Cost effectiveness of population health interventions: rapid reviews

An ***Evidence Check*** Review
brokered by the Sax Institute for the
NSW Department of Health

the saxinstitute
RESEARCH PARTNERSHIPS FOR BETTER HEALTH

NSW HEALTH

© The Sax Institute, March 2007.

This work is copyright. It may be reproduced in whole or in part for study training purposes subject to the inclusion of an acknowledgement of the source. It may not be reproduced for commercial usage or sale. Reproduction for purposes other than those indicated above requires written permission from the copyright owners.

Enquiries regarding this report may be directed to the:

Manager
Knowledge Transfer Program
The Sax Institute
www.saxinstitute.org.au
Phone (02) 9514 5950
Fax (02) 9514 5951
Email: directorate@saxinstitute.org.au

Suggested Citation:

Cost effectiveness of population health interventions: *Evidence Check* rapid reviews brokered by the Sax Institute (http://www.saxinstitute.org.au) for the Centre for Epidemiology and Research, NSW Department of Health; 2007.

Disclaimer:

This ***Evidence Check*** Review was produced using the *Evidence Check* methodology in response to specific questions from the commissioning agency. It is not necessarily a comprehensive review of all literature relating to the topic area. It was current at the time of production (but not necessarily at the time of publication). It is reproduced for general information and third parties rely upon it at their own risk.

CONTENTS

A

Reviews of the cost effectiveness of prevention: an introduction.

Glenn Salkeld

University of Sydney

What is a rapid review?

A rapid review represents a summary of what is known about the size of a health problem, its amenability to prevention, which prevention programs work and, for each program, the size of benefit, the cost and finally the cost effectiveness.

The summary has been prepared by an academic health economist who is recognised nationally (and in some cases internationally) as a leading researcher in that field. The review is rapid because it can draw upon the reviewer's current knowledge of the literature and the reviewer's own experience in applying that knowledge in a policy context.

A rapid review is not a substitute for a systematic review.

What is the purpose of a rapid review?

The purpose of a rapid review is to provide an indicative picture of the relative costs and effects of health prevention programs. They are a guide to policy makers rather than policy making documents per se.

Levels of evidence

The brevity of the reviews in no way excuses the need to ensure that advice to policy makers is based on the best available evidence. Wherever possible, the reviewers have used the NHMRC level of evidence criteria when describing the effectiveness of prevention programs (Appendix 1).

Health economic terminology

A brief glossary of health economic terms has been included in this document (Appendix 2). The most important concept to come to grips with is the notion of cost-effectiveness analysis itself. As used in health, cost effectiveness analysis refers to a set of techniques that express 'value for money' as a ratio of a difference in costs ($) to the difference in health effects (often expressed as life years gained). This acknowledges that the primary outcome of health care (and prevention) is health. All economic evaluations, of which cost effectiveness is but one type, compare at least two programs or interventions. The return on investment is health – which in turn manifests itself in how people live, work and play. Prevention programs have the potential to save money downstream in the health system. Those potential savings are captured in the 'cost' part of the cost effectiveness equation. But there is a trap in framing the merit of prevention programs solely in terms of their potential to save the health system money. The truth is that prevention programs, like most health programs, never pay for themselves in cost offsets or savings. Health is an expensive business. You have got to spend money to save money.

What are the limitations of rapid reviews?

A rapid review is not a substitute for a systematic review. For that reason, the information contained in a rapid review is indicative rather than comprehensive.

COST-EFFECTIVENESS LEAGUE TABLES

What is a league table?

A cost-effectiveness league table lists health programs in order of 'value for money'. Value is represented by the incremental cost-effectiveness ratio (ICER). Those interventions which have the lowest cost per ICER represent the best value for money at the top of the table. Those at the bottom of the league table represent the poorest value for money.

What does an ICER mean?

An ICER represents the ***additional*** cost of producing an extra year of life (or QALY) compared to current treatment or usual care. For example, a cost per LYS of $24,000 for bowel cancer screening means that it costs $24,000 to prevent one year of life lost due to a premature death caused by bowel cancer relative to not screening. The comparison (or increment) is what would happen in the absence of screening – which is the symptomatic detection and treatment of bowel cancer.

Using league tables for decision making

In order to be meaningful a league table must express health gain in the same units of measurement, such as Life Years Gained (LYG) or Quality Adjusted Life Years (QALYs). For a decision maker with a fixed health budget, it is possible to maximise health gain by allocating funds to those interventions at the top of the league table, working down the list of interventions. In practice, other factors apart from cost effectiveness are considered when making funding decisions. These factors include equity, how many people benefit, and whether an alternative treatment or intervention is already funded. A cost effectiveness league table thus makes explicit the opportunity cost of funding decisions. Policy makers may want to trade-off some 'efficiency' in order to achieve equity – a league table makes that trade-off more explicit.

Limitations

First of all, cost effectiveness league tables are only useful if comparing like with like. That means health gain must be expressed in the same unit of measure, such as LYS or QALYs, and the perspective needs to be used when assessing costs. Secondly, the studies behind each ICER must be subjected to critical appraisal to ensure that they provide worthy information to decision makers. Thirdly, whilst league tables can address the issue of 'value for money' they do not really answer the question of whether an intervention is affordable. As would happen for any health funding decision, further calculations must be made to estimate the total cost of implementing a program given the size of the target population.

What is cost effective?

There are many and varied approaches by governments across the world in using cost-effectiveness league tables as a guide on what to fund and what not to fund. In the UK, the National Institute for Clinical Effectiveness (NICE) has declared that it will likely fund health interventions that fall within a range of £20,000 to £30,000. In Australia, there is no explicit threshold below which government will definitely fund a health intervention. However, where cost-effectiveness analysis is a requirement for health funding, as it is for new drugs and for population-based screening programs, past decisions provide a good guide as to what the Commonwealth regard as acceptable value for money.

Decisions made by the Pharmaceutical Benefits Advisory Committee (PBAC) [where cost effectiveness data is a legal requirement] on whether a drug should be listed on the government price subsidy scheme (the PBS) suggest that the government is prepared to fund a new drug where the cost per LYS is below $42,000 (in 1999 prices). Above $76,000 per LYS and a drug is very unlikely to be listed on the PBS[1].

Commonwealth decisions to fund population-based screening programs such as breast cancer, bowel cancer and cervical cancer screening ***suggest that a cost per LYS below $40,000 is regarded as acceptable***.

Prevention

To the best of our knowledge an up to date cost effectiveness league table for prevention programs in Australia is not available. Furthermore, it is not possible to assemble a meaningful league table based solely on the rather limited published cost effectiveness studies of prevention programs conducted in Australia. A key question for any policy maker is not just whether to fund a prevention program but the scale or size of the program. For that, there needs to be a systematic approach to modelling all the prevention options, taking into account scale and scope. In this context, scope would reflect the possible mix of prevention programs that might be funded from a notional ‘health prevention’ budget.

References

1. George B, Harris A, Mitchell A. Cost-effectiveness analysis and the consistency of decision making. *Pharmacoeconomics* 2001;19:1103-09.

B Reviews of the cost effectiveness of urban planning approaches that maximise opportunities for physical activity participation.

Alan Shiell

University of Calgary

Physical Inactivity

Physical inactivity is a major cause of chronic disease in Australia. Fewer than 50% of adults in Australia are sufficiently active to derive a health benefit[1]. Physical inactivity ranks second only to tobacco use in terms of its adverse effects on health[2]. It is responsible for more than 8,000 deaths each year, of which nearly one fifth occur before the age of 70 years, causing more than 77,000 potential years of life lost[3]. The annual costs of treating diseases related to physical inactivity exceed $370 million[4].

The causes of physical inactivity are multifactorial but there is growing evidence of the effect that the built environment has on activity levels. The urban form (i.e. street layout, presence and quality of pavements, the scale of development and types of land-use patterns) can encourage or discourage walking and cycling and is therefore an important background determinant of physical activity and health.

Evidence of effectiveness

There is growing evidence of the *association* between features of the built environment and levels of activity, in particular on walking and cycling. People walk and cycle more if they live in neighbourhoods characterised by a grid-style layout (which gives choice of route), green spaces and variety and mix of use at the scale of the block and the neighbourhood and with footpaths that are continuous and high quality[5-10].

A recent systematic review of this evidence identified 12 studies that had evaluated the impact on physical activity of pedestrian-friendly, community-scale urban design and land-use policy[11]. No formal synthesis of the results was undertaken but the authors show that the results are generally consistent with the suggestion that pedestrian-friendly neighbourhoods are associated with higher levels of physical activity. They conclude that there is 'sufficient evidence' to implement urban design and land use policies.

However, the evidence that is available is all cross-sectional and so it is possible that the observed relationship owes more to self-selection bias[12]. That is, that people who like to walk select into more walkable neighbourhoods. The evidence in this respect is mixed. One study finds that the relationship between urban sprawl and obesity disappears when one controls for selection[13], but there are two studies suggesting the opposite: that the relationship between urban features and physical activity is robust to efforts to control for selection[14,15].

Cost Effectiveness

The only evidence on the cost-effectiveness of urban planning approaches relates to the development of cycle paths in the US[16-18] and in Norway[19]. This finds cycle paths to be a low cost way of encouraging physical activity and, even in the most pessimistic scenarios, the cost of the pathways is more than offset by the value of reductions in the use of medical services (with benefit to cost ratios in excess of 1.65). There are at least two economic evaluations of the effects of neighbourhood walkability on physical activity in progress though, one in Canada and one in Western Australia.

Conclusion

Pedestrian and cycle-friendly urban planning initiatives represent a promising approach to increasing physical activity. They have the potential to promote health, and reduce demands on the health care sector. They also offer potential for wider ranging social benefits including more sustainable transportation choices, improved road safety, improved air quality, and increased social connectedness and sense of community. At the moment, urban design approaches represent potentially high-gain, but high risk strategies given the question marks over the direction of causation[20].

