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Clustering of unhealthy behaviours over time

Implications for policy and practice



Key points

- People's health behaviours are widely known to affect their health and risk of mortality. Less is known about how these behaviours cluster together in the population and how multiple lifestyle risk patterns have changed over time between different population groups. Focusing on changes in the English population between 2003 and 2008, this paper considers these questions in relation to policy and practice.
- Using data from the Health Survey for England, we examined how four lifestyle risk factors – smoking, excessive alcohol use, poor diet, and low levels of physical activity – co-occur in the population and how this distribution has changed over time.
- We found that the overall proportion of the population that engages in three or four of these unhealthy behaviours has declined significantly, from around 33 per cent of the population in 2003 to around 25 per cent by 2008.
- However, these reductions have been seen mainly among those in higher socio-economic and educational groups: people with no qualifications were more than five times as likely as those with higher education to engage in all four poor behaviours in 2008, compared with only three times as likely in 2003.
- The health of the overall population will improve as a result of the improvement in these behaviours, but the poorest and those with least education will benefit least, leading to widening inequalities and avoidable pressure on the NHS.
- If policy-makers, public health commissioners and the NHS wish to address health inequalities, they will therefore need to find effective ways to help people in lower socio-economic groups to reduce the number of unhealthy behaviours they have.
- This is likely to work only if a holistic approach to policy and practice is adopted that addresses lifestyles that encompass multiple unhealthy behaviours. At a policy level, this is likely to mean moving beyond siloed approaches to public health behaviour policies, in which the focus is on renewing strategies on individual lifestyle risks one at a time, as this ignores how behaviours are actually distributed in the population.

- A more integrated approach to behaviour change is required that links more closely to inequalities policy and is focused more directly on the government's stated goal to 'improve the health of the poorest, fastest' (Her Majesty's Government 2010).

Introduction

People's lifestyles – whether they smoke, how much they drink, what they eat, whether they take regular exercise – are widely recognised as affecting their health and risk of dying young.

In 2002, the World Health Organization revealed that in the world's most highly industrialised countries in North America, Europe and Asia, alcohol and smoking, low consumption of fruit and vegetables and lack of physical activity were associated with about 29 per cent of the disease burden, estimated by disability-adjusted life years (DALYs) lost (World Health Organization 2002). These behaviours are also linked to high cholesterol, obesity and overweight, which were associated with a further 15 per cent of the disease burden in these countries.

Close to half of the burden of illness in developed countries is therefore associated with the four main unhealthy behaviours: smoking, excessive consumption of alcohol, poor diet and low levels of physical activity.

The collective term for these behaviours is the subject of much debate, with professionals from different fields preferring different terminology, each having a view about what is pejorative and what is not. Phrases used range from 'unhealthy behaviours' and 'poor health behaviours', through to 'multiple lifestyle risks'. We use these terms interchangeably in this paper.

It is well known that each of these lifestyle risk factors is unequally distributed in the population and that these behaviours are differentially associated with income, educational achievement and social class. There has been an increasing amount of research into how these lifestyle risks co-occur or cluster in the population, but the logical next question – how have these patterns of multiple lifestyle risk been evolving over time? – has not been examined to our knowledge in England. The core purpose of this paper is to answer that question in the context of the English population and to set out the implications for public health policy and practice.

Our analysis and findings relate to a period when the Labour Party had been in power for 11 years. We believe they are consistent with its approach to public health policy: a story of much effort, and some real successes, but also of far too little co-ordination. Individual lifestyle policies were developed in siloes and behaviour change policies were produced separately from inequalities policy.

Lifestyles were consistently conceptualised in policy circles as separate problems, to be dealt with by separate policy teams, actions and resources. The Labour government sought to achieve reductions in the prevalence of the four main lifestyle risk behaviours, but with little initial interest in which groups were benefitting. In addition, there was a focus on each 'issue' in turn, with little notice paid to how these risks were *jointly* distributed in the population, or how people actually experienced them in different social contexts. Only towards the end of the period was there any significant effort to understand how the population actually experienced lifestyle risk, or to relate this to policy on inequalities.

Although the coalition government's first priority was to reform the public health system, it is also notable that it has released three separate strategies – one each on tobacco, alcohol and obesity – with little or no reference to one another, how these behaviours co-occur or cluster in the population, or the level of inequalities in them individually or when experienced together.

In the next section, we review the current evidence on multiple lifestyle risks, and then present our analysis of two waves of the Health Survey for England (HSE) (NHS Information Centre 2012), exploring how smoking, excessive use of alcohol, poor diet and low levels of physical activity are distributed in the adult population and how this is changing over time. Finally, we discuss whether the single-issue approach to behaviour change policy is sufficient in the light of our findings, and make recommendations for policy, practice and research. These include learning lessons from parallel issues in other areas of health care, such as the treatment of those with multiple co-morbidities.

What do we already know about multiple lifestyle risks?

There is a small but growing body of international literature looking at the prevalence and co-distribution of lifestyle risks factors in the general adult population and in specific age groups, particularly adolescents and the elderly. The main risk factors analysed have been the four already mentioned, although drug use, sexual activity and other factors have also been investigated, particularly in younger populations.

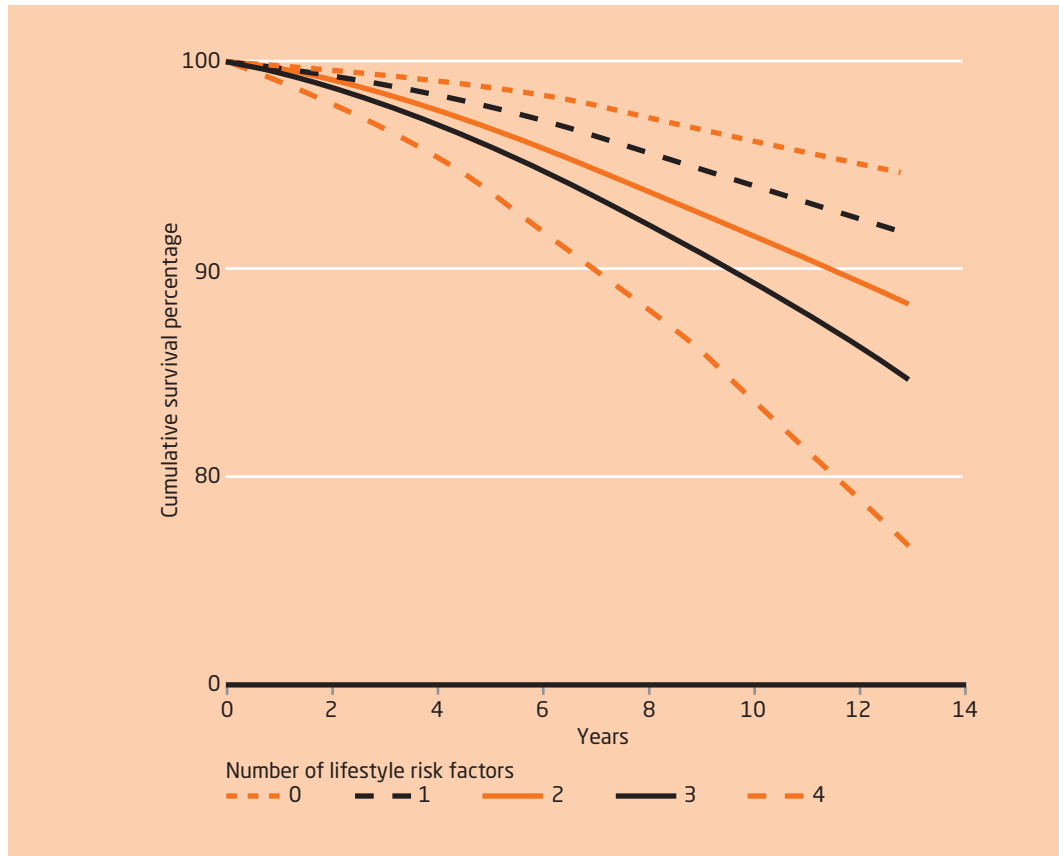
Despite differences in the research in terms of the settings, analytical tools, data sources, and ways of defining risk factors, three consistent themes emerge.

