NHS
Cambridgeshire and Peterborough
Clinical Commissioning Group

Health Insight and Intelligence Report

Estimating the impact of risk factors on health and care costs

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Funding for healthcare across Cambridgeshire and Peterborough is under pressure. More people are using our services and NHS resources are limited, this includes staff and money. We need to understand what is most important to you, our local community.

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Contents

Introduction	4
What does the Global Burden of Disease work tell us about risk factors in the Cambridgeshire and Peterborough population?	6
What is the Global Burden of Disease project?	
How is data produced?	
What does it tell us about risk factors in Cambridgeshire and Peterborough?	
Impact of risk factors on premature death	
Impact of risk factors on years lived with disability	
What do Return on Investment Tools tell us about benefits of addressing risk factors?	12
Improving effectiveness of cardiovascular interventions	
Improving smoking cessation	
Reducing BMI for the overweight/obese population	
Conclusions	18

Introduction

The vision of Cambridgeshire and Peterborough CCG is to work in partnership to improve care, develop healthy communities and make wise decisions about the use of resources available to us. This Health Intelligence and Insight Report examines the possible collective impact of some key behavioural and metabolic risk factors on health and health costs for people in the Cambridgeshire and Peterborough health care system. It applies recently available modelling tools to the population of Cambridgeshire and Peterborough, and uses the analyses produced by these tools to quantify possible benefits of addressing some of the key behavioural factors in our population.

We all make choices about how we live and spend our money. We do this both individually, for example we may choose to eat or not eat certain foods, and collectively, for example how best to spend the money that we have available to provide public services. However final health outcomes are not solely down to us as individuals. Each of us has various characteristics that influence our health and we all live in a wider environment which also influences, directly and indirectly, both our choices and our health.

Dahlgren and Whitehead illustrated these different factors in the diagram below:

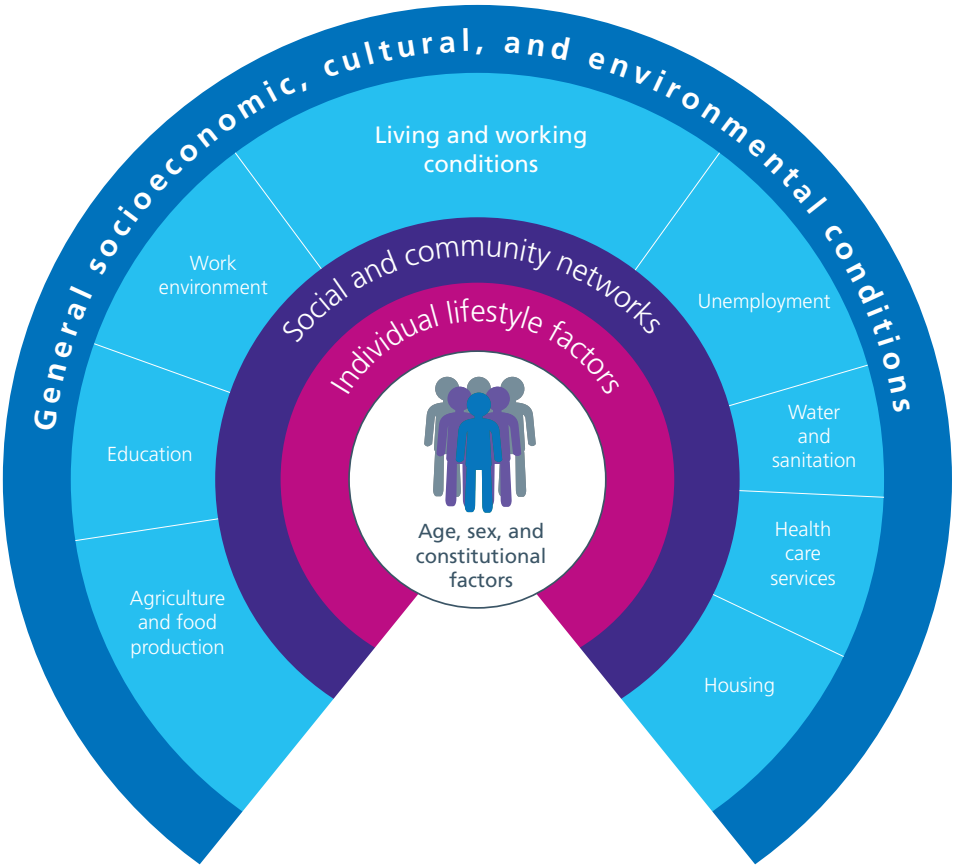

Figure 1: Taken from Dahlgren and Whitehead 1991[1]

1 Dahlgren G, Whitehead M. (1991) ***Policies and Strategies to Promote Social Equity in Health.*** Stockholm: Institute for the Futures Studies.

Figure 1 also illustrates how addressing behavioural and metabolic risk factors is complex [2]. This paper does not detail how to bring about the behaviour changes or assess their feasibility.

To gain an overview of risk factors in our population this paper starts with some summary information from the Global Burden of Disease project. It then considers tools that assess health and financial return on investment for cardiovascular risk factor reduction, smoking cessation and reductions in overweight and obesity levels.

