Emerging Health Concerns with Prolonged Computer Usage

Efforts to implement ergonomic desktop wallpapers within Rutgers University computer labs

Tag Words: Computer; Usage; Ergonomics; Injury; Musculoskeletal; Repetitive; Stress; Workplace; OSHA; Posture; Vision; Syndrome

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Summary

Increasing usage of computers today has brought about the development of numerous health concerns. Health concerns resulting from poorly designed workstations, improper posture, and prolonged inactivity are a growing trend in the workplace. Disorders such as carpal tunnel syndrome, computer vision syndrome, and musculoskeletal pains are among the top reported injuries. Due to these growing concerns organizations such the Occupational Safety and Health Administration (OSHA) set criteria for employers and corporations to follow. Such criteria include positioning and use of workplace equipment to maximize ergonomic efficiency and productivity. While OSHA makes large-scale improvements in the workforce, we are applying these principles to a small scale community such as Rutgers to educate, and prevent similar injuries. (RH/PL)

Video Link:

http://www.youtube.com/watch?v=B7ECfltJauU

OSHA and the Ergonomics Program Standard

(RH) The Occupational Safety and Health Administration (OSHA) has been serving the United States of America since 1970. In December of 1970, President Nixon signed the Occupational Safety and Health Act into law. This act ensured that employers created a safe working environment for their employees. Upon its creation OSHA was given the ability to create and enforce workplace health and safety standards [7]. Section 5 of the Occupational Safety and Health Act requires that each employer create a safe, hazard free working environment for their employees. Section 5 also states that every employer must comply with the rules and regulations created in the Occupational Safety and Health Act of 1970 [3]. OSHA has created a set of

guidelines to determine if a workplace is considered "unsafe" for its employees and whether it is appropriate to take action and remove the hazard(s). The first criterion is that there must be a hazard. The second is that the hazard must be obvious and should have been recognized by the employer and within the industry. Third, the hazard is capable of causing serious harm or death. And fourth, the hazard must be one that is correctable [7]. Section 5 is also known as the "general duty clause" and is used to cover hazards that OSHA does not have specific standards for (Kris Hoffman).

In the year 2001 the Ergonomics Program standard was put into place by OSHA under the Clinton administration. This standard addressed the risks of employees being exposed to ergonomic hazards in the workplace [4]. The standard recognized that every year hundreds of thousands of workers are unable to continue their work due to musculoskeletal disorders (MSDs) [4]. Section 6 of the preamble acknowledges that assessment of risks and ergonomic programs have been shown to decrease the number and severity of musculoskeletal disorders related to computer usage [4]. As a matter of fact the video display terminal (VDT) hazard identification tool was created primarily to target risk factors related to computer use! The VDT hazard identification tool was basically a checklist that employers could use while working with their employees to determine if their workstation needed to be reevaluated and redesigned. For example, the VDT hazard identification tool checklist provides clear and detailed instructions for the employer on how to design and setup a computer workstation. Upon completion, the workstation complies with the control requirements of the Ergonomics Program standard. The checklist contains virtually any hazard that can be encountered while working at a computer workstation and how to correct the problem. One of the beauties of this VDT checklist is that it was much more flexible than some of the previous checklists. This checklist is known as a "risk factor-based" rather than equipment-based checklist. Equipment based checklists require that employers provide their employees with specific equipment in order to be cleared by OSHA standards. Risk factor-based checklists are more flexible and do not require specific equipment to pass OSHA's standard. For example the standard may question the employer if their employee's heads and necks are in straight, neutral position, rather than an awkward position that may result in a MSD. If the employer can supply their employees with a safe working condition, then in the eyes of OSHA that is sufficient for the standard [4].

Preventative Measures and the End of the Ergonomics Program Standard

There are many ways (controls) in which an employer could reduce musculoskeletal disorders in their work environment. These controls are known as engineering, work practice, and administrative controls. OSHA stated that any combination of these controls could be used to reduce the MSD hazards [4]. OSHA allowed this broad range of preventative measures due to the large amount of working conditions that the standard would apply. The final ergonomic standard defined engineering controls as controls that physically alter the working environment for employees in such a way as to prevent musculoskeletal disorders [4]. These changes could be as simple as raising a monitor vertically by using a phone book, or placing wooden blocks under desk legs to accompany a tall employee. These 'quick fixes' would be both very effective and inexpensive for the employer. Or sometimes a complete revamp of a workplace would be needed to enhance productivity and reduce workplace MSDs [4]. This method of control was noted by OSHA as the most effective method [4]. Work practice controls are simply changes in the way an individual performs the physical aspect of their job in order to decrease the likeliness of an MSD.