References

1. NHMRC. *Acting on Australia's weight*. Canberra: Commonwealth of Australia; 1997.
2. McGinnis JM, Foege WH. Actual causes of death in the United States. *Journal of the American Medical Association* 1993;270:2207-10.
3. Mathers C, Vos T, Stevenson CE, Begg SJ. The burden of disease an injury in Australia. *Bulletin of the World Health Organization* 2001;79:1076-84.
4. Stephenson J, Bauman A, Armstrong T, Smith B, Bellew B. *The Cost of Illness Attributable to Physical Inactivity in Australia.* Canberra: Commonwealth Department of Health and Aged Care; 2000.
5. French SA, Story M, Jeffery RW. Environmental influences on eating and physical activity. *Annual Review of Public Health* 2001;22:309-35.
6. Giles-Corti B, Donavon R. Increasing walking: the relative influence of individual, social environmental and physical environmental factors. *American Journal of Public Health* 2003;93:1583-9.
7. Saelens BE, Sallis JF, Frank LD. Environmental correlates of walking and cycling: findings from the transportation, urban design and planning literatures. *Annals of Behavioural Med*icine 2003;25:80-91.
8. Ewing R, Schmid T, Killingsworth R, Zlot A, Raudenbush S. Relationship between urban sprawl and physical activity, obesity & morbidity. *American Journal Health Promotion* 2003;18:47-57.
9. Lopez R. Urban sprawl and the risk for being overweight or obese. *American Journal of Public Health* 2004;94:1574-9.
10. Saelens BE, Sallis JF, Black JB, Chen D. Neighborhood based differences in physical activity: an environment scale evaluation. *American Journal of Public Health* 2003;93:1552-8.
11. Heath GW, Brownson RC, Kruger J, Miles R, Powell KE, Ramsey LT. The effectiveness of urban design and land use and transport policies and practices to increase physical activity: a systematic review. *Journal of Physical Activity and Health* 2006;3(Suppl 1):S55-S76.
12. Oakes JM. The (mis)estimation of neighborhood effects: causal inference for a practicable social epidemiology. *Social Science and Medicine* 2004;58:1929-52.
13. Eid J, Overman HG, Puga D, Turner MA. *Fat City: Questioning the Relationship between Urban Sprawl and Obesity*. Toronto: University of Toronto, Department of Economics Working Paper; 2006.

14. Handy S, Cao XY, Mokhtarian P. Correlation or causality between the built environment and travel behavior? Evidence from Northern California. *Transportation Research Part D: Transport and Environment* 2005;10:427-44.
15. Schwanen T, Mokhtarian PL. What if you live in the wrong neighborhood? The impact of residential neighborhood type dissonance on distance traveled. *Transportation Research Part D: Transport and Environment* 2005;10:127-51.
16. Wang G, Macera CA, Scudder-Soucie B, Schmid T, Pratt M, Buchner D. A cost-benefit analysis of physical activity using bike/pedestrian trails. *Health Promotion Practice* 2005;6:174-9.
17. Wang G, Macera CA, Scudder-Soucie B, Schmid T, Pratt M, Buchner D. Cost-effectiveness of bicycle/pedestrian trail development in health promotion. *Preventive Medicine* 2004;38:237-42.
18. Wang G, Macera CA, Scudder-Soucie B, Schmid T, Pratt M, Buchner D, Heath G. Cost analysis of the built environment: the case of bike and pedestrian trails in Lincoln, Neb. *American Journal of Public Health* 2004;94:549-553.
19. Saelensmide K. *Walking and cycling track networks in Norwegian cities. Cost benefit analyses including health effects and external costs of road traffic*. Report # 567/2002. Oslo: Institute of Transport Economics, Norwegian Centre for Transport; 2002.
20. Hawe P, Shiell A. Preserving innovation under increasing accountability pressures: the health promotion investment portfolio approach. *Health Promotion Journal of Australia* 1995;5:4-9.

C Reviews of the cost effectiveness of community-based falls prevention interventions for the over 55s, with a focus on physical activity interventions.

Glenn Salkeld

University of Sydney

Falls prevention

About 30% of people aged over 65 years and living in the community fall each year[1]. The rate of falls is higher in institutions. About 60% of people living in institutions will have at least one fall per year. Falls in older people are a significant source of morbidity and mortality. NSW Health Department statistics show that in 1997-98 16,951 people aged over 65 were hospitalized consuming just over 200,000 public hospital bed days in that year[2]. By 2030 the projected demand for public hospital bed days due to falls is expected to nearly double to 400,000[2].

Evidence – amenability to prevention

Preventing falls

Gillespie and colleagues conducted a systematic review of interventions for preventing falls in elderly people[1]. This review, updated in 2006, is held on the Cochrane Database of Systematic Reviews. The review studies published trials that examine the efficacy of interventions. The following interventions have been identified by Gillespie as 'likely to be beneficial'[1]:

- Multidisciplinary interventions targeting multiple risk factors, including muscle strengthening combined with balance retraining;
- Home/institution hazard assessment and home/institution modification for people with a history of falling;
- Withdrawal of psychotropic medication;
- Cardiac pacing for fallers with cardioinhibitory carotid sinus hypersensitivity; and
- Tai Chi exercise.

Ameliorating the effect of a fall

External hip protectors have been shown to reduce the incidence of hip fractures amongst older people living in institutions[1] although there is no evidence that it is effective in frail older people who live independently in the community.

Falls prevention – what works?

Exercise/physical therapy

37% relative risk reduction in the number of individuals sustaining a fall over a one year period and 31% over two years.

Home hazard reduction

Amongst those people with a history of falling in the year prior to randomisation there was a ***34% relative risk reduction*** in the number of individuals sustaining two or more falls There was no significant difference amongst those people who did not have a history of falls.

Medication withdrawal

The combined effect of an individual exercise program and a placebo-controlled medication withdrawal program produced a ***66% reduction in the overall risk of falls***

Cost Effectiveness

A cost effectiveness analysis of a home hazard reduction program found that the mean cost per fall prevented for those with a fall in the previous year was $3,980 (1997 prices) [3].

A cost effectiveness study on a nurse delivered home exercise program to prevent falls yielded a cost per fall prevented of NZ$1,803 (at 1998 prices) and NZ$155 per fall prevented when hospital costs averted were considered[4].

References

1. Gillespie LD, Gillespie WJ, Robertson MC, Lamb SE, Cumming RG and Rowe BH. Interventions for preventing falls in elderly people. *Cochrane Database of Systematic Reviews* 2003;(4):CD000340. http://www.cochrane.org/reviews/en/ab000340.html Accessed 14th March 2007
2. Moller J. Changing health resource demands for injury due to falls in an ageing population. *NSW Public Health Bulletin* 2002;13(1-2):3-6.
3. Salkeld G, Cumming RG, Oneill E et al. The cost effectiveness of a home hazard reduction program to reduce falls among older persons. *Australian and New Zealand Journal of Public Health* 2000;24:265-71.
4. Robertson MC, Devlin N, Gardner MM, Campbell AJ. Effectiveness and economic evaluation of a nurse delivered home exercise program to prevent falls: 1: Randomized controlled trial. *British Medical Journal* 2001;322:1-6.

D Reviews of the cost effectiveness of programs to establish healthy eating habits and increase physical activity amongst children in childcare settings.

Stephen Jan

The George Institute

Overweight and obesity amongst preschool children

It is estimated that 15.2% of Australian preschool children are overweight and that 5.5% are obese. Furthermore, a non-English speaking background, particularly for boys, as well as socioeconomic disadvantage and Aboriginality, are strong predictors of higher body mass index (BMI)[1.]

Evidence – amenability to prevention

One study conducted in Thailand involved a kindergarten based intervention comprising exercise classes three times a week in addition to the usual curriculum. Those receiving the intervention achieved modest improvements above those achieved in the control groups in the level of obesity at 30 weeks and 6 months (as measured by triceps skinfold) but such differences were unlikely to be clinically significant[2,3].

In the US an intervention for preschoolers known as 'Hip-hop to Health Jr' targeted both children and parents through a 14 week diet and physical activity curriculum. Whilst the intervention was found to be effective in reducing increase in BMI at 1 and 2 year follow-up when targeting black children[4], no difference in BMI outcomes was found when the intervention was deployed targeting Latino children[5].

Return on investment

No economic evaluation evidence was found for interventions of this type.

References

1. Wake M, Hardy P, Canterford L, Sawyer M, Carlin JB. Overweight, obesity and girth of Australian preschoolers: prevalence and socio-economic correlates. *International Journal of Obesity (Lond)* 2006 Dec 5; [Epub ahead of print]
2. Mo-suwan L, Pongprapai S, Junjana C, Puetpaiboon A. Effects of a controlled trial of a school-based exercise program on the obesity indexes of preschool children *American Journal of Clinical Nutrition* 1998;68:1006-11.
3. Summerbell CD, Waters E, Edmunds LD, Kelly S, Brown T, Campbell KJ. Interventions for preventing obesity in children. *Cochrane Database of Systematic Reviews* 2005;(3):CD001871.
4. Fitzgibbon ML, Stolley MR, Schiffer L, Van Horn L, KauferChristoffel K, Dyer A. Two year follow-up results for Hip-Hop to Health Jr.: a randomized controlled trial for overweight prevention in preschool minority children *Journal of Pediatrics* 2005;146:618-25.
5. Fitzgibbon ML, Stolley MR, Schiffer L, Van Horn L, KauferChristoffel K, Dyer A. Hip-Hop to Health Jr. for Latino Preschool Children. *Obesity* 2006;14:1616-25.

E

Reviews of the cost effectiveness of programs to establish healthy eating habits and increase physical activity amongst children and adolescents in school settings.

Stephen Jan

The George Institute

Overweight and obesity amongst school-aged children

It was estimated in 1995 that 15% of boys and 15.8% of girls aged between 2 and 18 years were overweight, and that an additional 4.5% of boys and 5.3% of girls were obese across Australia. Such rates have been increasing over the years. In comparison, in 1985, 9.3% of boys and 10.6% of girls were overweight and 1.4% of boys and 1.2% of girls were obese[1]. More recently, in NSW, up to 33% of both boys and girls aged 9-12 were found to be overweight or obese[2].

Evidence – amenability to prevention

A study in the UK where students aged 7-11 were given classes to promote drinking water and eating fruit in preference to soft drinks found, at 12 months, some change in self reported consumption of soft drinks but no statistically significant change in BMI or levels of obesity[3].

The Active Programme Promoting Lifestyle in Schools (APPLES) study was based on a school level intervention of teacher education, modification of school meals and physical exercise for one year and was aimed at children aged 7-11. At 12 months follow-up, no change in BMI was found although there were higher levels of vegetable consumption found in the intervention group[4].

An alternative approach to weight reduction is to discourage sedentary behaviours – particularly watching TV and playing video games. In a study conducted in the US, a series of such lessons incorporated into the standard curriculum for children aged 8-10 years were trialled. Promisingly, the study reported favourable outcomes at 6

month follow-up in terms of BMI, triceps skinfold, waist circumference and hip to waist ratio[5].

The 'Planet Health' study in the US, targeting children aged 11 to 12, was based on workshops to encourage physical activity with a major emphasis on reducing TV viewing. At 18 months follow-up, a significant effect was detected in lower levels of obesity amongst girls receiving the intervention. No such effect was found in boys. Amongst girls, TV viewing was found to be a strong predictor of obesity prevalence[6].

Generally speaking there is little evidence of interventions leading to changes in the weight status of children[7]. Even studies with relatively long follow-up (3 years) and demonstrated changes in knowledge and behaviour have been unable to demonstrate improvements in weight[8]. One possible exception to this seems to be interventions aimed at discouraging TV and video games where some promising results have been found at up to 18 months[5,6]. It is possible, however, that this link between obesity and watching television is explained by a tendency for children to snack on energy dense foods during this activity[9].

