

NEUROLOGICAL PROBLEMS IN THE ELDERLY,

Stroke  
Parkinsonism and Parkinson's Disease

AAIM  
October 17, 2012

Robert Lund, MD

STROKE

**Ischemic**

(over 80% of CVA's above age of 70)

- Atherothrombotic
  - Lacunar
  - Cardioembolic
- } (mean age ~ 72 years)

**Hemorrhagic**

- Intracerebral (mean age ~ 79 years)
- ~~Subarachnoid (mean age ~ 49 years)~~

Expression of cardiovascular disease at the oldest ages may be as stroke. Increased survival from CAD has increased the incidence of stroke in North America

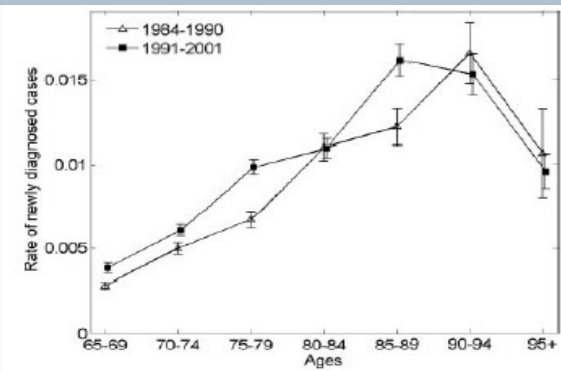


Figure 1. Age-specific rate of first stroke diagnosis

- There has been a slight increase in age-adjusted rate of first stroke appearance from 1984 – 1990 until 1991 – 2001
- One-year survival after stroke improved from 53% in 1984 – 199 to 65% in 1991 – 1996
- Overall, stroke tends to occur around ten years later than most initial expressions of coronary atherosclerotic heart disease

## Stroke Prognosis

Munich RE 

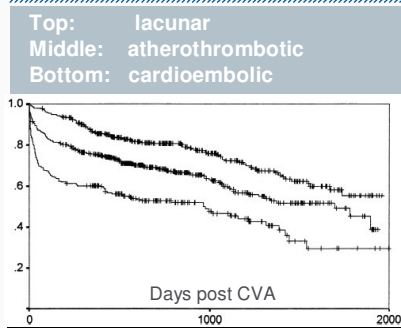
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Etiology	Post Stroke Level of Function	Risk Factor Control
<ul style="list-style-type: none"> <li>Ischemic Stroke                             <ul style="list-style-type: none"> <li>Lacunar</li> <li>Atherothrombotic</li> <li>Cardioembolic</li> </ul> </li> <li>Intracerebral Hemorrhage</li> </ul>	<ul style="list-style-type: none"> <li>Time since stroke when level of function determined</li> </ul>	<ul style="list-style-type: none"> <li>Hypertension</li> <li>Diabetes</li> <li>Smoking</li> <li>Cardiac arrhythmias</li> <li>Lipid abnormalities</li> <li>It is unknown whether treating risk factors post initial stroke lowers post stroke mortality or not</li> </ul>

De Jong G, et al, J Clinical Epidemiology 2003;56:262 – 268. 5

## Survival after **First Ischemic Cerebral Infarct** by Etiology, (in Holland)

Munich RE 



- Annual risk of dying after first-time stroke is about 9% (approximately 2.3 times that of general population)
- Death related to recurrent stroke was about the same in all three subtypes (13 – 16%)

Type of Stroke (All Presentations)	Mortality Ratio (%)	Ave. ED / K / Y
Lacunar	201	54.735
Atherothrombotic	243	82.369
Cardioembolic	260	122.471

De Jong G, et al, J Clinical Epidemiology 2003;56:262 – 268.

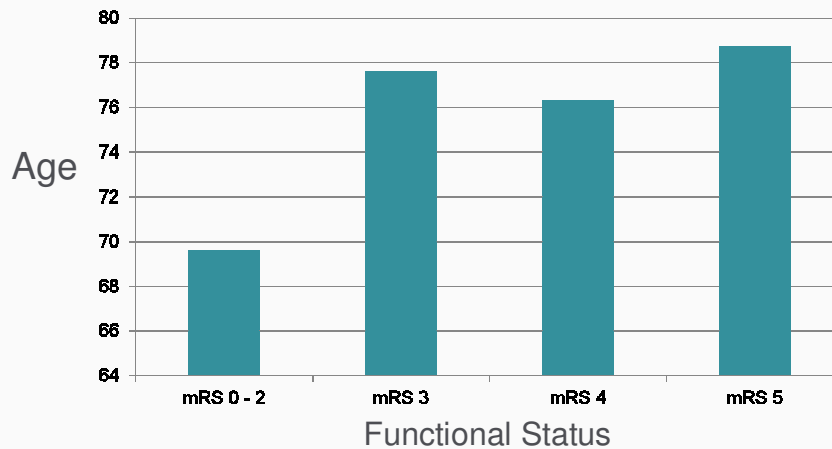
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## Post Stroke Level of Function Modified Rankin Scale (mRS)

Score	Description
0	No symptoms at all
1	No significant disability despite symptoms; able to carry out all usual duties and activities
2	Slight disability; unable to carry out all previous activities, but able to look after own affairs without assistance
3	Moderate disability; requiring some help, but <b>able to walk without assistance</b>
4	Moderately severe disability; unable to walk without assistance and unable to attend to own bodily needs without assistance
5	Severe disability; bedridden, incontinent, and requiring constant nursing care and attention
6	Dead

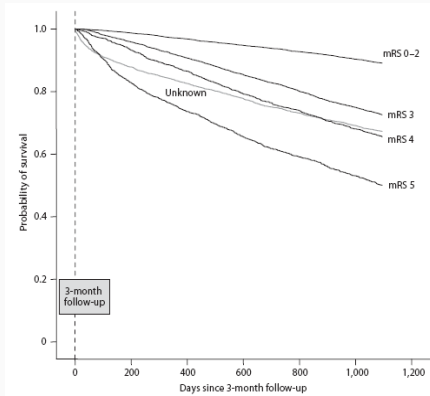
## Elderly Suffer Relatively Greater Functional Debilitation after Stroke

