Older Age Risk Assessment Workshop

AAIM Triennial October 18-23, 2025
San Deigo, CA

Facilitator

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Credit: Sheila MacDonnell, MD, MS, DBIM

Objectives

At the end of this presentation, attendees will be able to:

- Identify key predictors and causes of mortality and morbidity in older age applicants and address trends in life expectancy and functional loss in older ages.
- Compare traditional biometric screening in older versus younger applicants and understand older applicant heterogeneity and its impact on underwriting and risk classification.
- Apply screening for successful aging and early mortality risks using concepts like frailty phenotype, failure to thrive (weight loss), and comorbidity.
- Integrate tools to assess functionality and cognition and their relationship to mortality and morbidity.

Chronologic vs Physiologic Age

- Age is commonly measured chronologically and a person 65 years or older is often referred to as “elderly”.
- From the SOA Older Age Underwriting Practices Survey, most respondents consider older age as 70+.
- It is well understood that **chronological age does not account for the significant heterogeneity in the aging process**.
- The concept of **physiologic age provides a better understanding** of the diversity of health and the aging process in this group.

Defining ‘elderly’ in clinical practice guidelines for pharmacotherapy.
Singh S, Bajorek B.
Pharmacy Practice 2014 Oct-Dec;12(4):489

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4282767/

2016 Older Age Underwriting Practices Survey Report

https://www.soa.org/globalassets/assets/Files/Research/Exp-Study/older-age-underwriting-report.pdf

Physiologic Age

- Based on **physical, cognitive and psychosocial health.**
  - Number and severity of chronic diseases.
    - **Multimorbidity**.
  - Degree of independence or dependance.
    - **Functional ability vs disability**.
    - **Frailty vs vitality**.
  - Variety of social networks.
  - Daily activities, exercise, lifestyle and habits.
- **In general, these physiologic age characteristics are better predictors of outcome in the older age population than chronological age alone**.

Goodwin, L (2006) *Brackenridge's Medical Selection of Life Risks Fifth Edition*, Chapter 7

Successful Aging and Resilience

- **Successful aging** - older individuals who continue to function well, **both physically and cognitively**, with **minimal to no chronic disease impact**.
  - These are individuals who have a high quality of life, low stress, are quick to recover from adversity, and have a high level of vitality/activity.
- **Resilience** (per the American Psychological Association) – "The process of **adapting well in the face of adversity, trauma, tragedy, threats, or significant sources of stress**, or 'bouncing back' from difficult experiences".
  - Characteristics that foster resilience:
    - Higher quality of life.
    - Greater happiness.
    - Better mental health/wellbeing.
    - Optimism.
    - Successful aging.
    - Lower depression.
    - Strong coping skills.
    - A strong social network.
  - These characteristics lead **to longevity and reduced mortality risk**.

The impact of resilience among older adults
MacLeod, S et. al.
Geriatric Nursing Volume 37, Issue 4, July–August 2016, Pages 266-272

https://www.sciencedirect.com/science/article/pii/S0197457216000689#bib1

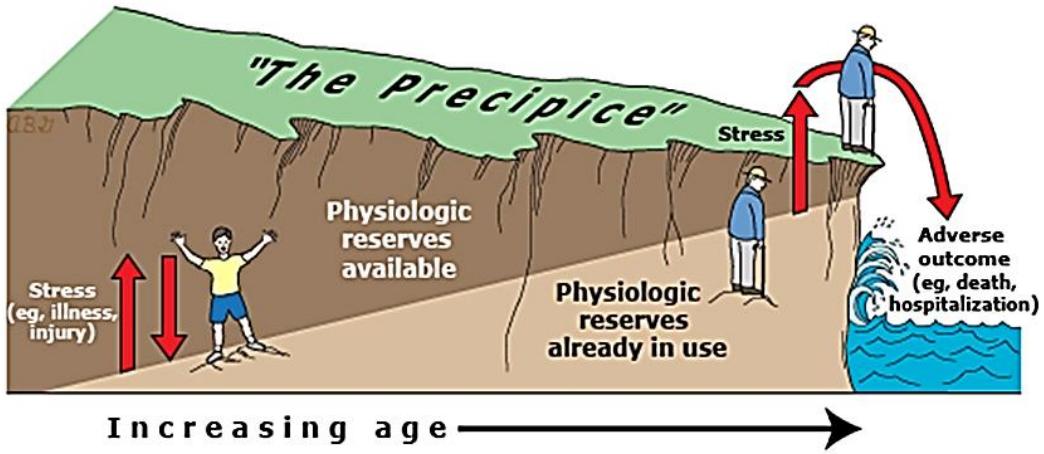
Physiologic Changes Associated with Normal Aging

- **Hematopoietic system**
  - Functional bone marrow reserves are reduced.
  - Reduced WBC function.
- **Gastrointestinal**
  - Increased reflux esophagitis.
  - Sensitivity to gastric irritants (NSAIDS).
- **Renal**
  - Renal mass and function decline with reduced creatinine clearance.
  - Increased sensitivity to medication toxicity.
- **Cardiovascular**
  - Elevated blood pressure.
    - Ventricular cardiomyocytes hypertrophy in compensation.
  - Increased risk for CAD.
  - Impaired LV filling/diastolic dysfunction leading to increased LA size and resultant risk of A. Fib.
  - Reduced response in HR and EF to exercise.
  - Increased calcification of heart valves.
- **Pulmonary**
  - Increased frequency of pneumonia and likelihood of hypoxia.
  - Loss of lung volume surface area and lung elasticity.
  - Cough is less vigorous and mucociliary clearance is slower.
- **Genitourinary**
  - Prevalence of urinary incontinence increases.
- **Musculoskeletal**
  - Reduced muscle mass in relation to body weight.
  - Recovery to injury is slowed.
  - Impaired mobility and balance.
  - Increased probability of fracture with reduced bone mass.
- **Central Nervous System**
  - Brain volume loss/atrophy most prevalent in the frontal and temporal lobes.
- **Skin**
  - Atrophy, decreased elasticity, and impaired reparative responses.
- **Eyes**
  - Presbyopia.
- **Immune system**
  - Immunosenescence –
    - Disruption in the ability of lymphocytes to work in concert to generate effective immune responses.
    - Loss of precise regulation of the inflammatory process.
    - Increased risk of infection, malignancy and autoimmune disorders.

Taffert, G. (2025). Normal Aging. In *UpToDate*, J. Givens (Ed.), UpToDate, Waltham, MA. (Accessed on Aug 4, 2025), from https://www.uptodate.com/contents/normal-aging

Homeostenosis

- As one grows older, there are **progressive and predictable biological changes** associated with increased susceptibility to many diseases.
- **Aging is a heterogeneous process.**
- **Multiple factors** affect each individual differently based off their chronic disease profile/severity, genetics and lifestyle/habits, among other physiological and psychological factors.
- **Homeostasis** – a state of balance of the within the body needed to survive and function.
- The ability to maintain homeostasis is challenged over time due to diminishing physiologic reserves that occurs with aging – **homeostenosis**.
- **Frailty** occurs when physiologic reserves available are diminished to a point that the individual is unable to return to homeostasis.



Based on information from: Taffet GE. Physiology of aging. In: Cassel CK, Leipzig RM, Cohen HJ, et al [eds]. Geriatric Medicine: An Evidence-Based Approach, 4th ed. New York, Springer, 2003.

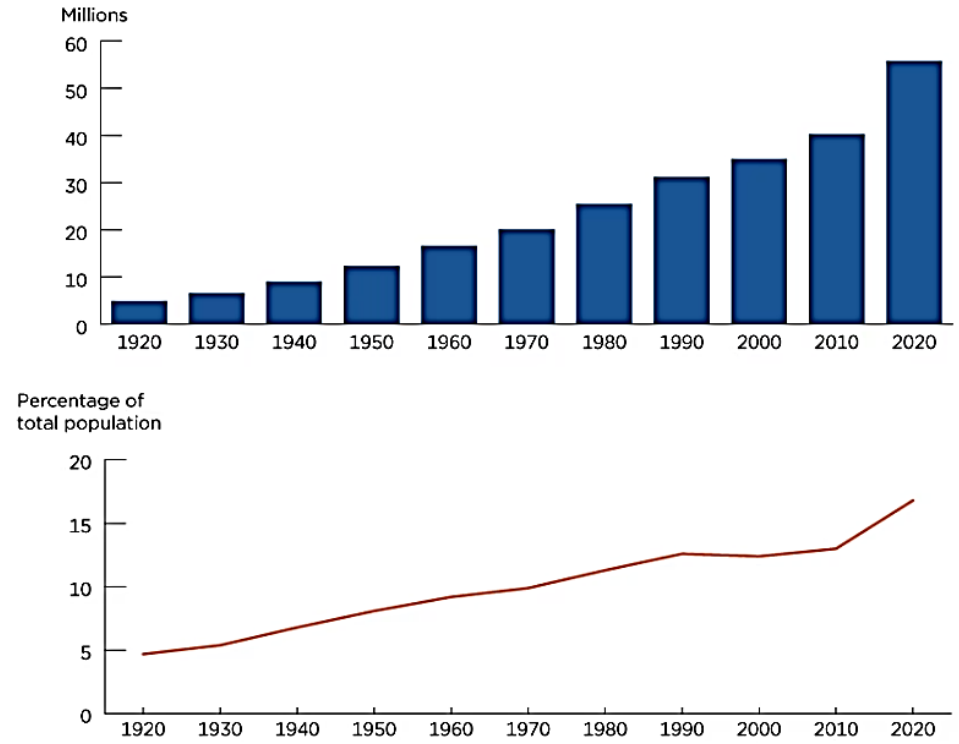
Graphic 58907 Version 9.0

Taffert, G. (2025). Normal Aging. In *UpToDate*, J. Givens (Ed.), UpToDate, Waltham, MA. (Accessed on Aug 4, 2025), from https://www.uptodate.com/contents/normal-aging

The US Population is Aging…

- In 2020, about 1 in 6 people in the United States were age 65 and over.
- From 2010 to 2020, the 65-plus population experienced:
  - Largest-ever percentage-point increase, from 13.0% to 16.8% of the total population.
  - Fastest growth rate, 38.6% from 40.3 million to 55.8 million.
- 2060, nearly 1 in 4 Americans will be 65 years and older.

Figure 1.
Population 65 Years and Over by Size and Percentage of Total Population: 1920 to 2020



https://www.census.gov/library/stories/2023/05/2020-census-united-states-older-population-grew.html
US census Bureau data accessed 8/2025

Percentage of Total Deaths 2018-2023

- Actuaries price products with the understanding that older age individuals die at a higher rate than younger.
- ~ 75% of those who have died between 2018 - 2023 are age 65+.

