PHASE 1

RESEARCH DOCUMENT

Duc Pham | YSDN3008

TABLE OF CONTENTS

TOPIC DESCRIPTION AND POSITION STATEMENT

TOPIC DESCRIPTION

With the modern lifestyle being dependent on digital devices for daily activities and entertainments. The chances are that we spend the majority of our day to day life sitting down. The long-term consequences of this sedentary behaviour are highly overlooked by our modern office working culture.

When comparing the difference between people having shorter and longer sedentary time, the ladder is correlated with an increased risk of diabetes, cardiovascular disease, and all-cause mortality. In details, the study showed that the greatest sedentary time compared with the lowest was associated with a 90% increase in the risk of cardiovascular mortality and a 49% increase in the risk of all-cause mortality. Furthermore, the lack of physical activity is globally responsible for 6% of the burden of coronary heart disease and 7% of type 2 diabetes. There is an abundant amount of research when it comes to sedentary behaviour due to its re-ignition in the past decade.

After exploring and understanding the possible outcomes of a sedentary lifestyle, the solutions to reduce the extensive sitting time and the physiological changes it makes to our bodies can be present to the viewers. For examples, how changing the surrounding environments of school and offices can increase activity in our population and how adjusting posture can positively affect our bodies.

The target audience consists mainly of individuals who tend to or are required to sit for extended time periods, like students and office workers.

TOPIC DESCRIPTION AND POSITION STATEMENT

POSITION STATEMENT

HEADLINE:
The effects and solutions to a sedentary lifestyle

SUMMARY STATEMENT
Adults to young adults living with extended periods of physical inactivity need to be informed about the effects of a sedentary lifestyle so that they can take precautions to prevent long-term medical consequences and even risk of death.

THE ISSUE
In the study of "sitting time and mortality from all causes, Cardiovascular Disease, and Cancer" in Medicine & Science in Sports & Exercise's Volume 41, Issue 5, the researchers looked at the risk of all-cause, cardiovascular disease, cancer, and other mortality associated with daily sitting time between 17,013 men and women. This sample included 7278 men and 9735 women 18-90 yr of age, who participated in the 1981 Canada Fitness Survey.

The amount of regular sitting time was positively associated with mortality rates from all causes, cardiovascular disease, and other causes but not from cancer in the combined sample of men and women. After comparing with age, sex, smoking status, alcohol consumption, leisure time physical level, the results remain suggesting that greater sedentary periods in daily activities is associated with elevated risks of mortality.

In Medicine & Science in Sports & Exercise Volume 42, Issue 5, The study of "Sedentary Behaviours Increase Risk of Cardiovascular Disease Mortality in Men" compared characteristics of men who did and did not experience fatal CVD. Which showed no significant difference between the two groups for the time reported riding in a car, time spent viewing TV was significantly different between the non-CVD death and the CVD death groups.

Based on American Journal of Preventive Medicine's study "Sitting-Time, Physical Activity, and Depressive Symptoms in Mid-Aged Women," women who sat more than seven h/day and women who did no physical activity are three times more likely to have depressive symptoms.

ACTIONS NEEDED
Based on research of sedentary behaviours, the addition of regular physical activities, stretching breaks in between focus working/studying sessions, adjustments of sitting postures and changes in the surrounding environments can help reduce risks of heart diseases and mortality rates along with improving our physical and mental health. Another suggestion can be changing the school or work environment to increase physical activity.

THE ADVOCATE
The most likely advocate of this paper is the Canadian Public Health Association. It's an organization that promotes the public health perspective and evidence to government leaders and policy-makers. They identify and address emerging medical research which aligns with my purpose for the project. The CPHA also host various conferences with public health professionals, researchers, academics and students to fortify the aims to enhance the public health and well-being.

APPENDIX

THE EFFECTS OF A SEDENTARY LIFESTYLE

GENERAL

- Sedentary lifestyle involve activities that require very little movement, that involve sitting or reclining, are called sedentary behaviours. Common sedentary behaviours include watching TV, sitting at a desk or driving in an automobile. Research shows that sedentary behaviour is associated with chronic disease and other poor health outcomes.
- On average, Canadian adults spend 9.8 hours of their daily waking hours being sedentary
- Canadians adults get an average of 7.1 hours of sleep each night
- Look at Appendix for Average amount of time spent in sedentary behaviour in US between different age groups.

Government Of Canada:
"Canadians adults get an average of 7.1 hours of sleep each night.

On average, Canadian adults spend 9.8 hours of their daily waking hours being sedentary. Activities that require very little movement, that involve sitting or reclining, are called sedentary behaviours. Common sedentary behaviours include watching TV, sitting at a desk or driving in an automobile. Research shows that sedentary behaviour is associated with chronic disease and other poor health outcomes."

American Journal of Epidemiology:
"Across the age range of the study population, there were two striking peaks in the amount of time spent in sedentary behavior. Children aged 6–11 years were the least sedentary group in the United States (males: 41.4 percent, 6.0 hours/day; females: 43.4 percent, 6.1 hours/day), but by age 16–19 years, time spent in sedentary pursuits had increased by about 2.0 hours/day (males: 55.8 percent, 7.9 hours/day; females: 59.0 percent, 8.1 hours/day). Young adults (ages 20–29 years) were less sedentary than older adolescents, but sedentary time increased by about 2 hours/day between the ages of 30 and 39 years (men: 50.8 percent, 7.2 hours/day; women: 53 percent, 7.3 hours/day) and the ages of 70 and 85 years (table 2). Adults aged 70–85 years were the most sedentary group in the population (men: 67.8 percent, 9.5 hours/day; women: 66.3 percent, 9.1 hours/day). Tests for linear trend by age were significant ($p < 0.001$) overall (table 2) and when evaluated separately in youth and adulthood (data not shown)."

