

Canadian Initiative on Frailty and Aging
Initiative canadienne sur la fragilité et le
vieillessement

www.frail-fragile.ca

Developing a working Framework for
Understanding Frailty

Howard Bergman MD

Christina Wolfson PhD

David Hogan MD

François Béland PhD

Sathya Karunanathan MSc (cand)

for the Investigator Group

Funding :

Max Bell Foundation

Institute on Aging, CIHR

Quebec Research Network on Aging (FRSQ)

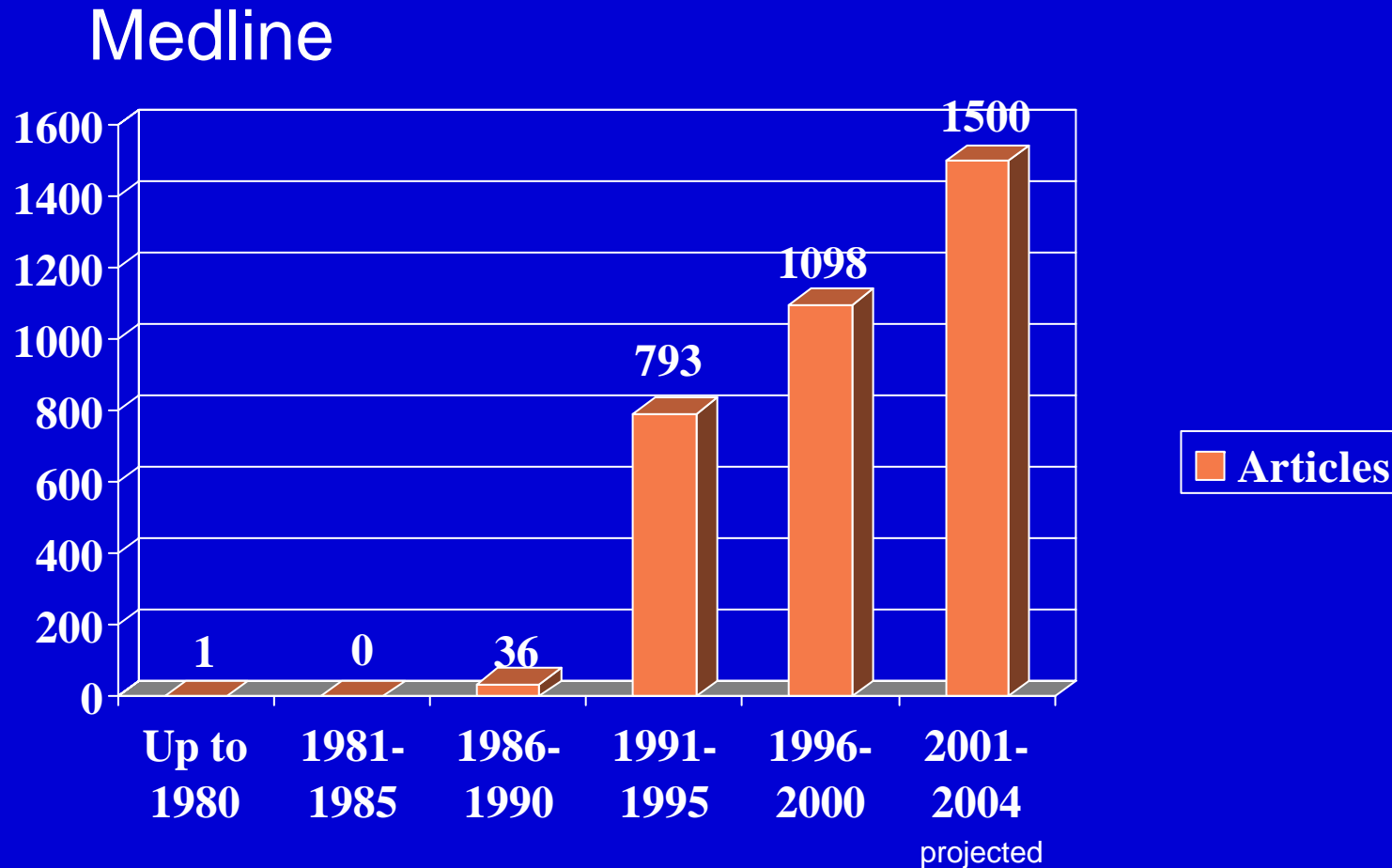
Gustav Levinschi Foundation

Canadian Geriatrics Society

In partnership with Canadian, European, Israeli Research Groups

Version 10.06.04

Frailty: an emerging concept¹

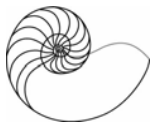


Adapted from Swine, Age & Ageing 1998,
27:411-13

Frailty: an enigmatic concept¹

- ◆ Frailty is like pornography: You can't define it but you recognize it when you see it.

