Considering Consumer Choice in the Economic Evaluation of Mandatory Health Programmes: A Review

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Abstract

Objective: Governments are increasing their focus on mandatory public health programmes following positive economic evaluations of their impact. This review aims to examine whether loss of consumer choice should be included in economic evaluations of mandatory health programmes (MHP).

Method: A systematic literature review was conducted to identify economic evaluations of MHP, whether they discuss the impact on consumer choice and any methodological limitations.

Results: Overall 39 economic evaluations were identified, of which ten discussed the loss of consumer choice and six attempted to place a value on the loss of consumer choice. Methodological limitations included: measuring the marginal cost of compliance, unavailability of price elasticity estimates, the impact of income effects, double counting health impacts, biased willingness-to-pay responses, and “protest” responses. Overall it was found that the inclusion of the loss of consumer choice rarely impacted on the final outcome of the study.

Conclusion: The impact of MHP on the loss of consumer choice has largely been ignored in economic evaluations. Its importance remains uncertain due to its infrequent inclusion and significant methodological limitations. Further research regarding which methodology is best for valuing loss of choice and whether it is importance to the final implementation decision is warranted.

Key words: Mandatory Programs, Economics, Public Opinion, Consumer Choice, Cost-Benefit Analysis

Word count: 199 (abstract), 4175 (text, excluding tables and references).

1. Introduction

Governments are increasing their focus on preventative public health programmes to contain rising health costs caused by population ageing and the availability of more effective but costly technologies. Public health programmes can be introduced on either a voluntary or mandatory basis. Voluntary programmes give consumers the option (or 'choice') of adhering to a particular programme and impose no penalties for non adherence. Mandatory health programmes (MHP) require government legislation, but are appealing because there are significant savings in terms of enforcement and promotion costs in addition to being the most effective method of ensuring population compliance [1].

Recently some Governments have commissioned economic evaluations of MHPs to ascertain whether they result in a net gain to society [2-4]. The evaluation of MHPs, such as fortification and immunisation programmes, involves balancing two essential factors – benefits and risks – in the population. That is to say, the potential societal benefits (such as improved compliance) must be balanced against the risks, and potential harms, to individuals and communities [5]. While some people will benefit from MHPs, not all people will benefit and a small minority may experience harm, for example through adverse events.

Regardless of whether the programme enforces or bans consumption of a good, MHPs restrict personal choice and deny consumers the ability to readily substitute particular goods or services. For example, some people may value the loss of the availability of a good (such as folate-free bread or iodine-free salt), incur the cost of buying a more expensive alternative (such as fluoride-free bottled water), prefer to not be vaccinated on the basis of religious, medical or social reasons [6], have a high risk aversion to adverse events (whereas the government is risk neutral), or simply prefer to exercise free choice in deciding what to consume. The 'restriction' on choice represents a loss in consumer welfare or more specifically consumer surplus – a measure of the net

benefit of consumption (i.e. the difference between the consumer actually pays and the amount the consumer is willing to pay)[1].

The aim of this paper is to review the literature on the measurement and inclusion of the loss of consumer choice in economic evaluations of MHPs, and to discuss the potential policy implications of excluding consumer choice from economic evaluations.

2. Methods

A literature review was conducted to ascertain whether economic evaluations of MHPs include loss of consumer choice, and if so what methodology was used to quantify the loss of consumer surplus. The review focussed on finding examples of MHP economic evaluations that either mandatorily enforced, or banned, the consumption of a good. The search was conducted in Medline, EMBASE, EconLit and NHS EED databases. The review also included grey literature searches of published Government reports known to the authors. Search terms utilised were fortification or folate or folic or iodine or vaccination and (compulsory or mandatory) or fluoridation or trans-fat$ or (smoking near public) or cannabis or (food and (unhealthy or junk) and school$) or SunSmart or (bicycle and helmet) in combination with the search terms cost-benefit or cost-effectiveness or cost-utility or (economic and evaluation). The bibliographies of all retrieved publications were hand-searched for any relevant references missed in the database search.

