The role of work in the etiology of obesity

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Obesity, age 20-74, by income, NHANES, U.S. (BMI ≥30)
Top 3 and bottom 3 male occupations in obesity prevalence (from Caban et al., 2005)

- **Top 3 occupations:**
  - motor vehicle operators (31.7%)
  - private household occupations (31.3%)
  - firefighters and police (29.8%)
Obesity: Contributing Factors
(from the US Centers for Disease Control and Prevention)

- Overweight and obesity result from **energy imbalance**.
  - eating too many calories and/or
  - not getting enough physical activity.

- Body weight is the result of **genes, metabolism, behavior, environment, culture, socioeconomic status and activity level**.

- **Our environment** plays a large role in causing people to be overweight/obese
  - Influences behaviors and activity level.
  - These are the greatest areas for prevention and treatment actions.
Peter, I think you may modify this part. I remember that CDC point out two factors - environment and behaviors - but here you emphasize only environment. Definitely you can do - but the audience may be confused about whether this paragraph comes from CDC or you. So it should be clarified here.

BongKyoo Choi, 10/3/2014
The environment has been shaped by industrialization -> the transformation of rural agricultural society to urban industrial society

- Migration from rural areas to urban areas is associated with concomitant change in diet, caloric intake and physical activity levels.
MDZ2  Peter, I don't mind this argument but I think you will have to carefully make a distinction between the historical argument and contemporary transitions. It is not always clear when you are talking about historical shifts vs. contemporary transitions in China. Also, I think it might be more powerful to show some stats about obesity increases globally - especially in China? And then make this argument.
Marnie Dobson, 10/2/2014

BC1  I had a similar feeling with Marnie on this slide
BongKyoo Choi, 10/3/2014
Urbanization and Dietary Changes

- In the past 50 years there has been a twofold increase in the percentage of the world's population living in urban areas (UN, 1999).

- Rural dwellers tend to be
  - more self-reliant in obtaining food
  - tend to eat traditional diets that are high in grains, fruit and vegetables, and low in fat.

- Once in urban areas, same people tend to rely
  - more on external forces for sustenance,
  - resulting in a shift from production of their own food to the purchase of processed foods (Popkin, 1993)
  - increased intake of energy, sugar, refined grains and fat (Monteiro et al., 1992).
Urbanization and Physical activity changes

- Rural to urban migration
  - Those in lower socio-economic situations
    - Those moving to large cities tend to find work primarily as day laborers or factory workers.
    - They leave behind continuous, physical labor and adopt sedentary, sporadic work (Popkin, 1998).

- Physical activity, the one controllable component of total energy expenditure, accounts for 15-30 percent of daily energy expenditure.

- A person experiencing a change in labor practices
  - may see a decline of as much as 1000 or more calories per day,
  - translates into more than a 50 percent reduction in physical activity.
  - such a decline in total energy expenditure, if not accompanied by a reduction in energy intake, may result in weight gain and potential obesity.
I think there are too many words on these slides
Marnie Dobson, 10/2/2014

I think the information on this slide needs to be rechecked again because the paper that examined the change of work-related physical activity concluded that there was about a 100 cal per day over 5 decades in US. The paper - Church et al.
BongKyoo Choi, 10/3/2014
Work and Obesity: Mechanisms
(From Choi et al., 2009: obesity in firefighters)

• Working Conditions -> Decrease Energy Expenditure
  • Decreased work-related physical activity
  • Decreased leisure-time physical activity

• Working Conditions -> Increased Energy Consumption
  • Stress-induced overeating
  • Sweet/chocolates over fruit/fish/vegetables (Oliver and Wardle, 1995)

• Working Conditions -> Chronic strain -> Hypothalamus Dysfunction
  • Alternations of the autonomic nervous system, endocrine systems, and circadian rhythms in relation to lipid metabolisms (Björntorp, 2001)

• Or a combinations of the above
Work Related causes of obesity

- Sedentary Labor $\rightarrow$ decreases caloric expenditure

- Long Work Hours $\rightarrow$ +/- caloric expenditure
  - Increase expenditure if job is physically demanding or if stress causes increase caloric consumption or change in eating habits
  - Decrease caloric expenditure if job is fundamentally sedentary and more hours are spend at sedentary labor

- Job stress due to Psychosocial Factors such as Job strain
  - thru behavioral (over eating)
  - and other pathways (e.g., reduced physical activity in and out of work)
Sedentary Labor

• Modern work requires less expenditure of physical energy than farming or pre-industrial work. Large shifts towards less physically demanding work have been observed on a worldwide basis, both in terms of the proportion of people working in agriculture, industry and services, and in the type of work within most occupations.

