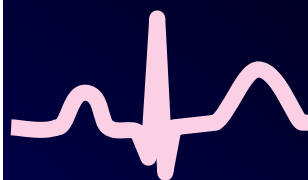


Cardiac Rehabilitation in Special conditions



서울아산병원
심장 예방·재활 센터
남호정

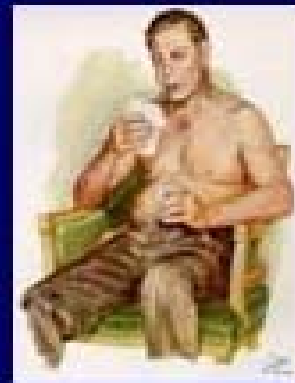


Special conditions

1. Pulmonary disease Patients
2. Women
3. Older Patients
4. Cardiac Transplantation

Special conditions

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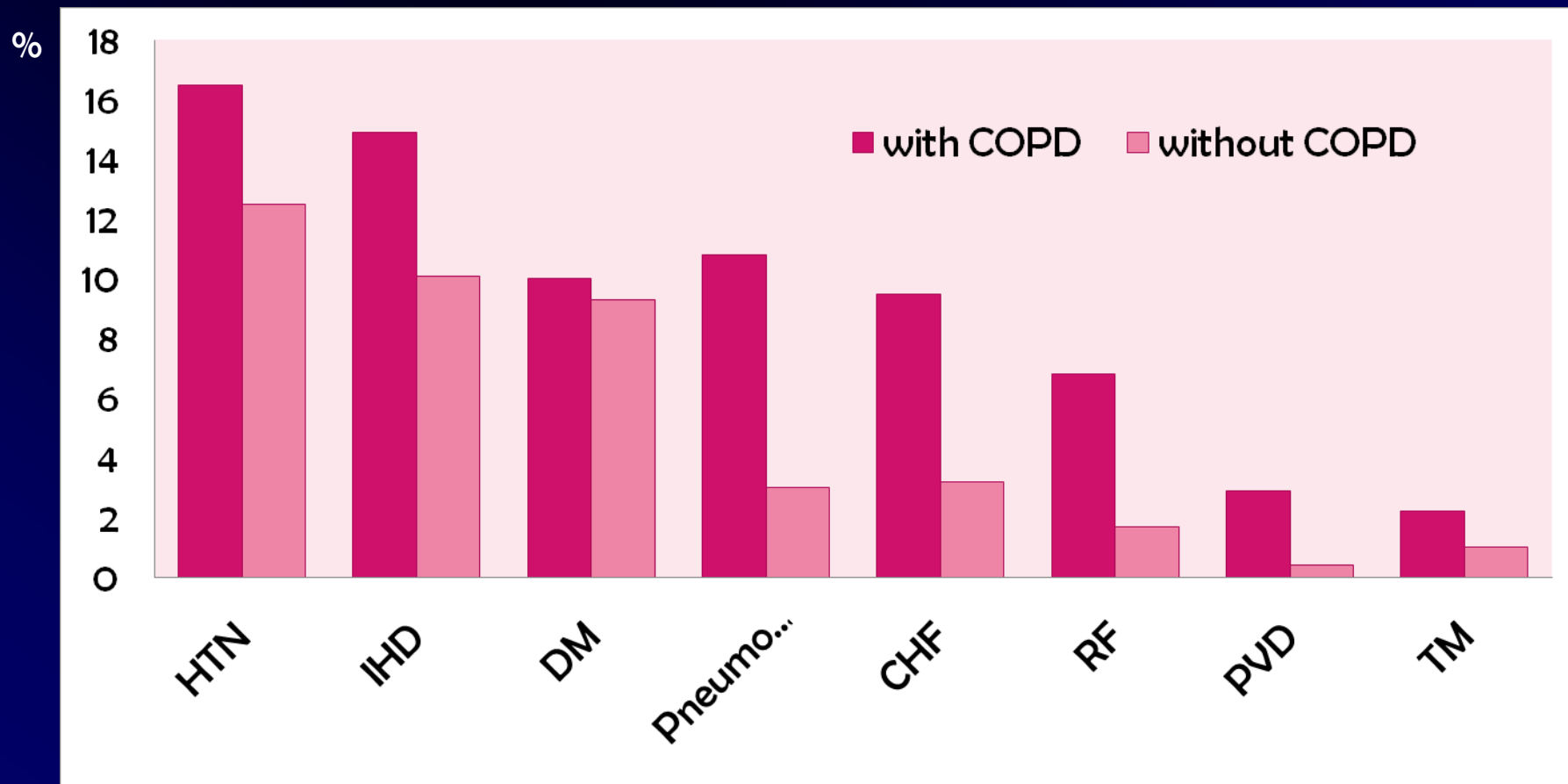
Pulmonary Disease



- Chronic cardiac diseases and COPD coexist
- CVD in COPD
 - more frequent
 - more frequent cause of death
- COPD predispose to CVD
 - Old age
 - Heavy smoker
 - Physical inactivity
 - Medications; β -agonist, steroid
 - Depression, etc

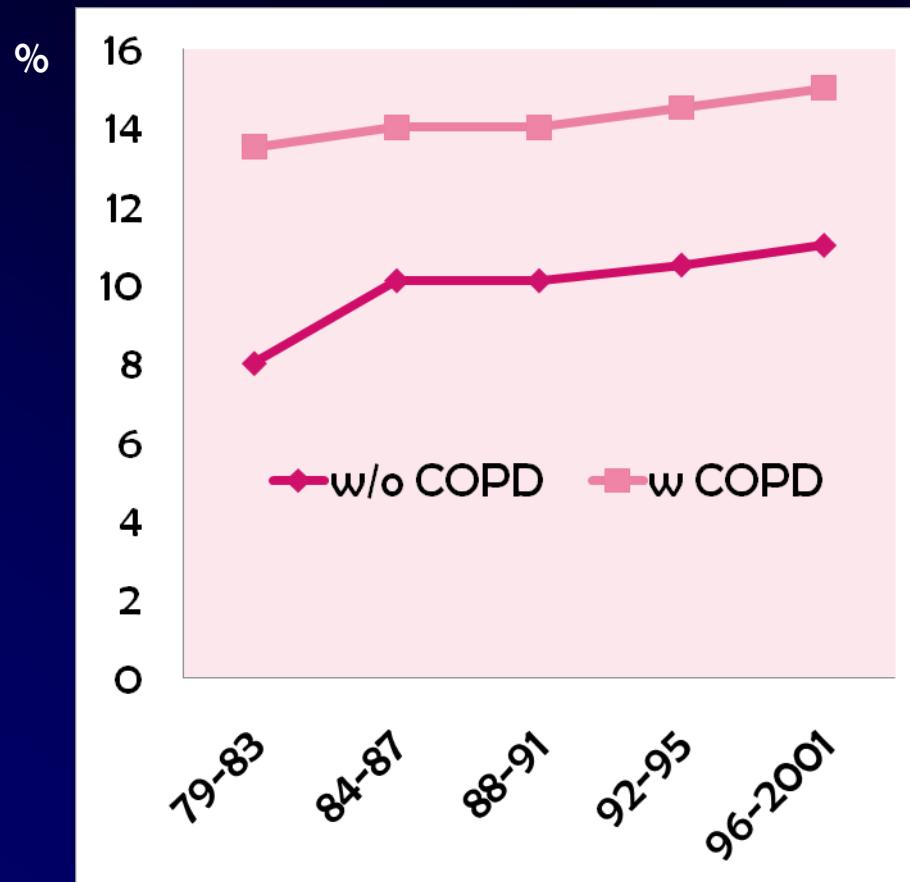
Estimated Prevalence of Hospital Discharges with Co-morbidities in patients with and without COPD