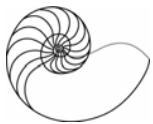
an anonymous clinician



Frailty: an enigmatic concept²

“Frailty is one of those complex terms – like independence, life satisfaction, and continuity – that trouble gerontologists with multiple and slippery meanings”

SR Kaufman, *The Social Construction of Frailty*, 1994



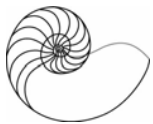
Frailty: an enigmatic concept³

◆ Models

- Demographic and mathematical
- Aging
- Genetic
- Primary pathways
- Concurrent dysfunction of multiple biological systems
- Combined bio-medical/psychosocial

◆ 30 criteria for identifying frailty or predicting frailty

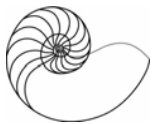
Hogan DB, MacKnight C, Bergman H.. Models, definitions and criteria for frailty. Aging Clin Exp Research. 2003 Vol 15, suppl. to No. 3: 3-29



Early definitions

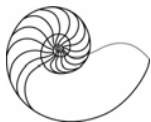
- ◆ Disability caused by chronic diseases and their sequelae
- ◆ Comorbidity
- ◆ Defined by eligibility for specialized geriatric programs

NIH Consensus Development Conference on geriatric assessment methods (1988)



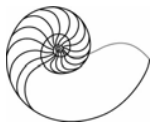
The Uncoupling of Disability and Frailty

- ◆ Population data on decreasing disability
- ◆ Interest in healthy/successful aging and the potential for prevention
- ◆ Data from longitudinal and intervention studies
 - markers of frailty in healthy individuals
 - not all persons with disability are frail
 - not all frail persons have disabilities
 - there is potential for prevention



Growing body of knowledge

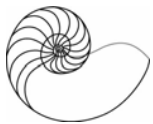
- ◆ Basic biological mechanisms (genetic (APOE4); inflammatory (IL-6, IGF-1, C-Reactive Protein); hormonal, oxidative stress)
- ◆ Socio-economic factors
- ◆ Early and midlife experiences
- ◆ Prevalence and risk factors
- ◆ Markers for early detection and diagnosis
- ◆ Population health and social interventions
- ◆ Clinical interventions (detection, prevention, treatment & rehabilitation)
- ◆ Use of assistive technology and modification of the environment
- ◆ Organisation of services