Age group (years)		All participants	Males	Females	*p* value†
Total		7.67 (0.04)‡	7.63 (0.04)	7.70 (0.03)	0.001
Youths					
	6–11	6.07 (0.06)	6.00 (0.10)	6.14 (0.05)	0.002
	12–15	7.53 (0.10)	7.37 (0.15)	7.70 (0.08)	0.003
	16–19	8.03 (0.08)	7.91 (0.13)	8.13 (0.10)	0.028
Adults					
	20–29	7.48 (0.11)	7.27 (0.16)	7.68 (0.09)	0.001
	30–39	7.25 (0.10)	7.17 (0.17)	7.34 (0.08)	0.061
	40–49	7.55 (0.08)	7.57 (0.11)	7.53 (0.11)	0.252
	50–59	7.87 (0.09)	7.93 (0.14)	7.82 (0.08)	0.515
	60–69	8.41 (0.09)	8.80 (0.14)	8.08 (0.10)	0.003
	70–85	9.28 (0.06)	9.52 (0.06)	9.11 (0.08)	0.015
p-trend		<0.001	<0.001	<0.001	

Average amount of time spent in sedentary behaviour in US between different age groups from "Amount of Time Spent in Sedentary Behaviors in the United States, 2003-2004"

APPENDIX

THE EFFECTS OF A SEDENTARY LIFESTYLE

PHYSICAL EFFECTS

WEIGHT GAIN

- In 2015 researchers found a positive association between sitting and body composition, heart fat, liver fat, visceral fat, and waist circumference independent of physical activity. Interruptions of sitting time with standing and stepping were associated with lower BMI scores

MORTALITY:

- Sedentary behaviour has been associated with 8% of all mortality
- Watching TV for more than 2 hours per day was associated with a 13% increased mortality risk
- The men in the study who spent six hours or more per day of their leisure time sitting had an overall death rate that was about 20 percent higher than the men who sat for three hours or less.
- Replacing one hour of sitting with low exercise activities such as household chores, garden work and daily walking were sufficient to reduce all-cause mortality by 30%. Exercise reduce the same risk by 48%.

BMJ OPEN

"There were significant correlations between average daily sitting and liver adiposity and visceral/subcutaneous abdominal fat ratio (r=0.66 and 0.64, respectively); standing

This pilot study has provided preliminary evidence of the strong relationships between objectively measured sitting and standing (an accelerometer/inclinometer attached to the participant's thigh mid-way between the hip and the knee) and precise measures of body composition."

US NATIONAL LIBRARY OF MEDICINE & NATIONAL INSTITUTE OF HEALTH

"This study demonstrates an increasing risk of disease and mortality with increasing total sitting time and TV viewing time. It also revealed a threshold of 6–8 h/day of total sitting and 3–4 h/day of TV viewing, above which risk for several important health outcomes increased more rapidly. This suggests that sedentary behaviour guidelines may need further quantification of sitting time volumes that should be avoided, although for some outcomes such as T2D, any sitting time reductions would be beneficial. With 8% of all mortality and 29% of T2D in the English population associated with certain sedentary behaviours, there is great potential for substantial public health benefits. "

GET AMERICAN STANDING

"Sedentary behaviour has been associated with an increased risk of all-cause mortality of up to 24%-49%.
Both maintaining sitting time low and reducing it was associated with a reduced risk of all-cause mortality in American post-menopausal women. Increasing standing time among Australians aged 45 and above seemed to lower the risk of all-cause mortality. Watching TV for more than 2 hours per day was associated with a 13% increased risk
The association between sitting and all-cause mortality among older adults (over 60 years old) has also been supported by evidence. Replacing one hour of sitting with low exercise activities such as household chores, garden work and daily walking were sufficient to reduce all-cause mortality by 30%. Exercise reduced the same risk by 48%.
Replacing sedentary time with equal amounts of sleeping (in people who sleep less than 7 hours/day) and standing had beneficial effects."

APPENDIX

THE EFFECTS OF A SEDENTARY LIFESTYLE

PHYSICAL EFFECTS

METABOLIC SYNDROME:
- Men and women who sit more might have up to 73% increased risk of developing metabolic syndrome compared with those who sit little, regardless of activity and cardiorespiratory fitness. Simiaarly reported in children
- Among older adults (over 60 years old), each hour of TV watching has been associated with a 19% increased risk of having metabolic syndrome

OSTEOPOROSIS
- Prolonged sitting might be a risk factor for bone health in women.
- Women can lose up to 1% of bone mass a year by sitting more than 6 hours per day

ELSEVIER

"This study reports first evidence that objectively measured sedentary time is negatively associated with bone mineral density of the femur region in women. This association appears independent of the level of PA and is not attenuated by the engagement in moderate and vigorous activity during the rest of the day. There is also an association between LIPA and BMD. Collinearity between LIPA and SB time does not allow for checks for independence between the two, however, the strength of this positive effect is comparable to the negative effect seen for total SB time."

GET AMERICAN STANDING

"Approximately 25% of European, American and Canadian adults have metabolic syndrome.
Men and women who sit more might have up to a 73%-76% increased risk of developing metabolic syndrome compared with those who sit little, regardless of activity and cardiorespiratory fitness. A similar association has been reported for children and youth.Being physically active might reduce the risk. Among older adults (over 60 years old), each hour of TV watching has been associated with a 19% increased risk of having metabolic syndrome."

NEUROIMAGE

"This systematic review suggests that objectively measured total sedentary time is negatively associated with bone outcomes of the lower extremities in schoolchildren. This association seems rather small and independent of MVPA but clearly needs further study. Based on the available literature, we calculated that 1 h less sedentary time per day is associated with the same effect on femoral neck BMD as 18 min of MVPA, but it should be noted that this conclusion is based on one high-quality longitudinal study."

MEDICINE & SCIENCE IN SPORTS & EXERCISE

"Meta-analysis also indicates significantly greater odds for metabolic syndrome."
"Sedentary time was self-reported in 9 of 10 studies (3). Comparing relatively low and high categories of sedentary time, the most sedentary categories had 73% greater odds for metabolic syndrome, even after some of these studies apparently adjusted for BMI and MVPA."