NHDS 1979 to 2001

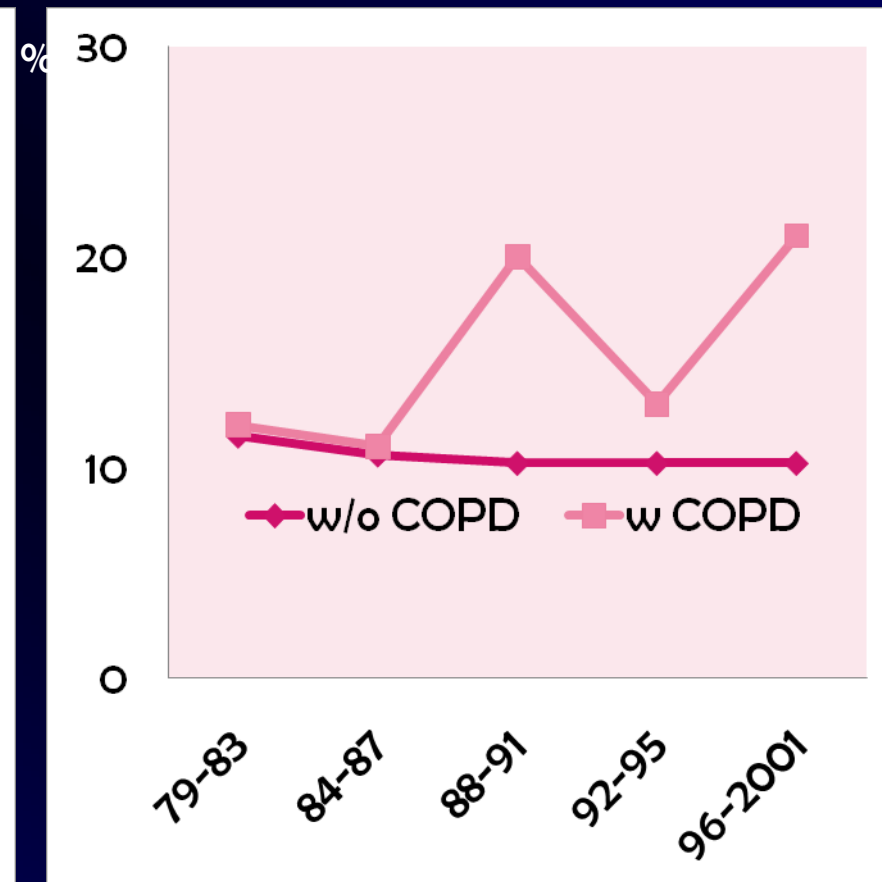


Ischemic Heart Disease with or without COPD

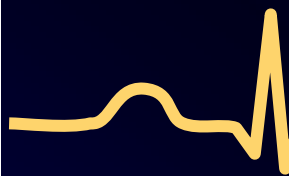
Hospitalizations



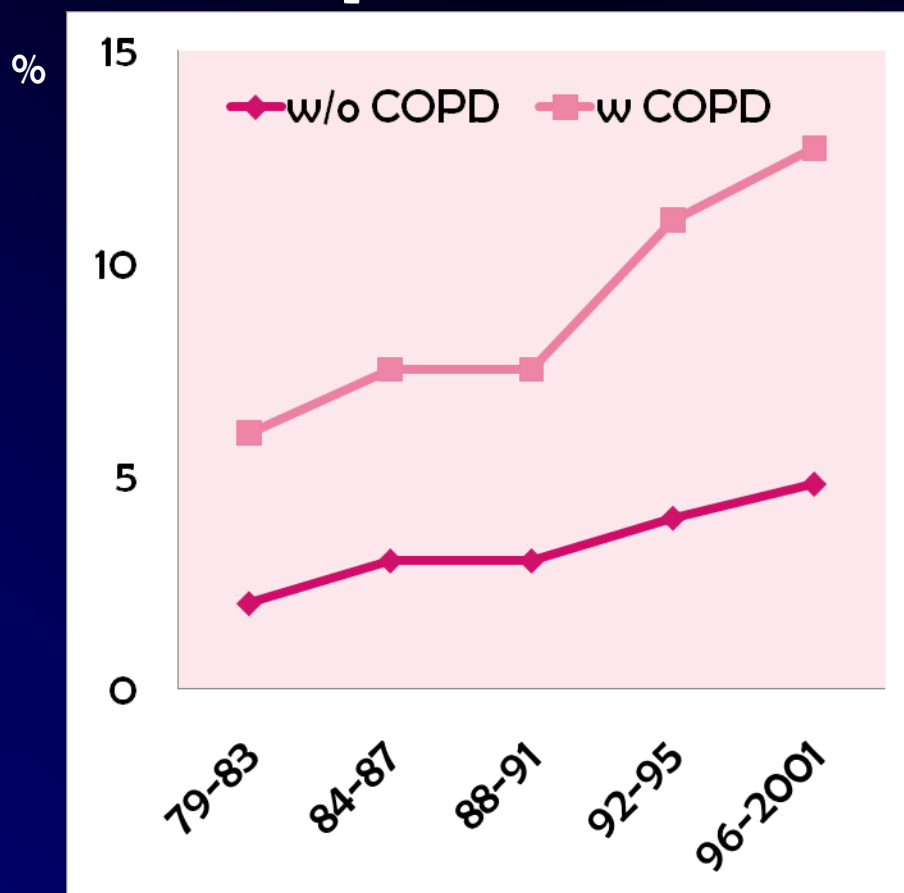
Mortality



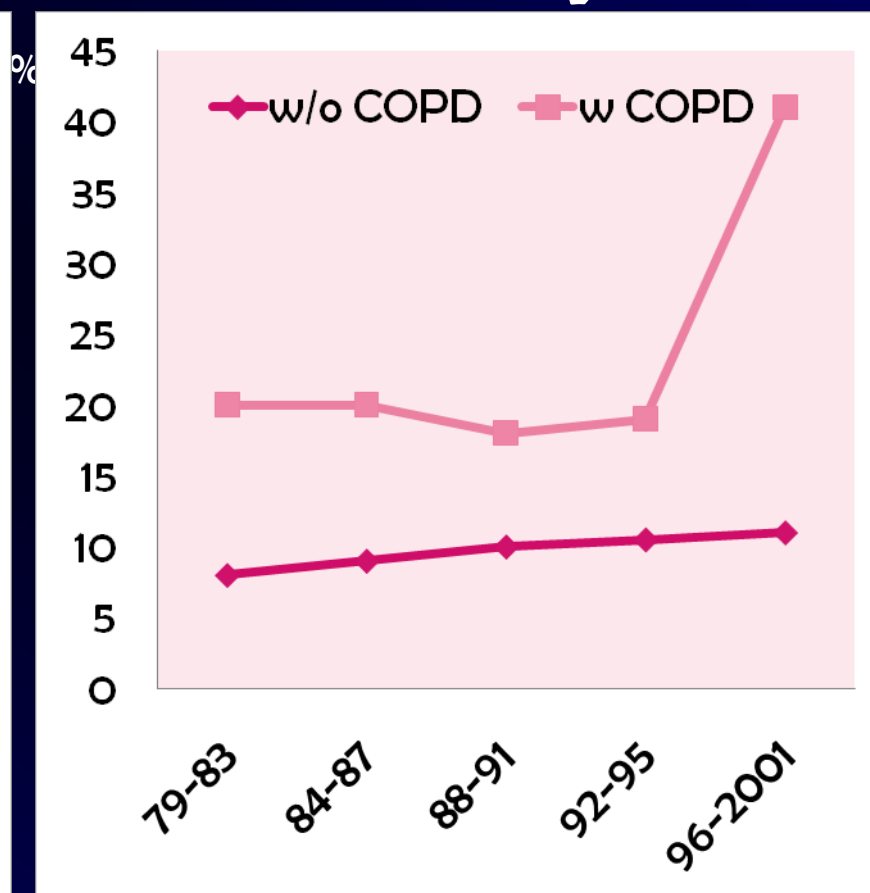
Congestive Heart Failure with or without COPD



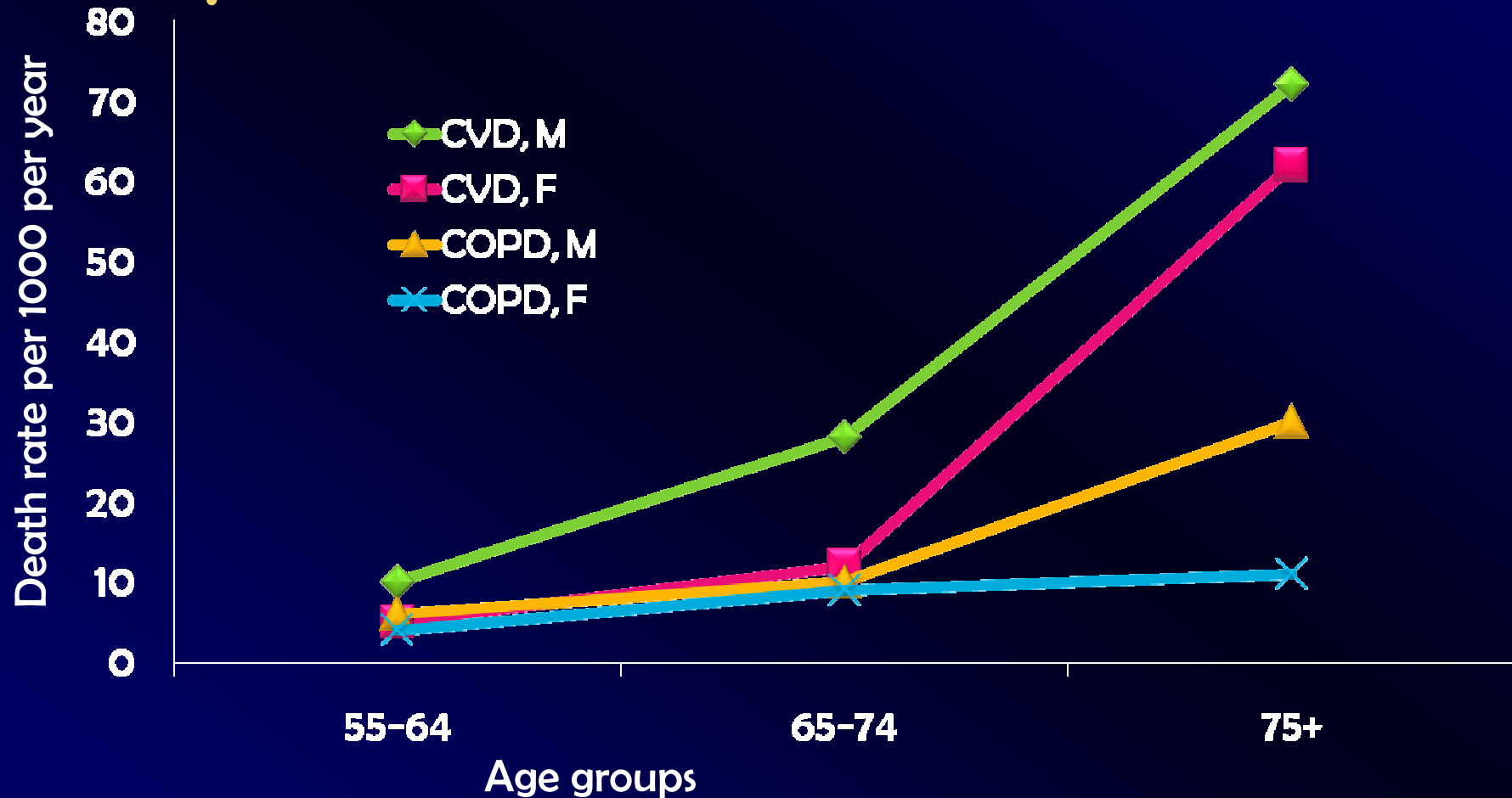
Hospitalizations



Mortality



Deaths rates for COPD and CVD according to gender and age



Mechanism of Functional Deterioration



- **Chronic Lung disease**
 - Limitation of Gas exchange / Elevation of pulmonary vascular pressure
 - Dyspnea / Limitation on physical activity
 - Dependence on others
 - Depression/ anxiety
 - sense “loss of control” and “exertion phobia”
 - physical inactivity
 - muscular atrophy
 - vicious cycle of inactivity/dyspnea