- A significant minority of people in western developed countries have three or more risk factors, equating to more than 25 per cent of English adults (Poortinga 2007).
- Multiple risk factors are not randomly distributed across populations but are more common in some groups than others.
- Several studies have found a consistent socio-demographic gradient in the prevalence of multiple risk factors, with men, younger age groups and those in lower social classes and with lower levels of education being more likely to exhibit multiple lifestyle risks (Schuit *et al* 2002; Berrigan *et al* 2003; Laaksonen *et al* 2003; Chioloro *et al* 2006; Poortinga 2007; Tobias *et al* 2007; Shankar *et al* 2010).

Although there is a growing body of work on multiple behaviours, there is a surprising lack of research on how the presence of multiple behaviours affects mortality or morbidity. We are aware of only one study that has actively looked at this issue. As part of the Norfolk (United Kingdom) arm of the European-wide European Prospective Investigation into Cancer (EPIC) study of cancer risk and outcomes, Khaw and colleagues (Khaw *et al* 2008) examined the prospective relationship between lifestyle and mortality in a prospective population study of 20,244 adults aged 45–79 years at induction between 1993 and 1997, with a follow-up in 2006. Their results showed conclusively that mortality risk decreased as the number of lifestyle risks engaged in also decreased (*see* Figure 1 overleaf).

Over the average follow-up of 11 years, approximately 75 per cent of those who engaged in all four behaviours of smoking, drinking to excess, poor consumption of fruit and vegetables, and low levels of physical activity (the bottom line in Figure 1) were still alive, compared with around 95 per cent of those who had none of those behaviours (the top line). The authors found that there was a fourfold difference in mortality risk between those engaging in all four poor health behaviours versus none, equivalent to a difference of 14 years of chronological age at death.

A later study, by Myint and colleagues (2011), examined 13,358 of the men and women participating in the EPIC-Norfolk project. Comparing baseline data gathered between 1993 and 1997 with data from a follow-up in 2007, the authors found an additional quality-of-life penalty for multiple lifestyle risk, although this was much less severe.

Figure 1 The relationship between multiple lifestyle risks and mortality

Source: Adapted from Khaw *et al* (2008)

Although scarce, the evidence is of high quality and shows that the distribution of multiple lifestyle risks has a strong effect on long-term mortality risk. It is therefore important to know how such multiple lifestyle risk is changing in our population. This paper is the only one we know of – with the exception of a study in Belgium by Drieskens *et al* (2010) – to look at how multiple lifestyle risk patterns have changed over time between different population groups.

Methods

We used the 2003 and 2008 waves of the HSE to explore multiple lifestyle risk in a representative sample of the English adult population (meaning here those aged 16 years and older) living in private households. We chose this time period for practical reasons:

- at the time of the analysis, 2008 was the latest year for which data were available
- five years is a reasonable period in which to expect to see some changes
- the relevant questions were present in both surveys.

We focused on four risk factors that are generally considered important causes of morbidity and mortality:

- smoking
- consumption of alcohol in excess of government guidelines
- low consumption of fruit and vegetables
- physical inactivity.

These are also the four behaviours that the government has recently chosen to emphasise in its ‘every contact counts’ policy in the NHS (Department of Health 2012).

Our definition of having these risk factors is based on national guidelines. A multiple lifestyle index ranging from 0 (no risk factor) to 4 (all four risk factors) was created using these data, along with a simpler, dichotomised index of low risk (no, one or two risk factors) and high risk (three or four risk factors). We hypothesised – as have previous studies – that age, gender, economic status, socio-economic position and education are related to these behaviours in terms of how they co-occur in the population.

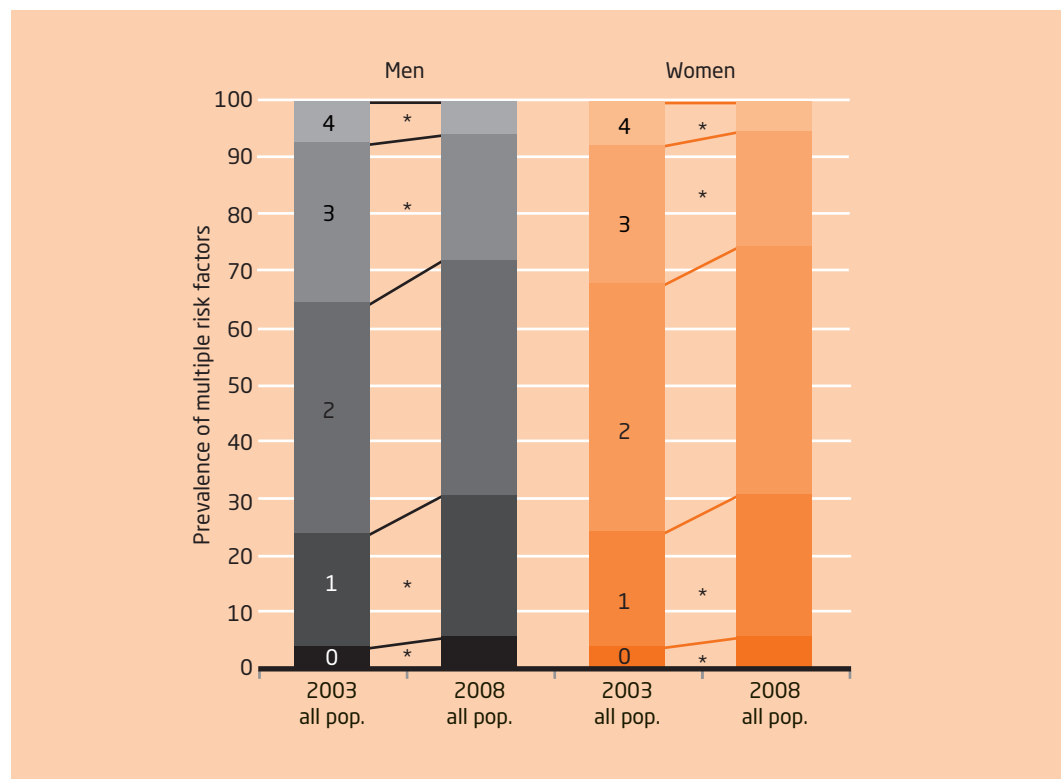
As we are looking at two different years of a cross-sectional survey, we are not following exactly the same people over time; rather we are observing two different populations, albeit sampled using identical methods; this has implications for the interpretation of our findings, which we return to below. (See separate appendix www.kingsfund.org.uk/multiplebehaviours for a full definition of our variables and analytical methods and choices.)

Results

How has the prevalence of multiple lifestyle risk factors in the English population changed over time?

In 2003, approximately 7 per cent of the population had all four risk factors and very few, around 4 per cent, had none. The majority – about 60 per cent – had one or two risk factors, but around a third of the population had three or more risk factors. The pattern of multiple lifestyle risks was similar in men and women (see Figure 2).

Figure 2 Change in the prevalence of multiple lifestyle risk factors between 2003 and 2008, by gender



Notes: 0 to 4, number of lifestyle risk factors; * significant change between years, $p < 0.05$

