

# **Healthy behaviour change in Scotland: can we project future trends using existing data?**

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## **Scottish Public Health Observatory (ScotPHO) collaboration**

The Public Health Observatory Division at NHS Health Scotland is part of this collaboration, led by ISD Scotland and NHS Health Scotland, that brings together key national organisations in public health intelligence in Scotland. We are working closely together to ensure that the public health community has easy access to clear and relevant information and statistics to support decision making. For further information, please see the ScotPHO website at [www.scotpho.org.uk](http://www.scotpho.org.uk)

# Summary

This report sets out projections for selected health behaviours in Scotland as a contribution to debate and thinking about monitoring health improvement trends over the next decade. The behaviours are those for which the Scottish Health Survey provides consistent data: tobacco smoking; physical activity; diet (5-a-day); body mass index; and alcohol consumption. We emphasise the uncertainty of the projections. They are based on only three data points – 1998, 2003 and 2008 (and only the last two for fruit and vegetable consumption) – which may not provide a stable baseline period. They also rely upon the standard caveat of ‘all other things remain unchanged’. The projections are shown as a cone of uncertainty, becoming wider the more uncertainty there is around the projection. They are therefore primarily an exercise in examining the strengths and weaknesses of using the data as a means of considering future health behaviour trends.

The baseline behaviour trends show that the proportion of people leading lives that are smoke-free and physically active increased between 1998 and 2008 but fruit and vegetable consumption barely changed. The number of people with a healthy weight declined, but the rate of decrease has recently slowed. Although fewer people are making moderate use of alcohol, the trend has been particularly unstable. Inequalities appear to be narrowing for smoking and weight, static for fruit and vegetable consumption and widening for physical activity and excessive alcohol use.

In comparison with the modest degree of change seen in the decade to 2008, levels of uncertainty about the future are very high for most behaviours. This uncertainty is mainly due to the few data points in the baseline. It highlights the importance of maintaining key data sources, such as the Scottish Health Survey, in order to more accurately ascertain past trends and project future ones.

# Introduction

It is widely acknowledged that Scotland's health is worse than it should be for an affluent western European nation.<sup>1</sup> Comparison with other European nations<sup>2</sup>, and even comparison with regions that have suffered levels of economic dislocation similar to the Clydeside conurbation<sup>3</sup>, show Scotland in a poor light. It is not clear why Scotland's health is relatively poor, but it is likely that there are several contributing causes with deep historical roots including: deprivation; economic inequality; and social and cultural forces inimical to health such as excessive materialism and emotional inarticulacy.<sup>4,5,6,7</sup> The collective outcome of these factors is a high level of behavioural risk factors affecting the population as a whole, but also with a strong socio-economic gradient.<sup>8</sup>

Improving Scotland's health has probably been a stated government policy ever since there have been government policies on health, and it has been repeatedly expressed in policy documents over recent decades.<sup>9</sup> It requires action on the possible causal chains between the fundamental factors of culture, society and the global environment at all points, through the intermediate steps of daily living environments, behaviours and health and care services.

Much of the thrust of formal health improvement action in Scotland in recent decades has been focused on the intermediate steps of behaviours and daily living environments. There is evidence of progress in some health-related behaviours e.g. tobacco smoking and physical activity over the past decade.<sup>10</sup> For others, the picture is mixed and not consistent across data sources or time periods (e.g. alcohol<sup>11</sup>, diet<sup>10</sup>, breastfeeding<sup>12</sup> and drugs<sup>13,14,15</sup>). But for some behaviours the picture is one of deterioration rather than progress (e.g. obesity<sup>16</sup> and sexual health<sup>17</sup>).

## **What are the prospects for progress in the next decade if we assume that the type and level of health improvement activity, and the wider context, remain as they have been for the past decade?**

This report sets out projections for selected behaviours over the next decade as a contribution to debate and thinking about health improvement. The selection consists of those behaviours for which the SHeS provides consistent data: tobacco smoking; physical activity; diet (5-a-day); body mass index; and alcohol consumption. These include those that some commentators have described as “the magic formula for health”... not smoking, not being obese, eating a healthy diet and exercising with moderate intensity for at least 3.5 hours a week. Such a lifestyle can, it has been suggested, add up to 13 years of extra life.<sup>11</sup>

The methods we adopt are robust and have been used previously<sup>18,19</sup>, but we emphasise the uncertainty of the projections presented here. Not only do they rely upon the standard caveat of ‘all other things remain unchanged’, but they are also based on only three data points – 1998, 2003 and 2008 (only the last two data points for fruit and vegetable consumption). For this reason we show our projections not as a single line into the future, but as a cone of uncertainty – becoming wider the more uncertainty there is.

Our purpose in writing this report is not to predict the future, but to entice others to think about the future; and then to act so that ‘all other things’ **do not** remain unchanged.

# Approach

## Study population

The Scottish Health Survey (SHeS) provides a nationally representative picture of the health of the Scottish population in private households, and is designed to make a major contribution to the monitoring of health in Scotland.<sup>20</sup> The survey was first conducted in 1995 and then repeated in 1998 and 2003. Following a review and redevelopment, it is now running continuously from 2008–2011. The age of the target population has been extended over the survey series: 16–64 years in 1995, 2–74 years in 1998 and individuals of all ages from 2003 onwards. Achieved sample size for adults (aged 16+) was approximately 8,000 in the 1998 and 2003 surveys and 6,500 in 2008. Individual response rates for adults (aged 16+) were 76%, 60% and 54% in 1998, 2003 and 2008 respectively. For this report we have used data from the 1998, 2003 and 2008 surveys for adult respondents aged 16–74.

## Healthy behaviours

We describe and project the adult prevalence of five healthy behaviours:

- **non-smoking:** not smoking cigarettes
- **physically active:** undertaking at least 30 minutes of moderate-intensity activity on at least five days a week<sup>i</sup>
- **healthy eating:** consuming five or more helpings of fruit and vegetables per day
- **healthy weight<sup>ii</sup>:** a body mass index (BMI) between 18.5 and 25 kg/m<sup>2</sup>
- **moderate drinking:** drinking no more than 21 units per week for men and 14 units for women, including those not drinking alcohol at all.

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<sup>i</sup> The recording of physical activity in the SHeS changed in 2008. We used physical activity episodes that lasted for 15 minutes or longer as the basic unit of measurement in order to be consistent across the survey years.

<sup>ii</sup> Healthy weight is not a behaviour – it is an outcome of physical activity and diet – but we call it a behaviour throughout this report for brevity.

## Statistical Analysis

The projection method used in this report makes assumptions about future changes based on past SHeS patterns with 1998–2003–2008 as the baseline period. Only 2003 and 2008 data were available for healthy eating. The prevalence of each healthy behaviour was calculated at each time point by sex, age group (16–34, 35–54, 55–74) and 2006 Scottish Index of Multiple Deprivation (SIMD) quintile. Data broken down by SIMD were age- and sex-standardised using 2008 mid-year population estimates for Scotland.

Linear, exponential, power and logarithmic curves were fitted to the baseline prevalence data for each behaviour using the SPSS (Version 17) curve estimation procedure, and the best-fitting curve for each was selected based on the coefficient of determination ( $R^2$ ). The prevalence rates were then projected to 2018 and 95% prediction (confidence) intervals calculated.<sup>18</sup>

Additionally, we calculated the total number of people in Scotland with each **unhealthy** behaviour in 1998, 2003 and 2008 by applying the prevalence rates to the corresponding mid-year population estimates.<sup>21</sup> The numbers for 2018 were then calculated by applying the projected prevalence rate – using the best fitting curve over the entire baseline period (1998, 2003, 2008) – to the 2008-based projected population for 2018.<sup>21</sup>

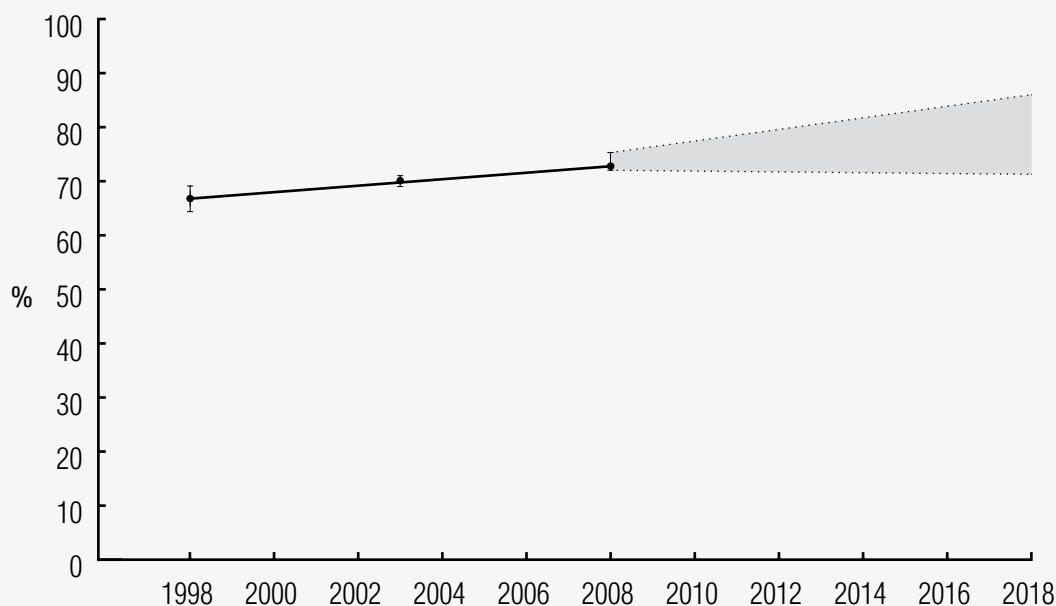


# Results

## Non-smoking

The prevalence of adult non-smokers in Scotland increased from 67% in 1998 to 73% in 2008 (Figure 1a). Based on a linear trend, the projected rate of non-smoking in 2018 is estimated to be between 71% and 87%.

