

# Physical and Cognitive Changes with Age

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## Agenda

- ? What are the general changes with age
- ? Trends in each physical & cognitive category
- ? **Goal**
  - ? Present the facts and data on the effects of aging on physical and cognitive capabilities
  - ? Lay foundation for discussion
    - Will not discuss H&S, Ergo or Accommodation



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2

## Aging is Not Necessarily Bad – Some Things Are Better With Age

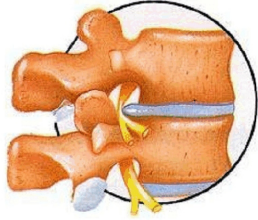


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## Some Things Are Not



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## Changes With Age

- ? Age-related diseases
- ? Physical & Musculoskeletal
  - Strength, endurance and flexibility
- ? Cardiovascular
  - Aerobic capacity and endurance
- ? Neurological
  - Sensory-perceptual (hearing/vision)
  - Mental processing, decision making and memory
  - Postural steadiness, balance, reaction time

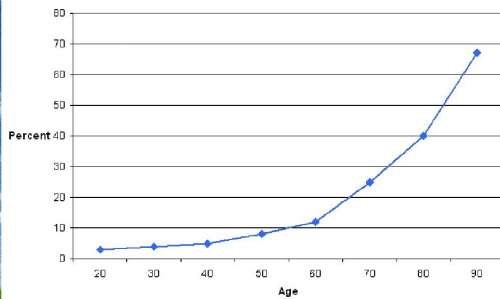
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## Age Related Diseases - Prevalence of Disability



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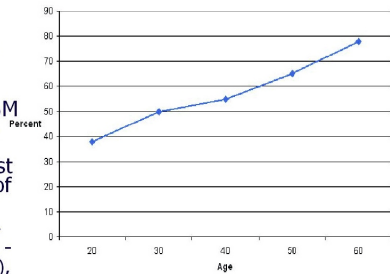
## Age Related Diseases – Big 3

- ? Heart Disease
  - >1M people every year have heart attack or stroke
  - CV disease accounts 40% US deaths
- ? Cancer
  - 74% cases occur after age 54
  - Most preventable – 90% have no hereditary link (ACS)
  - Avoid know carcinogens and early detection
- ? Diabetes
  - On rise
  - Obesity?



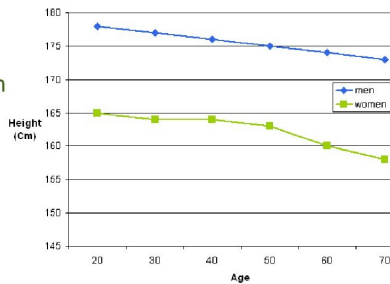
## Age Related Illness – Back Pain

- ? Prevalence
  - 80%, 40-80% recurrence within 1 yr
  - 80%(W), 90%M @ 65yrs show radiological signs of at least some degree of spondylosis
  - Changes in 1+ discs with age - 30% (20-30yr), 80% (60-70yr)
- ? Common problem for all types of people, all occupations



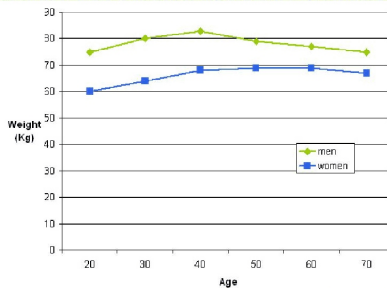
## Physical/Musculoskeletal - Height

- ? Decrease in Stature ~40 yr
- ? Loss 2.5 cm from 20 yrs to 60 yrs
- ? ▲ discs
  - rounded back



## Physical/Musculoskeletal - Weight

- ? Increase until ~50 yr, then slow decline
- obesity
- ? Loss lean muscle mass



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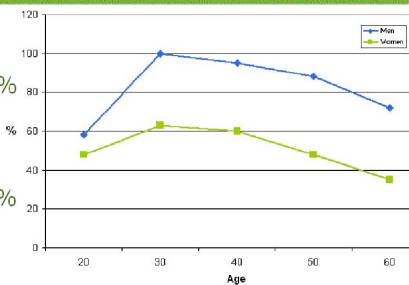
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## Physical/Musculoskeletal - Strength

- ? Peak 25-35 yr
- ? General 15-45%
- ↓ by 60 yrs
- body part specific
- ? Women 60-66% of men
- Variation of 40-90%



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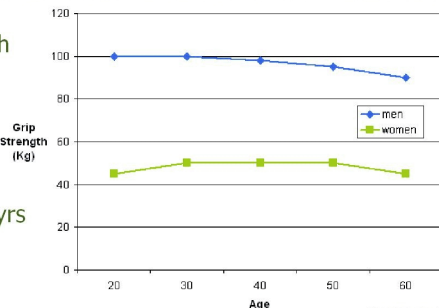
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## Physical/Musculoskeletal – Strength Specific Body Parts