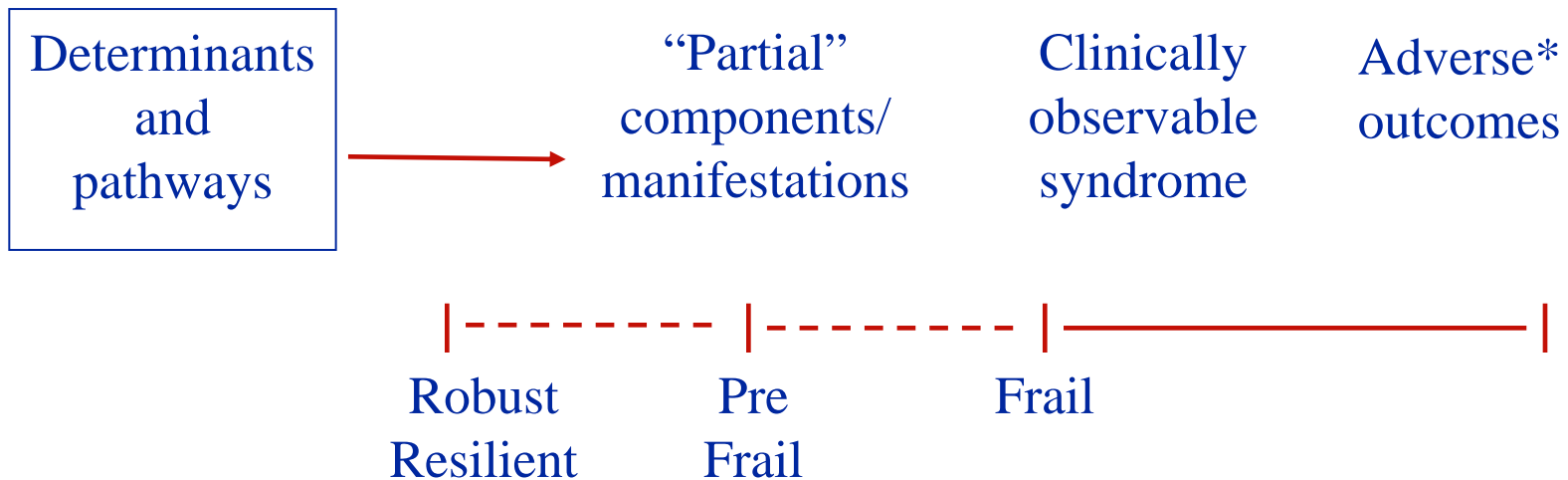
Growing consensus

- ◆ Frailty: state of increased vulnerability
 - Vulnerability to what?
 - Components?
 - Trajectories?
 - Determinants/risk factors?
 - Prevention/management?

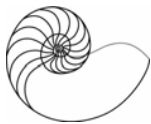
Hogan, MacKnight, Bergman. June 2003. Aging: Clinical and Experimental Research



Hypothesized Pathway to Frailty



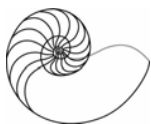
*Disability, morbidity, hospitalization, institutionalization, mortality



FRAILTY-Models/Approaches - are they competing?

Hogan, MacKnight, Bergman. Aging: Clinical and Experimental Research, Sept. 2003)

- ◆ Accelerated or advanced aging
- ◆ A physiologic syndrome with specific pathway(s)
- ◆ A complex syndrome with biological, social, psychological determinants across the life-course



Accelerated or Advanced Aging

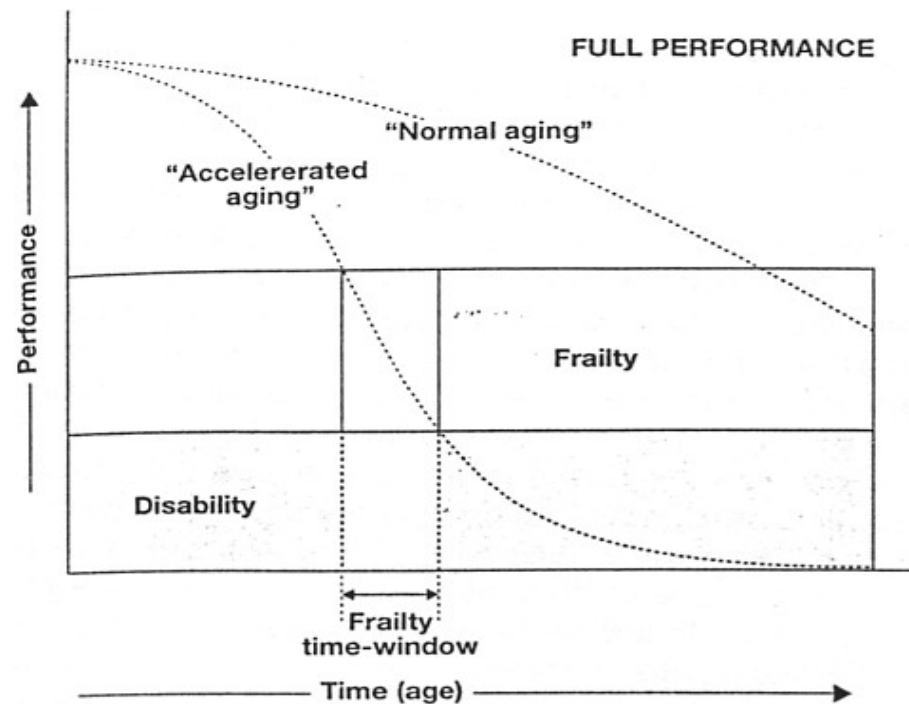
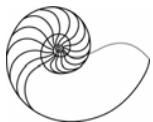


Fig. 1 - Trajectories of performance over the life span. The 2 curves represent "normal" aging and "accelerated" aging. Areas of "full performance", "frailty" and "disability" are indicated with different shades of grey.