2 Finegood et al. (2008) ***Getting from Anaysis to Action Framing Obesity Research Policy and Practice Healthcare Papers*** Vol 9 no 1 [online] pp 36 - 41 https://www.researchgate.net/profile/Ozge_Karanfil/publication/23442227_Getting_from_Analysis_to_Action_Framing_Obesity_Research_Policy_and_Practice_with_a_Solution-Oriented_Complex_Systems_Lens/links/55c554ed08aeb9756741f3e6.pdf#page=38

What does the Global Burden of Disease work tell us about risk factors in the Cambridgeshire and Peterborough population?

What is the Global Burden of Disease project?

The Global Burden of Disease (GBD) project is the world's largest effort to systematically measure premature mortality and morbidity in one comparable statistical model. The project is led by the Institute of Health Metrics and Evaluation (IHME), University of Washington, Seattle, and is primarily funded by the Bill and Melinda Gates Foundation. The project initially only produced national level estimates, but Public Health England have provided funding to produce data at a local authority level from 1990 to 2017. The project provides a wealth of health and risk factor data at a local level, allowing us to look at both Cambridgeshire and Peterborough.

How is data produced?

Public Health England submit data to the Institute of Health Metrics and Evalution, who also use published studies, routinely available data and national surveys from around the world to produce global, national, regional and local estimates. There are three main measures, first, premature mortality is measured using Years of Life Lost (YLLs); second, disability is measured using Years Lived with Disability (YLDs); and finally, both premature mortality and morbidity are combined into a single measure called Disability Adjusted Life Years (DALYs). Data is freely available on the GBD compare website https://vizhub.healthdata.org/gbd-compare/. More information on the measures can be found on the GBD website http://www.healthdata.org/ .

The graphs presented below have been produced by downloading data from the GBD Results tool (http://ghdx.healthdata.org/gbd-results-tool) and generating graphs within Excel.

What does it tell us about risk factors in Cambridgeshire and Peterborough?

The GBD project produces data on 84 different risk factors split by behavioural, metabolic and environmental. Here we focus on behavioural and metabolic because they have the greatest impact on health.

Half of all premature years of life lost[3] in Cambridgeshire and Peterborough are due to known risk factors, including behavioural and metabolic risk factors. Behavioural risk factors include smoking, alcohol, diet (such as high salt and low fibre, fruit and vegetables diets) and drug misuse. Metabolic risk factors include high blood pressure (hypertension), blood sugar, BMI and cholesterol.

Perhaps more importantly, tackling known risk factors would also increase the quality of life, with about a quarter of years lived with disability potentially avoidable by reducing these risk factors to zero.

Behavioural risk factors, such as smoking, diet and drug and alcohol use, are the most common cause of premature mortality and morbidity in Cambridgeshire and Peterborough.

The figures for the potential improvements are based on an 'ideal world' comparison where smoking prevalence is (and always has been) zero, alcohol consumption is within recommended limits, substance misuse is zero and the impact of diet on health is the lowest seen anywhere in the world. It also assumes that metabolic risk factors are not present in the population and so do not increase disease risk.

3 'Years of life lost' is calculated by subtracting the age at death from the longest possible life expectancy for a person at that age. For example, if the longest life expectancy for men in a given country is 75, but a man dies of cancer at 65, this would be 10 years of life lost due to cancer.

Impact of risk factors on premature death

Figure 2 is an output from the Global Burden of Disease work and shows that 35% of years of the life lost prematurely in Cambridgeshire could be avoided with large improvements in key behavioural risk factors, and in Peterborough 37% of years of life lost could be avoided. Most improvement in behavioural risk factors could be made by reducing the negative influence of smoking and unhealthy diet on life expectancy, but reductions in harm from alcohol and substance misuse also have an impact. A greater proportion of premature mortality is caused by behaviour risk factors in Peterborough compared with Cambridgeshire.

Metabolic risk factors, such as high blood pressure, BMI, blood sugar and cholesterol, are the second most common cause of premature mortality after behavioural risks. Considerable years of life lost prematurely could be avoided with improvements in key metabolic risk factors too. A greater proportion of premature mortality is caused by metabolic risk factors in Cambridgeshire than Peterborough.