**Mean Age by Functional Status, 3 Months Post CVA**



## Functional Outcome 3 Months After Stroke (~ 85 % Ischemic) Predicts Long-Term Survival

Follow up begins at 3 months post CVA  
per modified Rankin Scale score



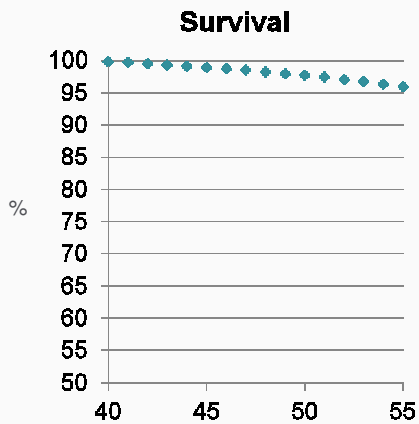
Modified Rankin Scale score = 3  
"Moderate disability; requiring some help,  
but able to walk without assistance"

mRS Score	Mortality Ratio (%)	Average ED / K / Y
0 - 2	122	8.5
3	188	47.9
4	277	82.4
5	372	147.5
Unknown	341	84.2

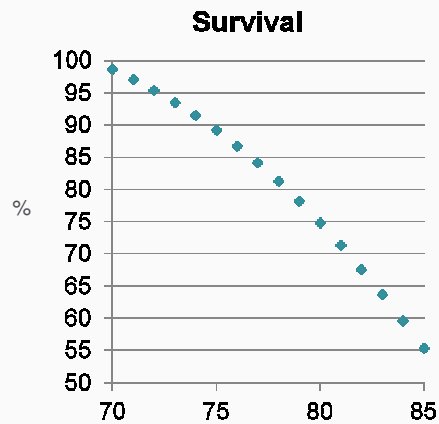
Eriksson M, et al, Cerebrovasc Dis 2008;25:423 – 429.

## Expected Survival Much Worse in Elderly

15 Year Survival after Age 40



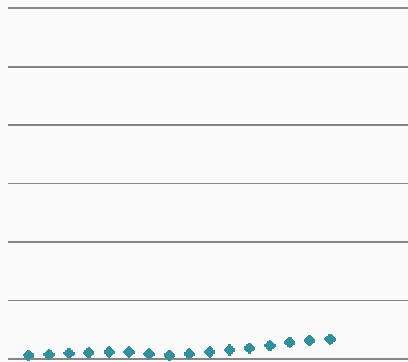
15 Year Survival after Age 70



## Yearly **Expected Mortality** Increases Much More Steeply in Elderly

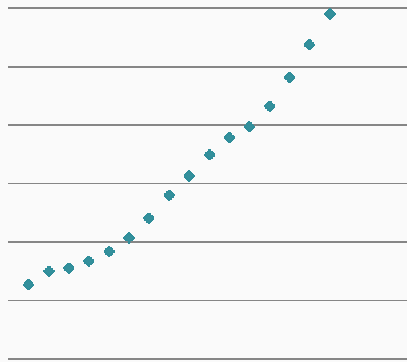
Yearly interval mortality increases,

Ages 40 through 55



Yearly interval mortality increases,

Ages 70 through 85



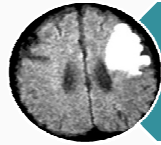
## Effect of Rapidly Rising Expected Mortality on Mortality Ratios in The Elderly

Stroke survivors with moderate disability (**mRS = 3**)  
 Mean age = 77.6 years, Mortality Ratio = 188 %, Average ED / K / Y = 47.876

### Using Average Annual Excess Deaths to Compute Mortality Ratios in the Elderly

Age	Mortality Ratio ( % )	Ave. ED / K / Y
70	283	47.876
74	225	47.876
78	185	47.876
82	156	47.876
86	137	47.876

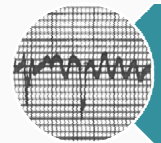
Ischemic Strokes - Comprise between 85 % and 90 % of Strokes in Those 70 Years Old and Older



Atherothrombotic

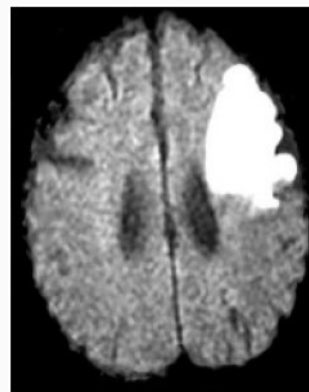
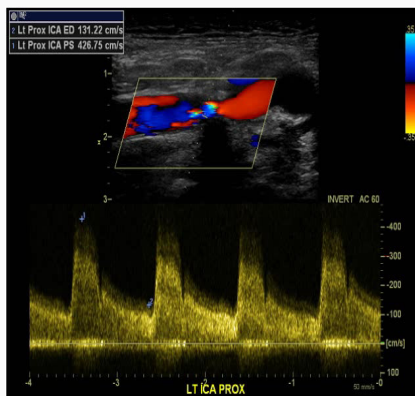


