



# Standing Up for Workplace Wellness

A WHITE PAPER

## FORWARD

Someone who spends several hours each day working at a computer may already know that they are at risk for a host of repetitive stress injuries (RSIs) related to monitor, keyboard and mouse use. But it may come as a surprise to learn that there are other dangers at the opposite end of the spectrum: the absence of body motion is known as static loading; and prolonged sitting—what some people are calling a “silent killer” and others refer to as “sitting disease”—could be responsible for the deaths of 300,000 people annually in the United States alone.

For example, an American Cancer Society study published in July, 2010, in the American Journal of Epidemiology examined the amount of time 123,000 participants spent sitting along with their levels of physical activity. The results are alarming. Women who were inactive and sat more than 6 hours per day had a 94% higher risk of dying during the study period than those who were physically active and sat less than 3 hours per day. This and other studies linking prolonged sitting to cardiovascular disease, cancer, diabetes, obesity and a shorter lifespan raise the question: are people aware that they are sitting too much for their own good?

Sitting time adds up quickly. When you take into account commuting, watching TV, armchair sports, playing video games and sitting at a computer, it’s obvious that modern humans conduct their lives with far fewer imperatives for motion than did their ancestors. Paradoxically, the fact that we no longer spend the majority of our day building shelter, procuring food and fleeing predators works against us at a fundamental level.

For many years, medical professionals have recommended moderate physical activity for good health. Now scientists are pointing to distinctions between types of physical activity, with significant ramifications globally, for the millions of people who work at computers. These “knowledge workers” (expanding on a term first used by social ecologist Peter Drucker in 1959), may unwittingly expose themselves to harm by underestimating how repetitive stress and static loading impact their bodies over time.

The purpose of this paper is to raise awareness about how physical inactivity and sedentary behavior impact our health and to demonstrate how simple interventions, like adopting a sit-stand workstation for computer work and increasing non-exercise activity, can mitigate the harmful effects of sitting disease.



“

**OUR DNA HAS ABSOLUTELY NOT CHANGED IN THE PAST THIRTY YEARS. OUR ENVIRONMENT HAS.**

- DR. JAMES A. LEVINE

”



## PART ONE

### Sitting as an Occupational Hazard

Today, our bodies are breaking down from obesity, high blood pressure, diabetes, cancer, depression, and the cascade of health ills and everyday malaise that come from what scientists such as myself have named sitting disease.

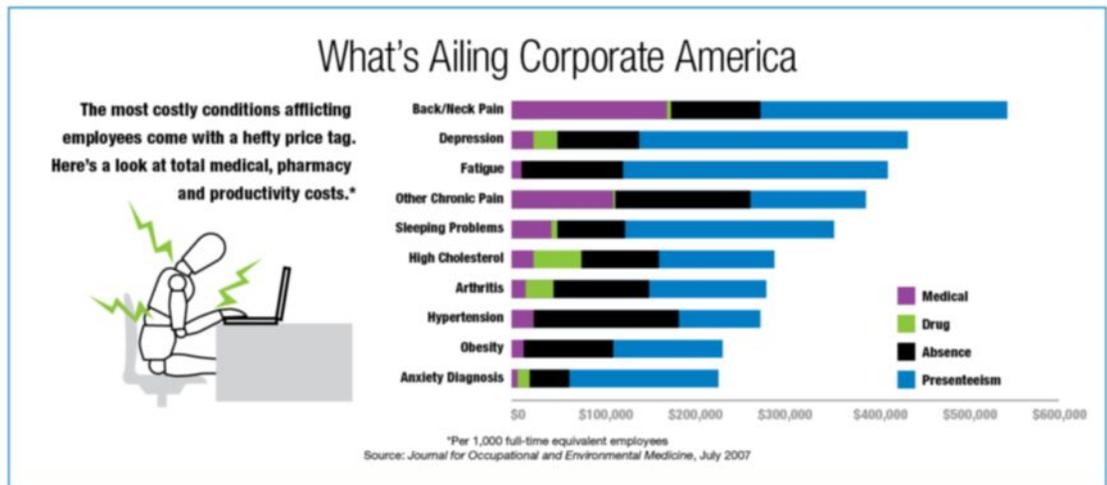
~ James A. Levine, MD, PhD. *Move a Little, Lose A Lot*, 2009

Knowledge workers who spend too large a portion of their day sitting down are victims of an occupational hazard created by technology. "Sitting disease" impacts the lives of individuals, businesses, and society as a whole. In the United States an estimated 88 million people are sedentary. According to Dr. James A. Levine, a Mayo Clinic endocrinologist who specializes in the study of energy expenditure, if those people became even moderately active, yearly medical costs could be reduced by as much as \$76.6 billion. Add to that expected gains in productivity then multiply by the number of other countries in similar situations, and the economic argument against sitting is compelling.

Research into sitting disease has emerged from a new discipline called inactivity physiology. As Professor E E Bak of the Åstrand Laboratory of Work Physiology noted, "A possible new paradigm of inactivity physiology is suggested, separate from the established exercise physiology ... This new way of thinking emphasizes the distinction between the health consequences of sedentary behavior, that is, limiting everyday life non-exercise activity and that of not exercising ... Sedentary time should be defined as the muscular inactivity rather than the absence of exercise."