The search was limited to publications published in English. In EconLit the subject was limited to health. Papers were included if they compared health outcomes to the costs of the MHP. Papers were excluded if the mandatory programme preserved consumer choice. For example, mandatory nutritional labelling, smoking warnings on cigarette packets and banning of junk food advertising.

[1] In addition to restricted choice, consumers may also face increased prices for these goods or services due to increased demand or higher manufacturing costs. However this amount is distinguished from the cost of reduced choice.

The following information was extracted from each study: country, perspective of the analysis, methodology, primary measure of benefit, inclusion of adverse events and productivity impacts, and estimate of loss of consumer choice.

3. Results

The search for MHP economic evaluations identified 30 relevant articles [7-36]. Four additional government reports were identified [2-4, 37] and another nine articles were identified through pearling of references [38-46]. Overall 43 relevant articles were identified (see Table 1), representing 39 economic evaluations.

The most common methodology used in the economic evaluations was cost-effectiveness analysis (24 studies), followed by cost analysis (13 studies), cost-benefit analysis (7 studies), and cost-utility analysis (4 studies). Several studies used a range of methods to analyse the impact of the MHPs. The perspective of the evaluation was reported in only 10 studies, of which 9 claimed to use a societal perspective. Often the perspective was not discernable on the basis of the cost categories included in the evaluations. Health care costs were not included in ten studies. Given that they are economic evaluations of MHPs the exclusion of health care costs may have a significant impact on the final conclusion of these studies[2]. Adverse events associated with the MHP were included in six studies. For some MHPs, such as banning smoking in public places and mandatory bicycle helmet use, it is appropriate to not include adverse events. However for other MHPs, such as folate fortification, the omission of both treatment costs and pain and suffering caused by adverse events may have a significant impact on the final conclusion of the study. Productivity impacts incurred by individuals[3] were explored in 12 studies and one included the productivity losses due to compliance with the legislation [37]. Exclusion of productivity impacts would be appropriate if the study took a health system or payer approach. However in three cases the authors stated that the study took a societal perspective but excluded productivity impacts. Again this may have a significant impact on the final conclusion of these studies.

[2] This is not an issue for the WTP studies where health care costs are included implicitly.

[3] Productivity impacts incurred by health workers were considered a health care cost.

Insert Table 1 here

Of the 39 MPH economic evaluations identified, five studies(7 articles)[4] attempted to value loss of consumer choice [2, 16, 31-33, 37, 47] while a further four studies mentioned that the introduction of a MHP would result in a loss of consumer choice [3, 4, 11, 34]. One additional study did not mention consumer choice directly, but estimated the loss in terms of people who quit cycling as a consequence of the introduction of mandatory helmet wearing legislation [28] (see Table 2). These articles are discussed below.

Insert Table 2 here.

Several methods have been suggested for valuing loss of consumer choice, these include: the cost of compliance, price elasticities, lost productivity and contingent valuation. The relative merits of each are discussed below.

The cost of compliance

Two studies that evaluated the cost-effectiveness of mandatory bicycle helmet legislation assumed that the maximum value of loss of consumer choice, to people who subsequently quit cycling, was the cost of complying with the regulation (i.e. the cost of a helmet) [16, 28]. The use of the Marshallian demand curve is appropriate in the case of bicycle helmet legislation as the income effect of a once-off purchase of a helmet is likely to be small. This is because the Hicksian compensated demand curve approaches the Marshallian demand curve as the income effect approaches zero [48]. However the methodology utilised overestimates the loss of consumer surplus – if it is assumed that the value each person places is uniformly distributed between zero and the cost of the helmet, thus the demand curve is linear and the loss of consumer surplus is a triangle, a closer approximation to the loss of consumer choice would be halve this number. However if the demand curve is convex to the origin, the loss of consumer surplus would remain overestimated.

[4] One study assumed a value of the loss of consumer choice due to folate fortification of bread products to be $1 per person per year for each person not in the target population (women aged between 18 and 45 years) [2, 20]. This assumption was not based on any evidence and consequently will not be discussed further in the report.