APPENDIX

THE EFFECTS OF A SEDENTARY LIFESTYLE

PHYSICAL EFFECTS

MUSCLE DEGENERATION
- Older adults watching TV at least 6 hours a day have poorer strength compared to those who engage in less than 2 hours of TV watching a day.

BACK/NECK PAIN
- Sitting time has been positively associated with both low back pain and neck-shoulder pain intensity among office workers.

CARDIOVASCULAR DISEASE
- Higher levels of sedentary behaviour are associated with a 64%-82% increase in relative risk of Cardiovascular disease
- Muscles burn less fat and blood flows more slowly during prolonged sitting, which leads to clogged arteries and fatty liver disease

PLOS ONE
"The associations we observed for screen-based sedentary behaviour were largely confined to hand grip strength. This is perhaps not surprising because chair rising is a far more complex test that not only involves strength but also neuromuscular control. Hand grip is a simple isometric test of upper body muscle strength. Previous data from middle aged British adults suggested that physical activity had stronger protective effects on handgrip strength in men than in women."

US NATIONAL LIBRARY OF MEDICINE & NATIONAL INSTITUTE OF HEALTH
"Transitioning from a seated to a standing work posture every 30 min across the workday, relative to seated work, led to a significant reduction in fatigue levels and lower back discomfort in overweight/obese office workers, while maintaining work productivity. Future investigations should be directed at understanding whether sustained use of height-adjustable workstations promote concentration and productivity at work."

MEDICINE & SCIENCE IN SPORTS & EXERCISE
"377 CVD deaths occurred during 21 years of follow-up. After age-adjustment, time riding in a car and combined time spent in these two sedentary behaviors were positively (p trend <.001) associated with CVD death. Men who reported >10 hrs/wk riding in a car or >23 hr/wk of combined sedentary behavior had 82% and 64% greater risk of dying from CVD than those who reported <4 hr/wk or <11 hr/wk, respectively. The pattern of the association did not materially change after multivariate adjustment. Regardless of the amount of sedentary activity reported by these men, being older, normal weight, normotensive, and physically active was associated with a reduced risk of CVD death."

APPENDIX

THE EFFECTS OF A SEDENTARY LIFESTYLE

PHYSICAL EFFECTS

DIABETES

- Higher levels of sedentary behaviour are associated with a 112% increase in relative risk of Diabetes
- A positive association between sedentary behaviour and type 2 diabetes has been reported among adults, independent of physical activity.
- People who watch TV more than 2 hours a day had a 20% increased risk of type 2 diabetes

JAMA

"Our results from the meta-analysis of prospective cohort studies suggest that TV viewing is consistently associated with higher risk of type 2 diabetes, fatal or nonfatal cardiovascular disease, and all-cause mortality. We observed RRs of 1.20 for type 2 diabetes, 1.15 for cardiovascular disease, and 1.13 for all-cause mortality per every 2-hour increase in TV viewing per day. Based on incidence rates in the United States, we estimated that the absolute risk difference (cases per 100 000 individuals per year) per 2 hours of TV viewing per day was 176 for type 2 diabetes, 38 for fatal cardiovascular disease, and 104 for all-cause mortality."

MEDICINE & SCIENCE IN SPORTS & EXERCISE

"Meta-analysis (10 studies) suggest there is a 112% greater relative risk associated with a large duration of sedentary behavior for type 2 diabetes. "

"One meta-analysis examined 10 studies (6 prospective) including 505,045 participants (10) and found that there was a 112% greater pooled relative risk of diabetes associated with large vs. small amounts of TV time"

APPENDIX

THE EFFECTS OF A SEDENTARY LIFESTYLE

MENTAL EFFECTS

PSYCHOLOGICAL DISTRESS

- Compared to those sitting at work less than 3 h/day, men sitting more than 6 h/day had increased prevalence of moderate psychological distress, and women sitting more than 6 h/day had an increased prevalence of moderate and high distress. The current study found an association between occupational sitting and intermediate levels of psychological distress, independent of leisure-time physical activity.

MENTAL HEALTH AND PHYSICAL ACTIVITIES

"Compared to those sitting at work less than 3 h/day, men sitting more than 6 h/day had increased prevalence of moderate psychological distress (adjusted PR = 1.90, 95%CI 1.22, 2.95), and women sitting more than 6 h/day had an increased prevalence of moderate (adjusted PR = 1.25, 95%CI 1.05, 1.49) and high (adjusted PR = 1.76, 95%CI 1.25, 2.47) distress."

"Prolonged sitting, a potentially modifiable behaviour, has established adverse implications for physical health. Our study found a significant association between prolonged sitting at work and intermediate levels of psychological distress, notwithstanding there was no consistent relationship observed for very high distress. Those in this latter category may be experiencing stressors that overshadow any potential weaker association with occupational sitting. While further prospective research is required before causal inferences can be drawn, these findings contribute to the emerging literature researching the independent health outcomes associated with sedentary behaviours."

APPENDIX

THE EFFECTS OF A SEDENTARY LIFESTYLE

MENTAL EFFECTS

DEPRESSION

- A 31% increased risk for developing a mental disorder has been linked to adults who engage in 42 hours of watching TV and/or using the computer per week when compared with those who do so for less than 10.5 hours per week
- The likelihood of depressive symptoms in women who sat more than 7 hours per day and did no physical activity was triple that of women who sat less than 4 hours per day and met physical activity guidelines.
- People who sat for 8-10 hours or more than 10 hours had increased risk of major depressive disorder compared to those who sat for less than 5 hours a day
- Subgroup analysis showed that the strongest effect of reported sitting time on risk of MDD was found in men with lower levels of physical activity who sat for 8 to 10 hours.
- Level of physical activity was not an independent predictor for MDD.
- A study of more than 3,300 government workers in Australia found that those who spent more than six hours of a typical workday seated were more likely to score in the moderate to high range on a test of psychological distress than those who sat fewer than three hours

GET AMERICAN STANDING

"A 31% increased risk for developing a mental disorder has been linked to adults who engage in 42 hours of watching TV and/or using the computer per week when compared with those who do so for less than 10.5 hours per week (93).