• Sedentary occupations such as driving, home workers, firefighters and police have the greatest prevalence of obesity.
Sedentary Labor

- The process of increasingly sedentary work appears to have accelerated since 1950 or so
  - evidence suggests that a sizable portion of the U.S. weight gain may be explained by declining physical activity during the workday.

- Jobs requiring moderate physical activity have declined precipitously since 1960 from 50% to today 80% percent of jobs are sedentary or require only light activity*. 

- The shift translates to an average decline of about **120 to 140 calories a day in physical activity**, closely matching the nation’s steady weight gain over the past five decades*. 

- Moreover, the life course of workers within a job or occupation as they age is towards ever more diminishing physical demands.

- Sedentary labor at work also appears to be associated with decreased physical activity outside of work as well.

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*Church et al. 2011 Trends over 5 decades in U.S. Occupational-Related Physical Activity and their associations with obesity. Plos One May 2011, Vol 6, #5*
Goods Producing Jobs

Manufacturing

Construction

Mining/Logging

Year


Add citation
These need a title - I am assuming this is US labor patterns?

Marnie Dobson, 10/2/2014
Dataset: MIDUS* II dataset:
*Midlife Development in the United States

- From 1995 to 1996, the MacArthur Midlife Research Network carried out a national survey (ie, MIDUS I study) over 7,000 Americans to investigate the role of behavioral, psychological, and social factors in understanding age-related differences in physical and mental health.

- The Institute on Aging at the University of Wisconsin, Madison to carry out a longitudinal follow-up (ie, MIDUS II study) interview/survey (2004-2006) over 4,963 Americans.

- Only approximately representing US workers (but low educated persons were relatively underrepresented in the MIDUS II study).
Results: Sedentary work and general obesity – multivariate analysis*

*Controlled for socio-demographic variables, psychosocial working conditions, health status, and health behaviors.

Multivariate logistic regression in male workers (40+ hrs per week):
Sedentary work + low physical activity

Odds ratios of physical inactivity at work for central obesity: * < 0.05

- Low: 3.35*
- Middle: 4.39*
- High: 5

In summary -> Evolving modern work leads to changes in activity level

- Jobs are continually changing requiring less and less physical activity.
  - Machines leverage human activity so as to make people more productive.
- In addition, as workers age they are promoted and/or rotated to jobs that require less physical activity.
Long Work Hours

- The workweek is getting longer in many countries of the world.
- While many western countries regulate workweek length this is not true in the U.S. nor in much of the developing world.
- The ILO reports that 22% of the world’s workforce is working more than 48 hours a week. In the U.S. salaried workers are putting in more hours than the standard 40-hour workweek.
- Long workweeks are positively correlated with obesity. For example, in our FORWARD study of obesity among firefighters we observe that the more 24 hour shifts that are performed in a month the greater the prevalence of obesity.*
- Long workweeks may also act to moderate psychosocial stressors to enhance stress related maladaptive eating behaviors.

Psychosocial stressors

- The past several years has seen an increasing body of research linking work stressors to obesity including concepts like job strain, effort-reward imbalance*, organizational justice, and engagement (inter alia).
- One of the most important and well researched concepts is that of job strain (work high in demands and low in control).

