Visualizing value for money in public health interventions

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Abstract

Background: The Socio-Technical Allocation of Resources (STAR) has been developed for value for money analysis of health services through stakeholder workshops. This paper reports on its application for prioritisation of interventions within public health programmes.

Methods: The STAR tool was used by identifying costs and service activity for interventions within commissioned public health programmes, with benefits estimated from the literature on economic evaluations in terms of costs per Quality-Adjusted Life Years (QALYs); consensus on how these QALY values applied to local services was obtained with local commissioners.

Results: Local cost-effectiveness estimates could be made for some interventions. Methodological issues arose from gaps in the evidence base for other interventions, inability to closely match some performance monitoring data with interventions, and disparate time horizons of published QALY data. Practical adjustment for these issues included using population prevalences and utility states where intervention specific evidence was lacking, and subdivision of large contracts into specific intervention costs using staffing ratios. The STAR approach proved useful in informing commissioning decisions and understanding the relative value of local public health interventions

Conclusions:. Further work is needed to improve robustness of the process and develop a visualisation tool for use by public health departments.

Background

Following the Health and Social Care Act 2012 most public health functions moved from Primary Care Trusts to Local Authorities in April 2013. Following this public health funding has come under threat both from the Council wide efficiencies as part of the Government's debt reduction policy and further in-year cuts to Public Health in 2015 (1). For Wakefield Local Authority this equated an estimated 20% reduction in the money available to commission public health services between 2015 and 2020. This has placed pressure on the Council's ability to fulfil its statutory public health responsibilities at previous levels of service delivery (2).

To help minimise the population health impact of spending decisions a clear and transparent prioritisation process was designed. This was based on public health outcomes, population need, equity of access, current provider performance, best evidence and value for money. It also encompassed the political, financial and reputational risks around re-commissioning with a reduced budget. The process encompassed three distinct stages.

1. Firstly, public health spend was divided into ten commissioning programmes (e.g. obesity, tobacco, sexual health) and their relative importance was ranked using multi-criteria decision analysis.
2. Secondly, each programme was reviewed separately using the Socio-Technical Allocation of Resources (STAR) Tool (3) in order to visualise cost effectiveness of elements of each programme and provide recommendations to maximise value for money.
3. Following discussions based on the results of the multi-criteria decision analysis and STAR approach, public health commissioning intentions were determined for 2015-2020, with services either being re-commissioned, re-designed or de-commissioned.

This paper reports on an experimental use of the STAR Tool for stage 2. STAR is an approach to informing value for money analysis of clinical services, which requires three basic sets of data on:

costs (fixed costs, costs per case, and numbers of patients treated) and benefits (benefits of typical patients) and numbers who benefit from treatment. In STAR these basic sets of data are transformed by visual models into information that stakeholders can easily understand.

In STAR there are three visual models for each component of the care pathway: rectangles of total costs (fixed and variable); rectangles of total benefits; and value triangles (Figure 1). In the value triangle total costs are on the horizontal axis, total benefits on the vertical axis, and value on the hypotenuse (i.e. the slope, which gives ratio of benefits to costs). This visual model makes clear that components with steep and shallow slopes are better and worse value respectively.

Insert Figure 1 Here

STAR's fourth visual model, the efficiency frontier, is generated by ordering value triangles in terms of their value (slope) for a given use of resources. Components with the highest value tend to be those at the start of the care pathway and those with the lowest value at the end. This allows illustration of the relative scale of different components in clinical care pathways in terms of their costs and benefits (4). Analytic and managerial effort can then be directed at how to reallocate resources to improve the value of those care pathways.

STAR's visual models are designed to be used as a basis for discussions on investment and dis-investment. These discussions could be based on either ranking or agreed threshold levels of the cost effectiveness. Sensitivity analyses around each estimate of local cost effectiveness ratio should also be undertaken to inform discussions as there are no definitive estimates of individual benefit. While it was originally developed as a tool for clinical services, recent financial challenges have presented an opportunity to adapt the tool for prioritisation of public health programmes**.** We report the results of our cost effectiveness analysis of public health services using the STAR Tool and the main methodological issues encountered.

Methods

We aimed to produce a STAR efficiency frontier for each of ten local public health programmes: sexual health, tobacco control, alcohol, substance misuse, physical activity, obesity, NHS Health checks, public mental health, oral health and domestic abuse. For this work a programme was defined as an area of commissioning spend covering one area of public health, including one or more services; a service was defined as a discrete public health activity with an associated cost. To produce an efficiency frontier, costs and benefits needed to be defined for each service within the chosen programme.

Identification of Costs

Costs were derived for all commissioned services within a programme from the most recent contract value. The cost of each service was averaged over a year and divided by the number of individuals accessing each service or component of a service to give an estimate of the cost per person. Where numbers accessing services were unavailable, estimates were made from the number of individuals offered the service, adjusted by an estimated take up rate.

Calculation of Benefit

The design of the STAR Tool when used for analysis of clinical services involves a series of stakeholder workshops including commissioners, providers, clinicians and patients to determine the estimated individual benefit achieved for individuals benefiting from each intervention; this uses assessment of Quality of Life states before and after each intervention. Our experimental public health approach to STAR used a modified approach drawing on estimates of benefit in terms of Quality-Adjusted Life Years (QALYs) per person from interventions in the economic evaluation literature that were comparable to those delivered by the local services. Where possible UK derived QALY estimates with a lifetime horizon were used (5). These estimates were then multiplied by the numbers benefiting to identify the total benefit achieved locally for each service.

Modelling of Uncertainty

Following identification of the initial cost effectiveness estimates, a number of approaches were taken to ensure validity of findings. Discussions were held with the relevant local public health commissioners to identify whether the results reflected the effectiveness of the local intervention. In addition sensitivity analyses were undertaken by entering estimates for all interventions from the STAR Tool into a locally developed Microsoft Excel® tool; conservative and optimistic scenario estimates derived from halving and doubling the calculated estimate respectively for each intervention were plotted on a graph alongside the original intervention estimate to visualise the costs and benefits for public health spend for all the relevant commissioning programmes. Furthermore, individual cost effectiveness estimates were also triangulated with values from other health economic assessment tools for relevant interventions where possible (5).