Patients Exercise Assessment

- Maximum workload
 - O₂ consumption, CO₂ production
- Ventilatory response
 - minute ventilation and post exercise spirometry, dead space development, ventilatory equivalent for CO₂ production (VE/VCO₂), arterial PCO₂
- Gas exchange
 - pulse oximetry , arterial PO₂



| Primary Exercise Limitation | Maximum V_e/MVV | Peak HR | SpO₂ (%) |
|------------------------------------|-------------------------------------|----------------|----------------------------|
| Ventilatory | > 0.8 | < 0.8 | > 90 |
| Gas exchange | < 0.8 | < 0.8 | < 90 |
| CV | < 0.8 | > 0.8 | > 90 |
| Ventilatory + CV | > 0.8 | > 0.8 | > 90 |
| Ventilatory + gas exchange | > 0.8 | < 0.8 | < 90 |
| Gas exchange + CV | < 0.8 | > 0.8 | < 90 |
| Ventilatory + gas exchange + CV | > 0.8 | > 0.8 | < 90 |

Exercise Prescription

- Balance of three types of exercise



Exercise Prescription

- **Stretching and flexibility**
 - Develop suppleness
 - Improve range of motion
 - Provide general warm-up
- **Strengthening exercise**
 - With dumbbells, cuff weights,



Exercise Prescription

- Endurance exercise
 - Produce cardiopulmonary stress
 - Elevated heart rate and ventilation
 - Walking, rowing, swimming, water aerobics, cycling (arm or leg), stair climbing





Exercise Prescription

- Initial load
 - **Never destroys the patient's motivation**
 - Should sufficiently low intensity can be accomplished without discomfort
 - Stationary bicycle and arm ergometer
 - Bicycle; 50% of maximum workload during exercise test (W_{max})
 - Arm; 30% of W_{max}



Exercise Prescription

- Recommended minimum duration and frequency of endurance exercise
 - No less than 20 min
 - Three times per week



Monitoring

- **PaO₂ > 55 mmHg, SO₂ > 88% in pulmonary patients**
 - Inadequate oxygenation during exercise
 - Oxygen delivery 2L/min, nasal cannula
 - Reduce the Intensity of exercise
 - Stop exercise until re-oxygenation

Summary



- The Cardiac and pulmonary disease states often coexist
- Disabilities from both cardiac and pulmonary diseases clearly benefit from rehabilitation program
- Need to be aware of specific assessment, monitoring, rehabilitation methods.



Special conditions

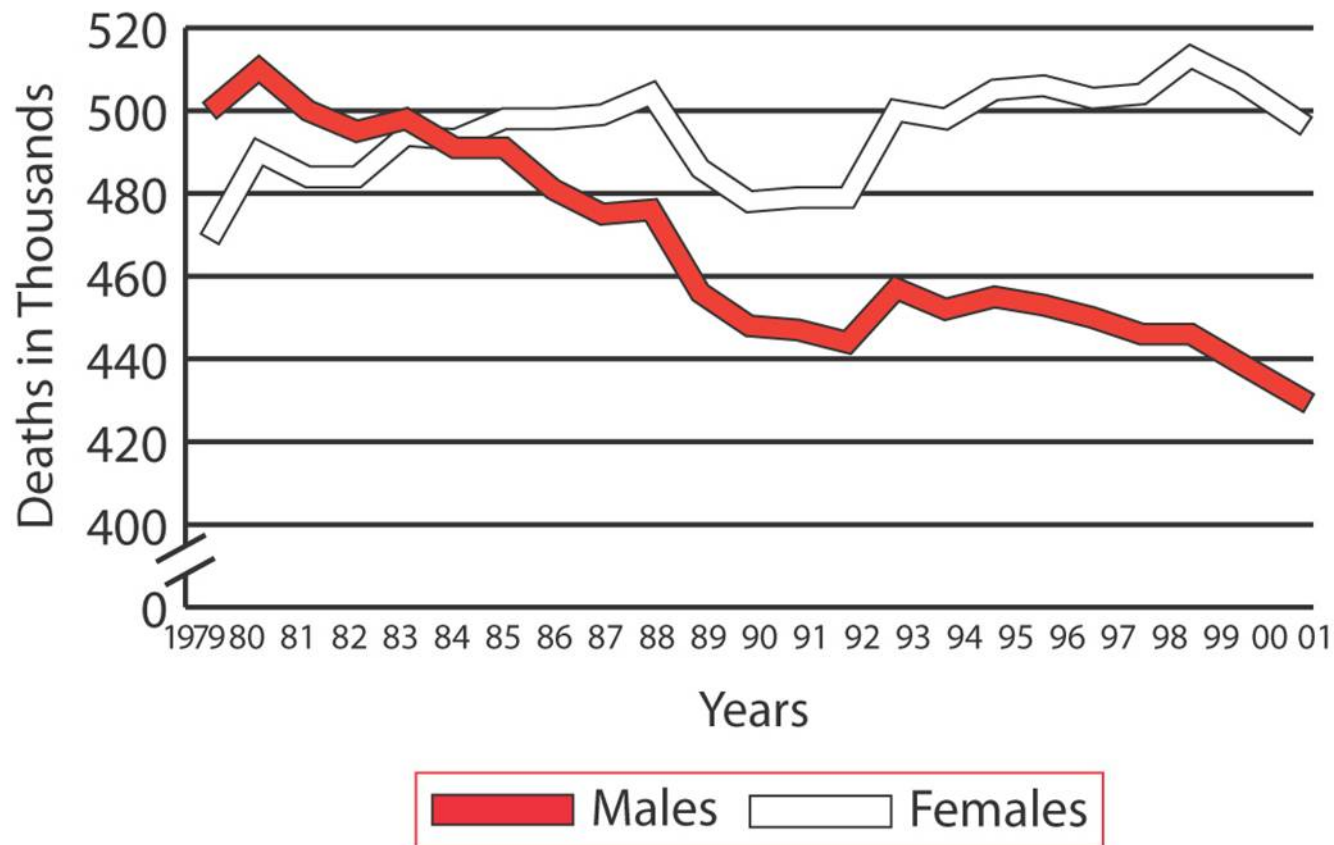
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Cardiovascular Disease in Women