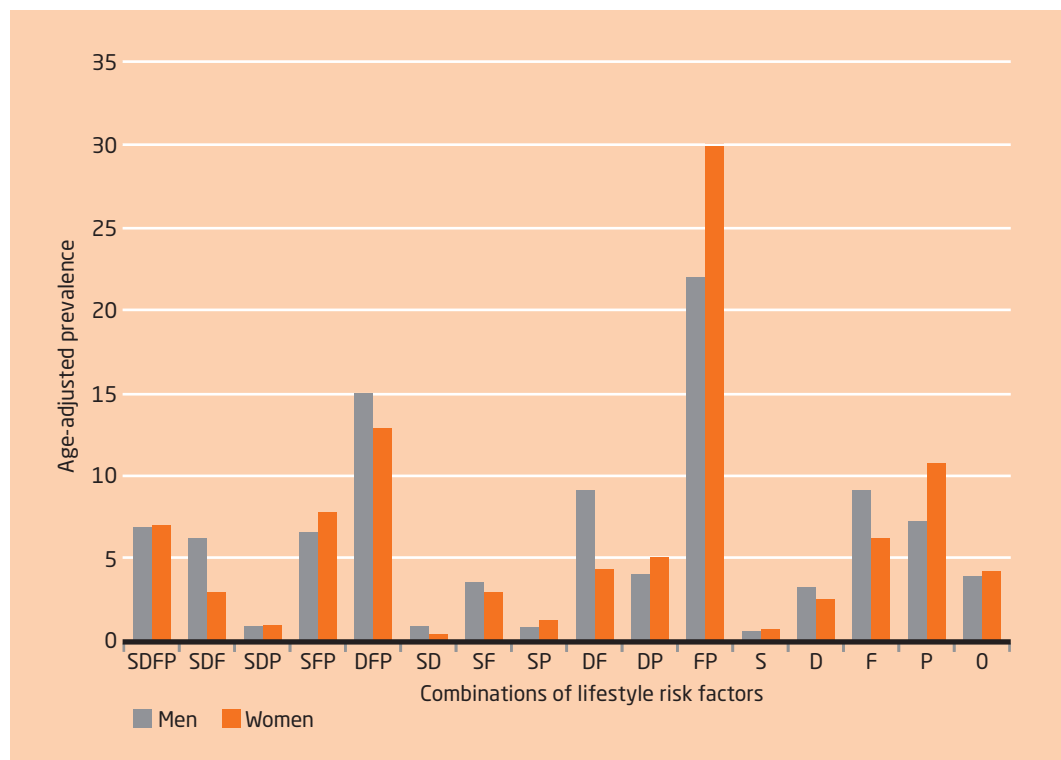
Source: Authors’ analysis of the Health Survey for England 2003 and 2008 (NHS Information Centre 2012)

Between 2003 and 2008, there was a clear improvement in the distribution of multiple lifestyle risk in both men and women. The proportion of people with all four risks fell from 7 per cent to 5 per cent; the proportion who reported engaging in three risk behaviours fell from 29 to 23 per cent for men and from 25 per cent to 21 per cent for women. Overall, by 2008, about 25 per cent of the population reported having three or more risk factors, compared with more than 33 per cent in 2003. There was a corresponding increase in the proportions of the population reporting one behaviour, and an increase from 4 per cent to 6 per cent in the proportion of the population reporting none.

There are 16 possible combinations of risk factors – six pairs of behaviours, four triple combinations, and the presence or absence of all four behaviours, – along with the four single behaviours. We assessed how these 16 specific combinations have changed over time in order to look for specific patterns.

In 2003, the lack of adherence to the recommended level of consumption of fruit and vegetables was striking across the 16 patterns (see Figure 3 below). The four most common combinations accounted for about half of the sample – all of these in men and three of these in women involved failure to meet government recommendations on fruit and vegetable consumption.

Figure 3 Prevalence of combinations of multiple lifestyle risk factors in 2003, by gender



Notes: S, smoking; D, drinking; F, low consumption of fruit and vegetables; P, low levels of physical activity; O, no risk factors
 Source: Authors' analysis of the Health Survey for England 2003 and 2008 (NHS Information Centre 2012)

Between 2003 and 2008, there was a significant improvement at the extremes for both men and women – a significant drop in the proportion reporting four risks and a significant increase in those reporting none. There were also significant drops in most of the triple combinations involving fruit and vegetable consumption (see Figure 4 opposite). There were fewer differences for combinations of two risk factors: for men there were no significant changes; for women there was a significant increase (from 4 per cent to 6 per cent) in the proportion drinking an excessive amount of alcohol in combination with

poor fruit and vegetable consumption, and a significant decrease (from 5 per cent to 4 per cent) in the proportion drinking an excessive amount of alcohol in combination with doing little physical activity. Most single behaviour patterns saw statistically significant increases over the period. The exceptions were no significant changes in those reporting just smoking for both men and women, and, for women alone, no change in those reporting a poor level of physical activity alone.

Figure 4 Change in prevalence of combinations of multiple lifestyle risk factors between 2003 and 2008, by gender



Notes: S, smoking; D, drinking; F, low consumption of fruit and vegetables; P, low levels of physical activity; O, no risk factors; *, significant difference ($p < 0.05$) between the years

Source: Authors' analysis of the Health Survey for England 2003 and 2008 (NHS Information Centre 2012)

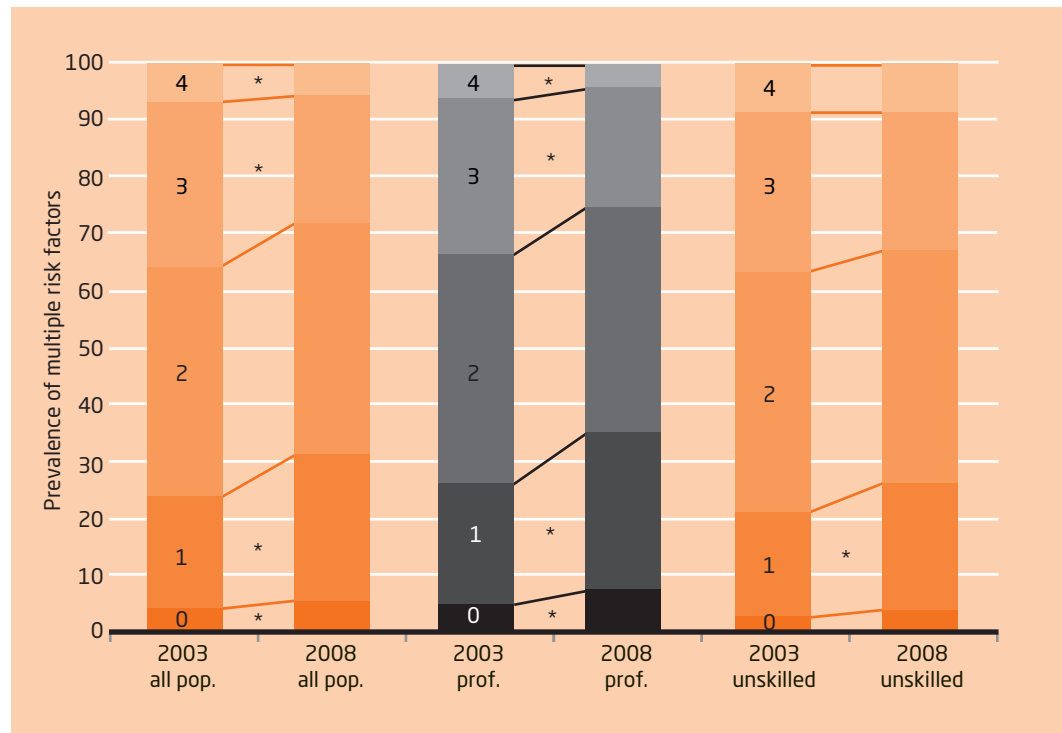
Overall, these findings suggest that people have managed to modify their behaviours in a positive direction, with a general reduction in the prevalence of those engaging in three or four behaviours, which is reflected in an increase in single behaviours.

However, the less good news is that although our data show a general improvement in the distribution of multiple lifestyle risk factors as a whole, this improvement has not been shared equally.

For all that the proportion of people engaging in multiple risky behaviours has fallen in the general population, the reductions are greater in the higher socio-economic groups, contributing to widening health inequalities. For professional men, the prevalence of four behaviours dropped significantly from 6.2 per cent to 4.2 per cent, and of three behaviours from 7.5 per cent to 4.5 per cent. But there was no statistically significant change among men in the unskilled manual class (see Figure 5 overleaf and Table 1, p9). Equally, while there was a statistically significant increase in the prevalence of no risk factors for professional men (from 4.8 per cent to 7.6 per cent) and skilled non-manual workers (from 2.3 per cent to 4.3 per cent), there was no significant change for men in the manual social classes. Patterns were similar for women. Table 1 (p9) shows the results in more detail for both genders.

We observed similar findings when we looked at education – a significant reduction in the prevalence of four risk factors and a significant increase in the prevalence of no risk factors in people with a higher level of education, but no change in people with no qualifications (see Table 2 opposite).

