess their effectiveness or cost benefit. The University is paying for the tables and their installation, yet there is no certainty as to whether or not they are increasing worker comfort, reducing worker pain or increasing productivity.

# Opportunity Statement

Determine if adjustable workstations decrease worker pain and increase productivity.

# Benefits

Our strategic business goal for this project is to assess if adjustable workstations increase worker comfort. This would benefit external customers because Ohio University faculty and staff can provide better service if they experience less pain throughout the day, possibly even at greater speed. Also, if we can prove that the workstations are effective and beneficial to the employees then the university might be more willing to provide employees with adjustable worktables.

# Cause and Effect Diagram

Cause and effect diagrams allow us to identify key process input variables (KPIVs) for data collection and analysis. The cause and effect diagram, shown in Figure 2, identifies some of the typical causes of pain at the workplace. By categorizing the KPIVs we can more easily decide which ones to focus on when collecting our data. The three input variables with red boxes around them are what we believe to be the most important. All of our survey questions relate to these possible input variables.



Figure 2: Cause and Effect Diagram with Potential KPIVs Marked

# Survey Layout

To collect data from individuals who currently use the height adjustable workstations, we created a survey consisting of six major sections:

1. General Information
	* This section will include questions that give us a general picture of the individual completing the survey: age, height, weight, etc.
2. Typical Workday
	* This section will include questions that give us an idea of what a general workday is like for the individual: shift length, time spent sitting, time spent standing.
3. Workstation and Posture
	* This section includes questions that tell us what type of adjustable workstation the individual has, how they got it, if they know how it should be adjusted, and if they follow those adjustment recommendations.
4. Pain and Discomfort
	* This section includes questions that ask what types, frequencies, and severity of pain they had with a regular workstation and now with an adjustable workstation.
5. Productivity
	* This section asks questions relating to how many breaks they require in a day to alleviate pain and how long these breaks are, both before and after receiving their adjustable station.
6. Personal Opinion Questions.
	* This section includes questions that give us a general sense of the individual’s opinion of their adjustable workstation.

We also chose a pain scale to measure the amount of pain an individual experiences at their workstation, adapted from a similar study of shoulder pain in the workplace by Orhan Korhan, titled *Work-Related Musculoskeletal Discomfort in the Shoulder due to Computer Use*. This survey can also be used to assess an individual’s workstation before receiving an adjustable table to perform a before and after analysis. The survey was conducted through the online survey platform Qualtrics to aid in the distribution of the survey and the collection of results.

# Process Flow

Figure 3 below outlines the steps by which we created our survey and then the data we received.

Figure 3: Flow of Our Research Process

# Workflow Diagram

Figure 4 shows the current workflow before our team’s intervention in the process. Once Marty installs the adjustable workstation, no feedback is received to let him know if the individual who received it has benefited from it or not.

Figure 4: Previous Workflow Diagram

Figure 5 shows the workflow after our team intervenes in this process. Once we create the survey, Marty will be able to utilize it for feedback after every installation. This will allow him to constantly analyze and determine if the individuals who receive the workstations are more comfortable and productive than they were before, or if he needs to look into alternative methods to help improve worker comfort around the university.

Figure 5: Workflow Diagram with Our Intervention

# Process Analysis

 Out of 23 individuals that we determined to be able to give us the most useful data for this project, 15 completed our survey. This is a small sample size but it includes as many individuals with the right qualifications who were willing to take part in our research.

 The first step in our analysis process included determining what factors were most influential in the amount of pain an individual experienced. We asked questions that related to 12 different factors which we believed could influence an individual’s pain. The results to these questions were numerically coded, like a Likert Scale. For yes and no type questions, yes responses were given a value of 1 and no values were given a value of 0. Questions relating to the frequency of certain events were given values in a similar fashion; never received a value of 0, rarely was 1, sometimes was 2, often was 3, and always was 4. These values were recorded and graphed with reported pain levels from which Pearson’s R correlation values could be calculated. Given our sample size and considering a confidence level of α=.1, and correlation value above 0.441 was considered significant. Table 1 shows all the factors we had questions relating to and their correlation values.