Return on investment

The evidence of cost effectiveness is mixed. Interventions that have been found to be not cost-effective are a 'Walking School Bus' program for primary school children and an active transport program for primary school children. Those that have been found to be cost-effective are a multifaceted school based intervention without active physical education. Programs found to be cost-effective and cost-saving are[10]:

- A school based health promotion strategy to reduce TV viewing;
- A multi-faceted school-based intervention with additional active physical exercise;
- A school based focused nutrition education to reduce the consumption of sweetened carbonated beverages; and
- A multi-faceted school based intervention targeted at overweight or obese children (age 7-10 years).

These studies were based on modelled projections of costs and outcome. A major limitation of these is the assumption employed in all that a reduction in BMI found in the relevant studies would be maintained throughout the life of the child. Likewise, a

separate the economic evaluation of the 'Planet Health' program assumed continued constant lifetime intervention effect casting serious doubts over the finding that the intervention is cost-effective[11,12].

References

1. Margarey A, Daniels L, Boulton T. Prevalence of overweight and obesity in Australian children and adolescents: reassessment of 1985 and 1995 data against new standard international definitions. *Medical Journal of Australia* 2001;174:561-9.
2. Booth M, Okely AD, Denney-Wilson E, Hardy L, Yang B, Dobbins T. *NSW Schools Physical Activity and Nutrition Survey (SPANS) 2004: Full Report*. Sydney: NSW Department of Health; 2006.
3. James J, Thomas P, Cavan D, Kerr D. Preventing childhood obesity by reducing consumption of carbonated drinks: cluster randomised controlled trial. *British Medical Journal* 2004;328:1237.
4. Sahota P, Rudolf MCJ, Dixey R, Hill AJ, Barth JH, Cade J. Randomised controlled trial of primary school based intervention to reduce risk factors for obesity. *British Medical Journal* 2001;323:1029-32.
5. Robinson TN. Reducing children's television viewing to prevent obesity: a randomized controlled trial. *Journal of the American Medical Association* 1999;282:1561–7.
6. Gortmaker S, Peterson K, Wiecha J, et al. Reducing obesity via a school-based interdisciplinary intervention among youth. *Archives of Pediatric Adolescent Medicine*1999;153:409-418.
7. Summerbell CD, Waters E, Edmunds LD, Kelly S, Brown T, Campbell KJ. Interventions for preventing obesity in children. *Cochrane Database of Systematic Review* 2005;(3):CD001871.
8. Caballero B, Clay T, Davis SM et al. Pathways: A school-based, randomized controlled trial for the prevention of obesity in American Indian schoolchildren. *American Journal of Clinical Nutrition* 2003;78:1030-8.
9. Wake M, Salmon L, Waters E, Wright M, Hesketh K. Parent-reported health status of overweight and obese Australian primary school children: a cross-sectional population survey. *International Journal of Obesity* 2002;26:717–724.
10. Victorian Department of Human Services. *ACE-Obesity. Assessing Cost-effectiveness of obesity interventions in children and adolescents: Summary of Results*. Melbourne, Victoria: Victorian Government Department of Human Services; 2006. http://www.health.vic.gov.au/healthpromotion/downloads/ace_obesity.pdf
11. Dalziel K, Segal L. Uncertainty in the economic analysis of school-based obesity prevention programs: urgent need for quality evaluation. *Obesity* 2006;14:1481-2.

12. Wang LY, Yang Q, Lowry R, Wechsler H. Economics analysis of a school-based obesity prevention program. *Obes Res* 2003;11:1313-24.

F Reviews of the cost effectiveness of integrated multi-strategic community-wide programs to prevent and or reduce obesity in children and adolescents.

Stephen Jan

The George Institute

Physical activity and nutrition in children and adolescents

In 2004, 75% of boys and girls aged 11-16 years reported at least one hour of moderate to vigorous physical activity per day. Rates of physical activity in NSW amongst children have tended to increase since 1985. However up to 40% of high school students do not eat breakfast and 60% of boys and 40% of girls drink more than 250 mls of soft drink a day[1].

Evidence – amenability to prevention

Integrated approaches to reducing obesity fall into two categories: vertical and horizontal. Horizontal integration involves partnerships and collaborations across sectors and between organisations. Examples of these include large scale policy programs both at the local level, such as the Penrith food project[2], and international initiatives, such as the World Health Organization INTERHEALTH program[3]. The types of policies these include are media regulation, increasing the 'walkability' of neighbourhoods and subsidising of healthy foods. Vertical integration involves intervening at a number of levels in the same setting – for instance within schools, the inclusion of nutrition education along with providing healthier food in canteens[4]. Such integration can occur within schools, worksites, and the community more generally. An example of this type of intervention within schools is the 'Planet Health' intervention discussed above (page 20)[5.]

Overall the evidence for horizontal and vertical integration is inconclusive – particularly in terms of weight status – although for various programs there is evidence of impact on behavioural and knowledge measures. Tellingly, many of the

studies did not factor in outcome evaluation or were not designed to demonstrate intervention effect (RCTs)[4.]

Return on Investment

Active after school community program – a vertical program which is an intervention involving the appointment of program co-ordinators who, in conjunction with local sporting clubs, provide a 2-3 one hour sessions each week for 8 weeks, to develop a physical activity program and nutrition education. This was found to be not cost effective.

Two integrated interventions involving GPs have also been evaluated – the first, a family based GP-mediated intervention targeting overweight and moderately obese children, based on training sessions for GPs and identification and recruitment of at risk patients was found to be cost-effective whilst a family based targeted program for obese children based on opportunistic recruitment of patients and involving counselling and medical examination was found to be both cost effective and cost saving. Again, the tenuous assumption underlying these studies included the maintenance of reduction in BMI maintained over lifetime[6].

References

1. Booth M, Okely AD, Denney-Wilson E, Hardy L, Yang B, Dobbins T. *NSW Schools Physical Activity and Nutrition Survey (SPANS) 2004: Full Report*. Sydney: NSW Department of Health; 2006.
2. Webb, K, Hawe, P, Noort, M. Collaborative intersectoral approaches to nutrition in a community on the urban fringe. *Health Education and Behaviour* 2001;65:499-543.
3. Alberti KG. Interhealth: the WHO integrated programme for community health in non-communicable diseases. *Journal of the Royal College of Physicians of London* 1993;27:65-9.
4. McLaren L, Shiell A, Ghali L, Lorenzetti D, Rock M, Huculak S. *Are Integrated Approaches Working to Promote Healthy Weights and Prevent Obesity and Chronic Disease? A Review and Synthesis of the Literature with Suggestions and Recommendations for Policy and Decision Makers*. Calgary: Centre for Health & Policy Studies, Dept Community Health Sciences, University of Calgary; 2004. http://www.chaps.ucalgary.ca/Working_papers/Report_BRIEF_McLaren.pdf
5. Gortmaker S, Peterson K, Wiecha J, et al Reducing obesity via a school-based interdisciplinary intervention among youth *Archives of Pediatrics and Adolescent Medicine* 1999;153:409-18.
6. Victorian Department of Human Services. *ACE-Obesity. Assessing Cost-effectiveness of obesity interventions in children and adolescents: Summary of Results*. Melbourne, Victoria: Victorian Government Department of Human Services; 2006. http://www.health.vic.gov.au/healthpromotion/downloads/ace_obesity.pdf

G

Reviews of the cost effectiveness of school based drug and alcohol prevention programs.

Marian Shanahan and Laura Vogl

University of New South Wales

Universal School Based Drug Prevention Programs

In Australia, alcohol dependence and harmful use account for 11.3% of total disease burden in the 15-24 year age group[1], with heroin dependence and harmful use accounting for a further 6%. Despite the sale of alcohol being restricted to those over the age of 18, by early adolescence the majority of young people have tried alcohol[2], with almost half of teenagers consuming alcohol weekly and approximately 20% placing themselves at risk of acute harm at least monthly[3]. In the 14-19 year age group, 29.3% have used an illicit drug in their lifetime. Universal school-based drug prevention programs are one means of providing young people with preventive information and skills prior to the initiation or establishment of harmful patterns of drug use.

Evidence – amenability to prevention

The efficacy of school-based drug prevention is contentious[4-6]. Evidence from reviews which include a broad variety of school-based drug prevention programs suggest that school-based programs are effective in increasing students' knowledge of drugs and related harms, but have little impact on drug use behaviour[5,6]. However, reviews which focus on school-based drug prevention programs based specifically on the social influence and competence-enhancement model have been able to demonstrate significant changes in drug use behaviour[4,6,7].

The majority of school-based drug prevention research has been conducted in the United States where the desired goal of prevention program is abstinence[5,7]. The focus on abstinence as the desired goal of such programs may not be as applicable to the Australian setting, where the goal of the National Drug Strategy is one of harm minimisation. However, recent programs which have allowed for or focused upon

harm minimisation outcomes have demonstrated considerable reductions in drug use and related harms[8-12].

Return on Investment

Health Benefits

Reviews of social influence and competence enhancement programs have demonstrated 40-80% reductions in drug use. [12] The actual effect sizes for these programs are small (0.14-0.19) and without ongoing intervention these effects gradually decay over time[13,14].

Costs and cost effectiveness

One US program that estimated the total costs of providing a school-based tobacco-use prevention program to 1234 seventh grade students reports that the costs were $16,403 (USD 1990). Costs included were training costs, class time and student materials. The program consisted of 10 lessons in the seventh grade followed by two booster sessions in the eighth grade. This study, which uses decision analysis methods to model delayed uptake of smoking, costs, cost savings, and life years saved related to a decrease in smoking rates, reports a saving of $13,316 (USD 1990) per life year saved[15]. This paper, while somewhat dated, provides a credible assessment of the direct costs of the program, and potential savings related to the prevention of taking up smoking.

Caulkins and colleagues[16] use a different methodology to assess the social benefits from reduced use of illicit drugs and alcohol from school-based prevention programs. Using mathematical models, they estimate the quantity of each drug used by the average person, multiply that by reduction in use achieved by school based prevention programs, and then multiply that by published social costs averted. It is this final step which generates the social value of drugs not used. They estimate that the social benefit per prevention participant is $840 compared to their estimate of $150 cost per participant (for 30 session curriculum) to provide the school based prevention programs (USD 2001). While this paper uses a number of assumptions in its modelling approach, is based in the US context, and again is somewhat dated, it none the less provides an example of the positive impact that an educational based program may have on health, crime, and social welfare.