Figure 5 Change in prevalence of multiple lifestyle risk factors between 2003 and 2008 for men in professional and unskilled manual households



Note: *, Significant difference ($p < 0.05$) between the years

Source: Authors' analysis of the Health Survey for England 2003 and 2008 (NHS Information Centre 2012)

Table 1 Changes in the prevalence of combinations of multiple lifestyle risk factors between 2003 and 2008, by social class and gender

Number of lifestyle risk factors	Social class	Men			Women		
		2003 (%)	2008 (%)	p value 2008/2003	2003 (%)	2008 (%)	p value 2008/2003
4	Professional	6.2	4.2	0.001	5.7	3.1	0.000
	Skilled non-manual	7.5	4.5	0.020	9.6	5.0	0.000
	Skilled manual	6.3	5.3	ns	7.0	5.3	ns
	Unskilled manual	8.8	8.4	ns	8.3	7.0	ns
3	Professional	27.2	21.0	0.000	22.8	19.1	0.000
	Skilled non-manual	30.8	22.1	0.000	26.2	23.1	0.060
	Skilled manual	29.7	24.1	0.001	26.2	21.0	0.001
	Unskilled manual	28.2	24.6	ns	26.2	22.8	0.047
2	Professional	40.4	39.7	ns	42.7	41.8	ns
	Skilled non-manual	38.9	43.4	0.088	41.5	44.7	ns
	Skilled manual	39.7	41.6	ns	44.2	46.3	ns
	Unskilled manual	42.1	40.7	ns	45.9	43.3	ns
1	Professional	21.3	27.5	0.000	23.5	29.1	0.000
	Skilled non-manual	20.6	25.7	0.019	18.7	21.9	ns
	Skilled manual	20.4	24.4	0.008	19.2	22.6	0.024
	Unskilled manual	18.0	22.3	0.019	16.3	22.3	0.000
0	Professional	4.8	7.6	0.000	5.2	7.0	0.004
	Skilled non-manual	2.3	4.3	0.029	4.0	5.3	ns
	Skilled manual	3.9	4.5	ns	3.5	4.9	0.044
	Unskilled manual	3.0	4.0	ns	3.3	4.6	ns

Note: ns, not significant; where significant ($p < 0.05$), p valued reported

Table 2 Changes in the prevalence of patterns of multiple lifestyle risk factors between 2003 and 2008, by education and gender

Number of lifestyle risk factors	Education	Men			Women		
		2003 (%)	2008 (%)	p value 2008/2003	2003 (%)	2008 (%)	p value 2008/2003
4	Higher education	5.7	3.9	0.024	4.8	3.2	0.047
	Intermediate	7.6	6.0	0.030	8.2	5.3	0.000
	No qualifications	8.7	7.1	ns	8.6	7.3	ns
	Full-time students	4.9	3.4	ns	6.1	2.5	0.021
3	Higher education	25.8	20.8	0.001	21.5	16.5	0.000
	Intermediate	30.9	24.5	0.000	26.8	23.3	0.003
	No qualifications	33.8	28.3	0.023	26.8	23.9	ns
	Full-time students	25.5	10.7	0.000	23.1	10.7	0.000
2	Higher education	40.6	37.6	ns	42.0	39.4	ns
	Intermediate	38.7	41.8	0.038	39.3	43.0	0.011
	No qualifications	38.9	40.1	ns	46.3	44.6	ns
	Full-time students	39.5	45.8	ns	43.1	33.5	0.041
1	Higher education	23.2	28.8	0.001	26.1	32.1	0.000
	Intermediate	19.1	23.7	0.000	21.5	23.7	ns
	No qualifications	16.4	21.2	0.013	15.4	19.5	0.033
	Full-time students	25.7	27.2	ns	22.9	48.2	0.000
0	Higher education	4.7	8.8	0.000	5.7	8.8	0.000
	Intermediate	3.7	4.1	ns	4.3	4.6	ns
	No qualifications	2.1	3.3	ns	2.9	4.7	ns
	Full-time students	4.4	12.8	ns	4.8	5.1	ns

Note: ns, not significant; where significant ($p < 0.05$), p valued reported

Analysis of changes over time by age group showed that the decrease in the proportion of those engaging in three or four multiple risk behaviours was greater in those in middle-age or younger groups than in the older age groups (see Table 3 below). Although overall elderly people were generally less likely to have a risky lifestyle than those in other age groups, there was no evidence of any further improvement between 2003 and 2008. The improvements in the general population came from those in middle-age or younger, with large declines in the 16–24 year age group for three risk factors (from 32.5 per cent to 21.4 per cent for men, and from 31.2 per cent to 23.8 per cent for women). Among women, there was also a striking decrease in the proportion of those aged 16–24 years who had four risk factors (from 10.5 per cent to 5.7 per cent).

Table 3 Changes in the prevalence of patterns of multiple lifestyle risk factors between 2003 and 2008, by age and gender

Number of lifestyle risk factors	Age (years)	Men			Women		
		2003 (%)	2008 (%)	p value 2008/2003	2003 (%)	2008 (%)	p value 2008/2003
4	16-24	7.0	6.7	ns	10.5	5.7	0.000
	25-44	9.1	6.9	0.008	9.7	6.2	0.000
	45-64	7.0	4.8	0.002	6.3	4.7	0.012
	65+	2.1	2.4	ns	1.2	1.2	ns
3	16-24	32.5	21.4	0.000	31.2	23.8	0.001
	25-44	32.9	25.3	0.000	27.5	22.7	0.000
	45-64	27.6	23.7	0.003	24.8	22.0	0.017
	65+	19.1	17.6	ns	16.1	13.9	0.060
2	16-24	38.2	38.2	ns	39.6	43.3	ns
	25-44	36.3	37.8	ns	38.6	39.0	ns
	45-64	38.8	39.2	ns	40.5	39.7	ns
	65+	52.0	51.7	ns	60.0	56.6	0.035
1	16-24	18.6	27.7	0.000	14.9	22.2	0.000
	25-44	17.7	24.2	0.000	20.1	25.9	0.000
	45-64	22.2	26.3	0.002	22.5	26.3	0.002
	65+	23.2	23.8	ns	20.3	24.7	0.002
0	16-24	3.6	6.0	ns	3.8	4.9	ns
	25-44	4.0	5.8	0.012	3.8	6.2	0.001
	45-64	4.3	6.0	0.014	5.8	7.3	0.030
	65+	3.5	4.6	ns	2.4	3.7	0.018

Note: ns, not significant; where significant ($p < 0.05$), p valued reported

The relative impacts of social class, education, age and other factors

In order to understand how age, gender and socio-economic factors interact in explaining multiple lifestyle risk, we performed regression analysis (see separate Appendix at www.kingsfund.org.uk/multiplebehaviours for details). In line with existing research (Shankar *et al* 2010), we present separate models of the impact of social class and education (results were qualitatively similar when social class and education were entered into the same model).

Tables 4 and 5 opposite show the results of this analysis. The dependent variable was our lifestyle risk index ranging from 0 (the default, having no risk factors) to 4 (all four lifestyle risks present) for our populations in 2003 and 2008. The results are expressed as odds ratios and show the relative odds that a particular group had one, two, three or four risk factors versus none compared with the reference group (in brackets).