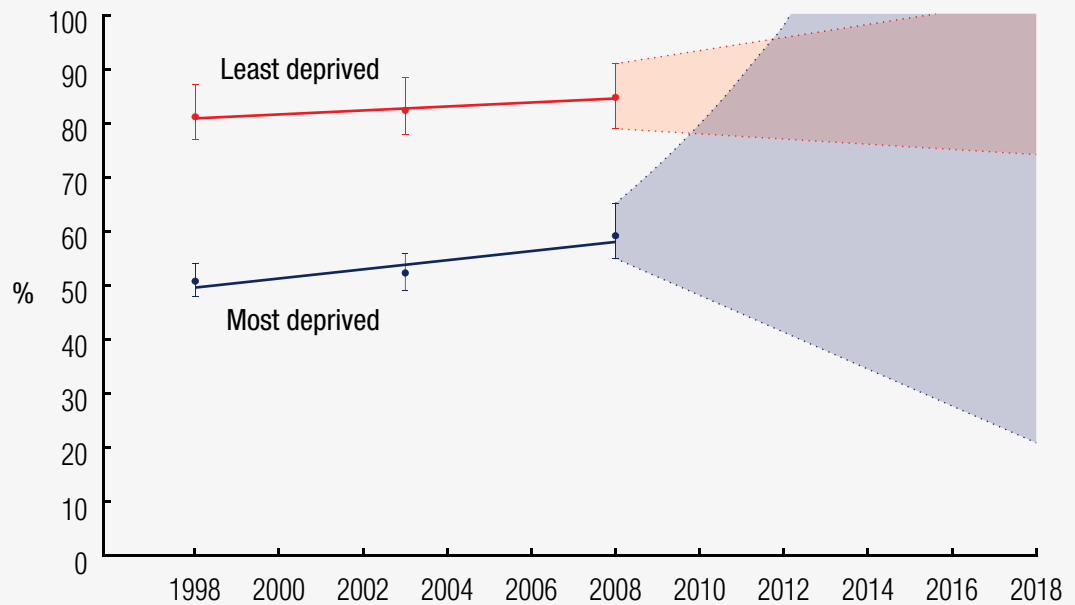
**Figure 1a**  
Prevalence of adult non-smokers in Scotland, 1998 to 2008 and projected prevalence range in 2018



Linear curve:  $66.262 + 0.605t$  where  $t = \text{year} - 1997$  ( $R^2 = 0.997$ )

The age- and sex-adjusted prevalence of non-smokers in the least deprived areas of Scotland increased from 81% in 1998 to 85% in 2008 and is projected, based on an exponential trend, to be between 73% and 100% in 2018 (Figure 1b). In the most deprived areas, despite a consistently lower prevalence, there was a slightly greater increase in non-smokers over the baseline period, from 51% in 1998 to 59% in 2008. However, there is greater uncertainty in the estimated 2018 prevalence, as shown by the very wide projected range.

**Figure 1b**  
Prevalence of adult non-smokers in the 20% most and least deprived areas in Scotland, 1998 to 2008 and projected prevalence range in 2018

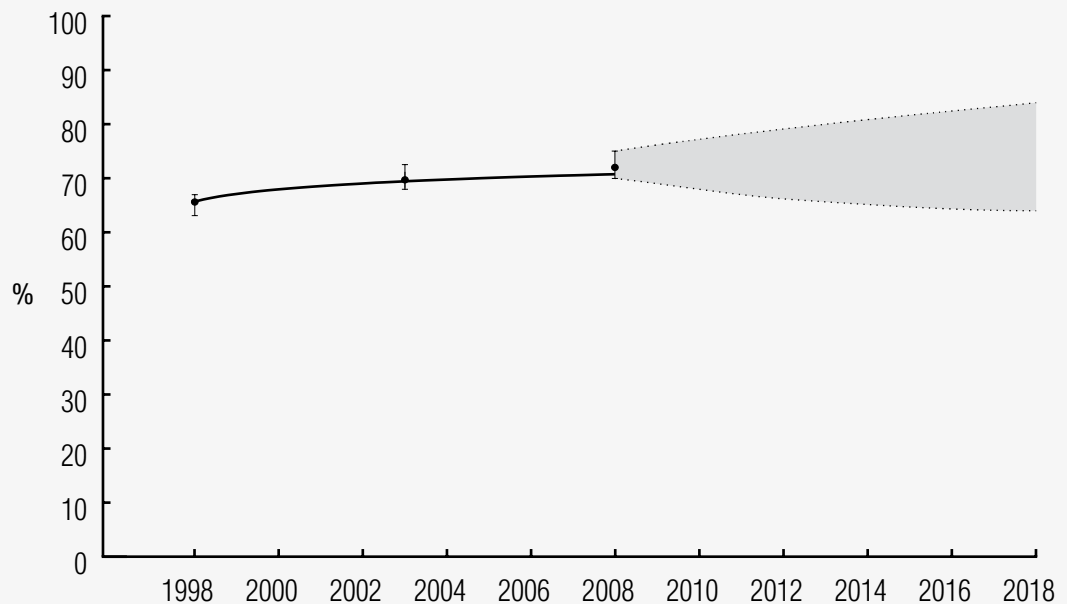


Least deprived: Exponential curve:  $80.690e^{0.004t}$  where  $t = \text{year}-1997$  ( $R^2 = 0.961$ )

Most deprived: Exponential curve:  $49.253e^{0.015t}$  where  $t = \text{year}-1997$  ( $R^2 = 0.887$ )

Among men, the prevalence of non-smokers increased from 66% in 1998 to 72% in 2008 (Figure 1c). Based on a power projection, the estimated prevalence range in 2018 is between 64% and 84%.

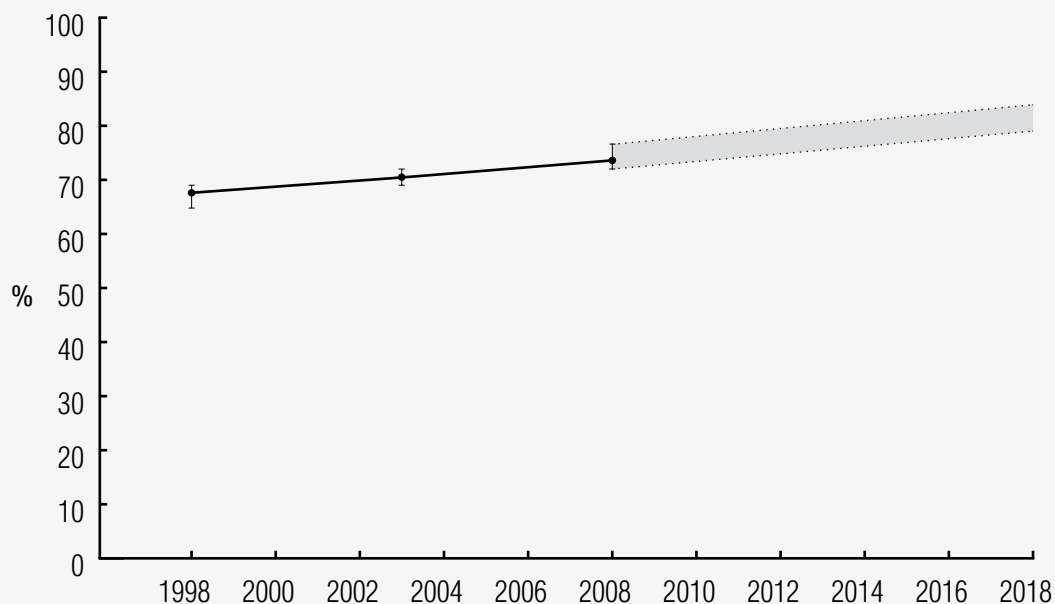
**Figure 1c**  
Prevalence of male adult non-smokers in Scotland, 1998 to 2008 and projected prevalence range in 2018



Power curve:  $65.535t^{0.037}$  where  $t = \text{year}-1997$  ( $R^2 = 0.988$ )

The prevalence of women non-smokers was slightly higher than that of men over the 10-year baseline period, but the increase was comparable – from 68% in 1998 to 74% in 2008 (Figure 1d). There is less uncertainty in the projected prevalence of non-smoking women in 2018, which shows an increase in the narrow range of 79% to 82% (exponential trend).