Underlying Cause of Death, 2018-2023, Single Race Results

Deaths occurring through 2023

Request Form | Results | Map | Chart | About

Underlying Cause of Death Data | Dataset Documentation | Other Data Access | Help for Results | Printing Tips | Help with Exports | Save | Export | Reset

Quick Options | More Options | API Options | Top | Notes | Citation | Query Criteria

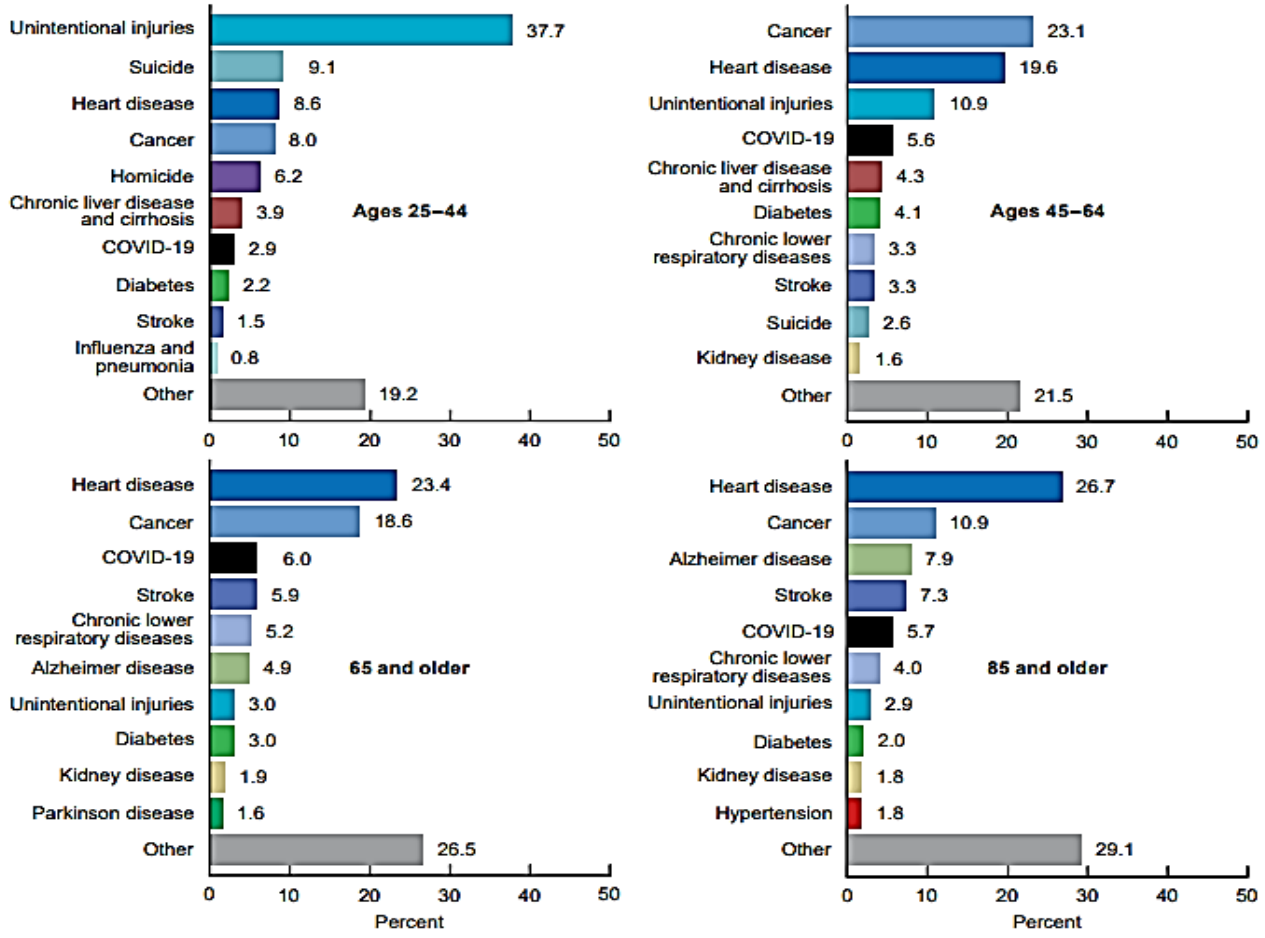
Ten-Year Age Groups	Deaths	Population	Crude Rate Per 100,000	% of Total Deaths
< 1 year	122,588	22,262,530	550.6	0.6%
1-4 years	23,066	92,302,571	25.0	0.1%
5-14 years	34,789	246,687,153	14.1	0.2%
15-24 years	202,991	259,530,880	78.2	1.1%
25-34 years	415,600	274,246,662	151.5	2.2%
35-44 years	609,736	256,563,136	237.7	3.2%
45-54 years	1,082,466	244,486,596	442.8	5.7%
55-64 years	2,462,568	253,867,762	970.0	13.0%
65-74 years	3,794,371	196,664,992	1,929.4	20.1%
75-84 years	4,638,060	99,910,510	4,642.2	24.5%
85+ years	5,525,906	38,464,485	14,366.3	29.2%
Not Stated	683	Not Applicable	Not Applicable	0.0%
Total	**18,912,824**	**1,984,987,277**	**952.8**	**100.0%**

https://wonder.cdc.gov/ Accessed 8/2025

CDC National Vital Statistics Report

- **Greater than 50% of deaths age 65 in 2022 age 65 and older attributed to:**
  - **Heart disease.**
  - **Cancer.**
  - **Stroke.**
  - **Alzheimer's disease.**
  - **Chronic lower respiratory disease.**

Percent distribution of the 10 leading causes of death, by age group: United States, 2022.



https://www.cdc.gov/nchs/data/nvsr/nvsr73/NVSR73-10.pdf

The Impact of Disease on Life Expectancy

- **The ability to assign mortality risk and determine insurability stems from an understanding of life expectancy within a given disease(s)/impairment(s)**.
- Reports of **cause of death from a single underlying disease** are often flawed or outright incorrect in the older age group.
  - Can lead to an underestimation of the extent of other contributing conditions.
- **Coexisting conditions can contribute to death but are not always accounted for in studies or death reports**.
- **Assessing mortality risk in the older age population is complex**.
- Research addressing survival and treatment in the older age group is lacking.

Contribution of Individual Diseases to Death in Older Adults with Multiple Diseases
Tinetti, M et al.
J Am Geriatr Soc. 2012 Aug; 60(8): 1448–1456 https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3419332/

Multimorbidity

- **“The co-occurrence of two or more chronic medical or psychiatric conditions, which may or may not directly interact with each other”**.
- Multimorbidity is common and increases substantially with age.
- There is evidence to suggest that multimorbid individuals:
  - Have **higher mortality**.
  - Have **higher rates of functional decline and disability**.
  - Report poorer quality of life.
  - Have higher healthcare costs.
- Mental illness, especially depression, has been shown to increase the negative outcomes associated with multimorbidity.

Effect of Chronic Diseases and Multimorbidity on Survival and Functioning in Elderly Adults

Debora Rizzuto, PhD, Rene J. F. Melis, PhD, Sara Angleman, PhD, Chengxuan Qiu, PhD.

The Journal of the American Geriatrics Society 5:1056–1060, 2017

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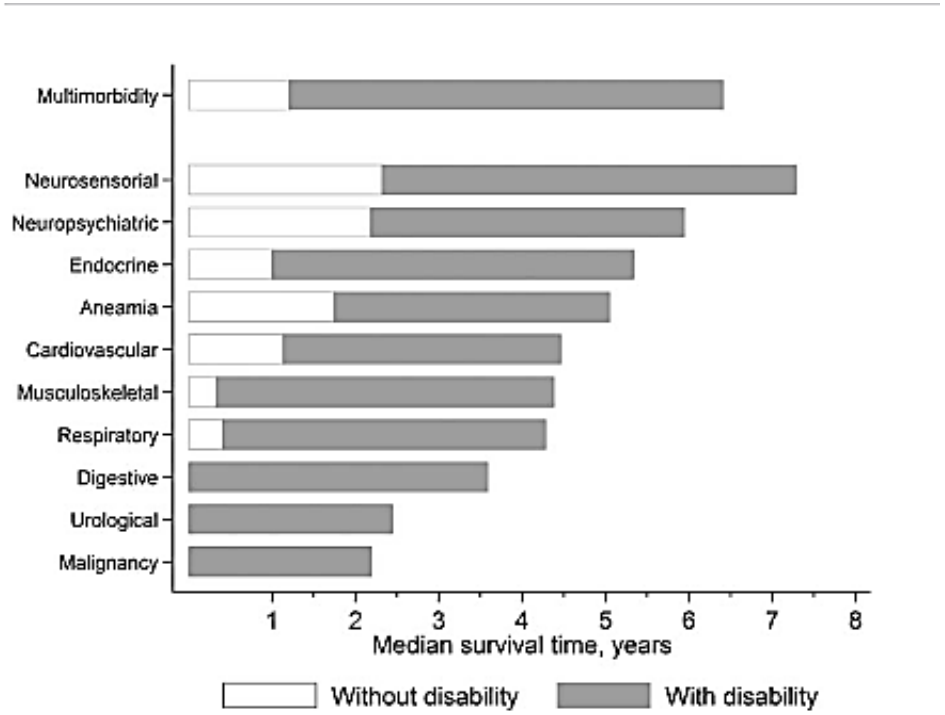
- Study consisting of 1099 individuals of Central Stockholm aged 75 and older – The Kungsholman Project.
- This was an **11-year** follow-up study.
- Most common condition in this study was multimorbidity affecting 70%.
  - Multimorbidity defined as ≥ 2 coexisting chronic diseases of 38 chronic conditions.
  - The 38 chronic diseases were grouped using the ICD-10 classification system into 10 categories.



https://agsjournals.onlinelibrary.wiley.com/doi/epdf/10.1111/jgs.14868

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Table 1. Number and Prevalence of Cases at Baseline of group of Chronic Diseases and Multimorbidity, Number of Related Deaths, Hazard of Mortality, Population Attributable Risk (PAR) of Death, and Median Years of Life Lost (YLL) at Follow-Up

	Baseline		11 Year of Follow-Up			
Organ System	Cases, n	Prevalence per 100 (95% CI)	Deaths, n	Mortality, HR (95% CI)[a]	PAR, % of Death (95% CI)	Median YLL[b]
Anemia	199	18.1 (15.9–20.5)	165	1.5 (1.3–1.7)	5.4 (3.6–7.2)	−1.6
Cardiovascular	655	59.6 (56.7–62.5)	492	2.7 (2.2–3.2)	28.0 (24.7–31.2)	−5.0
Digestive	80	7.3 (5.9–9.0)	57	1.2 (0.9–1.4)	—[c]	—[c]
Endocrine	156	14.2 (12.3–16.4)	110	1.0 (0.8–1.2)	—[c]	—[c]
Malignancy	153	13.9 (12.0–16.1)	117	1.8 (1.6–2.1)	6.7 (5.4–8.0)	−4.3
Neuropsychiatric	297	27.0 (24.5–29.7)	264	2.3 (2.0–2.7)	17.0 (15.0–19.0)	−2.0
Musculoskeletal	279	25.4 (22.9–28.0)	238	1.5 (1.3–1.7)	8.8 (6.1–11.4)	−2.5
Neurosensorial	285	25.9 (22.9–28.1)	229	1.1 (0.9–1.3)	—[c]	—[c]
Respiratory	86	7.8 (6.4–9.6)	71	1.4 (1.2–1.8)	2.5 (1.3–3.7)	−1.5
Urological	99	9.0 (7.5–10.9)	73	1.3 (1.0–1.7)	—[c]	—[c]
Multimorbidity	774	70.4 (67.7–73.1)	608	5.1 (2.6–9.6)	69.3 (50.7–80.8)	−7.5

[a]Hazard ratios (HRs) were derived from two flexible parametric models using age as time scale; the first model included all specific group of diseases, sex, education, and age at baseline. The second model included multimorbidity, sex, education, and age at baseline.
[b]Median YLL was estimated comparing median survival with and without the specific chronic condition, that were derived from survival functions.
[c]Estimates only for conditions with a clear effect on mortality.
CI = confidence interval.