Washington State Institute for Public Policy assessed how various early intervention programs for youth addressed seven outcomes in which they were interested, to determine it there was credible evidence; they then estimated the comparative benefits and costs of each program by constructing a cost benefit model. They found that for youth substance abuse prevention programs the benefits per dollar of costs ranged from $5 to $100 (USD 2003)[17].

Limitations

No Australian economic costing or economic analyses were located. As the American and Australian health care, criminal justice and educational systems are noticeably different, as are the use of illicit drugs, we have made no attempt to adjust these data to the Australian context but present them as the type of research that has occurred elsewhere.

References

1. Mathers C, Vos T, Stevenson C. *The Burden of Disease and Injury in Australia*. Canberra: Australian Institute of Health and Welfare; 1999.
2. McAllister I. *Alcohol Consumption among Adolescents and Young Adults*. Canberra: Research School for Social Sciences, Australian National University; 2003.
3. AIHW. *Statistics on Drug Use in Australia 2004*. AIHW Cat. No. PHE 62. Canberra: Australian Institute of Health and Welfare; 2005.
4. Tobler NS, Roona MR, Ochshorn P, Marshall DG, Streke AV, Stackpole KM. School-based adolescent drug prevention programs: 1998 meta-analysis. *journal of primary prevention* 2000;20:275-336.
5. Foxcraft DR, Ireland D, Lister-Sharp D, Lowe G, Breen R. Primary prevention for alcohol misuse in young people. *Cochrane Database of Systematic Reviews* 2002;(3):CD003024.
6. Faggiano F, Vigna-Taglianti FD, Versino E, Zambon A, Borraccino A, Lemma P. School-based prevention for illicit drugs' use*. Cochrane Database of Systematic Reviews* 2005;(2):CD003020.
7. White D, Pitts M. *Health Promotion with Young People for the Prevention of Substance Misuse.* London: NHS Centre for Reviews and Dissemination; 1997.
8. McBride N, Farringdon F, Midford R, Meuleners L, Phillips M. Harm minimization in school drug education: Final results of the School Health and Alcohol Harm Reduction Project (SHAHRP). *Addiction* 2004;99:278-91.
9. Shope JT, Copeland LA, Maharg R, Dielman TE. Effectiveness of a high school alcohol misuse prevention program. *Alcoholism, Clinical and Experimental Research* 1996;20:791-8.
10. Griffin KW, Botvin GJ, Nichols TR, Doyle MM. Effectiveness of a universal drug abuse prevention approach for youth at high risk for substance use initiation. *Preventive Medicine* 2003;36:1-7.
11. Hansen WB, Graham JW. Preventing alcohol, marijuana, and cigarette use among adolescents: Peer pressure resistance training versus establishing conservative norms*. Preventive Medicine* 1991;20:414-30.
12. Botvin G, Griffin K. Drug Abuse Prevention Curricula in Schools. In Sloboda Z, Bukoski WJ (Eds), *Handbook of Drug Abuse Prevention: Theory, Science and Practice.* New York: Kluwer Academic/Plenum Publishers; 2003.
13. White D, Pitts M. Educating young people about drugs: A systematic review. *Addiction* 1998,93:1475-87.

14. Flay B. Approaches to substance use prevention utilizing school curriculum plus environment change. *Addictive Behaviors* 2000;25(6):861-85.
15. Wang L, Crossett L, Lowry R, Sussman S, Dent C. Cost-effectiveness of a school-based tobacco use prevention program. *Archives of Pediatric Adolescent Medicine* 2001;155:1043-9.
16. Caulkins J, Pacula S, Paddock R, Chiesa J. What we can – and cannot – expect from school-based drug prevention. *Drug and Alcohol Review* 2004;23:79-87.
17. Aos A, Lieb R, Mayfield J, Miller M, Pennucci A. *Benefits and Costs of Prevention and Early Intervention Programs for Youth*. Olympia, WA: Washington State Institute for Public Policy; 2004.

H Reviews of the cost effectiveness of social marketing campaigns to prevent overweight and obesity (physical activity) by life stage (children, adolescents, parents and adults and older people).

Stephen Jan

The George Institute

Social marketing

The 2004 NSW SPANs survey provided some background insights into the influences on diet and physical activity of children. Some of the more notable findings were: that the positive influence on dietary choices of family tended to decline with the age of the child; that fast foods were often consumed for convenience rather than value for money or advertising; and only 20% of children thought drinking soft-drink made them feel good[1].

Evidence – amenability to prevention

A cross country study (USA, Australia and eight European countries) based on ecological data found some evidence to suggest that food advertising affects the dietary behaviour of children. It found a strong positive association between proportion of children overweight and number of food advertisements per hour of energy dense food – correlation coefficient of 0.81; $p<0.005$[2].

In the same study a weaker correlation was detected between the number of children overweight and the number of advertisements encouraging healthier diets (Correlation co-efficient of -0.51; $p<10$) [2].

Return on investment

A modelled economic evaluation was conducted of a regulatory intervention to reduce TV advertisements of high fat and/or sugar foods and beverages to children up to the age of 14. The intervention was found to be cost effective and cost saving

but, like other economic evaluations based on long term obesity outcomes, subject to the tenuous assumption that reductions in BMI found within the timescale of relevant studies could then be sustained over a lifetime[3].

References

1. Booth M, Okely AD, Denney-Wilson E, Hardy L, Yang B, Dobbins T. *NSW Schools Physical Activity and Nutrition Survey (SPANS) 2004: Full Report*. Sydney: NSW Department of Health; 2006.
2. Lobstein T, Dibb S. Evidence of a possible link between obesogenic food advertising and child overweight. *Obesity Reviews* 2005;6:203–8.
3. Victorian Department of Human Services. *ACE-Obesity. Assessing Cost-effectiveness of obesity interventions in children and adolescents: Summary of Results*. Melbourne, Victoria: Victorian Government Department of Human Services; 2006. http://www.health.vic.gov.au/healthpromotion/downloads/ace_obesity.pdf

I Reviews of the cost effectiveness of community-based diabetes prevention strategies including intensive lifestyle interventions for those at high risk.

Philip Clarke

University of Sydney

Type 2 Diabetes

Diabetes is a major and growing health problem in Australia. It is associated with reduced life expectancy and increases in morbidity from cardiovascular disease and other complications (eg blindness, kidney failure). The disease imposes a considerable burden on the Australian community. For example, a recent study has shown that people with diabetes incur on average 40% more hospital costs each year than a comparable group without diabetes[1]. Diabetes has been recognised in its nomination as one of the national health 'priority' areas by the Commonwealth Government[2].

Evidence – amenability to prevention

Interventions to delay or prevent diabetes have the potential to improve the health of the population and may reduce long-term health care costs associated with the disease.

Lifestyle interventions to prevent diabetes consist of either dietary advice, exercise, or a combination of the two. These interventions are normally targeted at people with impaired glucose tolerance (IGT), which occurs when the blood glucose level is higher than normal, but not high enough to be classified as diabetes. IGT is an established risk factor for developing diabetes[3].

The main evidence for the effectiveness of these interventions comes from randomised controlled trials that have been conducted overseas, the largest of which is the Diabetes Prevention Program (DPP)[4] which involved a healthy low fat diet and moderate physical activity such as brisk walking. The DPP used an intensive lifestyle

intervention taught by case managers on a one-to-one basis. This was followed by monthly group and individual sessions over the duration of the study. Other studies of lifestyle interventions have been conducted in Finland[5] and Japan[6], and at least one small study has been undertaken in Australia[6]. Typically these studies follow patients for between two and four years.

A recent synthesis of the evidence of all available lifestyle interventions for preventing diabetes concluded that lifestyle interventions such as diet and exercise reduced the risk of progressing to diabetes by up to 50% [6].

Cost Effectiveness

Based on benefits observed within the DPP trial, the cost per quality adjusted life year was around $US51,600 for lifestyle intervention[7]. However, as diabetes is a chronic disease, a comprehensive analysis needs to extrapolate from a study like the DPP to understand the consequences of lifestyle modification over the patients' remaining lifetime.

There have been two major studies examining the cost-effectiveness of lifestyle interventions primarily based on extrapolating results of the DPP. These studies which were conducted independently draw quite different conclusions regarding cost-effectiveness. The first estimates the cost-effectiveness to be around $US1100 per quality adjusted life year (QALY). If this is the case, lifestyle interventions represent outstanding value for money[8]. However a second analysis has recently been published, which is also based on extrapolating results from the DPP[9]. This analysis estimates lifestyle interventions to be much less cost-effective with the cost per QALY of around $US62,000 and concludes that the intensive lifestyle modification program used in the DPP may be too expensive to implement in practice.

Why do two health economic studies based on the same evidence draw such different conclusions about the potential costs and benefits of lifestyle interventions to prevent diabetes? The main reason is that the DPP only followed patients over a period of three years and so the long-term benefits need to be obtained through extrapolation. There is considerable uncertainty as to what rate people progress to diabetes and whether such lifestyle modification simply delays the onset of diabetes, or leads to long-term prevention. These extrapolations require models that are based

on assumptions. Different assumptions will lead to different conclusions about whether lifestyle interventions can considered cost-effective.

Another issue that will influence cost-effectiveness is whether the results of interventions conducted in studies such as the DPP could be replicated in a “real world” setting. In particular the DPP involved intensive one-on-one counselling which may be difficult to implement in practice.

Conclusions

Evidence largely based on studies conducted overseas has demonstrated that lifestyle modification such as diet and exercise can delay and potentially prevent diabetes. The cost-effectiveness of these interventions is more uncertain as it is based on extrapolation of the long-term benefits of prevention.

References

1. Clarke P, Kelman C, Colagiuri S. Factors influencing the cost of hospital care for people with diabetes in Australia. *Journal of Diabetes Complications* 2006; 20:349-55.
2. Commonwealth Department of Health and Ageing. *National Diabetes Strategy 2000-2004*. Canberra: Commonwealth of Australia; 1999.
3. Edelstein SL, Knowler WC, Brain RP. Predictors of progression from impaired glucose tolerance NIDDM: an analysis of six prospective studies. *Diabetes* 1997; 46:701-10.
4. Knowler WC, Barrett- Connor E, Fowler SE, Hamman RF, Lachin JM, Walker EA, et al. Reduction in the incidence of type 2 diabetes with lifestyle intervention or metformin. *New England Journal of Medicine* 2002;346:393-403.
5. Tuomilehto J, Lindstrom J, Eriksson JG, Valle TT, Hamalaine H, Ilanne-Parikka P, et al. Prevention of type 2 diabetes mellitus by changes in lifestyle among subjects with impaired glucose tolerance. *New England Journal of Medicine* 2001;344:1343-50.
6. Gillies CL. Abrams KR. Lambert PC, Cooper NJ, Sutton AJ, Hsu RT, Khunti K. Pharmacological and lifestyle interventions to prevent or delay type 2 diabetes in people with impaired glucose tolerance: systematic review and meta-analysis. *British Medical Journal* 2007;334:299.
7. Diabetes Prevention Program Research Group. Within-trial cost-effectiveness of lifestyle intervention or metformin for the primary prevention of type 2 diabetes. *Diabetes Care* 2003;26:2518-23.
8. Diabetes Prevention Program Research Group. The cost-effectiveness of lifestyle modification or metformin in preventing type 2 diabetes in adults with impaired glucose tolerance. *Annals of Internal Medicine* 2005;5:323-32.
9. Eddy DM, Schlessinger L, Kahn R. Clinical outcomes and cost-effectiveness of strategies for managing people at high risk for diabetes. *Annals of Internal Medicine* 2005;143:251-64.

