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# Informing Interventions to reduce health Inequalities (Triple I)

National overview report 2019

**Triple I: Informing • Inequalities • Interventions**

Comparing the potential population impact of interventions on health inequalities in Scotland

NHS Health Scotland

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# Take home messages

**Health inequalities** are the unjust and avoidable differences in people's health across the population and between specific population groups. They represent thousands of premature deaths and preventable hospitalisations every year. Tackling health inequalities requires a range of actions to:

**undo** their fundamental causes, which arise from the unfair and unequal distribution of income, wealth and power

**prevent** wider environmental influences (for example, housing, work, education, services) from reinforcing or widening health inequalities

**mitigate** the negative impact of things that harm individuals' health and reinforce health inequalities

The Triple I (Informing Interventions to reduce health Inequalities) project models the impact of interventions that operate across these three types of action. It brings together robust evidence to estimate the potential population health impact of specific interventions on hospitalisation and death up to 20 years into the future.

Our modelling suggests that:

- Interventions that aim to **undo** the fundamental causes of health inequalities have the greatest potential to achieve the win–win situation of improved health and reduced health inequalities for the people of Scotland. These types of interventions included in our study redistribute income disproportionately to those on the lowest incomes. For more information on such interventions please see our **briefing on income-based interventions**.
- Interventions that aim to **prevent** poor health and health inequalities (for example, increased tobacco taxation, improving the physical environment, increasing access to jobs, or increasing the uptake of benefits to which people are already entitled) are important for creating healthy environments for us to live and work in. These types of interventions had a smaller potential population impact than the **undo** interventions but still achieved that win–win situation.
- Interventions that aim to **mitigate** the effects of things that are bad for our health (for example, support for people who smoke, drink alcohol at a level which is likely to cause them harm, or are physically inactive) are important for supporting individuals. These types of interventions are typically more cost-effective than **undo** or **prevent** interventions (based on the limited economic analysis currently possible within Triple I). However, they are limited in their reach, which means that they tend to have a small potential population impact. These types of actions have the potential to improve health but widen health inequalities. A win–win situation can be achieved for most of these types of interventions by targeting more resources to those in greater need.

These findings reinforce NHS Health Scotland's approach that all three types of action are necessary, and specifically emphasise the following messages:

- While **mitigate** interventions are important, doing more of them is likely to have a limited population impact. Nevertheless, Triple I is useful for informing how these types of actions can best be targeted to achieve the win–win situation of improved population health and reduced health inequalities.
- Further evidence is required to model a greater range of **prevent** interventions, and consideration of suitable evaluation methods (for example, natural experiments) for these types of action would be of value.
- More action is required to **undo** the fundamental causes of health inequalities as this is the type of action with the greatest potential population impact. We are now able to model a wide range of income-based interventions that would fall within this type of action. Further evidence would be beneficial to model how changes to the distribution of wealth and power might impact on population health and health inequalities.

## Suggested actions

Triple I provides tools to inform decision-makers about the likely impact of different interventions on population health and health inequalities before discussing and deciding on how best to invest public money. Our interactive modelling tools allow users to model their own scenarios by changing aspects like the area of interest and number of people treated for selected interventions. The following actions are suggested for local and national decision-makers.

- For **local decision-makers**:
  - Consideration of the potential impact and cost of **prevent** and **mitigate** interventions should be combined with local knowledge of their potential reach. This will help inform optimal targeting strategies which can achieve the win–win situation of improved population health and reduced health inequalities.
  - Our **income-based interventions briefing** highlights a number of areas in which local decision-makers can support action to **undo** and **prevent** health inequalities. These include exploring opportunities to encourage payment of the real Living Wage and finding ways to maximise income, including through the increased uptake of benefits by those who are entitled to receive them.
- For **national decision-makers**:
  - Recognition should be given to the potential scale of **undo** interventions in relation to improved population health and reduced health inequalities. National decision-makers should consider the balance between interventions designed to **undo**, **prevent** and **mitigate** health inequalities within national strategies across all policy areas. This will help maximise their contribution to population health improvement and the reduction of health inequalities.