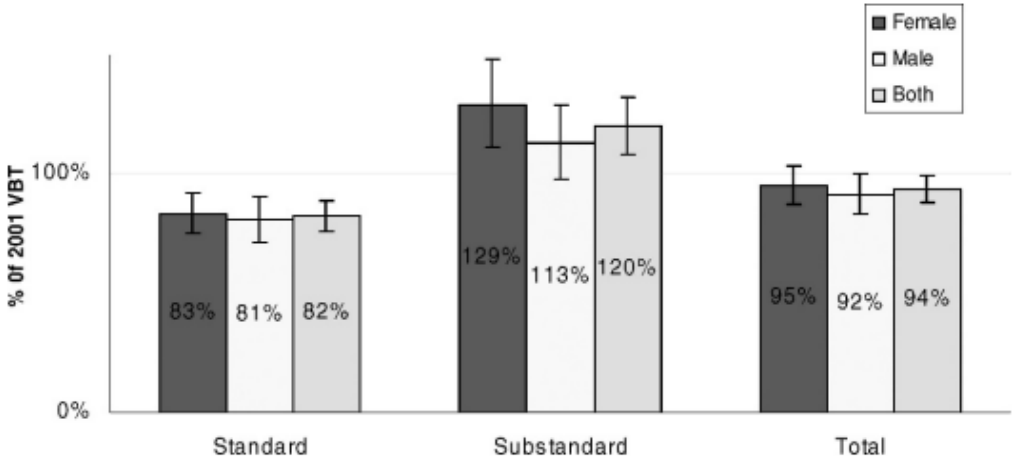
- **Multi-Morbidity accounted for 69% of deaths, 7.5 years lost.**
- **Those with multimorbidity lived 81% of their remaining years of their life with disability (median 5.2 years).**
- **1/3 of the total deaths in this study were attributed to CVD.**

https://agsjournals.onlinelibrary.wiley.com/doi/epdf/10.1111/jgs.14868

Mortality Experience in the Elderly in the Impairment Study Capture System

Thomas Ashley, MD, FACP; Clifton Titcomb, Jr, MD; Anna Hart, MS; Richard Bergstrom, FSA, MAAA – J Insur Med 2008;40:110-115

- Mortality experience and underwriting analyzed on policies issued at ages 70 +.
- Policy issue dates from 1990–1998 and observation ran from 5–12 years.
- 64% Female, 36% male.
- 1430 deaths occurred within the study group of 102,507 policy years.
- Groups divided into standard and substandard issued policies and MR were calculated.
- **Cases issues standard had MR of 82% of the 2001 VBT.**
- **Cases issues substandard had worse mortality with MR of 120% of 2001 VBT.**



"Proper risk selection in the elderly is difficult. Our study provides reassurance that industry risk classification performance is effective".

Older Age Underwriting Tools

- **Application and paramedical exam**
  - Build, BP, pulse, EKG, level of activity, reported medical conditions, alcohol use and smoking history.
- **Older age supplement**
  - Driving, IADLs, ADLs, social activities.
  - Get up and go (GUG), clock draw, delayed word recall (DWR), other cognitive screens.
- **Current insurance labs**
  - Cholesterol, albumin, NT-probnp, HbA1c, other screening labs.
- **Prescription data**
  - Medication compliance, number of medications, stability in dosing.
- **Motor vehicle report (MVR)**
- **Lab data**
  - Prior labs ordered and/or resulted.
- **Medical claims data**
  - Diagnosis and procedural codes, emergency room visits, hospitalizations.
- **Attending physician statements (APS)**
  - Physicals and Medicare assessments, (in)stability/trends in medical and psychological impairments, biometrics, labs including Hb etc.

Total and Cause-Specific Mortality in the Cardiovascular Health Study

Anne B. Newman , Michael C. Sachs , Alice M. Arnold , Linda P. Fried , Richard Kronmal , Mary Cushman , Bruce M. Psaty , Tamara B. Harris , John A. Robbins , Gregory L. Burke , Lewis H. Kuller , and Thomas Lumley

J Gerontol A Biol Sci Med Scil. 2009; Vol. 64, No. 12, 1251–1261

- 5,888 men(42.4%) and women(57.6%) were followed in the U.S. for an average of 13 – 16 years.
- Age 65 and older (avg 72.8 years).
- Mortality rates were calculated per 100 person-years.
- Survival curves for the CHS cohort were compared with an age-, race-, and sex-matched sample from the U.S. population.

Factors associated with <u>increased</u> relative risk of mortality

- **Low body weight.**
- **Smoking.**
  - **Most significant > 50 pack year.**
- **Low self-rated health report.**
- **ADL difficulties.**
- **Low physical activity.**
- **History of CHF.**
- **History of CAD.**
- **Low FVC.**
- **Major EKG abnormality.**
- **Carotid Stenosis.**
- **Low ABI.**
- **Low Serum Albumin.**
- **Elevated Serum Creatinine.**
- **Elevated IL-6 level.**
  - **Marker of dysregulation of immune function and a chronic inflammatory state.**

2014 CRL Build Study of Life Insurance Applicants

Michael Fulks, MD; Vera F. Dolan, MSPH; Robert L. Stout, PhD – *J Insur Med 2016; 46:13-19*

- Determine the impact of build on insurance applicant mortality accounting for smoking, lab, and BP values.
- 2,051,370 applicants tested at CRL between 1993 and 2007 with build and cotinine results available and BMIs between 15 and 47.
- Exclusions- HbA1c $\geq$6.5%, SBP$\geq$141mmHg, albumin$\leq$3.3g/dl, total cholesterol $\leq$130mg/dl, BMI <15 or >47.
- Median duration of follow up was 7 years (0-18).
- Data provided on applicants including ages 60-89 years old.

2014 CRL Build Study of Life Insurance Applicants

Michael Fulks, MD; Vera F. Dolan, MSPH; Robert L. Stout, PhD – J Insur Med 2016; 46:13-19

"As Americans have broadened, the BMI band with the lowest relative risk has also broadened and moved higher, leaving lower BMI bands with a lower percentage of healthy lives and higher relative risk".

Table 3. Female Non-smokers Age 60 to 89

BMI group	Vital status			Covar = age			Covar = age and other test-mortality score		
				MR	95% CI		MR	95% CI	
	Alive	Dead	Distn	(Cox)	Lower	Upper	(Cox)	Lower	Upper
15 to 17	432	61	1.0%	**2.36**	1.81	3.09	**2.33**	1.79	3.05
18 to 19	2082	160	4.6%	**1.53**	1.28	1.83	**1.51**	1.26	1.81
20 to 21	5274	277	11.4%	**1.17**	1.01	1.35	**1.19**	1.03	1.38
22 to 24*	11,661	478	24.9%	**1.00**			**1.00**		
25 to 29	16,754	700	35.8%	**1.11**	0.99	1.25	**1.08**	0.96	1.21
30 to 34	7220	316	15.5%	**1.30**	1.13	1.50	**1.18**	1.02	1.36
35 to 39	2362	129	5.1%	**1.79**	1.47	2.18	**1.55**	1.28	1.89
40 to 41	365	22	0.8%	**2.07**	1.35	3.17	**1.72**	1.12	2.65
42 to 47	375	21	0.8%	**2.14**	1.38	3.32	**1.66**	1.07	2.58
Total	46,525	2164							

(reference group BMI 22 to 24)*

Table 4. Male Non-smokers Age 60 to 89

BMI group	Vital status			Covar = age			Covar = age and other test-mortality score		
				MR	95% CI		MR	95% CI	
	Alive	Dead	Distn	(Cox)	Lower	Upper	(Cox)	Lower	Upper
15 to 17	125	25	0.2%	**2.37**	1.59	3.52	**2.16**	1.45	3.21
18 to 19	500	50	0.8%	**1.29**	0.97	1.71	**1.22**	0.92	1.62
20 to 21	2364	200	3.7%	**1.20**	1.03	1.40	**1.13**	0.97	1.32
22 to 24*	13,184	863	20.3%	**1.00**			**1.00**		
25 to 29	34,245	1767	52.1%	**0.92**	0.85	1.00	**0.91**	0.84	0.99
30 to 34	12,011	648	18.3%	**1.08**	0.97	1.19	**1.04**	0.94	1.16
35 to 39	2423	142	3.7%	**1.25**	1.04	1.49	**1.16**	0.97	1.38
40 to 41	275	25	0.4%	**1.98**	1.33	2.95	**1.76**	1.18	2.63
42 to 47	214	17	0.3%	**1.76**	1.09	2.85	**1.49**	0.92	2.41
Total	65,341	3737							

(reference group BMI 22 to 24)*

Albumin and All-Cause Mortality Risk in Insurance Applicants

Michael Fulks, MD; Robert L. Stout, PhD; Vera F. Dolan, MSPH

J Insur Med 2010;42:11–17

- Determine the relationship between albumin levels and all-cause mortality in life insurance applicants.
- 1,704,566 insurance applicants were enrolled where CRL had test blood samples.
- 53,211 deaths were observed over medial 12-year follow-up.
- Results were stratified by 6 age-sex groups.
- The middle 50% band of albumin values in each subpopulation (25th to 74th percentile) was assigned a mortality ratio of 100%.

Albumin and All-Cause Mortality Risk in Insurance Applicants

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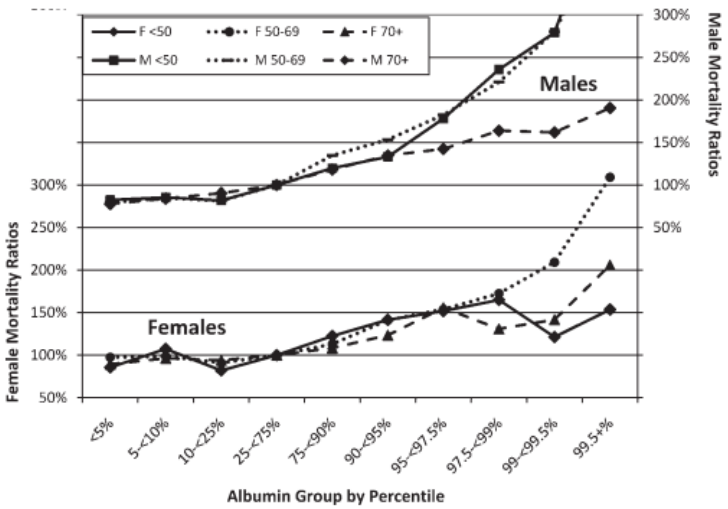
J Insur Med 2010;42:11–17

Table 3. Mortality in Females Ages 70+

Percentile Band	Albumin Values	Vital Status Alive	Vital Status Dead	Mortality Ratio	Lower 95% CI	Upper 95% CI
<5%	>4.7	621	166	89%	78%	102%
5–<10%	4.7–>4.6	547	161	96%	84%	110%
10–<25%	4.6–>4.4	3871	1105	94%	89%	99%
25–<75%	4.4–>4	5818	1800	100%		
75–<90%	4–>3.8	2527	869	108%	102%	115%
90–<95%	3.8–>3.75	651	268	123%	112%	137%
95–<97.5%	3.75–>3.6	337	196	156%	139%	174%
97.5–<99%	3.6–>3.5	239	107	131%	112%	153%
99–<99.5%	3.5–>3.3	153	77	142%	118%	170%
99.5+%	≤3.3	55	52	206%	169%	250%

Table 6. Mortality in Males Ages 70+

Percentile Band	Albumin Values	Vital Status Alive	Vital Status Dead	Mortality Ratio	Lower 95% CI	Upper 95% CI
<5%	>4.85	644	181	78%	68%	88%
5–<10%	4.85–>4.7	517	161	84%	73%	96%
10–<25%	4.7–>4.5	2265	777	90%	85%	96%
25–<75%	4.5–>4.1	8760	3451	100%		
75–<90%	4.1–>3.95	3136	1572	118%	113%	123%
90–<95%	3.95–>3.8	828	509	135%	126%	144%
95–<97.5%	3.8–>3.7	742	499	142%	133%	152%
97.5–<99%	3.7–>3.5	138	119	164%	144%	187%
99–<99.5%	3.5–>3.4	102	86	162%	139%	189%
99.5+%	≤3.4	42	49	191%	158%	230%



"Albumin level predicted mortality risk in this healthy population of insurance applicants in an age- and sex-specific manner both at high values (reduced risk) and low values (increased risk) relative to the middle 50% of albumin values".