For example, an employee may be provided with an ergonomically designed chair, but if they are unable to use it properly, then the hazard for an MSD is still present. Another example of work practice controls could be the utilization of neutral positions and postures. By having your wrists straight and relaxed while typing, or bending your knees while lifting heavy objects, the employee would be reducing the chances of an MSD. The use of "micro-breaks" would also reduce muscle fatigue and therefore reduce the likelihood of an MSD [4]. Enforcement of safe work practices by the employer is critical in the effectives of this control. Finally, administrative controls are work policies put in place by the employer. They are designed to reduce employee exposure to risk factors by altering the work of the employee. For example the employer may reduce the duration that an employee is exposed to a potential risk [4]. This would obviously be the most difficult, expensive, and time consuming control used to reduce MSDs.

According to OSHA the most effective control to be used to prevent MSDs was engineering controls. As previously mentioned this would include changing the physical workplace for the employee. If a hazard was recognized in a workplace the employer had many options on how to eliminate the hazard. These were known as control approaches. For the hazards in maintaining an awkward posture, OSHA provided a list of controls. Some of the fixes included raising / lowering the workstation or workers position, repositioning an object to allow for neutral posture, providing lumbar support for seated workers, providing anti-fatigue mats, and foot rests. A major component of this standard was designed to make the transition to a compliant workplace as easy as possible for the employer. The employer was given up to four years to implement permanent controls. Having this large window of time allowed for employers to plan, obtain, and implement the necessary controls in order to be in compliance with the Ergonomics Program Standard [4].

The Ergonomics Program was estimated to protect 27 million workers in over 1.9 million workplaces from repetitive motion injuries and illnesses alone [2]. The standard was signed into law by President Clinton on January 16th 2001, however, only two months later Congress used the Congressional Review Act to repeal the ergonomics standard (under President Bush) [2]. This is the one and only time a law has been repealed by Congress. Many speculate that the law was repealed due to a very "business friendly" approach by Congress [2] (Kris Hoffman). The Congressional Review Act also prevents OSHA from issuing a revised standard that is practically the same as the Ergonomics Program standard. This does not mean that OSHA does not have the ability to give citations to employers if there is a serious hazard caused by ergonomic conditions. This is where the general duty clause is used. Kris Hoffman is OSHA's area director in Parsippany New Jersey and stated that the general duty clause is used to cover hazards that OSHA does not have specific standards for, and ergonomics is one of them (Kris Hoffman). This means that even though Congress repealed the ergonomics program standard, workers are still covered under section 5 of the Occupational Safety and Health Act.

OSHA's Ergonomic eTool

Even though there is no longer a standard for ergonomics in the workplace, guidance is still available and provided to the public by OSHA. An eTool can be found on OSHA's website which addresses the hazards of improper computer use and related items during everyday work procedures. This eTool is an interactive webpage that provides users with the necessary information needed to develop a risk free workstation. It makes the user aware of many possible risks, and provides effective solutions to remove them. In the following paragraph, OSHA's

recommendations / solutions will be discussed on how to prevent musculoskeletal disorders created while working on a desktop computer for prolonged durations of time.

In order to successfully setup a hazard free workstation OSHA suggests many solutions. The main goal of these solutions is to create a good neutral working position. The proper neutral working position is one in which the individuals joints are naturally aligned therefore creating a comfortable working posture [1]. Working for prolonged periods of time in a neutral working position reduces the risk of developing a musculoskeletal disorder. Working in non-neutral (or awkward) positions can strain and irritate the bone-tendon-muscle connections. These positions also cause tendons to stretch and become fatigued, and nerves and blood vessels to become pinched and restricted [1]. While attaining the correct neutral work position one needs to consider the position of every part of their body. The hands, wrists, and forearms must be straight, in-line, and parallel to the floor. The head must be looking straight forward, balanced, and generally is in-line with the torso. The shoulders must be relaxed with the arms hanging normally at the sides. Elbows must stay close to the body and are bent at 90-120 degrees. The feet must lay flat on the floor, or are supported by a foot rest if the height of the desk cannot be adjusted. Utilizing the appropriate lumbar support will completely support the back. The thighs and hips should also be parallel to the floor, and are supported by a well-padded seat. Following these instructions will create a safer work environment for the employee. It is important however to keep in mind that regardless of how correct your posture is, a musculoskeletal disorder can develop from working in the same position / posture [1]. Specific muscular hazards while working on a computer will now be discussed.