# What is this report about?

Improving population health and reducing health inequalities are distinct but related objectives. While a lot of effectiveness evidence is available about specific interventions that improve health at an individual level, there is relatively little evidence regarding which interventions are likely to have a population impact. Similarly, while much is known about the causes of health inequalities, there is little evidence about the relative impact of interventions on health inequalities at a population level.

Our Informing Interventions to reduce health Inequalities (Triple I) modelling tools form part of NHS Health Scotland's approach to addressing these evidence gaps. The aim of Triple I is to provide national and local decision-makers with practical tools and interpreted research findings that will inform discussions and decisions about the potential health and health inequalities impacts of different interventions across a number of policy domains.

Triple I includes interventions that operate across the three types of action required to reduce health inequalities:

- Changes to income, benefits and taxation policies, which aim to **undo** the fundamental causes of health inequality by redistributing income, power and wealth.
- Changes to policy or legislative measures, such as tobacco taxation, which aim to **prevent** health harms and health inequalities.
- Health improvement programmes, such as smoking cessation, which aim to **mitigate** health harms and health inequalities.

The interventions can be categorised as operating at either an individual level to influence behaviour change, or at a structural level to influence the wider determinants of health.

This report describes the latest findings from Triple I. It updates and expands on the interventions modelled in our **2014 report** and follows on from our recent **briefing paper** on how different income policies would affect health and health inequalities in Scotland.

# How did we do this research?

Triple I works by bringing together data and evidence from a range of sources to model and compare the impact of two scenarios – referred to as the baseline and intervention scenarios – on hospitalisation and death among the adult population in Scotland (aged 16 years and over).

A summary of our approach is described below. A full description of the methods used within Triple I are provided in the accompanying **technical report**.

## Prioritisation of interventions and review of evidence

In addition to the existing topics included in the first phase of Triple I, a list of priority topics for inclusion was agreed in consultation with our Project Advisory Group. Topics were allocated to members of the Triple I Project Team, who then sought relevant evidence on the effectiveness and cost of interventions by approaching topic experts and conducting rapid evidence reviews. Clearly defined interventions for which robust evidence (such as National Institute for Health and Care Excellence (NICE) guidance or a systematic review) was available were considered appropriate for inclusion within Triple I.

### Triple I topic areas

| Updated from 2014 | New to 2019 | Considered for 2019 |
|---|---|---|
| • Alcohol consumption<br>• Employment<br>• Income<br>• Obesity<br>• Physical activity<br>• Smoking | • Mental health<br>• Physical environment | • Adult education<br>• Housing<br>• Models of health and social care designed to reduce hospitalisation |

We made a number of changes to the interventions that were modelled in the previous version of Triple I. The intervention modelled to tackle obesity changed from being solely based on the Counterweight adult weight management service, to a generic lifestyle weight management intervention in the current version. Active travel to work was included as a notional intervention in the previous phase of Triple I, but has been removed from the current suite of tools as specific physical activity interventions have now been modelled.

Suitable evidence for modelling using Triple I could not be found for the following topic areas considered for inclusion during this phase: adult education, housing, and models of health and social care designed to reduce hospitalisation. Job quality and workplace mental health interventions were considered under the employment and mental health topic areas respectively but suitable evidence for modelling these interventions could not be found.

## Which interventions did we model?

The interventions included in this report are presented in **Figure 1.** All the **undo** interventions plus 20 mph speed limits and tobacco taxation are structural-level interventions. All the **mitigate** interventions plus job provision and increasing benefit uptake are individual-level interventions. Full definitions of the interventions can be found in **Appendix 1**.

**Figure 1:** Interventions modelled within Triple I classified according to the undo-prevent-mitigate typology of actions for reducing health inequalities (topic area in brackets).