Case 1

- **Medical Referral:** 76-year-old male with a past medical history of a partial glossectomy 13 years ago for stage 0 carcinoma in situ of the tongue, hyperlipidemia, hypertension, osteoarthritis, Stage 3 renal insufficiency, and major depressive disorder in remission.
- The underwriter is asking if you feel this applicant is at average mortality risk…
  - In broad categories, what information or details do you look for in the file to underwrite and assess older age applicant mortality risk?

Older age underwriting categories

- **Vital signs**
  - Weight including stability.
  - Blood pressure and control.
- **Labs**
  - Albumin.
  - Serum Creatinine (eGFR).
  - Cholesterol.
  - NT-pro-BNP.
- **Cardiovascular assessment**
  - EKG.
  - Stress testing.
  - Calcium Score.
  - Echocardiogram.
- **Pulmonary**
  - COPD history (PFTs).
  - Smoking history.
- **Stroke/vascular risks**
  - Carotid dopplers.
  - ABIs.
- **Cognitive Testing**
  - MOCA/MMSE/DWR.
- **Cancer Screens**
  - Colonoscopy.
  - Mammogram.
  - PSA.
- **Frailty Testing**
  - Get up and go.
  - Mobility devices or aids.
  - Recent/prior falls.
  - ADL needs.
- **Medication list.**
- **Social and Occupational history.**
- **Depression and substance use screening.**
- **Self rate of health status (Annual Medicare Physical).**

Case 1: 76-year-old male

- **Last office visit 4/2024, 2 months prior to application was for a Medicare Wellness Physical.**
- **Medical History**
  - Mixed Hyperlipidemia.
  - Benign Essential HTN.
  - Primary OA of the knees.
  - MDD in full remission.
  - History of tongue cancer stage 0 in 2011.
  - Chronic kidney disease, stage 3.
- **Medications**
  - Rosuvastatin 20mg qd.
  - Losartan 25mg qd.
  - Citalopram 40mg qd.
- **Social History**
  - Retired.
  - Never smoked.
  - Drinks alcohol < 1 time a month.
  - Exercise: yes.

- **ROS negative.**
- **Current PHQ-9 (2024) is 0**
  - **2023 PHQ-9 was 4.**
  - **2022 PHQ-9 was 2.**
  - **2020, 2021 PHQ-9 was 10.**
- **HPI: "**The patient maintains an active lifestyle and is independent in his daily activities, including driving, shopping, and financial management. He is currently employed part-time as a bartender for spring training, working 30 consecutive days. His current employment involves carrying a case of beer through the stands at the diamondback games. He reports feeling well overall and denies any falls. His mood remains stable".
- **He denied any memory concerns though no specific cognitive testing was noted in the 4 years of records.**
- **He self describes his health as "excellent".**
- **Colonoscopy in 2022 was normal.**
- **There are no cardiac or pulmonary tests in the records.**

Case 1: 76-year-old male

- **Ht. 69 in, Wt. 183.4, BMI 27.08, Pulse 65, BP 135/85.**
  - **Prior weights**
    - 2023 182 lbs.
    - 2022 190 lbs.
    - 2021 185 lbs.
- **Complete physical exam:**
  - Bilateral knee crepitus documented as the only abnormality.
  - No cervical lymphadenopathy and tongue was documented as “normal”.

- **Medical history**
  - Chronic kidney disease, stage 3.

Year	Serum Creatinine	eGFR
4/2024	1.36	54
1/2023	1.35	55
2/2022	1.38	54
8/2019	1.28	56
11/2017	1.31	55

Case 1: 76-year-old male

- Paramed exam:

HEIGHT	5' 8.0"
WEIGHT	180
BLOOD PRESSURE 1ST	120/80
BLOOD PRESSURE 2ND	124/82
BLOOD PRESSURE 3RD	122/78
AVG BLOOD PRESSURE	122/80
PULSE PRESSURE RATIO	0.34
PULSE STANDARD-AT REST	58
PULSE IRREGULAR-AT REST	0
BODY MASS INDEX (BMI)	27.36

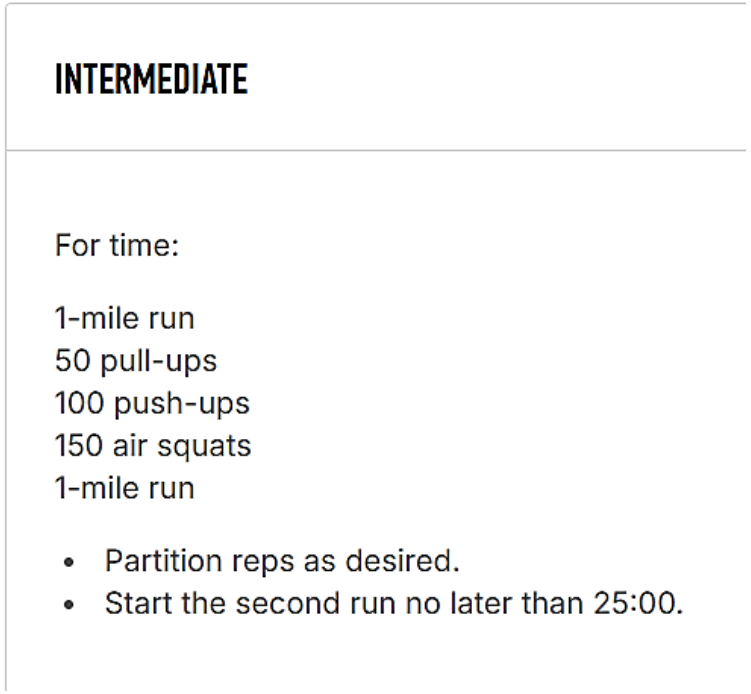
HIV		NON-REACTIVE	NON-REACTIVE
URINALYSIS----------			
URN SPECIFIC GRAVITY	1.031		1.003-1.035
URN CREATININE	169.0		10.0-300.0 mg%
URN GLUCOSE	0.00		0.00-0.15 g/dL
URN TOTAL PROTEIN	10.0		0.0-19.0 mg/dL
URN PROTEIN/CREATININE	0.05		0.00-0.20 g/gCREA
URN RED BLOOD COUNT	0		0-4 HPF
URN WHITE BLOOD COUNT	0		0-9 HPF
URN HYALINE CASTS	0		0 LPF
URN GRANULAR CASTS	0		0 LPF
URN BLOOD		NEGATIVE	0-100 mg/dL

.	RESULT/STATUS		CUTOFF/EXPECTED VALUE
CHEMISTRIES----------			
GLUCOSE	86		70-110 mg/dL
FRUCTOSAMINE	1.68		1.20-2.50 mmol/L
HEMOGLOBIN A1C	6.1	HIGH	3.0-6.0 %
BLOOD UREA NITROGEN (BUN)	28	HIGH	6-25 mg/dL
CREATININE	1.40		0.60-1.50 mg/dL
GFR (MAYO)	57.99	LOW	65.00-186.00 mL/min
ALKALINE PHOSPHATASE	83		30-115 U/L
TOTAL BILIRUBIN	1.39	HIGH	0.10-1.20 mg/dL
SGOT (AST)	35		0-41 U/L
SGPT (ALT)	24		0-45 U/L
GAMMA GLUTAMYLTRANSFERASE	14		2-65 U/L
TOTAL PROTEIN	6.5		6.0-8.5 g/dL
ALBUMIN	4.3		3.9-5.5 g/dL
GLOBULIN	2.2		1.0-4.6 g/dL
ENZYMATIC CREATININE PERFORMED.			
CARDIAC RISK----------			
CHOLESTEROL	153		140-225 mg/dL
HIGH DENSITY LIPOPROTEIN(HDL)	43.2		25.0-75.0 mg/dL
LOW DENSITY LIPOPROTEIN (LDL)	89		80-200 mg/dL
TRIGLYCERIDES	104		10-200 mg/dL
CHOLESTEROL/HDL RATIO	3.54		1.50-5.00
LDL/HDL RATIO	2.06		0.00-3.60
SERUM ANTIGENS PANEL----------			
PROSTATE SPECIFIC ANTIGEN	1.20		0.00-4.00 ng/mL
SEROLOGY----------			
ANTI-HCV (HEPATITIS C)		NON-REACTIVE	NON-REACTIVE
NT-PROBNP	207	HIGH	0-124 pg/mL

Case 1: 76-year-old male

- **Cover letter from agent:**
  - The applicant “is in phenomenal health as a 76-year-old. He is retired but works part-time as a photographer and a bartender for local sporting events. 13 years ago, he was diagnosed with a zero-grade tongue cancer and went through treatment with no further issues. He is physically active doing “Murphs” which is a legendary Navy Seal workout people do to pay tribute/remembrance etc… 2 miles, 200 push ups, 330 squats and 100 pull ups in less than 1 hour. He, his son, and grandson have auditioned to American Ninja Warrior to compete as a 3-generation team which would be wild. Pretty crazy for a 76-year-old”!

- **What is a Murph?**
  - https://www.crossfit.com/heroes/murph-workout
  - “Murph is a CrossFit Hero workout that stands as a testament to the enduring legacy of U.S. Navy SEAL Lt. Michael Murphy, who died heroically in the line of duty in Afghanistan on June 28, 2005”.



INTERMEDIATE

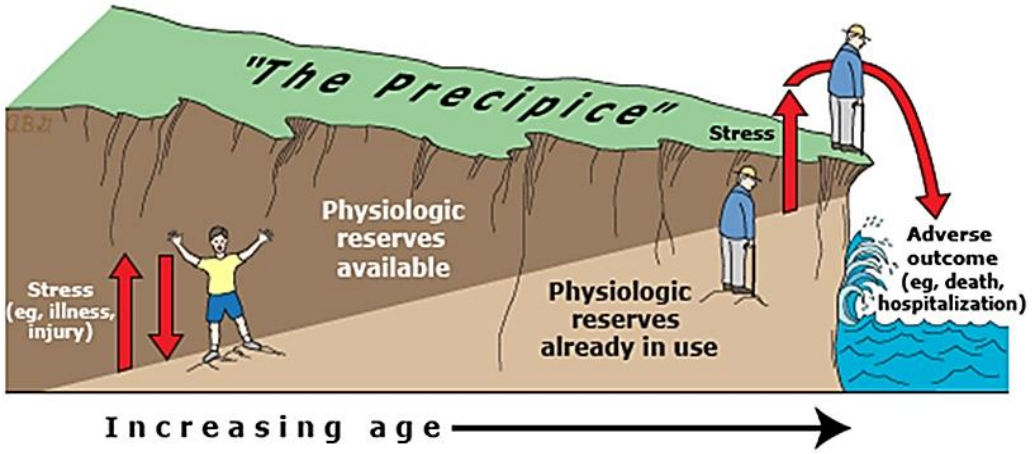
For time:

1-mile run
50 pull-ups
100 push-ups
150 air squats
1-mile run

- Partition reps as desired.
- Start the second run no later than 25:00.