Placing the computer monitor at the appropriate position is critical in preventing injuries in the neck, shoulders, and upper back. If the monitor is placed too far away from the user it may cause the user to lean forward in order to read small text. Leaning forward removes the torso from the backrest and therefore removes support. The computer monitor should be placed directly in front of the user so the entire upper body faces the viewing screen. If the monitor is placed to the side at an angle greater than 35 degrees muscles in the neck will become strained. The monitor also needs to be placed below eye level. If the monitor is placed above eye level the muscles in the neck, back, and shoulders force you to work in an awkward posture [1]. Working in an “awkward posture” causes muscles to stretch or compress which results in muscle exhaustion. Fatigue, pain, and possibly musculoskeletal disorders result from continuous use of awkward postures [1].

Keyboard placement is also very important while using a desktop computer. With the arms resting comfortably at the side, the keyboard and all other equipment should be at elbow height. This prevents the keyboard from being too close or too far away from the user. This setup will naturally allow the shoulders to be relaxed and provide the arms and wrists with a neutral working position. Keyboards that are small in size are likely to create contact stress in the users wrists. Contact stress occurs internally, externally, or both at the same time. Internal contact stress results when tendons, nerves, or blood vessels are pulled and restricted [1]. External contact stress is caused when a body part continuously rubs against the workstation. The result of external contract stress is irritated nerves and possibly constricted blood vessels [1]. While typing on a small keyboard the wrists are bent in order to reach all keys on the keyboard. This fatigues the muscles of the wrists and can quickly lead to a musculoskeletal disorder. The user can eliminate awkward angles by raising or lowering the keyboard to attain a neutral wrist position

that prevents internal and external contact stress. Ergonomic keyboards can also replace standard keyboards and reduce almost all contact stress on the user's wrists and forearms. After proper placement of the keyboard, the mouse should be placed right by its side. If the mouse is not placed directly next to the keyboard stress in the muscles of the arms and shoulders will increase. This is due to the repetitiveness of reaching for the mouse in between typing on the keyboard. Over time a musculoskeletal disorder may emerge [1]. Under some circumstances the mouse will not physically fit besides the keyboard at the workstation. In this case the user can use a keyboard with a pointing device built into the keyboard (like a laptop keyboard). A mouse tray can also be installed on the keyboard tray to provide space for the mouse.

Some users need to read documents, books, articles, etc, while working on the computer. Workers who find themselves doing this often should incorporate the use of document holders into their work technique. Document holders are useful tools because they allow the user to keep printed materials at eye level, and next to the monitor. When located correctly, the document holder reduces tension in the upper neck and back and creates a neutral working posture [1]. The most favorable position for the document holder should be at the same height and distance as the monitor. Document holders that attach directly to the side of the monitor are available for users. The holder can also be placed directly under the monitor if the document being read from is heavy such as a textbook [1]. The only other hazard to be aware of while placing the document holder is glare on the reading material.

The desk is one the most important pieces of machinery needed to create a neutral working position. A well-designed desk will provide the user with ample space for their legs, allow proper placement of the computer monitor, and minimize awkward postures and exertions [1]. If the user has a limited amount of workspace on the desk surface, they may be forced to put components such as the keyboard or mouse in places that cause awkward postures and can lead to discomfort and possibly MSDs. The work surface should allow for the monitor to be twenty to forty inches away from the user and be placed directly in front of the user at or just below eye level. One of the greatest hazards of computer desks is the hard, angled edges of the workstation that come into contact with the user's arm or wrist [1]. This edge causes great contact stress on the user and can constrict blood vessels in the arms or wrists. Padding the hard workstation edges with low-cost materials such as pipe insulation is a quick fix. The area under the desk is also important to the user. If clutter such as boxes is placed under the desk it may prevent the user from sitting with proper posture while in their chair. It may force the user to sit further away from the desk, which results in upper body fatigue, low blood circulation, and internal / external contact stress caused by restricted movement [1]. The user would need to stretch and reach in order to perform computer tasks. If the work surface of the desk is too high or low it needs to be adjusted accordingly to prevent awkward postures. Inserting risers under the legs of the desk, or removing the drawers directly above the legs allows for additional thigh clearance.