Results

During the application of the STAR tool a number of data problems were encountered, namely a lack of detailed contract information, a lack of relevant performance monitoring data, gaps in the health economic evidence base, and disparate time horizons. Of the ten public health programmes we attempted to model, cost and contract activity data could be sub-divided to allow mapping to evidence on the benefits of public health interventions for tobacco control, sexual health, alcohol and substance misuse, physical activity, obesity, NHS Health checks and domestic abuse. For mental health and oral health, contract data and published evidence were too mismatched to produce a STAR tool. We report in detail on two of the programmes, the tobacco control programme and alcohol and substance misuse programme, but discuss issues encountered with respect to the eight programmes analysed.

Contract activity data

Where contract information was unavailable on the cost of individual components of a service, the overall contract was divided by: either the proportion of individuals receiving each component of a service, for example the numbers receiving opiate treatment as part of the substance misuse service; or the proportion of workforce time delivering each component of a service, for example the number of full time equivalent counsellors as a proportion of all staff within the domestic violence service. Where it was not possible to subdivide the cost of a service into the costs of the components because the latter were delivered simultaneously by one individual, for example the health checks, the service was considered as a single entity for the purposes of identifying costs.

It was not straightforward to identify the number of individuals being offered or benefitting from some services where there was no directly related performance data, for example mass media campaigns around smoking cessation. For these, prevalence figures of the relevant sub group of the population being targeted were used as an estimate of numbers receiving the service, for

example the proportion of the local population smoking. For other services, an estimate of the number of individuals with a condition or behaviour potentially averted was calculated using local prevalence data and the latest national yearly increase in incidence of new cases. Other service outcome data was used where appropriate to derive estimates, for example trading standards data on illicit tobacco seizures was used to derive an estimate of individuals prevented from smoking. Where services aimed to train healthcare staff, an estimate was made of the proportion of the local population who would benefit as a result of that training, for example services seeking to educate primary care staff to better identify victims of domestic abuse.

Benefit estimates

We were not able to extract estimates of QALYs gained per person for some interventions, so the following model adjustments were made. Where there was no identifiable cost effectiveness estimate for a specific intervention but the evidence base suggested a lack of evidence of effectiveness, a near zero QALY value was used. Where there was no identifiable QALY per person value for a specific intervention but the evidence base suggested effectiveness, an estimate was derived by comparing lifetime QALYs lost for an individual with a condition to an individual without it, for example by comparing QALYs lost for a smoker versus a non-smoker and applying this to an estimated change in prevalence to find the total QALYS gained. Where a multi-component service comprised a number of interventions, but there was no single QALY per person value for the service as a whole, an average QALY per person value was derived. For example, for the health checks service we identified local numbers of new diagnoses for each component of the service, and for each diagnosis used estimates of benefit as a result of appropriate further management of each from the literature to calculate an average individual benefit for the service as a whole. A similar approach was taken for a condom distribution programme, where the total number of QALYs gained was calculated based on the QALYs that would be lost for each infection that the condom distribution programme was likely to prevent.

Time horizon of benefits and costs

Estimates of benefit based on a lifetime horizon were used as a gold standard. Where they were unavailable or the time horizon used for the estimate in the evidence base was different from the length of follow up for the service, adjustments were made; for example, estimates for weight loss interventions from the evidence were based on a lifetime horizon, so were reduced to reflect that the service outcomes were measured after three months. Where time horizons differed between services within a programme, adjustments were made to reflect lifetime benefit and allow comparisons between services. Whilst this was possible for tobacco control, since all services had essentially the same desired outcome of permanent quitting, it was not possible for all programmes due to the very different nature of the services within them; for example no adjustment was made to the estimate for the service aimed at improving the ability of primary care staff to identify domestic abuse to allow comparison with the estimate for the domestic abuse counselling service which used a different time horizon.

Neither benefits nor costs were discounted over time as there is dispute between economists over what the discount rate should be and whether the same rate should be used for costs as well as benefits (6). The justification for discounting costs of commodities is that they reduce over time as economies become more productive, but as this justification does not apply to well-being, it has been argued that it is wrong to discount benefits in QALYs (7). It may also be inappropriate to discount costs of health services in austerity as it is unclear that these will be less burdensome in future, particularly given health services suffer from Baumol's disease where labour intensive services become relatively more expensive over time (8). An alternative approach would have been to discount in line with NICE guidance at an annual rate of 1.5% or that of the United Kingdom treasury at 3.5%.

Tobacco Control Programme STAR Tool

For the tobacco control programme there were four interventions or services: the specialist smoking cessation service, the GP delivered smoking cessation service, and contributions to both the West Yorkshire Mass Media Campaign and West Yorkshire Trading Standards, with the majority of the funding going to the specialist stop smoking service (Table 1). Mass media campaigns and trading standards were estimated to be the most cost effective investments, as they reach a far larger population despite having lower estimated benefits per person. GP delivered smoking cessation services were estimated to be more cost effective than specialist services despite a lower quit rate, as they have lower operating and fixed costs being delivered in-house (Figure 2).

Alcohol and Substance Misuse Programme

For the alcohol and substance misuse programme there were five interventions or services: the alcohol and substance misuse treatment and recovery services for opiate use, non-opiate use and at-risk alcohol use, an alcohol liaison service, and a support service for parents and carers of those with alcohol and substance misuse issues (Table 1). Individual costs of the three treatment recovery services were unavailable as they were contained within a single integrated service so an assumption was made of equal costs per individual for each component. Opiate treatment and recovery accounted for three-quarters of the overall costs of the alcohol and substance misuse programme but a third of the estimated benefits. The non-opiate and alcohol addiction recovery services were estimated to be the most cost effective components (Figure 3).

Insert Table 1 Here

Insert Figure 2 Here

Insert Figure 3 Here

Discussion

Main finding of this study

This is the first use of the STAR approach to prioritise within public health programmes. It has proved useful in informing commissioning decisions, strategic planning of future provision and engaging public health staff in key health economic principles.