The trend towards a sedentary lifestyle is on an incline. Data from the US Centers for Disease Control shows that within a 20-year period "no leisure-time physical activity" has dropped steadily among U.S. citizens from 31% in 1988 to 25% in 2008, suggesting that sitting disease is the tip of an iceberg that has been looming in the distance for some time—as far back as the 18th century when people began to exchange a traditional agrarian lifestyle for an urban, industrial one, when the impetus behind sedentary behavior (greater gain with less effort) was sent it motion. Says Dr. Levine, "Our DNA has absolutely not changed in the past thirty years. Our environment has."

The challenge to those affected by sitting disease is three-fold: to understand the nature of sitting disease, to become informed about the specific dangers of sitting disease, and, if possible, to provide the means to avoid sitting disease altogether.



“

**OUR BODIES ARE  
PROGRAMMED AT THE  
GENETIC LEVEL TO MOVE.  
THE BEST POSTURE IS  
THE NEXT POSTURE.**

”

Why the concern? Consider the results from the American Cancer Society 2010 study that reported that “time spent sitting was independently associated with total mortality, regardless of physical activity level.” Among its findings:

- Women who sat over 6 hours per day were 37% more likely to die sooner when compared to women who sat for 3 hours per day
- Men who sat over 6 hours per day were 18% more likely to die sooner than their standing counterparts
- Women were 94% and men 48% more likely to die sooner compared with those who reported sitting the least *and being most active*.

The report concluded with this recommendation: “Public health messages should include both being physically active and reducing time spent sitting.”

Even before the American Cancer Society study was published in July, 2010, getting a handle on the risk factors at the heart of sitting disease has been an ongoing concern of researchers—and the results seem to corroborate.

For instance, a study of 17,000 Canadians over more than a decade indicated “a dose-response relationship between sitting time and mortality from all causes and CVD [cardiovascular disease], independent of leisure-time physical activity.” This was true for exercisers as well as non-exercisers. The authors concluded by saying, “In addition to the promotion of moderate-to-vigorous physical activity and a healthy weight, physicians should discourage sitting for extend periods.” (Katzmarzyk et al., 2009)

Similarly, the conclusion of a University of South Carolina study of men involved in two sedentary behaviors (riding in a car and watching TV): advised that for optimal cardiovascular health and longevity, “Health promotion efforts targeting physically inactive men should emphasize both reducing sedentary activity and increasing regular physical activity.” (Warren et al., 2010)

And in Australia, a University of Queensland, School of Population Health report stated that, “Even when adults meet physical activity guidelines, sitting for prolonged periods can compromise metabolic health.” (Owen et al., 2008)

**In these studies, the common message is that physical activity does not counteract the negative effects of prolonged sitting.**

“People need to understand that the qualitative mechanisms of sitting are completely different from walking or exercising,” says University of Missouri-Columbia microbiologist Dr. Marc Hamilton. “Sitting too much is not the same as exercising too little. They do completely different things to the body.”

In other words, exercising more will not counteract the problems caused by sitting too much. It may seem a subtle point, but the distinction is key to our new understanding of sedentary behavior.

“

**EVEN WHEN ADULTS  
MEET PHYSICAL  
ACTIVITY GUIDELINES,  
SITTING FOR  
PROLONGED PERIODS  
CAN COMPROMISE  
METABOLIC HEALTH.**

- UNIVERSITY OF QUEENSLAND STUDY

”

For instance, a person who diligently puts in several hours at the gym each week may be dismayed to learn that if they sit all day at work, they would be defined as “inactive” according to the latest research. On the flip side, a person who doesn’t engage in a regular exercise program but who spends the day moving about and sitting very little would be considered physically active by the same standard.

It just goes to show, that you can’t judge a person’s health status through casual observation. Even obesity cannot be trusted as an indication of poor health. While being overweight can be an outcome of physical inactivity, it does not necessarily mean that a person is inactive or unhealthy. By the same token, a person who is slender may not be physically active or healthy. “Normal-weight adults who are sedentary are at increased risk for cardiovascular disease-related outcomes than are overweight or obese adults who are aerobically fit.” (Warren-Findlow & Hooker, 2009)

By now it should be obvious that managing the risk associated with sedentary behavior is not intuitive. If our assumptions about what constitutes physical activity and wellness cannot be trusted, we must go back to square one: how does sitting affect the body? Historically, sitting reflected a higher worker status; it was the posture of the privileged classes. Standing, on the other hand, was associated with blue collar or even unskilled labor. Why would one stand if one could sit?

### Energy Expenditure and the Daily Grind

Understanding how prolonged sitting, as a sedentary behavior, and sit-stand alternation, as an active behavior, differ from one another depends to some extent on your knowledge about how the body uses energy and how energy consumption relates to movement. There are basically three ways your body expends energy:

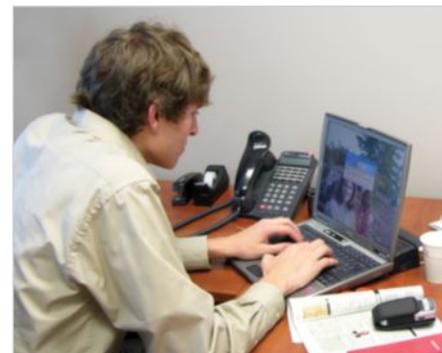
- BMR—Base Metabolic Rate equals the amount of energy your body requires just to stay alive and depends on your size. The larger you are, the higher your BMR.
- TEF—Thermal Effect of Food is associated with the digestion, absorption and storage of food and accounts for 10–15% of total Energy Expenditure.
- Activity Thermogenesis is the energy expenditure left over after BMR and TEF are calculated; there are two types of Activity Thermogenesis (not counting the small amount of energy expended due to medication and emotion), which are:
  - Exercise activity (short bursts of physical activity)
  - Non-exercise activity (puttering around the house, daily living tasks)

Contrary to what you might expect, exercise activity, at least among the majority of people in the United States, is a negligible constituent of Activity Thermogenesis, whereas, even among avid exercisers, *non-exercise activity* is the predominant constituent of Activity Thermogenesis.

