# Obesity and Weight Management in the Elderly

Geriatric Medicine Academic Grand Rounds

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# Objectives

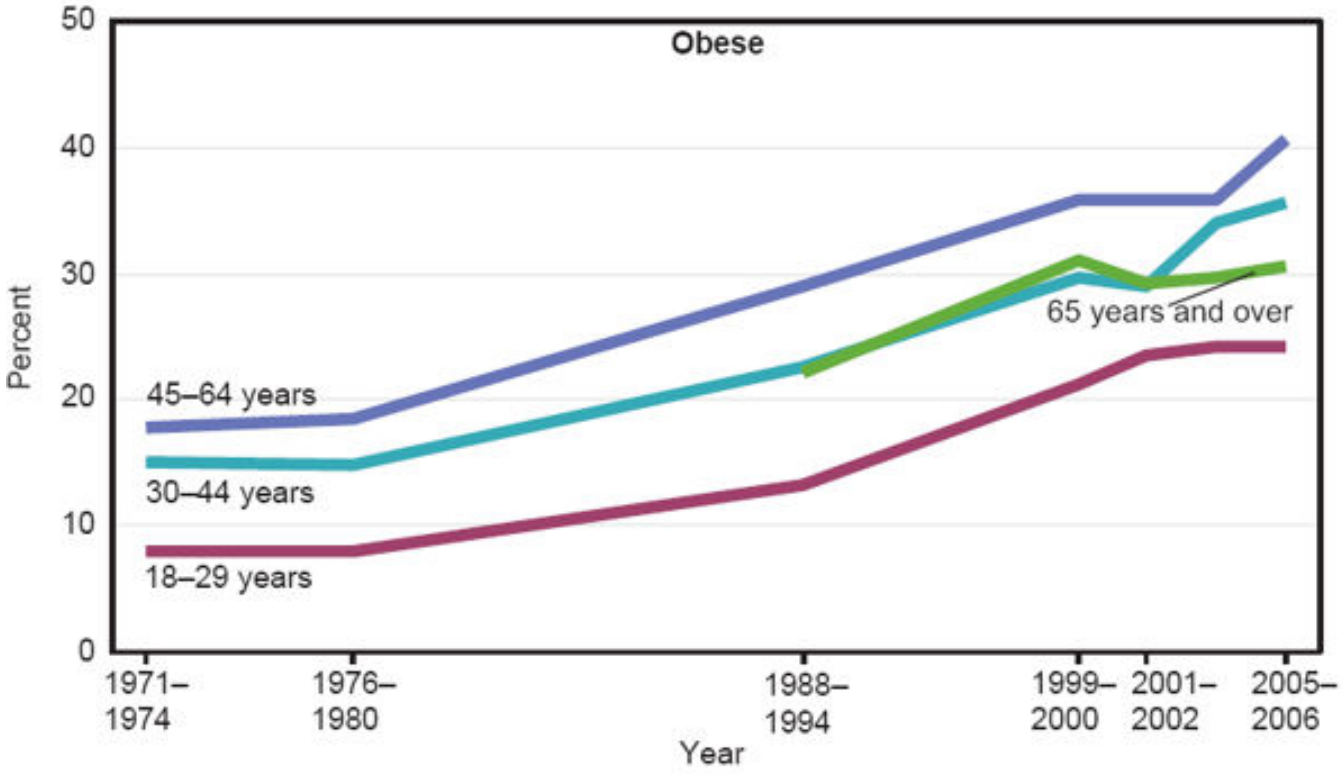
- Is obesity in the elderly a problem (or a growing problem)?
- How is obesity in the elderly measured/ defined?
- What impact does weight/BMI have on health (morbidity / mortality) – is it protective of harmful in the elderly?
- Is voluntary weight loss beneficial to the health of the elderly and should we recommend it for our patients?

*What is the prevalence of obesity among the elderly and what is the trend?*

# Obesity Prevalence

- Obesity on the rise in all age categories
- Number of obese elderly also increasing
  - Increase in total number of elderly
  - Increase in % of elderly who are obese
  - Mortality among obese adults decreasing in the last decades (better health care, etc…)

# United States Overweight and Obesity Levels, 1971-2006




NOTES: Overweight (not including obese) is defined as a body mass index (BMI) greater than or equal to 25 but less than 30 and obese as a BMI greater than or equal to 30. See data table for Figure 7 for estimates for children, data points graphed, standard errors, and additional notes.