Lacunar



Cardioembolic

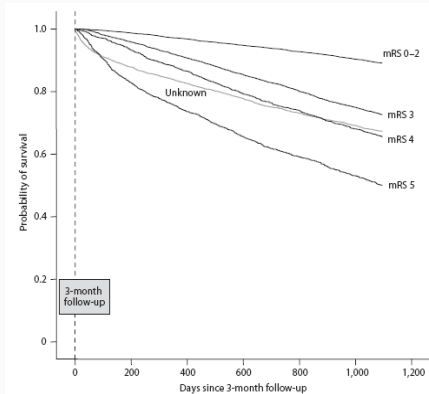
Atherothrombotic Stroke



Mortality is the same whether due to athero-emboli or to thrombosis

## Functional Outcome **3 Months** After Stroke (~ 85 % Ischemic) Predicts Long-Term Survival

Follow up begins at 3 months post CVA per modified Rankin Scale score



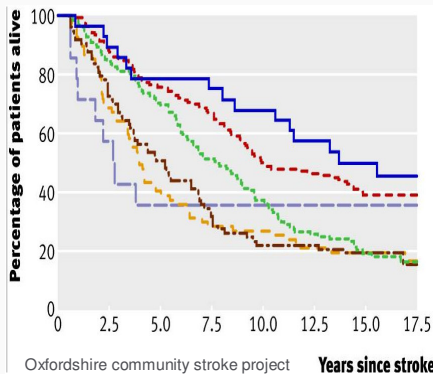
Modified Rankin Scale score = 3  
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mRS Score	Mortality Ratio (%)	Average ED / K / Y
0 - 2	122	8.5
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4	277	82.4
5	372	147.5
Unknown	341	84.2

Eriksson M, et al, Cerebrovasc Dis 2008;25:423 – 429.

## Functional Outcome **6 Months** After Ischemic Stroke Predicts Long-Term Survival

Follow up begins at 6 months post CVA per modified Rankin Scale score




Modified Rankin Scale score = 3  
"Moderate disability; requiring some help, but able to walk without assistance"

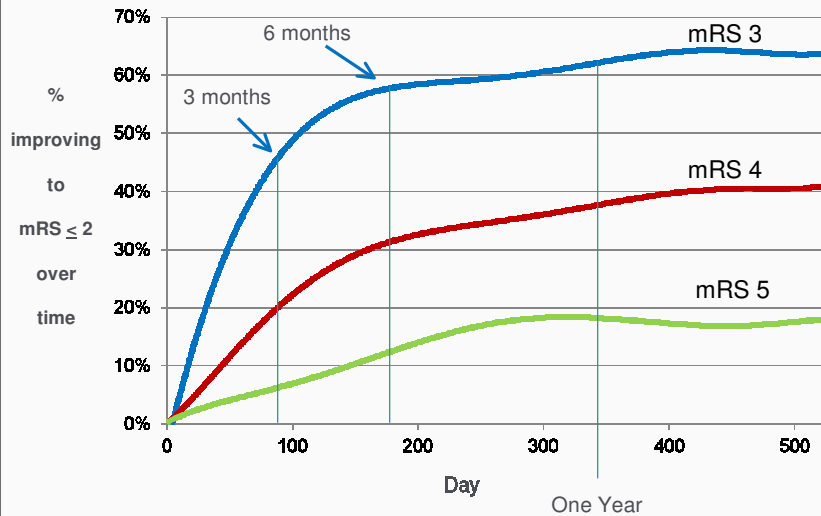
mRS Score	Mortality Ratio (%)	Average ED / K / Y
0 - 2	112	7.967239
3	246	67.24617
4	322	93.53013
5	393	116.9909

**At 6 months post stroke potential for further functional improvement is limited**

Slot KB, et al, *BMJ* 2008; 336(7640):376 – 9.



Likelihood of Recovering to A Functionally Independent State (< mRS 3) According to mRS Level after A Disabling Ischemic Stroke Munich RE 




Hankey GJ, et al, *Neurology* 2007;68:1583 – 1587.

Title of presentation and name of speaker

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**Stroke in The Very Old:** Traditional Risk Factors Less, Atrial Fibrillation More, Vast Majority Are Ischemic Strokes Munich RE 

	< 85 Years (%)	≥ 85 Years (%)	
Female	50.5	75.4	
Living Alone	53.5	83.5	
<b>Atrial Fibrillation</b>	<b>14.6</b>	<b>37.4</b>	↑
Smoking	49.9	17.8	↓
Diabetes	22.0	13.7	↓
Hypertension	34.4	25.3	↓
Daily Alcohol	33.5	15.9	↓
Cerebral Hemorrhage	8.0	6.7	↓
Scandinavian Stroke Scale	36.9	30.9	
Died Acutely or D/C'd to NH	31.2	58.6	

Less than 10% of those ≥ 85 suffering from stroke were alive and living in their own home after 5 years from onset

Kammersgaard LP, et al, *Age and Aging* 2004;33:149 – 154.

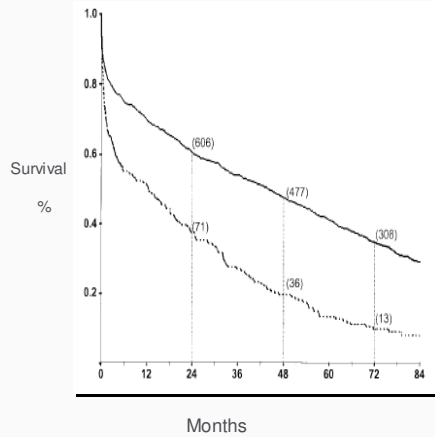
Title of presentation and name of speaker

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# High Expected Mortality Effects Risk Assessment in The Very Old with Stroke

Upper curve cohort < 85 years  
Lower curve cohort ≥ 85 years



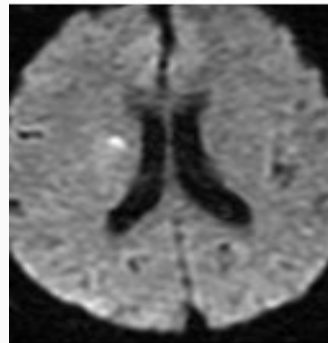
Eliminating first year mortality greatly improves potential offers

Cohort	No PP		PP x 1 Year	
	MR (%)	ED / K / Y	MR (%)	ED / K / Y
< 85 Y (71.7 Y)	291	105.2	141	23.7
≥ 85 Y (88.0 Y)	165	111.5	45	—

Kammersgaard LP, et al. *Age and Aging* 2004;33:149 – 154.