**Figure 1d**  
Prevalence of female adult non-smokers in Scotland, 1998 to 2008 and projected prevalence range in 2018

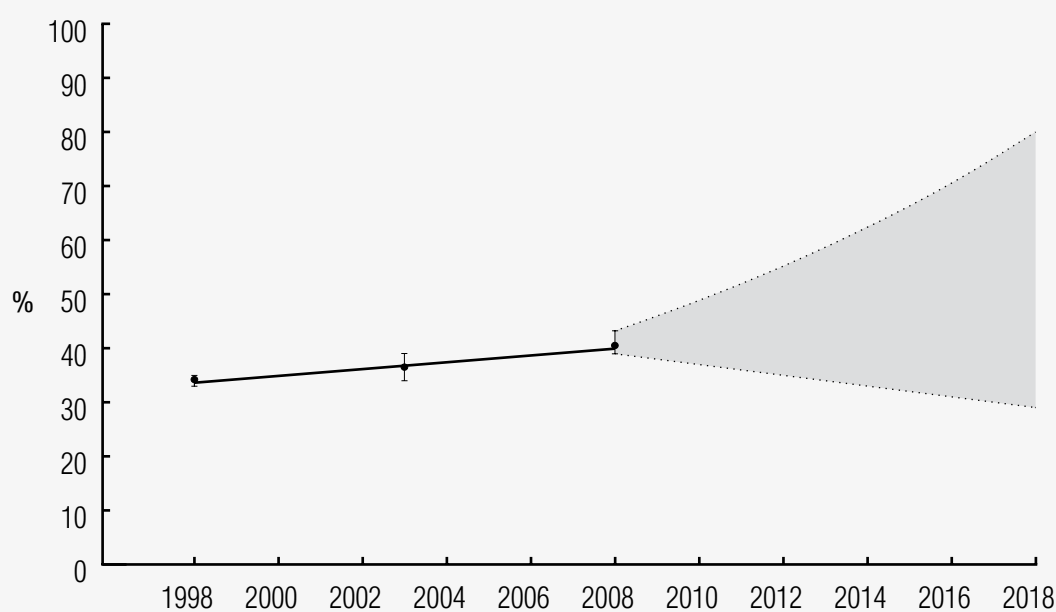


Exponential curve:  $67.030e^{0.009t}$  where  $t = \text{year} - 1997$  ( $R^2 = 1$ )

## Physically active

The prevalence of adults in Scotland who were physically active for at least 30 minutes on at least five days per week increased from 34% in 1998 to 41% in 2008 (Figure 2a). Based on an exponential trend, the projected prevalence of physically active adults in 2018 is between 29% and 80%.

**Figure 2a**  
Prevalence of physically active adults in Scotland, 1998 to 2008 and projected prevalence range in 2018

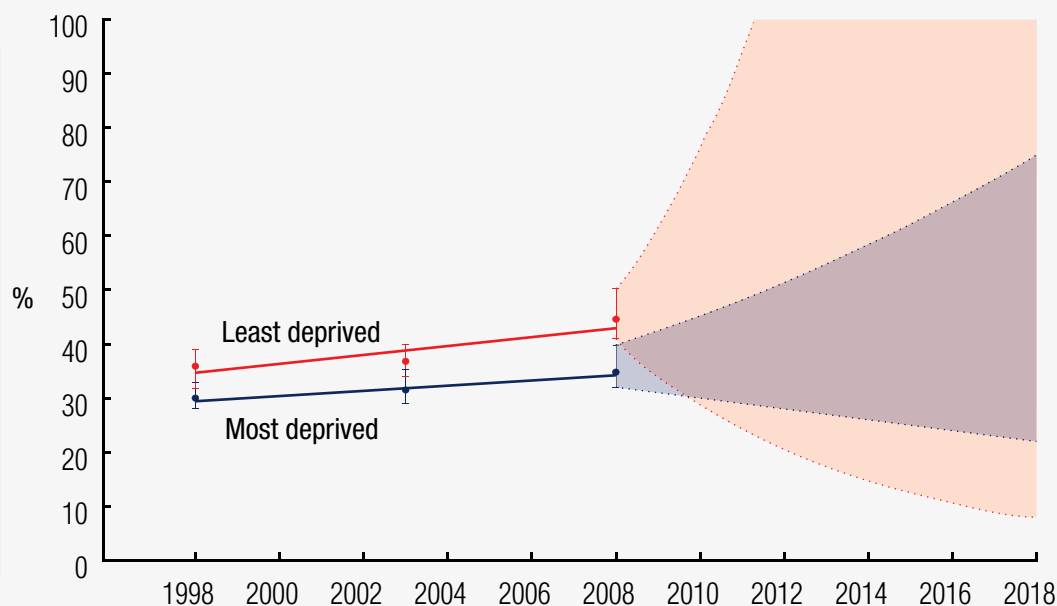


Exponential curve:  $33.440e^{0.017t}$  where  $t = \text{year} - 1997$  ( $R^2 = 0.981$ )

The age- and sex-adjusted prevalence of physically active adults living in the least deprived areas of Scotland increased from 36% in 1998 to 45% in 2008 (Figure 2b). Most of this increase occurred between 2003 and 2008. The prevalence of physically active adults in the most deprived areas also increased but at a slower rate, from 30% in 1998 to 35% in 2008. Thus, inequalities in physical activity appear to have widened.

Projections based on exponential trends estimate that between 21% and 75% of adults in the most deprived areas will be physically active in 2018. The projected 2018 prevalence in the least deprived areas is exceptionally uncertain, because the baseline trend is not stable.

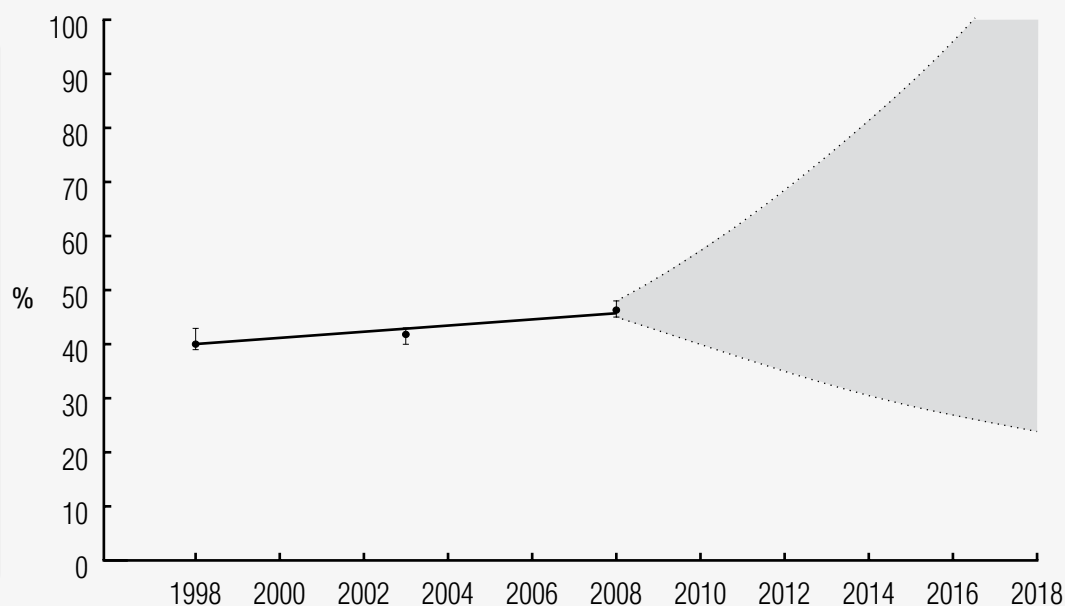
**Figure 2b**  
Prevalence of physically active adults in the 20% most and least deprived areas in Scotland, 1998 to 2008 and projected prevalence range in 2018



Least deprived: Exponential curve:  $34.176e^{0.022t}$  where  $t = \text{year}-1997$  ( $R^2 = 0.833$ )  
 Most deprived: Exponential curve:  $29.346e^{0.015t}$  where  $t = \text{year}-1997$  ( $R^2 = 0.964$ )

There was an upward trend in the proportion of physically active men and women between 1998 and 2008 (Figures 2c and 2d). In 1998, 40% of men were classified as physically active, increasing to 42% in 2003 and 46% in 2008. In 2018, based on an exponential projection, it is estimated that between 25% and 100% of adult men will be physically active.