Chair selection is a vital component in acquiring the neutral body posture required for the minimization of musculoskeletal disorders while working on a computer. An acceptable chair design supports the back, legs, and forearms of the user, which in turn removes risks of non-neutral postures [1]. The backrest of the chair should have lumbar support to fit the natural S curve of the spinal cord. If no lumbar support is available a rolled up towel or back support cushions should be used temporarily [1]. The backrest should also allow the user to recline 15°, and lock in place for resistance to lower back movement. The backrest should also be adjustable in order for

shorter users to have back support while still utilizing the full support from the seat. The seat of the chair must be positioned so that the user can place their feet flat on the floor with their knees slightly higher than the seat pan of the chair. If the seat pan is too high and the user cannot reach the floor with their feet, the user may slide forward and remove their back from the backrest. Without the back support awkward postures and positions will follow and fatigue, restricted circulation, swelling, numbness, and pain can result [1]. A footrest may be needed in order to elevate the knees slightly higher than the seat pan to relieve pressure on the back of the legs. The armrests of the chair should be adjustable, especially if used by multiple workers. If the armrests are incorrectly positioned, awkward postures will certainly result [1]. The bottom line is that the armrest, as well as the other parts of the chair must be able to be adjusted to the needs of the user. A relaxed, neutral posture position should be the goal of all adjustments made to the chair.

Improper adjustment of the chair can lead to more than musculoskeletal disorders; it can lead to a new type of deep vein thrombosis known as e-Thrombosis. Deep vein thrombosis (DVT) is the formation of a blood clot in a vein that is deep inside the body, usually in the legs [6]. However, DVT can also occur in the pelvis and arms. DVT first became associated with long periods of sitting during World War Two, when Londoners sitting in air raid shelters suffered accelerated rates of fatal embolisms [5]. Dr. Richard Beasley and colleagues described the first reported case of e-Thrombosis in *The European Respiratory Journal*. A New Zealand man developed DVT after periods of sitting at a computer for up to 18 hours a day! The journal article reveals that the popularity of computers may pose problems for those that use them for prolonged periods of time. Beasley suggests that it may be similar to the situation with an increased risk of blood clots with long distance air travel. It was not publicly recognized until there was publicity with individual cases such as with this New Zealand man [5].

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Ocular Health and Vision

(PL) Individuals working for prolonged periods of time with computers often exhibit high levels of ocular stress and discomfort. These symptoms are most notable in the work place where workers are engaged for at least eight hours in front of the screen. Discomfort and related symptoms have become so prevalent in the workforce that eye/vision problems resulting from near-sighted work is known as Computer Vision Syndrome (CVS).[4] "CVS symptoms occur as a result of visual interaction with a computer monitor which stresses the visual system.[2]"

When an individual is working at a computer, processes in the eye such as movement, alignment, and focusing utilize repetitious muscular activity. Computer vision symptoms usually occur because the visual demands of the task at hand are beyond an individual's abilities. While working, frequent eye movements from various objects, like documents or the keyboard, to the screen are used. As the eye moves from each object, it also changes focus to maintain a clear image. These processes occur repeatedly and, over time, can eventually decrease the flexibility of the ocular muscles.[7] Studies have found that 50-90% of computer users experience some form of eye or vision problems.[11,10] The most commonly reported symptoms are headaches, eyestrain, blurred vision, double vision, and neck pain[2]. The repetitious nature of work serves as the driving impetus for many of these symptoms.

Working on a computer is much different from reading printed documents due to the way computer monitors are designed. Aspects such as screen resolution, contrast, brightness, glare, working distance, and viewing angles can all contribute to the symptoms so many workers experience. Letters viewed on a monitor are not as defined as those on printed paper and the presence of glare creates extra stress on workers' eyes. As the age of the individual increases, visual difficulties become more pronounced and place a greater demand on the visual system.[4,7]

From a survey of optometrists, it was found that 14 percent of their patients experienced some form of computer-related eye or vision problem.[8] Likewise, over 10 million primary eye exams are conducted per year as a result of visual problems at work[1]. Though some visual problems are linked to computers, they are neither new nor isolated to computer usage. According to the American Optometric Association (AOA), "Uncorrected vision conditions, poor computer design, workplace ergonomics, and a highly demanding visual task can all contribute to the development of visual symptoms and complaints.[4]" Individuals with pre-existing conditions, such as dry eyes, often find that computer work will aggravate their symptoms more due to staring, elevated gaze angle, and decreased blinking[2].