J

Reviews of the cost effectiveness of telephone counselling as smoking cessation measure.

Marian Shanahan

University of New South Wales

Smoking

Tobacco smoking is one of the largest causes of premature and preventable deaths in Australia. While the smoking rates have continued to decline, 20% of all men and 18% of all women still smoke regularly[1]. Tobacco related illnesses account for an estimated 19,000 annual deaths, representing 80% of all drug-or alcohol-related deaths[2].

Evidence – amenability to prevention

There is high-quality evidence that the disease risks from smoking are reduced following smoking cessation[3]. There is also good evidence that repeated telephone support counselling with call back is an effective quit strategy for smokers who are ready to quit (NHMRC Level II) and some evidence of moderately effectiveness even in those who are not yet ready to quit (NHMRC Level IV)[4]. Additionally, in the absence of contraindications, pharmacotherapy should be offered to all motivated smokers who have evidence of nicotine dependence with the choice of pharmacotherapy depending on clinical suitability and patient choice (NHMRC Level II) [4] with evidence that the addition of proactive telephone counselling programs to pharmacotherapies improves the effectiveness of pharmacotherapies[5,6].

Return on Investment

Health Benefits

For every 1000 individuals who take up telephone counselling, 40 additional smokers would successfully quit smoking compared to brief advice provided by a general

practitioner[5-9]. Taking relapse rates into account[10] an additional 90 life years would be saved.

Costs

The direct costs of providing interactive telephone counselling to a 1000 people was found to be $30,290 (2003 AUD)[11].

Cost Effectiveness

The cost of providing telephone counselling compared to the provision brief interventions by general practitioners is a cost saving of $86 for every additional LYS (this was estimated from work by Shearer and Shanahan 2006).

The addition of proactive telephone counselling to the pharmacotherapies, bupropion or NRTs costs an additional $38 or $50 per LYS respectively. So whether telephone counselling is provided on its own or accompanying bupropion or nicotine replacement therapies it provides value for money.

References

1. AIHW. *Statistics on drug use in Australia 2004*. AIHW Cat. No. PHE 62. Canberra: Australian Institute of Health and Welfare; 2005.
2. Ridolfo B, Stevenson C. *Quantification of Drug-caused Mortality and Morbidity in Australia, 1998*. Canberra: Department of Health and Welfare; 2001.
3. Skaar KL, Tsoh JY, McClure JB, Cinciripini PM, Friedman K, Wetter DW, et al. Smoking cessation: 1. An overview of research. *Behavioural Medicine* 1997;23:5-13.
4. Zwar N, Richmond R, Borland R, Stillman S, Cunningham M, Litt J. *Smoking Cessation Guidelines for Australian General Practice*. Canberra: Australian Government Department of Health and Ageing; 2004.
5. Macleod Z, Charles M, Arnaldi V, Adams I. Telephone counselling as an adjunct to nicotine patches in smoking cessation: a randomised controlled trial. *Medical Journal of Australia* 2003;179:349-52.
6. Swan G, Jack L, Curry S, Chorost M, Javitz H, McAfee T, et al. Buproprion SR and counselling for smoking cessation in actual practice: predictors of outcome. *Nicotine Tobacco Research* 2003;5:911-21.
7. Fiore M. Treating tobacco use and dependence: An introduction to the US Public Health Service Clinical Practice Guideline. *Respiratory Care* 2000;45:1196-9.
8. Silagy C, Lancaster T, Stead L, Mant D, Fowler G. Nicotine replacement therapy for smoking cessation. *Cochrane Database of Systematic Reviews* 2004;(3):CD000146.
9. Stead L, Lancaster T. Group behaviour therapy programmes for smoking cessation. *Cochrane Database of Systematic Reviews* 2005;(2):CD001007.
10. Woolacott N, Jones L, Forbes C, Mather L, Sowden A, Song F, et al. *A rapid and systematic review of the clinical and cost effectiveness of bupropion SR and nicotine replacement therapy (NRT) for smoking cessation*. York, University of York: NHS Centre for Reviews and Dissemination; 2002.
11. Shearer J, Shanahan M. Cost effectiveness analysis of smoking cessation interventions. *Australian and New Zealand Journal of Public Health* 2006;30:428-34.

K

Reviews of the cost effectiveness of screening for colorectal cancer.

Glenn Salkeld

The University of Sydney

Colorectal Cancer

In Australia, 1 in 17 males and 1 in 26 females will develop colorectal cancer (CRC) in their lifetime (up to age 75). Colorectal cancer is the second leading cause of cancer death in Australia. In 2001, 2,601 males and 2,153 females died of bowel cancer losing an average of 6.6 and 5.9 years of life for each premature death that occurred before the age of 75 years[1].

Evidence – amenability to prevention

Preventing the disease from developing

There is moderate evidence (NHMRC level III) showing that dietary change, regular physical exercise and maintaining a healthy weight could, over time, lead to substantial reduction in the incidence of CRC. This is consistent with an overall approach to prevention that emphasises modifying diet and lifestyle factors to improve health[2].

Detecting disease early

There is high level evidence (NHMRC level I) demonstrating that colorectal cancer screening using a faecal occult blood test (FOBT) can reduce disease specific premature deaths[3-7]. A FOBT tests for the presence of blood in the stool, which in turn may be a sign of a bleeding polyp or growth. The early detection and removal of precancerous polyps and growths using diagnostic procedures such as colonoscopy has been shown to reduce the rate of early deaths due to the disease. In a review of trials of FOBT screening, Towler found that: an average ***16% decrease in the rate of colorectal cancer death based on intention to screen***[10].

Screening for colorectal cancer

Return on Investment – Health Benefits

If 10,000 people aged > 50 years were offered FOBT screening every two years and at least two thirds attended for at least one test, ***8.5 deaths from colorectal cancer would be prevented over a period of 10 years***[10].

Costs

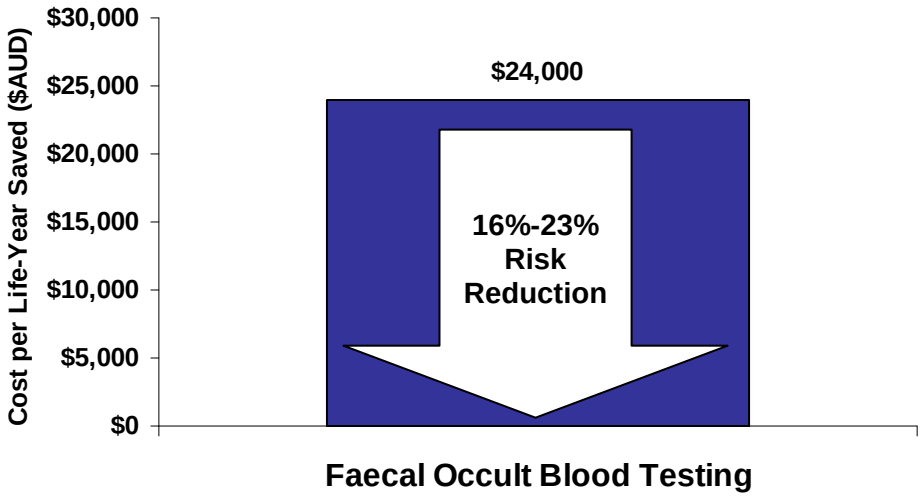
If 10,000 people aged > 50 years were offered FOBT screening every two years it would ***cost an additional $5.5 million*** on top of what is already spent on treatment of CRC and surveillance[11].

Potential harmful effects of screening

The number of colonoscopies or sigmoidoscopies performed in a screened group could range from 20 to 800 per life prolonged[10]. In review of six prospective studies of colonoscopy, about one in 1000 patients suffer perforation, three in 1000 suffer major haemorrhage, and between one and three in 10,000 die as a result of the procedure [11,12].

Cost Effectiveness

Screening for colorectal cancer is cost effective, costing $24,000 per each life year saved (LYS)[13]. The $24,000 per LYS includes the costs that would be saved in treating later stage disease.


$30,000
$25,000
$20,000
$15,000
$10,000
$5,000
$0
Cost per Life-Year Saved ($AUD)
$24,000
16%-23%
Risk
Reduction
Faecal Occult Blood Testing

References

1. Australian Institute of Health and Welfare. *Australia's Health 2006*. Canberra: AIHW; 2006.
2. Australian Cancer Network Colorectal Cancer Guidelines Revision Committee. Guidelines for the Prevention, Early Detection and Management of Colorectal Cancer. Sydney: The Cancer Council of Australia and Australian Cancer Network; 2005.
3. Mandel JS, Bond JH, Church TR et al. Reducing mortality from colorectal cancer by screening for faecal occult blood. *New England Journal of Medicine* 1993;328:1365-71.
4. Mandel JS, Church TR, Ederer F, Bond JH. Colorectal cancer mortality: effectiveness if biennial screening for faecal occult blood*. Journal of the National Cancer Institute* 1999;91:434-7.
5. Mandel JS, Church TR, Bond JH. The effect of faecal occult blood screening on the incidence of colorectal cancer. *New England Journal of Medicine* 2000;343:1603-7.
6. Hardcastle JD, Chamberlain JO, Robinson MHE et al. Randomised controlled trial of faecal occult blood screening for colorectal cancer. *Lancet* 1996;438:1472-7.
7. Kronborg O, Fenger C, Olsen J, Jorgensen OD, Sondergaard O. Randomised study of screening for colorectal cancer with faecal occult blood test. *Lancet* 1996;348:1467-71.
8. Scholefield JH, Moss S, Sufi F, Mangham CM, Hardcastle JD. Effect of faecal occult blood screening on mortality from colorectal cancer: results from a randomized controlled trial. *Gut* 2002;50:840-4.
9. Jorgensen OD, Kronborg O, Fenger C. A randomized study of screening for colorectal cancer using faecal occult blood testing: results after 13 years and seven biennial screening rounds. *Gut* 2002;50:29-32.
10. Towler, B, Irwig L, Glasziou P, Kewenter J, Weller D, Silagy C. A systematic review of the effects of screening for colorectal cancer using the faecal occult blood test, haemoccult. *British Medical Journal* 1998;317:559-65.
11. Viiala CH, Zimmerman M, Cullen DJ, Hoffman NE. Complication rates of colonoscopy in an Australian teaching hospital environment. *Internal Medicine Journal* 2003;33:355-9.
12. Commonwealth of Australia. The Australian Bowel Cancer Screening Pilot Program and Beyond. Final Evaluation Report. Screening Monograph No. 6/2005. Canberra; 2005.