|  |  |
| --- | --- |
| **Factor** | **Correlation Value** |
| BMI | 0.488 |
| Days of Exercise per Week | -0.270 |
| Hours of Work per Day | 0.299 |
| Hours Spent Standing at Work | -0.010 |
| Hours Spent Sitting at Work | 0.032 |
| Number of Position Changes Each Day | 0.588 |
| Hours Spent Sitting at Home | -0.057 |
| Hours Spent Standing at Home | 0.500 |
| Been Instructed to Adjust Their Workstation? | 0.006 |
| Use a Floor Mat? | -0.012 |
| Age | 0.687 |
| Suffered a Previous Injury? | 0.168 |

Table 1: Factor and Pain Correlation Values

 From the table, it is apparent that only four factors seemed to be significant. However, one does not seem logical. It makes sense that an individual’s BMI, the amount of time they spend standing at home, and their age could all positively correlate to the pain that they currently experience. However, the number of position changes from sitting to standing throughout the day also had a statistically significant correlation to pain. This does not seem logical and seems to be insignificant. It is important that correlation does not always mean causation. It is possible that this could in some way contribute to an individual’s pain, but it does not seem likely.

 The next step in our process analysis involved determining the difference between the pains experienced with a traditional non-adjustable workstation as opposed to a height adjustable one. As this data was collected after the individuals received their height adjustable workstation, it is important to keep in mind that this comparison was made using data which the respondents had to think back and remember. It is a useful comparison but not as accurate as it could have been if we had the opportunity to survey them earlier.

 We asked questions which related to the frequency and severity of pains experienced. Figure 5 shows how the frequency of pains in each of eight body areas we asked about changed. For the frequency scores, as described previously we said that 0 equals never, 1 equals rarely, 2 equals sometimes, and 3 equals often. Average values for each area of the body were calculated and graphed. As can be seen in Figure 6, the average frequency of pain decreased in all areas except the legs and the feet, where it stayed constant and increased, respectively. This result was expected for the lower extremities, as standing more often than previously will certainly put more stress on those areas of the body. For the other six areas, we believe the decrease in pain frequency is significant as individuals who request adjustable workstations most often do so to help relieve pain in one or more of those areas.

0=Never 1=Rarely 2=Sometimes 3=Often

Figure 6: Pain Frequency

 Figure 7 shows how the severity of pain changed in the survey respondents. Relating to severity, we only asked if the respondent experienced severe pain in that body area. This does leave some question as to what they each would personally describe as severe. However, the results received are very encouraging. Respondents only reported increased severity of pain in one area, the feet. This once again was expected and is perfectly logical. In all other areas, the number of respondents reporting severe pain decreased and most reported no severe pains at all.

Figure 7: Severe Pain

Relating to productivity, we asked how many breaks the individual had to take during each day to relieve pain. We also asked how long these breaks were. From this we calculated how much time each individual saved each day by taking fewer and shorter breaks to relieve pain. This does assume that the time saved will be spent working and not just used to other time wasting activities. Figure 8 shows how the frequency of breaks decreased. Figure 9 shows how the length of breaks also decreased.

Figure 8: Frequency of Breaks

Figure 9: Length of Breaks

# Cost-Benefit Analysis

 In completing a cost-benefit analysis for height adjustable workstations, we looked at the price of an adjustable workstation and the possible benefits associated with it. Through the research that we did, we had much difficulty finding the studies which reported the rate at which these workstations could decrease musculoskeletal claims. This area is where the largest benefit from purchasing adjustable workstations could come from, but it did not seem correct to include it without being able to find better information. Therefore, we chose to focus our cost-benefit analysis solely on the productivity increase it could bring about. Also, all the respondents reported utilizing push-button programmable workstations which we know to cost $1400. Retrofit adjustable kits are available for a slightly cheaper price, around $800, but as no one who completed our survey utilized one, we chose to only consider the more expensive unit.