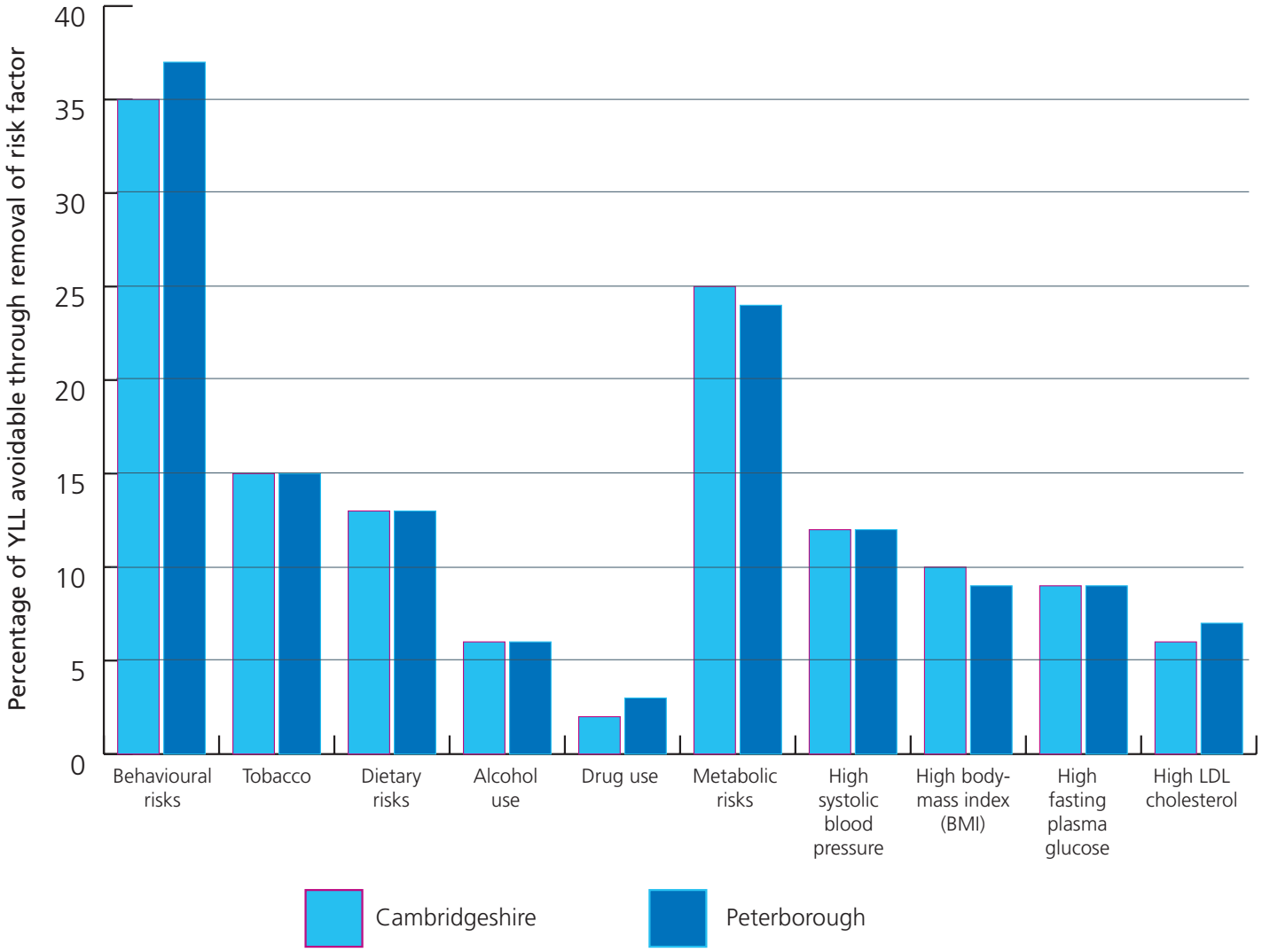

Figure 2: Percentage of premature mortality which is avoidable with a reduction in behavioural or metabolic risk factors for all causes, both sexes 2017

Data taken from the Global Burden of Disease Study

Figure 2 also shows the percentage improvement in years of life lost prematurely across Cambridgeshire and Peterborough by going from our current level to the theoretical minimal level or 'ideal world' scenario.

- 15% gain in years of life lost from improvements in smoking.
- 13% gain in years of life lost from improvements in diet.
- 6% gain in years of life lost from improvements in alcohol use.
- 2% gain in years of life lost from improvements in substance misuse.
- 12% gain in years of life lost from improvements in blood pressure.
- 10% gain in years of life lost from improvements in BMI.
- 9% gain in years of life lost from improvements in blood sugar.
- 6% gain in years of life lost from improvements in cholesterol.

Figure 3 shows that behavioural risk factors are also currently causing many premature deaths from common conditions and removing these risks could reduce premature mortality due to cardiovascular disease by over 50%, cancer by over 30% and chronic respiratory disease by over 35%.