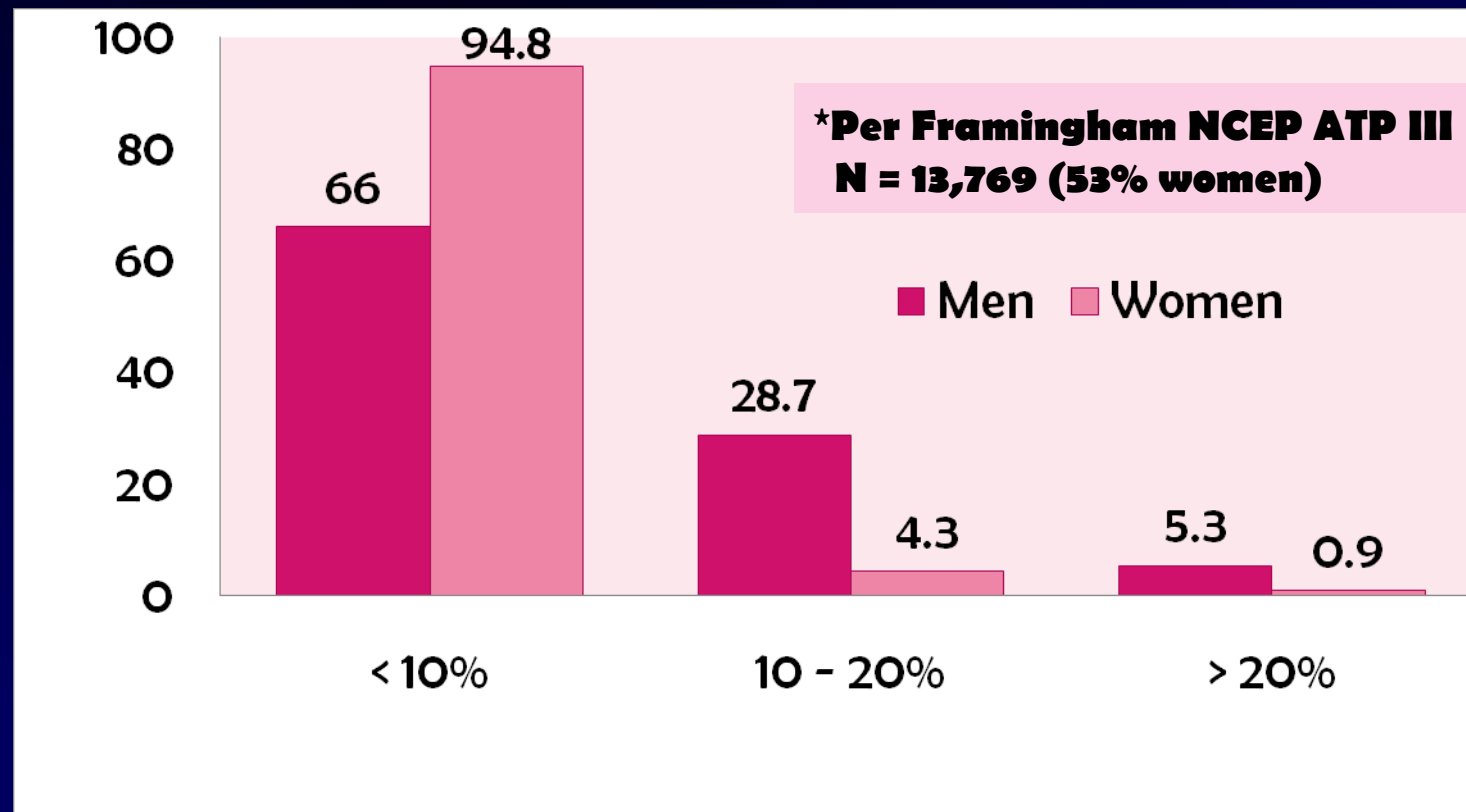
- Leading cause of mortality in women
- Age-dependency clinical CHD
 - 1 of 8-9 women aged 45-64 yr
 - 1 of 3 women \geq 65 yr
- 64% of women who die suddenly of CHD
 - no previous symptoms
- time of their first heart attack
 - ten years older than men

Cardiovascular Disease Mortality Trends



Age-Adjusted distribution of 10-Year CAD Risk*

NHANES III (1988-2004)



Lifetime Mortality Risks: Postmenopausal Women



| Condition | % Lifetime Mortality Risk |
|------------------------|---------------------------|
| Coronary heart disease | 31.0 |
| Breast cancer | 2.8 |
| Hip fracture | 2.8 |
| Endometrial cancer | 0.7 |

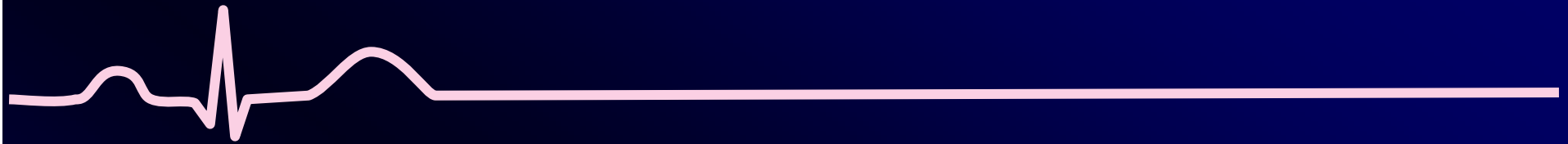
- Only 13% of US women believe
 - heart disease and stroke are their greatest health threat

Potential Contributors:

Less Favorable Outcome of MI in Women



- Older age
- Greater co-morbidity ; diabetes, hypertension
- Later arrival to hospital, delayed recognition of MI
- ↓ Use standard therapies that ↑ survival
 - Thrombolytic agent, β -blockers, aspirin
- ↓ Coronary angiography, PCI, CABG
- ↓ Referral to cardiac rehabilitation
- Post MI depression 2x ↑ women



Evidence-Based Guidelines for Cardiovascular Disease Prevention in Women: 2007 Update

Mosca L, et al. *Circulation* 2007; 115:0000-0000

Clinical Recommendation

A yellow ECG line graphic is positioned on the left side of the slide, extending horizontally across the top. It features a standard ECG waveform with a P wave, a sharp QRS complex, and a T wave, followed by a flat line.

- Life Style intervention
- Major risk factor intervention
- Preventive drug intervention

Clinical Recommendation




- Life Style intervention
 - Cigarette smoking cessation
 - Physical activity
 - Rehabilitation
 - Dietary intake
 - Weight maintenance/ reduction
 - Omega-3 fatty acids
 - Depression control

Clinical Recommendation



- Major risk factor intervention
 - Blood pressure
 - Lipid and lipoprotein levels
 - Diabetes mellitus
- Preventive drug intervention
 - Aspirin
 - β -blockers
 - ACE inhibitors/ARBs
 - Aldosterone blockade

Summary


- 
- CHD is clearly the major cause of morbidity and mortality in women
 - Many of the factors that place women at risk from this disease are modifiable.
 - It is crucial, to educate women and their health care providers about the diagnosis, evaluation, and treatment of this disease in women.