According to Dr. Alpa Patel, lead researcher for the American Cancer Society 2010 study, “Several factors could explain the positive association between time spent sitting and higher all-cause death rates. Prolonged time spent sitting, independent of physical activity, has been shown to have important metabolic consequences, and may influence things like triglycerides, high-density lipoprotein, cholesterol, fasting plasma glucose, resting blood pressure, and leptin, which are biomarkers of obesity and cardiovascular and other chronic diseases.”

“  
**SITTING TIME AND  
NON-EXERCISE ACTIVITY  
HAVE BEEN LINKED  
IN EPIDEMIOLOGICAL  
STUDIES TO RATES  
OF METABOLIC  
SYNDROME, TYPE 2  
DIABETES, OBESITY,  
AND CARDIOVASCULAR  
DISEASE.**  
- DR. MARC HAMILTON

”

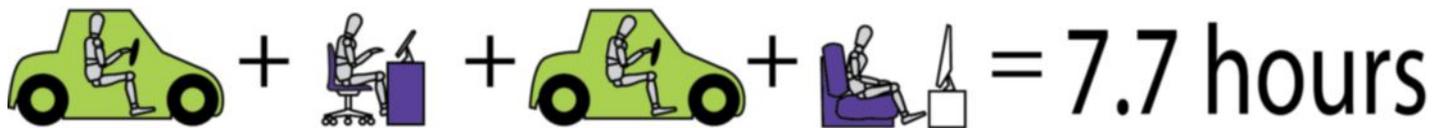


**What do Energy Expenditure (EE) and, more specifically, Activity Thermogenesis mean to people who work in the traditional office setting?**

It appears that it takes only four hours of continuous sitting for the body to go into a sort of “sleep” mode, when the genes regulating the amount of glucose and fat in the body start to shut down. This means that from an Energy Expenditure standpoint, your body is operating closer to the BMR level than the Activity Thermogenesis level. For example, an inactive person’s BMR comes to about 60% their total daily energy expenditure, which means that they are pretty much stagnant. Before you exempt yourself from this category of activity level, consider this: you may be sitting more than you think.

At least one study demonstrated that people generally underestimate the time they spend sitting. The true numbers are startling. The 6,300 participants in a Vanderbilt University study were found to spend 55% of their waking time (7.7 hours per day) engaging in sedentary behaviors. Dr. Frank Booth at the University of Missouri-Columbia doesn’t mince words in his assessment of the situation: “Sedentary Death Syndrome” (SeDS) is the term he uses to refer to the host of health disorders that are exacerbated due to a lack of physical activity, causing premature disability and death. In 2001, he declared that “60% of all Americans were at risk due to SeDS, including children,” and his call for government intervention has garnered attention in the United States and abroad.

Out of mounting concern about SeDS, national leaders dedicated to improving the public’s health gathered in Washington D.C. in April, 2006, to discuss proposed public policy changes. These changes would “concentrate on a particular lifestyle change for which the scientific evidence for its ability to improve health and reduce chronic disease is certain: The United States must take more coordinated, integrated, and funded steps to increase levels of physical activity (and thereby improve health) and reduce physical inactivity (and its related chronic diseases, including coronary heart disease, diabetes, obesity, and osteoporosis).” (ACSM Scientific Roundtable, 2006)



**What scientists are asking of us is fairly straight forward: substitute non-exercise activity for the amount of time currently spent sitting in order to avoid the low-grade energy expenditure that freezes your body in place.**

So if you typically watch your daughter’s soccer game in a lawn chair, walk up and down the sideline instead. If your television viewing normally takes place on the couch, stand-up and iron clothes, or lift weights or take a spin on a stationary bike. If your kids are playing video games sitting on the floor, raise the screen to the level of their chest and make them play standing up.

It’s all about movement. As many ergonomists assert, “The best posture is the next posture.” Our bodies are programmed at the genetic level to move.