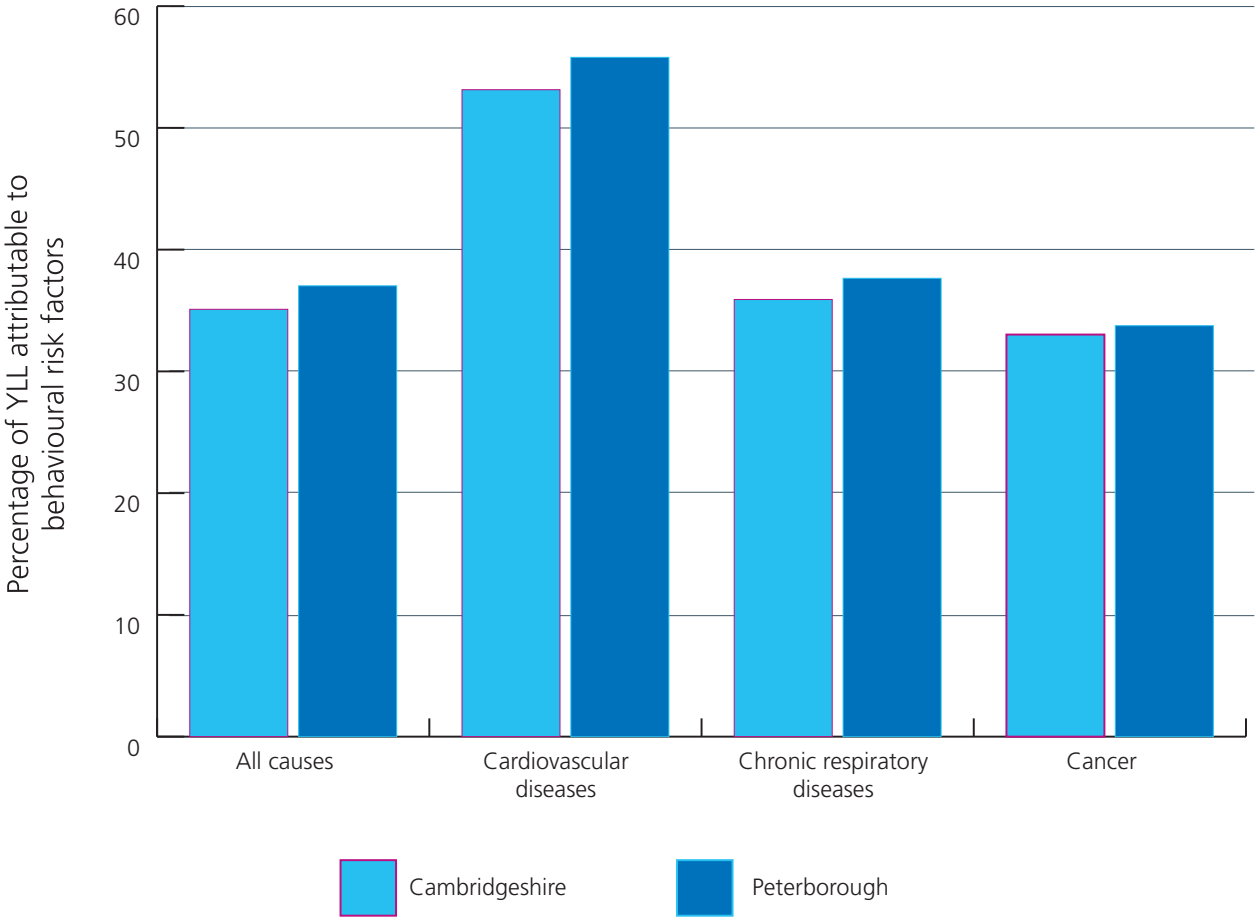

Figure 3: Percentage of premature mortality which is avoidable with a reduction in behavioural risk factors[4] for specific common conditions, both sexes 2017

Data taken from the Global Burden of Disease Study

4 Such as smoking, diet and alcohol and drug use

A reduction in metabolic risk factors could reduce premature mortality due to cardiovascular disease by almost 70% and cancer by over 10% (see Figure 4)[5]. A greater proportion of premature mortality is caused by metabolic risk factors in Cambridgeshire compared with Peterborough (25% premature mortality attributable to metabolic risk factors in Cambridgeshire compared with 24% in Peterborough).

