

Ergonomics and the Changing Workforce

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Disclaimer

- The findings and conclusions in this presentation are those of the author and do not necessarily represent the views of the National Institute for Occupational Safety and Health.

The Changing Workforce

- According to the Bureau of Labor Statistics (BLS), for the year 2013, nearly 139 million individuals in the U.S. were employed in either full-time (74.9%) or part-time (25.1%) work.
- [Full-time is 35+ hours per week]

Gender

- Of all workers, male workers accounted for 53.4%; female workers for 46.6%.
- Over 81% of male workers were full-time; nearly 68% of female workers were full-time

Gender

- Of full-time workers, nearly 58% are male
- Of part-time workers, nearly 60% are female

Who is an “older worker”?

- The definition changes depending on who is asked.
- The U.S. Department of Labor considers it to be anyone 55 years or older.
- The Age Discrimination in Employment Act provides protection for anyone in the workplace older than 40 years old.

Age

- About 22% of all workers (~ 30 million) were 55 years old or more of whom 71% held full-time positions.
- About 13% of all workers (~ 18 million) were under 25 years old of whom 50% held full-time positions.

Age

- The BLS projects that nearly all of the 12.6 million additional workers in the labor force added from 2009-2018 will be in the 55-and-older age group.
- This age group is expected to be near 40 million by 2018, composing nearly a quarter of the labor force then.

Why an increase in labor force participation rate for older workers?

- Living longer and healthier; working for additional income
- Remain employed to keep/get health insurance through employer
- Rise in Social Security normal retirement age and delayed retirement credit
- Defined contribution pension plans (401k)
- Current financial concerns, retirement savings

Physical decrements with age

- Workers' visual acuity, hearing, balance, physical strength, bone density, joint mobility, manual dexterity, reaction and movement times, pulmonary oxygen uptake, exercise capacity and endurance all worsen with age.

Physical work capacity

- Leaviss et al. (2008) found that the physical work capacity of a 65 year old is about half that of an average 25 year old worker.



Physical strength and aging

- Reduction of physical strength with increasing age is generally believed to be potentially hazardous, especially to older workers in jobs requiring exertion of high muscular forces such as lifting, lowering, and carrying of moderate to heavy loads, and pushing and pulling of heavy carts

Endurance and fatigue

- Ades and Toth (2005) found that, overall, the effects of age on endurance and fatigue were more substantial and consistent for the shoulder musculature than for the torso muscles.



Musculoskeletal issues with aging

- The reduced resiliency in the ligaments, tendons and muscles places older workers at a greater risk of injury, and the lower back seems to be especially prone



Musculoskeletal functional capabilities

- Age-related musculoskeletal changes in functional capabilities include: 1) a reduction in joint mobility, 2) a decrease in muscular strength, and 3) a slowing of reaction and movement times



MSDs and older workers

- MSDs tend to be more severe for older workers than younger workers in terms of longer recuperation, lost work time and costs, for the same condition
- However, a higher probability of sick days has been reported for younger workers in terms of higher total days away, and a decreased number of one-day absences reported for older workers

[HSE 2010]

- Ilmarinen (2002) reports that between the ages of 51 and 62 years, the prevalence of MSDs may increase as much as 15% among workers, with more pronounced increases occurring in physically demanding occupations



- Though a higher prevalence of MSDs is often reported for older workers, this may reflect the fact that older workers are working closer to their physical capacity. The propensity for injury is more related to the difference between the demands of the work and the worker's physical work capacity than their age [HSE 2010]

- Highly trained older individuals may be able to outperform younger workers depending on the type of job and physical capacity required [HSE, 2010]



- Employers who do not anticipate the physical and cognitive capacities of older workers and who fail to provide the programs and policies needed to support their productive capacities and minimize their vulnerabilities will experience adverse impacts on quality, productivity, workplace safety, and workers' compensation [Silverstein 2008]

- Employers who promote and support the work ability of employees as they age may gain in safety, productivity, competitiveness, and sustainable business practices [Silverstein 2008]



- Strategies for fitting the workplace to the worker include:
 - Substituting mechanical for manual strength
 - Reducing highly repetitive tasks
 - Allowing adequate recovery time
 - Reducing static and stressful postures
 - Job rotation
- [Silverstein 2008]

- Four strategic dimensions for programs that meet the needs of an aging workforce:
 - The work environment
 - The organization of work
 - The employee
 - Social support

[Silverstein 2008]



– The work environment

- Ergonomics
- Human Factors Engineering

– The organization of work

- Alternative forms of work organization
- Vocational rehabilitation and return to work