**Undo fundamental causes**

- Income Tax +1p (income)
- Income Tax -1p (income)
- Personal Allowance +£1,000* (income)
- Personal Allowance -£1,000* (income)
- Council Tax increase (income)
- Means-tested benefits +50%* (income)
- Devolved benefits +50% (income)
- Citizen's Basic Income* (income)
- Citizen's Basic Income Plus* (income)
- Local Income Tax (income)
- 'Real' Living Wage* (income)

**Prevent environmental influences**

- 20 mph speed limits (physical environment)
- Tobacco taxation +10%* (smoking)
- Job provision (employment)
- Benefit uptake +1% (income)

**Mitigate individual experiences**

- Computerised cognitive behavioural therapy (CBT) for depression (mental health)
- Individual guided self-help for depression (mental health)
- Group physical activity for depression (mental health)
- Lifestyle weight management service (obesity)
- Pedometer-based intervention (physical activity)
- Physical activity brief intervention (physical activity)
- Smoking cessation service (smoking)
- Alcohol Brief Intervention (alcohol)

* These interventions could not be introduced in Scotland with existing devolved powers.

## Outcome measures

Three outcome measures are modelled in the Triple I tools.

- **Hospitalisation:** the estimated number of all-cause hospital admissions occurring within the whole adult population.
- **Premature mortality:** the estimated number of all-cause deaths occurring within the adult population aged under 75 years.
- **Years of life lost:** the total number of additional years that the adult population would have been expected to live if individuals had not died before their estimated age- and sex-specific life expectancy.

This report focuses on the impact of modelled interventions on hospitalisation and premature mortality. In addition to the absolute and percentage change for these measures, several measures of absolute and relative inequality are also calculated (see **technical report**). In this report we will focus on the Relative Index of Inequality (RII). The RII is a summary measure of relative inequality which takes into account differences across the whole gradient of inequality, not just the gap in health outcome between the most and least deprived. An RII value of zero would indicate no relative inequality.

## Baseline scenario

The baseline scenario starts with the Scottish adult population in 2016, grouped by sex, five-year age group and Scottish Index of Multiple Deprivation quintile (20% of the population). This cohort is closed throughout the model: it cannot be added to, and the only way a person can leave is if they die. Prevalence data are used to estimate the proportion of the population exposed to the relevant risk factor (for example, current smokers). Administrative data are used to project rates of death and hospitalisation over time for both the exposed and unexposed population groups separately. Expected rates for the exposed population group are calculated based on evidence of the effect of the risk factors on the modelled outcomes.

## Intervention scenario

For the intervention scenario, individual-level interventions can be modified to specify:

- How many of the eligible population[1] are treated with the intervention.
- What targeting strategy will be used (evenly across the population, proportionate to need based on the prevalence of the risk factor by age group, sex and deprivation category, or targeted to the most deprived areas).

For structural-level interventions the eligible population is fixed and the targeting cannot be modified.

[1] Defined as the proportion of the exposed population who could be expected to be willing and able to receive the intervention (for example, smokers who reported being motivated to quit).

Individual-level interventions are implemented during year 1 with varying levels of decay over time applied to the intervention effect (based on evidence of drop-out and relapse for each intervention), whereas the structural-level interventions represent permanent changes. The mortality and hospitalisation rates from year 2 to year 20 for the treated population are modified by an intervention effect (derived from published sources) as well as the exposure effect. The combined results are the population effects for the intervention scenario.

## Intervention impact

Triple I calculates the intervention impact as the difference between the baseline and intervention scenarios.

## Which intervention scenarios did we model?

Interventions have been classified according to their type of action (i.e. **undo**, **prevent** or **mitigate**). As **undo** interventions have already been reported in a **separate briefing paper on income-based interventions** and, as their potential reach and estimated direct costs are typically much higher, this report will briefly compare all three types of action but then focus on those interventions that aim to **prevent** or **mitigate** health inequalities.

All the scenarios modelled in this report present outcomes for Scotland at year five. Other aspects within the intervention scenarios (such as the level of investment or targeting strategy) are altered for illustrative purposes depending on the type of action being compared.

### Setting the level of investment for different types of action

Ideally, every modelled intervention would have the same level of investment throughout the report. However, this was not possible for the following reasons.