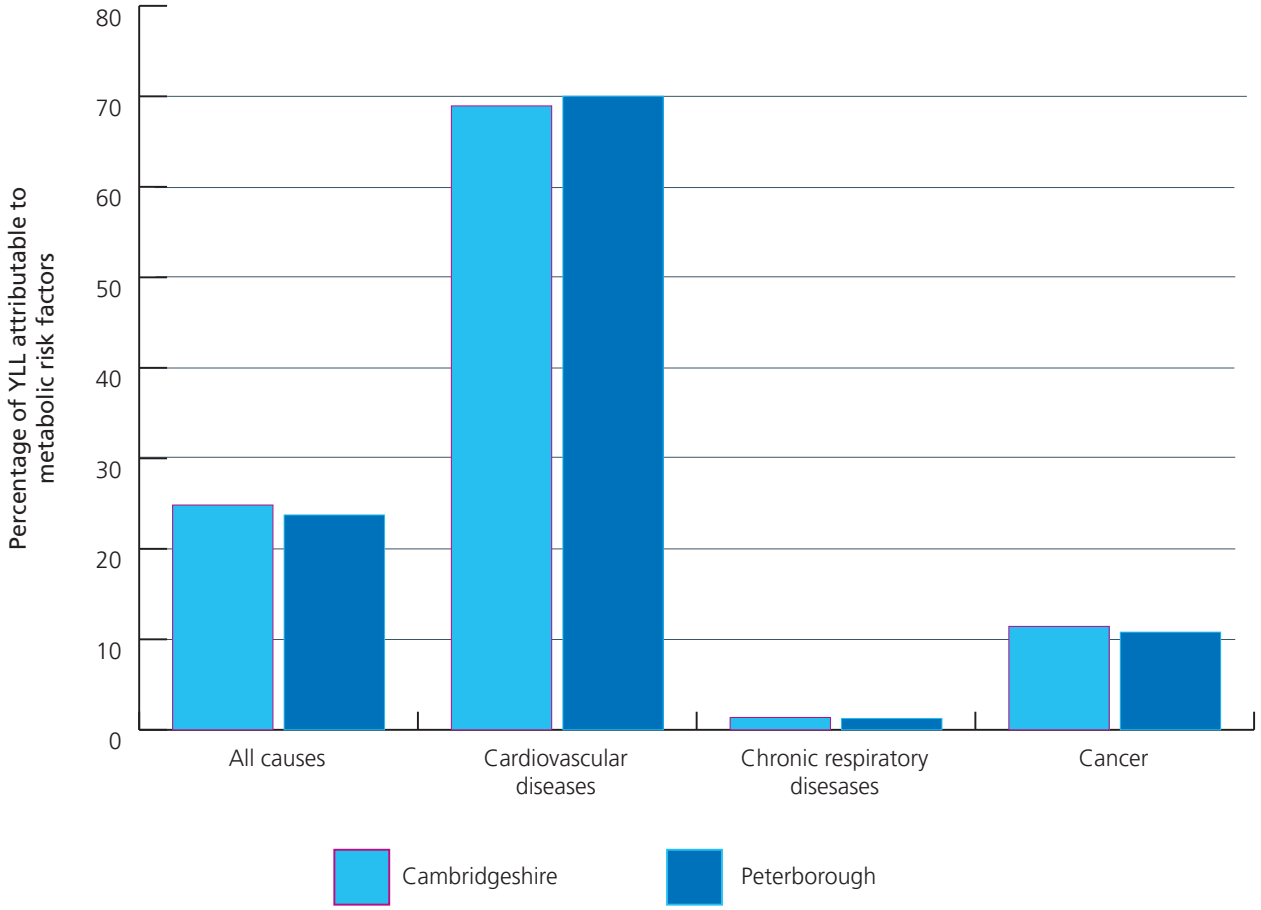

Figure 4: Percentage of premature mortality which is avoidable with a reduction in metabolic risk factors[6] for specific common conditions, both sexes 2017

Data taken from the Global Burden of Disease Study

6 Such as blood pressure, cholesterol, BMI and blood sugar

Impact of risk factors on years lived with disability

Figure 5 considers the reductions in years lived with disability if behavioural risk factors were reduced from current level to the theoretical minimal level or 'ideal world'.

16% of years lived with disability could be avoided with large improvements in behavioural risk factors. The largest impact would come from reducing high BMI, blood sugar and smoking.

Percentage improvements in years lived with disability if risk factor goes from current level to the theoretical minimal level.

- 6% reduction with improvements in smoking.
- 3% reduction with improvements in diet.
- 2% reduction with improvements in drug use.
- 2% reduction with improvements in alcohol use.

The percentage improvement in years lived with disability with improvement in metabolic risk factors could be

- 7% with improvements in BMI.
- 6% with improvements in blood sugar.
- 2% with improvements in blood pressure.
- 1% with improvements in cholesterol.

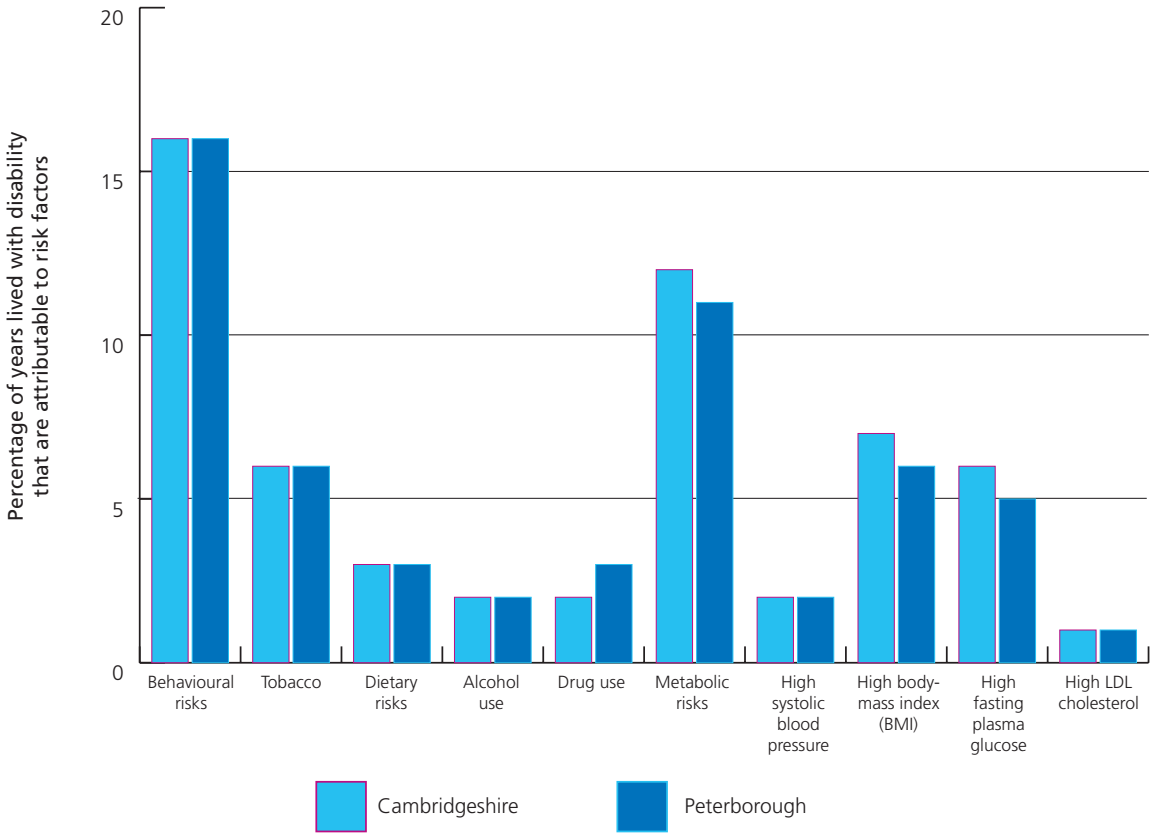

Figure 5: Percentage of disability (disability adjusted life years) which is avoidable with a reduction in behavioural or metabolic risk factors for all causes, both sexes 2017

Data taken from the Global Burden of Disease Study

What do Return on Investment tools tell us about benefits of addressing risk factors?