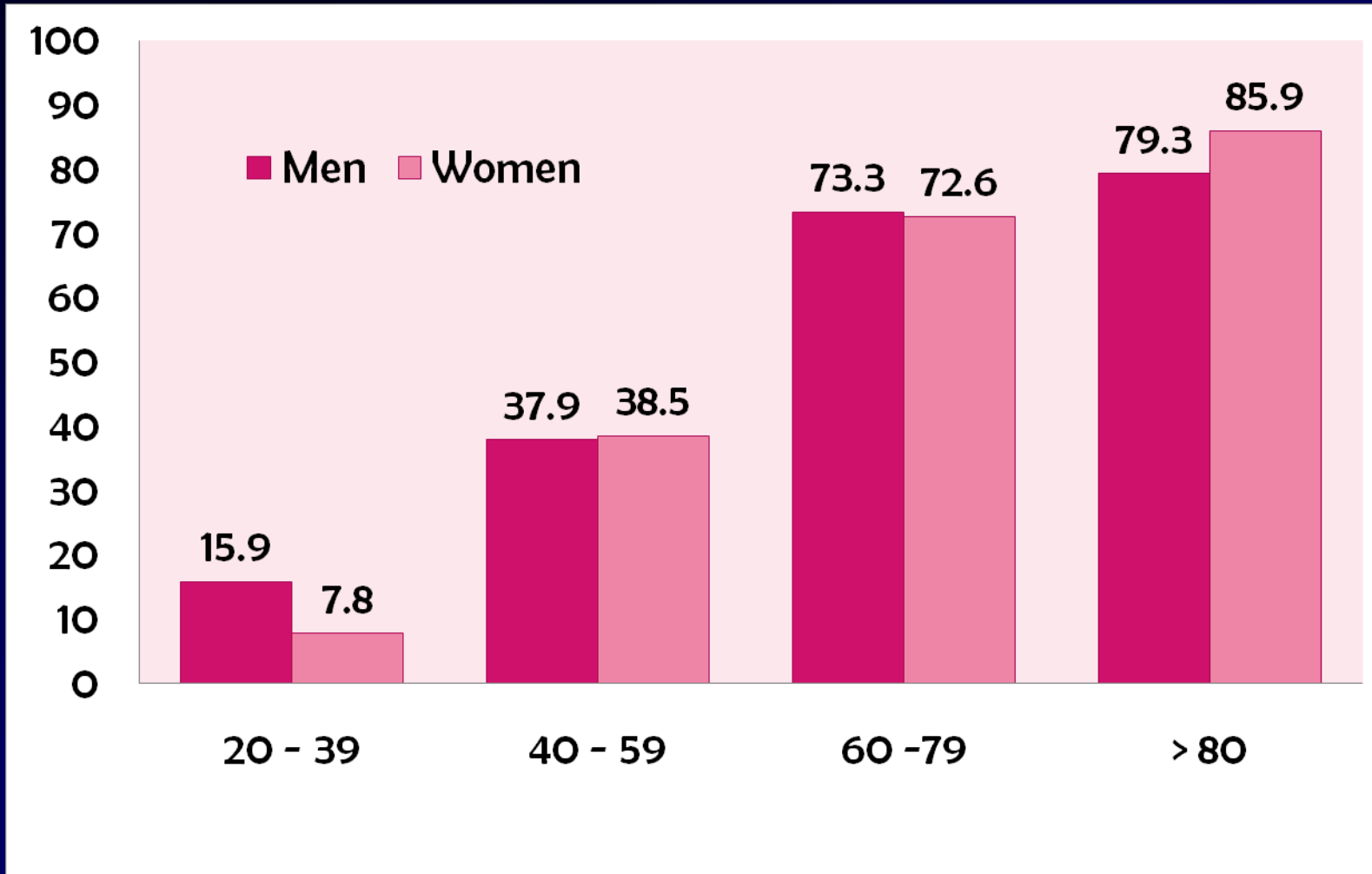
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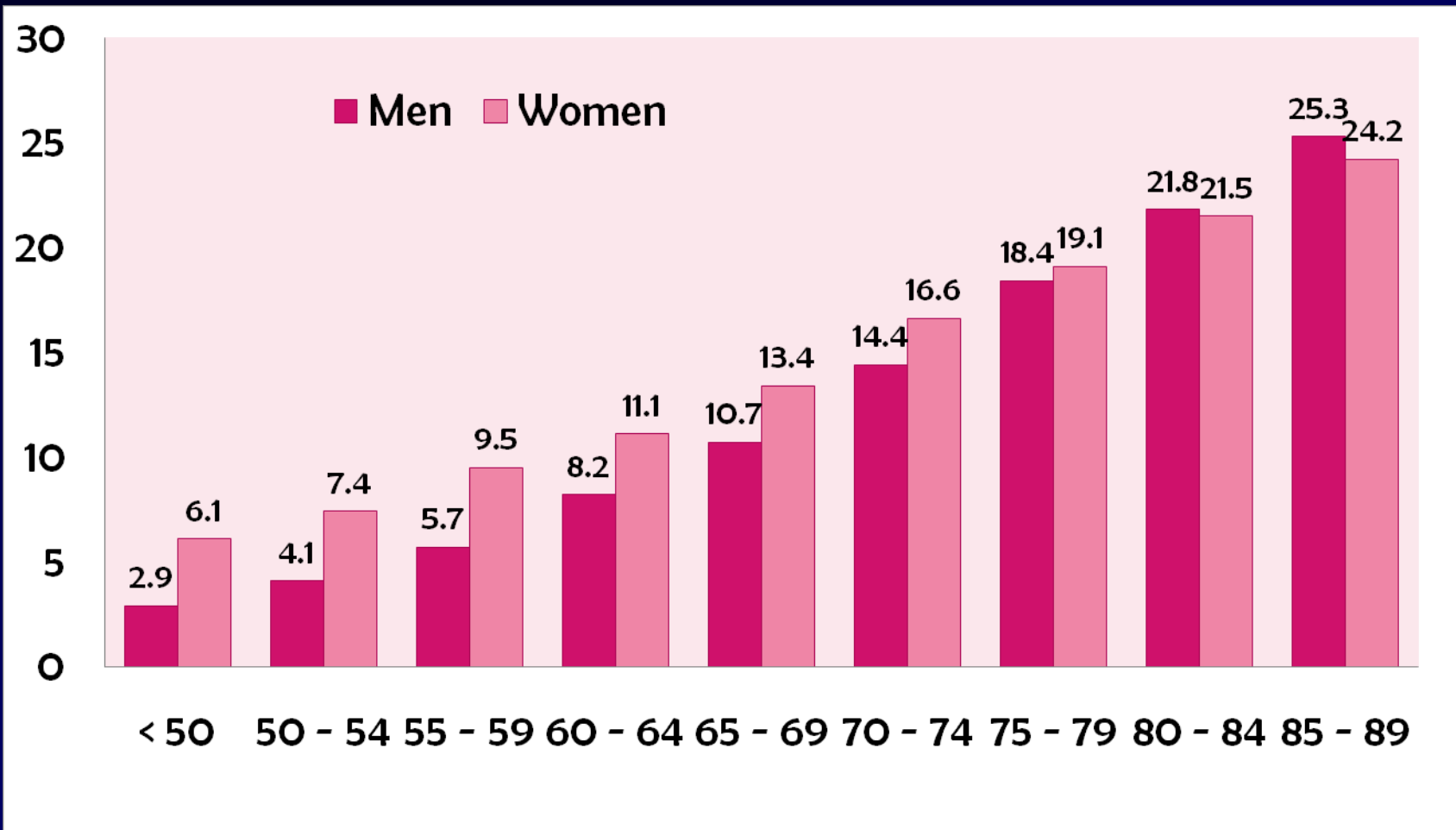
Older Patients