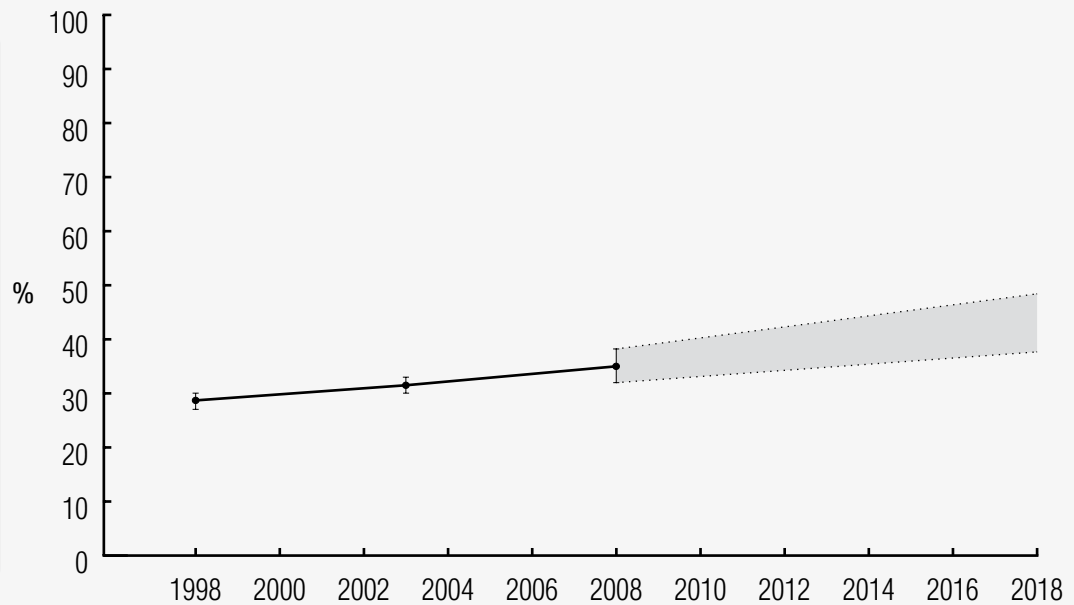
**Figure 2c**  
Prevalence of physically active adult men in Scotland meeting national physical activity guidelines, 1998 to 2008 and projected prevalence range in 2018



Exponential curve:  $39.021e^{0.015t}$  where  $t = \text{year}-1997$  ( $R^2 = 0.948$ )

Women were less physically active than men in the baseline period (Figure 2d). However, the increase over time – from 29% in 1998 to 35% in 2008 – was similar to men. Based on an exponential trend, the projected rate in 2018 is between 38% and 48%, suggesting that the upward trend observed over the baseline period is likely to continue.

**Figure 2d**  
Prevalence of physically active adult women in Scotland meeting national physical activity guidelines, 1998 to 2008 and projected prevalence range in 2018



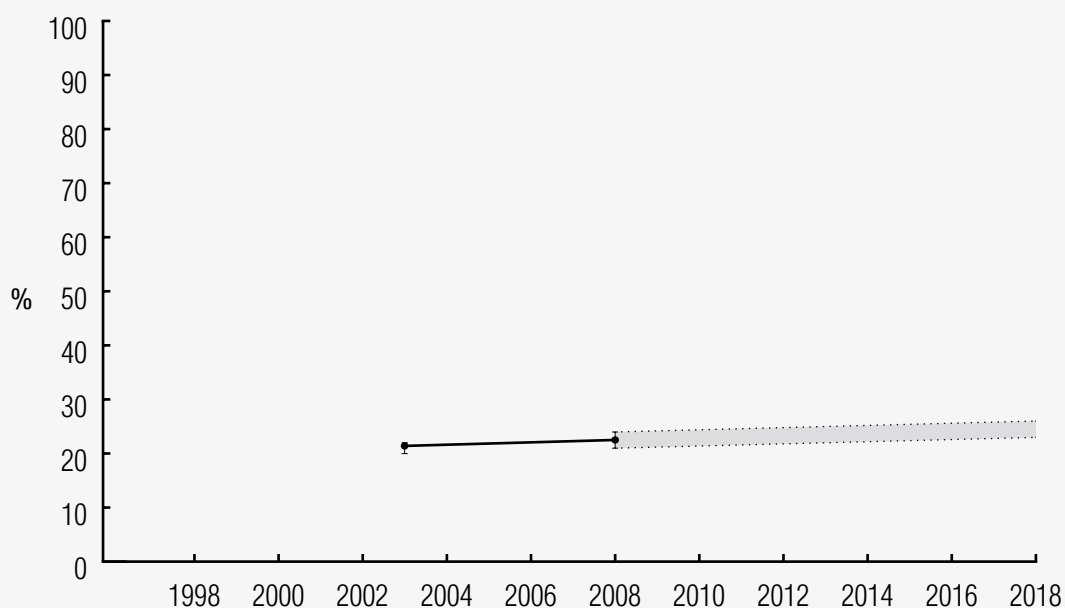
Exponential curve:  $28.074e^{0.020t}$  where  $t = \text{year} - 1997$  ( $R^2 = 0.999$ )

## Healthy eating

Between 2003 and 2008, there was no significant change in the proportion of adults in Scotland consuming five or more portions of fruit and vegetables daily: 21% in 2003 and 22% in 2008 (Figure 3a). Based on a linear projection of the two confidence intervals in the baseline period, it is estimated that the prevalence of fruit and vegetable consumption will remain low in 2018 at between 23% and 26%.

**Figure 3a**

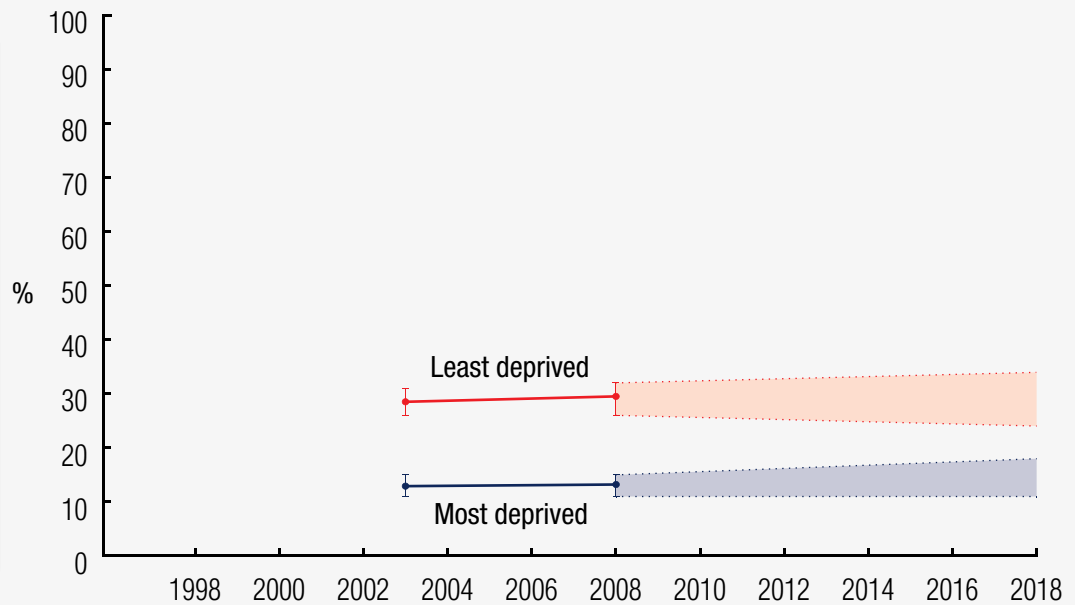
Prevalence of adults in Scotland eating five or more portions of fruit and vegetables per day, 1998 to 2008 and projected prevalence range in 2018



Linear trend:  $21.154 + 0.217t$  where  $t = \text{year} - 1997$

Adults living in the most deprived areas of Scotland were less likely to eat five or more portions daily than those living in the least deprived areas over the baseline period (Figure 3b). In the least deprived areas, the age- and sex-standardised prevalence of consuming five or more portions a day was 28% in 2003 and 30% in 2008. In the most deprived areas, only 13% of adults met healthy eating recommendations in 2003 and 2008. Based on a linear trend, these inequalities are projected to remain in 2018; 11–17% of adults in the most deprived areas are projected to be healthy eaters in 2018, while for the least deprived areas the projection range is 25–34%.

**Figure 3b**  
Prevalence of adults in Scotland eating five or more portions of fruit and vegetables per day in the 20% most and least deprived areas in Scotland, 1998 to 2008 and projected prevalence range in 2018

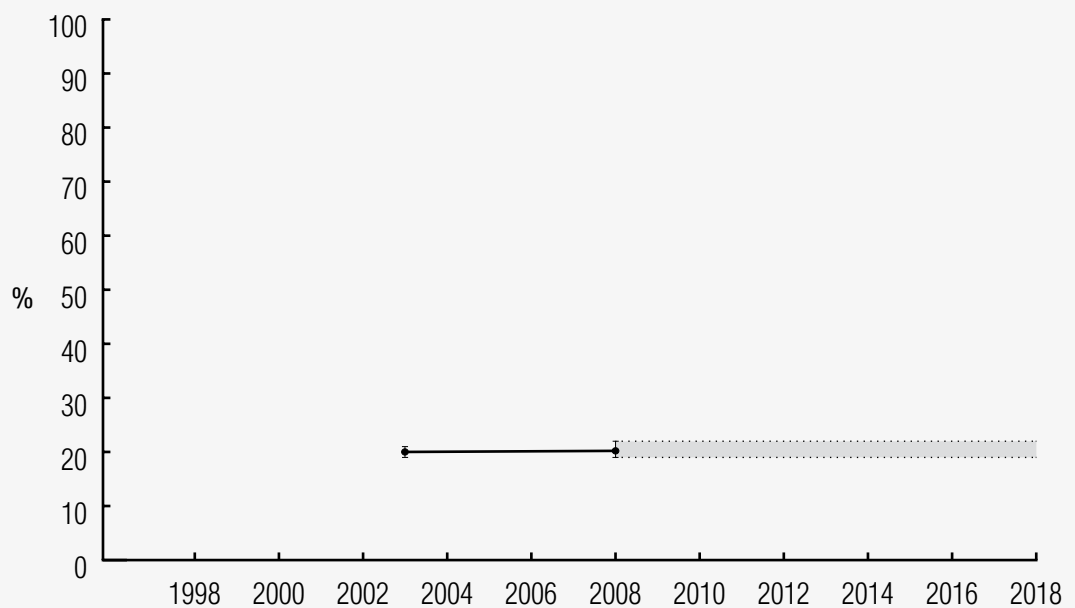


Least deprived: Linear trend:  $27.225 + 0.211t$  where  $t = \text{year} - 2002$

Most deprived: Linear trend:  $12.636 + 0.049t$  where  $t = \text{year} - 2002$

A fifth of adult men (20%) consumed five or more portions of fruit and vegetables per day in 2003 and this remained unchanged in 2008 (Figure 3c). If this linear trend is assumed to continue, the prevalence of men eating '5-a-day' in 2018 is estimated to be between 19% and 22%.