Having considered the Global Burden of Disease work to quantify the impact of behavioural and metabolic risk factors on health, we then used three publicly available and validated Return on Investment models to look at the financial and health impacts of population-level changes in smoking, obesity, and other cardiovascular risk factors.

The smoking tool is published by NICE and the cardiovascular disease prevention and weight management tools by Public Health England. It is important to note that all these tools produce estimates based on theoretical models and are intended to give estimates of the impact of various possible interventions, in order to support commissioning decisions. Using these tools has revealed some of their practical strengths and weaknesses.

In each of the three cases, the Return on Investment Tools were used to produce estimates of impact on health and spending in optimistic or best-case scenarios for improvement of behavioural and metabolic risk factors in the Cambridgeshire and Peterborough population. We cannot add up the benefits from the three separate tools as there are causative overlaps, they differ in their methodology and also use different output measures.

Health outcomes in all three tools were given in quality-adjusted life-years (QALYs), which is a commonly used way to represent the quality of life gained as well as the duration of additional life. For example, one QALY represents one year of life lived in perfect health; half a QALY may represent six months in perfect health or one year of poorer health valued at 0.5 of full health.

Improving effectiveness of cardiovascular interventions

We used a model from the University of Sheffield, published by Public Health England. We chose inputs to that modelled improvements in four areas of care for people already at risk of cardiovascular disease, namely: anti-hypertension therapy, weight management, NHS health checks and blood pressure self-monitoring.

Use of antihypertensives in the target population was assumed to increase from 54.1% to 70%; use of the weight management intervention from 13% to 50%; NHS Health Check uptake from 44% to 66%; and use of blood pressure self-monitoring from 31% to 50%.

The model already included some values for the costs of this care, and the savings it could produce, which we left unaltered. If costs could be significantly reduced for these interventions it would change the results of the model.

The tool produces estimates of the number of cardiovascular events prevented, the number of deaths prevented, and QALYs gained as a result.[7] It also estimates the cost of these interventions across the whole of Cambridgeshire and Peterborough and the savings to the health and social care system. Summary results are shown in Table 1.

None of these four interventions alone resulted in an overall cost saving in a short three-year period. However, after ten years, the model projected a cumulative saving of just over £2 million with improved use of anti-hypertensive therapy, and a break-even cost for improved use of weight management. From these two interventions, anti-hypertensive therapy prevented more deaths (44) and CVD events (789) than improved use of weight management services (three deaths and 73 events prevented). The cost of improving anti-hypertensive therapy was £13m over ten years, and improved weight management cost £3m over ten years. Anti-hypertensive therapy produced 894 QALYs over ten years and weight management produced 211 in the same period.

The other two interventions modelled (increased attendance and NHS health checks and increased blood pressure self-monitoring) did not show cost savings after 10 years although health check attendance did show large savings at 20 years. However, increased attendance at health checks did reduce the projected number of CVD events by 696 although premature deaths prevented was just two at the ten-year point.

7 For a helpful definition of QALY see https://www.nice.org.uk/glossary?letter=q

Table 1: Summary of health benefits and return of investment for the modelled CVD risk reduction interventions in Cambridgeshire and Peterborough.

Cumulative cost savings are shown as positive values (green), an overall cost increase appears as a negative value (red)

Anti-hypertensive therapy	Year 3	Year 10	Year 20
QALYs gained	80	894	2,857
Number of premature deaths prevented	10	44	99
CVD clinical events*	-251	-789	-1,487
Intervention costs (£)	-4,976,945	-13,321,381	-24,234,505
Savings in health + social care costs (£)	2,886,214	15,339,052	40,337,672
Overall saving, net of cost of intervention (£)	**-2,090,731**	2,017,671	16,103,167
Weight management	Year 3	Year 10	Year 20
QALYs gained	34	211	307
Number of premature deaths prevented	2	3	3
CVD clinical events*	-62	-73	-38
Intervention costs (£)	-4,374,605	-3,155,524	-3,108,024
Savings in health + social care costs (£)	1,111,516	3,157,280	4,062,256
Overall saving, net of cost of intervention (£)	**-3,263,089**	1,755	954,232
NHS Health Checks	Year 3	Year 10	Year 20
QALYs gained	13	547	2584
Number of premature deaths prevented	1	2	4
CVD clinical events*	-70	-696	-1823
Intervention costs (£)	-3,136,618	-13,055,002	-13,824,746
Savings in health + social care costs (£)	612,939	9,727,441	27,253,439
Overall saving, net of cost of intervention (£)	**-2,523,678**	**-3,327,562**	13,428,693
Blood pressure self-monitoring	Year 3	Year 10	Year 20
QALYs gained	11	119	352
Number of premature deaths prevented	1	2	4
CVD clinical events*	-39	-106	-165
Intervention costs (£)	-2,470,369	-7,597,243	-14,146,264
Savings in health + social care costs (£)	470,234	2,311,482	4,681,576
Overall saving, net of cost of intervention (£)	**-2,000,136**	**-5,285,761**	**-9,464,688**
All interventions above combined	Year 3	Year 10	Year 20
QALYs gained	140	1,848	6,400
Number of premature deaths prevented	19	118	297
CVD clinical events*	-425	-1,730	-3,677
Intervention costs (£)	-16,546,758	-41,957,123	-63,075,842
Savings in health + social care costs (£)	5,148,935	31,769,598	80,621,731
Overall saving, net of cost of intervention (£)	**-11,397,823**	**-10,187,525**	17,545,888

**Includes heart attacks, angina, stroke, TIAs and congestive heart failure*

Improving smoking cessation

We used the 'Tobacco Return on Investment Tool' from NICE, amending some of the parameters to accurately reflect local smoking prevalence. This tool is still in beta version and allows the user to assign different proportions of their smoking population to various possible interventions. In Cambridgeshire and Peterborough it was assumed that just over 100,000 adults smoke (15%) and 11.5% of pregnant women are smoking at the time of delivery.