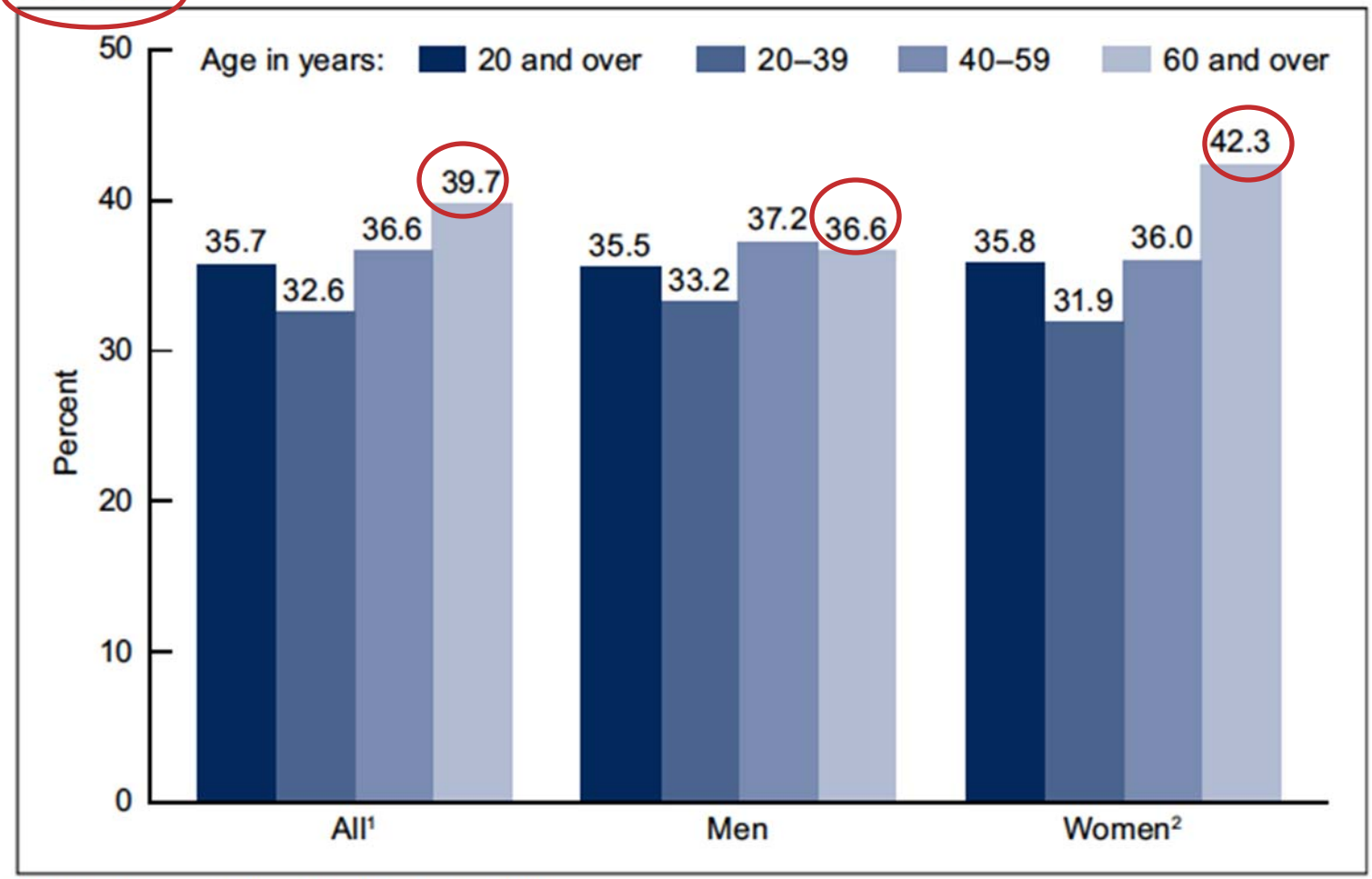
SOURCE: CDC/NCHS, National Health and Nutrition Examination Survey.

# Obesity Prevalence USA

**Data from the National Health and Nutrition Examination Survey, 2009–2010 (USA)**

- >than 1/3rd (35.7%) of adults and almost 17% of youth were obese.
- Adults aged 60+ were more likely to be obese than younger adults – with 39.7% of those 60 yoa and over as obese
- Healthy People 2010 (initiative developed in 2005)
  - Goal of 15% obesity in ≥60yoa group
  - Projections according to trends
    - Best case scenario: 33.6% by 2010
    - Worse case scenario: 39.6% by 2010

Figure 1. Prevalence of obesity among adults aged 20 and over, by sex and age: United States, 2009–2010




[1]Significant increasing linear trend by age ($p < 0.01$).
[2]Significant increasing linear trend by age ($p < 0.001$).
NOTE: Estimates were age adjusted by the direct method to the 2000 U.S. Census population using the age groups 20–39, 40–59, and 60 and over.
SOURCE: CDC/NCHS, National Health and Nutrition Examination Survey, 2009–2010.