Relative to those who were sedentary (4 hours or more/day), older adults who were moderately (2–4 hours/day) and least sedentary (<2 hours/day) were 38% and 43% more likely to age successfully, respectively (50).

Less convincing evidence is available for the association between sedentary behaviour and anxiety. However, moderate evidence suggests a link between total sitting and a greater risk of anxiety (96)

Although there seems to be a positive association between sitting and depressive symptoms in children, teenagers and adults, the evidence remains inconclusive (74, 86).

The type and context of the sedentary behaviour is important, as activities such as computer use, reading, playing board games and craft activities might be associated with a reduced risk of dementia among older adults (over 60 years old) (81)."

BMC PSYCHIATRY

"This study is the first to consider evidence for the effect of overall sitting time on risk of MDD in Korea. Using cross-sectional design, our study found that sitting time was positively associated with MDD. Sitting for long periods (>10 h/d) was significantly related to higher risk of MDD in both men and women. Sitting for 8–10 h/d was associated with risk of MDD in both sexes; however, the association was statistically significant only in women. In addition, PA was inversely related to MDD risk, although this association was nonsignificant."

APPENDIX

THE EFFECTS OF A SEDENTARY LIFESTYLE

MENTAL EFFECTS

ANXIETY

- Employees who reported sitting for longer than six hours per day had higher rates of anxiety
- Going to the gym after work doesn't protect workers from the effects of prolonged sitting.
- When study participants were sedentary for most of the work day, even if they were physically active and getting exercise outside of work, they still showed relatively higher rates of anxiety and depressive symptoms than did workers who sat for less than three hours a day.
- Consequently, individuals may be meeting recommended levels of health promoting physical activity, yet their physical and mental health may remain at risk if they are also sedentary for prolonged periods,
- The risk of mental disorders in those with high physical activities levels and short periods of sedentary behaviour was 25% lower relative to that of those opposites.

BMC PUBLIC HEALTH

This is the first review to examine evidence regarding the association between sedentary behaviour and risk of anxiety. It is important to better understand this relationship as this information may help to inform the development of lifestyle change strategies for reducing the risk of anxiety in different population groups. It is clear from this review that the current body of evidence exploring the relationship between sedentary behaviour and risk of anxiety is limited, with only nine studies currently been published. On the balance, however, most studies (78 %) found at least one positive association between sedentary behaviour and anxiety risk.

NEUROIMAGE

"For women, compared to those sitting at work less than three hours/day, those sitting between three and six hours/day or more than six hours/day were more likely to fall into the category of experiencing a mild mental disorder (PR = 1.50, 95%CI 1.06 2.14, $p < 0.05$ and PR = 1.38, 95%CI 0.98, 1.97, $p > 0.05$, respectively). Further analyses, using a three-group 'Plain English' K10 categorisation (Boufous, Silove, Bauman, & Steel, 2005), produced significant associations with prevalence of moderate symptoms of depression and/or anxiety (men, PR = 1.61, 95%CI 1.16, 2.24, $p < 0.01$, and women, PR = 1.31, 95%CI 1.15, 1.50, $p < 0.001$), for those who sat six or more hours/day relative to employees who sat less than three hours/day."

APPENDIX

PREVENTION METHODS OF LONG TERM EFFECTS

CHANGING POSTURES

- By leaving our torso slumped for an extended period of time, we put a huge strain on the vertebrae. It is necessary for us to change posture to create movement and comfortability in our sitting.
- There are two ways to lessen the strains on your vertebrae, which is through slanting the upper body backwards or forward-leaning your torso and your thighs sloping down.

MICROBREAKING

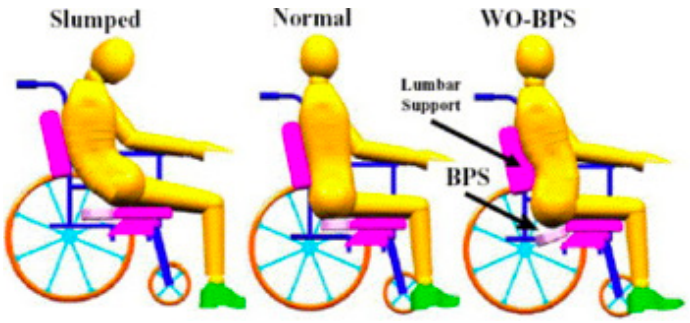
- Taking short and frequent breaks from sitting during the workday lead to reduction of sedentary time and beneficial health outcomes.
- Humans bodies are designed for dynamic use and are not well adapted to static strain. We soon feel discomfort if we have to keep our whole body or parts of our body still for any length of time.
- Introducing exercise microbursts across the day can reduce fatigue and improve energy level and mood, while maintaining usual cognitive performance.

ENVIRONMENTAL DESIGN

There is now a movement in the occupational space, which the environmental graphic designers can introduce certain behaviours to bring back the movement and variation our bodies need. For example, placing the photocopier, coffee machine and fax to be a farther distance from the workspace.

ERGONOMIC CHAIRS AND STANDING DESKS

- It is unnatural for us to stay put in the same position for any length of time, we are much happier rotating into different positions. It is necessary for chairs to accommodate this basic natural need.
- In the study "Effect of different sitting postures on lung capacity, expiratory flow, and lumbar lordosis," the researchers looked at different postures shown bellow.



- In the study, the subject's posture influenced the airflow during the subject's breathing test. In the posture WO-BPS, the subject recieve the most airflow then to the normal and lastly, the slumped posture.
- The slumped posture was detrimental to both spinal alignment and respiratory function.