A similar methodology was applied in an economic evaluation of restrictions on smoking in workplaces [37]. It was assumed the maximum value of loss of consumer choice to people who subsequently quit smoking was half their total expenditure on cigarettes forgone (assumed to be 20 cigarettes a day). In the cycle helmet example, this is akin to measuring the loss of consumer choice to cyclists on the basis of the cost of the bike rather than the helmet. Thus in the case of smoking, a more appropriate proxy would be the inconvenience of finding a designated smoking area or the value of cigarettes not consumed during working hours. The authors note that those who choose to stop altogether may welcome the ban as a cessation aid. Consequently their loss of consumer choice is likely to be much lower. Importantly, the methodology of estimating the cost of compliance does not consider the loss in consumer choice incurred by individuals who face no other alternatives (such as compulsory vaccination).

Price Elasticities

An alternative approach used to estimate the loss of consumer choice in continuing smokers was to multiply the reduction in cigarettes consumed at work by the price increase that would lead to the same change in behaviour, using price elasticities reported in the literature, multiplied by half [37]. This methodology estimates the loss of consumer choice using the Marshallian demand curve and assumes that the income effect of banning smoking in workplaces is small. This is a strong assumption since expenditure on cigarettes can be over a fifth of total income in the lowest socioeconomic group [49]. Furthermore price elasticity estimates based on small changes in taxation may not be appropriate for extreme policy changes (such as banning or forced consumption). Price elasticity estimates are often based on surveys or natural experiments involving people who voluntarily consume a good, not those for whom consuming a good gives them a negative utility. Consequently this methodology may underestimate the loss of consumer choice from forcing consumption. Finally, this methodology relies on the availability of price elasticity estimates, which may be problematic in circumstances when the good is not normally traded in the market place (such as fluoridated water).

Lost Productivity

Another alternative was to estimate drivers of the loss of consumer choice separately. For example, one study estimated the additional inconvenience incurred by smokers in terms of the lost productivity associated with time required to find a designated smoking area during work hours [37]. However, this cost may be incurred (partially or fully) by the employer rather than the employee and thus is not an accurate estimate of inconvenience. Furthermore this methodology does not value other factors driving loss of consumer surplus, such as the inconvenience to the smoker of standing outside in the cold wet weather.

Contingent valuation

Stated preference methods have been used to value loss of consumer choice. For example, a study may ask individuals hypothetical questions regarding their willingness to pay (WTP) for the introduction of a MHP or willingness to accept (WTA) compensation for not introducing a MHP[5] to estimate their compensating or equivalent variation, respectively [50, 51].

Contingent valuation was used by one study which examined the impact of introducing fluoridated tap water into a community in the United Kingdom [31, 33]. After determining whether respondents were for or against the programme, respondents were asked either a) how much compensation would be required if they were willing to accept an annual tax rebate as compensation for fluoridation being implemented or b) how much they would be willing to contribute in extra annual taxation to have a device fitted to their water supply which would remove the fluoride from their drinking water. Two respondents gave a zero WTP stating that they could not afford to pay. The main reasons that people were willing to pay (or accept compensation) were violation of freedom of choice and the desire to have pure water. The study also identified a group of respondents, referred to as “protesters”, who refused to provide information regarding their WTP for water fluoridation, citing that they were “paying enough taxes/water rates already” or “the water companies should

[5] Where people incur a loss from the introduction of a programme the questions should be phrased in terms of willingness to pay to avoid the introduction of a programme (equivalent variation), or willingness to accept compensation for introducing a programme (compensating variation).

pay" (against taxation in general), or no amount of money would be sufficient to compensate for fluoride being added to the drinking water.

Another study used contingent valuation to examine the impact of introducing folate fortification of flour. However, the study only explored the WTP for the introduction of the programme and not the WTP to avoid the introduction of the programme [32]. The study identified a group of respondents, referred to as "protesters" or "zeros", who refused to provide information regarding their WTP for folate fortification. Reasons cited by these respondents included "manufacturers should pay or simply increase the price of food" (against taxation in general), or "there are other issues that I feel more strongly about" (awareness of opportunity cost), the respondent was too poor to pay any money (income bias), "it would only benefit pregnant women and not all society" or "because I don't need it personally" (irrelevance or non-altruistic reasons), "people should know about folic acid already" and "people already have good access to information, it is generally available" (individual responsibility), "it is not necessary at the current time" or "I would want to know the outcome of further research" (lack of information), and "I am against universal additives in principle" (distrust of additives). It should be noted that some individuals, although against folate fortification, were willing to pay for fortification on the basis of altruism [32].