– The employee

- Health promotion, disease prevention and management
- Training and skill development

– Social support

- Community-based support services
- Access to health care
- Protection from discrimination

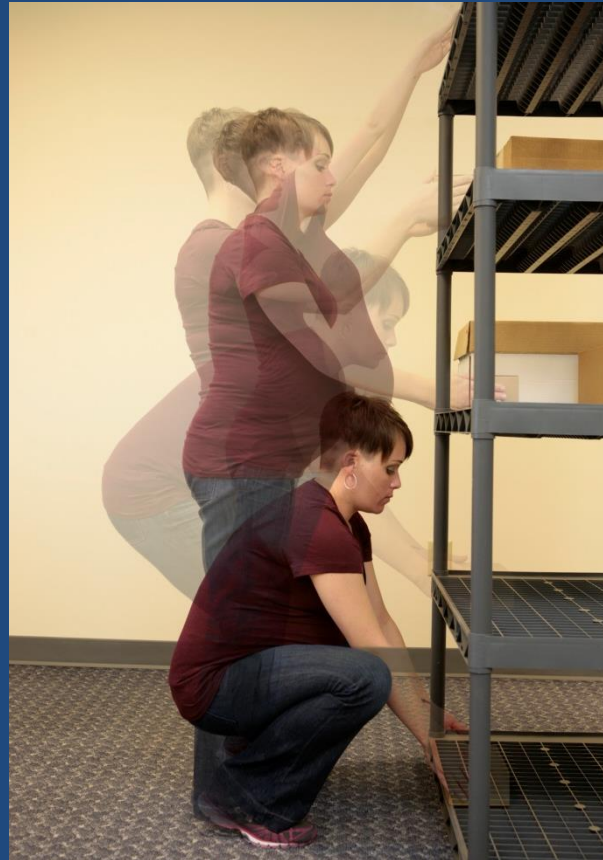
What other segment of the workforce is at risk?



How many women of child-bearing age are in the workforce?

- Approximately 37 million women between the ages of 16-44 in the U.S. workforce
- Among first-time pregnant workers, 67% worked during pregnancy
- Of this group, 87% worked into the final month of pregnancy

How much weight can pregnant workers safely lift at work?



Safe?

- Safe for worker?
- Safe for fetus?
- Stage of pregnancy matter?
- Lifting conditions?



Guidelines for Occupational Lifting during Pregnancy



Professional Guidance on Maternal Lifting at Work

- American Congress of Obstetricians and Gynecologists
 - No lifting-specific guidance
- American College of Occupational and Environmental Medicine
 - No lifting-specific guidance
 - Reference AMA Guidance [JOEM 2011]

Professional Guidance on Maternal Lifting at Work

- American Medical Association
 - Define permissible weight limits for uncomplicated pregnancies
 - Focus to reduce risk to pregnancy

Professional Guidance on Maternal Lifting at Work

- American Medical Association [JAMA 1984]

Trimester	Weeks gestation	Lifting Frequency	
		Intermittent	Repetitive
1	1 -12	--	--
2	20	--	> 51 lbs
2	24	--	51 lbs
3	30	> 51 lbs	51 lbs
3	40 (full-term)	< 31 lbs	< 24 lbs

Summary of Existing Guidance

- There was a clear need for up-to-date evidence-based guidance addressing:
 - Maternal health
 - Fetal health
 - Full duration of pregnancy
 - Consideration of task conditions
 - Postural load
 - Metabolic demands

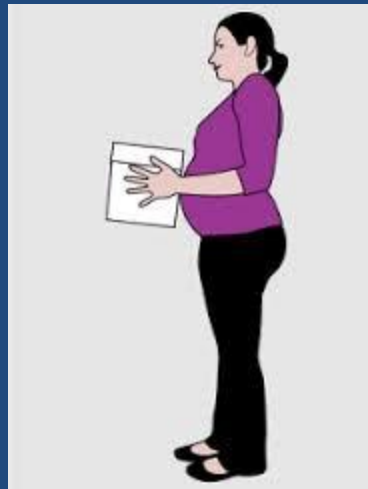
Lifting and maternal/fetal health

- Preeclampsia
- Lower back and pelvic girdle pain
- Spontaneous abortion
- Preterm labor
- Preterm birth



Biomechanical considerations

- Ligament laxity
- Anthropometric characteristics of pregnancy
- Balance control from changes in body's center of mass



Revised NIOSH Lifting Equation

- $RWL = 51 \text{ lbs} \times HM \times VM \times FM \times DM \times AM \times CM$