While majority of workers experience eye and vision problems, many of these symptoms can be reduced or eliminated by taking preventative measures like adjusting the placement of the computer monitor, using proper lighting, and seeing an optometrist.[4] The AOA suggests that having eye care services provided for employees through a third party program will remove financial barriers and allow everyone access to eye care[3]. Eyeglasses used for day-to-day activities sometimes may not meet the demands of work. Under these circumstances, there are specialized lenses that can be prescribed to alleviate visual stress at work. These lenses contain special tints or coatings that can reduce stressful light patterns and maximize comfort. Ocular difficulties with focusing and coordination cannot be corrected with glasses, however, optometric vision therapy designed to treat binocular vision problems is available[5]. Many symptoms of CVS can be alleviated by simply implementing proper ergonomic design in the work place. One of the most underestimated factors in the workplace is lighting. The most common issue is that the lighting was originally designed for desktop work rather than computer

work. Improper lighting creates glare on the monitor as well as unbalanced light between the room and the monitor. For example, monitors with dim screens require lower light levels. At the same time, adjusting the screen brightness and contrast to levels that balance with the room's lighting can provide maximum visibility and clarity. Generally, lowering screen brightness will reduce the stress placed on an individual's eyes. To control the amount of glare and reflections cast on the screen, workers should never be positioned in such a way that their back is facing a window. Blinds and curtains should be used to allow the proper levels of light from the windows and specialized screen filters can be applied over monitors to reduce glare and reflection.[4] Finally, adjusting the workstation to each individual's needs is crucial to maximize comfort and efficiency. Improper viewing distances and angles create awkward postures and eye strain when viewing a computer screen. Monitors should be placed at arm's length to create a viewing distance of approximately 20-28 inches. The monitor should also be placed lower to create a 15 degree downward gaze. This is the optimal position for the eyes to focus. Ultimately, the top of the screen is below eye level and is tilted back slightly away from the user.[9] Higher gaze angles (looking up at the screen) create greater strain on the eyes' focusing mechanism, whereas downward gaze angles (looking down at the screen) reduce eye strain.

Usually, vision problems experienced by workers are not permanent and gradually improve after work. However, most workers find that their symptoms resume when they return to work the next day, while some may continue to experience persisting symptoms without end, like blurry vision. If this recurs repeatedly without correction, the symptoms have the potential to worsen with future computer use. The visual system is not like other body processes where repeated exposure allows it to adapt, but rather the problems become more significant over time.[7] Ocular and visual problems during work can be detrimental to work productivity/quality and job satisfaction.

Though computer workers make up the majority of those affected by CVS, this statistic is rapidly changing. When computers were first introduced, they were primarily used by adults. Today, millions of children and young adults are increasingly using computers for both education and recreation. While children can experience the same symptoms as adults, there are many factors that make them even more susceptible to CVS than adults. They have less self-awareness and are more prone to using a computer for prolonged periods without breaks (e.g. playing video games). They are more adaptable and will ignore problems that adults would otherwise address. For example, a child playing a game with a large amount of glare will ignore it and tune it out, whereas an adult would consider rearranging the surroundings. Lastly, children are much smaller than adults and most computers are set up for adult height. This causes children to look upward at the monitor or sit too closely.[5] Further research and accommodation should be considered to address the growing eye and vision problems workers and young adults are facing.

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Repetitive Stress Injuries: Carpal Tunnel Syndrome

As people are spending more time on the computers, they are also inevitably spending more time on the keyboard. The trend has shifted towards sedentary work environments, with individuals' eyes and hands performing most of the day's activities. This had led to a surge in "repetitive strain injuries" among individuals, especially in the workforce.

Repetitive Strain Injury (RSI) is a condition that can occur when the hands and wrists frequently perform repetitive tasks like typing and clicking. More specifically, it is a cumulative trauma disorder that is aggravated by repetitive and awkward hand movements. Prolonged aggravation results in damage to the nerves, muscles, and tendons of the affected area. RSI symptoms are often painful and can lead to weakness and numbness. Severe conditions will impair basic motor functions.[6] Frequent computer users are generally at risk, though RSI can easily be prevented.