13. Salkeld G, Young G, Haas M and Glasziou P. Cost effectiveness analysis of screening by faecal occult blood testing for colorectal cancer in Australia. *Australian and New Zealand Journal of Public Health* 1996;20:138-43.

L Reviews of the cost effectiveness of cost effectiveness of screening for breast cancer.

Glenn Salkeld

The University of Sydney

Breast Cancer

In Australia, 1 in 11 females will develop breast cancer in their lifetime (up to age 75). In 2001, there were 11,791 new cases of breast cancer diagnosed. Breast cancer is the leading cause of cancer death amongst women in Australia. In 2004, 2,641 women died of breast cancer losing an average of 10.7 years of life for each premature death that occurred before the age of 75years[1].

Evidence – amenability to prevention

Detecting disease early

There is high level evidence (NHMRC level 1) demonstrating that biennial mammographic X-Ray screening of women aged 50-69 years can reduce disease specific premature deaths by about 25%[2-3]. The effect of screening amongst women who actually attend screening is higher with a 37% relative risk reduction[3].

Biennial mammographic X-Ray screening of women aged 40-49years can reduce disease specific premature deaths by about 15%[4,5].

Screening for breast cancer

Return on Investment – Health Benefits

If 10,000 women aged 50-59 years and another 10,000 women aged 60 to 69 years were offered mammographic screening every two years there would be an additional 169 new cases of invasive breast cancer diagnosed and an additional 95 cases of

ductal carcinoma in situ (DCIS) when compared to no screening. ***40 deaths from breast cancer would be prevented over a period of 10 years*** [6].

If 10,000 women aged 40-49 years were offered mammographic screening every two years there would be an additional 44 new cases of invasive breast cancer diagnosed and an additional 31 cases of ductal carcinoma in situ (DCIS) when compared to no screening. ***5 deaths from breast cancer would be prevented over a period of 10 years***[6].

Costs

The approximate present day cost of recruitment, screening and diagnostic assessment for 10,000 women aged 50-69 years every two years would be ***an additional $9.7 million*** on top of what is already spent on treatment of breast cancer[7,8]. This figure does not include possible cost savings due to less invasive treatment for women with early stage breast cancer.

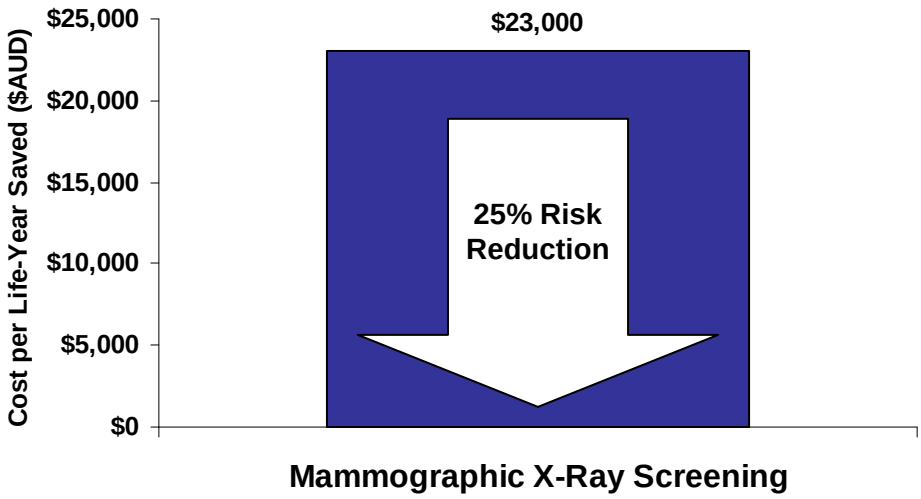
Potential harmful effects of screening

The combined effect of biennial screening for 20,000 women aged 50 to 69 years would result in a total of 4,266 women being recalled for diagnostic assessment and 1,201 women undergoing at least one biopsy[6].

The effect of biennial screening for 10,000 women aged 40 to 49 years would result in a total of 2,509 women being recalled for diagnostic assessment and 595 women undergoing at least one biopsy[6].

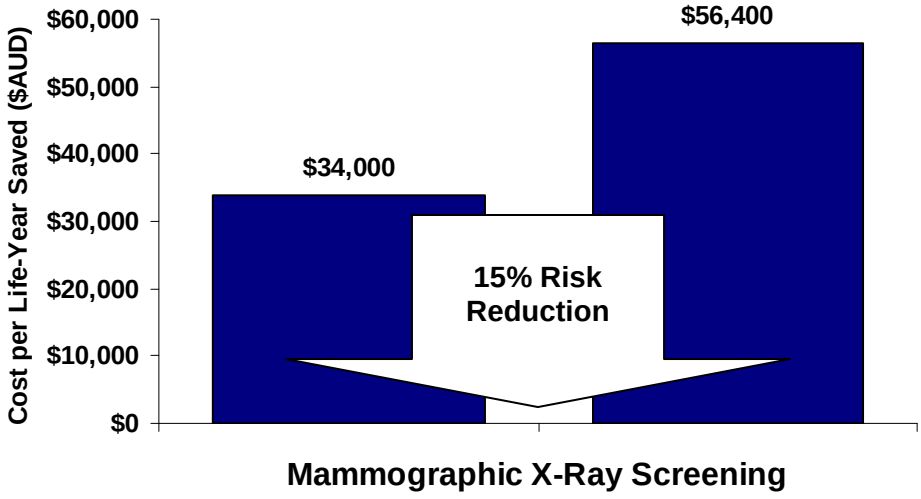
Cost Effectiveness

Screening women aged 50-69 years for breast cancer every 2 years is cost effective, costing $23,000 per each life year saved[7].



Screening women aged 40-49 years

Screening women aged 40-49 years for breast cancer every 2 years ranges from $34,000 per life year saved to $56,400. The upper end of the range may not be considered cost effective[6].



References

1. Australian Institute of Health and Welfare. *Australia's health 2006*. Canberra: AIHW; 2006.
2. Kerlikowske K, Grady D, Rubin SH, Sandrock C, Ernster VI. Efficacy of screening mammography: a meta-analysis. *Journal of the American Medical Association* 1995;273:149-54.
3. Glasziou P. Meta analysis adjusting for compliance: the example of screening for breast cancer. *Journal of Clinical Epidemiology* 1992;45:1251-6.
4. Breast-cancer screening with mammography in women aged 40-49 years. Report of the organizing committee and collaborators, Falun Meeting, Falun, Sweden 1996. *International Journal of Cancer* 1996;68:693-9.
5. Irwig L, Glasziou P, Barratt A and Salkeld G. *Review of the evidence about the value of mammographic screening in 40-49 year old women*. National Breast Cancer Centre 1997. http://www.nbcc.org.au/bestpractice/resources/MMG_40-49yoreviewofscreening.pdf Accessed 13th March 2007.
6. Barratt A, Howard K, Irwig L, Salkeld G, Houssami N. Model of outcomes of screening mammography: information to support informed choices. *British Medical Journal* 2005;330:936.
7. Carter R, Glasziou P, van Oortmarssen G, deKoning H, Stevenson C, Salkeld G and Boer R. Cost-effectiveness of mammographic screening in Australia. *Australian Journal of Public Health* 1993,17;1:42-50.
8. Australian Institute of Health and Welfare. *Health Expenditure Australia 2004-5*. Health and Welfare expenditure series no 28. Canberra. http://www.aihw.gov.au/publications/index.cfm/title/10350 Accessed 13th March 2007.

M

Reviews of the cost effectiveness of cost effectiveness of needle exchange programs for preventing transmissions of HIV And HCV.

Marian Shanahan

University of New South Wales

Needle syringe programs

Needle syringe programs (NSPs) distribute needles and syringes either free of charge or for a minimal charge as one method of preventing transmission of HIV, Hepatitis B and Hepatitis C among injecting drug users (IDU). Programs vary, with some requiring the return of a used needle while others do not, and some provide counselling or other services. NSPs may operate from a variety of locations including drug treatment centres, stand alone fixed locations or movable vans.

While the annual incidence of HIV/AIDS in Australia may not be not large compared to other public health interventions, there were an estimated 15,310 people living with HIV and 3200 with AIDS at the end of 2005. [1] There are an estimated 264,000 people in Australia living with the HCV antibodies, with 88.7% exposed to the virus through drug use[1].

Evidence – amenability to prevention

A recent detailed review of the international NSP literature concludes that there is strong evidence that available and accessible NSPs reduce HIV infection substantially (6 of 9 Bradfield criteria are met as are 5 additional criteria)[2]. NSPs have also been effective in reducing HCV incidence among IDUs, although the rate of incident HCV has increased until recent years. One reason postulated for this continued growth in HCV rates was the high baseline HCV levels among IDUs when NSPs were introduced in Australia in the late 1980s. At that time, only one in 200 IDUs undergoing treatment in Sydney were infected with HIV compared with a prevalence of HCV of 50-70%[3].

As of the year 2000, the twenty-two year investment in NSPs in Australia resulted in the prevention of 25,000 HIV and 21,000 HCV infections. Forty years after their introduction, it is projected that NSPs will have prevented 14,220 deaths from AIDS and HCV[4]. This avoidance of HIV and HCV has been estimated to result in a gain of an additional 15,336 life years (18,772 QALYs).

Costs

Again, using data from the Return on Investment in Needle and Syringe Programs in Australia report, the total cost of the needle exchange project from its inception, through to the year 2000 was $150 million (2000 AUD)[4] .

Return on Investment

Over the expected life time of the HIV and HCV cases avoided, the total treatment costs avoided in Australia as a result of the introduction and uptake of NSPs was estimated at $2.4 billion (5% discount rate)[3].

Additional Comments

This review draws heavily on the Return on Investment in Needle and Syringe Programs in Australia Report[4].

References

1. Ministerial Advisory Committee on AIDS, Sexual Health and Hepatitis and H. C. Sub-committee. *Hepatitis C virus projections working group: Estimates and projections of the Hepatitis C virus epidemic in Australia 2006*. Sydney, University of New South Wales: NCHECR; 2006.
2. Wodak A, Cooney A. Do needle syringe programs reduce HIV infection among injecting drug users: A comprehensive review of the international evidence. *Substance Use and Misuse* 2006;41:777–813.
3. Law M, Batey R. Injecting drug use in Australia: needle/syringe programs prove their worth, but hepatitis C still on the increase. *Medical Journal of Australia* 2003;178:197-8.
4. Health Outcomes International Pty, NCHECR, Drummond M. *Return on Investment in Needle and Syringe Programs in Australia Report*. Canberra: The Commonwealth Department of Health and Ageing; 2002.