**SEDENTARY TIME ADDS UP FAST: COMMUTING TO AND FROM WORK, SITTING AT A DESK, WATCHING TV, ARM CHAIR SPORTS AND PLAYING VIDEO GAMES CONTRIBUTE TO THE AVERAGE 7.7 HOURS PER DAY SPENT PHYSICALLY INACTIVE**



## Benefits of Sit-Stand Work

If you're one of the millions of knowledge workers worldwide who spend the majority of their working day sitting behind a computer, the simplest *non-exercise activity* intervention you can do for yourself is to stand up. Barring medical conditions that prohibit you from doing so (e.g., pregnant women, people with varicose veins), getting out of your chair is like a wake-up call for your body. Engaging in a combination of postures, as is possible with a sit-stand workstation, has many benefits:

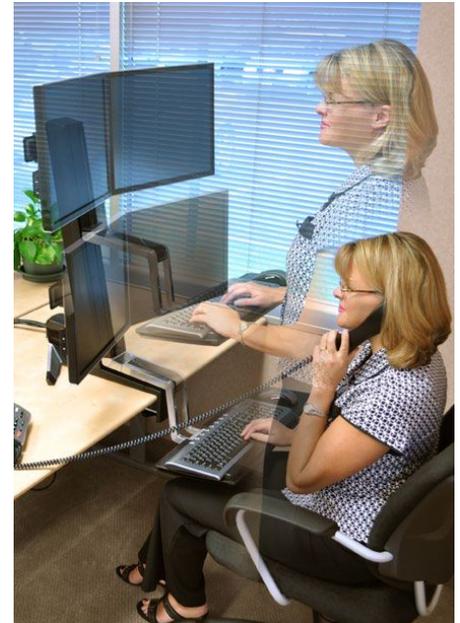
- Strengthens leg, ankle and foot muscles
- Improves balance
- Mitigates formation of blood clots deep in the legs
- Squeezes valves in the leg veins, pushing blood upward toward the heart
- Reduces risk of cardiovascular disease
- Improves alertness
- Encourages movement
- Discourages "mindless" snacking
- Allows deep breathing
- Increases good HDL cholesterol levels
- Decreases bad LDL cholesterol levels
- Promotes weight loss
- Is better for the back
- Is a natural posture for humans
- Is less fatiguing

The fundamental notion behind a sit-stand workstation is that it engages all human physiological systems, integrating mechanical, physical and biochemical functions for optimum health. In and of itself, sitting, or indeed any static posture, has a limiting effect on both the electrical and chemical methods used for communication between systems. When these systems operate in balance to maintain stability, there is homeostasis.

Sitting disease reflects a disturbance of homeostasis, a condition known as homeostatic imbalance. Aging is a common example of how the body loses efficiency in its control systems; these inefficiencies gradually result in an unstable internal environment that increases the risk for illnesses, like cancer, which is estimated will kill 600,000 people in the United States in 2010 alone.

"The genes that unmoor normal cell division are not foreign to our bodies, but rather mutated, distorted versions of the very genes that perform vital cellular functions. And cancer is imprinted in our society: as we extend our life span as a species, we inevitably unleash malignant growth (mutations in cancer genes accumulate with aging; cancer is thus intrinsically related to age). If we seek immortality, then so, too, in a rather perverse sense, does the cancer cell." (Mukherjee, 2010)

Despite lines of evidence suggesting the biological plausibility of sitting disease, the news has touched off intense reactions, with expressions of acceptance and denial made in equal measure. Addressing resistance is the crucial first step in helping people pursue healthy, productive lifestyles.



## PART TWO

### Conquering Doubts

The often-perceived notion that being sedentary has no adverse clinical effect has no biological basis to it and hence is false.

~ *Waging War on Physical Inactivity*, 2002

There might always be a segment of the population that outright rejects the possibility that sitting could lead to death. After all, if you let statistics guide you, there are a whole lot of things people do in every-day life that we now consider risky. No wonder those other warnings—against smoking, drinking, eating fast food, texting when driving—eclipse the banal act of sitting throughout one's day.

When you consider that a few decades ago, physicians actually smoked cigarettes while examining patients, it's possible to understand the magnitude of the struggle it took to convince our society that smoking could be lethal. "By the early 1940s, as one epidemiologist ironically has written, 'asking about a connection between tobacco and cancer was like asking about an association between sitting and cancer.'" (Mukherjee, 2010)

Then too, it's possible that some people don't think about sitting as an activity at all. In 2009, full-time workers reported that they spent nearly 17 hours each week watching television. And how many of us would make the mental leap required to see a common risk factor between watching TV and working in the office?

Finally, among the doubtful, are the "Ah ha, I thought so!" individuals who readily accept the premise that sitting can lead to death, but point out that there is nothing that can be done about it. Pro or con, the attitude that sitting and office work are an inevitable pairing comes from the same, outdated work culture. Things are going to have to change.

### Convincing Employers

"At the beginning of the 20th century, unskilled labor accounted for about 90% of the work force; today that figure is closer to 20%. As a result, the knowledge work force has become the linchpin to an organization's success, as the world morphs into a knowledge economy. The change represents a significant challenge to managers who are accustomed to managing workers in more traditional roles. The minimum cost of tools and technologies that supports these workers, estimated to be between \$5,000 and \$10,000 per employee per year, is growing steadily, yet most companies have failed to recognize the changes they need to make in how they conduct business." (Spira, 2005)

In today's "knowledge economy," harnessing the power of healthier, happier employees is an essential strategy. In light of the amount of time an average employee spends at their desk, and the inherent risks of all that sitting, a responsible employer must entertain the prospect of sit-stand workstations for their knowledge worker base. What does this look like for the average company? At minimum it means cultural shifts, like standing at meetings. For maximum impact, it may mean ergonomic training and investing in more flexible office equipment, such as ergonomic monitor mounts or adjustable desks. This proactive approach can offset forces beyond the employer's

“

**ASKING ABOUT A  
CONNECTION BETWEEN  
TOBACCO AND CANCER  
WAS LIKE ASKING  
ABOUT AN ASSOCIATION  
BETWEEN SITTING AND  
CANCER**

”

control, like ever-rising healthcare premiums as well as the cost of absenteeism and presenteeism (where the employee is present, but not productive)?