The results largely reinforce our bivariate analyses: taking into account other characteristics, we found an increasing polarisation in the prevalence of multiple lifestyle risk factors, particularly between those in the highest and lowest socio-economic and

Table 4 Changes in the odds ratios of predictors of multiple lifestyle risk factors between 2003 and 2008, social class model

Category*	One risk factor			Two risk factors			Three risk factors			Four risk factors		
	2003	2008	p value 2008/2003	2003	2008	p value 2008/2003	2003	2008	p value 2008/2003	2003	2008	p value 2008/2003
Sex (female)												
Male	0.91	0.95	ns	0.96	0.99	ns	0.78 [†]	0.66	ns	0.91	0.82	ns
Age (16-24 years)												
25-44	1.07	1.00	ns	0.99	1.00	ns	0.97	0.70	ns	1.15	1.19	ns
45-64	0.98	0.96	ns	0.80	0.90	ns	0.64 [†]	0.46	ns	0.62 [†]	0.79	ns
65+	1.30	1.52	ns	1.42	1.79 [†]	ns	0.55 [†]	0.34	ns	0.21 [§]	0.49 [†]	0.041
Social class (professionals)												
Skilled non-manual	1.37 [†]	1.25	ns	1.51 [†]	1.58 [§]	ns	1.76 [†]	1.30 [§]	ns	2.22 [§]	1.95 [§]	ns
Skilled manual	1.21	1.30 [†]	ns	1.33 [†]	1.65 [§]	ns	1.49 [†]	1.16 [§]	ns	1.48 [†]	2.22 [§]	0.07
Partly/unskilled manual	1.20	1.32 [†]	ns	1.61 [†]	1.70 [§]	ns	1.66 [§]	1.23 [§]	ns	2.12 [§]	3.43 [§]	0.041
Economic status (active)												
Inactive	1.09	1.15	ns	1.37 [†]	1.29	ns	1.28	0.99	ns	1.50 [†]	1.31	ns
Retired	1.37	0.90	ns	1.55 [†]	1.12 [†]	ns	1.48 [†]	1.02	ns	1.33	0.83	ns

Notes: *, reference groups in parentheses; †, p<0.05; ‡, p<0.01; §, p<0.001 between groups within year; ns, not significant (p>0.05) within group across years; people with no risk factors form the reference group for the lifestyle indicator

educational groups. For example, in 2003, the odds of having all four risk factors versus having none were more than twice as high for those from unskilled manual households than those from professional households, as were the odds for skilled non-manual households compared with professionals (see Table 4 above).

By 2008, the relationship between social class and the number of lifestyle factors remained strong but was largely unchanged between the two periods. Nonetheless, by 2008 there was an increasing divergence between professionals and others in the risk of having four lifestyle risk behaviours: for those from unskilled households this increased from twofold to more than threefold compared with professionals.

Being in intermediate education or having no qualifications was strongly correlated with having a higher number of risk factors in 2003, and this strengthened strongly over time (see Table 5 below). In 2003, the odds of those with no qualifications having all four risk factors were threefold greater than for those with higher education; by 2008 this had increased to more than fivefold, controlling for other factors.

Table 5 Changes in the odds ratios of predictors of multiple lifestyle risk factors between 2003 and 2008, education model

Category*	One risk factor			Two risk factors			Three risk factors			Four risk factors		
	2003	2008	p value 2008/2003	2003	2008	p value 2008/2003	2003	2008	p value 2008/2003	2003	2008	p value 2008/2003
Sex (female)												
Male	0.91	0.92	ns	0.93	0.94	ns	0.75 [†]	0.81 [†]	ns	0.87	0.75	ns
Age (16-24 years)												
25-44	1.02	0.91	ns	0.85	0.84	ns	0.78	0.78	ns	0.87	0.77	ns
45-64	0.93	0.83	ns	0.63 [†]	0.69 [†]	ns	0.48 [§]	0.60 [†]	ns	0.42 [§]	0.43 [§]	ns
65+	1.21	1.25	ns	0.99	1.21	ns	0.37 [§]	0.57 [†]	ns	0.12 [§]	0.22 [§]	ns
Education (higher education)												
Intermediate	1.06	1.51 [†]	0.016	1.21	2.06 [§]	0.000	1.51 [§]	2.48 [§]	0.001	1.97 [§]	3.15 [§]	0.012
No qualifications	1.19	1.56 [†]	ns	1.95 [§]	2.59 [§]	ns	2.12 [§]	3.24 [§]	0.038	3.05 [§]	5.16 [§]	0.033
Full-time students	0.94	0.93	ns	0.78	0.94	ns	0.66 [†]	0.63	ns	0.61 [†]	0.62	ns
Economic status (active)												
Inactive	1.11	1.26	ns	1.43 [†]	1.42 [†]	ns	1.42 [†]	1.48 [†]	ns	1.67 [†]	1.72 [†]	ns
Retired	1.37	0.90	ns	1.53 [†]	1.10	ns	1.48 [†]	0.93	ns	1.32	0.82	ns

Notes: *, reference groups in parentheses; †, p<0.05; ‡, p<0.01; §, p<0.001 between groups within year; ns, not significant within group across year, where significant (p<0.05), p value reported; people with no risk factors form the reference group for the lifestyle indicator

Although our bivariate analysis by age suggested a decreasing age-related gap in the number of risk factors over time – with young adults and the middle-aged improving and the elderly largely maintaining their lifestyles – our multivariate models suggest that over time this relationship may be weaker once other factors are accounted for. There is little sign that young adults, the middle-aged or the elderly were improving in their behaviours over time compared with the very youngest group, as demonstrated by the lack of significant differences for the age variables between 2003 and 2008 in Tables 4 and 5.

The only significant age-related difference over time – from the model with social class in Table 4 – was that while people aged 65 years and older were about 80 per cent less likely than those in the 16–24 age group to have four risk factors in 2003, by 2008 they were only half as likely to do so. This is difficult to interpret, but it may be that socio-economic and educational differences are driving the change, age being less influential once these are taken into account.

Increases in measures of inequality in the distribution of the four lifestyle risks

Finally, we assessed the change in socio-economic and educational inequalities in multiple lifestyle risk factors by comparing how four summary measures of inequalities had changed between 2003 and 2008 (*see* Tables 6 and 7 below). Two of these came from our existing analyses, and the others are commonly used in the literature on inequality.

Table 6 Change in inequalities in multiple lifestyle risk factors between 2003 and 2008, by social class and gender, summary measures

Summary measures of inequality	2003	2008	Relative change	p value 2008/2003
Men				
Prevalence difference (%), manual unskilled versus professional	3.46	7.78	2.25	0.08
Odds ratio (95% CI), manual versus professional	1.11	1.41	1.27	0.04
Population attributable risk (%)	5.97	10.63	1.78	na
Relative index of inequality	1.15	1.65	1.43	0.01
Women				
Prevalence difference (%), manual unskilled versus professional	5.90	7.64	1.29	0.43
Odds ratio (95% CI), manual versus professional	1.33	1.51	1.13	0.2
Population attributable risk (%)	9.96	12.53	1.26	na
Relative index of inequality	1.43	1.72	1.20	0.182

Note: CI, confidence interval; na, not applicable

Table 7 Change in inequalities in multiple lifestyle risk factors between 2003 and 2008, by education and gender, summary measures

Summary measures of inequality	2003	2008	Relative change	p value 2008/2003
Men				
Prevalence difference (%), no qualifications versus higher education	11.07	10.72	0.97	0.91
Odds ratio (95% CI), no qualifications versus higher education	1.25	1.61	1.29	0.03
Population attributable risk (%)	11.46	12.13	1.06	na
Relative index of inequality	1.25	1.66	1.34	0.05
Women				
Prevalence difference (%), no qualifications versus higher education	9.17	11.49	1.25	0.414
Odds ratio (95% CI), no qualifications versus higher education	1.51	2.07	1.37	0.003
Population attributable risk (%)	17.26	22.21	1.29	na
Relative index of inequality	1.56	2.26	1.44	0.006

Note: CI, confidence interval; na, not applicable

Overall, this analysis further reinforced the conclusion of an increasing gap between socio-economic and educational groups in the prevalence of multiple risk factors.

On these measures, the polarisation between men in manual occupation households and those in professional occupation households significantly increased between 2003 and 2008 (Table 6). The relative index of inequality,¹ commonly used as a measure of inequalities in life expectancy, also suggests an increase in the gap between the different social classes, with a large relative increase of 43 per cent over the period. But these effects differed by gender, being present for men but not for women. The same statistics for relative educational attainment showed larger inequality gaps over time, and they were also significant for women (Table 7).

Discussion and policy implications

Our findings suggest that a remarkable public health success story has been lying hidden and unremarked upon in government statistics on health and lifestyles. Between 2003 and 2008 there was a large and significant improvement in multiple lifestyle risk in the English population characterised by a reduction in the number of people with three or four lifestyle risk behaviours and a corresponding increase in the number with one or none as people 'downshifted' their multiple behaviours.

Given the evidence on how damaging multiple lifestyle risks are for health and mortality, this is really good news. Contrary to common belief, more affluent, Western lifestyles need not be increasingly injurious to health and lead to chronic illness and shorter lives. It is clearly possible for those in generally richer populations to achieve an improvement in lifestyle and a reduction in mortality risk.