- ? Grip Strength
- ? Avg 16% ↓ up to 60yrs
- ? 45% ↓ at 80yrs



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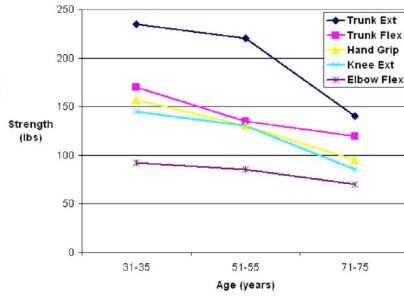
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## Physical/Musculoskeletal – Strength Specific Body Parts

- ? 55+ significant changes occur
- ? Declines related to Disuse not age
  - Up to 50% ↑ with exercise



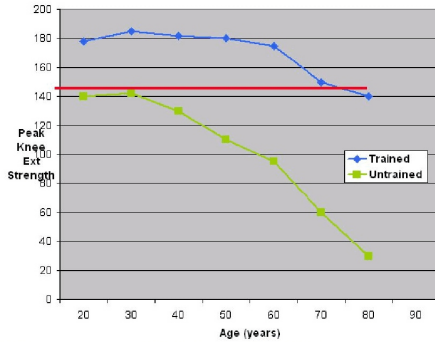
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## Physical/Musculoskeletal - Strength



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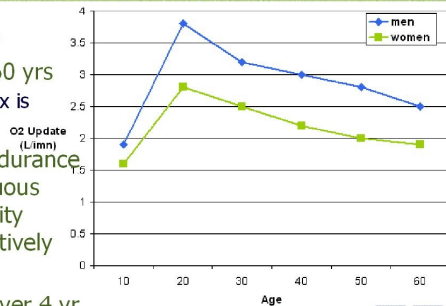
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## Cardiovascular – Max Aerobic Power

- ? Peak 20yrs
- ? 33% ↓ by 60 yrs
  - ↓ VO<sub>2</sub> max is 1-2%/yr
- ? Submax endurance and continuous work capacity remain relatively unchanged
- ? 20-25% ↓ over 4 yr FU w/o exercise



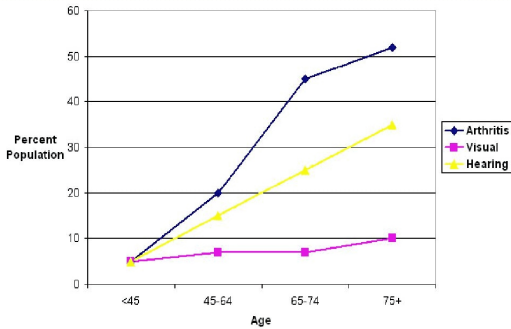
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## Neurological – Perceptual/Motor Impairments



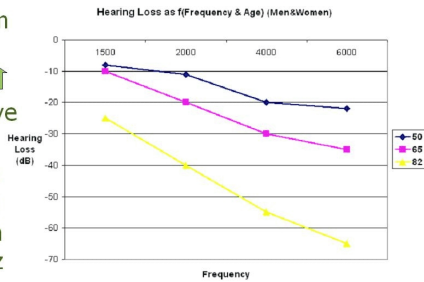
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## Neurological – Sensory - Hearing

- ? Major problem for elderly
- ? Hearing loss ↑ with age above 1000 Hz
- ? Women more loss at 500 to 1000 Hz, men 3000-6000 Hz – Bells, sirens



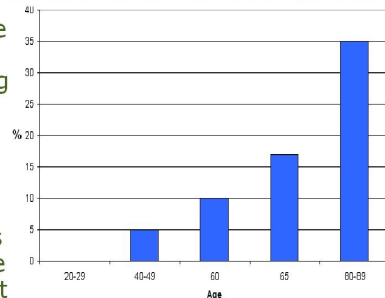
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## Neurological – Sensory – Hearing, Speech Intelligibility

- ? Context experience compensates for auditory processing decrements – can compensate for poorer hearing through having a larger database of words and phrases and the experience to discern the most likely content.