Case 1: 76-year-old male

- **Let's discuss this case:**
  - **Better than average mortality risk.**
  - **Average mortality risk.**
  - **Moderately elevated mortality risk.**
  - **High mortality risk.**



- **How does his reported functional capacity affect your risk assessment?**
  - **Is there Avocational risk?**
- **Differentiate his Chronologic age vs his Physiologic age.**
- **Is there risk associated with:**
  - **Chronic Kidney Disease stage 3?**
  - **Remote Tongue Cancer Stage 0?**
  - **NT-pro-BNP 207?**
  - **Major Depressive D/O in remission?**
  - **A1c of 6.1?**

Total and Cause-Specific Mortality in the Cardiovascular Health Study

Anne B. Newman , Michael C. Sachs , Alice M. Arnold , Linda P. Fried , Richard Kronmal , Mary Cushman , Bruce M. Psaty , Tamara B. Harris , John A. Robbins , Gregory L. Burke , Lewis H. Kuller , and Thomas Lumley

J Gerontol A Biol Sci Med Scil. 2009; Vol. 64, No. 12, 1251–1261

- 5,888 men(42.4%) and women(57.6%) were followed in the U.S. for an average of 13 – 16 years.
- Age 65 and older (avg 72.8 years).
- Mortality rates were calculated per 100 person-years.
- Survival curves for the CHS cohort were compared with an age-, race-, and sex-matched sample from the U.S. population.

Table 2. Hazard Ratios for Total 16-Year Mortality in the Cardiovascular Health Study Cohort

	n	Total	*p*
Physical activity (kcal)			
≤67.5	602	1.00	.01
>67.5 to ≤472	916	0.9 (0.8–1.02)	
>472 to ≤980	976	0.92 (0.81–1.04)	
>980 to ≤1890	1,106	0.89 (0.79–1.01)	
>1890	1,622	0.82 (0.72–0.92)	
Fasting glucose (mg/dl)			
≤94	1,395	1.00	<.001
>94 to ≤100	969	0.98 (0.88–1.09)	
>100 to ≤108	1,267	0.99 (0.9–1.1)	
>108 to ≤130	926	1.08 (0.97–1.21)	
>130	665	1.51 (1.35–1.7)	

Table 2. Hazard Ratios for Total 16-Year Mortality in the Cardiovascular Health Study Cohort

	n	Total	*p*
Serum albumin (mg/dl)			
≤3.70	947	1.00	<.001
>3.70 to ≤3.90	1,265	0.89 (0.8–0.99)	
>3.90 to ≤4.00	748	0.99 (0.88–1.11)	
>4.00 to ≤4.20	1,242	0.85 (0.76–0.94)	
>4.20	1,020	0.83 (0.74–0.93)	
Serum creatinine (mg/dl)			
≤0.90	2,138	1.00	<.001
>0.90 to ≤1.10	776	1 (0.89–1.12)	
>1.10 to ≤1.20	1,186	1.12 (1.01–1.24)	
>1.20 to ≤1.50	664	1.31 (1.17–1.48)	
>1.50	458	1.6 (1.4–1.82)	

https://academic.oup.com/biomedgerontology/article/64A/12/1251/567245

Correlates and Predictors of NT-proBNP in Life Insurance Applicants

Steven J. Rigatti, MD, DBIM, DABFM; Robert Stout, PhD J Insur Med 2023;50:65–73

- A study of 1.34 million insurance applicants between 50 and 85 years of age.
- Document the effect other labs, sex, age, and disease has on the expected value of NT-proBNP.
- Development of a predictive model to demonstrate their effect on the NT-proBNP result.
- **Age was found to have the highest correlation with NT-proBNP level.**
- Found that **eGFR** and unexpectedly, **Albumin** have a negative correlation with NT-proBNP.
  - As Albumin and eGFR rises, NT-proBNP levels decline.
- Dr. Rigatti developed an interactive APP using the variables studied.
  - https://sjrigatti.shinyapps.io/BNPpredict/

NT-proBNP Prediction Tool

Age: 76 (40–85)

Sex: Male / Female

History of Heart Disease?: Yes / No

Creatinine: 1.4 (0.5–2)

BMI: 27 (16–50)

Systolic BP: 122 (90–180)

Albumin (g/dl): 4.3 (3–6)

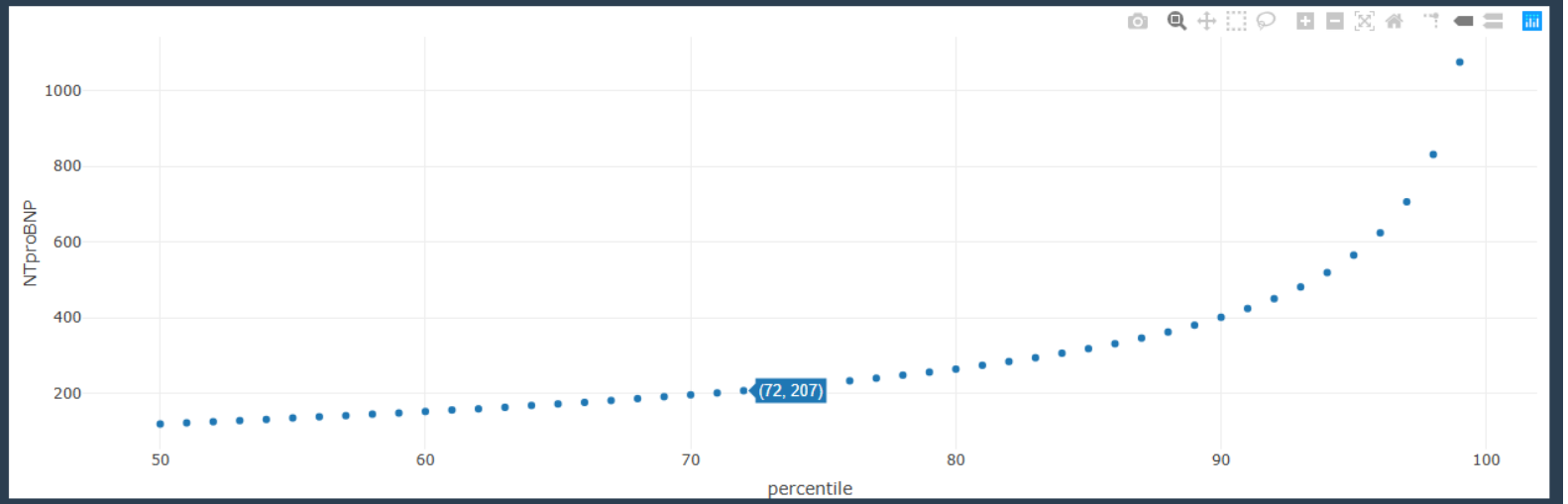
Calculate

The predicted NT-proBNP is: 119

The predicted 75th percentile is: 226

The predicted 90th percentile is: 401

The predicted 95th percentile is: 565



NT-proBNP Predicts All-Cause Mortality in a Population of Insurance Applicants, Follow-up Analysis and Further Observations

Michael Fulks, MD; Valerie Kaufman, MD, FACC, DBIM; Michael Clark, MD, FACC, DBIM; Robert Stout, PhD – J Insur Med 2017;47:107-113

- NT-proBNP can be elevated in congestive heart failure and left ventricular strain as a result of various cardiac conditions including coronary artery disease, cardiomyopathy, congenital heart disease and diastolic dysfunction
- Life and disability applicants ages 50-89 tested at CRL for NT-proBNP levels from 2004 through 2015 who answered the test authorization question “any history of heart disease”(97.8% responded with 6.3% answering “yes”)
- 245,322 applicants with 2,079 deaths with median follow up of 2.7 years with a mean follow up of 3.5 years
- Distribution of NT-proBNP values vary substantially by sex and age
- “The relative all-cause mortality risk increases with increasing levels of NT-proBNP, although the value at which risk begins to increase varies by age and sex”

NT-proBNP Predicts All-Cause Mortality in a Population of Insurance Applicants, Follow-up Analysis and Further Observations

Michael Fulks, MD; Valerie Kaufman, MD, FACC, DBIM; Michael Clark, MD, FACC, DBIM; Robert Stout, PhD – J Insur Med 2017;47:107-113

"NT-proBNP is a strong independent predictor of all cause mortality in the absence or presence of known heart disease but the range of values associated with the risk varies by sex"

Table 3. Relative Risk for All-cause Mortality by NT-proBNP Level with ≤75 pg/mL as Reference Range with 95% Confidence Intervals

	≤75 (ref)	76-175	176-300	301-500	501-1,000	>1,000
Male age 50-69	1	1.85 *1.51-2.26*	2.54 *1.77-3.64*	6.55 *4.47-9.60*	6.63 *4.16-10.5*	16.15 *10.4-25.0*
Male age 70-89	1	1.72 *1.38-2.15*	2.84 *2.20-3.67*	3.23 *2.37-4.39*	5.07 *3.72-6.91*	7.17 *5.20-9.90*
Female age 50-69	1	0.88 *0.59-1.31*	1.58 *0.91-2.72*	2.65 *1.22-5.80*	4.11 *1.75-9.64*	8.24 *2.58-26.3*
Female age 70-89	1	1.49 *1.10-2.01*	1.96 *1.41-2.72*	2.29 *1.57-3.35*	4.14 *2.79-6.15*	7.7 *5.10-11.6*

Case 2

- **Medical Referral:** 77-year-old male electrical engineer/business owner with a past medical history of CAD, HTN, hyperlipidemia, anxiety and GERD.
- His Mature Assessment recorded 10/10 DWR but his serial sevens answered 1 out of 5 correctly.
- The underwriter is asking if you feel this applicant is at average to mildly increased mortality risk…

Case 2: 77-year-old male

- **Last office visit 2/2024, which was the same month of his application was for a routine follow up visit (handwrittenn and mostly illegible).**
- **Medical History**
  - CAD – reports he sees cardiologist.
  - Hyperlipidemia.
  - Benign Essential HTN.
  - Generalized anxiety d/o.
  - Osteoarthritis.
- **Medications**
  - Amlodipine 5mg qd.
  - Atenolol 25 mg qhs.
  - Olmesartan 40mg qd.
  - Rosuvastatin 10mg qd.
  - Alprazolam 0.25mg prn.
  - Aspirin 81mg qd.
- **Social History**
  - Occupation: Electrical engineer, owns company.
  - Never smoker.
  - Drinks alcohol, wine 1-2 times a month.
  - Exercise: none noted.
- **There is no cardiac, pulmonary, vascular, or cognitive testing in the records received.**

- **ROS not recorded.**
- **HPI: 77-year-old male here for follow-up medical conditions. Complaints of "weakness and fatigue".**
- **No physical exam was documented.**
- **Wt. 138, Ht. 66", BP 101/61, 97% O2 sat.**
- **Colonoscopy report from 3 years prior with internal hemorrhoids and small uncomplicated diverticula. Prep was fair.**
- **Prior office visits which occur every 6 months consistently document complaints of weakness and fatigue.**
- **The last "typed" office visit from 1.5 years prior to application notes on physical exam…**

Physical Examination:

General: Appeared weak and fatigued

HEENT:

Musculoskeletal: Diminished strength and mobility

Psych: Euthymic mood. Good affect. No nervousness. concentration. Good attention span.