We modelled a very optimistic scenario in which all smokers in Cambridgeshire and Peterborough receive smoking cessation services. We chose the two most effective interventions delivered by smoking cessation services, Varenicline (a prescription medication to treat smoking) with group support, and Nicotine Replacement Therapy (NRT) Combo with group support, and assigned 50% of our adult (non-pregnant) smokers to each intervention using pre-entered values for the cost of treatment. The model also allowed for the influences of a background quit rate and subnational programmes/campaigns aimed at reducing smoking prevalence. Summary results are shown in Table 2.

The model projected 26,200 additional quits as a result of treatment, with a cost of £18.3m. The modelled treatment would produce 2,631 additional QALYs. Health and social care savings as a result of the treatment were not produced by the model which instead estimated 'quasi-societal savings and value of health gains' but it is not clear where these benefits are felt. However, the tool estimates savings of around £140 per smoker in just two years and projects £3,945 per smoker over a lifetime of a smoker.

Table 2: Summary of return of investment for the modelled smoking cessation interventions in Cambridgeshire and Peterborough.

Cumulative cost savings are shown as positive values (green), an overall cost increase appears as a negative value (red)

	Adult smoking population (n=100,718)			Pregnant smoking population (n=1,233)		
	Year 2	Year 10	Lifetime	Year 2	Year 10	Lifetime
QALYs gained (per 1,000 smokers)	11.03	51.46	168.32	0.01	0.03	0.12
Savings in social care costs (£)*	-80.7	197.0	578.2	-1.0	-0.8	-0.3
Savings in social costs + healthcare costs* (£)	139.9	1,226.0	3,945.0	-0.8	-0.1	2.2

*social care savings only includes costs related to care received by stroke victims

Reducing BMI for the overweight/obese population

We used the Weight Management Economic Assessment Tool to model the effects of weight loss across the overweight/obese population in Cambridgeshire and Peterborough. We set up two optimistic scenarios to illustrate the possible benefits of weight loss: in the first scenario everyone with a BMI of 30 over lost weight resulting in a two point decrease in their BMI score and maintained the weight loss for 25 years, in the second scenario everyone with a BMI of 30 or over lost weight resulting in a five point decrease in BMI. The model assumed that no cost was incurred to the health system as part of this weight loss. As the causes of weight gain and the solutions to it sit outside of the formal health system this is a realistic assumption. The results of the modelling are summarised in Table 3.

This population-level weight loss led to large projected savings for healthcare spending; after three years it would reduce spend by £6m with just a two point BMI reduction or even £19.2m with a five point reduction. The impact on quality of life would also be considerable over just three years in the two point BMI reduction scenario, with an increase in QALYs of 7,464 across Cambridgeshire and Peterborough with the greatest QALY benefit in the 60-73 age group. A five point reduction would be even more beneficial to quality of life, producing an increase in QALYs of 14,564 over three years. The benefits in terms of financial savings and QALYs increased further over longer time periods, and the model also estimated impressive results in terms of savings on social care costs and increased employment, and prevention of premature deaths.

Knowing where to start to make changes can be a challenge. Tind out more about how to make healthy living choices by visiting https://www.nhs.uk/live-well/

> “To put this into context, if everyone in Cambridgeshire and Peterborough with a BMI of over 30 managed to reduce their BMI by two points, then over the next 25 years almost 20,000 premature deaths would be avoided.”

Table 3: Summary of health and financial return for modelled weight loss in Cambridgeshire and Peterborough.

Age groups are ages at which the weight loss occurs. This intervention only shows cumulative savings since was modelled assuming there were no costs for the NHS.