Poor posture, poor technique, and overuse are the primary causes of RSI and are often exacerbated by poorly designed workstations. Each year, thousands are diagnosed with illnesses directly related to poorly designed workstations.[1,6] Initial warning signs of RSI are tingling and numbness in the hands and fingers, inability to grasp objects between the thumb and fingers, and pain in the wrist. One of the most debilitating illnesses to fall under repetitive strain injuries is Carpal Tunnel Syndrome (CTS). CTS affects the tendons, nerves, arteries, and veins of the wrist and upper arm and occurs when the median nerve becomes pressed at squeezed at the wrist.[2,7] Decreased muscle bulk in the thumbs and decreased sensation are characteristics of advance stage RSI. If left untreated, these symptoms can persist throughout life and permanently disable the hands, wrists, and/or fingers.[7]

To prevent RSI, there are two areas to focus on: individual technique and the workstation. Three principles to follow to maintain proper technique are to keep your wrists straight, let your

hands float, and don't strain your fingers. When the wrists are straight, less strain is put on the tendons and nerves. Allowing your hands to float enables you to reach more keys, keep your wrists straight, and distribute work across different muscles. Rather than straining your pinky to reach certain keys, move your entire hand and use your stronger fingers (index or middle finger) to reach. Instead of using one hand to hit multiple keys at once (e.g. Ctrl+V), use two hands. In the workstation, the keyboard should be positioned above the thighs with the elbows bent at 90 degrees and forearms roughly parallel to the ground. The mouse should be located to one side of the keyboard to discourage leaning, stretching, or hunching in the direction of the mouse.[6]

Regarding workstations, there is an alternate keyboard layout available known as the Dvorak layout, which is actually much more ergonomic than the standard QWERTY layout. When typing on QWERTY, your fingers rest on home row and the more typing you can do without moving your fingers from home row, the faster you can type. Typing is done slowest when the fingers have to travel away from home row; it is slowest on the bottom row. Many would believe that the QWERTY keyboard was designed for speed and efficiency; however the layout was actually designed to maximize the amount of finger movement and slow down the rate of typing as a way to avoid jammed levers in old typewriters. The QWERTY layout is actually plagued with awkward finger positions and long travel distances. Type the words "pumpkin" and "minimum" and observe the way your fingers move back and forth across rows. In contrast, the Dvorak layout was created to minimize these movements by adhering to the following principles:

- To increase typing speed and accuracy, the hands should alternate between letters when typing. This can also reduce hand fatigue and create a more rhythmic typing.
- Because most typing is done on home row, the most common letters should be found on home row. This maximizes typing speed and efficiency by allowing the letters to be struck by the strongest fingers. For this reason, the 70% of words are typed on home row when using a Dvorak Keyboard.
- On a keyboard, the hardest row to reach is the bottom row. Therefore, the least common letters should be found here.
- The right hand should do the most typing since most people are right-handed. Lesser used letters should be typed with the left hand.
- Keyboard strokes should generally move from the edges of the board to the middle. For example, when most people tap their fingers on a table, it usually begins at the pinky and ends at the index finger. To do this in reverse is more difficult and less intuitive. This motion from the edge to the middle is called inboard stroke flow. [4]

When Navy troops were retrained to type using Dvorak, they found that their typing accuracy increased by 68 percent and speed by 74 percent. The layout is much easier to learn as well. It would take 56 hours of training on a QWERTY keyboard for a beginner to reach 40 words per minute, but only 18 hours on a Dvorak keyboard. The Dvorak keyboard is not only more accurate and quicker, but it was remarkably more comfortable. The reduction in distance that fingers had to travel resulted in faster rates of typing and reduced repetitive strain injuries, including carpal tunnel syndrome.[3]

Recent statistics from the U.S. Bureau of Labor Statistics reveal that ergonomic disorders are among the fastest growing categories of work-related illnesses. They make up more than 56% of

the illnesses reported to the Occupational Safety and Health Administration.[4] Repetitive Strain Injury and Carpal Tunnel Syndrome have become the most common work-related illnesses, resulting in the longest absences from work and costing over $20 billion a year in workers compensation.[1] As the world shifts towards computers and information technology, repetitive strain injuries will only continue to climb if changes are not made.

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Service Project

Rutgers Computer Labs

Under The Office of Information Technology (OIT), the Rutgers Computer Lab provides computing and printing services throughout Rutgers University. This area would be the prime location to make an impact on students. The following idea is simple, easy to implement, and would have an immediate and huge impact on the student population if implemented.

Currently when the computers are booted up, students are greeted by a generic wallpaper. This wallpaper is displayed for several seconds to a minute before the desktop has completed startup. The idea is to create a wallpaper that lists suggestions for ergonomic positions and stretching tips. Another suggestion is to list the labs' hours of operation and relevant announcements to keep students informed. Listing the hours will allow students working late at night to allocate their time accordingly. Because the wallpaper is the first thing displayed by the computer when booted, it will be viewable by every student that utilizes the computer lab.