Case 2: 77-year-old male

BLOOD CHEMISTRY PROFILE				
GLUCOSE	92		65 -	109*
HB A1C	5.3		4.3 -	6.1*
BUN	19		5.0 -	25.0*
CREATININE	1.1		0.5 -	1.5*
EST. GFR (MAYO)	82		>=	66*
ALK. PHOS.	71		20 -	125*
BILI. TOT.	0.8		0.1 -	1.5*
AST	20		0 -	41*
ALT	6		0 -	45
GGT	12		2 -	65*
TOT. PROTEIN	7.0		6.5 -	8.5*
ALBUMIN	4.4		3.8 -	5.2
GLOBULIN	2.6		1.0 -	4.5*
CHOLESTEROL		127 L	140 -	240*
HDL CHOLESTEROL		64 H	35 -	55*
LDL (CALCULATED)	51		0 -	129
CHOL/HDL CHOL RATIO	2.0			*
LDL/HDL RATIO		0.80 L	1.0 -	3.7*
TRIGLYCERIDES	58		0 -	150
CARDIAC MARKERS				
NT-proBNP	255		<	450

HEPATITIS TEST		
HEPATITIS C Ab	NEGATIVE	NEGATIVE
URINALYSIS		
GLUCOSE	NEGATIVE	0.00 - 0.15*
PROTEIN	8	0 - 20*
LEUKOCYTE SCREEN	NEGATIVE	NEGATIVE
HEMOGLOBIN SCREEN	NEGATIVE	NEGATIVE
WHITE BLOOD CELLS	NOT PERFORMED	0 - 10*
RED BLOOD CELLS	NOT PERFORMED	0 - 6*
GRANULAR CASTS	NOT PERFORMED	0 - 5*
HYALINE CASTS	NOT PERFORMED	0 - 5*
SPECIFIC GRAVITY	NOT PERFORMED	1.002 - 1.035*
URINE TEMPERATURE	94.0	90.5 - 99.6
CREATININE	100.0	10 - 300*
PROT/CREATININE RATIO	80	0 - 200*
ADULTERANT TESTS WITHIN NORMAL LIMITS		

PROSTATE SPECIFIC ANTIGEN RESULTS		
PSA	1.14	< 4.01

HEIGHT	(FT/IN)	5/6.0		
WEIGHT	(LBS)	143.0		
BMI		23.0	NORMAL WEIGHT STATUS: 18.5 - 24.9	
BLOOD PRESSURE		130/78	128/80	130/82

Case 2: 77-year-old male

- **Mature Assessment**

2. Mobility Assessment

Examiner Instructions

- Ask the applicant to rise from his/her chair and walk 10 feet, turn around, walk back to the chair, and sit back down.
- Time how long it takes the applicant to perform the above tasks and record the time below.
- Observe the proposed insured's mobility and then record the answers below. Also supply details for any difficulties below.

1) Rising from chair:
- [x] Rises easily with no assistance
- [ ] Requires more than one attempt
- [ ] Has balance issues, needs assistance or has sever difficulty

2) Walking:
- [x] Unassisted at a normal pace
- [ ] With assistance or mild difficulty
- [ ] Stumbles, extremely slow pace, needs substantial assistance

3) Turning:
- [x] Smoothly with no hesitation
- [ ] Needs mild assistance or has mild difficulty
- [ ] Stumbles or needs support

4) Sitting down in chair:
- [x] Smoothly with no hesitation
- [ ] Relies on armrest for support or drops suddenly into chair
- [ ] Needs assistance

Comments: _____

TIME: ____:13S.

3. Activities of Daily Living

1) What is the highest level of education you have completed? *(check one)*
- [x] Advanced college degree
- [ ] College degree
- [ ] High School
- [ ] Did not complete high school

2) Which of these household activities do you perform regularly? *(check all that apply)*
- [ ] Cleaning
- [ ] Lawn mowing
- [ ] Laundry
- [x] Shopping
- [ ] Meal preparation
- [x] Handling finances
- [x] Using a computer

3) Do you need help with any of the following? *(check all that apply)*
- [ ] Cooking
- [x] Cleaning
- [x] Laundry
- [ ] Shopping
- [ ] Banking
- [ ] Taking medications
- [ ] Making phone calls

4) Have you had any falls in the past 3 years? ..... [ ] Yes [x] No

If "Yes", how many falls in the **past year**? _____

Give details below. *(If needed, use the addendum page)* _____

5) Do you exercise? ..... [x] Yes [ ] No

If "Yes", what type of exercise and how often. *(x times/day – x-times/month)* _____

Daily around the house

6) Are you self-employed, a homemaker, or living off your own earnings? ..... [x] Yes [ ] No

If "Yes", how many hours do you work per week? 40 hours

7) Do you participate in any of the following *(check all that apply)*?
- [x] Hobbies
- [ ] Volunteer work
- [ ] Other outside activities

If "Yes", explain and indicate the number of hours you participate each week. playing piano. /music.

Case 2: 77-year-old male

- **Mature Assessment**

4. Delayed Word Recall Part II

Examiner Instructions

- Record all words, stated, both correct and incorrect words.
- Then show the total number of correct words recalled. Do not count duplicate words or incorrect words.
- Note the time once the test is completed.
- Read the statement below to the applicant.

A few minutes ago, I showed you some words and asked you to form a sentence using each word. At this time, I would like to as to tell me as many of the words you can recall. Take your time.

Chimney	Harp	meadow	pug
Book	train	finger	
Salt	Button	Flower	

Total numbers of words correctly recalled out of the 10 choices: 10

TIME OF COMPLETION 08 : 52 (AM) PM

5. Cognitive Questionnaire

Examiner Instructions

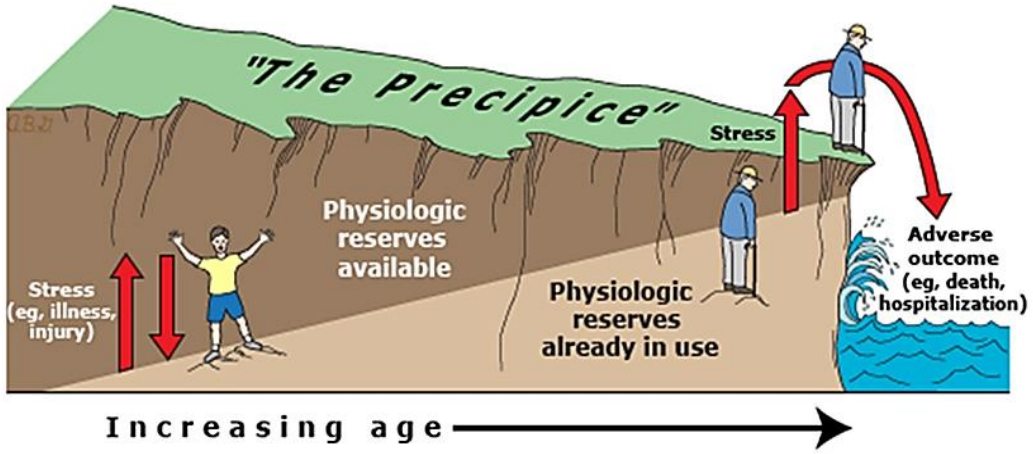
- Please read the statement below to the applicant.

Now I am going to ask you some questions that deal with your memory and orientation. You may find some of these questions to be very simple, but please bear with me because they are important for underwriting your application.

1) What is the year? 2024.
2) What is the month? February
3) What is the date? 23
4) What is the day of week? Friday.
5) What state are we in ? CA
6) What country are we in? USA.
7) What city are we in? Glendale. 100 93 86 71 64 59
8) Begin with 100 and count backward by 7. Stop after 5 answers. Record responses below. *(Correct response 93, 86, 79, 72, 65)*

Case 2: 77-year-old male

- **Let's discuss this case:**
  - **Better than average mortality risk.**
  - **Average mortality risk.**
  - **Moderately elevated mortality risk.**
  - **High mortality risk.**



- **Electrical engineer, owns business.**
- **What do you think about this cognitive testing?**
- **Is he frail?**
- **What about the physical examination and HPI comments?**
- **Do you understand is his cardiac risk?**
- **Any concern with his medication list?**

Serial Sevens

- Serial sevens – subtracting 7 repeatedly from 100.
- This testing is also part of MMSE
- Assesses several cognitive functions.
  - Attention/concentration.
  - Working memory.
  - Arithmetic/mental calculation.
  - Processing speed.
  - Executive function – self-monitoring, error correction.
- Caution as performance is influenced by education and math ability.
- DWR – assess episodic memory to encode and later retrieve details to be remembered.

https://www.psychdb.com/cognitive-testing/mmse

Mild Cognitive Impairment (MCI) and Dementia

- **Mild Cognitive Impairment (MCI)** –A measurable **deficit in cognition in at least one domain**, **without dementia or impairment in daily functioning.** (amnestic - most common and typically precedes Alzheimer's dementia)
- MCI is common in older adults.
  - 65-69 years (8.4%), 70-74 years (10.1%), 75-79 years (14.8%) 80-84 years (25.2%).
- Older people with MCI are **approximately three times more likely to develop dementia over the next two to five years** compared with age-matched controls.
- Age is the primary predictor of progression from MCI to Alzheimer disease (AD) but other factors associated with increased prevalence of MCI include – lower educational level, hypertension, midlife diabetes, obesity, stroke or heart disease, apolipoprotein E (epsilon 4), neuropsychiatric symptoms.
- (AD) and other dementias are associated with increased mortality.
- **The average life expectancy after a diagnosis of AD has been reported to be between 8 and 10 years** but may range from 3 to 20 years.
  - Depends on how impaired the person is at the time of diagnosis.
  - Survival also relates to age at onset of symptoms.

Peterson, R. (2021). Mild Cognitive Impairment: Prognosis and Treatment. In *UpToDate*, J. Wilterdink (Ed.), UpToDate, Waltham, MA. (Accessed on September 11, 2022), from https://www.uptodate.com/contents/mild-cognitive-impairment-prognosis-and-treatment

Peterson, R. (2020). Mild Cognitive Impairment: Epidemiology, Pathology, and Clinical Assessment. In *UpToDate*, J. Wilterdink (Ed.), UpToDate, Waltham, MA. (Accessed on September 11, 2022), from https://www.uptodate.com/contents/mild-cognitive-impairment-epidemiology-pathology-and-clinical-assessment

Wolk, D. (2021). Clinical Features and Diagnosis of Alzheimer Diseae. In *UpToDate*, J. Wilterdink (Ed.), UpToDate, Waltham, MA. (Accessed on September 11, 2022), from https://www.uptodate.com/contents/clinical-features-and-diagnosis-of-Alzheimer-disease

Dementia - Major Neurocognitive Disorder DSM-5

- **Decline in more than one cognitive domain.**
- **Interferes with daily living and independence.**
- DSM-5 – all 6 cognitive domains given equal weight.
- Alzheimer disease (AD) accounts to 60-80% of all cases of dementia.
- Other less common causes include vascular dementia, dementia with Lewy bodies, frontotemporal dementia, Parkinson disease dementia, progressive supranuclear palsy, corticobasal degeneration, multisystem atrophy, Huntington disease dementia, alcohol related dementia, chronic traumatic encephalopathy, normal pressure hydrocephalus (NPH).
- **AD and vascular dementia are commonly present together (mixed dementia).**

Larson, E. (2019). Evaluation of Cognitive Impairment and Dementia. In *UpToDate*, J. Wilterdink (Ed.), UpToDate, Waltham, MA. (Accessed on September 11, 2022), from https://www.uptodate.com/contents/evaluation-of-cognitive-impairment-and-dementia

DSM-IV and DSM-5 criteria for dementia

DSM-IV criteria for dementia	DSM-5 criteria for major neurocognitive disorder (previously dementia)
A1. Memory impairment	**A.** Evidence of significant cognitive decline from a previous level of performance in one or more cognitive domains*: - Learning and memory - Language - Executive function - Complex attention - Perceptual-motor - Social cognition
A2. At least one of the following: - Aphasia - Apraxia - Agnosia - Disturbance in executive functioning	
B. The cognitive deficits in A1 and A2 each cause significant impairment in social or occupational functioning and represent a significant decline from a previous level of functioning.	**B.** The cognitive deficits interfere with independence in everyday activities. At a minimum, assistance should be required with complex instrumental activities of daily living, such as paying bills or managing medications.
C. The cognitive deficits do not occur exclusively during the course of delirium.	**C.** The cognitive deficits do not occur exclusively in the context of a delirium.
	D. The cognitive deficits are not better explained by another mental disorder (eg, major depressive disorder, schizophrenia).