- Some interventions (for example, smoking cessation) can be broken down into individual units of delivery (variable cost), while others are delivered at a population-wide level (for example, tobacco taxation) and are not divisible in this way (fixed cost).
- The maximum level of investment for individual-level interventions is limited by the number of people in the eligible population (for example, how many smokers there are who would be motivated to quit).
- The maximum level of investment is further limited when we target interventions to only the most deprived fifth of the population.

To address these issues we set the level of investment differently depending on the type(s) of action we were looking at. These are discussed in the following three sections.

## Comparing undo, prevent and mitigate interventions

When comparing all three types of action we have set the level of investment to the maximum amount possible based on the eligible population (for example, all smokers who are motivated to quit receive smoking cessation services). This was done to model each intervention on a whole-population basis so as to minimise the likelihood of making unfair comparisons between the three types of action that operate at different levels (individual or structural) with dissimilar reach and costs. However, it should be noted that a large variation in investment remained between the modelled interventions, with **mitigate** interventions typically being least costly but also most limited in their reach.

Interventions that could be targeted were modelled as being delivered proportionate to need based on the prevalence of the risk factor by age group, sex and deprivation category.

## Comparing prevent interventions

When comparing **prevent** interventions only, we had a mixture of fixed- and variable-cost interventions. To allow comparison of **prevent** interventions, intervention scenarios were modified to set a similar annual cost of intervention based on their population-wide implementation and/or a plausible level of service delivery.

The implementation of 20 mph speed limits in urban areas has an estimated fixed cost of £35 million. Increasing benefit uptake by 1% has an estimated recurring cost of £36 million per year (estimated at £143 million for the scenario modelled in this report). Job provision has been modelled on 8,000 jobs provided on a proportionate to need basis, selected as a plausible amount based on the current level of delivery between UK and Scottish Government work programmes. It has an estimated cost of £37 million. Tobacco taxation is revenue generating. Based on an increase of 10%, it is expected to save £71 million per year (estimated saving of £283 million for the scenario modelled in this report).

## Comparing mitigate interventions

When comparing **mitigate** interventions only, we had all variable-cost interventions. The challenge for these interventions was selecting a level of investment that was possible given the different eligible population for each intervention. This was particularly challenging when targeting to only the most deprived fifth of the population. In this scenario the investment levels similar to the **undo** and **prevent** interventions exceeded the maximum possible level for a number of interventions based on the eligible population. To address this, we set the level of investment for this part of the analysis to £1 million.

To illustrate the impact of different targeting strategies on population health and health inequalities, delivery of **mitigate** interventions has been modelled in three ways:

- Evenly across the population.
- Proportionate to need based on the prevalence of the risk factor in each age group, sex and deprivation category.
- Targeted at only the most deprived 20% of the population.

