

## The epidemiology of vulnerability – Who is at risk of infection?



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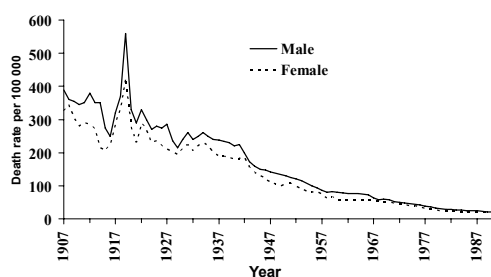
24 February 2006

## Infectious diseases causing *deaths* in Sydney – early 20<sup>th</sup> century

<i>Infants &amp; children</i>	<i>Adults</i>
Diarrhoea	Tuberculosis
Pneumonia	Pneumonia
Tuberculosis	Typhoid
Pertussis	Influenza
Measles	Syphilis
Diphtheria	
Scarlet fever	

Sydney ~1900, from Curson, 1985

## Mortality\* from infectious diseases, Australia, 1907–1990



\* directly age-standardised

redrawn, after Taylor *et al.*, 1998



Victims

## Incidence of selected infectious diseases, Victoria, 2001

Victorian Burden  
of Disease Study  
(2005)

Infectious & parasitic diseases	Tuberculosis	300	
	Chlamydia	12 600	
	Gonorrhoea	900	
	STI (Other)	5 500	
	HIV/AIDS	140	
	Diarrhoea	970 000	
	Vax preventable diseases	1 000	
	Meningitis	900	
	Septicaemia	3 100	
	Arbovirus	400	
Hepatitis A	Hepatitis A	500	
	Hepatitis B	200	
	Hepatitis C	4 600	
	Acute respiratory infections	Pneumonia	29 000
		Other lower RTI	490 000
Upper RTI		8 500 000	
Otitis media		230 000	

## Deaths, Victoria, 2001

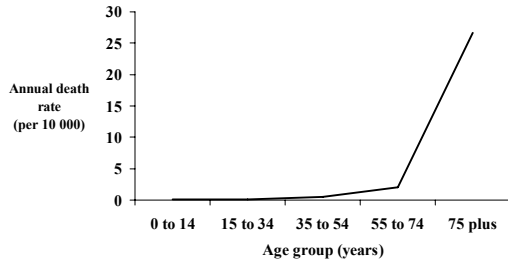
Victorian Burden  
of Disease Study  
(2005)

Infectious & parasitic diseases	Tuberculosis	18	~	
	HIV/AIDS	26	~	
	Diarrhoea	8	~	
	Meningitis	17	~	
	→ Septicaemia	233	0.7%	
	Hepatitis B	19	~	
	Hepatitis C	21	~	
	Other	62	~	
	Acute respiratory infections →	Pneumonia	597	1.8%
		Other	13	~
All the above (infectious diseases)		1 014	3.1% ←	
All the rest		31 371	96.9%	
All deaths		32 285		

~ <0.5%

## Infectious disease mortality, Victoria, 2001

Victorian Burden of Disease Study (2005)



## Disability-adjusted life-years, Victoria, 2001

Victorian Burden of Disease Study (2005)

Category	Disease	N	%
Infectious & parasitic diseases	Chlamydia	520	~
	STI (Other)	344	~
	HIV/AIDS	1170	0.2%
	Diarrhoea	608	~
	Meningitis	756	0.1%
	Septicaemia	2051	0.3%
	Hepatitis B	357	~
	Hepatitis C	468	~
	Other	1 334	0.2%
	Pneumonia	3 920	0.6%
Acute respiratory infections	Other lower RTI	695	0.1%
	Upper RTI	939	0.1%
	Otitis media	1 634	0.3%
All the above (all infectious diseases)	14 796	2.3%	
All the rest	638 345	97.7%	
Total	653 141		

~<0.1%

## Which *other conditions* do people who die of infectious diseases have?

### Proportion of ID deaths

Circulatory system	24%
"Ill-defined"	14%
Respiratory	12%
Genitourinary	10%
Digestive	10%
Endocrine, metabolic etc.	6%
Infectious	5%
Neoplasms	4%

Bi P, Parton KA, Whitty M. Co-existing conditions for deaths from infectious diseases in Australia. *Int J Infect Dis.* 2004; 8: 121-5.