However, although this is a story of success for the population as a whole, at least in England and over this period, there is no room for complacency. In 2008, around 70 per cent of the adult population was not adhering to government advice with regard to two or more of the four lifestyle risk behaviours of smoking, excessive use of alcohol, fruit and vegetable consumption and levels of physical activity.

Arguably even more importantly, however, is the fact that those from the lowest socio-economic groups and with the least education did not experience as much improvement and, in relative terms, have fallen further behind. This reflects one of public health's most difficult dilemmas: unless consciously designed not to, policies and actions that work for populations as a whole often inadvertently entrench inequalities. By 2008, those from unskilled manual backgrounds were more than three times as likely to have all four risk behaviours than professionals, and those with no qualifications were more than five times more likely to have all four than those with the highest level of qualification.

Our findings have implications for understanding the success and failure of public health policy over the past 15 years, for public health policy reform, and for future research in this area.

Our findings in their policy context: public health policy in the past 15 years

Labour's initial public health policy focus on coming to power in the late 1990s was controlling smoking. The government consistently pursued a combination of targets, legislation and an NHS-wide smoking cessation programme that resulted in a large fall in both the rates and intensity of smoking (Thorlby and Maybin 2010; Joossens and Raw 2011). Action in other lifestyle areas took much longer to develop, but stronger policy pushes, particularly on childhood obesity (Department of Health 2008c) emerged in the mid- and late 2000s.

¹ This is a common measure of inequality and describes the gradient of the indicator of 'health' observed across a social scale – commonly deprivation – relative to the mean health of the whole population. For another example of the use of this measure see Annex 3 of Scottish Government (2008), and for detailed background information on this and the other measures used here see separate Appendix at www.kingsfund.org.uk/multiplebehaviours.

In line with the generally target-driven approach to health policy, the government sought also to achieve changes in the other three main lifestyle risk behaviours, but there was much less initial interest in 'where' these changes would come from. Fundamentally, this was because policies on lifestyle risks were compartmentalised, given separate policy leads and teams in the Department of Health, and the focus was on the 'issue' rather than how these risks were *jointly* distributed in the population, or how people actually experienced them – in very different social contexts and very often more than one at a time.

Moreover, public health policy was functionally separate from that on inequalities in health. The latter had a different focus, being primarily driven by the need to meet a tough, short-term target to reduce life-expectancy gaps between poorer and wealthier parts of England. The measures necessary to make a sufficiently fast impact in that policy area were explicitly recognised to be in secondary prevention – the diagnosis and treatment of illness in its earliest stages before it has caused significant morbidity – rather than prevention (National Audit Office 2010). Although recognised as important in reducing inequality in the long run, the changing of unhealthy behaviours was not a priority in the drive by the Department of Health to meet its target on life-expectancy gaps agreed with the Prime Minister's Delivery Unit. Some funding was made available for lifestyle change programmes, particularly for local authorities (Department of Health 2009), but this was very much a subsidiary project and was not co-ordinated with broader policy on behaviour change.

Only towards the end of the period was there any significant effort to understand how the population actually experienced lifestyle risk behaviours. Although there was brief recognition of this as an issue in the Department of Health's update on health inequalities strategy in 2008 (Department of Health 2008a), a more serious attempt to understand why particular groups of the population are more likely to take lifestyle risks was pursued in the work driving the Department of Health's approach to social marketing campaigns, as exemplified by *Healthy Foundations* (Department of Health 2008b).

The implications of our findings for national policy and the new public health system

The coalition government's approach to public health policy has evolved since coming into power. Its first priority was to reform the public health system, with a clearer focus on outcomes and the role of local government, particularly in behaviour change. Beyond this, it released specific policy documents on tobacco, obesity and alcohol and made much of the *Public Health Responsibility Deal* (Department of Health 2011d).

The policy documents on obesity and tobacco (Department of Health 2011b, 2011c) are essentially evolutions of the previous government's approaches but with a clear message in each that, unlike its predecessor, the coalition government will not set targets for public health policy. Both documents emphasise that the role of central government is to support local decision-making on public health and to intervene only when necessary. However, in its most recent strategy, on alcohol (Her Majesty's Government 2012), the government has shown that it is prepared to act more strongly: it has committed to introducing a minimum unit price for alcohol, subject to legal challenge.

Nevertheless, it is striking that these policies – as with those of the previous administration – are produced in isolation from one another and in isolation from policies on inequalities in health. There are some encouraging signs at the level of national policy, however. In its new information campaigns, the Department of Health has changed the emphasis from targeting single health issues to an approach based on people and the social context of behaviour change over their lives (Department of Health 2011a). Social marketing should therefore be more attuned to the times when people are at risk of

taking up unhealthy behaviours – whatever they may be – or to life events when there are particularly good opportunities to help them change, such as pregnancy.

This is a welcome shift in focus but we contend is not sufficient on its own. There is little sign that the Department of Health has developed a more generally holistic approach to lifestyle risk, one that takes account of the fact that just under 70 per cent of adults currently engage in two or more of the main unhealthy behaviours, and that the situation is worse still for those in lower socio-economic and educational groups. This is worrying as, if the current government is to be taken at its word, the key test of its health policy is whether it is seen to be ‘improving the health of the poorest, fastest’ (Her Majesty’s Government 2010). It will be judged on whether its policies on lifestyle risk really do drive change that helps us all, but particularly the poorest in society, to move down the risk ladder from four unhealthy behaviours to none.

Behaviour change policy and practice need to be approached in a more integrated manner so that the successes there have been can be used as the basis for future success that is shared more equally across all population groups. This requires:

- the Department of Health to be more astute and refocused, learning more and integrating its own research
- more basic knowledge about so-far unanswered questions, such as how people give up multiple as opposed to single behaviours, what the most cost-effective approaches are, and what lessons can be learned from other fields
- a better-designed public health system that incentivises innovation and initiatives that work.

The need for a more astute Department of Health

In fact, the Department of Health has pursued, and is still pursuing, some very useful policy-relevant research into multiple behaviours, but in parallel streams and commissioned by different policy teams. Furthermore, the Department of Health is currently poor at integrating its own knowledge, with three areas in particular standing out.

First, it is not clear that its policy approach to behaviour change has developed or learnt from its own research for *Healthy Foundations* (Department of Health 2008b). This bespoke, in-depth study examined the drivers for people’s lifestyle behaviours and the interactions between personal motivations to be healthy, the socio-economic environment in which people live, and what stage they are at in their lives. Although this has certainly informed the Department of Health’s social marketing strategy, it needs to be more strongly integrated into its public health policy.

Second, the Department of Health has commissioned Sir Michael Marmot’s team at the Institute of Health Equity to develop resources (UCL Institute for Health Equity 2012) that will help local authorities understand how the wider social determinants of health directly affect health, as shown in *Fair Society, Healthy Lives* (Marmot Review 2010), and how they work *indirectly* to influence people’s lifestyle risk-taking behaviour and their ability to maintain changes in their behaviour.

This is a welcome and very important initiative, and reflects a more mature approach to behaviour-change policy that recognises the socio-economic context of people’s lives when explaining their degrees of willingness and ability to change their behaviour, as well as their understanding of and access to information about health risks.

Third, the Department of Health has enthusiastically adopted the NHS Future Forum’s recommendation to ‘make every contact count’, that is that those working in the NHS should take every opportunity to help people change their behaviour with regard to the four lifestyle risks we analyse (Department of Health 2012).

What is unclear, however, is how the information flowing from these and other separate initiatives is to be organised and used to inform policy and practice, how each of these relates to the other, and whether any account is being taken of the distribution of behaviours in the population that we have found in our analysis. So far, there has been little sign of a more integrated approach. There needs to be much more alignment between the different units of the Department of Health that are working on inequalities, public health and its research priorities. The Department needs to ensure that someone has both the responsibility and the power to look across the different lifestyle risk factors, at their clustering, and their socio-economic distribution.