Local cost-effectiveness estimates could be made for most interventions, allowing comparison within and between programmes using visual methods. In general primary prevention interventions were the most cost effective, for example mass media campaigns and trading standards to reduce smoking compared to specialist stop smoking services. The visual demonstration of the STAR efficiency frontiers helped facilitate discussions on how to increase return on investment in the future. The health economic evidence gathered for this work also informed commissioners as to how a more targeted and stratified approach may improve the overall cost-effectiveness of the public health budget, for example priority target groups within a universal NHS Healthcheck programme. Furthermore, most of the local estimates suggested existing services provided value for money with average cost effectiveness ratios of below £15,000 per QALY.

What is already known on this topic

The STAR tool has previously been used to prioritise competing service bids (24), and to prioritise interventions treating patients with eating disorders (25) and chronic obstructive pulmonary disease (26). This modified “lean STAR” approach involving only public health commissioners gave further guidance at a local level about which particular interventions provided the greatest value for money and facilitated communication of this information through graphical means.

What this study adds

This work should be seen within the context of the broader interdependencies of public health programmes and services. For example, STAR analysis often suggests, as in this case, that more 'upstream' primary prevention activities (e.g. education, campaigns, lifestyle interventions) are more cost-effective than treatment (such as sexual health and opiate addiction treatment). However it is simplistic to assume that this implies that the resources ought to be moved from the latter to the former because there is always a time lag from increasing primary prevention to reductions in needs for treatment; also the implications of not treating infections or addiction are serious as there is the potential to impact more widely on society (crime rates and secondary infections) and demand for other services (A&E attendances).

What STAR does is to identify the scale of the resources allocated to different interventions and their benefits which may lead into identifying scope for less costly treatment of less severe cases that might enable resources to be released for primary prevention. Before any re-allocation of resources can occur, assessment of the broader interdependencies of public health services within the health, social care and community sector, and the political and contractual consequences is necessary, to avoid increasing need in other areas and passing costs to other agencies. Any decision making informed by STAR therefore requires careful planning and collaboration across the statutory and third sector, especially where there are no alternative services.

Limitations of this study

While STAR tools could be produced for most of the programmes, not all of them were sufficiently robust to be useful in informing decisions. Limitations were identified with respect to the variable evidence base, lack of clearly associated performance monitoring data, and disparate time

horizons. Methods were developed to adjust for these issues but ultimately decisions were made not to use some estimates: for the mental health programme, which was identified as a priority within the district, it was not possible to align the contract data with the published evidence base to inform future planning; for the sexual health programme, it was not possible to sub-divide the majority of the spend in a meaningful way against published QALY data. As this approach took only the commissioner perspective, the perspectives of provider organisations and service users might need consideration if the tool is to be used beyond an internal prioritisation exercise.

The locally derived cost effectiveness estimates could also be strengthened by further modelling around uncertainty and developing a national online tool to assist local approaches. The latter should include evidence based value estimates for individual interventions, with the capacity to add locally derived activity and cost data; this would bring a broad health economic evidence base into a STAR visualisation tool for public health departments to adapt with local contract and cost data. Therefore, allowing for some limitations, this modified STAR approach has the potential to provide a useful health economic baseline to inform a broader public health prioritisation process and future commissioning arrangements.

Conflicts of Interest

Professor Muir Gray is the Director of Better Value Healthcare Ltd. On behalf of all authors, the corresponding author states that there are no other conflicts of interest.

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References

1. HM Treasury. Spending Review and Autumn Statement. 2015.
2. Heath S. Local authorities' public health responsibilities (England). 2014.
3. The Health Foundation. Socio-Technical-Allocation-of Resources (STAR) tool. Available from: http://www.health.org.uk/collection/star-socio-technical-allocation-resources.
4. London School of Economics. STAR: using visual economic models to engage stakeholders to increase value in the NHS. Available from: http://www.lse.ac.uk/publicEvents/events/2015/02/20150205t1830vHKT.aspx.
5. National Institute for Health and Care Excellence. Return on Investment Tool.
6. Oliver A. A normative perspective on discounting health outcomes. Journal of Health Services Research & Policy. 2013; 18:186-9.
7. Broome J. Discounting the Future. Philosophy & Public Affairs. 1994; 23:128-56.
8. Baumol WJ. The cost disease: Why computers get cheaper and health care doesn't. : Yale university Press; 2012.
9. Ferguson J, Bauld L, Chesterman J, Judge K. The English smoking treatment services: one-year outcomes. Addiction. 2005; 100:59-69.
10. National Institute for Health and Care Excellence. The clinical effectiveness and cost effectiveness of bupropion (Zyban) and Nicotine Replacement Therapy for smoking cessation. 2002.
11. Kaplan RM, Anderson JP, Kaplan CM. Modeling Quality-Adjusted Life Expectancy Loss Resulting from Tobacco use in the United States. Social Indicators Research. 2007; 81:51-64.
12. Hurley SF, Matthews JP. Cost-effectiveness of the Australian National Tobacco Campaign. Tobacco Control. 2008; 17:379-84.
13. Ratcliffe J, Cairns J, Platt S. Cost effectiveness of a mass media-led anti-smoking campaign in Scotland. Tobacco Control. 1997; 6:104-10.

14. Sims M, Salway R, Langley T, Lewis S, McNeill A, Szatkowski L, et al. Effectiveness of tobacco control television advertising in changing tobacco use in England: a population-based cross-sectional study. Addiction. 2014; 109:986-94.

15. Farrelly MC, Davis KC, Haviland ML, Messeri P, Healton CG. Evidence of a Dose—Response Relationship Between "truth" Antismoking Ads and Youth Smoking Prevalence. American Journal of Public Health. 2005; 95:425-31.

16. Centers for Disease Control and Prevention. Annual smoking attributable mortality, years of potential life lost, and productivity losses - United States, 1997–2001. Atlanta, USA, 2005.