# What did we find?

## Comparison of the maximum impact of undo, prevent and mitigate interventions

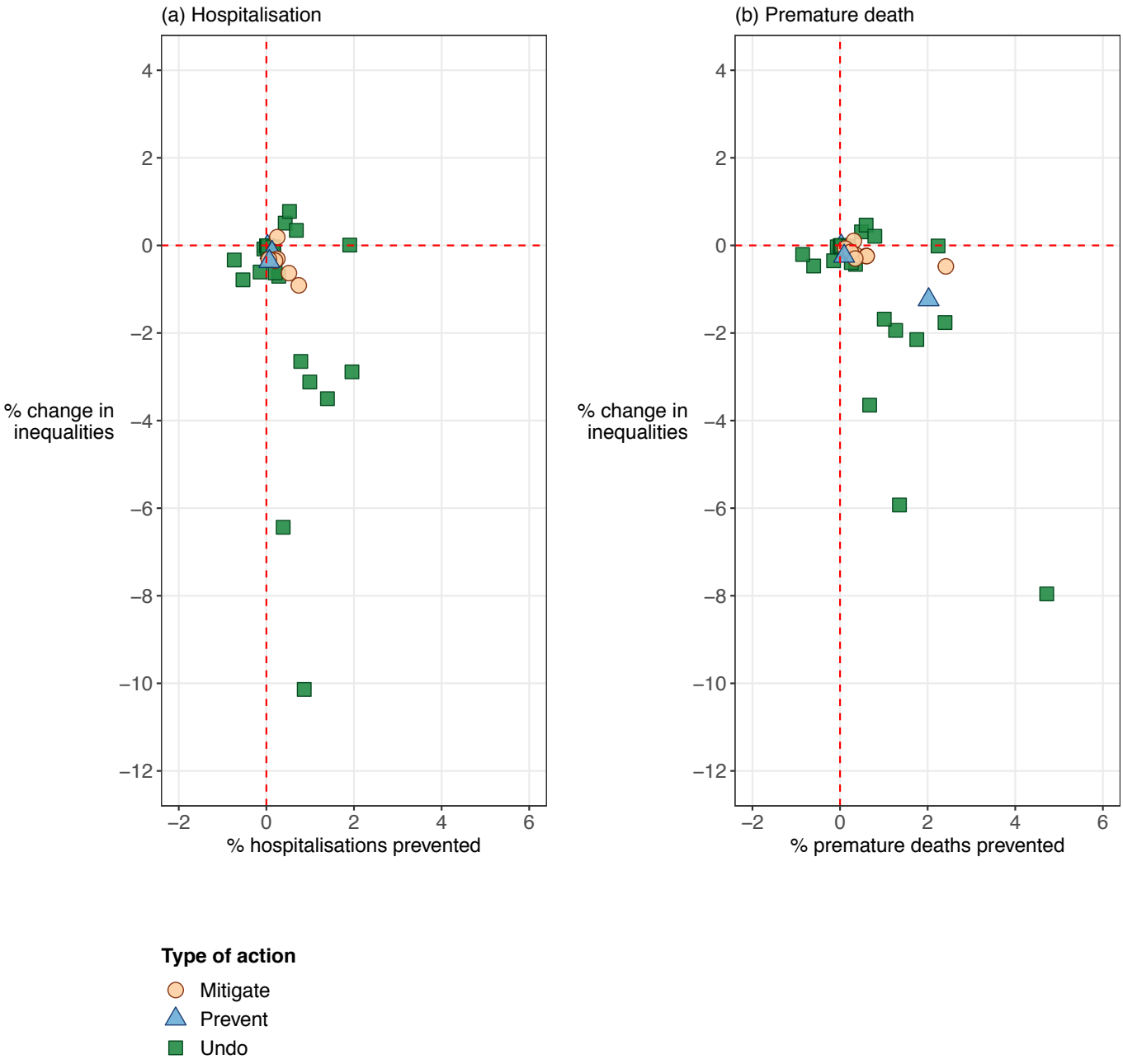
The maximum potential impacts of all modelled interventions on premature mortality and hospitalisation are presented in **Figure 2**. We use this type of quadrant chart to compare interventions throughout this report. Overall change in population health is plotted on the horizontal axis (with points further to the right indicating a greater improvement in health), while change in health inequalities is plotted on the vertical axis (with points further down the axis indicating reduced inequality). We ideally want to see interventions sitting in the lower right-hand quadrant, which indicates a win–win situation of improved population health and reduced health inequalities.

**Figure 2** presents the modelled interventions grouped according to the **undo-prevent-mitigate** typology. As noted earlier, it is challenging to make direct comparisons between the **undo, prevent** and **mitigate** interventions due to their differing reach and costs. However, for both objectives of improving population health and reducing health inequalities, the potential population impact was far greater for income-based interventions that aim to **undo** the fundamental causes of health inequalities than for other types of action. For further information on the **undo** interventions that we have modelled please refer to our **income-based interventions briefing**.

The following sections will focus on **prevent** and **mitigate** interventions separately. This allows us to zoom in to a small area around the intersection of the dotted lines in **Figure 2** where the **prevent** and **mitigate** interventions tended to cluster.