APPENDIX

PREVENTION METHODS OF LONG TERM EFFECTS

BMC PUBLIC HEALTH

"It clearly shows that the subject's posture influenced the airflow during the subject's breathing test. This particular subject had the best LC-EF when in the standing posture, then in the WO-BPS sitting posture, followed by the normal sitting posture. The most compromised LC-EF resulted from the slumped sitting posture."

US NATIONAL LIBRARY OF MEDICINE & NATIONAL INSTITUTE OF HEALTH

"When children attended school in their traditional environment, they moved an average (mean ± standard deviation) 71 ± 0.4 m/s2. When the children attended school in the activity-permissive environment, they moved an average of 115 ± 3 m/s2. The children moved 71 ± 0.7 m/s2 while attending the traditional school with standing desks. Children moved significantly more while attending school in the activity-permissive environment compared to the amount that they moved in either of the traditional school environments ($P<0.0001$ for both). Comparing children's activity while they were on summer vacation (113 ± 8 m/s2) to school-bound children in their traditional environment showed significantly more activity for the children on summer vacation ($P<0.0001$). The school children in the activity-permissive environment were as active as children on summer vacation."

MEDICINE & SCIENCE IN SPORTS & EXERCISE

"SFA FMD exhibits an acute decline during 3hr of sitting. Starting at 1hr, FMD in the SFA attenuates and remains significantly low through 3hr of quiet sitting. This is complimentary to the significant decline in mean and antegrade shear rates. The decline in FMD is counteracted by adding 5 min of light intensity physical activity (2 miles.hr-1) bouts each hour during the sitting time. Three hours of sitting is a common phenomenon in different settings such as workplace, transportation, and leisure settings. Our results provide with first experimental evidence demonstrating that breaking sitting time protects endothelial function and hence may be anti-atherosclerotic in nature. We believe our observations further the argument to have structured public health guidelines on limiting sitting time"

PREVENTIVE MEDICINE REPORTS

In conclusion, results of this study showed that taking short, frequent breaks from sitting during the workday was a feasible and effective approach for reducing sedentary time at work among participating employees. Future studies should complement the individual-level strategies delivered in this intervention with organizational and environmental changes at the worksite level to determine whether greater improvements in sedentary behavior and health outcomes can be achieved.

NOTES:

A lot of my information on prevention methods, specifically ergonomic chairs are also in the book "Rethinking Sitting" and "A Taxonomy on Office Chairs"

APPENDIX

THE BENEFITS OF REDUCING SITTING PERIODS

CONCENTRATION

When comparing sitting down and standing up, sitting regardless of posture, reduces blood flow and oxygen level, which results in a lower concentration level.

SLEEP

Both non-exercisers and exercisers who spent less than 6 h/day and 6 to less than 8 h/day reported significantly better sleeping than those who spent 8 h/day or more.

BACK AND BACK PAIN

When asked to interrupt office worker sitting every 30 min during the day, overweight/obese office workers showed a 32% reduction in lower back discomfort, compared to seated work.

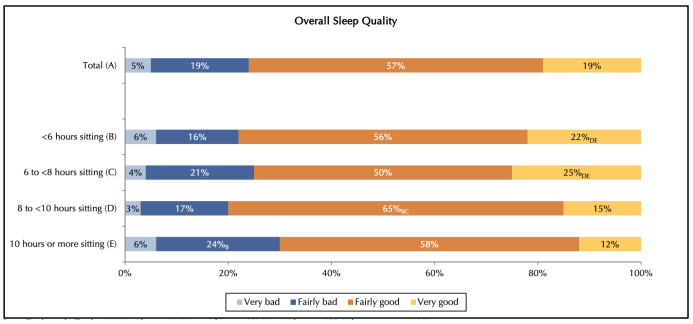
SCIENCEDAILY

"The findings, published in the International Journal of Health Promotion and Education, were based on a study of almost 300 children in second through fourth grade who were observed over the course of a school year. Engagement was measured by on-task behaviors such as answering a question, raising a hand or participating in active discussion and off-task behaviors like talking out of turn."

BMC PUBLIC HEALTH

"This is the first review to examine evidence regarding the association between sedentary behaviour and risk of anxiety. It is important to better understand this relationship as this information may help to inform the development of lifestyle change strategies for reducing the risk of anxiety in different population groups. It is clear from this review that the current body of evidence exploring the relationship between sedentary behaviour and risk of anxiety is limited, with only nine studies currently been published. On the balance, however, most studies (78 %) found at least one positive association between sedentary behaviour and anxiety risk."

NATIONAL SLEEP FOUNDATION



OCCUPATIONAL AND ENVIRONMENTAL MEDICINE

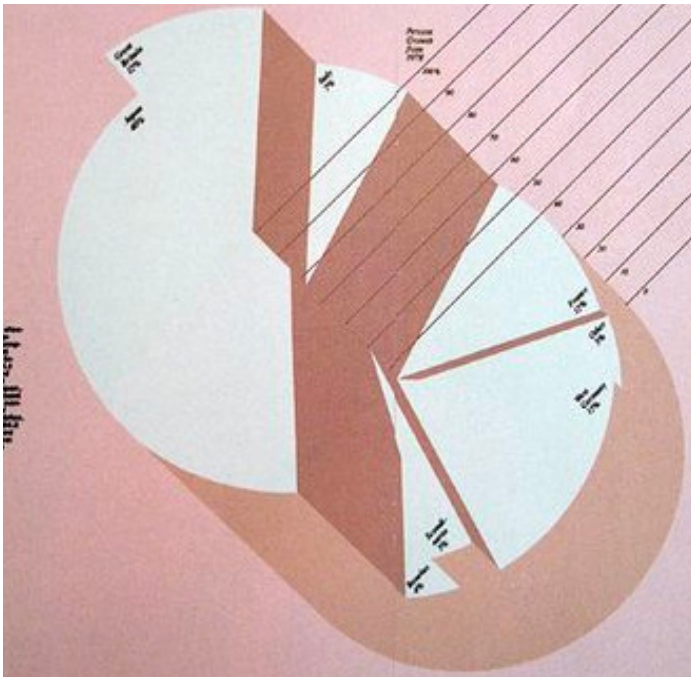
"During the preceding 12 months, a proportion of participants (14 out of 23) reported that they had experienced musculoskeletal symptoms (ache, pain, discomfort) in several anatomical areas; the most common areas being the neck and lower back region (data not shown). As shown in table 1, participants reported significantly fewer musculoskeletal symptoms (ache, pain, discomfort) in the lower back region (32% reduction; p=0.03) and a tendency for fewer symptoms in the ankles/feet (p=0.08) during the STAND-SIT condition compared with the SIT condition. For all other anatomical areas, musculoskeletal symptoms remained consistent between experimental conditions (all p>0.16). For both experimental conditions, participants did not report that their musculoskeletal symptoms in the past 5 workdays prevented them from performing their work tasks
(data not shown).