## Prevalence of selected vulnerabilities, Victoria, 2001

Victorian Burden of Disease Study (2005)

Disease category	N	Other
Malignant neoplasia	82 000	Breast 16 000 Prostate 13 500 Bowel 12 500 Melanoma 6 000 Lymphoma 4 500 Bladder 4 000 Other skin 4 000 Lung 3 000
Diabetes mellitus	255 000	
Neurological disorders	51 000	Alzheimer's etc. 40 000
Cardiovascular disease	97 000	IHD 45 000 Stroke 34 000
Chronic obstructive pulmonary disease	59 000	
Renal disease	4 000	
Rheumatoid arthritis	18 500	
Alcoholism	190 000	
Cirrhosis	2 000	

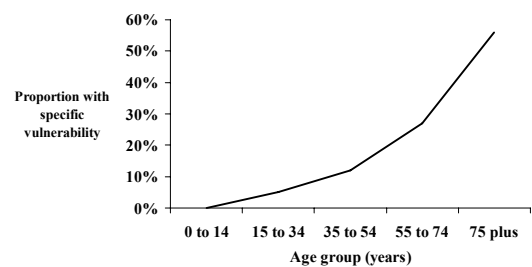
## Prevalence of selected vulnerabilities, Victoria, 2001

Victorian Burden of Disease Study (2005)

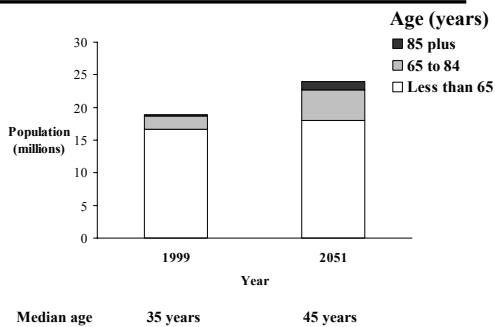
Disease category	N	% with disease (by age)		
		<54	55-74	75+
Malignant neoplasia	82 000	1	5	8
Diabetes mellitus	255 000	2	15	24
Neurological disorders	51 000	<1	2	13
Cardiovascular disease	97 000	<1	5	15
Chronic obstructive pulmonary disease	59 000	<1	3	6
Renal disease	4 000	<1	<1	<1
Rheumatoid arthritis	18 500	<1	1	2
Alcoholism	190 000	4	3	1
Cirrhosis	2 000	<1	<1	<1

## Vulnerability to infectious disease mortality, Victoria, 2001

Victorian Burden of Disease Study (2005)



## Age-structure of Australian population



## Australians in long-term care facilities

- 1996 130 000 in LTC
  - 0.7% of population
  - 4% of persons 65 to 84 years
  - 33% of persons >85 years
- 2051 360 000 in LTC
  - 1.5% of population

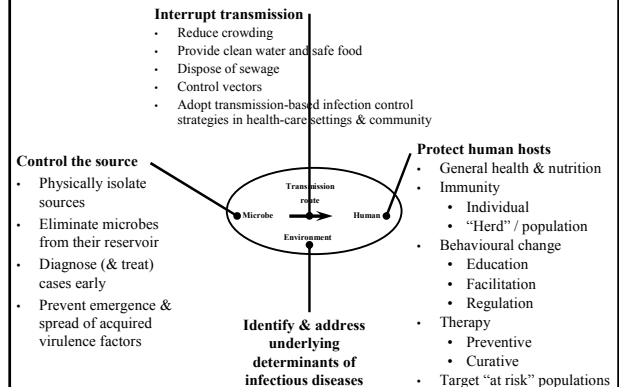
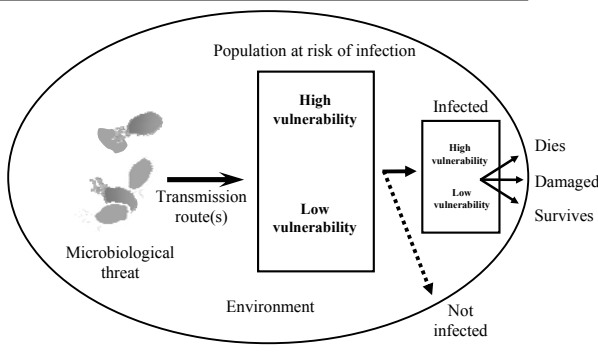
## What do these data tell us about infectious diseases in Victoria?

- Small contributor to death & disability
- Pneumonia, septicaemia → deaths
- HIV/AIDS, otitis media → disability
- Older adults
  - Bear the greatest proportion of ID burden
  - Co-morbidities → vulnerable to severe illness

## What *don't* these data tell us about infectious diseases?

- Proportions of infections that are ...
  - Community-acquired
  - Health-care associated
- Relative contributions (to outcome) of ...
  - Infection
  - Underlying (mostly non-infectious) illness
- Preventability of ...
  - Infection
  - Outcome

## An ecological model



## Engineering infection control – history

- Sanitary engineers of 19<sup>th</sup> century (& earlier)
- Swamp drainage (malaria)
- Ventilation (homes, workplaces, hospitals)
- Safe, low-tech water containers

### • Common themes ...

- Controlling the environmental hazard
- Interrupting transmission

## Engineering infection control

1. Appreciate who's at risk
2. Intrinsic vulnerability is common & difficult to control
3. Interrupt transmission
  - Engineer the physical environment to control environmental hazards
  - Modify behaviour
    - We've tried education, facilitation, coercion ...
    - Can we engineer the behavioural environment?

“All successful prevention undermines the grounds for its own existence.”

Johan Giesecke

2002 EPIET lectures