**Figure 2:** Maximum potential impacts of all interventions on (a) hospitalisation and (b) premature death in year five in Scotland; grouped by type of action.

Interventions for which targeting is possible are delivered proportionate to need.



## Assessing the impact of prevent interventions on population health and health inequalities

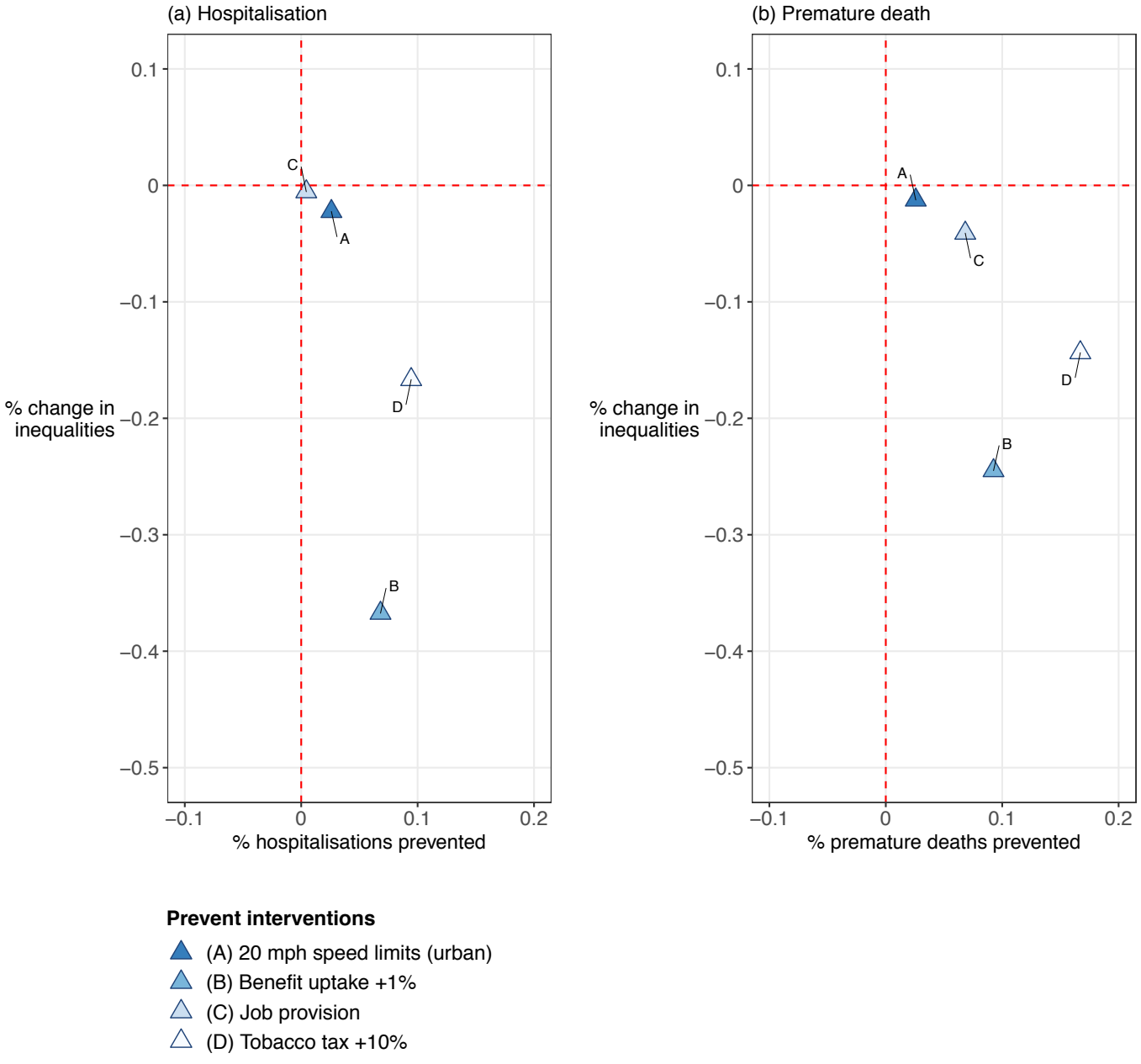
The intervention scenarios modelled for all four **prevent** interventions sit in the lower right-hand quadrant of **Figure 3** which indicates a win–win situation of both improving population health and reducing health inequalities.