Wang YC, et al. **Health and economic burden of the projected obesity trends in the USA and the UK**. The Lancet. **Volume 378, Issue 9793,** 27 August–2 September 2011, Pages 815–825

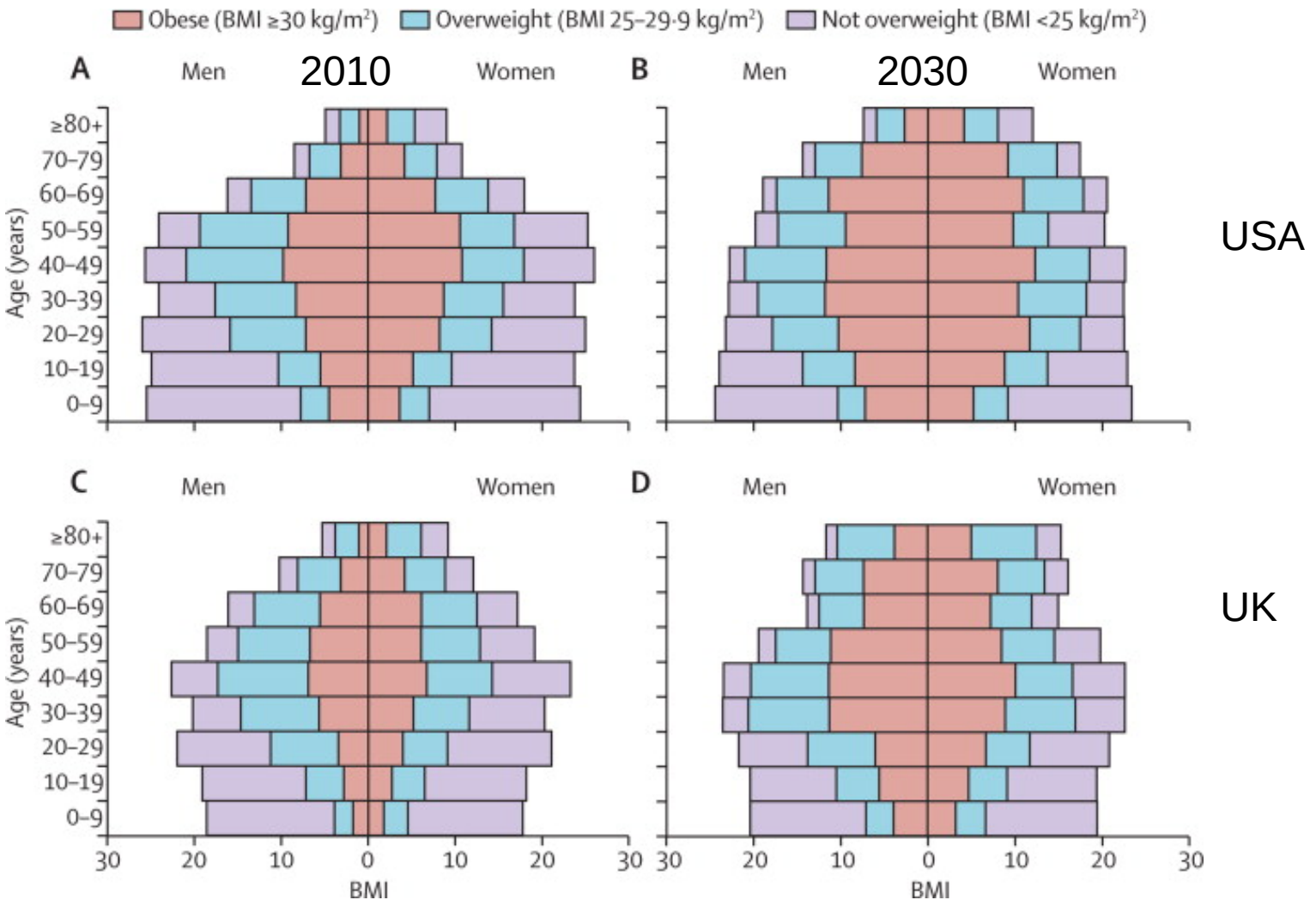



Figure 5. US and UK population projections 2010 vs 2030, by overweight or obesity status, assuming historic trend in BMIA=USA, 2010; B=USA, 2030; C=UK, 2010; D= UK, 2030. Population pyramid. **Size of bars shows the size of projected census population (×100 000) by BMI status, sex, and age category in USA and UK**

- *How is obesity defined / measured in the elderly?*

# Definition of Obesity

- ***Unhealthy excess of body fat which increases the risk of medical illness and premature mortality***
  - Strong links between obesity and disability and life-threatening diseases such as diabetes, heart disease, stroke, and multiple types of cancer
- Gold standard for definition of obesity (WHO):
  - obesity = Body Fat > 25% in men and > 35% in women
  - Where BF % = {weight-FFM/weight } x 100
    - (use resistance data from bioelectrical impedence analyzers)
- Use various formulas to estimate body fat:
  - BMI (body mass index)
  - WC (waist circumference)
  - WHR (waist hip ratio)
  - Others…