A Physiologic Syndrome

- ◆ A physiologic syndrome characterized by decreased reserve and resistance to stressors, resulting from cumulative decline across multiple physiologic systems, and causing vulnerability to adverse outcomes

(Fried et al. 2003)



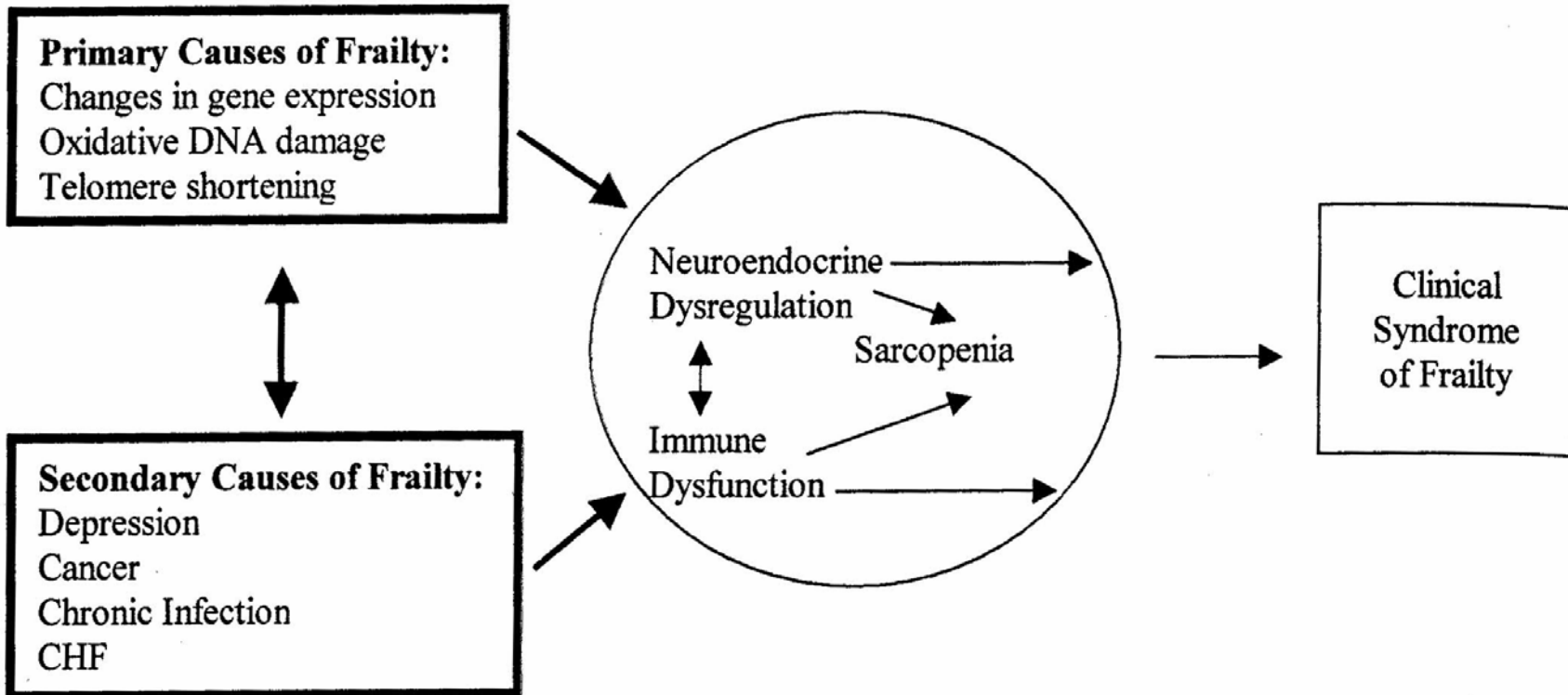
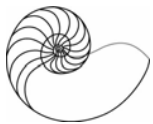


Figure 116-9 Hypothetical causal pathway of frailty focused on primary, age-related mechanisms, and secondary disease-related mechanisms. We hypothesize that both mechanisms can trigger the physiology of frailty, and that there is substantial interaction between primary and secondary mechanisms.