# Lacunar Infarct

- 71 YO hypertensive Woman developed hemiparesis of left face, arm and leg and dysarthria over the course of one day No sensory signs, no hemi-neglect
- 30 days later mild residual left-sided weakness persisted but she was able to do everything she could prior to the episode



- 2 to 15 mm diameter **subcortical infarcts (e. g., no aphasia, apraxia etc.)**
  - Caused by occlusion of a single penetrating artery originating from a large cerebral artery (due to lipohyalinosis or microatheroma at origin of penetrating artery – ? microemboli ?)
  - Affect mostly the basal ganglia, subcortical white matter and pons
- Have been felt to represent relatively better prognosis regarding disability and death than other ischemic strokes
- Evidence suggests that this may not be true over more extended periods of time (e.g. 5 years or more), however
- Those having lacunar infarcts have subsequent risk for stroke of about 7 % per year over the subsequent 5 years
  - The majority of subsequent recurrent strokes will be lacunar as well

Salgado AV, et al, *Stroke* 1996;26:661 – 666.

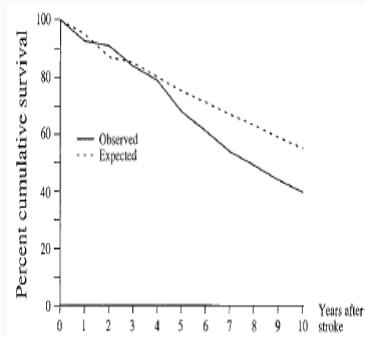
Risk for Death and Recurrent Stroke for Non-Lacunar Strokes Relative to Lacunar Infarcts		
Time from Initial Stroke	Death (Odds Ratio vs. Lacunar)	Recurrent Stroke (Odds Ratio vs. Lacunar)
1 month	3.81	2.11
1 – 12 months	2.32	1.24
1 – 5 years	1.77	1.61

Jackson C and Sudlow C, *Brain* 2005;128(Pt 11):2507 – 2517.

## Long-Term Survival after Lacunar Infarct Is Worse Than Earlier Thought –

(Late recurrent stroke risk might be less than after other types of stroke)

Overall mortality risk after lacunar infarct doesn't begin to rise until after 5 years

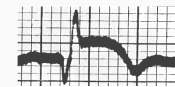
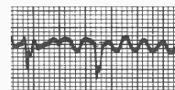


Staaf G, et al, *Stroke* 2001;32:2592 – 2596.

- Mortality Ratio = 138 %
  - Ave. ED / K / Y = 32.463
- Most deaths due to coronary atherosclerotic heart disease
- Risk factors for death
  - Age, non use of ASA
- Recurrent stroke risk (mostly lacunar)
  - ~ 5 to 7 % annually first 5 years
  - After 5 years < 1 – 2.5 % annually
- Risk factors for recurrent stroke
  - Hypertension, diabetes

## Cardioembolic Stroke: Highest Mortality of The Ischemic Strokes

- Suggestive features
  - Strokes characterized by
    - Sudden onset to maximal deficit
    - May be concurrent cerebral and systemic emboli
- High risk cardioembolic conditions
  - Atrial fibrillation (associated with worse outcomes)
  - Recent myocardial infarction
  - Mechanical prosthetic valve
  - Dilated cardiomyopathy



Harrison MJG and Marshall J, *Stroke* 1984;15(3):441 – 442.  
Arboix A and Alio J, *Current Cardiology Reviews* 2010;6:150 – 161.  
© The Cleveland Clinic Foundation 2005  
[www.clevelandclinic.org/heartcenter/pub/guide/disease/valve/valvetreatment](http://www.clevelandclinic.org/heartcenter/pub/guide/disease/valve/valvetreatment)

## As Age Advances Cardioembolic Strokes become More Prevalent and Lacunar Infarcts Less So

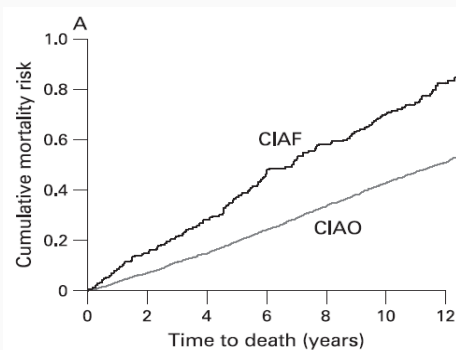
Type of Stroke (%)	Years of Age		
	65 - 74	75 - 84	≥ 85
Atherothrombotic	31.7	32.3	31.4
Lacunar	31.7	24	↓ 19.5
Cardioembolic	20	29.5	↑ 36
Unknown Cause	13.8	11.2	12.2
Unusual Cause	2.8	3.0	1.0

Arboix A and Alio J, *Current Cardiology Reviews* 2010;6:150 – 161.

## Comparison of Long-Term Mortality between Cardiac and Arterial Source of Minor Ischaemic Stroke (mRS ≤ 3) or TIA

CIAF (cerebral ischemia and atrial fibrillation)  
CIAO (cerebral ischaemia of arterial origin)

CIAF: Rx'd with anticoagulants (26%)  
CIAO: Rx'd with ASA



	Mortality Ratio (%)	ED / K / Y
CIAF	175	58.629
CIAO	137	15.531

### Recent CIAF

Annual risk of recurrent stroke:  
 No Rx. 12%  
 ASA 10%  
 Oral anticoagulants: 4%

### Recent CIAO Rx'd with ASA

Annual risk of all vascular events:  
 4% to 11%

Wijk LV, et al, *J Neurol Neurosurg Psychiatry* 2008;79:895 – 899.