* Inoue et al. 2010 Biopsychosocial Medicine
Karasek’s Demand-Control model: active-passive hypothesis

![Diagram](image)

*Source: Karasek and Theorell, 1990, p. 32*
Iso-Strain and Incident Obesity (BMI $\geq 30$ kg/m$^2$)

10,308 British Civil Servants, 19-year follow-up
(little change if further adjusted for health behaviors)

OR
(age, educ, employment grade adjusted)

* $p<.05$

Demand-Control quadrants and stress-related overeating† : MIDUS II

Stress-overeating by DC four quadrants
(*p < 0.05)

†Socio-demographic, psychosocial working conditions, health status, and health behaviors were controlled for. Obesity was also adjusted, but no major impact
Threat avoidant vigilant work

- A number of occupations with the greatest prevalence of obesity such as drivers, pilots, firefighters, police officers and ATC have jobs requiring constant vigilance to avoid catastrophe.
It's not clear why this slide should be here --- are you going to mention about bus drivers here as the heaviest occupational group in US?
BongKyoo Choi, 10/3/2014
Mechanisms by which work stressors may contribute to obesity

- Biological arousal from chronic stress leads to increased cortisol secretion.
  - Cortisol plays a role in overeating -- what we call stress-related overeating -- contributing to central obesity as well as insulin resistance.

- Work stressors decrease non-work related physical activity
How to reduce obesity epidemic

- Need to rethink the modern workplace as it is very likely that the chronic illnesses of HBP, obesity, diabetes, metabolic syndrome and ultimately CVD are the outcome of unhealthy work environments.

- Interventions must include efforts to reduce work related stress, long work hours and sedentary labor
The End
A theoretical framework on working conditions, health behaviors, and obesity in firefighters. CNS: central nerve system. From Choi et al., Safety and Health at Work 2011;2:301-12
Obesity (BMI $\geq 30 \text{ kg/m}^2$) prevalence rates of OECD countries

Obesity and the workplace?
Macro-level changes since 1980

- **Technology (automation)**
- **Work organization (Taylorism to lean production)**
- Decreased rates of unionization
- **Service-driven society**
- Globalization - 24/7/365 society
- Neo-liberalism – “Washington consensus”
- Social inequality
Sedentary Work and Obesity: MIDUS II

Odds ratios of sedentary work for obesity (BMI): * < 0.05

<table>
<thead>
<tr>
<th>Sedentary work</th>
<th>Odds ratio Men</th>
<th>Odds ratio Women</th>
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<tbody>
<tr>
<td>Low</td>
<td>1.00</td>
<td>0.98</td>
</tr>
<tr>
<td>Middle</td>
<td>1.60*</td>
<td>1.53*</td>
</tr>
<tr>
<td>High</td>
<td>1.28</td>
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Multivariate logistic regression in male workers (40+ hrs per week):
Sedentary work + low physical activity

Odds ratios of physical inactivity at work for central obesity: * < 0.05

<table>
<thead>
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<th>Odds ratio</th>
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<tbody>
<tr>
<td>Low</td>
<td>1.0</td>
</tr>
<tr>
<td>Middle</td>
<td>3.35*</td>
</tr>
<tr>
<td>High</td>
<td>4.39*</td>
</tr>
</tbody>
</table>

Multivariate logistic regression in male workers (40+ hrs per week):
Sedentary work + low physical activity

- Non-active LTPA: OR = \textbf{1.85} (1.20-2.78)
- Stress-related overeating: OR = \textbf{3.20} (1.99-5.12)
- \textbf{High physical inactivity at work}: OR = \textbf{4.39} (95% CI, 1.93-10.01)
Work and stress-related over-eating
Demand-Control quadrants and stress-related overeating† : MIDUS II

†Socio-demographic, psychosocial working conditions, health status, and health behaviors were controlled for. Obesity was also adjusted, but no major impact
Multivariate analysis (2)

- **Men:** high job demands (OR = 1.63 (1.13, 2.36)) and low supervisor support (OR = 1.46 (0.95, 2.23), p = .08)

- **Women:** low job control (OR = 1.53 (1.13-2.06)); low coworker support (OR = 1.31 (0.96-1.78, p = .09); and long work hours per week (57 or more vs. 35–40 hrs) OR = 1.70 (0.90, 3.21, p = .10).
Decline in goods producing jobs