The Life Course approach

- ◆ An integrative approach that includes the biological, social, clinical (including cognitive), psychological and environmental determinants which interact across a person's lifespan and which may promote healthy aging and either delay or promote the emergence of frailty
 - The contribution of early life factors jointly with later life factors to identify risk and protective processes
 - Integrate biological and social risk processes rather than draw false dichotomies

(Adapted from: Ben-Shlomo and Kuh, 2002)



Examples of risk factors/markers across the life span¹

◆ Low birth weight associated with

↓ grip strength 53 years later (Kuh 2002)

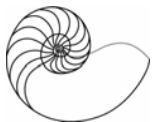
↑ risk of diabetes and cardiovascular disease (Aboderin et al. WHO 2002)

◆ Decreased grip strength in mid life

↑ risk of functional decline and disability 25 years later (Rantanen, Guralnik 1999)

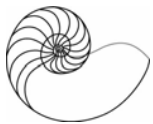
◆ Low education

– Increased risk of Alzheimer disease not mediated by adult SES or SES mobility (Karp 2004)



Examples of risk factors/markers across the life span²

- ◆ Longitudinal studies of aging: strong associations between lifestyle risks factors and the incidence of disability
 - Exercise, normal body mass index, non-smoker in mid and late years (Vita,1998)
 - » increased survival; postponement (7.75 years) of age of onset of disability- compression of disability
 - Physical activity (Leveille, 1999)
 - Prospective cohort study-runners vs community controls (Wang, 2002)
 - » Postponement and compression of disability (12.8 years)
 - High risk factors : more disability throughout and surge in last 2 years (Hubert, 2002)



Examples of risk factors/markers across the life span³

◆ Risk factors for frailty

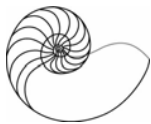
- Age, low education
- 30 year cumulative predictors: heavy drinking, cigarette, physical inactivity, depression, poor perceived health, 2 or more chronic symptoms, 1 or more chronic conditions, social isolation

(Strawbridge 1998 Alameda County Study)

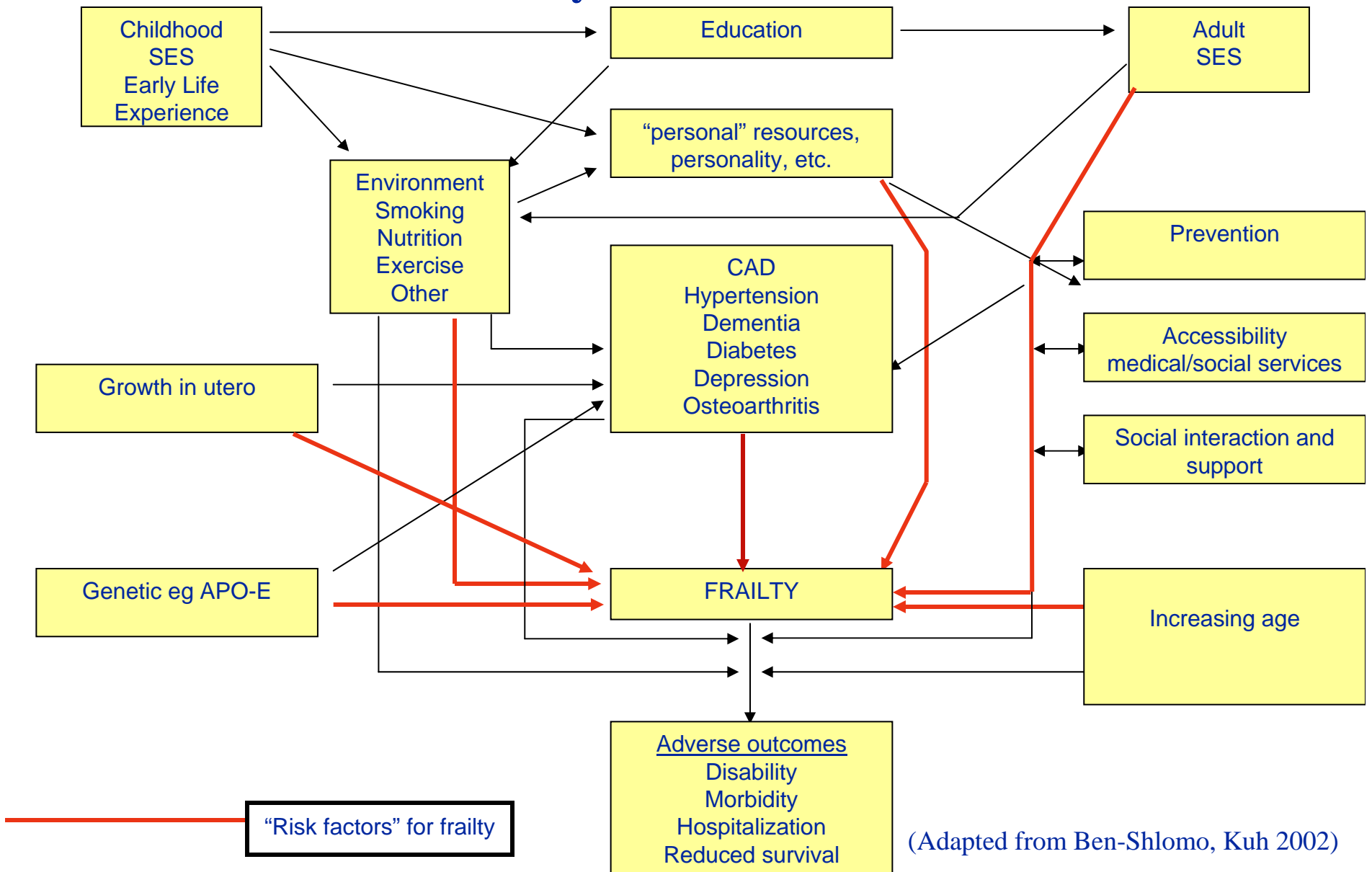
◆ Risk factors (in adult or late life) for functional decline