For diagnostic criteria of dementia subtypes such as Alzheimer disease or frontotemporal dementia, please refer to UpToDate topics on the clinical manifestations and diagnosis of individual dementia subtypes.

DSM: Diagnostic and Statistical Manual of Mental Disorders.

* Evidence of decline is based on concern of the individual, a knowledgeable informant, or the clinician that there has been a significant decline in cognitive function and a substantial impairment in cognitive performance, preferably documented by standardized neuropsychological testing or, in its absence, another quantified clinical assessment.

References:

1. *American Psychiatric Association Diagnostic and Statistical Manual, 4th ed, APA Press, Washington, DC 1994.*
2. *American Psychiatric Association. Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5), American Psychiatric Association, Arlington, VA 2013.*

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Cognitive Screening Tools

- **Delayed Word Recall (DWR).**
- **Mini-Cog.**
- **Clock Drawing Test (CDT).**
- Mini-Mental State Examination (MMSE).
- Short Portable Mental Status Questionnaire (SPMSQ).
- Montreal Cognitive Assessment (MOCA).
- St. Louis University Mental Status Examination (SLUMS).
- Enhanced Mental Skills Test (EMST).
- Minnesota Cognitive Acuity Screen (MCAS).

Many short cognitive screens with varying sensitivities and specificities for identifying dementia that perform less well as screens for MCI.

Life insurance screening tools typically include the mini-cog, CDT and/or DWR.

The APS in an older adult may include other cognitive screens – such as the MMSE, MOCA or SLUMS.

Cognitive screens often performed in older adults applying for long term care can include EMST and MCAS testing.

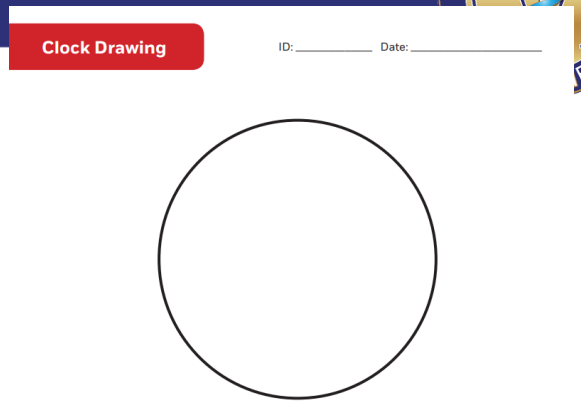
<u>Gold standard – neuropsychological testing.</u>

Mortality Risk Assessment in the Elderly: The Utility of DWR, Part II

Laura Vecchione, MD; Eric Golus, FSA, MAAA – *J Insur Med 2007; 39:264-269*

- Part II of a prior study published in 2006. Participants were applicants from an employer sponsored long-term care insurance program -aged 70 and older who were underwritten between 1995-2006 (prior study included up to 2003) and who underwent cognitive testing with delayed word recall (DWR) – Part II included omitted cases from the first study and an additional 3 years of applicants.
- Total # of applicants – 22,108– 3 decisions.
  - Accepted (12,928).
  - Declined for medical reasons.
  - Declined for cognitive impairment alone (1,703).
- **Total # of participants – 14,631** - those declined for non-cognitive reasons were excluded from the study.
- An error was made in the prior study – omitting 2196 cases that should have been included – these were included along with an additional 854 lives underwritten after 2003.
- 1995-2006, average duration 6.9 years, 4,388 deaths.
- DWR scores were grouped into those who scored 0-5 vs those who scored 6-10.
- Overall, mortality ratio (MR) for the entire study group was 141% (+/- 4%).
- **MR for DWR 0-5 was 196% (+/-9%) and for DWR 6-10 the MR was 114% (+/- 5%).**
- **Women with DWR 0-5 had a MR of 200%, DWR 6-10 had a MR of 113%.**
- **Men with DWR 0-5 had a MR of 192%, DWR 6-10 had a MR of 117%.**

Mini-Cog



https://www.alz.org/media/Documents/mini-cog.pdf

- Includes recall of 3 unrelated words and a clock draw test (CDT).
- 3-word DWR – 1 point for each word.
- CDT
  - All numbers should be present in correct order with hands displaying requested time.
  - No points off for length of the hands, circle is already provided.
  - Score - 0 points for an abnormality or 2 points if done correctly.
- Total score out of 5 - Impaired if cannot recall the 3 words or if recall only 1 or 2 words and have an abnormal CDT(cut-point of <3 for dementia screening).
- **Sensitivity 76 to 100% but specificity only 54 to 85% for dementia and worse for MCI - sensitivity 39 to 84% specificity 73 to 88%.**

Mendez, M. (2019). Mental Status Scales to Evaluate Cognition. In *UpToDate*, J. Wilterdink (Ed.), UpToDate, Waltham, MA. (Accessed on September 11, 2022), from https://www.uptodate.com/contents/mental-status-scales-to-evaluate-cogntion

Clock-Drawing Test (CDT)

- Utilizes visuospatial, executive function, motor, attention, language comprehension, and numerical knowledge.
- Many scoring systems.
  - Scoring complexity varies related to numbers, hands and placement, spacing, organization.
  - No particular scoring system appears clearly better for screening for dementia.
- **Sensitivity of 67 to 98% and specificity 69 to 94% for dementia detection.**
- **Performs less well for mild cognitive impairment (MCI) – sensitivity 41 to 85% and specificity 44 to 85%.**

Mendez, M. (2019). Mental Status Scales to Evaluate Cognition. In *UpToDate*, J. Wilterdink (Ed.), UpToDate, Waltham, MA. (Accessed on September 11, 2022), from https://www.uptodate.com/contents/mental-status-scales-to-evaluate-cogntion

Frailty

- Prevalence – 4 to 16% in community dwelling individuals 65 and older.
- Pre-frailty – prevalence ranges from 28 to 44% in community dwelling individuals 65 and older.
- Definition varies but typically includes physiologic decline and marked vulnerability to adverse health outcomes.
- Increased risk for procedural complications, falls, institutionalization, disability and death.
- After adjusting for comorbidities – frailty predicts hip fractures, disability and hospitalization.
- Pathophysiology driven in part by inflammatory pathways, dysregulation of neuroendocrine systems.
- No gold standard for detecting frailty – many tools.

Walston J. (2021). Frailty. In *UpToDate*, J. Givens (Ed.), UpToDate, Waltham, MA. (Accessed on September 11 2022), from https://www.uptodate.com/contents/frailty

Frailty - Definitions

- Two frameworks that impact frailty measurement tools.
- **Physical frailty – frailty phenotype** – fatigue, low activity, weakness, weight loss and slow gait.
  - Fried Frailty Tool or Frailty Phenotype.
- **Deficit accumulation frailty or index frailty** – cumulative comorbidities and cumulative illness.
  - Accumulation of illnesses, functional and cognitive decline and social situations.
  - Requires 20 or more questions, the higher number of deficits, the higher the frailty score.

Walston J. (2021). Frailty. In *UpToDate*, J. Givens (Ed.), UpToDate, Waltham, MA. (Accessed on September 11 2022), from https://www.uptodate.com/contents/frailty

Fried Frailty Tool (Frailty Phenotype)

- Requires participation and specialized equipment for grip strength and walking speed.
- 5 criteria:
  - **Weight loss** (≥ 5% of body weight in last year).
  - **Exhaustion** (positive response to questions regarding effort required for activity).
  - **Weakness** (decreased grip strength).
  - **Slow walking speed** (>6 or 7 seconds to walk 15 feet).
  - **Decreased physical activity** (males <383Kcals/week, females <270Kcals/week).
- Pre-frailty – 1 or 2 criteria.
- Frailty – 3+criteria.

Walston J. (2021). Frailty. In *UpToDate*, J. Givens (Ed.), UpToDate, Waltham, MA. (Accessed on September 11 2022), from https://www.uptodate.com/contents/frailty

Get Up and Go Test (GUG)

- A person is observed rising from a standard armchair, **walking forward 10 feet, turning around and walking back** to the chair and sitting back down.
- Originally described with a grading scale:
  - 1= normal, 5 =severely abnormal.
- Later versions used a timed component.
- May uncover issues with leg strength, balance and vestibular function, and gait.
- **Per the CDC, an older adults whose time > 12 secs is at risk for falling.**

The "Get up and go" test for gait assessment in older adult patients

The "Get up and go" test for gait assessment in older adult patients[1]	
Have the patient sit in a straight-backed high-seat chair	
Instructions for patient:	
Get up (without use of armrests, if possible)	
Stand still momentarily	
Walk forward 10 feet (3 meters)	
Turn around and walk back to chair	
Turn and be seated	
Factors to note:	
Sitting balance	
Transfers from sitting to standing	
Pace and stability of walking	
Ability to turn without staggering	
Modified qualitative scoring[2]	
(1) No fall risk	Well-coordinated movements, without walking aid
(2) Low fall risk	Controlled, but adjusted movements
(3) Some fall risk	Uncoordinated movements
(4) High fall risk	Supervision necessary
(5) Very high fall risk	Physical support of stand by physical support necessary
Timed test reference values (record time from initial rising to re-seating)[3]	
Age (years)	**Mean time in seconds (95% CI)**
60 to 69	8.1 (7.1 to 9.0)
70 to 79	9.2 (8.2 to 10.2)
80 to 99	11.3 (10.0 to 12.7)

Sources:

1. *Reproduced with permission from: Fleming KC, Evand JM, Weber DC, Chutka DS. Practical Functional Assessment of Elderly Persons: A Primary-Care Approach [Symposium on Geriatrics-Part III]. Mayo Clinic Proceedings 1995; 70:890. Copyright © 1995 Mayo Foundation.*
2. *From: Nordin E, Lindelöf N, Rosendahl E. Prognostic validity of the Timed Up-and-Go test, a modified Get-Up-and-Go test, staff's global judgement and fall history in evaluating fall risk in residential care facilities. Age Ageing 2008; 37:442. By permission of the British Geriatrics Society. Copyright © 2013 Oxford University Press.*
3. *Data from: Bohannon RW. Reference Values for the Timed Up and Go Test: A Descriptive Meta-Analysis. J Geriatr Phys Ther 2006; 29:64.*