# Measuring Obesity

- Body Mass Index:

$$\mathrm{BMI} = \frac{weight(\mathrm{kg})}{height^2(\mathrm{m}^2)}$$

Estimation of % body fat from total body mass, which is then correlated with health risks: *excess adipose tissue linked to DM, CAD, cancer, etc…*

Recommended by NIH and WHO for use in clinical practice for classifying medical risk by weight status and management of weight loss/ weight control

# Limitations of BMI in General Population

- Variable sensitivity / specificity at different BMI cut-offs / age/ gender (false pos/neg)
- Doesn't account for differences in body composition:
  - Doesn't differentiate between adipose tissue and lean body mass (which have opposite effects on health)
  - In children and the elderly, differences in bone density and, thus, in the proportion of bone to total weight can mean the number at which these people are considered *under*weight should be adjusted downward.

# BMI in the elderly

- Limitations in the elderly:
  - a) Height decreases
  - b) Body composition changes (decrease in FFM and increase / redistribution of FM)
- Body composition changes tend to underestimate fatness vs loss of height tends to overestimate fatness
  - *i.e. falsely elevated BMI b/c decreasing height and falsely decreased BMI b/c of changes to body composition*

$$\mathrm{BMI} = \frac{weight(\mathrm{kg})}{height^2(\mathrm{m}^2)}$$

# Changes in body weight and composition with aging

- BMI gradually increase during most of adult life and peak at 50-59yoa, then tends to decrease:
- Body fat mass increases up to 75yoa and then decreases or remains stable (Hickson M, 2005)
- Abdominal circumference increased 0.7cm/year among 1300 Swedish women (no difference across age strata)
- Distribution of Body Fat
  - Fat redistributed centrally (intra-abdo), intramuscular fat and intrahepatic fat also increase*
- Fat Free Mass (muscle, organ tissue, skin, bone)
  - Decreases (up to 40%) with age starting around 40-50yoa (some say FFM peaks at 20yoa)

# How/ why we get fatter as we age: Energy Imbalance

- **Lower basal metabolic rate / energy imbalance**: sarcopenia and ageing per se result in lower BMR.
  - Obesity usually develops slowly, e.g. 1 kg/year, through very small (undetectable) energy imbalance
- **Increased sedentary lifestyle** – retirement, decreased activity around home, co-morbidities limiting PA (COPD, OA, etc..)
- **Medications**:
- Other complex behavioural, psychological, social and metabolic factors.

# *So, its fairly safe to say that as we get older we are relatively fatter than our BMI would indicate – but does this have any impact on our health???*

*Health consequences of changing body composition*

- Central distribution of fat is associated with increased risk of stroke, diabetes, hyperlipidemia, heart disease and HTN
- Redistribution of fat into muscles and liver increase risk for insulin resistance and metabolic disease / DM2

Based on studies done in middle aged adults

*Are the risks associated with obesity in the general adult population also applicable in the elderly?*

# Obesity in the Elderly: Morbidity

*Obesity increases an elderly individual's susceptibility to **disability** and poor outcomes, leading to poor quality of life and increased demand for health care services.*

Johansen DL, etal. *Obesity in the elderly: is faulty metabolism to blame?* Aging Health 2010; 6:159-167

- HTN, DM2, CVD, CVA
- OA
- GERD
- Obstructive sleep apnea
- Urinary incontinence
- Erectile dysfunction
- Cataracts
- Cancer (breast, colon)
- Dementia*
- Chronic pain
- Decreased Physical function / Frailty

# Obesity and Frailty

- Frailty = Reduction in physiologic reserves severe enough to cause disability / impair function
- 96% of community living 65-80yo with BMI's ≥ 30 were frail
- Leads to limitations to basic ADLs
  - Older persons who are obese (BMI >30) have a greater rate of nursing home admissions than non-obese counterparts (Zizza CA, etal. 2002)

# Can obesity be good for us?

- Increased BMI can also mean increased Free Fat Mass (FFM)
  - Increased BMD, decreased OP and hip#s in older men and women
- May be protective against dementia
- Energy reserves in case of illness
- *May* be associated with reduced mortality

# The evidence thus far…

*"The mortality-obesity association is estimated to diminish with age, so as to suggest, for example, that for middle-aged people (age 40–65 years) obesity is a significant risk factor for mortality, but for older people (age ≥65 years) it is not significantly associated with increased mortality risk—or, as some evidence suggests, might even confer a survival advantage*

Ryan K. Masters, et al., Obesity and US Mortality Risk Over the Adult Life Course *(20–25)."* American journal of Epidemiology. Vol. 177, No. 5. 2013