- cognitive impairment; depression; disease burden; increased/decreased BMI; lower extremity function limitation; decreased social contacts; low physical activity; no compared to moderate alcohol consumption; poor self-perceived health; smoking; vision impairment
 - » Evidence for an association among biological, psychological and social risk factors

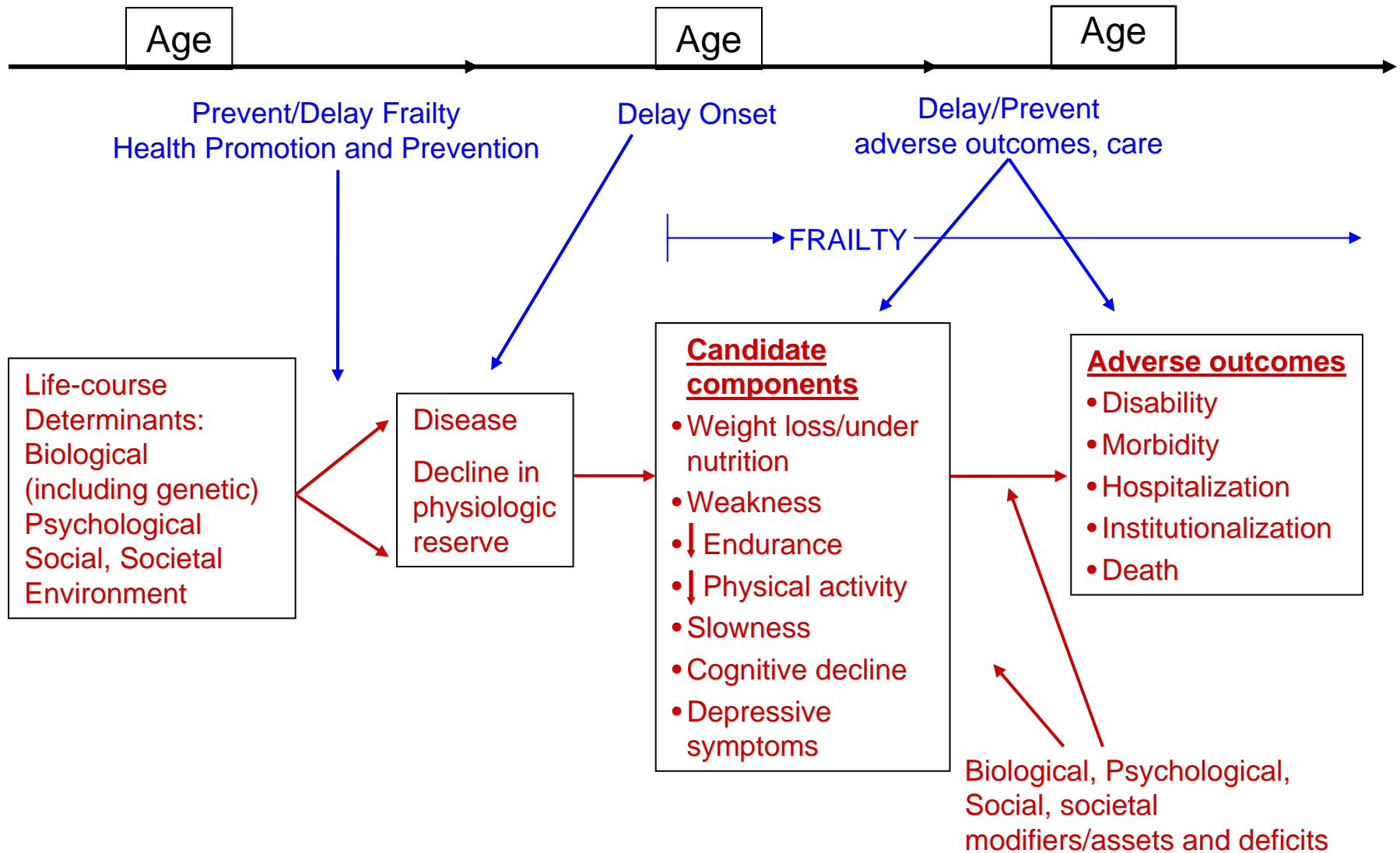
(Systematic review, Stuck et al 1999)



