YORK
Health Economics
CONSORTIUM

NATIONAL INSTITUTE FOR HEALTH AND CLINICAL EXCELLENCE

An Economic Evaluation of Different Interventions to Promote Tobacco Harm Reduction

November 2021: NICE guidelines PH45 (June 2013) PH48 (November 2013) have been updated and replaced by NG209. The recommendations labelled [2013] or [2013, amended 2021] in the updated guideline were based on these evidence reviews. See www.nice.org.uk/guidance/NG209 for all the current recommendations and evidence reviews.

Supplementary Report

Providing Consultancy & Research in Health Economics

DR MATTHEW TAYLOR, Deputy Director
LILY LEWIS, Research Assistant

THE UNIVERSITY of York
INVESTORS IN PEOPLE

SEPTEMBER 2012

Contents

Section 1: Introduction

1.1 BACKGROUND

The National Institute for Health and Clinical Excellence (NICE) has commissioned the development of an economic model for the evaluation of interventions to reduce harm from tobacco use.

The results of the model were presented to the Programme Development Group (PDG) in June 2012. At that meeting, the PDG made a number of further recommendations and requests for additional scenarios.

The methods and results of those scenarios are presented in this supplementary report. The reader is referred to the main report for full details of the model's structure and data inputs.

Section 2: Methods

2.1 REQUESTED CHANGES TO THE MODEL

The PDG made several recommendations for additional scenarios and assessments from the model. These are summarised below, in Table 2.1.

Table 2.1: Recommendations for additional scenarios

Number	Recommendation	Rationale
1	The removal of any 'direct' benefits associated with low-level smoking.	There is relatively little robust evidence to support the quantitative analysis of co-morbidity rates for different levels of smoking.
2	Include an additional 'indirect' benefit of low-level smoking (i.e. that reduction in tobacco intake is more likely to lead to a successful quit attempt in the future).	There is some evidence to suggest that people who reduce their intake of tobacco are more likely to quit smoking in the near future.
3	An additional scenario to assess the *long-term* use of nicotine containing products (NCP) for people who wish to reduce their tobacco intake.	The existing model only considered long-term use of NCP for people that have successfully *quit* smoking.
4	The inclusion of a more detailed 'population' assessment of tobacco harm reduction strategies.	Whilst 'per patient' outcomes are useful for decision-makers in some context, there is a need to quantify the magnitude of benefits at a national scale.
5	An explicit comparison of strategies aimed at encouraging patients to reduce their smoking levels compared to strategies aimed at quitting smoking.	Previous NICE public health assessments have measured the cost-effectiveness of interventions to *quit* smoking. It is not necessary appropriate to compare results from this study with those from previous studies due to the heterogeneity of approaches. As such, a direct comparison is included in this supplementary report for illustrative purposes.

2.2 KEY CHANGES

2.2.1 Removal of direct benefits associated with low-level smoking

For this scenario, it was assumed that the age-related risk (i.e. prevalence) of each co-morbidity was the same for all smokers, regardless of their level of tobacco use. That is, a composite risk of co-morbidity was applied to each age group for 'smokers' and 'former smokers' (as opposed to the previous version of the model, which included separate risks for

'high-level smokers', 'low-level smokers' and 'former smokers'). Likewise, the age-related risk of mortality was applied to a composite group of 'smokers' and also for 'formers smokers'.

Finally, it was also assumed that there would be no additional quality of life benefit for patients that switched to low-level smoking.

2.2.2 Likelihood of quitting if patient reduces tobacco intake

A recent study (Beard 2011) suggests that smokers who reduce their level of tobacco intake are significantly more likely to attempt a quit attempt in the near future. Specifically, that study suggests that people who experience 'smoking reduction' (as defined by the Beard study) are 1.51 times more likely to *quit* smoking at six months (they are 1.61 times more likely to *attempt* to quit smoking).

The quit rate for smokers not reducing their intake was 6.0% at six months. For those that *did* reduce their smoking level, the quit rate was 9.4% at six months. Furthermore, it is noted that 11.2% of smokers that used NRT to aid their reduction were abstinent at six months. As such, these values were used in the economic model to predict the indirect benefits associated with a reduction in tobacco intake.

2.2.3 Assessing the long-term use of nicotine containing products for tobacco harm reduction

The previous model contained an assessment of the long-term use of NCP for patients attempted an abrupt quit attempt. This additional analysis builds on the findings described in Section 2.2.2, above, and generates an estimate of the cost-effectiveness of long-term use of NCP in patients who reduce their intake (and, subsequently, may or may not quit smoking). The analysis assesses a range of durations of NCP use, between 12 weeks and 5 years. Two scenarios are presented: The first assumes that all people continue to use NCP, irrespective of whether or not they eventually quit smoking. The second assumes that only those patients who quit smoking will continue to use NCP.