# Obesity in the Elderly: Mortality

- Overweight / higher BMI associated with lower risk of mortality in elderly
- The BMI associated with the lowest mortality is slighter higher in the older population vs younger

Villareal DT, et al., Obesity in older adults: technical review and position statement of the American Society for Nutrition and NAASO, The Obesity Society. *Am J Clin Nutr.* 2005; 82:923-34

# The Obesity Paradox

Being overweight or obese is associated with better long-term survival than being normal weight

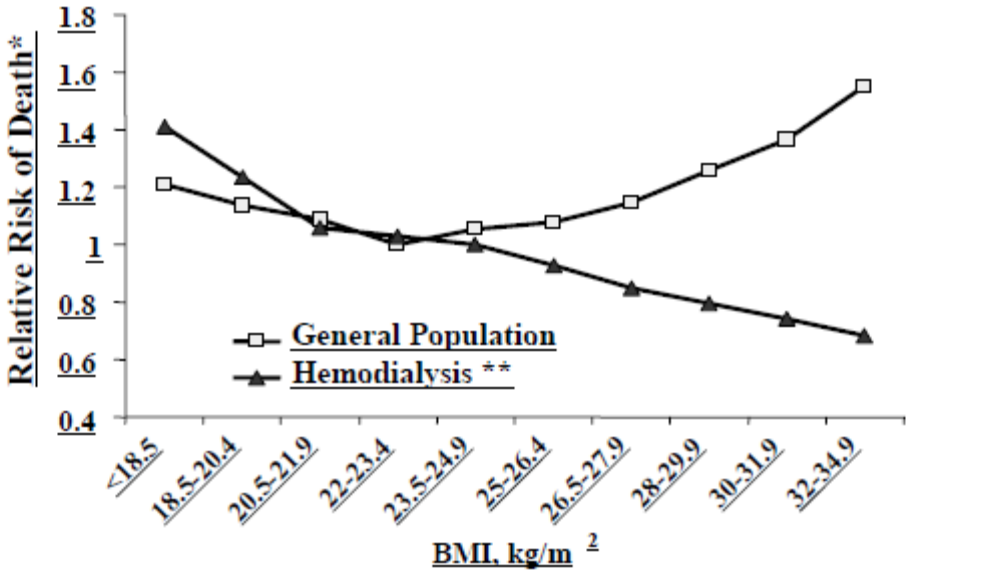
- In various populations
  - Elderly
  - CKD with HD
  - COPD
  - Cancer
  - CAD, Heart Failure
  - HIV
  - RA

*Oreopoulos et al., 2009*

**Two hypotheses:**
1) Excess fat in and of itself favors survival
2) Excess fat is associated with some other surrogate marker of another protective factor(s) – i.e. nutritional status, fitness, lean / fat free body mass

# BMI → ↓ Death in the Hemodialysis Population

**BMI Associated Death Risk:**
**General Population versus Patients with Hemodialysis**




*Kalantar-Zadeh et al 2005. Am J Clin Nutr;81:543-554*

**Table 2**
**Summary of studies with large sample sizes (>1000 subjects), mean follow-up time of at least 5 years, and mean age of ≥65 indicating a reverse epidemiology of obesity in older adults**