Biological and psychosocial exposures across the life course in relation to frailty and its adverse outcomes



A working framework in development



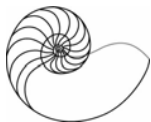
A possible working framework¹

- ◆ An identifiable and measurable syndrome (clinically and in the population)
A combination of **some or all** of the following components:
 - Decreased physical activity • weakness • decreased endurance • slowness
 - Under-nutrition (weight loss) • Cognitive decline • Depressive symptoms
 - (Impairment in (I)ADL)

- ◆ A dynamic complex process
 - Interaction of biological, psychological, cognitive and social factors
 - Complex interplay of assets and deficits of a given individual in a given context (effect modifiers)

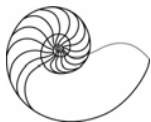
- ◆ Reduced homeostasis and resistance to stress leading to increased risk of adverse outcomes
 - Morbidity
 - Disability
 - Mortality

} increased health/social service utilization



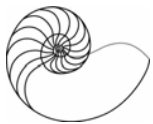
A possible working framework²

- ◆ Age-related but not uniformly present in aging
 - On a continuum
 - chronic and progressive
- ◆ Result of impact of multiple system impairment (or multiple system reduction in reserve capacity)
 - Critical mass of changes
 - particularly in metabolic, cardiovascular, musculoskeletal and neurological systems
- ◆ Underlying biological and social determinants/risk factors throughout the life course
- ◆ Potential for prevention/delay of onset of frailty and adverse outcomes; potential for management/treatment



Issues/Questions

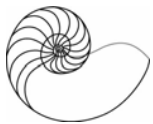
- ◆ Does Frailty exist
 - or simply “accelerated” aging. Flip side of healthy aging
- ◆ Is Frailty
 - a specific biological entity with defined pathway
 - a syndrome with biological, psychological and cognitive characteristics and multiple pathways
- ◆ Relationship between biological, psychological and cognitive components; role of social and environmental factors
- ◆ Understanding Frailty as an entity or syndrome but also as a state of risk for adverse outcome eg metabolic syndrome X
- ◆ How do we study candidate determinants, components, mediating factors with a working framework?



Challenge:

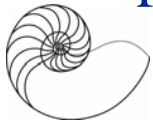
From a working framework to a model

1. Systematic review-understand/assess quality of evidence
2. Identification of candidate components
3. Agreement on candidate components
 - Clinician and expert consensus
4. Study
 - How do the components cluster-do they present together more often than you would expect if they were independent?
 - Which candidate components do you maintain
 - What is the relative importance of the components



Perspectives

- ◆ Complete the systematic review
- ◆ International working meeting
- ◆ Develop a working framework through this process
- ◆ Move ahead the Research agenda
 - Opportunity to study frailty in developing longitudinal studies in Europe, Canada, USA; Canadian Longitudinal Study on Aging with an embedded study on frailty
 - Exploitation of existing databases
 - Funding and collaboration opportunities for biological, clinical and population studies e.g., CIHR, NIA, other