Increasing tobacco tax by 10% is estimated to have the largest impact on population health, estimated to prevent over 4,000 hospital stays (0.09%) and over 140 premature deaths (0.17%) over five years. The estimated reduction in relative health inequalities was 0.17% for hospitalisation and 0.14% for premature death.

Increasing benefit uptake by 1% is expected to have the largest impact on relative health inequalities (an estimated reduction in RII of 0.37% and 0.24% for hospitalisations and premature deaths respectively). The estimated impact on population health was over 3,000 hospital stays (0.07%) and 79 premature deaths (0.09%) prevented over five years.

**Figure 3:** Impact of **prevent** interventions on (a) hospitalisation and (b) premature death in year five (please note different scale and level of investment to Figure 2).

The job provision intervention is modelled as 8,000 jobs provided proportionate to need.



## Assessing the impact of mitigate interventions on population health and health inequalities

**Figures 4** and **5** highlight the contribution that the targeting strategy of **mitigate** interventions can make to achieving both objectives of improving population health and reducing health inequalities. All targeting strategies assume equal intervention effectiveness across deprivation categories.

### Targeting interventions proportionate to need

Most **mitigate** interventions targeted proportionate to need achieved the win–win situation of both improving population health and reducing health inequalities, with the exception of Alcohol Brief Interventions and lifestyle weight management services, that were estimated to improve health but slightly increase health inequalities (**Figures 4b and 5b**)**.** For the Alcohol Brief Intervention model this is likely owing to the fact that the population at risk was defined as the proportion of adults categorised as being hazardous and harmful drinkers based on self-reported consumption. Even though the harm caused by alcohol is much higher in more deprived areas, and average weekly consumption among harmful drinkers in more deprived areas is much higher than those in less deprived areas, self-reported weekly consumption is not particularly socially patterned across the population as a whole.

For the lifestyle weight management model, health inequalities in hospitalisation initially reduce but, by year five, start to widen slightly. This is likely due to the relatively larger effect on mortality, meaning that people are expected to live longer but may experience more hospitalisations as a result.

Two interventions that aid in reducing depression were estimated to have the largest population impact on hospitalisation: computerised CBT (estimated to prevent over 2,500 hospital stays (0.06%) and result in a 0.07% reduction in health inequalities) and individual guided self-help (estimated to prevent over 1,800 hospital stays (0.04%) and result in a 0.05% reduction in health inequalities) (**see Figure 4b**).

The two interventions which were modelled based on a change in physical activity levels (pedometer-based intervention and physical activity brief intervention) were estimated to have the largest population impact of the **mitigate** interventions on premature deaths (**Figure 5b**). Both interventions are estimated to prevent around 100 premature deaths (0.12%) and result in a 0.05% reduction in relative health inequalities in year five. Their impact on hospitalisation was not modelled as no suitable evidence could be found.

### Targeting evenly across the population

By contrast, delivering **mitigate** interventions evenly across the population improved health to a similar level to when interventions were delivered proportionate to need, but resulted in slightly increased relative health inequalities in all cases (**Figures 4a** and **5a**).

### Targeting interventions to only the most deprived 20% of the population

Targeting only the most deprived 20% of the population resulted in a greater reduction in health inequalities than targeting evenly across the population or proportionate to need (**Figures 4c** and **5c**). The impact on population health was also typically larger, though the differences were less than those for health inequalities. However, it should be noted that targeting only the most deprived 20% of the population typically reduced the eligible population and by extension the maximum impact that could be made to improve population health and reduce health inequalities.

**Figure 4:** Impact of **mitigate** interventions on hospitalisation in year five; based on £1 million investment with delivery targeted (a) evenly across the population, (b) proportionate to need, (c) to only the most deprived 20% of the population (please note different scale and level of investment to Figure 2).