PROSOSAL AND SEQUENCES FOR PHASE TWO

VISUALIZATIONS

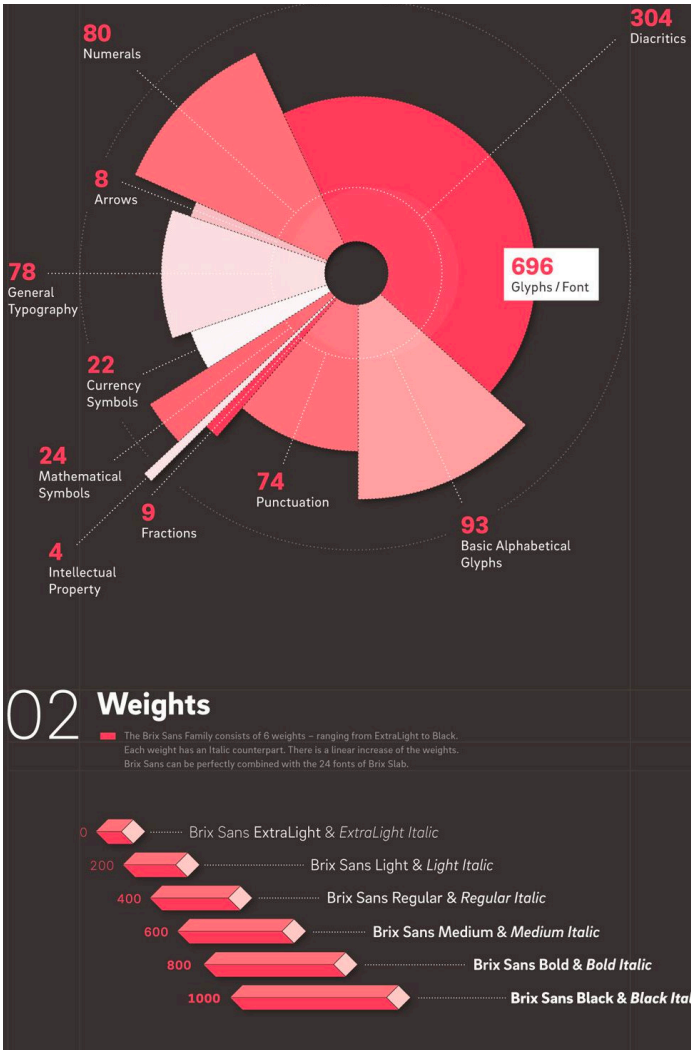
- Piecharts used for showcasing the average sitting and sleeping period of Canadian.
- Bar charts can be used to compare sitting periods between each age groups

- Displaying bar charts with height of chairs or having flat designed critters standing on the bar charts



Credits: insect54. Retrieved from https://www.flickr.com/photos/insect54/2294006000/

Credits: Evanto Elements. Retrieved from https://elements.envato.com/business-growth-flat-design-style-illustration-NJ26TR?utm_source=affiliates&utm_medium=banner-af&utm_campaign=elements_af_p_ksiosks



Credits: Brix Sans. Retrieved from https://www.pinterest.ca/pin/AV9NAQ4stN_EoDHACMXECL1XEOsqCSmOQwE04hJgMkMXc-Xgpbtll_w/

PROSOSAL AND SEQUENCES FOR PHASE TWO

ILLUSTRATION STYLE

The style is welcoming, engaging, well used in office working culture.

