Chronic Disease: the Real Epidemic

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Main points

- Chronic disease is big, and will become much bigger
- Approaches to controlling chronic disease: emphasis on prevention
- We should be careful what we prevent!
- What else should we do?

Chronic disease is big, and will become much bigger

"Demography explains 2/3 of everything" (D Foot: *Boom, Bust & Echo*)

- The population is aging apace
- *Low fertility (below replacement for decades)
- Falling mortality (due to prevention, treatment)
- There is no evidence that this will change; increased fertility would take decades to have an impact (and the world does not need more people)

Minor Causes of the Epidemic

- Smoking: effects still increasing in women
- Obesity: maybe now, certainly in future
- Lack of exercise
- Diet? Evidence contradictory
- Environmental factors?

Seniors (aged 65+)

- 2005: 13% of Canadian population Younger than most G8 nations, but aging faster (bigger Baby Boom)
- 2011: First Boomers reach age 65 Then rapid aging until 2031
- 2015: More seniors than children <15
- 2031: Twice as many seniors (24%)
- Most chronic diseases increase with age

How to quantify chronic disease?

- No point talking about mortality alone; in a successful society we would *all* die of chronic disease
- Therefore, PYLLs and life expectancy are not good enough
- Need to emphasize health-related quality of life
 - DALYs over PYLLs
 - HALE over LE

Disability-Adjusted Life Years, DALYs

- Calculate Years of Life Lost, then add additional years to adjust for years of ill health or disability
- When calculated for the world, it revealed a huge burden from mental and musculoskeletal illness, which had not previously been recognized

Disability-Adjusted Life-Years Lost



Components and Causes of DALYs (column %)

Conditions	Morbidity (YLD)	<i>Mortality</i> (YLL)	Total (DALY)
Communicable,	4%	9%	6%
Maternal, Perinatal, Nutritional			
Chronic	92%	74%	84%
Injuries	4%	18%	10%
Total	100%	100%	100%

Components and Causes of DALYs (row %)

Conditions	Morbidity (YLD)	<i>Mortality</i> (YLL)	Total (DALY)
Communicable,	39%	61%	100%
Maternal, Perinatal, Nutritional			
Chronic	62%	38%	100%
Injuries	24%	76%	100%
Total	57%	43%	100%

Which Chronic Diseases?



Impact of Chronic Diseases

Category	Mortality	Morbidity
Cancer	85%	15%
Cardiovascular	79%	21%
Diabetes	37%	63%
Respiratory	33%	67%
Neuropsychiatric	8%	92%
Musculoskeletal	7%	93%
Sense organs	0%	100%

Killing vs Disabling diseases

Killing Diseases	Disabling Diseases
Cancer	Mental diseases
Circulatory diseases	Diseases of sense organs
	Musculoskeletal diseases
(Diabetes)	
(Respiratory disease)	

Deaths vs Prevalence



Life and Health Expectancy

- Alternatively, we can calculate life expectancy, then remove some years to adjust for years of ill health or disability, yielding Health-Adjusted Life Expectancy (HALE) or Disability-Adjusted Life Expectancy (DALE)
- We can then estimate HALE if a certain disease were eliminated (see later slide)

A little epidemiology

- Frequency of a condition depends upon:
 Size of the age group that gets the condition
 Rate of the disease in that age group
- For chronic disease, the first factor is more important, although increasing obesity will increase rates of many diseases
- Age-specific rates allow us to remove effect of demographic differences

Elementary Relationships (1)

- Prevalence ≈ Incidence x Duration
- Incidence is mostly decreasing (where known); apparent increases sometimes due to earlier detection (e.g., prostate cancer)
- Crude prevalence is definitely increasing: denominator is increasing, treatment is prolonging survival
- Prevalence is the problem!

Elementary Relationships (2)

- Mortality ≈ Incidence x Fatality
- Fatality is mostly decreasing (improved treatment)
- Crude mortality is increasing (because population is aging, so denominator is increasing)
- Age-specific mortality is mostly decreasing (prevention, treatment)



(This is very approximate, containing many generalizations and some speculations)

It will become a bigger problem

- By 2015 (USA):
 - 73% of men and 68% of women will be overweight
 - Deaths from chronic disease will increase by 15%
 - Deaths from diabetes will increase by 44%
- Prevalence of Alzheimer will nearly quadruple in next 50 years

Implications of the Epidemic

- Huge increases in number of frail elders
- Huge increases in demands on health care system: visits, drugs, admissions
- Huge increases in demand for home support (but most women now work outside the home, families are widely dispersed, houses are smaller... or were)
- (Concurrent with smaller workforce, increasing dependency ratio)

A Dissenting Voice

- Robert Evans, Canada's leading health economist, argues that the "aging problem" has been greatly overstated
- Healthcare costs have been fairly stable (except during economic recessions), despite considerable aging
- I claim that "We ain't seen nothin' yet!", and that the problem is not just healthcare

Approaches to Controlling Chronic Disease: Emphasis on Prevention

What can we do about chronic disease?

- Prevent it
- Treat it effectively
- Support the patients

 What can we afford to do, with fewer people available to pay the bills?