Initially Hospitalized with Atrial Fibrillation and Some Form of Cardiovascular Disease Versus Cardiovascular Disease Alone  
Follow Up for Three Years

Mortality rate ~ 20% higher when atrial fibrillation complicates cardiovascular disease, Mortality generally higher in women

Age	Cardiovasc. Dis. With Atrial Fib.				Cardiovasc. Dis. (No Atrial Fib.)			
	No Postpone		Postpone x 1 Yr.		No Postpone		Postpone x 1 Yr.	
Men	MR (%)	ED/K/Y	MR (%)	ED/K/Y	MR (%)	ED/K/Y	MR (%)	ED/K/Y
65 – 74	339	107.64	239	57.50	265	72.43	202	41.68
75 – 84	219	136.36	185	80.96	191	99.40	155	51.51
85 - 89	177	174.92	162	100.68	161	133.41	144	71.91
Women	MR (%)	ED/K/Y	MR (%)	ED/K/Y	MR (%)	ED/K/Y	MR (%)	ED/K/Y
65 – 74	516	104.16	342	55.95	386	69.64	271	39.67
75 – 84	295	132.86	230	76.82	224	80.27	168	40.44
85 - 89	204	157.75	175	89.52	167	93.76	133	39.54

Wolf PA, et al, *Arch Intern Med* 1998;158:229 – 234.

Risk of Stroke in Medicare Patients with And without Both Atrial Fibrillation And Cardiovascular Disease

Three year cumulative risk of stroke (%) after initial hospitalization

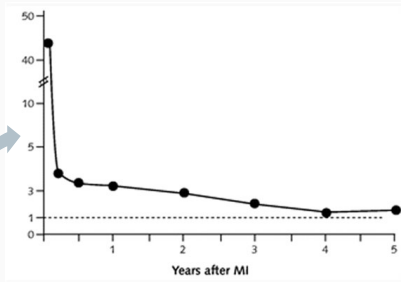
	With Other Cardiovascular Disease		No Other Cardiovascular Disease	
	Atrial fib.	No a. fib.	Atrial fib.	No a. fib.
Men				
65 – 74	10.8	8.7	3.7	1.9
75 – 84	12.0	13.8	4.6	3.2
85 - 89	14.8	13.9	4.6	4.0
Women				
65 – 74	11.7	7.5	2.4	1.4
75 – 84	<b>18.8</b>	12.3	5.6	3.8
85 - 89	<b>19.7</b>	14.8	6.4	5.0

- Those with CV Disease and atrial fibrillation had stroke rates significantly higher (up to 5 times) than those with no CV disease, including no atrial fibrillation
- Women ≥ 75 years with CV disease and atrial fibrillation had nearly 20% chance of stroke over the 3 years since hospitalization

Wolf PA, et al, *Arch Intern Med* 1998;158:229 – 234.

## Stroke after First Ever Myocardial Infarction

RR for stroke in first 30 days post MI is increased 44-fold



Risk for stroke relative to general population

- Risk remains 2 to 3 times higher than expected over 3 years following initial MI
- Post MI stroke associated with **increased mortality: hazard ratio = 2.89**
- Use of thrombolytics did not result in increase in hemorrhagic stroke
- Risk factors for post MI stroke (after initial MI)
  - Older age
  - Diabetes
  - Prior stroke

Survival post MI has increased along with increased prevalence of diabetes and an aging population – all suggest that post MI stroke will be an increasing problem

Witt BJ, et al, *Annals of Internal Medicine* 2005;143(11):785 – 792.

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## Pre and Post – Surgical Valvular Heart Disease Has Increased Risk for Stroke and Increased Mortality

Anticoagulant-related hemorrhage for both = 2.7% / year

St. Jude mechanical aortic valve replacement  
TE TIA or stroke ~ 1.77% / year

St. Jude mechanical mitral valve replacement  
TE TIA or stroke ~ 2.52% / year

Carpentier-Edwards Mitral Perimount Pericardial Bioprosthesis  
TE Stroke ~ 1.1% / year

Emery RW, et al, *Ann Thorac Surg* 2005;79:776 – 83.

Marchand MA, et al, *Ann Thorac Surg* 2001;71:S236 – 9.

Mitral valve prolapse  
Lifetime Relative Risk for TIA or stroke ~ 2.2  
Risk factors: Older age (> 50 years)  
Thickened leaflets  
Atrial fibrillation

Averinos JF, et al, *Stroke* 2003;34:1339 – 1345.

Follow-up after native aortic or mitral valve disease-associated initial TIA or stroke:  
(Overall) Mortality Ratio = 285%  
(entry age = 81 years)

Petty GW, et al, *Mayo Clin Proc* 2005;80(8):1001 – 1008.

“TE” = Thromboembolic

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## Stroke Mortality Decreasing, Post Stroke Dementia Increasing

### Second most prevalent dementia after Alzheimer's disease

Nearly two fold decline in stroke mortality in recent decades in those  $\geq 65$  years

- Stroke incidence rate has increased
- Post stroke dementia has increased
  - Mortality higher than in those having "vascular dementia" not associated with specific event

Wright CB, *UpToDate* March 2012

Ukrainitseva S, et al, *Stroke* 2006;37:1155 – 1159.