17. West Yorkshire Trading Standards. Tackling Illict Tobacco for better health 2015.

18. National Collaborating Centre for Mental Health. Opioid detoxification, National Clinical Practice Guideline Number 522008.

19. National Collaborating Centre for Mental Health. Psychosocial interventions, National Clinical Practice Guideline Number 512008.

20. Mortimer D, Segal L. Economic evaluation of interventions for problem drinking and alcohol dependence: do within family external effects make a difference? Alcohol and Alcoholism. 2005; 41:92.

21. Optimity Advisors. Health England Leading Prioritisation (HELP) Report 3. 2001.

22. National Institute for Health and Care Excellence. Alcohol-use disorders: prevention, NICE guidelines PH24, 2010.

23. Copello AG, Velleman RDB, Templeton LJ. Family interventions in the treatment of alcohol and drug problems. Drug and Alcohol Review. 2005; 24:369-85.

24. Airoldi M, Morton A, Smith JAE, Bevan G. STAR—People-Powered Prioritization. Medical Decision Making. 2014; 34:965-75.

25. Airoldi M. Disinvestments in Practice: Overcoming Resistance to Change through a Sociotechnical Approach with Local Stakeholders. Journal of Health Politics, Policy and Law. 2013; 38:1149-71.

26. Williams S, Baxter N, Holmes S, Restrick L, Scullion J, Ward M. IMPRESS Guide to the relative value of COPD interventions 2012.

Figure 1: The Value Triangle

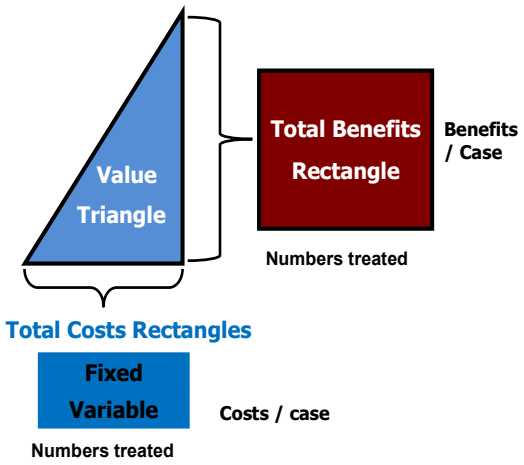


Table 1: STAR Tool Analysis for Two Programmes

Service/ Intervention	Cost of service per year	Numbers offered service each year	Estimated cost per person	Estimated % who benefit	Number benefiting each year	Estimated benefit per person benefiting (QALYs)	Total QALYs
Tobacco Control Programme							
Specialist smoking cessation	£774,000	2238 (setting 4 week quit date, mean 2013-15)	£345.85	9.2%	207 (14%(8) of successful 4 week quitters, mean 2013-15)	3 (2.7(9),3.5 (10))	620
GP delivered smoking cessation	£91,000	1478 (setting 4 week quit date, mean 2013-15)	£61.57	6.2%	91 (14% (8) of successful 4 week quitters, mean 2013-15)	3 (2.7 (9),3.5 (10))	272
Mass media campaign	£50,000	83,000 (Wakefield population who smoke)	£0.60	0.4%	166 (Based on 0.05% prevalence decrease in smoking prevalence 0.3-1.1(11),0.44 (12),1.2 (13),1.6% (14))	3 (1.05 (15),2.7(9), 3.5(10))	498
Contribution to West Yorkshire Trading Standards	£30,000	83,000 (Wakefield population who smoke)	£0.36	0.04%	30 (based on Wakefield proportional benefits (16))	3 (2.7 (9),3.5(10))	90

Service/ Intervention	Cost of service per year	Numbers offered service each year	Estimated cost per person	Estimated % who benefit	Number benefiting each year	Estimated benefit per person benefiting (QALYs)	Total QALYs
Alcohol and Substance Misuse Programme							
Alcohol and substance misuse recovery service	£4,057,347	6548 (commencing opiate treatment, mean 2015/16)	£524.21	6.2%	408	0.4 (0.32-0.34 (17), 0.68-0.71 (18))	163
		916 (commencing non-opiate treatment, mean 2015/16)	£524.21	50.7%	464	0.5 (0.24-0.25 (18), 0.25 (12), 0.77-0.79 (15), 0.38-0.39 (1))	232
		276 (commencing alcohol treatment mean 2015/16)	£524.21	94.2%	260	0.2 (0.11-0.33 (19))	52
Alcohol liaison service	£95,000	1400 (given brief advice, mean 2015/16)	£67.86	100%	1400	0.02 (0.0233 (20) 0.004-0.018 (21))	28
Relatives and carers support	£70,000	312 (relatives supported, mean 2015/16))	£224.36	100%	312	0.02 (0.01 (22), 0.02-0.03 (19))	6.3