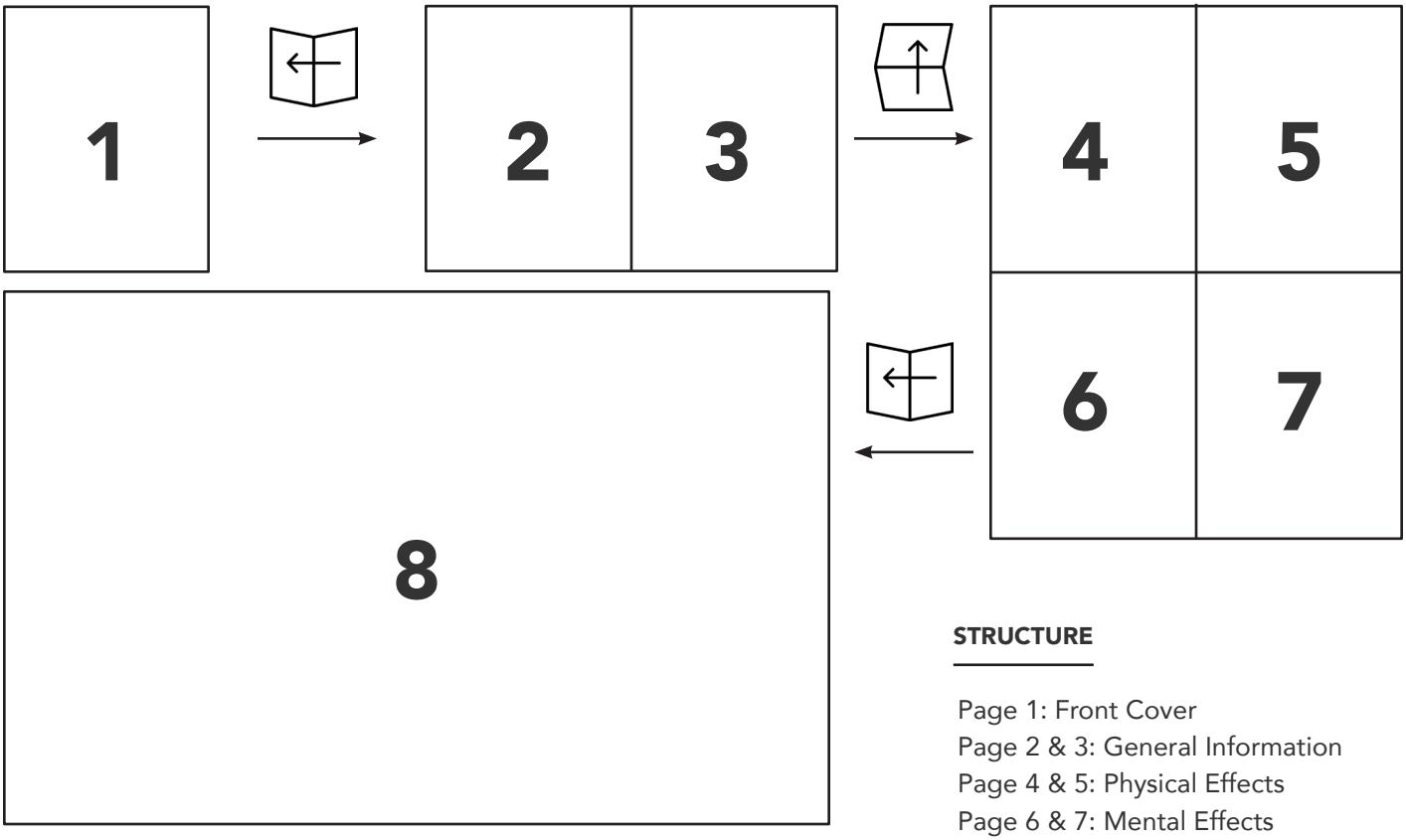
Credits: Justin Tran. Retrieved from https://dribbble.com/shots/3408347-kool-kidz

Credits: Csaba Khilenberg. Retrieved from https://dribbble.com/shots/3247242-Bus-Stop

Credits: Meier Delphine. Retrieved from https://www.pinterest.ca/pin/341007003013251852/

SEQUENCES AND STRUCTURE FOR PHASE TWO

SEQUENCING



4	5	3	2
6	7	9	1

STRUCTURE

Page 1: Front Cover
Page 2 & 3: General Information
Page 4 & 5: Physical Effects
Page 6 & 7: Mental Effects
Page 8: Preventions of long term effects and benefits of reducing sitting periods
Page 9: Back Cover

BIBLIOGRAPHY

Patel, A. V., L. Bernstein, A. Deka, H. S. Feigelson, P. T. Campbell, S. M. Gapstur, G. A. Colditz, and M. J. Thun. "Leisure Time Spent Sitting in Relation to Total Mortality in a Prospective Cohort of US Adults." American Journal of Epidemiology 172, no. 4 (2010): 419-29. Accessed October 4, 2018. doi:10.1093/aje/kwq155.
- Looking at leisure time spent sitting in relation to mortality rate

"Data Blog." Obesity in Canadian Adults: It's about More than Just Weight - Data Blog - Chronic Disease Infobase | Public Health Agency of Canada. April 26, 2017. Accessed October 05, 2018. https://infobase.phac-aspc.gc.ca/datalab/pass-blog-en.html.
- Explaining the definition of a sedentary lifestyle as well as providing general information

Nam, J. "The impact of sitting time and physical activity on major depressive disorder in South Korean adults: a cross-sectional study." BMC Psychiatry, 17, 274. (retrieved October 1, 2018).
- Looking at the impact of extended period of sitting and its effect on major depressive disorder

"2013 Exercise and Sleep." National Sleep Foundation. Accessed October 02, 2018. https://www.sleepfoundation.org/sleep-polls-data/sleep-in-america-poll/2013-exercise-and-sleep.
- Looking at the impact of how extended period of sitting affect sleep quality

Kilpatrick, Michelle. "Cross-sectional Associations between Sitting at Work and Psychological Distress: Reducing Sitting Time May Benefit Mental Health." NeuroImage. June 18, 2013. Accessed October 02, 2018. https://www.sciencedirect.com/science/article/pii/S1755296613000252.
- Looking at the reduction of sedentary behaviour periods and its effects on mental health

"Top 10 Risks." Get Canada Standing. Accessed October 02, 2018. http://getcanadastanding.org/top10risks.
- Providing evidence and research on the risk of negative physical effects by excessive sitting.

Mailey, Emily L., Sara K. Rosenkranz, Kelsey Casey, and Aaron Swank. "Comparing the Effects of Two Different Break Strategies on Occupational Sedentary Behavior in a Real World Setting: A Randomized Trial." Preventive Medicine Reports 4 (2016): 423-28. doi:10.1016/j.pmedr.2016.08.010.
- Understanding how taking small breaks can help reduce negative effects on the body.

Matthews, C. E., K. Y. Chen, P. S. Freedson, M. S. Buchowski, B. M. Beech, R. R. Pate, and R. P. Troiano. "Amount of Time Spent in Sedentary Behaviors in the United States, 2003-2004." American Journal of Epidemiology 167, no. 7 (2008): 875-81. doi:10.1093/aje/kwm390.
- Average time spent sitting per day based on age group

Opsvik, Peter. Rethinking Sitting. Oslo: Gaidaros Forlag AS, 2017.
- Looking at various prevention methods of long term effects when designing an ergonomic chair.