In some cases the existence of "protesters" would result in an underestimation of the WTP to avoid (or WTA compensation to allow) the MHP and thus lead to an underestimation of the loss of consumer choice. However the extent of underestimation depends on the specific MHP being evaluated and the reasons provided by respondents for not providing an estimate of their WTP or WTA. For example, if the key reason is 'irrelevance' the impact may be less than if the key reason is 'no amount of money would be sufficient to compensate the individual'.

Contingent valuation studies enable the valuation of aspects of a MHP not captured by other measures, such as quality adjusted life years (QALYs), and enable the estimation of value placed by all people from forcing consumption, unlike the price elasticity approach which is based on voluntary consumers only. On the other hand contingent valuation studies suffers from problems surrounding the hypothetical nature of the survey questions, the impact of different payment vehicles resulting in different valuations, and the association of WTP with ability to pay [50-52]. Protest

responses are a key limitation in the use of contingent valuation studies; in particular the ability to identify a realistic payment vehicle in countries where the public rarely face costs is difficult. Consequently respondents may ignore costs as they assume they are not borne by them directly [51, 52]. This is less of an issue in countries where health care co-payments are widespread, or equivalently surcharges and grants are common within the tax system. Another key issue with contingent valuation studies is responder bias. For example, if the responder believes the survey is gathering information to inform priority setting, but they will not incur any costs, they may over-estimate their WTP for programmes they value (and vice versa for programmes they place a negative value on). On the other hand if the respondent believes the survey is to inform fee setting then they may under-estimate their WTP.

Importantly, WTP methodology values MHPs as a whole [53], including the health benefits and harms. If the benefits and harms are excluded the responder may infer the level of benefits and harms incorrectly. Consequently, in the case of MHPs, WTP methodology suffers from the potential to double-count the value placed on negative aspects of the programme, such as the risk of adverse events, which are explicitly taken into account in economic evaluations. The methodology also provides no indication of the key drivers of disvalue of the MHPs which may be mitigated by the design of the programme. One alternative would be to consider these values as a stand-alone study during the decision making process.

In summary, the inclusion of loss of consumer choice only influenced the final outcome of one study. However loss of consumer choice was rarely and often inappropriately measured, consequently the relevance of this parameter during economic evaluation is uncertain.

Insert table 2 here

4. Discussion

The impact of MHPs on the loss of consumer choice has largely been ignored during economic evaluations. In some cases the lack of an estimate of the loss of consumer choice may not be an oversight, but rather a reflection of the perspective taken by the evaluators. For example, if a public health system perspective is adopted [54] then it would not be appropriate to include an estimate of the loss of consumer choice.

However, for many health programmes choosing a health system perspective is too restrictive to capture all benefits and costs and consequently may lead to inefficient allocation of resources. Therefore a broader societal perspective may be preferred, in which case including loss of consumer choice would be justified. This is important because a recent review of health care economic evaluations guidelines found that, of a total of 26 guidelines reviewed, a societal perspective is preferred in six countries (Cuba, Finland, France, The Netherlands, Portugal, and Sweden) and another five[6] countries preferred both a health system and societal perspectives (Austria, Ireland, Italy, Russia, and Spain) [55, 56].