- 
- Age
 - powerful risk factor for CV disease.
 - CVD
 - 12.5 million in the U.S older than 65 years
 - major cause of death and disability in elderly
 - CHD
 - predominant cardiac problem
 - Other important causes
 - followed by hypertensive cardiovascular disease; valvular and pulmonary heart diseases

Prevalence of CVD



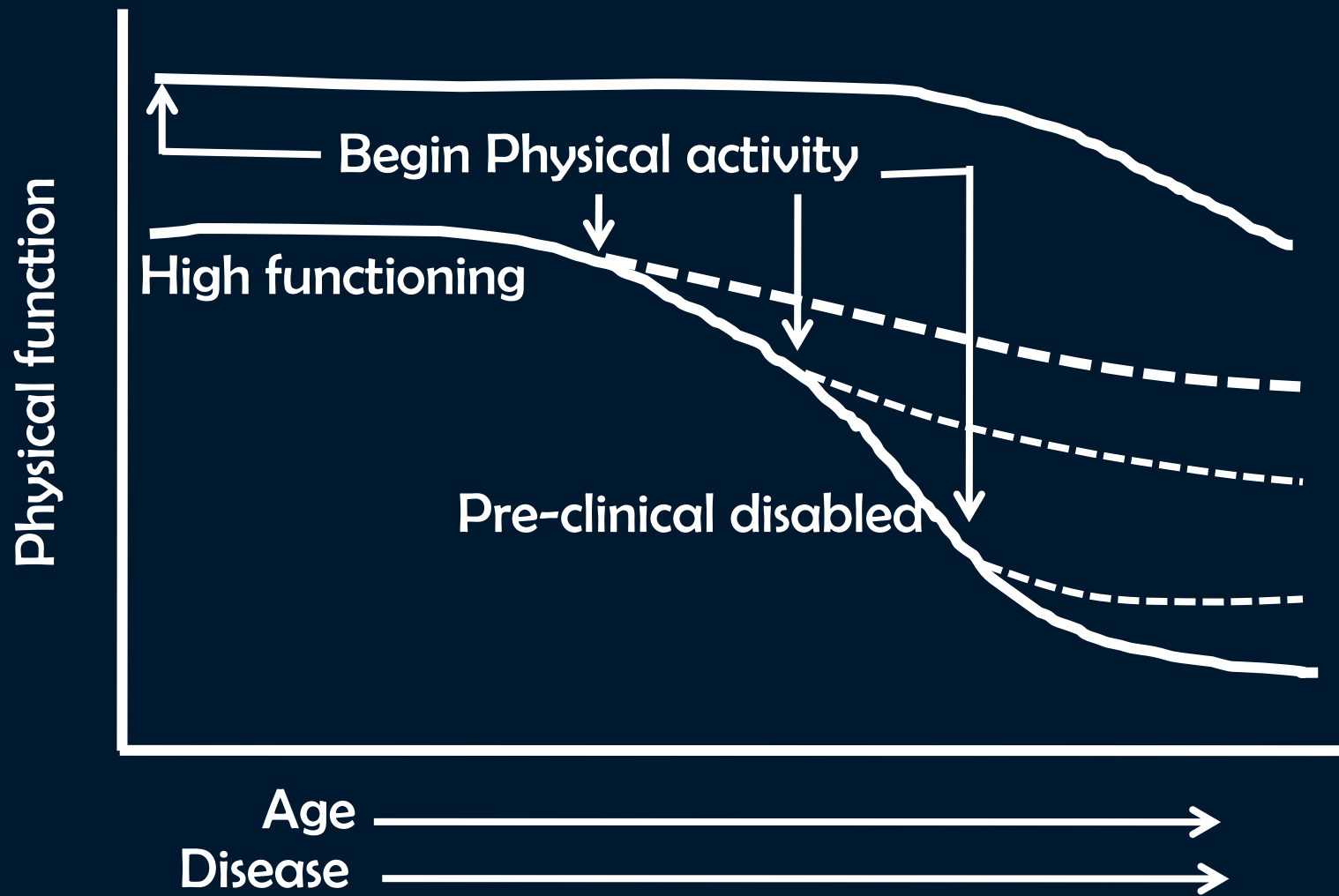
CHD Mortality



Coronary Heart Disease



- **Contribute factor to increase mortality rate**
 - **Increased prevalence of comorbid illness**
 - **Frequent complications of MI**
 - **More extensive coronary artery disease**
 - **More multi-vessel disease**
 - **More coronary artery calcification**
 - **More have a prior MI**




J Gerontol A Biol Sci Med Sci 2006:61:1157-66

Risk Factor Management



- Preventive approaches
 - hypertension control
 - control of hyperlipidemia
 - regular mod-intensity physical activity
 - weight reduction and control
 - dietary sodium and fat restriction
 - smoking cessation.

Exercise Training


- 
- Consider the physiologic characteristics of aging and the superimposed limitations caused by cardiovascular disease
 - individualized
 - avoiding excessive fatigue or exhaustion
 - limiting musculoskeletal injury by restriction of running, jumping and other high-impact activities.

Exercise training



- **Strength exercises**
 - Aim: to improve strength, balance and muscle coordination.
 - Progressive resistance training of the major muscle groups
 - 2-3 days per week with 2-3 sets of each exercise.