The conclusion of a study called “Comparisons of Musculoskeletal Complaints and Data Entry Between a Sitting and a Sit-Stand Workstation Paradigm” stated: “A sit-stand workstation paradigm reduces musculoskeletal complaints without considerably affecting data entry efficiency under the presented study conditions ... According to the present data, implementing a sit-stand workstation paradigm can be an effective workplace health intervention to reduce musculoskeletal complaints.” (Husemann et al., 2009)

Some employers will not acknowledge sitting disease, or worse, reject the simple interventions that can alleviate sitting disease. They may do so for a variety of reasons:

- Cost of labor
- Cost of products
- Fear of change
- Disruption of work time
- Dislike of speculative or new ideas
- Negative experiences with similar past interventions
- Not their idea (won't adopt another person's project)

These hurdles are understandable but surmountable. In the words of Dr. Siddhartha Mukherjee, “Science begins with measurement.” So too with business, where Return on Investment (ROI) is the best argument for the sit-stand paradigm. Studies in office ergonomics show productivity increases 12–18% following an ergonomic intervention where employees are provided with well-designed ergonomic furniture.

Preventing the risky behaviors which lead to maladies among office workers is of course the first line of defense. But the clock has already stopped for people who have been working with computers as their primary tool for the last 30 years. Many already have experienced repetitive injury disorders, and illnesses resulting from static postures.

Consider too the growing number of knowledge workers entering the workforce in rapidly developing countries on every continent. If western countries have taught us anything, it's that healthier economies can breed less healthy citizens. A population of workers at risk for computer-related occupational hazards will continue to be a concern long into the future.

Researchers heading a 2004–2009 study (Lambeek et al., 2010) of treatment alternatives for Dutch patients on sick leave because of chronic low-back pain sum up the situation:

**What is already known on this topic**

- The economic burden of low back pain is huge and related to costs of productivity losses
- A small group of patients with severe, chronic low-back pain generate most of the costs
- Cost-effective interventions are lacking for this selected group with chronic back pain

**What this study adds**

- An integrated care program substantially reduced sick leave for a small but relevant group of patients with chronic low-back pain

“

**PRODUCTIVITY INCREASES  
12 TO 18 PERCENT  
FOLLOWING AN ERGONOMIC  
INTERVENTION WHERE  
EMPLOYEES ARE PROVIDED  
WITH WELL-DESIGNED  
FURNITURE.**

”

- The program has large potential to significantly reduce the societal costs of low-back pain in this group of patients. Integrated care was more cost effective than usual care for return to work and quality-adjusted life years

If you work with someone who refutes the connection between sitting and poor health or believes that ergonomic interventions in the workplace are too expensive, there are models for successful implementation that you should both know about. In some cases, like the State of Maine, employees volunteered to manage workplace wellness initiatives in the absence of formal funding. They did so with such success that their program was eventually awarded a federal grant.

The merits of workplace wellness programs are also recognized and promoted at the institutional level by professional academics. Cornell University is a trusted resource for businesses concerned with employee health. Their web site CUErgo states its mission: “CUErgo presents information from research studies and class work by students and faculty in the Cornell Human Factors and Ergonomics Research Group (CHFERG), in the Department of Design and Environmental Analysis at Cornell University. CHFERG focuses on ways to enhance usability by improving the ergonomic design of hardware, software, and workplaces, to enhance people’s comfort, performance and health in an approach we call Ergotecture.”

Another potential model for employee wellness has emerged from frontline corporations like Liberty Mutual, whose work is reflected in their publication *From Research to Reality*, in which it reads, “Owned and operated by Liberty Mutual Insurance Company, Boston, MA, the Liberty Mutual Research Institute for Safety has helped to improve the occupational safety and health of workers for more than 50 years. Through laboratory and field-based investigations and global research collaborations, the Research Institute seeks to advance scientific, business-relevant knowledge in workplace and highway safety, and work disability.”

Ideally, all employers would recognize that individual employee-needs assessments are critical to productivity. Person-to-person ergonomic consultations ensure the best possible fit with better prospects for continued success. These should take into account the employee’s physical dimensions and job description. With the right latitude, businesses may want to consider that even in sit-stand options one size does not fit all. The style of cube configuration, the bifocal needs of the user, etc. may help determine the best solution for the employee’s greatest health benefit. Then it is up to the employee to choose when they want to sit or stand throughout their day. Initial comments from workers who have switched to sit-stand workstations confirm that the benefits outlined earlier in this paper are valid outcomes; still, some employees, despite employer encouragement, are reluctant to participate in their own wellness.

## Getting a Handle on Work Place Stress

Improving office wellness and productivity is the responsibility of both the employee and the employer. But realistically, who has power over what?



Researchers at the National Institute for Occupational Safety and Health have divided several stress-related factors into categories of control based on just that question.