**Figure 3c**  
Prevalence of adult men in Scotland eating five or more portions of fruit and vegetables per day, 1998 to 2008 and projected prevalence range in 2018



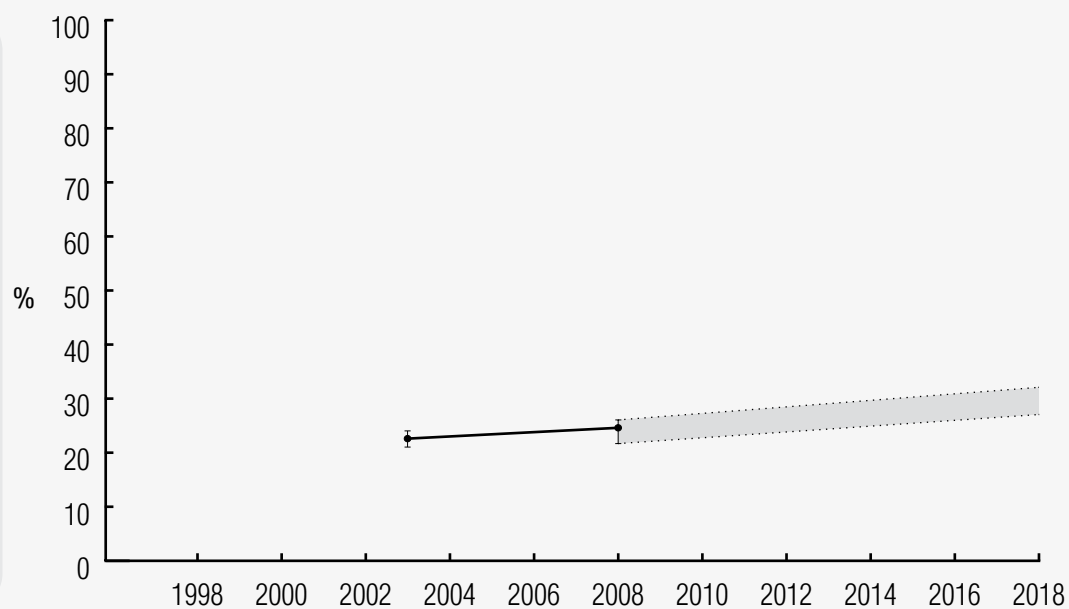
Linear trend:  $20.015 + 0.027t$  where  $t = \text{year} - 2002$



A higher proportion of women than men ate 5-a-day over the five-year baseline period, with a non-significant increase from 23% in 2003 to 25% in 2005 (Figure 3d). The projected linear trend over the next decade suggests that slightly more women – between 27% and 31% – will consume five or more portions per day in 2018.

**Figure 3d**

Prevalence of adult women in Scotland eating five or more portions of fruit and vegetables per day, 1998 to 2008 and projected prevalence range in 2018

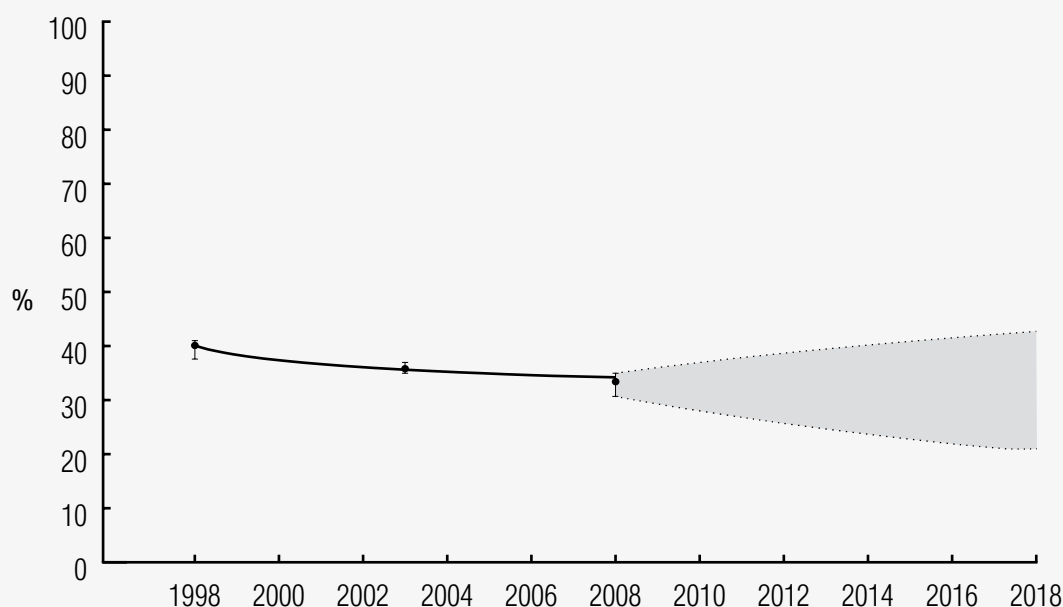


Linear trend:  $22.221 + 0.399t$  where  $t = \text{year} - 2002$

## Healthy weight

The prevalence of adults in Scotland classified as healthy weight decreased from 40% in 1998 to 33% in 2008 (Figure 4a). Based on a logarithmic trend, healthy weight prevalence in 2018 is estimated to be between 21% and 43%.

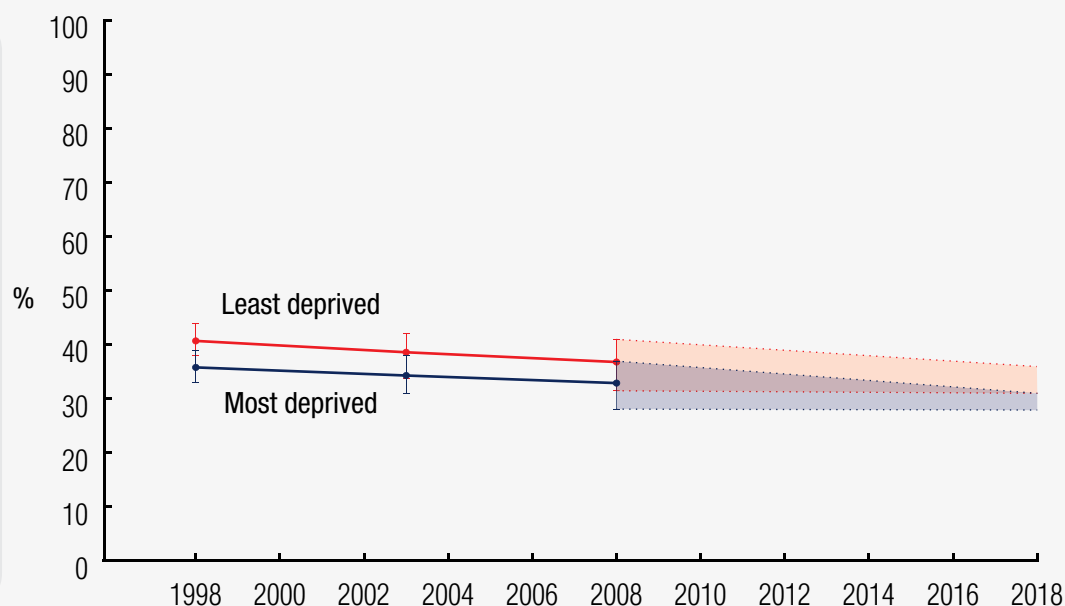
**Figure 4a**  
Prevalence of healthy weight adults in Scotland, 1998 to 2008 and projected prevalence range in 2018



Logarithmic curve:  $40.170 - (2.691 \times \log(t))$  where  $t = \text{year} - 1997$  ( $R^2 = 0.985$ )

The age- and sex-adjusted prevalence of healthy weight adults in the least and most deprived areas of Scotland was broadly similar between 1998 and 2008, decreasing slightly (but not significantly) over the baseline period in both groups (Figure 4b). In 1998, 41% of adults in the least deprived areas were healthy weight, compared with 37% in 2008. The projected prevalence in 2018, based on an exponential trend, is estimated to be between 31% and 36%. In the least deprived areas, healthy weight prevalence decreased from 36% in 1998 to 33% in 2008 and is projected, based on an exponential trend, to be between 29% and 31% in 2018.