Figure 2: Tobacco Control Programme Efficiency Frontier

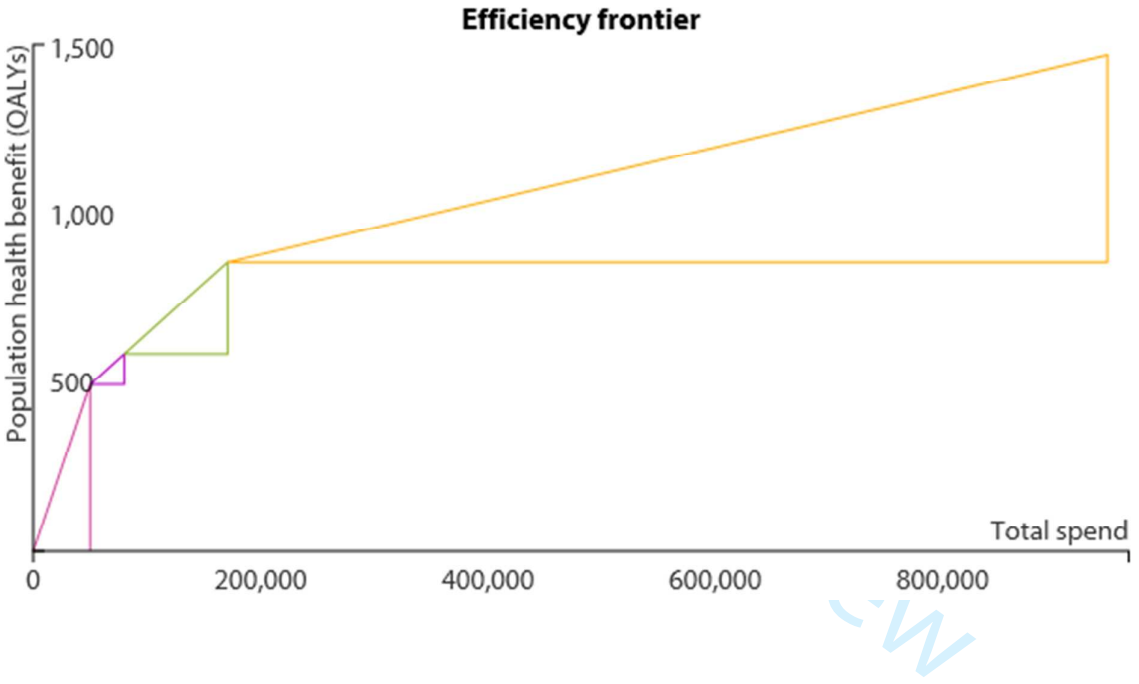
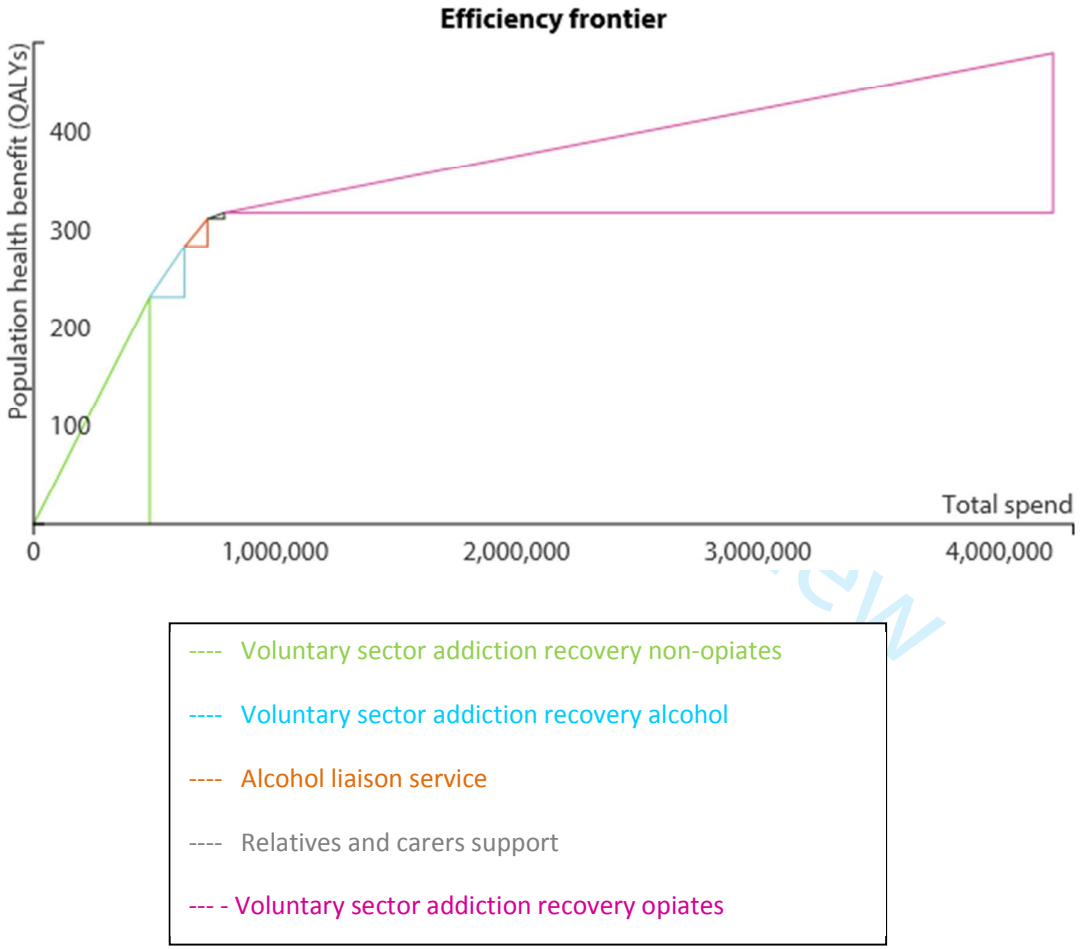


Figure 3: Alcohol and Substance Misuse Programme Efficiency Frontier



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Conclusions: ~~The STAR approach proved useful in informing commissioning decisions and understanding the relative value of local public health interventions~~. Further work is needed to improve robustness of the process and develop a visualisation tool for use by public health departments.

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In STAR there are three visual models for each component of the care pathway: rectangles of total costs (fixed and variable); rectangles of total benefits; and value triangles (Figure 1). In the value triangle total costs are on the horizontal axis, total benefits on the vertical axis, and value on the hypotenuse (i.e. the slope, which gives ratio of benefits to costs). This visual model makes clear that components with steep and shallow slopes are better and worse value respectively.

Insert Figure 1 Here

STAR's fourth visual model, the efficiency frontier, is generated by ordering value triangles in terms of their value (slope) for a given use of resources. Components with the highest value tend to be those at the start of the care pathway and those with the lowest value at the end. This allows illustration of the relative scale of different components in clinical care pathways in terms of their costs and benefits (4). Analytic and managerial effort can then be directed at how to reallocate resources to improve the value of those care pathways.

STAR's visual models are designed to be used as a basis for discussions on investment and dis-investment. These discussions could be based on either ranking or agreed threshold levels of the cost effectiveness. Sensitivity analyses around each estimate of local cost effectiveness ratio should also be undertaken to inform discussions as there are no definitive estimates of individual benefit. While it was originally developed as a tool for clinical services, recent financial challenges have presented an opportunity to adapt the tool for prioritisation of public health programmes**.** We report the results of our cost effectiveness analysis of public health services using the STAR Tool and the main methodological issues encountered.