More basic knowledge about how people give up multiple as opposed to single behaviours

Our findings show that although many of us have improved our health behaviours significantly, almost 70 per cent of us still engage in two or more unhealthy behaviours. Frankly those researching in the field of behaviour intervention have been as slow to recognise these facts as policy-makers. It is therefore difficult to direct policy-makers or public health commissioners to definitive existing research that lays out exactly what they should do to further reduce multiple lifestyle risks. Legitimate questions that policy-makers and public health commissioners are likely to ask in response to our findings include:

- how having multiple risks affects the dynamics of behaviour change – whether it makes it easier or harder
- whether for the individual it is more effective to tackle risks in sequence or in tandem
- whether, from a population health perspective, there should be a focus on one risk rather than another
- how cost-effective the different approaches to reducing multiple risk are from a commissioners' perspective
- whether we can learn anything from other areas of care, such as the effectiveness of approaches to treating multiple co-morbidities.

There are currently no clear answers to these questions, but our judgement is that strategies for individual behaviour change are necessary, though insufficient – as evidenced by our findings with regard to both the population as a whole and the poorest and least educated segments in particular. However, primary research is beginning to emerge that is likely to be helpful, and more should be invested in learning from practice and pursuing secondary data analysis, such as extensions to this study.

The research evidence thus far is limited, but Paiva *et al* (2012) and Johnson *et al* (2008) have shown, in separate studies, that people who have success in changing one behaviour are more likely than their peers then to be successful at changing others. In short, success can breed success.

From a population health perspective, ranking by the size of the health burden would suggest that the best place to start in multiple risk change would be smoking, and that this should be prioritised above other lifestyle risks. However, although this might seem obvious, it does not necessarily follow for three reasons.

First, we do not know how the risks of each of the four behaviours interact to influence the overall mortality risk: essentially, we need to redraw Figure 1 based on the 16 different combinations of risk shown in Figures 3 and 4. If sufficiently powered, longitudinal studies such as EPIC-Norfolk or modelling based on them could do this, we would know which combinations of risks are worst for health.

Second, we do not know whether the effectiveness of strategies to change behaviour differs according to the comparative ease of change. Is it easier to eat more fruit and vegetables than to give up smoking, for example?

Third, does the order in which you change behaviour matter? For example, is it easier to give up smoking first before taking up exercise?

The answers to these questions are likely to be different for different people, and also to be driven by their social and economic contexts. The research evidence cannot yet tell us which strategies are likely to be more effective, or, ultimately, cost-effective. Pursuing these research questions should be a priority for the triumvirate of the National Institute for Health and Clinical Excellence (NICE), Public Health England and the National Institute for Health Research as they take up their roles in supporting behaviour change in the new public health system.

Our analysis could also be developed further to provide insight into these questions. The data we have used in this analysis are cross-sectional: although they are representative of the population in 2003 and 2008, they are drawn from different people. To understand why people did or did not change their lifestyle behaviours and in what order, we really need to be able to follow up the same people over time. This analysis therefore needs to be repeated with longitudinal datasets, possibly from the British Household Panel Survey or, for older individuals, the English Longitudinal Study of Ageing. It would then be possible to track the impact of personal events and cumulative histories on behaviour change, and to see the sequences in which that change occurred in which groups of people.

For example, how do large changes in income or wealth, moving in or out of employment or to a different part of the country, and age-related factors such as risk-taking in adolescence, marriage or child-rearing impact on either taking up multiple behaviours or reducing them? How much of our age-related findings are due to cohort, survivor or other effects? We can only imperfectly infer these effects from cross-sectional data; further analysis with longitudinal data would complement the findings of primary research.

In addition, more could be done with the data we have analysed here. First, our choice of lifestyles – and the cut-off points for what is termed ‘unhealthy’ behaviour – are obviously subjective. We focused on four behaviours that are very prevalent in the population, that are generally regarded as being important drivers of health in both the long and short terms, and that have been the focus of political debate and policy, but obviously other lifestyle risks and effects could have been examined, such as illegal drug use, sexual behaviours and how lifestyle choices correlate with mental health.

Second, in this analysis we controlled statistically for the fact that individuals’ behaviours are likely to be related to those of the people they live with, and the sorts of communities they live in (see separate appendix at www.kingsfund.org.uk/multiplebehaviours), but we did not model these network, social norm or social capital effects specifically, nor did we consider how they might be related to individual motivations, as the *Healthy Foundations* work (Department of Health 2008b) had started to do.

We know that social capital can improve people’s resilience to peer pressure, but can also be a strong barrier to change. Research has shown that positive social capital is negatively related to undertaking individual lifestyle risks such as smoking (Brown *et al* 2006; Folland 2008), but we have not managed to identify any studies that have looked at social capital and multiple lifestyle risks. This could be achieved with further testing for intra-household effects in these data.

Finally, a longer-term linked goal that could take advantage of the increasing availability of longitudinal surveys with NHS administrative data, is to test whether having multiple lifestyle risk factors is related to the future incidence and severity of single and multiple long-term conditions, and if so to what extent. There has been little direct work in this

area, but such integrated research is necessary if we are to understand the strength of the connection between effective health improvement policy and intervention now, and the pressure on NHS and other public services in 10, 20 or 30 years' time.

A better-designed public health system that incentivises innovation and initiatives that work

As it develops the policy framework for the new public health system, the Department of Health has the opportunity to embed the concept of multiple lifestyle risk into the new institutions it is establishing: with Public Health England supporting the local public health system to intervene successfully to help people reduce their multiple lifestyle risks; and with NICE leading on the development of public health quality standards and supporting reviews that look at the usefulness and cost-effectiveness of public health interventions.

As future standards are developed for local authorities and the NHS, and as the Every Contact Counts policy is rolled out, those both making and implementing the initiatives need to take account of what we have found, namely that:

- the majority of people have multiple not single risks
- people have very different combinations of risks
- who these people are differs systematically.

In short, there needs to be a careful segmentation of approach if the Every Contact Counts policy is to be effective, particularly for those in lower socio-economic groups. NICE is ideally placed to develop such guidance and the tools that follow from it.

Public health reform offers a real opportunity for the embedding of incentives to reduce inequalities in multiple lifestyle risks. The Department of Health should seriously consider introducing multiple lifestyle risks as an outcomes indicator in the next edition of the public health outcomes framework, and as a criterion for payment of the incentive element of the public health premium. This would give local authorities the incentive to innovate and really focus on improving fastest the lifestyles of the poorest and most at risk. It would also provide real-world and 'live' evidence on which methods work best for improving multiple lifestyle risk behaviours, which could be disseminated by Public Health England.

These efforts could be further reinforced through the Quality and Outcomes Framework, which could explicitly reward general practices for recording, understanding and intervening successfully with patients with multiple lifestyle risks; for example, by offering tiered additional rewards for stepwise reductions in the number of unhealthy behaviours of patients from poorer backgrounds.

Monitor and the NHS Commissioning Board could also experiment and evaluate innovative financing mechanisms such as tariffs for multiple lifestyle risk reduction, to support Every Contact Counts, and other reward methods for success in such movements, particularly in specific sub-groups.

At a local level, wider reforms, especially the introduction of statutory health and wellbeing boards, should make it easier to take action on multiple lifestyle risks, especially in conjunction with the changes to the design of the national system proposed above, and with increased support from Public Health England and NICE. The prevalence of multiple lifestyle risks could be part of local areas' Joint Strategic Needs Assessments, and follow through into joint health and wellbeing strategies and other local plans.

Many areas already undertake local health surveys that would allow them to map out who has multiple risks and where they live. This information could then be used to develop local targets with incentive payments, or other shared rewards, to various partners including general practitioners, in order to reduce the prevalence of individuals with multiple lifestyle risks.

Priorities for local authorities and the NHS

These changes will help to incentivise more focused commissioning and the provision of services for people with multiple lifestyle risks. Given the lack of academic research evidence available on the usefulness and cost-effectiveness of different approaches, commissioners will need to innovate and take risks. They should consider enhancing the evidence base through their own practice and evaluation to be part of their role.

In our view, they should focus on three areas:

- the further development of ‘wellness services’
- investment in supporting and training staff to deliver the Every Contact Counts policy
- exploiting the potential of lay and peer support.

The further development of wellness services

A recent briefing on wellness services issued jointly by the NHS Confederation and the Faculty of Public Health (NHS Confederation 2011) commented: ‘Wellness services provide support to people to lead healthy lives. The wellness approach goes beyond looking at single-issue, healthy lifestyle services and a focus on illness, and instead aims to take a whole-person and community approach to improving health.’