| Reference | Sample Size | Mean Age and Range | Follow-up Period (Y) | Findings and Source of Data |
|---|---|---|---|---|
| Losonczy et al,[13] 1995, USA | 2449 men, 3938 women | ≥70 | 5 | Inverse BMI-mortality association, lowest mortality at BMI 26.3–28.3 in men and ≥29.2 in women; data from the Established Populations for Epidemiologic Studies of the Elderly |
| Allison et al,[23] 1997, USA | 2769 men, 4491 women | 77 (70–99) | 6 | U-shaped BMI-mortality association, lowest mortality risk at BMI 27–30 for men and 30–35 for women; data from the Longitudinal study of Aging |
| Wassertheil-Smoller et al,[27] 2000, USA | 3975 men and women | 71 | 5 | No relationship between death or stroke and BMI in the placebo group, a U- or J-shaped BMI-mortality association in the treatment group. Lowest risk of death for men at BMI of 26 and for women at BMI of 29.6 in the treatment group; data from the Systolic Hypertension in the Elderly Program trial |
| Dey et al,[18] 2001, Sweden | 1225 men, 1403 women | 70 | 15 | U-shaped BMI-mortality association, lowest mortality risk at BMI 27–29 for men and 25–27 for women, weight loss increased mortality; cohort study in Sweden |
| Grabowski and Ellis,[20] 2001, USA | 2860 men, 4667 women | 77 (≥70) | 8 | Inverse association between BMI and mortality, lowest mortality risk in subjects with obesity (BMI >28.5) compared with subjects with normal BMI (19.5–28.4); data from the Longitudinal Study of Aging |
| Janssen et al,[70] 2005, Canada | 2262 men, 2938 women | (65–90+) | 9 | Inverse relationship between BMI and mortality after adjustment of WC, linear positive relationship between WC and mortality after adjustment of BMI; participants of the Cardiovascular Health Study |
| Price et al,[34] 2006, UK | 7892 men, 13,667 women | 80 (≥75) | 5.9 | Inverse association between BMI and mortality, linear positive association between WHR and mortality; data from 53 family practices in United Kingdom |
| Corrada et al,[38] 2006, USA | 8609 women, 4842 men | 73 (44–101) | 23 | U-shaped BMI-mortality association among persons >80, lowest mortality risk at BMI 25–29.9 in persons >80; data from the Leisure World Cohort Study in California |
| Dolan et al,[31] 2007, USA | 8029 women | 72 (65–77) | 8 | U-shaped BMI-mortality and WC-mortality associations, lowest mortality risk at BMI 23.4–29.8; data from Community-based study in Baltimore, Maryland |
| Al Snih et al,[26] 2007, USA | 4870 men, 3489 women | 73 | 7 | U-shaped BMI-mortality association, lowest mortality risk at BMI 25–35; 5 sites of the Established Populations for Epidemiologic Studies of the Elderly |
| Mazza et al,[32] 2007, Italy | 1275 men, 1982 women | 74 (65–95) | 12 | Inverse association between BMI and mortality; participants from the Cardiovascular Study in the Elderly |

*Abbreviations:* BMI, body mass index; WC, waist circumference; WHR, waist-to-hip ratio.

Oreopoulos A, etal., The Obesity Paradox in the Elderly: Potential Mechanisms and Clinical Implications. *Clin Geriatr Med* 25 (2009) 643-659

*Are the health risks associated with obesity in the elderly <u>really</u> lower than in adults?*

*A closer look at the Obesity Paradox (and the epidemiological studies that are de-bunking it)*

# Why we might be underestimating the health risks of obesity in the elderly:

Table 3
Possible mechanisms leading to the observed associations between obesity and improved survival in the elderly

| Potential Biases | Potential Beneficial Effects |
|---|---|
| Survival effect | Prevention or delay in cognitive decline |
| Time discrepancy of competitive risk factors | Protection from bone mineral density loss and osteoporotic fractures |
| Reverse causation | Reduction in oxidative stress and inflammation |
| Confounding variables | Energy reserve and prevention of malnutrition |
| Cohort effect | |

*Oreopoulos, 2009*

# Masters et al., Am J Epi. Feb 2013

- Many large population-based studies suggest risk of obesity on mortality declines with age
- But, institutionalized people excluded from these surveys
  - Obesity ↑ risk of institutionalization (esp. in elderly)
  - Obesity ↑ risk of mortality
  - So, healthy elderly obese end up in these studies
- New study corrects for that, and finds that risk of obesity on mortality actually ↑ with age
  - BMI 30-34: OR = 1.4-1.6 age 65+
  - BMI 35-39: OR = 1.8-2.0 age 65+
  - BMI 40+: OR = 2.6-3.7 age 65+

# Fat Distribution

**Janssen I, et al**. Body mass index is inversely related to mortality in older people after adjusting for waist circumference. *J Am Geriatr Soc*. 2005; 53: 2112-2118

- 5000 people 65yoa or older followed for 5 yrs
- Both BMI and WC were inversely related to mortality
- High WC was associated with higher mortality when BMI was controlled
- High BMI was associated with lower mortality risk after controlling for WC

# Importance of Midlife Obesity

| Age of BMI measure | Sex-adjusted deaths per 10,000 person-years (95% confidence intervals) | | | Hazard ratio (95% confidence intervals)[a] | | |
|---|---|---|---|---|---|---|
| | Normal weight | Overweight | Obese | Normal weight | Overweight | Obese |
| 50s | 213 (203–223) | 227 (217–237) | 256 (241–272) | 1.0 | 1.06 (0.96–1.17) | 1.55 (1.36–1.75) |
| | (*n* = 1,237) | (*n* = 1,449) | (*n* = 552) | | | |
| 70s | 627 (598–657) | 594 (567–622) | 624 (586–661) | 1.0 | 0.99 (0.89–1.09) | 1.21 (1.06–1.37) |
| | (*n* = 1,112) | (*n* = 1,457) | (*n* = 669) | | | |

[a]Hazards ratios were adjusted for age, sex, smoking, alcohol, exam cycle of BMI assessment at age 70.

| BMI category at 50 years/70 years | Sex-adjusted deaths per 10,000 person-years (95% confidence intervals) | Hazard ratio (95% confidence intervals)[a] |
|---|---|---|
| Nonobese/nonobese (*n* = 2,397) | 594 (573–614) | 1.0 |
| Nonobese/obese (*n* = 289) | 514 (461–567) | 1.01 (0.85–1.20) |
| Obese/nonobese (*n* = 172) | 859 (762–957) | 1.56 (1.30–1.86) |
| Obese/obese (*n* = 380) | 718 (666–771) | 1.47 (1.28–1.69) |

[a]Hazards ratios were adjusted for age, sex, smoking, alcohol, exam cycle of BMI assessment at age 70.