2.2.4 Aggregated results for a population of smokers

The previous model presents results 'per patient', which is a useful method for determining cost-effectiveness of interventions. However, many decision-makers are interested in the aggregated impact upon society. Results are, therefore, presented for a cohort of 100,000 smokers. The results from this analysis may, of course, be multiplied to a greater number still, in order to estimate the impact at a national level.

2.2.5 Comparison against quitting

For illustrative purposes, a comparison is presented between the benefits of *reducing* tobacco intake (as quantified using the methods described above) and the benefits of *quitting* smoking. Although quitting smoking is clearly more beneficial than reducing

smoking levels, it does not necessarily follow that quit *attempts* will deliver more benefits than reduction *attempts*. It may be, for example, that people attempting to reduce their smoking level may experience a far higher success rate compared to those attempting to quit. As such, the additional benefits of quitting may be offset by the fact that a greater number of people may succeed in reducing. The analysis presented below demonstrates the quantitative nature of this trade-off, and allows the decision-maker to determine the relative benefits of reducing and quitting smoking.

Section 3: Results

3.1 A COMPARISON OF REDUCTION VERSUS NO REDUCTION

In this scenario, no benefits are directly accrued as a result of reducing smoking. However, smokers who reduce are more likely to ultimately quit smoking and, as such, indirect benefits may be experienced. For the purposes of this analysis, it is assumed that the cost of an intervention to aid a reduction attempt is £50 (this is based on two meetings with a generic healthcare professional, at £25 per visit (PSSRU *Unit Costs of Health and Social Care* 2011). Recall from Section 2.2.2 that the six-month quit rates for reducers and non-reducers are 9.4% and 6.0% respectively.

Table 3.1: Cost-effectiveness of tobacco harm reduction intervention (versus no intervention)

	Reduce without NRT	No attempt to reduce	Incremental
Intervention costs	£50	£0	£50
Comorbidity costs	£7,197	£7,255	-£58
Lung cancer	£504	£513	-£9
Stroke	£1,531	£1,533	-£2
CHD	£2,711	£2,743	-£32
MI	£1,897	£1,914	-£16
COPD	£554	£553	£1
Total costs	**£7,247**	**£7,255**	**-£8**
QALYs	**14.034**	**14.003**	**0.030**
Life years	**30.411**	**30.344**	**0.067**
Incremental cost per QALY			**Dominant**
Incremental cost per life year			**Dominant**
Net monetary benefit			**£616**

NB: Please note that these results do not match those of the 'no intervention' group in the main report, since this supplementary report uses different assumptions (e.g. no gain from reducing tobacco intake).

This demonstrates that, overall, the intervention to encourage reduction is both cost saving *and* beneficial (in terms of leading to a gain in QALYs). In cost-effectiveness terms, it is said to be a 'dominant' strategy.

3.2 A COMPARISON OF REDUCTION (WITH NCP) VERSUS NO REDUCTION

In this scenario, as above, the only benefits associated with reducing smoking levels are that the smokers is more likely to quit smoking at six months. As shown in Section 2.2.2, a

smokers who reduces their intake with the help of NCP has an 11.2% probability of being abstinent at six months, compared to 6.0% with no reduction.

For this analysis, it was assumed that the cost of the intervention was £235. This is derived from two visits to a generic healthcare specialist, and twelve weeks of nicotine replacement therapy, at £15.42 per week (PSSRU *Unit Costs of Health and Social Care* 2011).

Table 3.2: Cost-effectiveness of tobacco harm reduction intervention with NCP (versus no intervention)

	Reduce with use of NRT	No attempt to reduce	Incremental
Intervention costs	£235	£0	£235
Comorbidity costs	£7,167	£7,255	-£89
Lung cancer	£500	£513	-£13
Stroke	£1,530	£1,533	-£3
CHD	£2,694	£2,743	-£48
MI	£1,889	£1,914	-£25
COPD	£554	£553	£1
Total costs	**£7,402**	**£7,255**	**£146**
QALYs	**14.050**	**14.003**	**0.046**
Life years	**30.446**	**30.344**	**0.102**
Incremental cost per QALY			**£3,151**
Incremental cost per life year			**£1,432**
Net monetary benefit			**£783**

This analysis demonstrates that, although the intervention ultimately leads to a small increase in overall costs, the gain in QALYs is sufficiently high to justify the increase in spending. The incremental cost-effectiveness ratio (ICER) of £3,151 per QALY is substantially below the widely recognised threshold of £20,000 and, as such, reduction with NCP might be considered to be a cost-effectiveness use of NHS resources, when compared against no intervention.