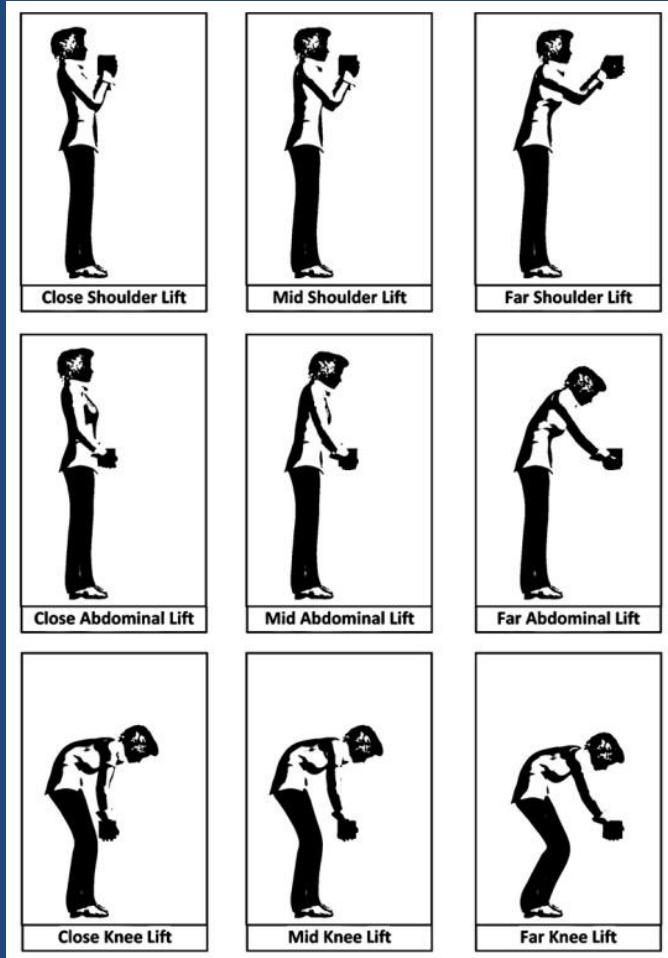
RNLE Adaptation for Clinical Guidelines

- $RWL = 51 \text{ lbs} \times HM \times VM \times FM \times DM \times AM \times CM$
- $RWL = 51 \text{ lbs} \times HM \times VM \times FM \times 1 \times 1 \times 1$

Vertical distance restrictions

- No lifting overhead; No lifting below mid-shin
 - Eliminates most severe postural stress
 - Reduces risk of postural imbalance/falls
 - Restrictions compatible with ACGIH Lifting TLV designed to reduce back and shoulder injuries in the general workforce

Nine Permissible Lifting Zones



Horizontal Distance

- Close (up to 14.9")
- Medium (15 – 20 ")
- Extended (> 20 ")

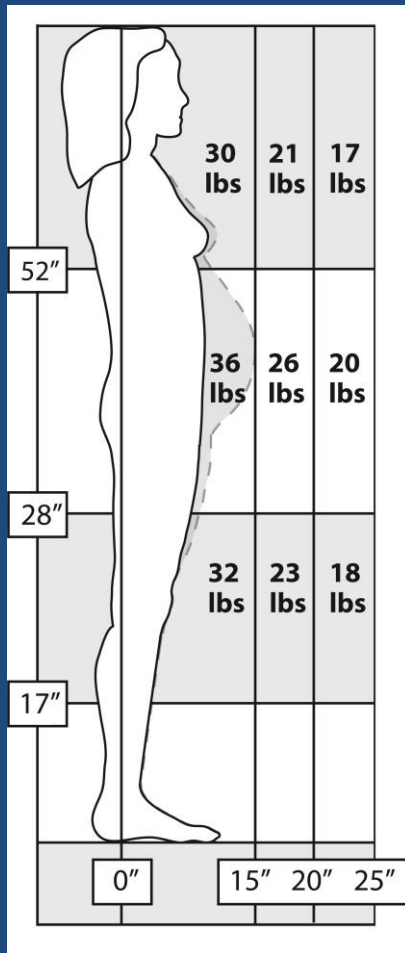
Vertical Distance

- Above shoulder (52" to top of head)
- Shoulder to knuckle height (28" - 51.9")
- Below knuckle height (17" – 27.9")