**Figure 4b**  
Prevalence of healthy weight adults in the 20% most and least deprived areas in Scotland, 1998 to 2008 and projected prevalence range in 2018



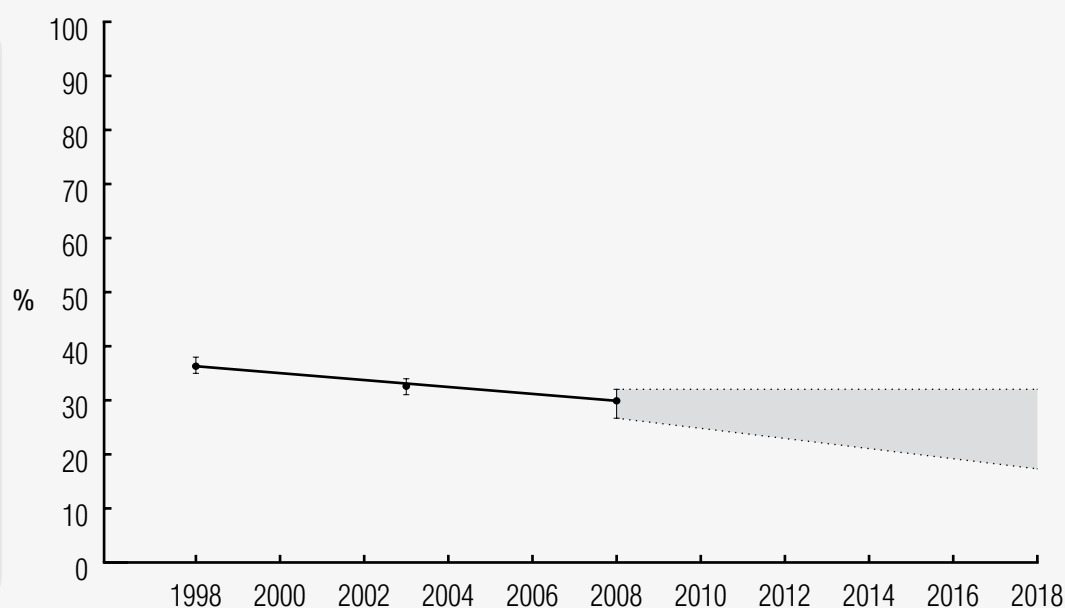
Least deprived: Exponential curve:  $41.066e^{-0.010t}$  where  $t = \text{year} - 1997$  ( $R^2 = 0.999$ )

Most deprived: Exponential curve:  $36.036e^{-0.008t}$  where  $t = \text{year} - 1997$  ( $R^2 = 1$ )

**Note:** The paradox that the projected prevalence range in 2018 is less uncertain than the estimates in the baseline period is explained by the strength of the fitted trends.

There was a steady downward trend in the proportion of men classified as healthy weight over the 10-year baseline period, from 36% in 1998 to 30% in 2008 (Figure 4c). Based on an exponential projection, the estimated prevalence range in 2018 is between 19% and 32%.

**Figure 4c**  
Prevalence of healthy weight men in Scotland, 1998 to 2008 and projected prevalence range in 2018



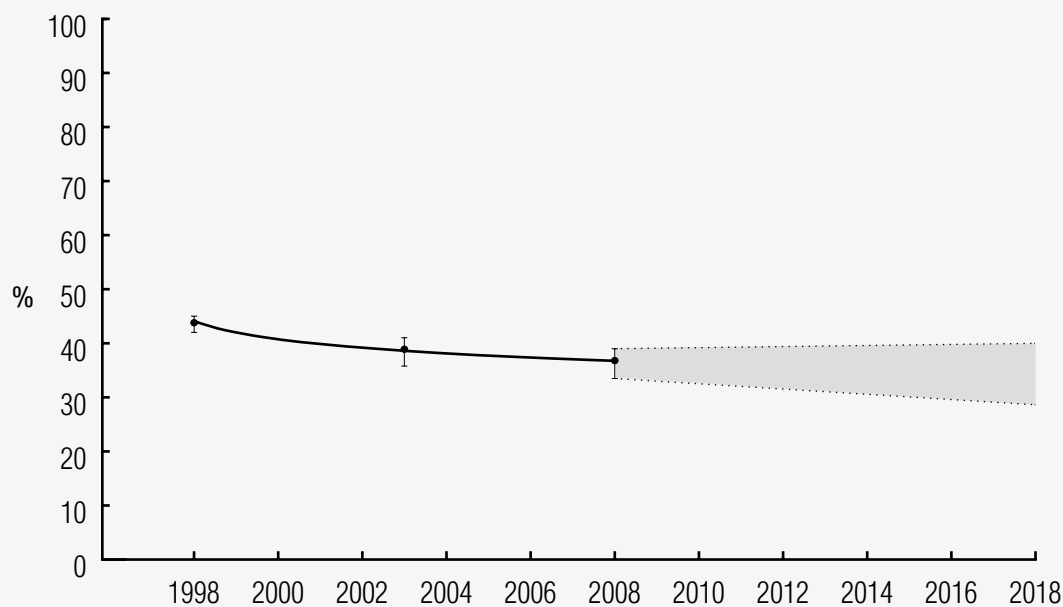
Exponential curve:  $36.892e^{-0.019t}$  where  $t = \text{year} - 1997$  ( $R^2 = 0.996$ )

## Healthy behaviour change in Scotland: can we project new trends using existing data?

The proportion of women in Scotland of healthy weight also decreased over time, from 44% in 1998 to 37% in 2008. Unlike men, the downward trend slowed between 2003 and 2008 (Figure 4d). Based on a logarithmic trend, the prevalence of healthy weight women in 2018 is estimated to be in the range from 30% to 40% in 2018.

**Figure 4d**

Prevalence of healthy weight women in Scotland, 1998 to 2008 and projected prevalence range in 2018



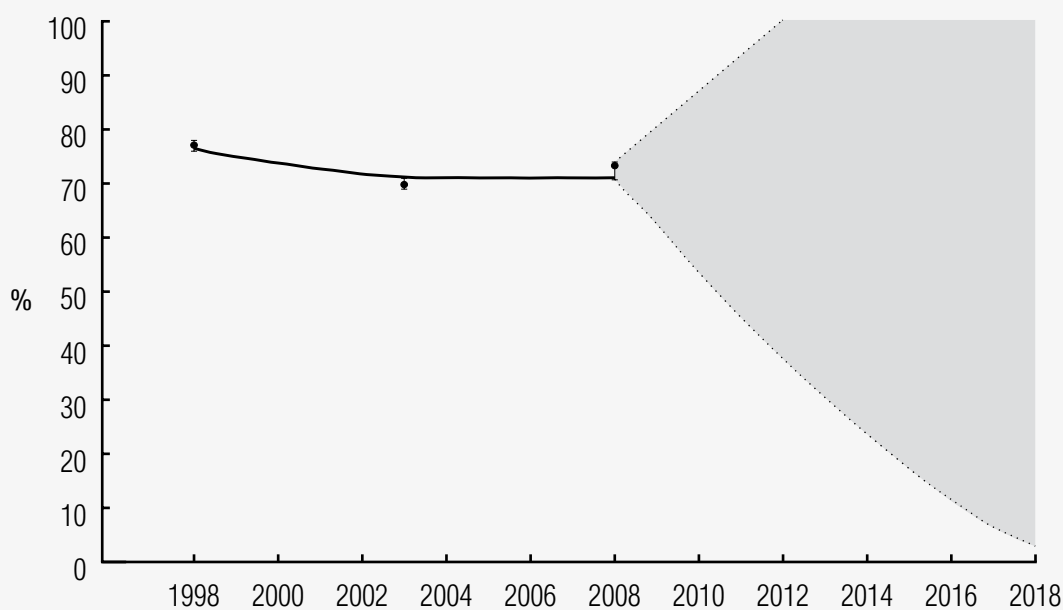
Logarithmic curve:  $43.857 - (2.888 \times \log(t))$  where  $t = \text{year} - 1997$  ( $R^2 = 0.997$ )

## Moderate drinking

Survey data understates the true level of alcohol consumption in comparison with sales data. The substantial level of understatement was fairly consistent during the 1990s but sales and survey data began to diverge around 1999/2000 with survey estimates levelling out while quantity sold continued to increase, indicating increased survey underestimation.<sup>11</sup> The divergence was because serving sizes and strengths were increasing and the conversion factors used by surveys to calculate units of alcohol consumed were no longer appropriate. New conversion factors were developed in 2006.<sup>22</sup> These were retrospectively applied to the 2003 SHeS and removed the increased divergence.<sup>23</sup> The same conversion factors were used in 2008. For the analysis here, we took the original 1998 data and the 2003 and 2008 data using the new conversion factors.