N

Reviews of the cost effectiveness of screening programs for the early detection of Chlamydia.

Glenn Salkeld

The University of Sydney

Chlamydia trachomatis infection

Genital *Chlamydia trachomatis* infection (Chlamydia) is the most common bacterial sexually transmissible infection worldwide. It is a notifiable infection, one where the number of cases reported has increased dramatically over the past decade[1]. In 2002 there were 26,000 cases reported nationwide although Chen and Donovan claim that this "likely represents only a fraction of the true incidence and prevalence"[1-4] .

Chlamydia can be treated quite cheaply with one-dose antibiotic treatment[5].

Evidence – amenability to prevention

Screening

Population screening using a nucleic acid amplification tests (NAATs) on a urine or cervical sample is relatively simple, safe and affordable. However, the evidence for the effectiveness for Chlamydia screening mostly comes from non randomised trial studies. There is one RCT that reported a 56% risk reduction in pelvic inflammatory disease rates in women at high risk for Chlamydia undergoing screening compared with usual care[5]. Other studies provide lower level evidence (NHMRC level II & III) on the impact of screening[6-8]. Ideally there would be more RCT evidence available before a population-based screening program was implemented in Australia. Yet other countries such as Sweden and the UK have already implemented national screening programs for Chlamydia based on the knowledge that treatment of cases detected is highly effective.

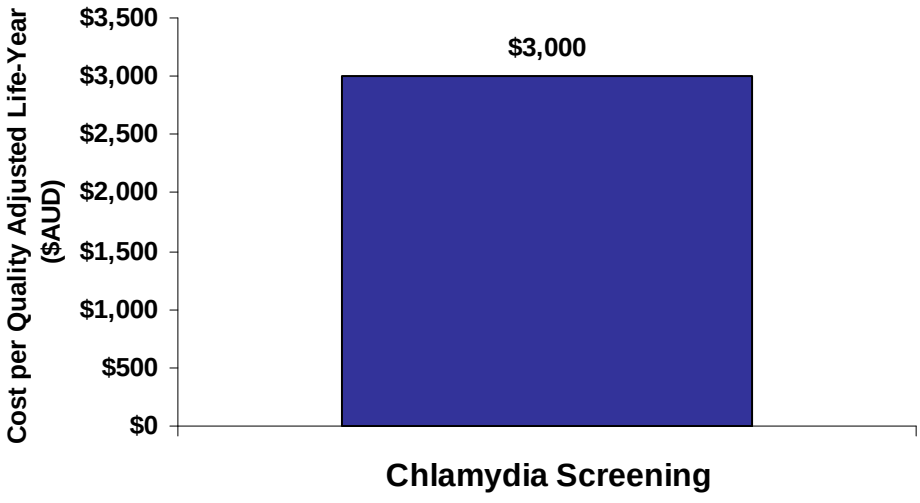
In Australia, the Commonwealth Government has committed $12.5 million for increased awareness, improved surveillance and a pilot testing program for Chlamydia[9].

Return on Investment – Health Benefits

The main benefits of screening and treating women diagnosed with Chlamydia include: averting pelvic inflammatory disease, ectopic pregnancy and infertility. In a cost effectiveness analysis of screening for genital *Chlamydia trachomatis* infection in Australia, Waleser, Salkeld and Donovan[10] modelled annual opportunistic screening for asymptomatic Chlamydia in women aged 16-25 years presenting to a GP compared to no screening. Both hypothetical cohorts were followed up for 25 years whereby the model simulated screening, diagnosis and treatment of Chlamydia and the outcomes of the disease (PID, infertility, ectopic pregnancy, chronic pelvic pain). Over 25 years, the cumulative incidence of PID was 7.9% in the screening group compared to 8.1% in the no-screening group. There was also a decrease in the rate of ectopic pregnancy, chronic pelvic pain and infertility with combined cumulative incidence of 2.1% in the screening group and 2.4% in the no-screening group.

Cost Effectiveness – an Australian study

Annual opportunistic screening of women aged 16-25 years who visit a GP is cost effective, costing $3,000 per quality adjusted life year gained[10].



Screening for Chlamydia may reduce the complications of Chlamydia and save money overall if the model assumes a higher rate of the following variables: incidence of asymptomatic Chlamydia, the probability of infertility, the probability of longer term complications[10].

Cost Effectiveness – a review of all studies

Roberts et al.[11] conducted a systematic review of 57 formal economic evaluations of Chlamydia screening and found Chlamydia screening to be cost effective, partner notification to be an effective adjunct, and testing with NAAT and treatment with azithromycin to be cost effective. However, the authors are critical of most of the cost effectiveness studies because they use what's known as 'static models'. That is, they don't take into account the interdependence of individuals as a dynamic model would do. Welte et al, conducted a cost effectiveness analysis based on a dynamic model that took into account the effects of Chlamydia transmission of re-infection and partner notification. The authors suggested that ***"opportunistic screening of asymptomatic heterosexual men and women attending general practices would become COST SAVING after about 5 years if over 90% of eligible individuals were screened annually"***[9].

References

1. Chen MY, Donovan B. Screening for genital Chlamydia trachomatis infection: are men the forgotten reservoir? (Editorial) *Medical Journal of Australia* 2003:179;3:124-5.
2. Bowden FJ, Paterson BA, Mein J et al. Estimating the prevalence of Trichomonas vaginalis, chlamydia trachomatis, Neisseria gonorrhoeae, and human pappilomavirus infection in indigenous women in northern Australia. *Sexually transmitted infections* 1999;75:431-4.
3. Fenton KA, Korovessis C, Johnson AM et al. Sexual behaviour in Britain: reported sexually transmitted infections and prevalent genital Chlamydia trachomatis infection. *Lancet* 2001;358:1851-4.
4. Turner CF, Rogers SM, Miller HG et al. Untreated gonoccocal and chlamydial infection in a probability sample of adults. *Journal of the American Medical Association* 2002;287:726-33.
5. Scholes D, Sterhachis A, Heidrich FF et al. Prevention of pelvic inflammatory disease by screening for cervical chlamydial infection. *New England Journal of Medicine* 1996; 334:1362-6.
6. Egger M, Low N, Smith GD et al. Screening for chlamydial infections and the risk of ectopic pregnancy in a county in Sweden: ecological analysis. *British Medical Journal* 1998;316:1776-80.
7. Hillis SD, Nakashima A, Amsterdam L et al. The impact of a comprehensive Chlamydia prevention program in Wisconsin. *Family Planning Perspectives* 1995;27:108-11.
8. Hermann BF, Johansson AB, Mardh PA. A retrospective study of efforts to diagnose infections by Chlamydia trachomatis in a Swedish county. *Sexually Transmitted Diseases* 1991;18:233-7.
9. Fairley CK, Hocking J, Gunn J and Chen MY. No barriers to Chlamydia testing in sexually active young women. *Medical Journal of Australia* (letter) 2005;183: 548-9.
10. Waleser S, Salkeld G and Donovan B. The cost effectiveness of screening for genital Chlamydia trachomatis infection in Australia. *Sexual Health* 2006,3:225-234
11. Roberts TE, Robinson S, Barton P et al. Screening for Chlamydia trachomatis: a systematic review of the economic evaluations and modeling. *Sexually Transmitted Infections* 2006;82:193-200.

O Appendices

Appendix 1: NHMRC Designations of Levels of Evidence According to Type of Research Question

Level	Intervention	Diagnosis	Prognosis	Aetiology	Screening
I	A systematic review of level II studies	A systematic review of level II studies	A systematic review of level II studies	A systematic review of level II studies	A systematic review of level II studies
II	A randomised controlled trial	A study of test accuracy with: an independent, blinded comparison with a valid reference standard, among consecutive patients with a defined clinical presentation	A prospective cohort study	A prospective cohort study	A randomised controlled trial
III-1	A pseudorandomised controlled trial (i.e. alternate allocation or some other method)	A study of test accuracy with: an independent, blinded comparison with a valid reference standard, among non-consecutive patients with a defined clinical presentation	All or none	All or none	A pseudorandomised controlled trial (i.e. alternate allocation or some other method)
III-2	A comparative study with concurrent controls: ▪ Non-randomised, experimental trial ▪ Cohort study ▪ Case-control study ▪ Interrupted time series with a control group	A comparison with reference standard that does not meet the criteria required for Level II and III-1 evidence	Analysis of prognostic factors amongst untreated control patients in a randomised controlled trial	A retrospective cohort study	A comparative study with concurrent controls: ▪ Non-randomised, experimental trial ▪ Cohort study ▪ Case-control study
III-3	A comparative study without concurrent controls: ▪ Historical control study ▪ Two or more single arm study ▪ Interrupted time series without a parallel control group	Diagnostic case-control study	A retrospective cohort study	A case-control study	A comparative study without concurrent controls: ▪ Historical control study ▪ Two or more single arm study
IV	Case series with either post-test or pre-test/post-test outcomes	Study of diagnostic yield (no reference standard)	Case series, or cohort study of patients at different stages of disease	A cross-sectional study	Case series

Appendix 2: Glossary

Absolute risk (AR)

The probability that an individual will experience the specified outcome during a specified period. It lies in the range 0 to 1, or 0% to 100%. In contrast to common usage, the word 'risk' may refer to adverse events (such as myocardial infarction), or desirable events (such as cure).

Absolute risk reduction (ARR)

The absolute difference in risk between the experimental and control groups in a trial. It is used when the risk in the control group exceeds the risk in the experimental group, and is calculated by subtracting the AR in the experimental group from the AR in the control group. This figure does not give any ideas of the proportional reduction between the two groups. For this, relative risk reduction (RRR) is needed (see below).

Absolute risk increase (ARI)

The absolute difference between the experimental and control groups in a trial. It is used when the risk in the experimental group exceeds the risk in the control group, and is calculated by subtracting the AR in the control group from the AR in the experimental group. This figure does not give any idea of the proportional increase between the two groups; for this, relative risk increase (RRI) in needed (see below).

Bias

Systematic deviation of study results from the true results, due to the way(s) in which the study is conducted.

Case control study

A study design that examines a group of people who have experienced an event (usually an adverse event) and a group of people who have not experienced the same event, and looks at how exposure to suspect (usually noxious) agents differed between the two groups. This type of study design is most useful for trying to ascertain the cause of rare events, such as rare cancers.

Clinically significant

A finding that is clinically important Here, 'significant' takes its everyday meaning of 'important' (compare with statistically significant, se below). Where the word 'significant' or 'significance' is used without qualification in the text, it is being used in its statistical sense.