Frequency and Duration Factors

- Three frequency/duration conditions
 - Infrequent (> 1 per 5 min)
 - Repetitive short-duration (up to 3x per min, < 1 hr)
 - Repetitive long-duration (up to 3x per min, 1 - 8 hr)

RWL for Infrequent Lifting



No lifting overhead

No lifting below mid-shin

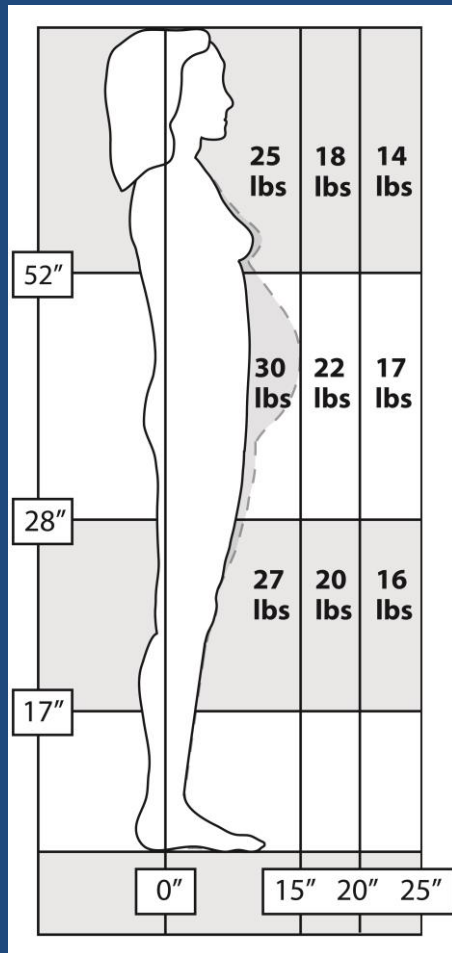
Less than 20 weeks gestation

RWL = 17 to 36 pounds

20+ weeks gestation

RWL = 17 to 26 pounds

RWL for Repetitive Short Duration Lifting



No lifting overhead

No lifting below mid-shin

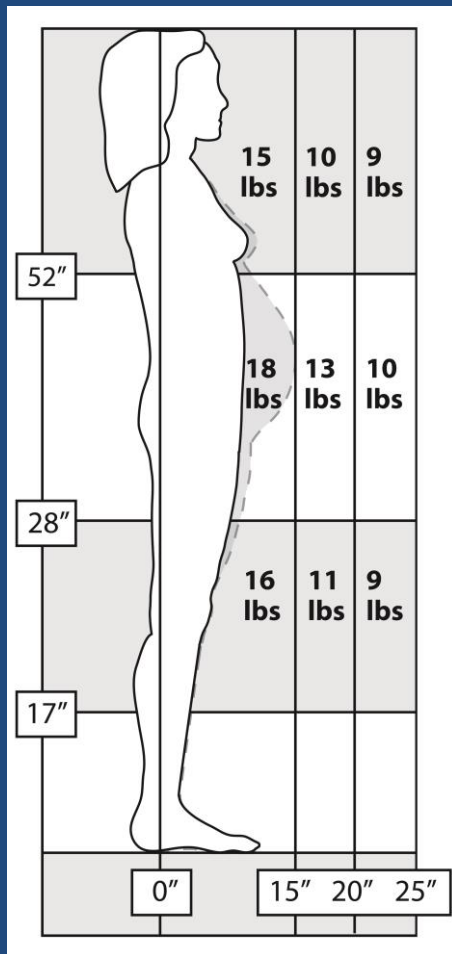
Less than 20 weeks gestation

RWL = 14 to 30 pounds

20+ weeks gestation

RWL = 14 to 22 pounds

RWL for Repetitive Long Duration Lifting



No lifting overhead

No lifting below mid-shin

Less than 20 weeks gestation

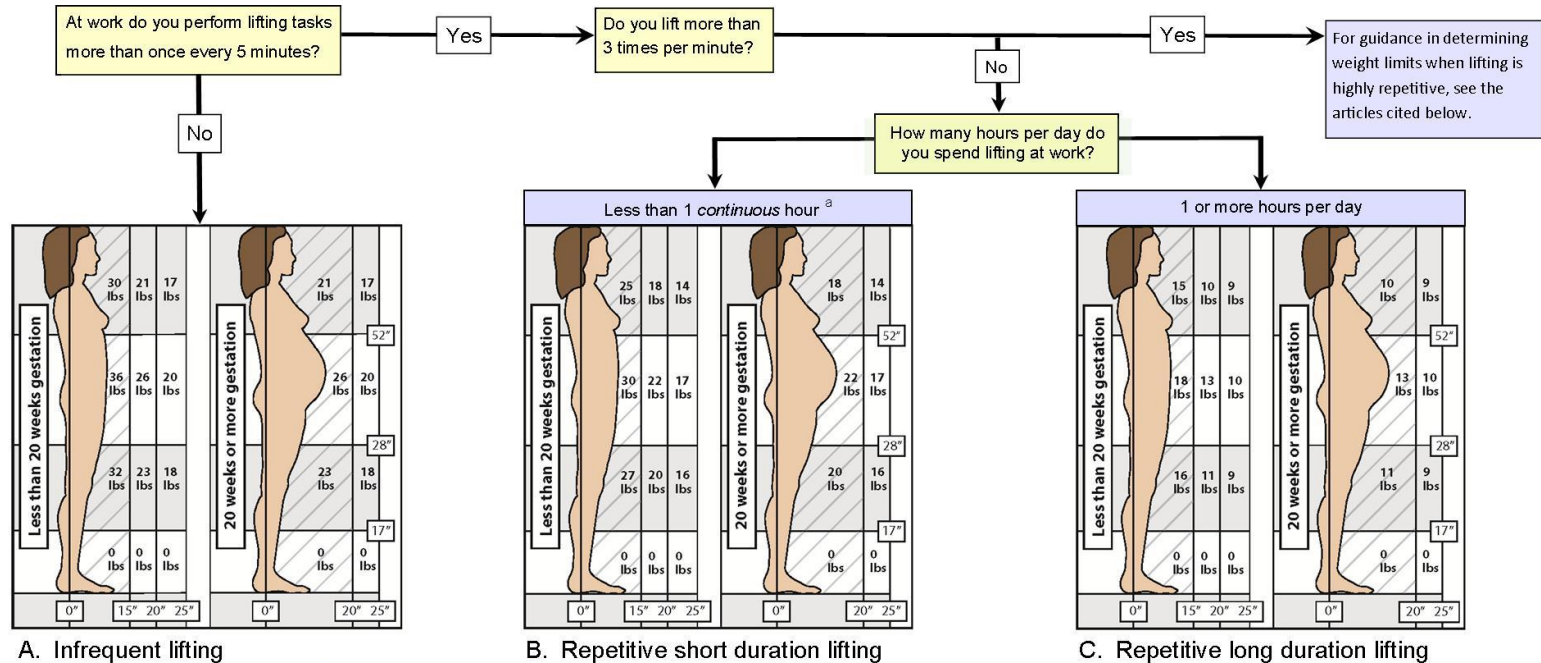
RWL = 9 to 18 pounds

20+ weeks gestation

RWL = 9 to 13 pounds

Clinical Guidelines for Maternal Lifting

Provisional Recommended Weight Limits for Lifting at Work During Pregnancy



Steps for determining the Recommended Weight Limit (RWL):

- 1) Answer the questions in the yellow-colored text boxes above to select the one graphic (A, B or C) that best describes the lifting frequency or frequency/duration pattern.
- 2) When less than 20 weeks pregnant, select the image on the left of the graphic; when pregnant for 20 weeks or more, select the image on the right.