There was an overall decrease in the proportion of adult moderate drinkers in Scotland over the 10-year baseline period, but the trend was unstable. It dropped from 77% in 1998 to 70% in 2003, then rose to 73% in 2008 (Figure 5a). Based on a logarithmic trend, this instability produces a very uncertain projected prevalence range for 2018.

**Figure 5a**  
Prevalence of adult moderate drinkers in Scotland, 1998 to 2008 and projected prevalence range in 2018

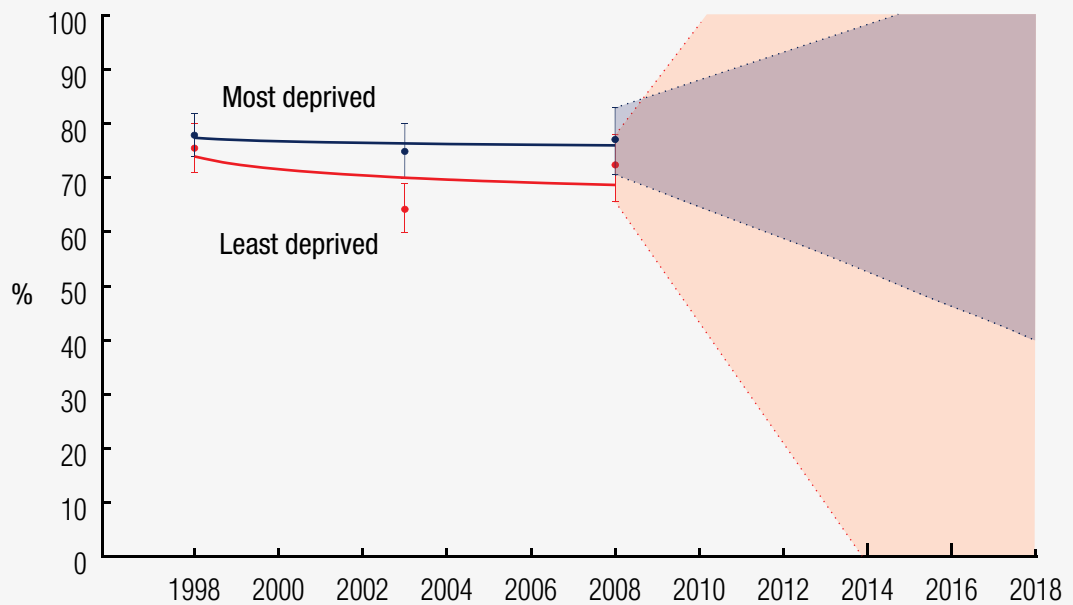


Logarithmic curve:  $76.388 - (2.160 \times \log(t))$  where  $t = \text{year} - 1997$  ( $R^2 = 0.540$ )

There was little change in the age- and sex-adjusted prevalence of adult moderate drinkers in the most deprived areas of Scotland between 1998 and 2008: 78% of adults were moderate drinkers in 1998, 75% in 2003 and 77% in 2008. In the least deprived areas, the proportion of moderate drinkers decreased from 75% in 1998 to 64% in 2003, but increased to 72% in 2008. Due to the uncertainty around these estimates, there was no significant difference over the 10-year baseline period. Based on logarithmic trends, the projected prevalence of moderate drinking in 2018 among adult populations living in the most and least deprived areas of Scotland is extremely uncertain because of these fluctuations over the baseline period (Figure 5b).

**Figure 5b**

Prevalence of adult moderate drinkers in the 20% most and least deprived areas in Scotland, 1998 to 2008 and projected prevalence range in 2018



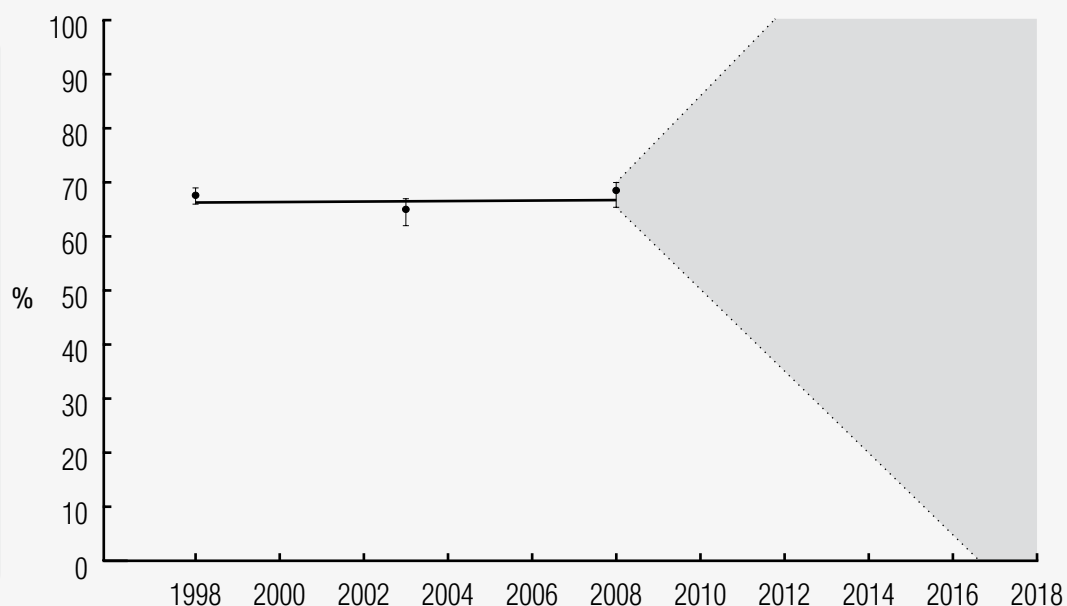
Least deprived: Logarithmic curve:  $77.493 - (0.628 \times \log(t))$  where  $t = \text{year} - 1997$  ( $R^2 = 0.261$ )

Most deprived: Logarithmic curve:  $74.060 - (2.426 \times \log(t))$  where  $t = \text{year} - 1997$  ( $R^2 = 0.269$ )

The proportion of men drinking moderately remained relatively stable between 1998 and 2008 (Figure 5c). In 1998, 68% drank moderately, dropping to 65% in 2003, before increasing again to 69% in 2008. A greater proportion of women than men were moderate drinkers over the 10-year baseline period, but the trend over time was different (Figure 5d). The prevalence of moderate drinking among females decreased considerably over the first half of the baseline period, from 86% in 1998 to 74% in 2003, before increasing to 78% in 2008.

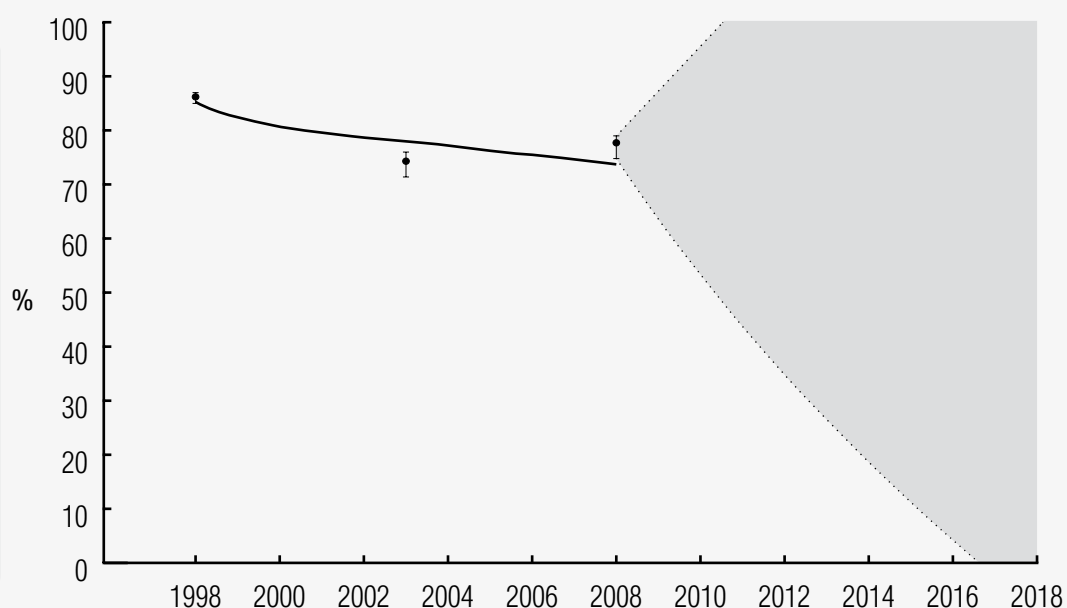
The unstable baseline trend for men and women results in very uncertain projections.