3.3 A COMPARISON OF REDUCTION (WITH NCP) VERSUS REDUCTION WITHOUT NCP

Finally, a scenario is presented comparing the use of NCP in reduction against reduction without the use of NCP. Section 2.2.2 established that the six month quit rates were 11.2% and 9.4% respectively. As described above, the costs for the two approaches are £235 and £50 respectively. The incremental analysis is shown below.

Table 3.3: Cost-effectiveness of tobacco harm reduction intervention with NCP (versus no reduction without NCP)

	Reduce with use of NRT	Reduce without NRT	Incremental
Intervention costs	£235	£50	£185
Comorbidity costs	£7,167	£7,197	-£31
Lung cancer	£500	£504	-£5
Stroke	£1,530	£1,531	-£1
CHD	£2,694	£2,711	-£17
MI	£1,889	£1,897	-£9
COPD	£554	£554	£0
Total costs	**£7,402**	**£7,247**	**£154**
QALYs	**14.050**	**14.034**	**0.016**
Life years	**30.446**	**30.411**	**0.035**
Incremental cost per QALY			**£9,594**
Incremental cost per life year			**£4,361**
Net monetary benefit			**£167**

As shown in Table 3.3, reduction *with* NCP is marginally more expensive than reduction without NCP, but also delivers a small increase in QALYs. The incremental cost-effectiveness ratio is £9,594, which is below the generally accepted threshold of £20,000 per QALY.

3.4 DURATION OF USE OF NICOTINE CONTAINING PRODUCTS

Section 3.3, above, describes a comparison of using NCP to aid reduction against reduction without NCP. In that analysis, the use of NCP was shown to be a cost-effective use of healthcare resources. However, the PDG requested that additional analysis be undertaken to demonstrate the impact of different durations of use of NCP. This analysis is presented below, in Table 3.4.

Table 3.4: Duration of use of NCP (assuming that all people continue to use NCP)

	Additional cost	Additional QALYs	ICER
12 weeks	£154	0.016	£9,594
24 weeks	£339	0.016	£21,093
36 weeks	£524	0.016	£32,592
52 weeks	£771	0.016	£47,925
2 years	£1,573	0.016	£97,754
5 years	£3,978	0.016	£247,244

An additional scenario is shown below, where only those people that successfully quit continue to use NCP (those who do not quit are assumed to return to smoking cigarettes only).

Table 3.5: Duration of use of NCP (assuming that only quitters continue to use NCP)

	Additional cost	Additional QALYs	ICER
12 weeks (base case)	£154	0.016	£9,594
24 weeks	£175	0.016	£10,882
36 weeks	£196	0.016	£12,170
52 weeks	£217	0.016	£13,500
2 years	£313	0.016	£19,468
5 years	£583	0.016	£36,211

It can be seen, therefore, that long-term use of NCP (i.e. use beyond six months) is generally only a cost-effective option, if it is provided only those people who successfully quit smoking.

3.5 AGGREGATED RESULTS FOR A POPULATION OF 100,000 SMOKERS

In the cases described above, in Sections 3.1, 3.2 and 3.3 were to be applied to a large population of smokers (e.g. 100,000 smokers), the results can be aggregated to demonstrate the overall impact upon society. The results are shown in Table 3.6, below.

Table 3.6: Aggregated impact of tobacco harm reduction for a cohort of 100,000 smokers

Comparison	Extra intervention costs	Saved healthcare costs	Extra QALYs	'Worth' of QALYs	Net gain for society
Reduction (without NCP) versus no intervention	£5,000,000	-£5,789,826	3,039	£60,777,218	£61,567,044
Reduction (with NCP) versus no intervention	£23,500,000	-£8,855,028	4,648	£92,953,392	£78,308,420
Reduction (with NCP) versus reduction (without NCP)	£18,500,000	-£3,065,202	1,609	£32,176,174	£16,741,376

As shown in Table 3.6, the societal benefits associated with tobacco harm reduction are potentially substantial. In all cases, the tobacco harm reduction strategy is shown to deliver a sizable net gain to society, with the majority of that gain being in the form of improved health (i.e. QALYs).