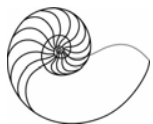


© Cartoonbank.com

WORRY TANK



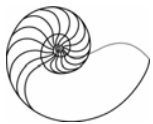
howard.bergman@mcgill.ca



Canadian Initiative on Frailty and Aging / Initiative canadienne sur la fragilité et le vieillissement
www.frail-fragile.ca

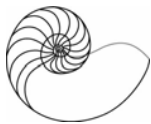
Immortality

Rather than achieve immortality through his films, Woody Allen stated: I would rather achieve immortality by not dying.



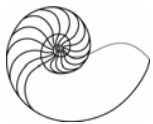
References

- ◆ Baltes PB, Smith J. 2003. New frontiers in the future of ageing: From successful ageing of the young Old to the dilemmas of the fourth age . Gerontology. 49:123-135
- ◆ Ben-Shlomo Y, Kuh D. 2002. International Journal of Epidemiology; 31:285-293
- ◆ Ferrucci L, Cavazzini C, Corsi AM et al. 2002. Biomarkers of Frailty in Older Persons. J. of Endocrinol. Invest. 25: (Suppl. To no. 10): 10-15
- ◆ Fried LP, Catherine M, Tangen J et al. 2001. Frailty in Older Adults: Evidence for a Phenotype. J. of Geront: Medical Sciences. Vol. 56A, No. 3. M146-M156
- ◆ Fried LP, Walston J. Frailty and Failure to Thrive. Principles of Geriatric Medicine & Gerontology; Fifth Edition. Hazzard WR, Blass JP, Halter JB, Ouslander JG, Tinetti ME ed. New York. NY: McGraw Hill: 2003:1487-1502
- ◆ Fried LP, Ferrucci L, Darer J et al,. Untangling the concepts of Disability, Frailty and Comorbidity: Implications for improved targeting and care. Journal of Gerontology: medical Sciences 2004, vol 59, no 3, 255-263.



References

- ◆ Hubert HB, Bloch DA, Oehlert JW, Fries JF. 2002. Lifestyle habits and compression of morbidity. *Journals of Gerontology*. Vol 57A; 6: M347-M351
- ◆ Hogan DB, MacKnight C, Bergman H. June 2003. Models, definitions and criteria for frailty. *Aging Clin Exp Research*. Vol 15, suppl. to No. 3: 3-29
- ◆ Karp A, Kareholt I et al. Relation of education and occupation-based socioeconomic status to incident Alzheimer's Disease. *Am J Epidemiol* 2004;159: 175-183
- ◆ Kaufman SR. 1994. The social construction of frailty: an anthropological perspective. *J Aging Studies*. 8: 45-58
- ◆ Lebel P, Leduc N, Leclerc C, Contandriopoulos AP, Béland F et al. 1999. Un modèle dynamique de la fragilité. *L'Année gérontologique*. 13:84-94 (Paris: Serdi)
- ◆ Leveille SG, Guralnik JM, Ferrucci L, Langlois JA. 1999. Aging successfully until Death in Old Age: Opportunities for Increasing Active Life Expectancy. *Am J Epidemiol* vol 149; 7: 654-664



References

- ◆ Mendes de Leon CF, Glass TA, Berkman LF. 2003. Social Engagement and Disability in a Community Population of Older Adults. The New Haven EPESE. Am J Epidemiol. 157:633-642
- ◆ Rockwood K, Fox RA, Stolee P, et al. 1994. Frailty in elderly people: an evolving concept. CMAJ. 150:489-495
- ◆ Stuck AE et al. Risk factors for functional status decline in community-living elderly people: a systematic literature review. Social Science & Medicine 48 (1999) 445±469
- ◆ Swinne C, Cornette P, Schoevaerds D, Latteur V, Melon C. 1998. Frailty in the medical literature. Age and Ageing vol 27; 3: 411-413
- ◆ Vita AJ, Terry RB, Hubert HB, Fries JF. 1998. Aging, Health risks and cumulative disability. NEJM 3338 (15): 1035-1041
- ◆ WHO. 1999. A Life Course Perspective of Maintaining Independence in Older Age. Prepared for WHO by Claudia Stein and Inka Moritz under the guidance of WHO's Ageing and Health. Geneva 1999