Cohort study

A non-experimental study design that follows a group of people (a cohort) and then looks at how events differ among people within the group. A study that examines two cohorts, one that has been exposed to a suspect agent or treatment, and one that has not been exposed, is useful for trying to ascertain whether exposure is likely to cause specified events (often adverse). Prospective cohort studies (which track participants forward in time) are more reliable than retrospective cohort studies (which look back in time to ascertain whether or not participants were exposed to the agent in question).

Completer analysis

Analysis of data from only those participants who remained at the end of the study. Compare with intention to treat analysis, which uses data from all participants who enrolled (see below).

Confidence interval (CI)

The 95% confidence interval (or 95% confidence limits) would include 95% of results from studies of the same size and design. This is close but not identical to saying that the true size of the effect (never exactly known) has a 95% chance of falling within the confidence interval. If the 95% CI for a relative risk or an odds ratio crosses 1, the effect size is likely to lie in a range where risk is either increased or decreased.

Continuous

Continuous outcomes can take on any value on a numerical scale – as far as the precision of measurement allows - within a certain range. Examples are weight, height or symptom scores. See also dichotomous.

Controls

Refers to the participants in the comparison group in a randomised controlled trial. They are allocated either to placebo, or no treatment, or to the standard treatment.

Cost

The value of opportunities lost by engaging resources in a service (also known as *opportunity cost*). Usually quantified by considering the benefit accruing by investing the same resources in the best alternative manner. The concept of opportunity cost derives from the notion of scarcity of resources.

Cost-benefit analysis (CBA)

A type of economic study design in which both inputs and consequences of different interventions are expressed in monetary units. This design allows their direct comparison across programmes, including outside healthcare.

Cost-effectiveness analysis (CEA)

A type of economic study design in which consequences of different interventions may vary, but can be measured in identical natural units; relative inputs are then costed. Interventions can then be compared in terms of cost per unit of consequence.

Cost-minimisation analysis (CMA)

A type of economic study design in which the consequence of competing interventions are the same and in which only inputs are taken into consideration. The aim is to decide the cheapest way of achieving the same outcome.

Cost-utility analysis (CUA)

A type of economic study design in which interventions that produce different consequences in terms of both quantity and quality of life are expressed as utilities. These are measures which comprise both length of life and subjective levels of well-being (eg quality adjusted life years, QALYs). In this type of analysis, competing interventions are compared in terms of cost per utility.

Cross sectional study

A study design that involves surveying a population about an exposure, or condition, or both, at one point in time. It can be used for assessing prevalence of a condition in the population.

Dichotomous

Dichotomous outcomes can take on isolated values corresponding to predefined categories. Examples are death or no death, myocardial infarction or no myocardial infarction. See also **continuous**.

Discounting

A technique that allows the calculation of present values of inputs and benefits that accrue in the future. It is based on a time preference, which assumes that individuals prefer to forgo a part of the benefits if they accrue them now, rather than fully in the uncertain future. This strength of preference is expressed by a discount rate that is inserted in economic evaluations. The choice of rate and to which items it should be applied are a matter of intense debate.

Economic evaluation

The application of analytical methods to define cost and consequences of interventions and aid explicit choice-making in resource allocation

Efficiency

Making the best use of available resources. There are two types: *allocative efficiency,* which assesses competing programs and judges the extent to which they meet objectives; *technical efficiency,* which assess the best way of achieving a given objective

Event

The occurrence of a dichotomous outcome that is being sought in the study (such as myocardial infarction, death, or a four-point improvement in pain score).

Effect size

Many methods are used to quantify the size of an effect. For dichotomous outcomes, relative risk and odds ratio are examples. Typically, the term 'effect size' is used for continuous variables (such as pain scores or height), where the standardised mean difference or weighted mean difference (see below) are commonly used.

Hazard ratio (HR)

This term is broadly equivalent to relative risk, but is used when the risk is not constant with respect to time. If, however, the assumption is made that the risks remain in proportion between population groups in a study, then although the absolute risks (hazards) may alter as time passes, the hazard ratio between groups remains constant. The term is typically used in the context of survival over time and is then broadly equivalent to the relative risk of death. If the hazard ratio is 0.5, then the relative risk of dying in one group is half the risk of dying in the other group.

Heterogeneity

In the context of meta-analysis, heterogeneity means dissimilarity between studies. It can be due to use of different statistical methods (statistical heterogeneity), or evaluation of different types of patients, treatments or outcomes (clinical heterogeneity). Heterogeneity may render pooling of data in meta-analysis unreliable or inappropriate.

Homogeneity

Similarity (see heterogeneity).

Incidence

The number of new cases of a condition occurring in a population over a specified period of time.

Intention to treat analysis

Analysis of data from all participants who were enrolled into the study as if they had remained in the group into which they were randomised, regardless of whether they actually remained until the end or withdrew from the trial. Compare with completer analysis (see above).

Marginal analysis

The process that examines the effect of small changes in the existing pattern of health care expenditure in any setting.

Marginal benefit

The value of benefit deriving from an extra unit produced.

Meta-analysis

A statistical technique that summarises the results of several studies in a single weighted estimate, in which more weight is given to results from higher quality studies.

Morbidity

Rate of illness but not death.

Mortality

Rate of death.

Negative predictive value (NPV)

The chance of not having a disease given a negative test result (not to be confused with specificity, which is the other way around, see below).

Number needed to treat (NNT)

One measure of treatment effectiveness. It is the number of people you would need to treat with a specific intervention for a given period of time to prevent one additional adverse outcome or achieve one additional beneficial outcome. NNT can be calculated as 1/ARR.

Number needed to harm (NNH)

One measure of treatment harm. It is the number of people you would need to treat with a specific intervention for a given period of time to prevent one additional

adverse outcome or achieve one additional adverse outcome. NNH can be calculated as 1/ARI.

Odds

The odds of an event happening is defined as the probability that an event will occur, expressed as a proportion of the probability that the event will not occur

Odds ratio (OR)

One measure of treatment effectiveness. It is the odds of an event happening in the experimental group, expressed as a proportion of the odds of an event happening in the control group. The closer the OR is to one, the smaller the difference in effect between the experimental intervention and the control intervention. If the OR is greater (or less) than one, then the effects of the treatment are more (or less) than those of the control treatment. Note that the effects being measured may be adverse (e.g. death or disability) or desirable (e.g. survival). The OR is analogous to the relative risk (RR).

P value

The probability that an observed difference occurred by chance if it is assumed that there is in fact no underlying difference between the means of the observations. If this probability is less than 1 in 20 (which is when the P value is less than 0.05), than the result is conventionally regarded as being 'statistically significant'.

Placebo

A biologically inert treatment given to the control participants in trials.

Positive predictive value (PPV)

The chance of having a disease given a positive test result (not to be confused with sensitivity, which is the other way around, see below).

Power

A study has adequate power if it can reliably detect a clinically important difference (for instance, between two treatments) if one actually exists. The power of a study is increased when it includes more events or when its measurement of outcomes is more precise.

Prevalence

The proportion of people with a finding or disease in a given population at a given time.

Price

Price reflects the value of resources for which there are markets.

Publication bias

Occurs where studies with positive results are more likely to be published than studies with negative results, so making it appear from surveys of the published literature that treatments are more effective than is truly the case.

Randomised controlled trial (RCT)

A trial in which participants are randomly assigned to two groups: one (the experimental group) receiving the intervention that is being tested, and the other (the comparison or control group) receiving an alternative treatment or placebo. This design allows assessment of the relative effects of interventions.

Relative risk (RR)

The number of times more likely (RR greater than 1) or less likely (RR less than 1) an event is to happen in one group compared to another. It is similar in concept to an odds ratio (OR), see above.

Relative risk increase (RRI)

The proportional increase in risk between experimental and control participants in a trial. It is calculated by dividing the absolute risk in the experimental group by the absolute risk in the control group.

Relative risk reduction (RRR)

The proportional reduction in risk between experimental and control participants in a trial. It is the complement of the relative risk (1-RR).

Resources

Classically, land, labour and capital. Specifically, any input into health service production (time, goods, equipment etc).

Sensitivity (epidemiological)

The chance of having a positive test result given that you have a disease (not to be confused with positive predictive value (PPV), which is the other way around, see above).

Sensitivity analysis (economic)

A technique that repeats the com-parison between inputs and con-sequences, varying the assumptions underlying the estimates. The technique tests the robustness of the conclusions by varying the items about which there is uncertainty.

Significant

By convention taken to mean statistically significant at the 5% level (see statistically significant).

Specificity

The chance of having a negative test result given that you do not have a disease (not to be confused with negative predictive value (NPV), which is the other way around, see above).

Standard gamble

See 'time-trade off'.

Standardised mean difference (SMD)

A measure of effect used when outcomes are continuous (such as height, weight, or symptom scores) rather than dichotomous (such as death and myocardial infarction). The mean differences in outcome between the groups being studies are standardised to account for differences in scoring methods (such as pain scores). The measure is a ratio, and therefore has no units.

Statistically significant

This means that the findings of a study are unlikely to be due to chance. Significance at the commonly cited 5% level ($P < 0.05$) means that the observed result would occur by chance in only 1 in 20 similar studies. Where the word 'significant' or 'significance' is used without qualification in the test, it is being used in the statistical sense.

Systematic review

A review in which all the trial on a topic have been systematically search for, appraised, and summarised according to predetermined criteria. It can, but need not, involve meta-analysis as a statistical method of adding together and numerically summarising the results of the trials that meet minimum quality criteria.

Time trade-off

A valuation technique based on eliciting preferences for a set health state or a set time, given a certain probability of the event happening.

Utility

A term that signifies the satisfaction accruing to a person from the consumption of a good or a service. The concept is applied to health care to mean the individual's valuation of their state of well-being deriving from the use of health care interventions.

Validity

The soundness or rigour of a study. A study is valid if the way it is designed and carried out means that the results are unbiased and give you an accurate estimate of the effect that is being measured.

Weighted mean difference (WMD)

A measure of effect size used when outcomes are continuous (such as symptom scores or height) rather than dichotomous (such as death or myocardial infarction). The mean differences in outcome between the groups being studied are weighted to account for different sample sizes and differing precision between studies. The WMD is an absolute figure, and so takes the units of the original outcome measure.

Willingness-to-pay (WTP)

A technique which relies on direct explicit eliciting of individual preferences in the views of samples of the general public who are asked how much they would be prepared to pay to accrue a benefit or to avoid certain events.

Sources

Godlee F (Ed). *Clinical Evidence. A Compendium of the Best Available Evidence for Effective Health Care. Issue 2*. London: BMJ Publishing Group; 1999.

Jefferson T, Demicheli V, Mugford M. *Elementary economic evaluation in health care. 2nd edition*. London: BMJ Publishing Group; 2000.