3.6 COMPARISON OF REDUCTION AGAINST QUITTING

As demonstrated above, tobacco harm reduction strategies can, in general, be considered to be a cost-effective use of healthcare resources. Although the scope of this Programme Development Group assessment does not include the analysis of smoking cessation interventions, it is useful to demonstrate the relative gains associated with quitting and reducing, using the York Tobacco Harm Reduction model.

In the updated version of the model, where low-level smokers do not experience any direct benefits associated with reduced co-morbidities, *etc*., the benefits associated with reducing smoking are modest. Around 9% to 11% of patients will go onto quit at six months which does, however, lead to significant health gains.

In the York model, a smoker that quits smoking will, on average, experience a total of 14.84 discounted QALYs over the remainder of their lifetime. A smoker who *reduces* their tobacco intake will experience a total of 14.03 QALYs. By comparison, a person who continues to smoke for the rest of their life will experience a total of 13.96 QALYs. This demonstrates that the benefits of quitting smoking far outweigh the benefits of reducing smoking. The key issue is, however, whether the availability of smoking reduction services will encourage a sufficient number of smokers to reduce their level of intake, without inadvertently impacting upon a population of smokers who may have intended to quit.

Addendum

The team at NICE requested an additional analysis to address two questions which are reported below with the results.

To repeat the analysis of the trade off between quitting and reducing tobacco reported in the main analysis (section 3.3.2 and table 3.7) using the assumptions for reducing that were in the supplementary report(no benefit in terms of QALYs and co-morbidities) but increased likelihood of quitting at 6 months. In the main analysis it was estimated that for each potential quitter lost to reducing you would need two reducers to offset the loss. Do we see the same trade off with the assumptions in place?

Table 3.7: Benefits of quitting smoking and reducing tobacco intake

	QALYs	Extra QALYs	Cost	Extra cost
Continuing to smoke	14.00	-	£7,255	-
Reducing tobacco intake	14.14	0.14	£6,974	-£281
Quitting smoking	14.84	0.84	£5,654	-£1,412

This suggests that, for each potential quitter lost, we would need to gain around 6 reducers in order to offset the lost benefits.

To run the 2-way sensitivity analysis of duration of use and effectiveness - Table 3.6 in the main report - with the assumptions used for reducers used in the supplementary analysis.

Replicating Table 3.6 in the main report would be largely unaffected by the changes implemented in the supplementary report. This is because Table 3.6 varies the *quit rate* of the intervention, not the reduction rate. The table below shows how a similar analysis would look if we vary the *reduction rate* instead.

		Duration of use							
		6m	12m	18m	24m	3y	4y	5y	10y
Effectiveness (reduction rate)	0%	No ben	No ben	No ben	No ben	No ben	No ben	No ben	No ben
	2%	No ben	No ben	No ben	No ben	No ben	No ben	No ben	No ben
	4%	£36,590	£75,238	£113,887	£152,535	£229,831	£307,127	£384,424	£770,906
	6%	£17,266	£36,590	£55,914	£75,238	£113,887	£152,535	£191,183	£384,424
	8%	£10,825	£23,707	£36,590	£49,473	£75,238	£101,004	£126,769	£255,597
	10%	£7,604	£17,266	£26,928	£36,590	£55,914	£75,238	£94,562	£191,183
	12%	£5,672	£13,401	£21,131	£28,861	£44,320	£59,779	£75,238	£152,535
	14%	£4,383	£10,825	£17,266	£23,707	£36,590	£49,473	£62,356	£126,769
	16%	£3,463	£8,984	£14,505	£20,027	£31,069	£42,111	£53,154	£108,365
	18%	£2,773	£7,604	£12,435	£17,266	£26,928	£36,590	£46,252	£94,562
	20%	£2,236	£6,530	£10,825	£15,119	£23,707	£32,296	£40,884	£83,827

References

- Taylor M, Lewis L. An Economic Evaluation of Different Interventions to Promote Tobacco Harm Reduction: Final Report 2012
- Beard E, McNeill A, Aveyard P *et al*., Association between use of nicotine replacement therapy for harm reduction and smoking cessation a prospective study of English smokers. *Tobacco Control* 2011
- PSSRU Unit Costs of Health and Social Care 2011

YORK
Health Economics
CONSORTIUM

INVESTORS IN PEOPLE

University of York
Market Square
Vanbrugh Way
Heslington
YORK YO10 5NH

Tel: +44 (0) 1904 323620
Fax: +44 (0) 1904 323628
Email: yhec@york.ac.uk
Web: www.yhec.co.uk

THE UNIVERSITY of York