Natural History of Chronic Disease

Stages **Health Determinants Risk factors Biological Onset Clinical onset** Death

SCOPE OF PREVENTION

Interventions **Stages** Health Determinants **Primordial Prevention Risk factors Primary Prevention Biological Onset** Secondary Prevention **Clinical onset** Tertiary Prevention, Death Treatment, Palliation

Environmental	Behavioural	Physiological
influences	risk factors	risk factors
Cars	Inactivity	[Diabetes]
Exercise facilities	Poor diet (salt,	Hypertension
Food choices	calories, fat)	Obesity
Poverty	Smoking	
Stress	Substance use	
Television		
Urban design		
Primordial	Primary	Secondary
prevention,	prevention	prevention,
Health promotion		

Primordial Prevention

- Creates conditions in which risk factors are unlikely to arise
- Broad determinants of health: urban planning, social supports, social security, employment, housing, education
- Mainly operate at population level, and influence many diseases
- Costly, mostly has to be done by governments, so unlikely to happen

Primary Prevention

Shall save it till last, because it is most interesting

Secondary Prevention

- Early detection (through screening or case-finding) to detect condition and intervene before it would normally present
- Effective only if earlier intervention actually happens and improves prognosis
- Reduces prevalence when it cures
- Applies to at least 3 cancers (breast, cervix, colon), hypertension, maybe diabetes

Tertiary Prevention

- Various definitions:
 - High quality medical care
 - Disability limitation
 - Etc.
- Sounds a lot like treatment to me

Treatment

- Reduces symptoms, improves quality of life
- Rarely cures, shortening duration and decreasing prevalence (exceptions: some cancers, cataracts)
- In most cases, prolongs survival, thereby increasing prevalence (transplants, diabetes, ischaemic heart disease)

Managing the Epidemic

- Social supports (housing, granny flats, leave for people to care for their parents)
- Tax relief for care-givers
- Train appropriate care personnel
- Expand home care, multilevel institutions
- All of these are costly
- Avoid heroic efforts in last days

Finally, Primary Prevention

- Reduces incidence, mainly by risk factor modification
- Reduces prevalence, at least in principle, since Prevalence ≈ Incidence x Duration

Risk factor modification (1)

- Risk factors for major killing diseases (heart, stroke, cancer, COPD, diabetes) are very similar
- Integrated approach would be more effective than attacking 1 disease at a time
- Education has enjoyed limited success when used alone
- Environmental approaches are more successful

Risk factor modification (2)

- Smoking: programs well established, carry on (tobacco tax, restrictions on sales and on smoking, etc.)
- Diet: regulation (salt, fat), maybe subsidies, school cafeterias, restaurants, grocery stores
- Exercise: school exercise programs, community and workplace exercise facilities, safer cycling... sounds expensive

Rectangularization of Survival

Rectangularization on the Survival Curve and Entropy



CHART 1. SURVIVORS OUT OF 100,000 BORN ALIVE BY AGE, CANADA: MALES, 1921, 1951 and 1981



CHART 2. SURVIVORS OUT OF 100,000 BORN ALIVE BY AGE, CANADA: FEMALES, 1921, 1951 and 1981

- 1970s: Fries showed that the survival curve is becoming a rectangle
- Fries predicted that this trend will continue, as more people live to "natural age of death" at about 85

Expansion of Morbidity?

- Rectangularization continues, as premature mortality is reduced
- "Natural age of death" is not so true: more people are living beyond 85 (French girl babies born now may live to 100)
- Quite apart from this, rectangularization implies that increasing numbers of people will survive well into their 80s. How frail will they be?

Compression of Morbidity?

- Fries believed that we can prevent much morbidity in the elderly, so that the inevitable period of sickness before death is shortened
- Lots of controversy about what is happening, what will happen, and whether we can influence it

Some Worrying Modeling Results (1)

Dutch disease modellers have shown that:

- Preventing killing diseases allows people to live longer and develop more morbidity from arthritis, mental diseases, etc., driving up healthcare costs
- Smoking prevention is a key example: preventing smoking *increases* health care costs
- We mostly prevent killing diseases

Some Worrying Modeling Results (2)

- Preventing disabling diseases reduces morbidity, by converting disabled years to healthier years without increasing life expectancy much
- But we don't know how to prevent the disabling diseases

And it's not just in the Netherlands



- Eliminating cancer, IHD increases LE>HALE: expansion of morbidity
- Eliminating mental disorders, osteoarthritis increases LE<HALE: compression of morbidity

We should be careful what we prevent!

We must prevent disabling diseases

- Most of the risk factors I have mentioned concern killing diseases
- Arthritis might be addressed through obesity and exercise (effective?)
- What can we do about mental illness?
- Prevention of disabling diseases must be a research priority

What else should we do?

- In a sense, we are facing the problems of success
- The problem is more demographic than medical, so at least some of the solutions (if any) must also be demographic
- Some say that we need do nothing: that Baby Boomers have lived so healthfully that they will not fall ill

- Credible? What about the obesity epidemic?

What else should we do? (2)

- Encourage people to have more babies?
 Feasible? Takes too long to have an effect
- Increase immigration?
 Some think this is the solution. Rather slow
- Spend more on health care?
 - Govt will not raise taxes. What should we cut?
- Reduce the standard of care?
 - Civilized? Public would scream
- Other: YOUR IDEAS, PLEASE