Methods

We aimed to produce a STAR efficiency frontier for each of ten local public health programmes: sexual health, tobacco control, alcohol, substance misuse, physical activity, obesity, NHS Health checks, public mental health, oral health and domestic abuse. For this work a programme was defined as an area of commissioning spend covering one area of public health, including one or more services; a service was defined as a discrete public health activity with an associated cost. To produce an efficiency frontier, costs and benefits needed to be defined for each service within the chosen programme.

Identification of Costs

Costs were derived for all commissioned services within a programme from the most recent contract value. The cost of each service was averaged over a year and divided by the number of individuals accessing each service or component of a service to give an estimate of the cost per person. Where numbers accessing services were unavailable, estimates were made from the number of individuals offered the service, adjusted by an estimated take up rate.

Calculation of Benefit

The design of the STAR Tool when used for analysis of clinical services involves a series of stakeholder workshops including commissioners, providers, clinicians and patients to determine the estimated individual benefit achieved for individuals benefiting from each intervention; this uses assessment of Quality of Life states before and after each intervention. Our experimental public health approach to STAR used a modified approach drawing on estimates of benefit in terms of Quality-Adjusted Life Years (QALYs) per person from interventions in the economic evaluation literature that were comparable to those delivered by the local services. Where possible UK derived QALY estimates with a lifetime horizon were used (5). These estimates were then multiplied by the numbers benefiting to identify the total benefit achieved locally for each service.

Modelling of Uncertainty

Following identification of the initial cost effectiveness estimates, a number of approaches were taken to ensure validity of findings. Discussions were held with the relevant local public health commissioners to identify whether the results reflected the effectiveness of the local intervention. In addition sensitivity analyses were undertaken by entering estimates for all interventions from the STAR Tool into a locally developed Microsoft Excel® tool; conservative and optimistic scenario estimates derived from halving and doubling the calculated estimate respectively for each intervention were plotted on a graph alongside the original intervention estimate to visualise the costs and benefits for public health spend for all the relevant commissioning programmes. Furthermore, individual cost effectiveness estimates were also triangulated with values from other health economic assessment tools for relevant interventions where possible (5).

Results

During the application of the STAR tool a number of data problems were encountered, namely a lack of detailed contract information, a lack of relevant performance monitoring data, gaps in the health economic evidence base, and disparate time horizons. Of the ten public health programmes we attempted to model, cost and contract activity data could be sub-divided to allow mapping to evidence on the benefits of public health interventions for tobacco control, sexual health, alcohol and substance misuse, physical activity, obesity, NHS Health checks and domestic abuse. For mental health and oral health, contract data and published evidence were too mismatched to produce a STAR tool. We report in detail on two of the programmes, the tobacco control programme and alcohol and substance misuse programme, but discuss issues encountered with respect to the eight programmes analysed.

Contract activity data

Where contract information was unavailable on the cost of individual components of a service, the overall contract was divided by: either the proportion of individuals receiving each component of a service, for example the numbers receiving opiate treatment as part of the substance misuse service; or the proportion of workforce time delivering each component of a service, for example the number of full time equivalent counsellors as a proportion of all staff within the domestic violence service. Where it was not possible to subdivide the cost of a service into the costs of the components because the latter were delivered simultaneously by one individual, for example the health checks, the service was considered as a single entity for the purposes of identifying costs.

It was not straightforward to identify the number of individuals being offered or benefitting from some services where there was no directly related performance data, for example mass media campaigns around smoking cessation. For these, prevalence figures of the relevant sub group of the population being targeted were used as an estimate of numbers receiving the service, for

example the proportion of the local population smoking. For other services, an estimate of the number of individuals with a condition or behaviour potentially averted was calculated using local prevalence data and the latest national yearly increase in incidence of new cases. Other service outcome data was used where appropriate to derive estimates, for example trading standards data on illicit tobacco seizures was used to derive an estimate of individuals prevented from smoking. Where services aimed to train healthcare staff, an estimate was made of the proportion of the local population who would benefit as a result of that training, for example services seeking to educate primary care staff to better identify victims of domestic abuse.

Benefit estimates

We were not able to extract estimates of QALYs gained per person for some interventions, so the following model adjustments were made. Where there was no identifiable cost effectiveness estimate for a specific intervention but the evidence base suggested a lack of evidence of effectiveness, a near zero QALY value was used. Where there was no identifiable QALY per person value for a specific intervention but the evidence base suggested effectiveness, an estimate was derived by comparing lifetime QALYs lost for an individual with a condition to an individual without it, for example by comparing QALYs lost for a smoker versus a non-smoker and applying this to an estimated change in prevalence to find the total QALYS gained. Where a multi-component service comprised a number of interventions, but there was no single QALY per person value for the service as a whole, an average QALY per person value was derived. For example, for the health checks service we identified local numbers of new diagnoses for each component of the service, and for each diagnosis used estimates of benefit as a result of appropriate further management of each from the literature to calculate an average individual benefit for the service as a whole. A similar approach was taken for a condom distribution programme, where the total number of QALYs gained was calculated based on the QALYs that would be lost for each infection that the condom distribution programme was likely to prevent.

Time horizon of benefits and costs

Estimates of benefit based on a lifetime horizon were used as a gold standard. Where they were unavailable or the time horizon used for the estimate in the evidence base was different from the length of follow up for the service, adjustments were made; for example, estimates for weight loss interventions from the evidence were based on a lifetime horizon, so were reduced to reflect that the service outcomes were measured after three months. Where time horizons differed between services within a programme, adjustments were made to reflect lifetime benefit and allow comparisons between services. Whilst this was possible for tobacco control, since all services had essentially the same desired outcome of permanent quitting, it was not possible for all programmes due to the very different nature of the services within them; for example no adjustment was made to the estimate for the service aimed at improving the ability of primary care staff to identify domestic abuse to allow comparison with the estimate for the domestic abuse counselling service which used a different time horizon.