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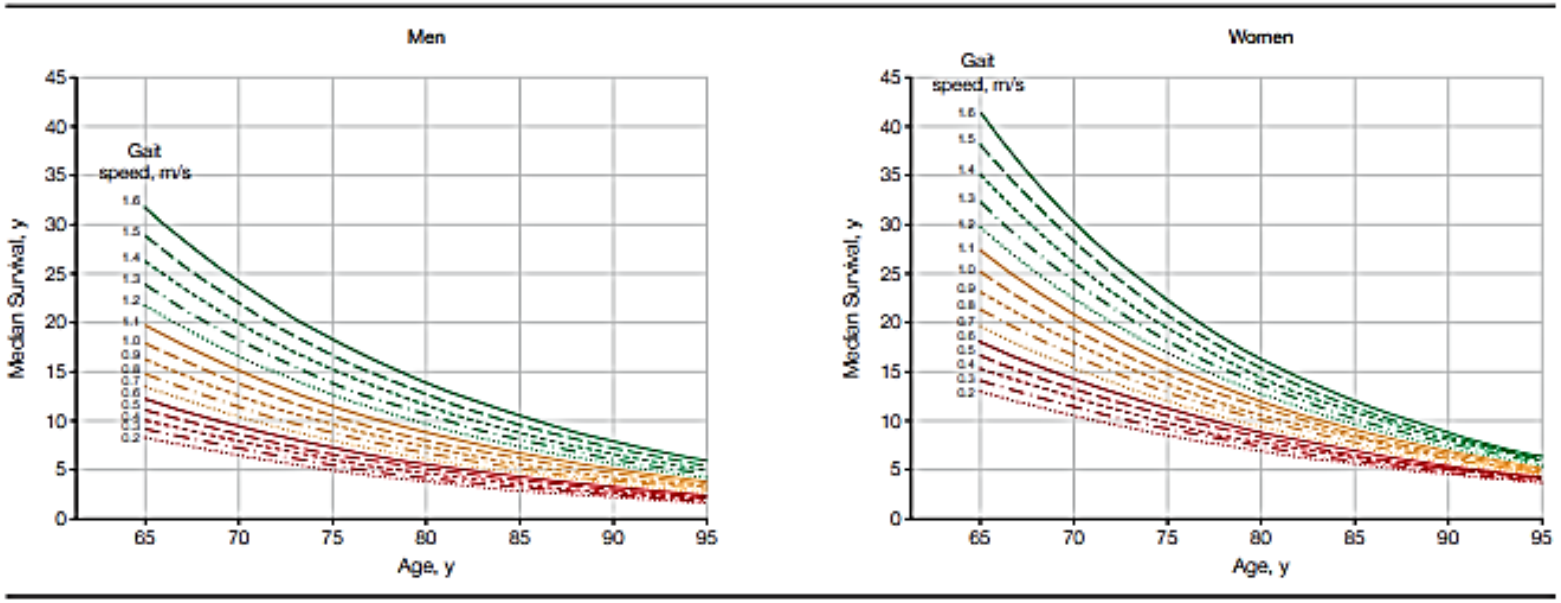
Kiel, D. (2022). Falls in Older Persons: Risk Factors and Patient Evaluation. In *UpToDate*, J. Givens (Ed.), UpToDate, Waltham, MA. (Accessed on September 11, 2022), from https://www.uptodate.com/contents/falls-in-older-persons-risk-factors-and-patient-evaluation

Gait Speed and Survival in Older Adults

Studenski S, et al. *JAMA*. 2011; 305(1): 50-58. doi:10.1001/jama.2010.1923.
https://jamanetwork.com/journals/jama/article-abstract/644554

- Data from 34,485 community dwelling adults 65 and older (pooled analysis – 9 cohort studies).
- Baseline gait speed data follow up for 6 to 21 years.
- Mean age 73.5 years, 59.6% women, 79.8% white, mean gait speed 0.92 (0.27)m/s.
- 17,528 deaths - **gait speed was associated with survival in all included studies.**



Discriminative Ability and Predictive Validity of the Timed Up and Go in Identifying Older People Who Fall: Systematic Review and Meta-Analysis

Schone D, et al. *J Am Geriatric Soc*. 2013. Feb; 61(2): 202-8. doi.10.1111/jgs.12106.Epub 2013 Jan25.

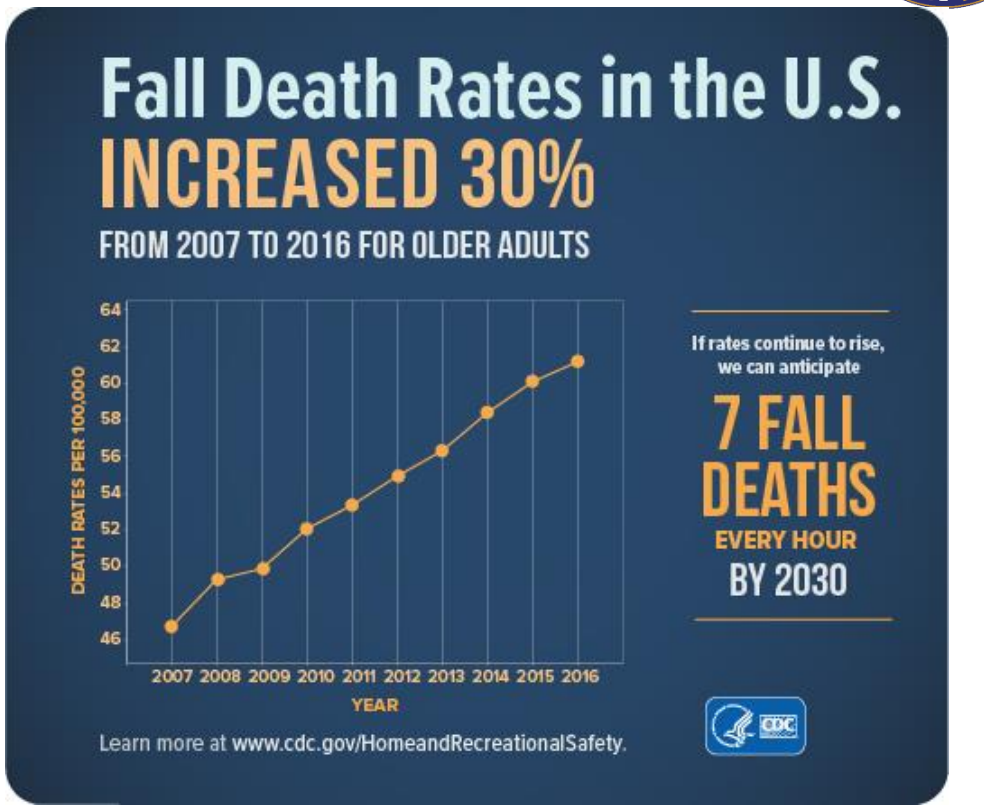
- 53 studies with 12,832 participants.
- **Findings suggested that timed up and go was not useful for discriminating "fallers" from "non-fallers" in healthy high functioning older adults.**
- In adults 60+ timed testing did not show a difference in those with falls and those without falls **who live independently.**
- **It was felt to be of more value in less healthy lower functioning older individuals.**
- The study suggested that the overall predictive ability and diagnostic accuracy of the timed up and go was moderate at best with no cut-points recommended.
- Authors suggested a quick multi-factorial fall risk screen should be considered in addition to help identify older adults at risk for fall.

Timed GUG – For Underwriting Purposes

- **Gait speed was associated with survival** in Studenski S, et al. study published in JAMA in 2011.
- Schone D, et al. published in J Am Geriatric Soc. from 2013 suggested that…
  - For adults 60+, the timed testing **did not show a difference in those with falls and those without falls who live independently.**
  - Timed testing was felt to be of more value in **less healthy lower functioning** older individuals.
- Perhaps the timed aspect of the GUG is more meaningful when there are:
  - **Co-morbidity or frailty concerns present.**
  - **A lack of information on an older applicant.**
- Although gait speed has been associated with survival, perhaps when there is significant underwriting evidence of a robust older applicant with no significant chronic conditions, the timed aspect of the GUG becomes less meaningful.

Falls in Older Individuals

- **Leading cause of injury-related death among adults age 65 and older**, and the age-adjusted fall death rate is increasing.
  - Age-adjusted fall death rate is **78 deaths per 100,000 older adults in 2021.**
- Fall death rates among adults ages 65 and older increased about 30% from 2009 to 2018.
  - The fastest growing rate was among adults aged 85 and older (about 4% per year).
- 2018 Behavioral Risk Factor Surveillance System.
  - 27.5% adults 65+ reported at least one fall within the past year (35.6 million falls).
    - 10.2% fall-related injury.
  - 85+ years old –falls within the past year increased to about 34%.
  - **Falls account for 62% of non-fatal injuries leading to ER visits in 65+.**
  - About 5% of falls in older individuals lead to hospitalization.



Source: https://www.cdc.gov/falls/data-research/index.html Accessed 9/11/2025

Kiel, D. (2022). Falls in Older Persons: Risk Factors and Patient Evaluation. In *UpToDate*, J. Givens (Ed.), UpToDate, Waltham, MA. (Accessed on September 11, 2022), from https://www.uptodate.com/contents/falls-in-older-persons-risk-factors-and-patient-evaluation

Preventing Falls in Older Persons

Lainie Van Voast Moncada, MD and L Glen Mire, MD – Am Fam Physician 2017; 96(4):240-247

Risk Factors for Falls in Older Persons

- **Cardiac** – arrhythmias, congestive heart failure (CHF), hypertension (HTN).
- Environmental hazards.
- **Medications** – risk is higher when 4+medications.
- Metabolic – Diabetes (DM), low body mass index (BMI), Vitamin D deficiency.
- **Musculoskeletal** – arthritis, balance impairment, foot problems, gait impairment, impaired activities of daily living (ADLs), limited activity, lower extremity muscle weakness, musculoskeletal pain, use of assistive device.
- **Neurologic** – delirium, dizziness or vertigo, Parkinson disease or other movement disorders, peripheral neuropathy, history of cerebrovascular accident/transient ischemic attack.
- **Psychological** – depression, fear of falling.
- **Sensory impairment** – auditory impairment, multifocal lens, visual impairment.
- Other – acute illness, anemia, cancer, inappropriate footwear, nocturia, obstructive sleep apnea (OSA), postural hypotension, urinary incontinence.
- Age>80, white race, female, **cognitive impairment, history of falling, history of fractures**, recently discharged from the hospital (within one month).

Polypharmacy

- Exact number of medications that qualify as **"polypharmacy" is variable but generally is considered 5-10 medications.**
- Typically includes prescription medications but can include over the counter medications and herbal or other supplements.
- **Approx. 20% of Medicare beneficiaries have 5+ chronic conditions and 50% receive 5+ medications.**
- Regardless of age, the greater numbers of medications used has been independently associated with an increased risk for an **adverse drug event (ADE) and increased risk of hospitalization.**
- Associated with decreased physical and cognitive capability, even after adjusting for disease burden.
- **Beers criteria** – originally developed by expert consensus panel (1991) medications considered potentially inappropriate for older individuals. https://sbgg.org.br/wp-content/uploads/2023/05/1-American-Geriatrics-Society-2023.pdf.
  - **Identifies 5 categories of concern** – Inappropriate for most older individuals, those medications that should be avoided in particular scenarios, those that should be used with caution, drug-drug interactions, require dose adjustment.

Rochon, P. (2022). Drug Prescribing for Older Adults. In *UpToDate*, J. Givens (Ed.), UpToDate, Waltham, MA. (Accessed on September 11, 2022), from https://www.uptodate.com/contents/drug-prescribing-for-older-adults

Polypharmacy – Older Ages at Risk

- Increases risk for ADEs due to metabolic changes and decreased drug clearance associated with aging.
  - Risk compounded by increasing numbers of drugs used.
- Increases potential for drug-drug interactions and for prescription of potentially inappropriate medications.
- Increases possibility of "prescribing cascades“.
  - Prescribing cascade – when an ADE is misinterpreted as a new medical condition and then another drug is prescribed to treat the ADE.
- Can lead to adherence issues, especially if compounded by visual or cognitive impairment.
  - 2017 systematic review of observational studies - suggested that medication regimen complexity is associated with nonadherence.

Rochon, P. (2022). Drug Prescribing for Older Adults. In *UpToDate*, J. Givens (Ed.), UpToDate, Waltham, MA. (Accessed on September 11, 2022), from https://www.uptodate.com/contents/drug-prescribing-for-older-adults

Conclusions

- By 2030 those Americans 65 and older are projected to make up 21% of population.
- Assessing mortality risk in the older age population is complex.
- The aging process is not uniform; there is significant heterogeneity observed among older adults which should be understood when assessing an individual's risk.
- The number and severity of chronic diseases (multimorbidity), the degree of independence/dependance (disability), and indicators of vitality/frailty are often the best predictors of outcome in the older age population.
- Frailty and prefrailty are prevalent at older ages and the insurance medical director can leverage biometrics, older age supplement information, cognitive screening, the GUG and APS information to help identify frailty concerns.
- Industry studies published in the Journal of Insurance Medicine support use of build, albumin, NT-probnp, and DWR when assessing mortality at older ages.