 From the results shown in Figures 8 and 9, we were able to calculate that a conservative estimate of the amount of time saved each day was 7.7 minutes. To turn this into a dollar amount, we had to determine and average salary and convert that to a minutely wage to determine the amount of money each day. We asked all survey participants what type of profession they had and then researched to find average salaries for those positions. Professions ranged from professors to accountants to procurement and annual giving employees. After determining average salaries for these positions, the average of that was $59,000. Assuming 251 working days in a year with 8 hour workdays, this equated to $29.45 per hour, or $0.49 per minute.

 Based on the wage per minute, we determined that $3.78 could be saved each day through an increase in productivity. Over the course of a year, this equates to about $948. Given that the cost of a push-button programmable workstation is $1400, this results in just a 1.47 year payback period for the investment. In the great scheme of things, this is a very short payback period. Figure 10 shows this payback period and estimated savings over a 5 year period. We chose to look only at 5 year length of time because that is how long the workstations are under warranty. They should last longer, but this is a safe estimate for the life of a table without any out of pocket expenses if something should malfunction or stop working on it.

Figure 10: Adjustable Workstation 5 Year Payback

# Findings from Other Studies

 While working on this project, we found two studies in particular with experimental methods similar to what we would have liked to have implemented if we had the means to do so. One study, titled *Effects of an Electric Height-Adjustable Worksurface on Self-assessed Musculoskeletal Discomfort and Productivity in Computer Workers* was conducted from 2003 to 2004 by Alan Hedge of Cornell University. In this study, 33 computer workers took part and were surveyed while using a traditional fixed height workstation. Questions were asked relating to their levels of musculoskeletal discomfort and work patterns. Then, participants were given an electronic height adjustable workstation for 4-6 weeks and surveyed again. After the data was analyzed, they found when using an adjustable workstation, there was a significant decrease in the severity of pain in the shoulders, neck, upper back, lower back, forearms, wrists, and hands. However, they found the frequency of pain in these same areas increased. Throughout the day, levels of discomfort increased at a lower rate. Over half of participants said that the adjustable workstation “somewhat/definitely helped” with their productivity and over 80% said the preferred the adjustable workstation to their traditional workstation (Hedge 2004).

 The other study we found was titled *Reducing Occupational Sitting Time and Improving Worker Health: The Take-a-Stand Project*, conducted in 2011 by Pronk, Katz, Lowry, and Payfer. This study has a very similar experimental method. They surveyed individuals utilizing fixed height workstations, gave them an adjustable workstation and surveyed them again, but then they replaced the fixed height workstation and surveyed them one last time. This study had similar findings as well. Upper back and neck pain was reduced by 54%. Workers reported increased mood and vigor along with decreased depression and tension. Once the fixed height workstations were replaced, all of the positive effects associated with the adjustable workstation went away (Pronk, et. al 2011).

 We believe the findings from these studies are significant because their experimental methods are much more in depth and they were able to survey participants before and after receiving an adjustable workstation, something which we were unable to do in our own project. The findings from these studies are also in line with the results we found, giving more weight to our findings.

# Personal Opinions of Respondents

 As one section of the survey was devoted to personal opinions, we got some valuable information regarding respondent’s qualitative assessment of their workstation. When asked if they feel more productive, 73% responded that they do and 27% reported no change in productivity. 93% reported that the overall comfort has improved and 7% reported no change in comfort. When asked if they would recommend an adjustable workstation to others, with or without pain, 100% said they would recommend them.

# Conclusions and Recommendations

 Overall, personal opinion of height adjustable workstations were overwhelmingly positive. Our findings support that these workstations reduce pain in the upper body and decrease the severity of pain, except in the legs and feet. Frequency of pain decreased in all areas except the legs where it stayed constant and the feet where it increased. With an adjustable workstation individuals took fewer and shorter breaks to relieve pain. These findings lead us to believe that height adjustable workstations are a sound investment to improve worker comfort and productivity.

 Based on our findings and research, we recommend that Ohio University help facilitate any individual who wants an adjustable workstation in getting one. They improve worker comfort and productivity. The payback period for one unit is conservatively estimated to be 1.47 years and the benefits will be far greater if they can decrease the number of medical claims for work related musculoskeletal claims. We also recommend that the university attempts to observe individuals for a longer period of time to see how utilizing an adjustable workstation affects individuals in the long run.

# References

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