Many MHPs may involve the use of resources that are not typically provided by a public health system (such as water treatment facilities or enforcement costs). Furthermore many MHPs are often evaluated by public health or non-health Government departments. Consequently, a whole-of-government or a societal perspective is the most appropriate. Guidelines for conducting economic evaluations by non-health Government departments suggest taking a societal perspective. For example, the UK Treasury suggests that [57]:

> *"In principle, appraisals should take account of all benefits to the UK. This means that as well as taking into account the direct effects of interventions, the wider effects on other areas of the economy should also be considered. These effects should be analysed carefully as there may be associated indirect costs, such as environmental costs, which would also need to be included in an appraisal. In all cases, these wider effects should be clearly described and considered."*

Similarly the Office of Best Practice Regulation in Australia suggests that[58]

> *"…the costs and benefits to all people residing in Australia should be counted, as far as practical."*

When a societal perspective is appropriate, the loss of consumer choice should be included in the analysis. Although it is worth noting that the inclusion of the loss of

[6] Note that the latest Pharmaceutical Benefits Advisory Committee guidelines for Australia suggest that PBAC prefers a health system perspective over a societal perspective.

consumer choice in all economic evaluations may raise equity issues. For example, there may be an increased probability that MHPs that largely affect low socioeconomic groups (e.g. smoking in public places) would be more likely to be cost-effective compared to those that largely affect high socioeconomic groups (i.e. cycling), all else being equal. This is because the 'ability-to-pay' effect would decrease the relative loss of consumer choice in the former group. This equity implication may or may not be acceptable to policy makers.

When loss of consumer choice has been included in the economic evaluation of MHPs there have been significant limitations in the methodologies used. These include: the methodology used to estimate of the marginal cost of compliance; the unavailability of measures of price elasticity; the impact of income effects of the programme and consequently whether the Marshallian demand curve would be an acceptable proxy for the Hicksian demand curve; double counting of the health impacts; and biased responses and "protest" responses in contingent valuation studies. In particular, double-counting of negative health impacts, such as adverse events, is a key issue since this would bias the economic evaluation against the MHP, and vice versa. To avoid this issue, decision makers could use estimates of the loss of consumer choice as an additional, but distinct, piece of evidence along with the economic evaluation. However if this approach was chosen the decision maker would need to decide how much weight should be applied to each piece of evidence.

None of the papers used discrete choice experiments (DCE) to estimate loss of consumer choice due to MHPs. According to Lancaster's economic theory of value, individuals derive utility from the underlying attributes of a good and that preferences (and thus utility) across goods are revealed through their consumption choices [59]. On the basis of this theory, in a DCE respondents choose their preferred alternative from a choice set. Each alternative is described by a bundle of attributes, including cost, with each attribute described using a different level (i.e. $0, $20, $100 etc). The respondents repeatedly choose their preferred alternative from a series of hypothetical choice sets where the levels of each attribute differs [53].

The strength of the DCE approach is that choosing between bundles of goods is an easily comprehended task for respondents and there is evidence that it is both consistent with welfare theory [60, 61] and consistent with that observed in practice

[62]. DCEs also enable the measurement in monetary terms of the marginal value placed on each attribute by including cost as one of the attributes. Thus DCEs are capable of directly measuring the compensation [61] required for introducing a MHP, while holding the health impacts constant. Unlike contingent valuation studies, this avoids the risk of double-counting the impact of the MHP on health and adverse events which have been considered explicitly in the economic evaluation. The problem of protest responders may be minimised if these responders simply ignore the cost variable, thus increasing the uncertainty but not necessarily biasing the results. Furthermore the estimated compensation can be directly incorporated into an economic evaluation, avoiding the need for decision makers to decide how much weight should be placed on each piece of evidence as with contingent valuation studies.

DCEs have the advantage of being able to disentangle the drivers of loss of choice in MHPs, since it is unlikely that loss of consumer choice will equate to a single universal value. The valuation is likely to vary by programme depending on the following: whether consumption of the good is being made compulsory or banned; the strength of opposition to mandatory programme; the proportion of people who voluntarily consume the health good without government intervention; and how strongly people care about deviations away from their voluntary level of consumption; the level of individual benefit and strength of altruism towards others. The latter point is interesting because this is likely to depend on who the others are and what they are gaining or losing. For example, evidence suggests that people value gains in health more highly for people with a low quality of life or short life expectancy before treatment, if there is no other treatment available, and if the individual is young [63]. Unfortunately some issues faced with contingent valuation, such as the association of WTP with ability to pay, would still be encountered in DCEs [64].