The wallpaper will be a 1920x1080 JPEG for use with both the Lenovo ThinkCentre and Apple iMac computers found in the computer labs. Two options are to simply overlay bullet points over the current wallpaper or to create an entirely new wallpaper. Below are tentative images and ideas to incorporate:

- Take a 3 minute break every hour or a 15 minute break every two hours to stretch.
- To avoid slouching, sit with your back against the chair. These chairs have built-in lumbar support!
- If you are having difficulty reading text on a webpage, enlarge the webpage by zooming in.

We sent an email (Appendix A) proposing our idea to the general and software branches of the OIT and to Joseph Sanders (University Director for Campus Computing Services). While initial reception was promising, we eventually received an email from the feedback coordinator of the OIT New Brunswick Labs (also manager of the College Avenue Computing Centers) stating "We do not accommodate requests from groups to modify our desktop backgrounds due to the large amount of effort it takes to modify all 1,000 of the labs' computers and the large number of groups that would want us to change them if we did." After it became clear that changing the wallpaper of even one lab or one computer was not a possibility, we switched our goal to a more traditional one: posters.

After reaching a dead end in our wallpaper idea, we decided that a more simple awareness method would have better reception from administration. The idea now was to create an 8.5x11 inch poster to hang near the computers at the labs and libraries. We met up with the assistant supervisor at the Loree Computer Lab to discuss our idea and left her with a copy of our poster. She said she would discuss our idea with her manager. After showing the manager our poster and instructional video, we were told that it would not be possible to put our posters up. The main issue was that the poster was created by students and not sanctioned by the OIT. When presented with an alternate idea of just putting up posters in employee areas for employees to view, we were met with the same answer.

Further discussion with the assistant supervisor led us to try our luck with the libraries instead, since they are maintained by the library staff rather than the OIT. Surprisingly, the managers at Mabel Smith Douglass Library and Chang Science Library were less receptive to the idea of ergonomic posters and desktop wallpapers. They expressed that they felt the posters would be distracting to computer patrons and that they ultimately could not display anything that was not approved by the OIT. It seems our initial perceptions were incorrect and that the libraries do have to abide by certain OIT regulations after all.

Ultimately, our efforts to change the desktop wallpapers and display posters had led us in circles and we could not make an impression on the administration. After speaking with numerous OIT and library staff, it was concluded that our posters can only be displayed on public bulletin boards around the Rutgers University Campus.

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Appendix A:
Letter to Rutgers OIT-NB Computing Center

(RH/PL) To whom it may concern:

Health concerns regarding prolonged computer usage are a growing hazard in students today. However, there are quick and easy remedies to prevent injury. The Rutgers computer lab facilities are the perfect location to make students aware of these hazards. After visiting the computer labs on each of the four campuses we have noticed that the majority of students are either slouching or sitting too closely to the monitors.

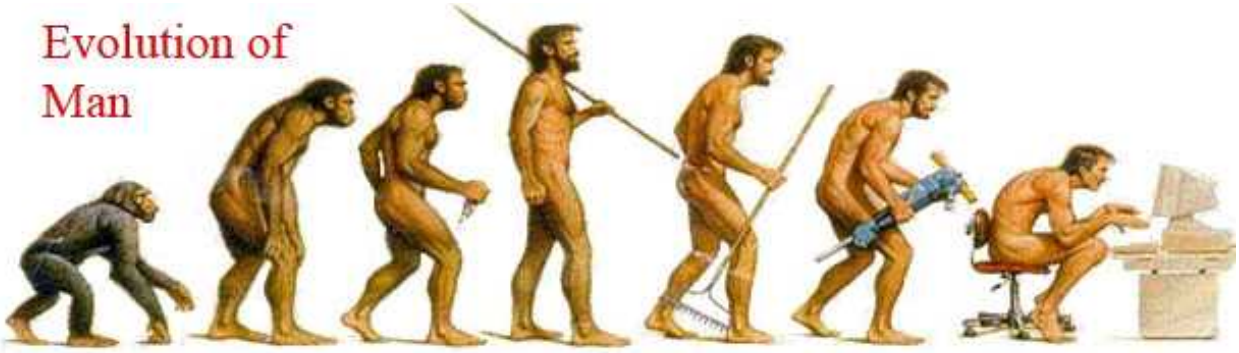
Currently the computer wallpapers are very minimal and generic. In previous years the wallpapers were used to inform students about the services of the OIT, e.g. employment opportunities. We would like to re-implement these custom wallpapers, and to have them display ergonomic suggestions and the hours of operation. This will have a great impact on students because a large majority of students use the campus computer labs. Over time these incorrect usage behaviors lead to chronic illness and disease. Below are a few suggestions that may be useful for the wallpaper.