There are various models of wellness services. Figure 6 overleaf, drawn from the briefing, gives an example, showing how multiple lifestyle risk factors must be addressed within the context of a service that supports people first to change, and then to maintain that change.

Investment in supporting and training staff to deliver the Every Contact Counts policy

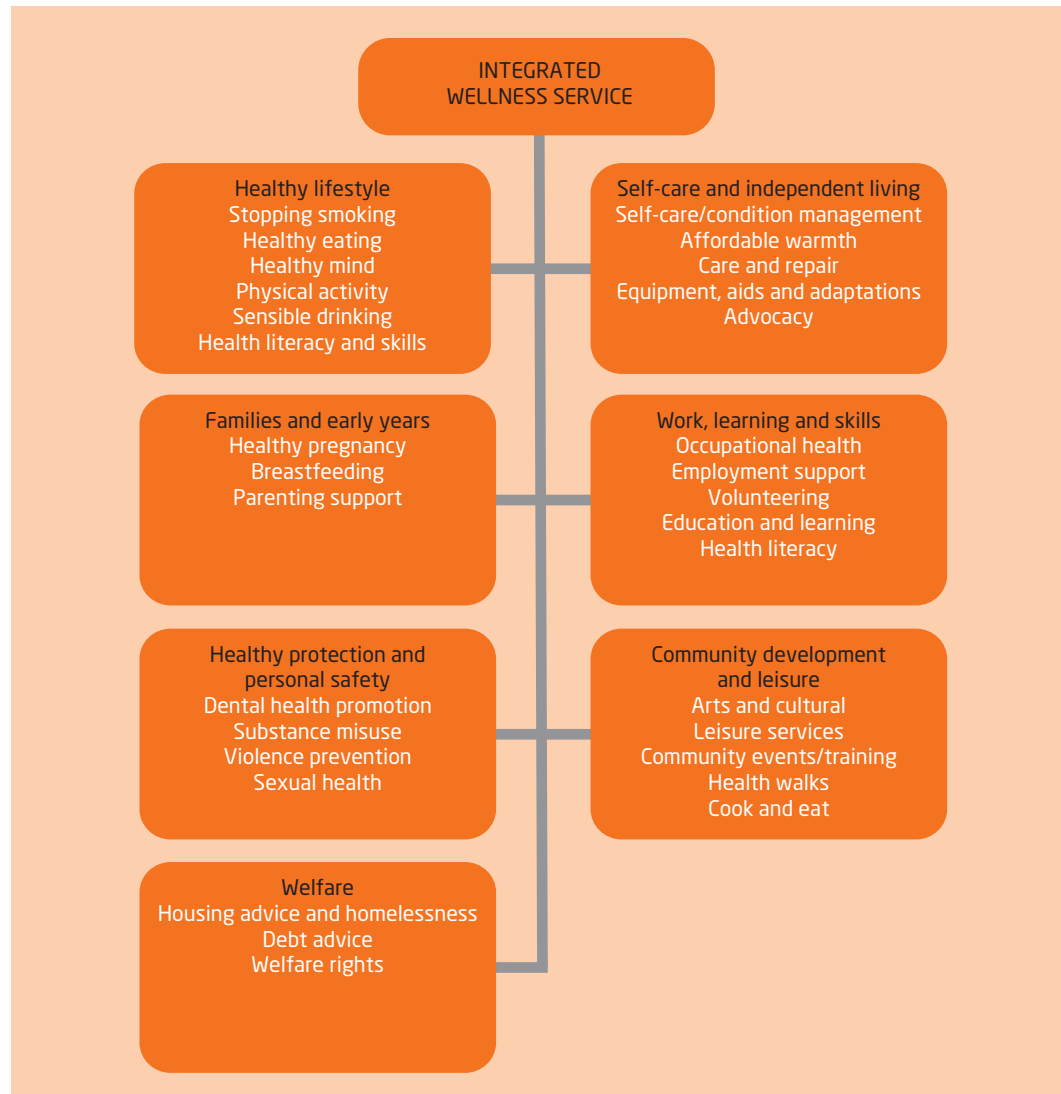
Patients make hundreds of millions of contacts with the NHS in any one year, and our findings suggest that a great many of these patients are likely to have multiple lifestyle risks. If every contact with the NHS is really to count in guiding behaviour change, then the people delivering NHS services need to have the skills, knowledge and confidence to support them. This entails understanding that lifestyle risks are more often than not experienced multiply, rather than singly, and that this is related to personal motivation, individual characteristics and socio-economic and community backgrounds.

Successful intervention is likely to require coaching and structured decision-making support to help people with multiple risk factors to focus on the areas that motivate them and to give them the confidence that they can change.

In addition, we can learn from programmes in other countries and related fields. For example, the Informed Medical Decisions Foundation (2012) provides information on structured behavioural support, and integrated care organisations such as Kaiser Permanente offer ‘Complete Care’ programmes (Kaiser Permanente, undated) for chronic conditions that include behaviour change approaches. More generally, we need to understand whether lessons from the success of integrated care in tackling multiple co-morbidities (Von Korff *et al* 2011) are transferrable to multiple behaviour change.

Overall, the message is that people are likely to require a more long-term relationship with services rather than one-off interventions if they are to change lifestyle risk behaviours successfully, especially if they need to change more than one. Thus the Every Contact Counts policy should be seen for many as ‘every relationship counts.’ This, in turn, requires a competent workforce that is committed to behaviour change in the long term.

NHS Yorkshire and the Humber Strategic Health Authority has been spearheading this agenda, developing a commissioning-led framework to embed competencies for Every Contact Counts across health and social care (NHS Yorkshire and the Humber 2011). In addition, several case studies setting out best practice have now been published, ranging from information for cardiology staff being trained in behaviour change to advice on embedding it as part of NHS Sheffield’s organisational development strategy (Powell

Figure 6 Model for an integrated wellness service

Source: NHS Confederation (2011)

and Thurston 2008; Gate and Williams 2011). This needs to be refreshed, evaluated and adopted on a larger scale with a focus on reducing multiple lifestyle risks.

Exploiting the potential of lay and peer support

Lay and peer support offers considerable potential for tackling multiple lifestyle risks. Many areas still support extensive health trainer programmes and networks, which offer tailored advice, motivation and practical support to people wanting to adopt healthier lifestyles delivered by staff who are representative of their local communities.

In theory, this is exactly the sort of service that could have a big impact. For innovative local areas that are keen to help people down the ladder of risk, appropriately skilled health trainers and lay 'health champions' represent an under-used and ready-made workforce to help drive the reduction of multiple lifestyle risks in the context of local joint health and wellbeing strategies.

An assessment of the experience of health trainers in the north-west of England showed that their clients were a close fit with the groups that our analysis has found are currently finding it hardest to give up multiple behaviours: clients are more likely to come from deprived areas and be in older age groups (Mason *et al* 2011).

Like health trainers, there is also emerging evidence that community health champions – lay people who are involved in supporting peers – can be successful and cost-effective

in supporting people from their communities to change their behaviour, though more formal evaluations are required (South *et al* 2010; Woodall *et al* 2012).

Conclusion

Our research has shown that the proportion of the population with a high number of lifestyle risks reduced significantly between 2003 and 2008. Within this success story for the population as a whole, however, is the fact that those in lower social classes and with less formal education have not shared in this progress. If the government's ambition to 'improve the health of the poorest, fastest' is to become a reality, it needs to tackle this issue head on.

Furthermore, we must not be complacent about the achievement made by the population as a whole, as just under 70 per cent of us still engage in two or more of the lifestyle risk behaviours that are to be the focus of every contact counts. Public health policy and practice needs to recognise this, and fast.

We have made suggestions on how policy and practice should respond to these findings, but it is clear that we have only scratched the surface of our understanding of multiple lifestyle risk and how this has evolved over time. It is hoped that this paper stimulates a much greater interest in and action on how these four unhealthy behaviours are distributed in the population in order to help curb the ever-increasing health care and wider costs associated with them, and prevent the widening of health inequalities in future.

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