Jansen I, Bacon E. Effect of Current and Midlife Obesity Status on Mortality Risk in the Elderly. *Obesity* (2008) **16** 11, 2504–2509. doi:10.1038/oby.2008.400

*What do we know about intentional / unintentional weight loss and weight management in the elderly?*

# Unintentional weight loss: Etiology

- Wasting: inadequate dietary intake
  - d/t disease, psychosocial factors, loss of appetite
- Cachexia: involuntary loss of FFM or BCM (body cell mass) caused by catabolism
  - Presence of an acute immune response
  - Characterized by raised BMR and increased protein degredation
- Sarcopenia: involuntary loss of muscle mass
  - May be intrinsic part of ageing, lack of physical activity
  - Biochemical component: GH, testosterone, estrogen, cytokines, neuronal loss from SC with ageing

Roubenoff R. The pathophysiology of wasting in the elderly. *J Nutr*. 1999; 129: 256-295

# Current weight management recommendations for all adults

**Lifestyle Management (Overweight & Obese Class 1-3)**

- Advise patients on strategies for achieving and maintaining a healthy weight using diet and exercise. Refer the patient to a weight loss program, if the program meets the following criteria:
  - Based on a balanced healthy diet (e.g., 500-1000 kcal/day deficit);
  - Encourages regular physical activity;
  - Expects people to lose no more than 0.5-1 kg (1-2 lb) a week; and
  - Establishes an initial weight loss goal of 5-10% of the original weight.

NICE, 2006
Lau DCW et al., CMAJ 2007

# Weight loss in the elderly

- Not usually recommended
- Weight loss / variations associated with increased mortality and disability in the elderly
  - Based on observational studies
  - Many of these studies don't differentiate between intentional vs. unintentional weight loss


Houston DK, et al. Weighty Concerns: The Growing Prevalence of Obesity among Older Adults. *American Dietetic Association*. 2009; 109(11)

# Intentional weight loss in the Elderly

**Risks**

- Malnutrition
- Loss of weight = further loss of muscle mass and bone density
- Loss of metabolic reserves against disease

**Benefits**

- Improved / normalized metabolic abnormalities
- Improve physical function and quality of life
- Beneficial or neutral effect on mortality

# Intentional weight loss in the Elderly

- 25% of diet induced weight loss will be composed of FFM (regardless of age)
- Adding endurance or resistance training to a diet program helps to preserve FFM during intentional weight loss
  - meta-analysis showed that exercise cuts number down by half from 25% to 12% loss of FFM
- RCT conducted in 65-80yos
  - no difference in loss of FFM after a 10% diet induced weight loss + regular exercise vs with the control group who did not lose weight – so exercise can attenuate diet-induced loss of FFM
- Bone density – 1-2% bone loss with a weight loss of about 10% over a 4-18 month period
  - weight loss increases markers of bone turnover and plasma concentration of hormones involved in bone metabolism
- Exercise can attenuate bone loss
  - ensuring sufficient calcium and vit D should help to preserve BMD

# Benefits of Intentional weight loss

- **ADAPT** : RCT, n=318, mean age 69, overweight /obese, 18-month weight loss intervention
  - better physical function in overweight patients with knee OA,
  - 50% lower mortality rate over 8yrs of f/u (HR: 0.5; 95% CI: 0.3, 0.9)

*Loeser SP, et al. 2004; Shea MK, et al., 2010*

- **TONE:** effect of intentional weight loss on all-cause mortality – RCT, mean age 66yrs, 12 yr f/u
  - Improved MMSE scores with ave wgt loss 10% ($p < 0.05$)
  - 30% reduction in Dx and Tx of HTN, CV events over 2.4yrs
  - No significant different in all-cause mortality

*Siervo M, et al. 2012*

# Fatness vs Fitness

- McCauley PA, etal. Obesity paradox and cardiorespiratory fitness in 12,417 male veterans aged 40 to 70 years. *Mayo Clin Prac.* 2012; 85:115-121
  - Fitness altered obesity paradox
  - Underweight men with low fitness had highest mortality risk vs highly fit overweight men had lowest