- To prevent back and neck pain, sit all the way back in your chair (built-in lumbar support utilized).
- For every hour of work, take a five-minute break to stretch.
- To prevent eye fatigue, maintain a reasonable viewing distance from the monitor.

If you have any questions or concerns, please do not hesitate to contact us via email or phone.

Sincerely,
Ryan Hoffman and Phuong Le

Appendix B:
Ergonomic Poster



✗ incorrect position

Don't bend your wrists up (shown) or down while keyboarding.

✔ correct position

Your wrists should be straight while keyboarding.

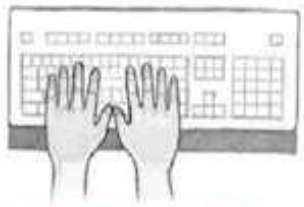
✔ correct position

If your wrists are straight while keyboarding, you decrease the risk of injury.

Preventing Computer-Related Stress

- Take a 5 minute break to stretch every hour
- Sit upright with back against the chair
- Sit at arm's length from the screen
- Adjust your chair height so that:
    - both feet rest flat on the floor
    - hands are at elbow height
- Place the mouse next to the keyboard so that:
    - your shoulders are relaxed
    - wrists are straight
    - elbows are by your side

✔ correct position



A palm rest – like the one shown here – can support your palms and wrists during rest periods from keying. Make sure you place the palm rest under your palms, not your wrists.

✔ correct position

✗ incorrect position

Letters to the Editor (RH & PL)

(RH)

Jennifer Dulin Wiley,

It has come to my attention that the increasing popularity of personal computer and laptop usage in America is starting to negatively impact the health of our country. More often than not, people are using computers incorrectly and are developing chronic injuries such as Repetitive Strain Injury (RSI), Computer Vision Syndrome (CVS), and musculoskeletal disorders. Many if not all computer related injuries could be prevented with simple, inexpensive precautions. For example, by adjusting your screen to the correct brightness and positioning the monitor correctly, one can prevent the symptoms of dry eyes! This "quick fix" does not cost any money and takes only a minute or two to complete. The correct placement of the keyboard and mouse can even prevent neck, back, and shoulder strain that lead to musculoskeletal disorders.

My idea is to effectively make people aware of risks of prolonged laptop / computer use. They need a simple guideline for setting up an ergonomically safe "working environment", along with the consequences of an "incorrect" or "improper" working environment. This can be achieved through the typical article format, which utilizes pictures, bullet points, and a brief description for each "quick fix". After individuals read the article they will be consciously aware of their body as they work at their computer or laptop. These preventative steps taken by your readers will prevent chronic illnesses later in life.

Thank you,
Ryan Hoffman

(PL)
Sent to Reader's Digest (11/15/11)

Dear Reader's Digest,

Over the years, we have become increasingly reliant on computers not only for recreational use, but for work and school as well. This increase in computer usage has changed the way we work for better and for worse. The impact on our overall health is growing every day. Even now, as I am typing this email to you, I am guilty of slouching at my computer for hours at a time staring up at the brightly lit monitor. Later I will complain that my back and neck hurts. But is it the computers fault or is it my fault?

Ergonomic disorders such as Repetitive Strain Injury and Computer Vision Syndrome are among the top work-related injuries reported today. These disorders are fostered by prolonged hours sitting and performing repetitive motions such as typing and mouse-clicking as our eyes stare intently at the screen. Modern workplaces often command hours of sitting and typing in front of a computer. Schools assign regular work that requires computer usage. It is almost impossible to go through life today without using a computer.

The most common complaints resulting from prolonged computer usage are back pain and eye fatigue. What many people fail to realize is that almost all ergonomic stresses are easily remedied at little to no cost. Remedies as simple as adjusting the height of the monitor, taking small breaks to stretch, improving sitting posture, and rearranging the workstation can make the world of a difference. Carpal Tunnel Syndrome, in the long run, can be prevented by taking breaks to stretch your fingers or using an ergonomic keyboard.

Pursuing this further, I would like to suggest an article in your magazine that discusses the health concerns that have emerged due to the prevalence of computers and our reliance on them. A small column reading 10 Ways to Surf the Web Comfortably with ergonomic tips would be a wonderful addition as well. As one of the best selling magazines in the United States with millions of subscribers both domestically and internationally, I feel that Readers Digest has the ability to make a tremendous impact on reducing ergonomic disorders and would appreciate it if you would consider my idea. Thank you very much for your time.

Sincerely,
Phuong Le