**Figure 5c**  
Prevalence of male moderate drinkers in Scotland, 1998 to 2008 and projected prevalence range in 2018



Linear curve:  $66.509 + 0.090t$  where  $t = \text{year} - 1997$  ( $R^2 = 0.060$ )

**Figure 5d**  
Prevalence of female moderate drinkers in Scotland, 1998 to 2008 and projected prevalence range in 2018



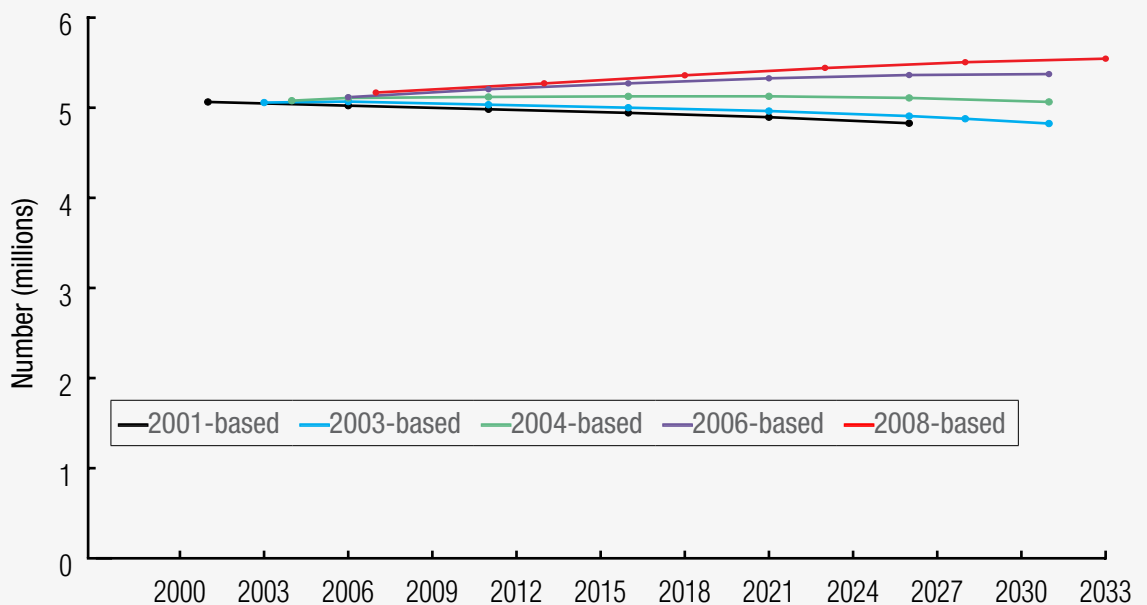
Logarithmic curve:  $85.339 - (4.255 \times \log(t))$  where  $t = \text{year} - 1997$  ( $R^2 = 0.744$ )

# Conclusion

There are two requirements for projections if they are to provide an accurate guide to the future. Neither is satisfied here. Firstly, there must be a stable baseline trend from which the future trend can be modelled. With only three data points, and for healthy diet only two, there can be no assumption that the baseline trends presented here provide a stable basis for projection. It is evident from the  $R^2$  values that past trends in self-reported alcohol consumption have been particularly unstable. Secondly, the circumstances and factors shaping trends in the baseline period must continue unaltered – and with their impact unaltered – throughout the projection period. Seldom can such a guarantee be offered, and none is offered here. Indeed, it is more likely that circumstances **will** alter than that they will remain the same.

So why have we prepared this report if the foundation for it appears so insecure? It is because the greatest value of projections often lies not in their ability to predict the future, but in their ability to stimulate thinking about the future and about actions to achieve a more desirable future than that projected. An example is the recent history of population projections for Scotland. Despite robust methods applied to a wealth of data compared with the limited data available here, these projections have changed considerably in only eight years because circumstances changed, in part because of deliberate government action in response to the initial projections (Figure 6).

**Figure 6**  
Projected population of Scotland:  
2001-based to  
2008-based



Source: General Register Office for Scotland



The behaviours projected here are those with data available through the SHeS so that consistent data from a single source could be used. Other behaviours might be modelled using other data, but the important point here is that the SHeS data covers behaviours that show varied trends. They are not untypical of the general range of health-related behaviour trends in Scotland.

Some progress towards healthier behaviour is being made. The baseline behaviour trends show that more people are leading lives that are smoke-free and physically active. However, fruit and vegetable consumption is barely changed. Fewer people are of a healthy weight, but the rate of decrease has slowed. Fewer people make moderate use of alcohol (but alcohol shows a particularly unstable baseline trend). Inequalities appear to be narrowing for smoking and weight, static for fruit and vegetable consumption and widening for physical activity and excessive alcohol use.

We could have presented the projected trends as single lines to 2018 but we have chosen to highlight the cone of uncertainty that surrounds the projections. As Table 1 shows, in comparison with the modest degree of change seen in the decade to 2008, levels of uncertainty about the future are very high for most behaviours. This is mainly methodological. The few baseline data points automatically lead to wide confidence intervals, and this is exacerbated – particularly for alcohol – when the projected trend lines fit the data poorly. But it also acts as a warning that health improvement gains, even modest ones, are not guaranteed to continue if the level of resourcing, effective intervention and innovation that was in place during the baseline period is not maintained.

**Table 1**

Prevalence of adult (aged 16–74) healthy behaviours in Scotland in 1998, 2003, 2008 and projected prevalence in 2018

(%)	Non-smoking <sup>a</sup>	Healthy weight <sup>a</sup>	Physically active <sup>a</sup>	Healthy eating <sup>b</sup>	Moderate drinking <sup>a</sup>
<b>All</b>					
1998	67	40	34	–	77
2003	70	36	37	21	70
2008	73	33	41	22	73
2018	71 to 87	21 to 43	29 to 80	23 to 26	3 to 100
<b>Men</b>					
1998	66	36	40	–	68
2003	70	33	42	20	65
2008	72	30	46	20	69
2018	64 to 84	19 to 32	25 to 100	19 to 22	0 to 100
<b>Women</b>					
1998	68	44	29	–	86
2003	71	39	32	23	74
2008	74	37	35	25	78
2018	79 to 82	30 to 40	38 to 48	27 to 31	0 to 100

<sup>a</sup> based on 1998–2008 best-fit trend

<sup>b</sup> based on 2003–2008 linear trend

We have demonstrated modest change towards healthier behaviour in the baseline period and, thus, at least the potential for that to continue. One way of showing this is to add up the unhealthy behaviours across the population in 2008 and to compare that with the number there might be in 2018. This can be done by projecting the adult prevalence based on the best-fitting trend over the baseline period and applying this to the projected population. In those circumstances, total unhealthy adult behaviours in Scotland would decrease by 2% in the 10-year period, despite a slightly increased population (Table 2). Unhealthy behaviours would decrease from an average of 2.7 per person in 2008 to 2.5 per person in 2018. As with all the projections presented here, these assume that everything other than behaviour trends and population size remain unchanged. However, one thing we can be certain of is that ‘everything else’ will not stay the same. Even the population projections we have used are likely to be different from the actual population in 2018.

**Table 2**

Number of unhealthy adult (aged 16–74) behaviours in Scotland in 1998, 2003, 2008 and projected number in 2018 (based on best-fitting trend over the baseline period)

<b>Unhealthy behaviour</b>	<b>1998</b>	<b>2003</b>	<b>2008</b>	<b>2018 (projected)</b>
Smoking	1,238,771	1,120,660	1,049,774	831,317
Unhealthy weight	2,234,414	2,405,530	2,572,951	2,688,829
Inactive	2,451,018	2,379,461	2,296,198	2,063,895
Not eating 5-a-day fruit and vegetables	–	2,946,532	2,994,616	2,979,409
Immoderate drinking	854,105	1,133,266	1,032,199	1,193,288
<b>Total unhealthy behaviours</b>	–	<b>9,985,449</b>	<b>9,945,738</b>	<b>9,756,737</b>
<b>Unhealthy behaviours per person</b>	–	<b>2.7</b>	<b>2.6</b>	<b>2.5</b>
<b>Population base (age 16–74)</b>	<b>3,727,386</b>	<b>3,747,363</b>	<b>3,861,787</b>	<b>3,952,834</b>

The certainty of change in ‘everything else’ is the reason why this short report matters. If we want social, economic and environmental change to be health-improving, we need to work at making it so. For the modest pace of health improvement of the previous decade to continue into the 2010s, it is a requirement that inputs and impacts are also maintained at the level that they have been for the past decade. If a faster pace of change is desired, then this will require more resources, more effective use of existing resources, or major innovation in health improvement intervention.

One further point is also important: if we want to monitor change and to project possible future trends with greater confidence, then it is essential to maintain the tools with which to do so. With more data points, which the SHeS will accumulate more rapidly now that it is run annually, not only will it become possible to monitor and project trends more robustly, but there will also be the ability to detect possible turning points in trends<sup>24</sup> by considering a substantial number of data points rather than the few currently available.

This short report is not the place to debate the future direction of health improvement in Scotland. Some would argue that a more radical approach is now being taken compared with the previous focus on stimulating individual behaviour change through education and regulation. Others would argue that any change of emphasis is not so radical as to alter trends. Our projections, by assuming ‘all other things remain unchanged’, take the latter position and thus might be conservative. For some behaviours there may be thresholds beyond which change – improvement or deterioration – accelerates. However, the long-term, slowly declining trend in smoking – a huge success for health improvement – suggests that what brings enduring results is the sustained and accumulating presence of multiple health improvement actions against a background of favourable social change. We hope that this report will contribute to making such circumstances increasingly common.

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All web links were verified as working on 10 January 2011.

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