BIBLIOGRAPHY

F, Lin. "Effect of Different Sitting Postures on Lung Capacity, Expiratory Flow, and Lumbar Lordosis." Current Neurology and Neuroscience Reports., U.S. (retrieved October 1, 2018).
- Looking at how different sitting postures affect expiratory flow and how lumbar supports can help with inhaling oxygen

THOSAR, SAURABH S.. "Effect of Prolonged Sitting and Breaks in Sitting Time on Endothelial Function." : Medicine & Science in Sports & Exercise." Medicine & Science in Sports & Exercise, Oxford University Press, Apr. (retrieved October 1, 2018).
- Taking breaks between sitting session and how it reduces mental and physical risks

Lanningham-Foster, Lorraine et al. "Changing the School Environment to Increase Physical Activity in Children." Obesity (Silver Spring, Md.) 16.8 (2008): 1849–1853. PMC. Web. 2 Oct. 2018.
- Looking at how the study changed children' behaviours and how this can be applied to office space.

"Data Blog." Obesity in Canadian Adults: It's about More than Just Weight - Data Blog - Chronic Disease Infobase | Public Health Agency of Canada. April 26, 2017. Accessed October 02, 2018. https://infobase.phac-aspc.gc.ca/datalab/pass-blog-en.html.
- General knowledge about sleeping, which can be affected by long sitting periods

Bergouignan, Audrey, Kristina T. Legget, Nathan De Jong, Elizabeth Kealey, Janet Nikolovski, Jack L. Groppel, Chris Jordan, Raphaela O'Day, James O. Hill, and Daniel H. Bessesen. "Effect of Frequent Interruptions of Prolonged Sitting on Self-perceived Levels of Energy, Mood, Food Cravings and Cognitive Function." International Journal of Behavioral Nutrition and Physical Activity 13, no. 1 (2016). doi:10.1186/s12966-016-0437-z.
- Looking at the effect of frequent breaks of prolonged sitting on mood, food cravings and cognitive function

Smith L, Thomas EL, Bell JD, et al. The association between objectively measured sitting and standing with body composition: a pilot study using MRI. BMJ open 2014;4(6):e005476.
- The study looks at the association between measured sitting time with weight gain.

"Top 10 Risks." Get America Standing. Accessed October 05, 2018. http://getamericastanding.org/top10risks.
- Looking at the health risks of extended periods of sitting

"Associations between Objectively-measured Sedentary Behaviour and Physical Activity with Bone Mineral Density in Adults and Older Adults, the NHANES Study." NeuroImage. April 13, 2014. Accessed October 05, 2018. https://www.sciencedirect.com/science/article/pii/S8756328214001446?via=ihub.
- Looking at the association between bone mineral density and sedentary lifestyle

"Sedentary Behaviour and Bone Health in Children ..." Accessed October 4, 2018. https://link.springer.com/content/pdf/10.1007/s00198-017-4076-2.pdf.
- Sedentary Lifestyle effects on bone density of young children.

BIBLIOGRAPHY

Hamer, Mark, and Emmanuel Stamatakis. "Screen-Based Sedentary Behavior, Physical Activity, and Muscle Strength in the English Longitudinal Study of Ageing." PLoS ONE 8, no. 6 (2013). doi:10.1371/journal.pone.0066222.
- Looking at grip strength in aging population and its correlation with sedentary behavior Thorp, Alicia A., Bronwyn

A. Kingwell, Neville Owen, and David W. Dunstan. "Breaking up Workplace Sitting Time with Intermittent Standing Bouts Improves Fatigue and Musculoskeletal Discomfort in Overweight/obese Office Workers." Occupational and Environmental Medicine 71, no. 11 (2014): 765-71. doi:10.1136/oemed-2014-102348.
- Looking at the relationship between back and neck pain vs. Sitting time.

Warren, Tatiana Y., Vaughn Barry, Steven P. Hooker, Xuemei Sui, Timothy S. Church, and Steven N. Blair. "Sedentary Behaviors Increase Risk of Cardiovascular Disease Mortality in Men." Medicine & Science in Sports & Exercise 42, no. 5 (2010): 879-85. doi:10.1249/mss.0b013e3181c3aa7e.
- Studying the Risk of Cardiovascular Mortality in correlation with Sedentary Behaviours

Hamilton, Marc T., Deborah G. Hamilton, and Theodore W. Zderic. "Sedentary Behavior as a Mediator of Type 2 Diabetes." Medicine and Sport Science Diabetes and Physical Activity, 2014, 11-26. doi:10.1159/000357332.
- Looking at sedentary behaviour in relation of type 2 Diabetes and Metabolic Syndrome

Teychenne, Megan, Sarah A. Costigan, and Kate Parker. "The Association between Sedentary Behaviour and Risk of Anxiety: A Systematic Review." BMC Public Health 15, no. 1 (2015). doi:10.1186/s12889-015-1843-x.
- Looking at Anxiety and Sedentary behaviour

Grøntved, Anders. "Television Viewing and Risk of Type 2 Diabetes, Cardiovascular Disease, and All-Cause Mortality." Jama 305, no. 23 (2011): 2448. doi:10.1001/jama.2011.812.
- Looking at the relationship between TV viewing and Type 2 Diabetes risk, cardiovascular disease and all cause mortality

Thorp, Alicia A., Bronwyn A. Kingwell, Neville Owen, and David W. Dunstan. "Breaking up Workplace Sitting Time with Intermittent Standing Bouts Improves Fatigue and Musculoskeletal Discomfort in Overweight/obese Office Workers." Occupational and Environmental Medicine 71, no. 11 (2014): 765-71. doi:10.1136/oemed-2014-102348.
- Looking at breaks in the work place and how it can imrpove fatigue and musculoskeletal discomfort.

"We Think Better on Our Feet, Literally." ScienceDaily. April 24, 2015. Accessed October 05, 2018. https://www.sciencedaily.com/releases/2015/04/150424121118.htm.
- Looking at the correlation of standing and concentration level