- Risk factors for post stroke dementia
  - Age
  - Increased stroke severity
  - Atrial fibrillation
  - Mild cognitive impairment prior to CVA
  - White matter disease, especially multiple events
  - Cortical atrophy
  - Hypertension
  - Diabetes
  - **Left hemisphere CVA with aphasia**
  - Second stroke

## Temporal Association of Stroke to Development of Vascular Dementia Significantly Effects Mortality

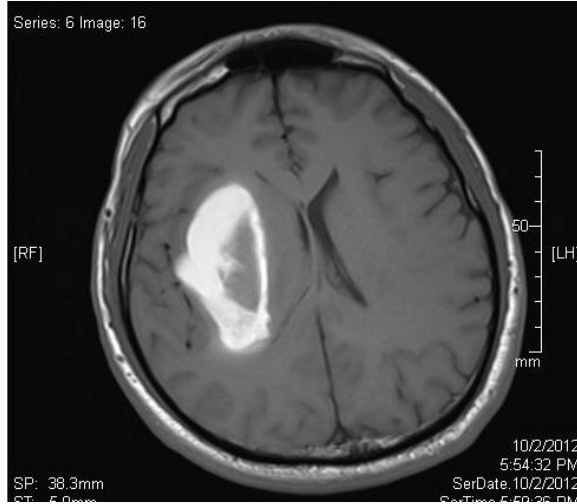
### 84 Year Old Minnesota Residents

Type of Dementia	Mortality Ratio (%)	Ave. ED / K / Y
Alzheimer's Disease	117	32.615
Vascular Dementia (multi-infarct dementia)	181	98.112
Post Stroke Dementia temporally related to CVA	268	210.518

Knopman DS, et al, *Arch Neurol* 2003;60:85 – 90.



# Intracerebral Hemorrhage (ICH)

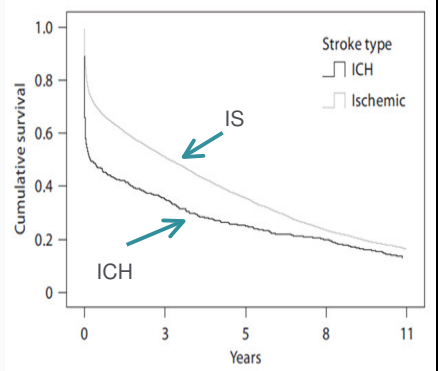


- 78 YO hypertensive man, excessive alcohol user who presented with headache and vomiting and left-sided motor and sensory deficits
- One year later he remains hemiparetic and continues to require assistance with bodily needs and is somewhat "slow"

# Initial Intracerebral Hemorrhage (ICH) Has Worse Short-Term Prognosis Than Ischemic Stroke (IS)

In this study ICH mortality acutely = 45.7% and at one year = 51.2%.  
One year mortality for the comparison cohort with IS = 39.9%

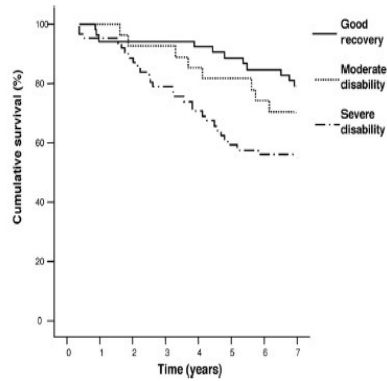
Redoing mortality calculations beginning after the first post-stroke year produces much more favorable results



Intracerebral Hemorrhage (ICH)	Ischemic Stroke (IS)
No Postpone: Mortality Ratio = 473 %	No Postpone: Mortality Ratio = 233 %
Postpone x One Year: Mortality Ratio = 164 %	Postpone x One Year: Mortality Ratio = 139 %

# Survival of Spontaneous ICH by Functional Status of Survivors at 3 Months Post Stroke

Level of recovery at 3 months determined by the Glasgow Outcome Scale (GOS)



Level of Recovery	Mortality Ratio (%)	Average ED / K / Y
Good recovery (normal activities, minor residual problems)	90	—
Moderate disability (disabled but independent)	153	22.019
Severe disability (conscious but requires support of others)	305	64.972

Saloheimo P, et al, *Stroke* 2005;37:487 – 491.

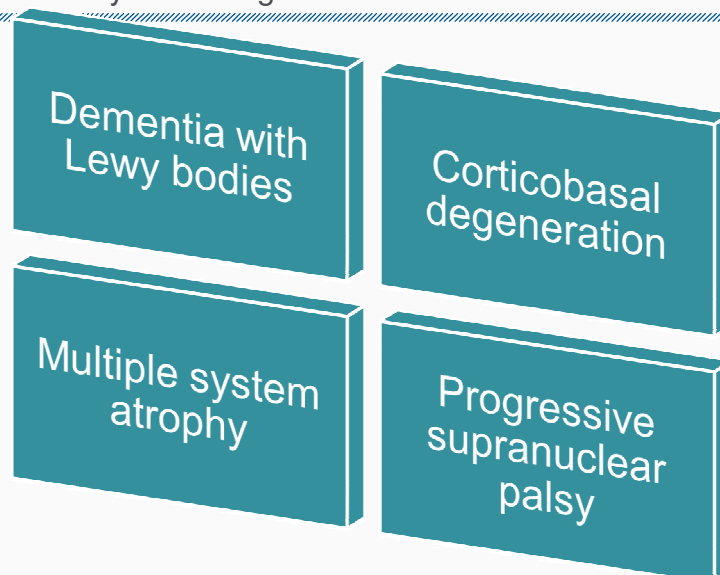
PARKINSON DISEASE

PARKINSONISM

## Idiopathic Parkinson Disease (PD)

- A clinical diagnosis based on neurological examination findings (there is no diagnostic test)
  - Main features: Tremor, rigidity, bradykinesia
  - Postural instability / gait disturbance occurs later in the disease
  - Initial evaluations may be only ~ 75 % accurate
- Distinguishing idiopathic PD disease from parkinsonism can be very challenging
  - Especially difficult early in disease
- Same medications used to treat both PD and parkinsonism
  - Currently, medications do not result in improved mortality

## Symptoms And Signs of Parkinsonism Can be Found in Many Neurodegenerative Diseases



## Secondary Parkinsonism Can Result from A Variety of Conditions

- Drugs
- Toxins
- Head trauma
- Structural brain lesions
- Metabolic and miscellaneous disorders
- Infections
- Cerebrovascular disease