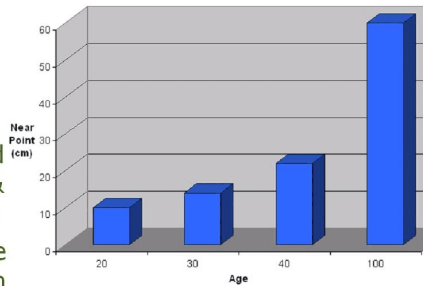
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## Neurological – Sensory – Vision

- ? Lens get stiff with age
  - presbyopia
- ? More muscular tension required for close work & accommodation
- ? Difficult to make rapid changes in focus



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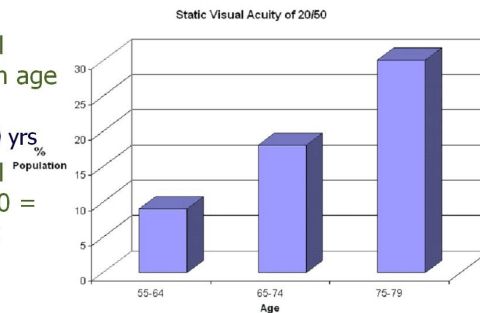
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## Neurological – Sensory – Vision

- ? Static visual acuity ↓ with age 15-90 yrs
  - ↓ after 40 yrs
- ? Static visual acuity 20/50 = impairment



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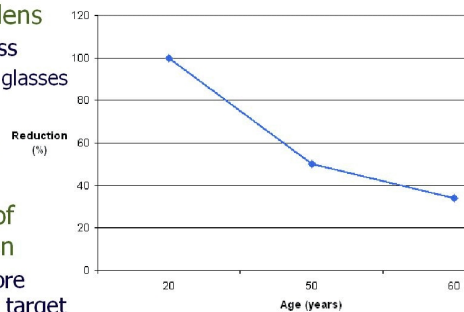
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## Neurological – Sensory - Vision

- ? Thickening of lens
  - Farsightedness
  - » Correct w/ glasses
- ? < illumination reaches retina
- ? Slows rate & reduces level of dark adaptation
  - 240 times more light to see a target



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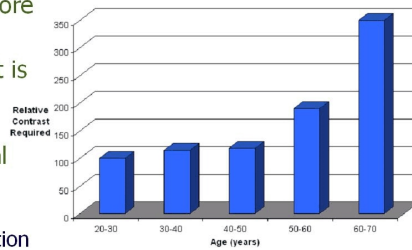
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## Neurological – Sensory - Vision

- ? Elderly need more light to see
- ? Higher contrast is needed to maintain/ maximize visual performance
  - Difficulties in facial recognition at low contrast



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## Neurological – Sensory - Vision

- ? Effects of Glare pronounced for 75-85 yrs, require a 50-70 fold increase in target luminance compared to 15yr old
  - can affect balance, orientation, attention and memory
- ? Reduction in size of visual field minimal up to 55, gradual shrinkage takes place, especially at 75
  - Detect, locate and identify objects in periphery
- ? Color vision tests reveal loss in color sensitivity clearly evident at age 70, progressing steadily to age 90
  - Occur at lower levels of illumination

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## Neurological – Reaction Time

- ? We lose 25-50% of our reaction time, especially for complex tasks
- ? We slip just as much when we get old, but are not able to recover from the slip as well, leading to more falls
  - Vision, strength, balance, motor control

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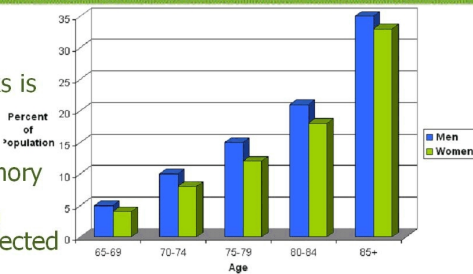
24





## Neurological – Memory Impairment

- ? 4-24% of variation in memory tasks is age related
- ? Short-term / working memory (reasoning /comprehension) minimally affected by age
- ? Working memory span unaffected by age
- ? Long-term memory deteriorates with age



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## Neurological – Mental Processing, Decision Making, etc

- Trivial/minimal changes before age 60
  - intellectual ability,
  - reasoning,
  - word fluency,
  - verbal meaning,
  - educational aptitude
- After 74yrs reliable decrements occur
- ? Total knowledge ↑ with age, older people retrieve info from their large information database as efficiently as younger people from their smaller database

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## Neurological – Learning

- ? Older people can learn, more selective in what they undertake to learn, then proceed to learn, reaching same proficiency level of younger persons
- ? Rate of learning is slower, and more marked with complexity of material
- ? Once learned the speed of performance is slower for complex operations compared to young adults, but often with fewer errors committed

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## Summary

- ? Large individual variation in physical and cognitive changes with age
- ? Most changes are minimal up to 60 yrs
- ? "Use It Or Lose It" applies
  - Exercise can increase strength up 50%, aerobic capacity by 30%
  - Trained 65yr old can have the same strength as untrained 30 yr old
- ? Most research has focused on elderly, not necessarily older workers or task specific activities

## Conclusion

- ? "Aging should not be considered a sufficient explanation for change without further supporting data"

Eisdorfer and Cohen

## Question

- ? Of all the physical and cognitive changes which one has the strongest association with age (i.e., strength, endurance, flexibility, etc)?