### EMPLOYEE

Balance between work & family or personal life

A support network of friends & coworkers

A relaxed and positive outlook

### EMPLOYER

The design of tasks

Management style

Interpersonal Relationships

Work Roles

Career Concerns

Environmental Conditions



**THE SIGNIFICANT POINT A COMPANY MAY BE MISSING IS TO ENGAGE THE EMPLOYEE IN THE ONE SPOT THAT THEY SPEND THE BULK OF THEIR TIME—THEIR WORKSTATION**



## Engaging Employees

Right or wrong, people don't necessarily count the time they spend in the workplace as amounting to much compared to the amount of time spent at home or engaged in recreational activities. Consequently, they may not see the wisdom of interventions aimed at improving their overall wellbeing. They may react negatively to employer-sponsored interventions, fearing changes to their work environment, or resenting schemes that spend company money possibly at the expense of individual salaries.

In a recent PricewaterhouseCoopers' Health Research Institute study, less than 40% of those surveyed who were eligible to participate in wellness programs were actually enrolling. The reasons that employees choose not to engage in healthy activities are difficult to pin-down and are more complex than a single reason can explain, but possible contributing factors include:

- Privacy issues
- Ignorance
- Lack of trust
- Unwilling to take the time
- Financial duress
- Stress
- Depression
- Dysfunctional home/workplace
- Temporary conditions (change in marital status, birth or death of loved one)

The alleviation of workplace stressors that contribute to sitting disease is a responsibility that employer and employee must share. But even the most diligent employers are still faced with the problem of engaging their employees in this goal. According to a 2008 report published by Reuters, 57% of employers with 500 or more workers provide some sort of wellness program such as smoking cessation, exercise planning or cancer screening; four out of five employers with wellness programs add incentives, with 40% offering gym memberships, 36% awarding gifts or prizes, and 27% offering a discounted employee contribution to medical plans.

Given these statistics one might expect to see a nation full of lean, motivated and healthy workers whose high energy positively contributes to their employer's bottom line.

How is it that with more than half of large U.S. employers offering wellness programs and incentives, we continue to experience rising healthcare costs? Why, despite health and wellness initiatives encouraged by the employer, are employees still struggling with metabolic syndromes and stress-related diseases? While it must be acknowledged that a large part of the failure to be healthy in the workplace is due to the employees themselves, the significant point a company may be missing is to engage the employee in the one spot that they spend the bulk of their time—their workstation. Motivating employee wellness cannot be accomplished with a "get well or else" attitude. Workplace wellness can, however, be cultivated over time. Conditions that promote a wellness culture must be intrinsic (coming from within the worker) and positive. And it is important to note that employers themselves, as participants in a work environment, hold key pieces to completion of the wellness puzzle. Technology has fostered an egalitarian aspect in modern offices that can work in favor of ordinary employees.

“

**THE DIRE CONCERN FOR  
THE FUTURE MAY REST  
WITH GROWING NUMBERS  
OF PEOPLE UNAWARE OF  
THE POTENTIAL INSIDIOUS  
DANGERS OF SITTING TOO  
MUCH.**

**DR. MARC HAMILTON**

”

Sit-stand workstations are the remedy employees *and* employers have been waiting for. And because corporate executives are as likely to be affected by sitting disease as everyone else in their office, they are also beneficiaries of the wellness to be gained from a workstation that allows movement from sitting to standing.

There is reason for optimism. Even small changes can result in big gains. For instance, Dr. Levine asserts that just sitting for 2.5 hours less each day would result in an extra energy expenditure of 350 kcal/day. Researchers for Inactivity-Related Disorders (IRD) claim that adults who walk just 600 more steps each day will avoid gaining 10 additional pounds of body weight over ten years.

As the researchers in the Norfolk, UK study said of the implications of their work, “These results may provide further support for the idea that even small differences in lifestyle may make a big difference to health in the population and encourage behavior change.” (Jakes et al., 2003)

Additionally, ergonomic payback and economic return on investment happen more rapidly than you might expect. Productivity gains from ergonomic equipment installations have been tracked. And if you recall that over 68% of workers surveyed indicated they value the choice to sit or stand, employee satisfaction in the overall measurement is eminently feasible.

What will the world be like if knowledge workers embrace the prescribed changes to their lifestyle? The Norfolk, UK study researchers calculated that “people who drink moderately, exercise, quit smoking and eat five servings of fruit and vegetables each day live on average 14 years longer than people who adopt none of these behaviours. This result demonstrates that modest and achievable lifestyle changes can have a marked effect on health.”

Those changes could also drop the numbers of individuals living in nursing homes. Among those ages 45 to 64, physical inactivity boosted the risk of entering a nursing home by 40% (although it had no significant impact at older ages). Apart from economic gains, the ultimate motivation behind adopting a sit-stand work culture is for a better quality of life.



## CONCLUSION

Nearly 30 years since the introduction of the personal computer, scientists are still learning about the effects this technology is having on modern workers. “Sitting disease” is a case in point.

Activities involving prolonged sitting, like TV viewing, commuting and seated office work add up—over half of a person’s waking day might be spent in sedentary behavior that has been shown in studies contribute to serious medical conditions that lead to shorten life spans.

The many costs associated with sedentary behavior make it imperative that employers implement known remedies to benefit their employees. Likewise, employees must learn to change the way they think about work and lifestyle, accepting that balance will improve wellness and enhance productivity, since increased physical activity alone is not enough.