## Parkinson Disease and Parkinsonism in Community Dwelling Elderly

### Prevalence of Parkinsonism Overall

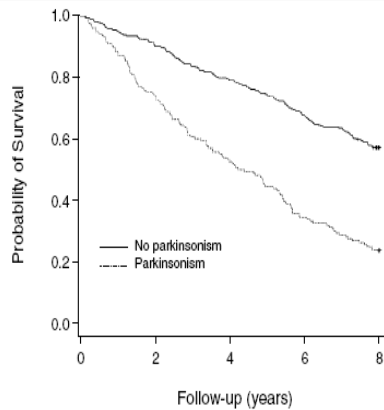
Age Band (years)	%
65 – 74	14.9
75 – 84	29.5
85 & above	52.4

### Parkinsonism: predominantly affects the very elderly

- Mean q age = 83 years
- 9.4 % clinically diagnosed Parkinson disease
- The rest (90.6%) had Parkinsonism

## Parkinson Disease and Parkinsonism in Community Dwelling Elderly, Mean Age = 83 Years

Overall mortality for all with PD / Parkinsonism



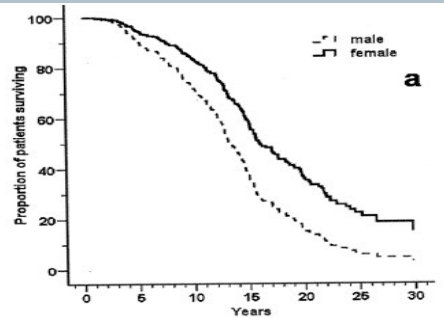
Bennett DA, et al, *NEJM* 1996;334(2):71 – 76.

MR's and ED determined using decennial general Massachusetts population mortality

	Mortality Ratio (%)	ED / K / Y
All with Parkinsonism	150	50.743

## Overall Parkinson Disease Mortality Parkinson Disease in The Community

Austrian study, mean age at onset = 62.4 years




	Mortality Ratio (%)	ED/K/Y
Women	126	14.805
Men	130	31.129


- Australian study over 10 years
  - Standardized Mortality Ratios (SMR)
    - Overall = 1.58
    - Men = 1.89 (age = 66.4 Y)
    - Women = 1.19 (age = 66.7 Y)
  - SMR's by age group
    - < 70 years = 1.8
    - ≥ 70 = 1.51

Hely MA, et al, *J Neural Neurosurg Psychiatry* 1999;67:300 – 307.

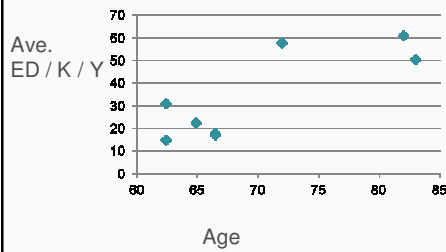
Diem-Zangerl A, et al, *Movement Disorders* 2009;24(6):819 – 825.

# Mortality Due to Idiopathic Parkinson Disease May Well be Different from Mortality Due to Parkinsonism

More likely idiopathic Parkinson Disease ? 

More likely parkinsonism ? 

ED / K / Y from various studies on Parkinson Disease / Parkinsonism

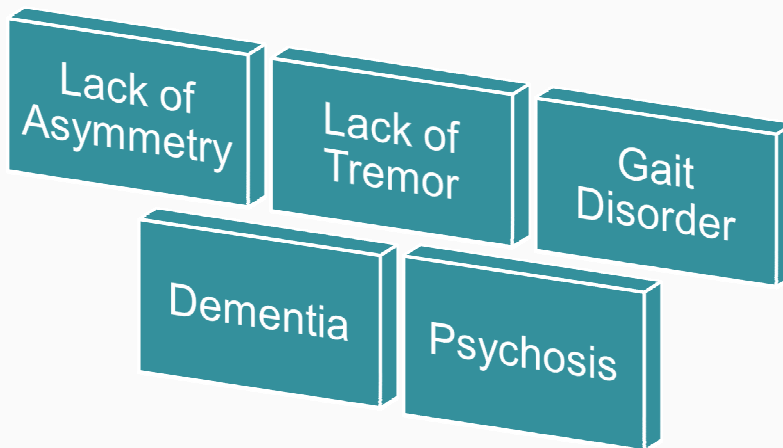


Calculations with VBT 2001 (Ultimate Composite)

Age Band (Age of Calc.)	Average ED / K / Y	Mortality Ratio (%)
60 – 69 (64)	20.7204	169
70 – 79 (74)	58.066	203
80 & up (82)	55.8985	152

Average Excess Deaths / K / Year are nearly three times greater for those with "PD / Parkinsonism" above age 70

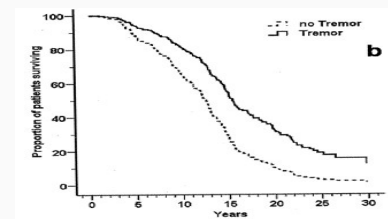
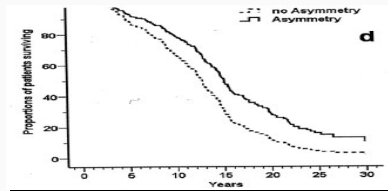
# Adverse Prognostic Indicators for Parkinson Disease / Parkinsonism



## Lack of Asymmetry And Lack of Tremor at Presentation Predict Worsened Survival

In addition to lack of tremor and no asymmetry at presentation, male gender and gait disorder also had negative impact on survival

Mean age at presentation = 62.4 years



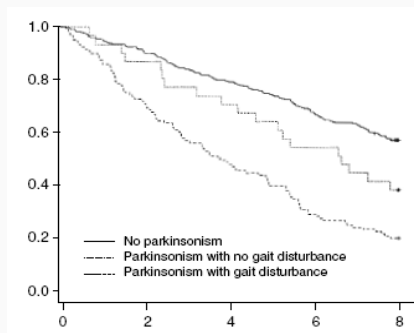
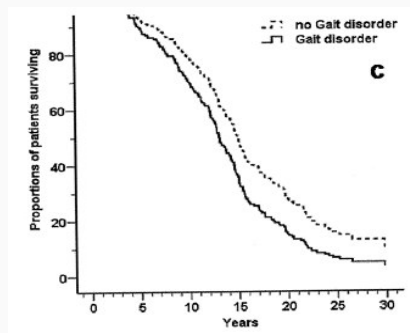
	Mortality Ratio (%)	ED / K / Y
No Asymmetry	184	43.748
Asymmetry Present	111	14.475
No Tremor	197	53.842
Tremor Present	102	11.923

Diem-Zangerl A, et al, *Movement Disorders* 2009;24(6):819 – 825.