Neither benefits nor costs were discounted over time as there is dispute between economists over what the discount rate should be and whether the same rate should be used for costs as well as benefits (6). The justification for discounting costs of commodities is that they reduce over time as economies become more productive, but as this justification does not apply to well-being, it has been argued that it is wrong to discount benefits in QALYs (7). It may also be inappropriate to discount costs of health services in austerity as it is unclear that these will be less burdensome in future, particularly given health services suffer from Baumol's disease where labour intensive services become relatively more expensive over time (8). An alternative approach would have been to discount in line with NICE guidance at an annual rate of 1.5% or that of the United Kingdom treasury at 3.5%.

Tobacco Control Programme STAR Tool

For the tobacco control programme there were four interventions or services: the specialist smoking cessation service, the GP delivered smoking cessation service, and contributions to both the West Yorkshire Mass Media Campaign and West Yorkshire Trading Standards, with the majority of the funding going to the specialist stop smoking service (Table 1). Mass media campaigns and trading standards were estimated to be the most cost effective investments, as they reach a far larger population despite having lower estimated benefits per person. GP delivered smoking cessation services were estimated to be more cost effective than specialist services despite a lower quit rate, as they have lower operating and fixed costs being delivered in-house (Figure 2).

Alcohol and Substance Misuse Programme

For the alcohol and substance misuse programme there were five interventions or services: the alcohol and substance misuse treatment and recovery services for opiate use, non-opiate use and at-risk alcohol use, an alcohol liaison service, and a support service for parents and carers of those with alcohol and substance misuse issues (Table 1). Individual costs of the three treatment recovery services were unavailable as they were contained within a single integrated service so an assumption was made of equal costs per individual for each component. Opiate treatment and recovery accounted for three-quarters of the overall costs of the alcohol and substance misuse programme but a third of the estimated benefits. The non-opiate and alcohol addiction recovery services were estimated to be the most cost effective components (Figure 3).

Insert Table 1 Here

Table 1: STAR Tool Analysis for Two Programmes

Service/ Intervention	Cost of service per year	Numbers offered service each year	Estimated cost per person	Estimated % who benefit	Number benefiting each year	Estimated benefit per person benefiting (QALYs)	Total QALYs
Tobacco Control Programme							
Specialist smoking cessation	£774,000	2238 (setting 4 week quit date, mean 2013-15)	£345.85	9.2%	207 (14%(9) of successful 4 week quitters, mean 2013-15)	3 (2.7(10),3.5 (11))	620
GP delivered smoking cessation	£91,000	1478 (setting 4 week quit date, mean 2013-15)	£61.57	6.2%	91 (14% (9) of successful 4 week quitters, mean 2013-15)	3 (2.7 (10),3.5 (11))	272
Mass media campaign	£50,000	83,000 (Wakefield population who smoke)	£0.60	0.4%	166 (Based on 0.05% prevalence decrease in smoking prevalence 0.3-1.1(12),0.44 (13),1.2 (14),1.6% (15))	3 (1.05 (16),2.7(10), 3.5(11))	498
Contribution to West Yorkshire Trading Standards	£30,000	83,000 (Wakefield population who smoke)	£0.36	0.04%	30 (based on Wakefield proportional benefits (17))	3 (2.7 (10),3.5(11))	90

Service/ Intervention	Cost of service per year	Numbers offered service each year	Estimated cost per person	Estimated % who benefit	Number benefiting each year	Estimated benefit per person benefiting (QALYs)	Total QALYs
Alcohol and Substance Misuse Programme							
Alcohol and substance misuse recovery service	£4,057,347	6548 (commencing opiate treatment, mean 2015/16)	£524.21	6.2%	408	0.4 (0.32-0.34 (18), 0.68-0.71 (19))	163
		916 (commencing non-opiate treatment, mean 2015/16)	£524.21	50.7%	464	0.5 (0.24-0.25 (19), 0.25 (13), 0.77-0.79 (16), 0.38-0.39 (1))	232
		276 (commencing alcohol treatment mean 2015/16)	£524.21	94.2%	260	0.2 (0.11-0.33 (20))	52
Alcohol liaison service	£95,000	1400 (given brief advice, mean 2015/16)	£67.86	100%	1400	0.02 (0.0233 (21) 0.004-0.018 (22))	28
Relatives and carers support	£70,000	312 (relatives supported, mean 2015/16))	£224.36	100%	312	0.02 (0.01 (23), 0.02-0.03 (20))	6.3

Discussion

Main finding of this study

This is the first use of the STAR approach to prioritise within public health programmes. It has proved useful in informing commissioning decisions, strategic planning of future provision and engaging public health staff in key health economic principles.

Local cost-effectiveness estimates could be made for most interventions, allowing comparison within and between programmes using visual methods. In general primary prevention interventions were the most cost effective, for example mass media campaigns and trading standards to reduce smoking compared to specialist stop smoking services. The visual demonstration of the STAR efficiency frontiers helped facilitate discussions on how to increase return on investment in the future. The health economic evidence gathered for this work also informed commissioners as to how a more targeted and stratified approach may improve the overall cost-effectiveness of the public health budget, for example priority target groups within a universal NHS Healthcheck programme. Furthermore, most of the local ~~cost-effectiveness~~ estimates suggested existing services provided value for money with average cost effectiveness ratios of below £15,000 per QALY~~, less than the NICE £20,000 threshold for investment for public health interventions.~~

What is already known on this topic

The STAR tool has previously been used to prioritise competing service bids (24), and to prioritise interventions treating patients with eating disorders (25) and chronic obstructive pulmonary disease (26). This modified “lean STAR” approach involving only public health commissioners gave further guidance at a local level about which particular interventions provided the greatest value for money and facilitated communication of this information through graphical means.