*Can we improve how we measure obesity / body fat in the elderly?*

# Recommendations

- Improving our estimation of body fat/ nutritional status
  - Obtain more accurate BMI:
    - Improved estimate of height (arm span or knee height have been suggested but yet to be validated) – (villareal et al)
    - More research into appropriate cut-offs/ targets for elderly
  - Use other surrogate measures of body fat:
    - Waist-Hip-Ratio
    - Waist Circumference,
    - Mid-arm circumference
    - Radiological measurements of body fat compartments
      - CT, Dual-energy X-ray absorptiometry (accurate but not feasible)

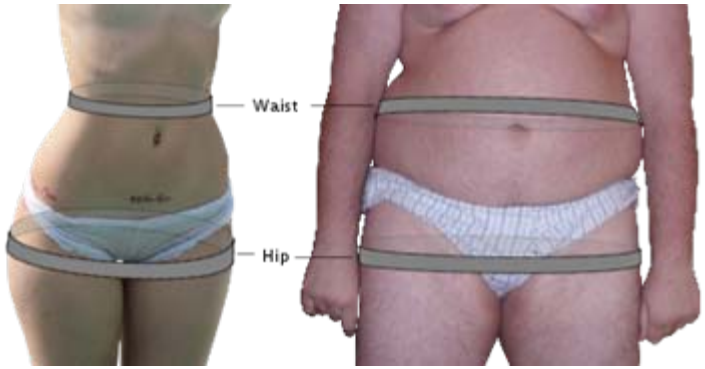
Zamboni M, etal., Health consequences of obesity in the elderly: a review of four unresolved questions. International Journal of Obesity (2005) 29, 1011–1029

## Waist Circumference

- Easy to measure
- Strongly related to both visceral and total fat (as evaluated by CT) – ie. Fat distribution
- Body composition more important than BMI in determining mortality risk associated with obesity in older adults
- Cut-off points of 102 in men and 88cm in women are used in adults and need to be validated in elderly population

# Waist-Hip-Ratio

- WHR has been found to be an efficient predictor of mortality in older people than waist circumference or BMI. (JE DeCaria et al., Int Journal Obesity, 2012; Oreopolous)
- More room for error and 2 measurements instead of one (WC)




Measurement of waist hip ratio: In a lean person (left), the waist can be measured at its narrowest point, while for a person with convex waist (right), it may be measured at about one inch1 above the navel. The hip is measured at its widest portion of the buttocks at left, and at the great trochanters at right

# Clinical implications

# What's the right BMI for the elderly?

- Established Populations for Epidemiologic Studies of Elderly
  - Followed 12,725 Americans >=65yoa for 7 yrs
  - Disability-free life expectancy was found to be greatest among people with BMI 25-30

Al Snih S, et al., The effect of obesity on disability vs mortality in older Americans. *Arch Intern Med*. 2007; 774-780

- BMI associated with lowest rate of decline of physical function: 23-30

(Oreopoulos, 2009)


ED FISCHER '08
yes, yes, yes - now, seriously - what can we do to improve our health!?
1. Exercise
2. Exercise
3. Exercise
4. Exercise
5. Exercise
6. Exercise
7. exercise
8 etc.
NEWS
EXERCISE THE KEY

# Weight loss or maintenance

- **Emphasize Exercise**: to improve strength, balance, endurance and minimize muscle/bone loss and prevent functional decline
- Dietary changes to improved **nutritional status** over weight loss
- **Modest weight reduction** (5%-10%) may be beneficial
  - Positive or neutral effect on mortality
  - Positive effect on function / QOL: GERD, OSA, OA, mobility, pain, HTN (Zamboni et al)
- **Target BMI: 25-30** (lower range for M, higher for W)

# Weight loss or maintenance

- **Individualized** as per patient's comorbidities, functional status and living situation
- Importance of **mid-life obesity** on long-term mortality risk: encourage weight loss in middle-age
- Always investigate **unintentional** weight loss
- Being **underweight** is associated with increased mortality at any age; in the elderly being underweight poses far greater risk than being overweight

# Resources in Ottawa

- Forever young:
  - Group exercise / physio program
  - Covered by OHIP
  - For seniors in RH or living ind.
- CCAC – OT / PT assessment
- Falls clinic: Montfort Hospital
- Geriatric Day Hospital
  - EBH: 2xwk physio/exercise
- Cardiac or Pulmonary Rehab Programs (TOH, Montfort)

# Next steps:

- Consensus on the definition of obesity in the elderly
  - Improving measurement/ surrogate estimate (BMI vs WC vs WHR)
- Better understanding of the effect of obesity on mortality / morbidity and the Obesity Paradox
- Look at sarcopenic obesity and its clinical implications on mortality
- Better understanding of effects of voluntary weight loss
- Understanding the gender differences in estimating obesity and mortality in elderly
- Approach to intentional weight loss in the elderly to minimize risks and help improve overall function

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Stay Young:
Eat Ice Cream!