Exercise training


- 
- **Aerobic exercises:**
 - Moderate intensity aerobic training like walking, ergometry or water exercises
 - reaching first a target frequency (3days/wk),
 - then duration (at least 20 min per session),
 - finally, appropriate intensity (40-60% HRR)
 - **Stretching, warming up and cooling down for older adults**
 - should be longer and more gradual

Summary



- **Elderly patients with CHD**
 - Co-morbidities
- **Cardiac rehabilitation services**
 - enhance functional capacity
 - limit disability and dependency
 - comprehensive approaches to risk reduction can be implemented

Summary

- 
- referral and participation of elderly
 - unacceptably low
 - Elderly patients need improved access to cardiac rehabilitation services to realize the benefits of secondary prevention
 - increased numbers of elderly patients have to be referred to and participate in cardiac rehabilitation



Special conditions

1. Pulmonary disease Patients
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Transplantation

- Treatment of choice in the terminal stages of congestive heart failure
- Survival rate
 - 5 yr: 60%, 12 yr: 35%
 - Not only the length but also the quality of life

Transplantation



Transplantation

- 
- Severe deconditioning follows months of debilitating ill health
 - Need formal postsurgical rehabilitation
 - Physical exercise training
 - Prudent diet, weight control, guidance in smoking cessation, advice on the effects and side effects of medication
 - Psychological and vocational counseling

Exercise Physiology



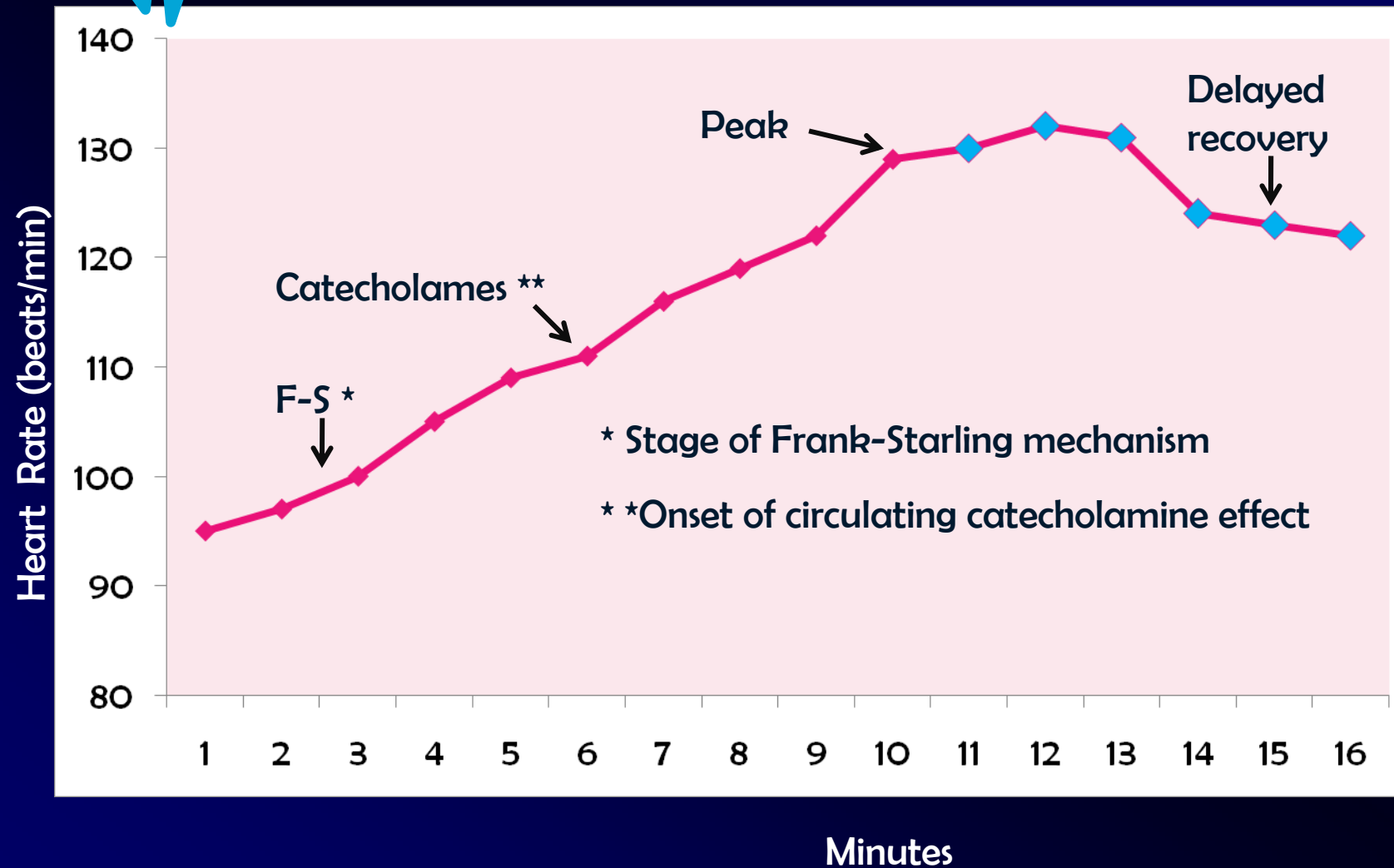
- Normal
 - Cardiac output (CO) = HR x SV
 - CO increase 5-6x the resting value
 - Normal resting CO = 4.5-5.0 L
- How to increase CO
 - Autonomic nervous system
 - initial increase in HR (30-50 beats in 1st min)
 - Cardiac sympathetic nerves
 - SV increases gradually during exercise

Exercise Physiology of HTPL

A blue ECG line graphic is positioned below the title, starting with a small wave, followed by a sharp peak, and then a series of smaller waves that level off into a horizontal line.

- Lack of autonomic function
 - Denervation of the heart
 - Delayed heart rate response
 - Decreased maximal heart rate
 - Impaired CO adaptation
 - SV increases more sharply during initial exercise
 - SV is the only mechanism for increasing CO

Exercise Physiology of HTPL





Exercise Prescription

- **Aerobic exercise**
 - Initial goal of 20 minutes
 - 30-40 min as an optimal progression goal
 - Weight and Non-weight bearing modalities
 - Utilize moderate and high intensity intervals based on METreserve or RPE
 - 3min moderate (50-60% or RPE 11-13)
 - 1min high (75-85% or RPE 14-15)
 - Effectively increase the anaerobic threshold (AT) and $\dot{V}O_2$ max more effectively

Exercise Prescription



- **Resistance Training**
 - Exercise to use big muscles and multiple joints
 - Surgical limitations
 - **Begin with lower extremities**
 - Body weight exercises are a great tool
 - Squats, lunges, wall press
 - **Light hand weights and bands**
 - 2sets of 12-15 reps is optimal
 - Great opportunity to incorporate stability and balance devices

Be cautious !



- **Hypertension**

- Side effects of immunosuppressant cyclosporine therapy
- Persistent response to chronic elevation of plasma norepinephrine.


- ➔ **Exercise training**

- reduce catecholamine levels
- antihypertensive effect



Summary

- **Routine use of comprehensive exercise rehabilitation**
 - maximizes the benefits of surgery
 - can induce a good training effect
- **The prescription of exercise**
 - the denervated heart's peculiar response to effort
 - perceived exertion and metabolic measurements
 - Not target heart rates for defining the training

An aerial photograph of a wetland or marsh area. A prominent, winding river or stream flows through the landscape, which is characterized by various patches of green and brown vegetation, likely reeds and sedges. The terrain appears to be flat and water-saturated. The text is overlaid in the center of the image.

경청해주셔서 감사합니다