	2 kg/m² BMI reduction			5 kg/m² BMI reduction		
Age 18-31	Year 3	Year 10	Year 25	Year 3	Year 10	Year 25
QALYs gained	5.8	78.8	9,288	12.8	173.7	15,444
Number of premature deaths prevented	0.1	7.3	407	0.2	17.3	997
Savings in healthcare costs (£)	108,981	1,385,933	15,585,483	241,481	3,023,728	34,530,633
Savings in social care costs (£)	13,229,134	41,897,694	74,400,399	27,147,131	84,810,477	152,367,884
Economic benefit of additional employment (£)	18,411,051	57,652,344	137,948,930	13,555,590	54,751,138	201,451,044
Age 32-45	Year 3	Year 10	Year 25	Year 3	Year 10	Year 25
QALYs gained	32.3	3,958.5	26,412	73.1	5,458.9	52,514
Number of premature deaths prevented	1.9	121.2	3,018	4.6	299.3	7,389
Savings in healthcare costs (£)	535,697	6,519,298	49,851,080	1,189,589	14,389,344	113,465,984
Savings in social care costs (£)	7,464,125	24,580,584	54,441,404	14,744,514	48,182,736	110,258,810
Economic benefit of additional employment (£)	9,093,958	43,530,120	228,534,756	6,545,941	45,723,704	384,143,084
Age 46-59	Year 3	Year 10	Year 25	Year 3	Year 10	Year 25
QALYs gained	2,797	14,585	37,524	5,026	27,792	80,405
Number of premature deaths prevented	8.6	602	8,746	21	1,473	21,406
Savings in healthcare costs (£)	1,704,741	19,782,843	82,358,573	3,867,680	44,783,044	193,108,092
Savings in social care costs (£)	5,856,000	22,405,840	58,621,216	11,478,362	43,851,640	121,420,055
Economic benefit of additional employment (£)	18,086,153	100,292,064	198,877,091	12,615,194	106,857,119	285,720,298
Age 60-73	Year 3	Year 10	Year 25	Year 3	Year 10	Year 25
QALYs gained	3,137	11,555	20,969	6,408	24,013	45,603
Number of premature deaths prevented	20.0	924	6,945	49.3	2,254	17,022
Savings in healthcare costs (£)	2,403,213	19,275,665	43,783,938	10,895,826	27,964,985	103,931,402
Savings in social care costs (£)	6,491,711	24,905,412	38,873,865	5,557,290	44,659,647	103,931,402
Economic benefit of additional employment (£)	15,346,968	34,831,280	31,966,444	12,852,867	49,558,212	80,384,764
Age 74-87	Year 3	Year 10	Year 25	Year 3	Year 10	Year 25
QALYs gained	1,492	4,200	4,265	3,043	8,645	8,864
Number of premature deaths prevented	17	416	772	42	1,016	1,847
Savings in healthcare costs (£)	1,261,489	6,652,438	7,501,224	2,971,431	15,686,957	17,800,946
Savings in social care costs (£)	5,023,841	11,332,431	9,834,973	10,442,995	23,500,457	20,490,304
Economic benefit of additional employment (£)	416,208	627,581	518,171	247,675	284,086	239,460

Conclusions

The Global Burden of Disease project estimates that between a quarter and a third of premature deaths are due to behavioural or metabolic risk factors. In addition between 10 and 16% of ill health (disability adjusted life years) is caused by these factors.

The Return on Investment Tools used have estimated that there may be considerable potential to improve health and reduce costs through addressing these risk factors for disease in Cambridgeshire and Peterborough. Table 4 summarises all the results.

The tools all use different methodologies and their outputs are not comparable. We have assumed that changes in factors, such as weight loss and smoking cessation, remain over long periods of time but even so the impact of these changes takes around 5-10 years to show significant health and financial gain.

At 10 years there was greater health gain from our weight management scenario (all people with a BMI of over 30 losing 2 BMI points) than from the smoking cessation scenario (all smokers undergo a smoking cessation intervention).

Savings to health were greater for the smoking cessation model than for the weight reduction model but wider societal savings are greater than savings to health for the weight reduction scenario.

The wider economic benefit of additional employment was not estimated in the tobacco model.

This wider economic benefit through additional employment was greater than the social care and healthcare financial benefit at all timeframes in the weight reduction model and was estimated to be £237m at year 10.

As expected the CVD model showed that there were health gains and financial savings but these were not as great as the scenarios that modelled primary risk factor reduction. This is partly because the assumptions in improvement used in the model were closer to values that could be feasibly achieved in the current system.

The use of these models and comparison of their outputs has identified several issues with these types of centrally produced products that are intended for local use.

The scenarios modelled are very optimistic and delivery of smoking cessation and weight reduction intervention on this scale would present substantial logistic difficulties. The amounts are cumulative and are considerably less than the overall size of the current health system financial deficit.

However this modelling, imperfect though it is, re-emphasises the importance of behavioural and metabolic risk factor reduction in improving health, reducing health and care costs and maximising economic benefits in the Cambridgeshire and Peterborough CCG population.

Table 4: The outputs produced by the three Return on Investment tools at 10 years (estimated cumulative values).

Area of change modelled	Tobacco reduction tool	Weight Management tool‡	CVD tool (anti-hypertensive therapy only)	CVD tool (combination of all interventions)
Health impacts				
Premature deaths prevented	(no output)	2,072	44	118
QALYs gained	5,191	34,378	894	1,848
Other			789	1,730
Financial				
Total cost of intervention (£)	18.3m	0‡	13.3m	42m
Savings to health (£)	103.6m* #	53.6m	9.6m	21.5m
Savings to social care (£)	19.8m ϕ # (*Net Present Value - Quasi-societal savings and value of health gains)*	125.1m	5.7m	10.3m
Savings to health and social care combined (£)	123.4m# *(Net Present Value - Quasi-societal savings and value of health gains)*	178.7m*	15.3m	31.8m
Other (£)		236.9m *(Economic benefit of additional employment)*	*Cost savings to primary and secondary care are given separately* (2.1m and 7.5m)	*Cost savings to primary and secondary care are given separately* (5.5m and 16m)

‡Assuming 2 kg/m² BMI reduction was reached for all five age groups at no cost for the NHS

**Value not provided directly by tool (calculated adding up health and social care savings output*

#Value not provided directly by tool (calculated from health and social care savings output multiplied by the number of smokers (100,718)

ϕSocial care savings from the tobacco tool only includes costs related to care received by stroke victims.

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