- 3) Underline the numerical value on the graphic that best corresponds with the object location at the start of the lift (height from the floor and the distance in front of the body); repeat for the object location at the end of the lift. Now underline all other numerical values along the entire path the object would travel during the lift (between the start and end points). Circle the lowest numerical value underlined.
- 4) The number circled in step 3 is the RWL (in pounds) for the gestation period and lift conditions specified in steps 1-3. Repeat these steps when the gestation period or task conditions change.

^a - this task duration category can encompass multiple hours of lifting in one work day provided that each continuous lifting period is less than one hour and followed by a minimum of one hour of non-lifting activity before lifting resumes.

References:

- 1) MacDonald L, Waters T, Napolitano P, Goddard D, Ryan M, Nielsen P, Hudock S (2013) Clinical Guidelines for Occupational Lifting in Pregnancy – Evidence Summary and Provisional Recommendations; doi: 10.1016/j.ajog.2013.02.047. <http://www.sciencedirect.com/science/journal/00029378>.
- 2) Waters T, MacDonald L, Hudock S, Goddard D (in press). Provisional Recommended Weight Limits for Manual Lifting during Pregnancy. Human Factors.



Guidelines Summary

- Guidelines specify the maximum weight that most pregnant workers with uncomplicated pregnancies should be able to perform without increased risk of adverse maternal or fetal health consequences

Thank you



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