Due to the limitations identified in the literature it is uncertain whether the inclusion of the loss of consumer choice in the economic evaluations would change the conclusion of these studies. Further research regarding the most appropriate method to measure the loss of consumer surplus, including the viability of using DCEs which is yet to be explored, and whether its inclusion would make a difference to the final implementation decision is warranted.

This paper raises the issue that loss of consumer choice, which has been identified by the general public as a key argument against the introduction of MHP, has largely been ignored by the literature. When it has been considered there are significant limitations with the approaches taken to date. Even so, incorporation of the loss of consumer choice into future economic evaluations of MHPs does not address key ethical issues with MHPs. For example, if education campaigns regarding the risk of certain behaviours on health fail are Governments justified in intervening with mandatory legislation or should the responsibility continue to lie with the individual? [65] It is generally accepted that the Government intervenes if individuals are directly harmed by other people's actions, such as with violence. However how far does this responsibility extend? For example, the failure to immunise children puts other children at risk consequently does this justify compulsory vaccination, despite significant risks of adverse events to some children? Is it more acceptable to ban smoking in workplaces due to second-hand smoke or due to concern for the health of the smoker? [66] Is Government intervention more justifiable if individuals are less able to make rational decisions for themselves, thus justifying banning junk food in schools or SunSmart for kids? Finally, are Government's more justified in using MHPs if they incur a majority, of not all, of the health costs? These questions cannot be answered directly by economic evaluations.

5. Conclusions

The impact of MHP on the loss of consumer choice has largely been ignored in economic evaluations. The importance of loss of consumer choice remains uncertain due to its infrequent inclusion. There are also significant methodological limitations for estimating the appropriate value. DCEs may provide an improved methodology to estimate the loss of consumer choice and avoid double counting in economic evaluations. Further research regarding the suitable methodologies, including DCEs, and the importance of the loss of consumer choice to the final implementation decision is warranted.

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MHP	Search Results				Relevant Articles	
	Medline*	EMBASE*	EconLit**	NHS EED**	Economic Evaluations	Includes estimate of loss of consumer choice
Compulsory Consumption						
Compulsory vaccination	18	33	3	2	2	
Folate or iodine fortification	200	813	50	48	14	3
Fluoridation of tap water	86	23	1	7	19	2
Sunsmart (no hat, no play)*	23	2	0	1	0	
Bicycle helmets use	12	8	3	4	5	2
Banning Consumption						
Trans fats	3	4	7	0	0	
Smoking in public places	19	21	57	47	3	1
Cannabis use	9	115	153	3	0	
Unhealthy food in schools	2	2	5	0	0	
Total	**382**	**1021**	**287**	**112**	**43 articles 39 evaluations**	**8 articles 6 evaluations**

* Search terms utilised were fortification or folate or folic or iodine or vaccination and (compulsory or mandatory) or fluoridation or trans-fat$ or (smoking near public) or cannabis or (food and (unhealthy or junk) and school$) or SunSmart or (bicycle and helmet) in combination with the search terms cost-benefit or cost-effectiveness or cost-utility or (economic and evaluation).

** Search terms utilised were fortification or folate or folic or iodine or vaccination and (compulsory or mandatory) or fluoridation or trans-fat$ or (smoking near public) or cannabis or (food and (unhealthy or junk) and school$) or SunSmart or (bicycle and helmet).

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Table 2: Details of economic evaluations of mandatory health programmes