## Development of Gait Disorder Portends Worse Prognosis

No gait disorder: MR = 115%, ED/K/Y = 15.943  
With gait disorder: MR = 166%, ED/K/Y = 35.193

No gait disorder: MR = 101%, ED/K/Y = ~ 0.00  
With gait disorder: MR = 170%, ED/K/Y = 71.177



MR's and ED determined using decennial **general Massachusetts population** mortality

Diem-Zangerl A, et al, *Movement Disorders* 2009;24(6):819 – 825.

Bennett DA, et al, *NEJM* 1996;334(2):71 – 76.

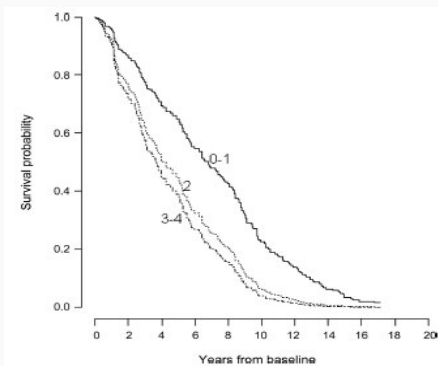
- Parkinson disease in the community: about 30% with associated dementia
  - Older age and severity of extrapyramidal signs are associated with increased risk for development of dementia in those with PD
  - Longer duration of PD increases risk of dementia (present in ~ 83 % of 20 years survivors)
- Onset of dementia in PD has an associated Relative Risk for increased mortality anywhere from 1.8 to 2.2
- Pathological evaluation on those with PD and dementia: about 47% have diffuse Lewy bodies

Hely MA, et al, *Movement Disorders* 2008;23(6):837 – 844.  
De Lau LML, et al, *Arch Neurol* 2005;62:1265 – 1269.  
Levy G, et al, *Neurology* 2002;59:1708 – 1713.

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## Parkinson Disease (PD) And Development of Psychosis (psychosis: greatest single risk for nursing home placement in PD – not motor dysfunction)

0 - 1 = no psychotic symptoms,  
2 = hallucinations with retained insight  
3 - 4 = hallucinations or delusions without insight



Forsaa EB, et al, *Neurology* 2010;75:1270 – 1276.

- Parkinson disease with psychotic symptoms
  - possibly due to medication side effects - particularly dopamine agonists - (occurs in 20 – 40% of drug Rx'd patients)
  - If not medication side effect, dementia with Lewy bodies must be considered (especially if dementia occurs simultaneously with onset of PD motor symptoms)
- Parkinson disease with hallucinations, not due to medications, has ...

**Mortality Ratio = 391 %**

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## Indications for Accelerated Functional Decline in Parkinson Disease (PD)

### Emergence of postural instability / gait impairment

Heralds onset of problems with posture/gait-dependent activities:

Housework  
Dressing  
Transferring



Activities of Daily Living (ADL's)

Parkinson disease demonstrates an opposite sequence in functional decline relative to Alzheimer's disease: earliest sign is difficulty ambulating and last signs are difficulty with eating, handling medication or money and using the telephone

- Threshold for disability for Long Term Care (LTC) and disability benefits:

Loss of independence in 2 Activities of Daily Living

- This occurs on average about 7 years from diagnosis of PD
- Period of transition from "impairment" to "disability":  
3 – 7 years from diagnosis of PD

## Early Retirement And Income Loss in Individuals with Newly Diagnosed and Recently Advanced Parkinson Disease

Two cohorts: 1. Newly diagnosed with Parkinson disease (PD)  
2. Recently diagnosed with advanced Parkinson disease (PDAAD) ("PD ambulating with assistive devices" characterized as first use of walker or wheelchair)

All individuals were actively employed, mean age of both groups = 53 years

- Hazard Ratios for early retirement
  - PD = 2.08
  - PDAAD = 5.01

### Estimated Earnings Losses Due to Early Retirement from Parkinson disease

Age at diagnosis	Estimated Amount Lost (in 2009 US \$)
45	569,393
55	188,590
65	35,496
75	2,451

Since the trend is towards older Americans working into more advanced ages it is likely that costs associated with early retirement due to Parkinson disease will significantly rise.

## Mortality Due to Idiopathic Parkinson Disease May Well be Different from Mortality Due to Parkinsonism

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- Elbaz A, et al, Survival Study of Parkinson Disease in Olmstead County, Minnesota, *Arch Neurol* 2003;60:91 – 96.
- Bennett DA, et al, Prevalence of Parkinsonian Signs and Associated Mortality in a Community Population of Older People, *NEJM* 1996;334(2):71 – 76.
- Diem-Zangerl A, et al, Mortality in Parkinson's Disease: A 20-Year Follow-Up Study, *Movement Disorders* 2009;24(6):819 – 825.
- Forsaa EB, et al, What predicts mortality in Parkinson disease?, *Neurology* 2010;75:1270 – 1276.
- Hely MA, et al, The Sydney multicentre study of Parkinson's disease: progression and mortality at 10 years, *J Neurol Neurosurg Psychiatry* 1999;67:300 – 307.

THANK YOU