Economic evaluation of elderly vaccination programs

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Why consider cost-effectiveness (CE)?

• Costs of vaccine programs increasing
  – 13.7% per year between 1999/00 and 2008/09*
  – Assess the **value for money** they achieve

• Opportunity cost
  – Resources scarce (e.g. health budgets limited), allocation of resources = opportunity cost of benefits forgone - because no longer available

• To achieve the most ‘health’ in society
  – Need to consider both the **costs and benefits** (health outcomes) of different alternatives

Lack of attention for elderly programs

• Majority of CE research to date in infants
  – Several reviews have outlined the specific modelling issues for childhood vaccine programs
  – Focus on herd immunity (protection conferred to the community by reducing transmission)
  – Specific issues in the elderly have not been explored (in detail) for vaccine CE analyses

• Lack of Australian CE studies in the elderly?
  – No published CE analyses of existing programs (influenza, pneumococcal vaccination)*

*Newall et al. 2014 Vaccine. 32(12):1323-5.
Published CE studies (>50 yrs)*

Presentation: not going to focus on these overseas analyses as CE results not transferable btw countries

Results: suggest vaccine programs in >50 yrs generally CE*

Issues of interest for elderly?

• Interactions with infant programs
  – Targeted at the same pathogen
• Immunosenescence
  – Wanning of immune functioning with age
• Generalisability
  – From clinical trials (RCT) to population impact
• Fairness and equity
  – Costs and consequences prevented per case
Interactions with infant programs

• For example: pneumococcal vaccination
  – Infants: PCV7 then PCV13
  – Elderly: PPV23 then/and ???

• Infant programs may impact on the elderly
  – May produce herd protection and serotype replacement that change the costs and benefits achieved by elderly vaccine programs over time
  – More herd protection from infant programs may mean less disease in the elderly, and so less disease preventable by elderly programs < CE
Immunosenescence

• Decline in immune function with age
  – Makes elderly an important immunisation target but also creates **challenges to protection**

• Relevance for CE modelling
  – For some vaccines (?) may be situations in which those **most at risk** of severe complications (e.g. very old, frail elderly) are also those **less likely** to respond to vaccination

  – This may create issues of generalisation from RCT est. **if** most at risk are excluded from enrolment
Generalisability

• Predicting population impact from RCTs
  – Applying a RCT est. in CE models (e.g. to all those 65+) may give inaccurate results, unless trial participants reflect the targeted population
  – Always something to be wary of but more of an issue in the elderly where age-differences and co-morbidities are more frequent than in infants

• For example: influenza vaccine
  – Limited observational impact of influenza on mortality (in US*) may reflect such issues

*Simonson et al. 2007 Lancet Infect Dis. 7(10):658-66
Fairness and equity

• Quality adjusted life years (QALYs)
  – Time spent health states * Quality-of-Life
  – Allows comparisons across programs ($/per QALY)
• Relevance for elderly
  – QALYs gained from prevented death = life-expectancy*quality-of-life (future health states)
  – Lower life-expectancy and lower QOL (self-rated) = less QALY gained per death prevented
• Equity: ‘Utilitarian ageism’ vs ‘Fair Innings’*

*Tsuchiya et al. 2000 Health Economics. 9:57-68
Simplified example: QALY gained

• QALYs gained by prevention of death
  – Infant = 80 years
  – Elderly = 15 years

• However - often burden in elderly v high
  – Programs may results in high total QALYs gained, even accounting for lower QALYs gained per death

• Discounting (adjustment time preference)
  – Significantly reduce differences, as benefits (e.g. QALYs gained) valued more sooner they occur
Value for $ with moderate efficacy?

• CE ‘judgement free’ on efficacy required
  – Moderate efficacy + high burden can be equivalent to high efficacy + lower burden
  – Total burden prevented (incremental QALY gained) is what matters in combination total incremental costs of program

• CE analyses
  – Advise on which programs have a lower cost per QALY gained, as funding these = more benefit
Influenza VE and CE in elderly

*Newall et al. 2014 Vaccine. 32(12):1323-5.
Conclusions

• Greater focus
  – Specific issues for CE of elderly vaccine programs

• Heterogeneity
  – Important to appropriately incorporate

• Ethical issues
  – Need to consider carefully (societal preferences?)

• High disease burden
  – May offset moderate efficacy (where relevant)
Questions?

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