Study	Health programme	Country	Methodology, Primary Measure of Benefit	Evaluation Perspective	Health Care Costs Included	Adverse Events Included	Productivity Impacts Included	Estimate loss of consumer choice
Department of Health (2005)[37]	Banning smoking in workplaces and public places	UK	CBA: increased life expectancy (valued using the value of a statistical life lost used by the UK Department of Transport)	Not stated	Yes	N/A	Productivity gains due to smokers quitting and increased life expectancy, and losses from smokers complying with legislation	Losses to continuing smokers and quitters was estimated by comparing the impact of bans on reduced smoking compared to price increases that would lead to the same change in behaviour. Additional lost productivity time due to leaving work to smoke was also estimated. In comparison the Overall the decision to implement the programme would be unchanged regardless of including the impact on consumer choice: £2,700m to £3,100m total benefits- £155m for continuing smokers - £550m for quitters - £430m for productivity impact = £1565m to £1965m
Dixon (1999) and Shackley (2000)[31, 33]	Fluoridation of tap water to prevent dental caries among children and adults	UK	WTP	Not stated	No	Small white patches on teeth	No	WTP and WTA compensation (n=100 surveyed, of which 53 answered the WTP/WTA question). Of the 13 that were against the programme, 8 were asked how much they were WTP to avoid, and 5 were asked how much they were WTA compensation. Overall the decision to implement the programme would changed by including the impact on those against the programme: 40 in favour/53* WTP=£12.63 – 8 against/53 * WTP=£29.38 – 5 against/53 * WTA=£76. = -£2.07
Dixon (2003)[32]	Folate fortification to reduce NTDs	UK	WTP	Not stated	No	Masking of vitamin B_{12} deficiency	No	WTP (n=76 surveyed, of which 40 answered the WTP question). Of the 15 that were against the programme, all were asked how much they were WTP to avoid, of which 7 refused to answer. Overall the decision to implement the programme would be unchanged regardless of including the impact on those against the programme: 32 in favour/40*£22.8 - 8 against/40* WTP= £11.9 = £15.86
Hansen (1995)[16]	Bicycle helmets use to prevent head injuries in children and adults	New Zealand	CEA: LYG or hospitalisations avoided	Not stated	No	N/A	No	Maximum value of cycling to irregular cyclists who subsequently quit cycling is assumed to be the cost of complying with the regulation i.e. the cost of a helmet. Overall the decision to implement the programme would be unchanged regardless of including the impact on those who quit cycling. Cost/LYG without lost to quitters = $83,857 to $107,924 for 5 to 12 year olds, $672,256 to $792,234 for 13 to 18 year olds, and $862,138 to $983,034 for 19+ year olds.

Study	Health programme	Country	Methodology, Primary Measure of Benefit	Evaluation Perspective	Health Care Costs Included	Adverse Events Included	Productivity Impacts Included	Estimate loss of consumer choice
								Cost/LYG with lost to quitters = $88379 to $113,744 for 5 to 12 year olds, $694,013 to $817,874 for 13 to 18 year olds, and $890,041 to $1,014850 for 19+ year olds).
Segal (2007)[2, 47]	Folate fortification of bread products to reduce NTDs	Australia	CEA: NTDs and DALYs avoided	Not stated	Yes	No	No	Assumed $1 per person per year for each person not in the target population (women aged between 18 and 45 years).
Taylor (2002)[28]	Bicycle helmets use	New Zealand	CBA and CEA: WTP and head injuries averted	Societal	Yes	N/A	Value of avoiding an injury requiring short stay hospital treatment or long stay hospital treatment was based on a WTP survey which included productivity costs, property damage, legal and court costs, and some medical costs.	Loss associated with people who quit cycling were assumed to incur 1) no cost, 2) cost equal to the cost of the helmet, and c) an additional $30 societal cost on top of the cost of the helmet to account for reduced exercise and increased motorcar use. Overall the decision to implement the programme would be unchanged regardless of including the impact on those who quit cycling. Benefit:cost ratios (assuming all scenarios involves quitters and the same value of benefits): 1) 13.5 for children aged 5-12 years, 5.9 for children aged 13-18 years, 2.6 for adults. 2) 12.6 for children aged 5-12 years, 5.5 for children aged 13-18 years, 2.5 for adults. 3) 6.6 for children aged 5-12 years, 2.9 for children aged 13-18 years, 1.8 for adults.

WTP=Willingness-to-pay, WTA = Willingness-to-accept, CBA = cost-benefit analysis, CEA = cost-effectiveness analysis, CUA = cost utility analysis, DMFT = decay, loss, and filled teeth, NTD = neural tube defects, QALYs = Quality adjusted life years, DALYs = Disability Adjusted Life Years, LYG = life years gained.