What this study adds

This work should be seen within the context of the broader interdependencies of public health programmes and services. For example, STAR analysis often suggests, as in this case, that more 'upstream' primary prevention activities (e.g. education, campaigns, lifestyle interventions) are more cost-effective than treatment (such as sexual health and opiate addiction treatment). However it is simplistic to assume that this implies that the resources ought to be moved from the latter to the former because there is always a time lag from increasing primary prevention to reductions in needs for treatment; also the implications of not treating infections or addiction are serious as there is the potential to impact more widely on society (crime rates and secondary infections) and demand for other services (A&E attendances).

What STAR does is to identify the scale of the resources allocated to different interventions and their benefits which may lead into identifying scope for less costly treatment of less severe cases that might enable resources to be released for primary prevention. Before any re-allocation of resources can occur, assessment of the broader interdependencies of public health services within the health, social care and community sector, and the political and contractual consequences is necessary, to avoid increasing need in other areas and passing costs to other agencies. Any decision making informed by STAR therefore requires careful planning and collaboration across the statutory and third sector, especially where there are no alternative services.

Limitations of this study

While STAR tools could be produced for most of the programmes, not all of them were sufficiently robust to be useful in informing decisions. Limitations were identified with respect to the variable evidence base, lack of clearly associated performance monitoring data, and disparate time

horizons. Methods were developed to adjust for these issues but ultimately decisions were made not to use some estimates: for the mental health programme, which was identified as a priority within the district, it was not possible to align the contract data with the published evidence base to inform future planning; for the sexual health programme, it was not possible to sub-divide the majority of the spend in a meaningful way against published QALY data. As this approach took only the commissioner perspective, the perspectives of provider organisations and service users might need consideration if the tool is to be used beyond an internal prioritisation exercise.

The locally derived cost effectiveness estimates could also be strengthened by further modelling around uncertainty and developing a national online tool to assist local approaches. The latter should include evidence based value estimates for individual interventions, with the capacity to add locally derived activity and cost data; this would bring a broad health economic evidence base into a STAR visualisation tool for public health departments to adapt with local contract and cost data. Therefore, allowing for some limitations, this modified STAR approach has the potential to provide a useful health economic baseline to inform a broader public health prioritisation process and future commissioning arrangements.

Conflicts of Interest

Professor Muir Gray is the Director of Better Value Healthcare Ltd. On behalf of all authors, the corresponding author states that there are no other conflicts of interest.

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References

1. HM Treasury. Spending Review and Autumn Statement. 2015.
2. Heath S. Local authorities' public health responsibilities (England). 2014.
3. The Health Foundation. Socio-Technical-Allocation-of Resources (STAR) tool. Available from: http://www.health.org.uk/collection/star-socio-technical-allocation-resources.
4. London School of Economics. STAR: using visual economic models to engage stakeholders to increase value in the NHS. Available from: http://www.lse.ac.uk/publicEvents/events/2015/02/20150205t1830vHKT.aspx.
5. National Institute for Health and Care Excellence. Return on Investment Tool.
6. Oliver A. A normative perspective on discounting health outcomes. Journal of Health Services Research & Policy. 2013; 18:186-9.
7. Broome J. Discounting the Future. Philosophy & Public Affairs. 1994; 23:128-56.
8. Baumol WJ. The cost disease: Why computers get cheaper and health care doesn't. : Yale university Press; 2012.
9. Ferguson J, Bauld L, Chesterman J, Judge K. The English smoking treatment services: one-year outcomes. Addiction. 2005; 100:59-69.
10. National Institute for Health and Care Excellence. The clinical effectiveness and cost effectiveness of bupropion (Zyban) and Nicotine Replacement Therapy for smoking cessation. 2002.
11. Kaplan RM, Anderson JP, Kaplan CM. Modeling Quality-Adjusted Life Expectancy Loss Resulting from Tobacco use in the United States. Social Indicators Research. 2007; 81:51-64.
12. Hurley SF, Matthews JP. Cost-effectiveness of the Australian National Tobacco Campaign. Tobacco Control. 2008; 17:379-84.
13. Ratcliffe J, Cairns J, Platt S. Cost effectiveness of a mass media-led anti-smoking campaign in Scotland. Tobacco Control. 1997; 6:104-10.

14. Sims M, Salway R, Langley T, Lewis S, McNeill A, Szatkowski L, et al. Effectiveness of tobacco control television advertising in changing tobacco use in England: a population-based cross-sectional study. Addiction. 2014; 109:986-94.

15. Farrelly MC, Davis KC, Haviland ML, Messeri P, Healton CG. Evidence of a Dose—Response Relationship Between "truth" Antismoking Ads and Youth Smoking Prevalence. American Journal of Public Health. 2005; 95:425-31.

16. Centers for Disease Control and Prevention. Annual smoking attributable mortality, years of potential life lost, and productivity losses - United States, 1997–2001. Atlanta, USA, 2005.

17. West Yorkshire Trading Standards. Tackling Illict Tobacco for better health 2015.

18. National Collaborating Centre for Mental Health. Opioid detoxification, National Clinical Practice Guideline Number 522008.

19. National Collaborating Centre for Mental Health. Psychosocial interventions, National Clinical Practice Guideline Number 512008.

20. Mortimer D, Segal L. Economic evaluation of interventions for problem drinking and alcohol dependence: do within family external effects make a difference? Alcohol and Alcoholism. 2005; 41:92.

21. Optimity Advisors. Health England Leading Prioritisation (HELP) Report 3. 2001.

22. National Institute for Health and Care Excellence. Alcohol-use disorders: prevention, NICE guidelines PH24, 2010.

23. Copello AG, Velleman RDB, Templeton LJ. Family interventions in the treatment of alcohol and drug problems. Drug and Alcohol Review. 2005; 24:369-85.

24. Airoldi M, Morton A, Smith JAE, Bevan G. STAR—People-Powered Prioritization. Medical Decision Making. 2014; 34:965-75.

25. Airoldi M. Disinvestments in Practice: Overcoming Resistance to Change through a Sociotechnical Approach with Local Stakeholders. Journal of Health Politics, Policy and Law. 2013; 38:1149-71.

26. Williams S, Baxter N, Holmes S, Restrick L, Scullion J, Ward M. IMPRESS Guide to the relative value of COPD interventions 2012.