Prolonged sitting, like physical inactivity in general, is a behavior that people choose to participate in. If people are not aware that their choices lead to chronic health problems, they can’t be faulted for continuing along the same path year after year. Since a large portion of a knowledge worker’s day is spent sitting, it is only logical that their employers educate them about how standing, along with other forms of non-exercise activity (pacing during phone calls, frequent breaks, walking meetings, etc.), contributes to their health.

Sit-stand workstations are a viable method for increasing *non-exercise activity* in a computer operator’s work time. Forward thinking companies have already begun to equip their workers with the means to accomplish tasks for greater health and productivity. The time for change has come.

Charlotte J. Schmitz  
Manager, Human Factors & Engineering Publications,  
Ergotron, Inc.

## A NOTE FROM THE AUTHOR

In writing this paper my intention was to share with people data supporting the implementation of a sit-stand workstation. Please note that the views expressed in this paper should not be construed as safety or medical advice. It is important that individuals consult directly with their physician or other medical professional regarding their personal health condition and proceed accordingly.



**Join the JustStand uprising!  
Go to [juststand.org](http://juststand.org)  
for the latest information about  
sit-stand work culture. Read more  
about sedentary behavior, sitting  
disease and inactivity physiology.  
Join the online discussions about  
ergonomics and workplace  
health and learn about products  
designed to make computing more  
comfortable than ever.**

**Plan your own sit-stand workspace;  
visit <http://planner.ergotron.com>**

© 2011 Ergotron, Inc. rev. 01/04/2010 **Content is subject to change without notification**

<b>Americas Sales and Corporate Headquarters</b>	<b>EMEA Sales</b>	<b>APAC Sales</b>	<b>Worldwide OEM Sales</b>
St. Paul, MN USA (800) 888-8458 +1-651-681-7600 <a href="http://www.ergotron.com">www.ergotron.com</a> <a href="mailto:sales@ergotron.com">sales@ergotron.com</a>	Amersfoort, The Netherlands +31 33 45 45 600 <a href="http://www.ergotron.com">www.ergotron.com</a> <a href="mailto:info.eu@ergotron.com">info.eu@ergotron.com</a>	Singapore <a href="http://www.ergotron.com">www.ergotron.com</a> <a href="mailto:info.apac@ergotron.com">info.apac@ergotron.com</a>	<a href="http://www.ergotron.com">www.ergotron.com</a> <a href="mailto:info.oem@ergotron.com">info.oem@ergotron.com</a>



## WORKS CITED

### BOOKS

Levine, James A. MD, PhD, and Yeager, S. *Move a Little, Lose A Lot*. Crown Publishing, 2009.

Mukherjee, Siddhartha, PhD. *The Emperor of All Maladies—A biography of Cancer*. New York, Scribner, 2010.

### ARTICLES and RESEARCH

ACSM Scientific Roundtable. "Charting and Changing the Policy Landscape: Promoting Physical Activity & Reversing Physical Inactivity through Policy Solutions". April 27, 2006.

American Cancer Society (July 23, 2010). "More time spent sitting linked to higher risk of death; Risk found to be independent of physical activity level." *ScienceDaily*. Retrieved December 15, 2010, <<http://www.sciencedaily.com/releases/2010/07/100722102039.htm>>.

Bak EE. Åstrand Laboratory of Work Physiology, Swedish School of Sport and Health Sciences, Box 5626, 114 86 Stockholm, Sweden.

Booth FW, Chakravarthy MV, Gordon SE, Spangenburg EE. "Waging war on physical inactivity: using modern molecular ammunition against an ancient enemy." *J Appl Physiol*. 2002;93:3–30.

Booth, Frank and Gordon, Scott. "Advocacy Is Needed to Promote Research into Diseases of Physical Inactivity", *Exercise & Sport Sciences Reviews*, October 2000, Vol. 28, No. 4, pp. 145–147.

Carney, DR, Cuddy, AJC, Yap, AJ. 2010. "Power posing: Brief nonverbal displays affect neuroendocrine levels and risk tolerance." *Association for Psychological Science*, <<http://pss.sagepub.com>>.

Dunstan DW, Salmon J, Owen N, et al.; AusDiab Steering Committee. "Associations of TV viewing and physical activity with the metabolic syndrome in Australian adults". *Diabetologia* 2005;48: 2254–61.

Elin Ekblom-Bak, Mai-Lis Hellénus, Björn Ekblom. 2009. "Are we facing a new paradigm of inactivity physiology?". *British Journal of Sports Medicine*, doi 10.1136/bjism.2009.06702.

Hamilton MT, Hamilton DG, Zderic TW. "Role of low energy expenditure and sitting in obesity, metabolic syndrome, type 2 diabetes, and cardiovascular disease". *Diabetes* 2007;56:2655–67.

Healy GN, Dunstan DW, Salmon J, et al. "Breaks in sedentary time: beneficial associations with metabolic risk". *Diabetes Care* 2008;31:661–6.

Healy GN, "Get up, Stand Up Sedentary Behavior and Health", Baker IDI Heart & Diabetes Institute, School of Population Health The University of Queensland.

Husemann B, Von Mach CY, Borsotto D, Zepf KI, Scharnbacher J. 2009. Comparisons of musculoskeletal complaints and data entry between a sitting and a sit-stand workstation paradigm. *Human Factors: The Journal of Human Factors and Ergonomics Society*, Volume 51, Number 3, June 2009. pp. 310-320(11).

Jakes RW, Day NE, Khaw KT, et al. "Television viewing and low participation in vigorous recreation are independently associated with obesity and markers of cardiovascular disease risk: EPIC-Norfolk population-based study. *Eur J Clin Nutr* 2003;57:1089–96.

Katzmarzyk PT, Church TS, Craig CL, et al. "Sitting time and mortality from all causes, cardiovascular disease, and cancer". *Med Sci Sports Exerc* 2009;41:998–1005.

Khaw et al., "Combined Impact of Health Behaviours and Mortality in Men and Women: The EPIC-Norfolk Prospective Population Study". *PLoS Medicine* 5(1) e12. doi:10.1371/journal.pmed.0050012 Published January 8 2008.

Lambeek LC, Bosmans JE, Van Royen BJ, Van Tulder MW, Van Mechelen W, Anema JR. 2010. "Effect of integrated care for sick listed patients with chronic low back pain: economic evaluation alongside a randomised controlled trial." *BMJ* 2010;341:c6414.

Mathews CE, Kong YC, Freedson PS, Buchowski MS, Beech BM, Pate RR, and Troiano RP. 2007. "Amount of time spent in sedentary behaviors in the United States 2003-2004". *American Journal of Epidemiology*, 2008 167(7):875-881; doi:10.1093/aje/kwm390.

## WORKS CITED

Owen N, Bauman A, and Brown W. 2008. "Too much sitting: a novel and important predictor of chronic disease risk?". *British Journal of Sports Medicine*, 2009; 43:81-83 doi:10. 1136/bjism. 2008. 055269.

Patel AV, Bernstein L, Deka A, Spencer Feigelson H, Campbell PT, Gapstur SM, Colditz GA, and Thun MJ. "Leisure Time Spent Sitting in Relation to Total Mortality in a Prospective Cohort of US Adults". *American Journal of Epidemiology*, 2010; DOI: 10.1093/aje/kwq155.

Valiyeva E, Russell LB, Miller JE, Safford MM. 2006. "Lifestyle-Related Risk Factors and Risk of Future Nursing Home Admission". *Arch Intern Med*. 2006;166:985-990.

Pate, Russell R.; O'Neill, Jennifer R.; and Lobelo, Felipe. "The Evolving Definition of Sedentary". *Exerc. Sport Sci. Rev.*, Vol. 36, No. 4, pp. 173–178, 2008.

Pricewaterhouse Coopers Health Research Institute: complete reference available on request.

Reuters 2008: complete reference available on request.

U.S. Centers for Disease Control, U.S. Physical Activity Statistics, 1988-2008 No Leisure-Time Physical Activity Trend Chart, <[http://www.cdc.gov/nccdphp/dnpa/physical/stats/leisure\\_time.htm](http://www.cdc.gov/nccdphp/dnpa/physical/stats/leisure_time.htm)>.

Warren-Findlow, Jan, and Hooker, Steven P. "Disentangling the Risks Associated With Weight Status, Diet, and Physical Activity, Preventing Chronic Disease Public Health Research, Practice, and Policy". Volume 6: No. 4, October 2009.

Warren TY, Barry V, Hooker SP, Sui X, Church TS, Blair SN. "Sedentary behaviors increase risk of cardiovascular disease mortality in men." Department of Exercise Science, Arnold School of Public Health, University of South Carolina, Columbia, CS 29208, USA.

## INTERNET

Skerrett, Patrick J. Aug 2010. The Many Benefits of Standing at Your Desk. *Your Health at Work*. <<http://blogs.hbr.org/your-health-at-work/2010/08/the-many-benefits-of-standing>>.

Spira, Jonathan B. "In praise of knowledge workers". Feb 1, 2005, *KMWorld magazine*, <<http://www.kmworld.com>>.

Cornell University Ergonomics Web, <<http://ergo.human.cornell.edu/>>.

Ergotron, Inc. Press Release 2010. "Two of three office workers want choice of 'Sit or Stand' desks, says new Ergotron Survey", *EarthTimes*, Aug 2010.

Lev-Ram, Michal, "Designing the 21st century cubicle". *Business 2.0*, Nov 15, 2006, (Business 2.0 Magazine).

Liberty Mutual Insurance, Work Systems Design, <<http://www.libertymutualgroup.com/omapps/ContentServer?pagename=LGroup/Views/LMG&ft=5&fid=1138365473784&ln=en>>.

McPeck, William C. 2006. "Maine State Government's Worksite Wellness Program" The Selected Works of William C. McPeck, <[http://works.bepress.com/william\\_mcpeck/3](http://works.bepress.com/william_mcpeck/3)>.

Whitman-Salkin, Sarah. "5 Metabolic Myths Debunked" *The Daily Beast*. Aug 25, 2009, <[www.thedailybeast.com/](http://www.thedailybeast.com/)>.

Price, Will. "Primal Instincts, How Body Language and Personality Dictate Success", <<http://willprice.blogspot.com/>>.

University of Missouri-Columbia (2007, November 20). Sitting May Increase Risk of Disease, ScienceDaily. Retrieved July 12, 2010, from <<http://www.sciencedaily.com/releases/2007/11/071119130734.htm>>.