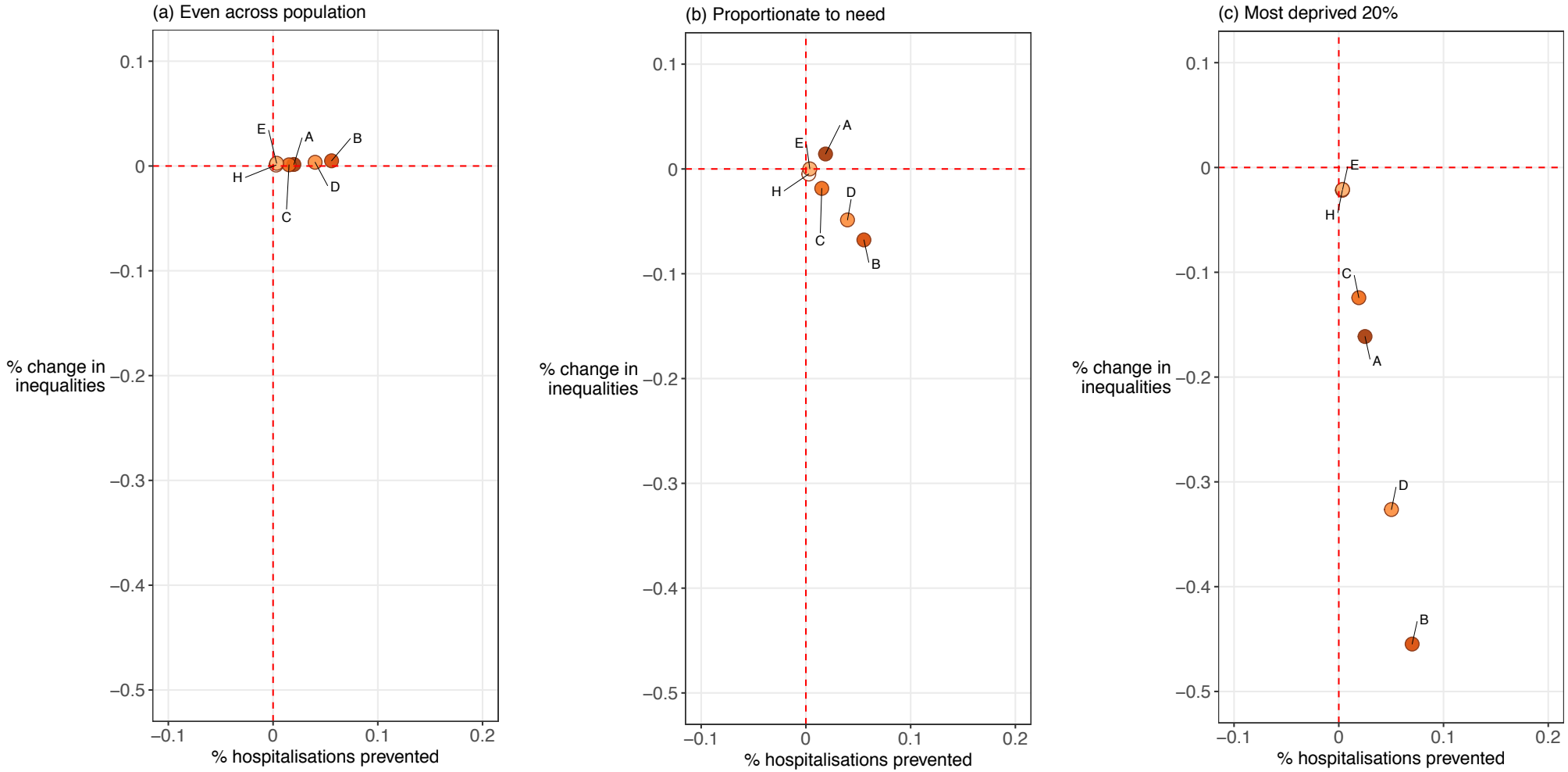
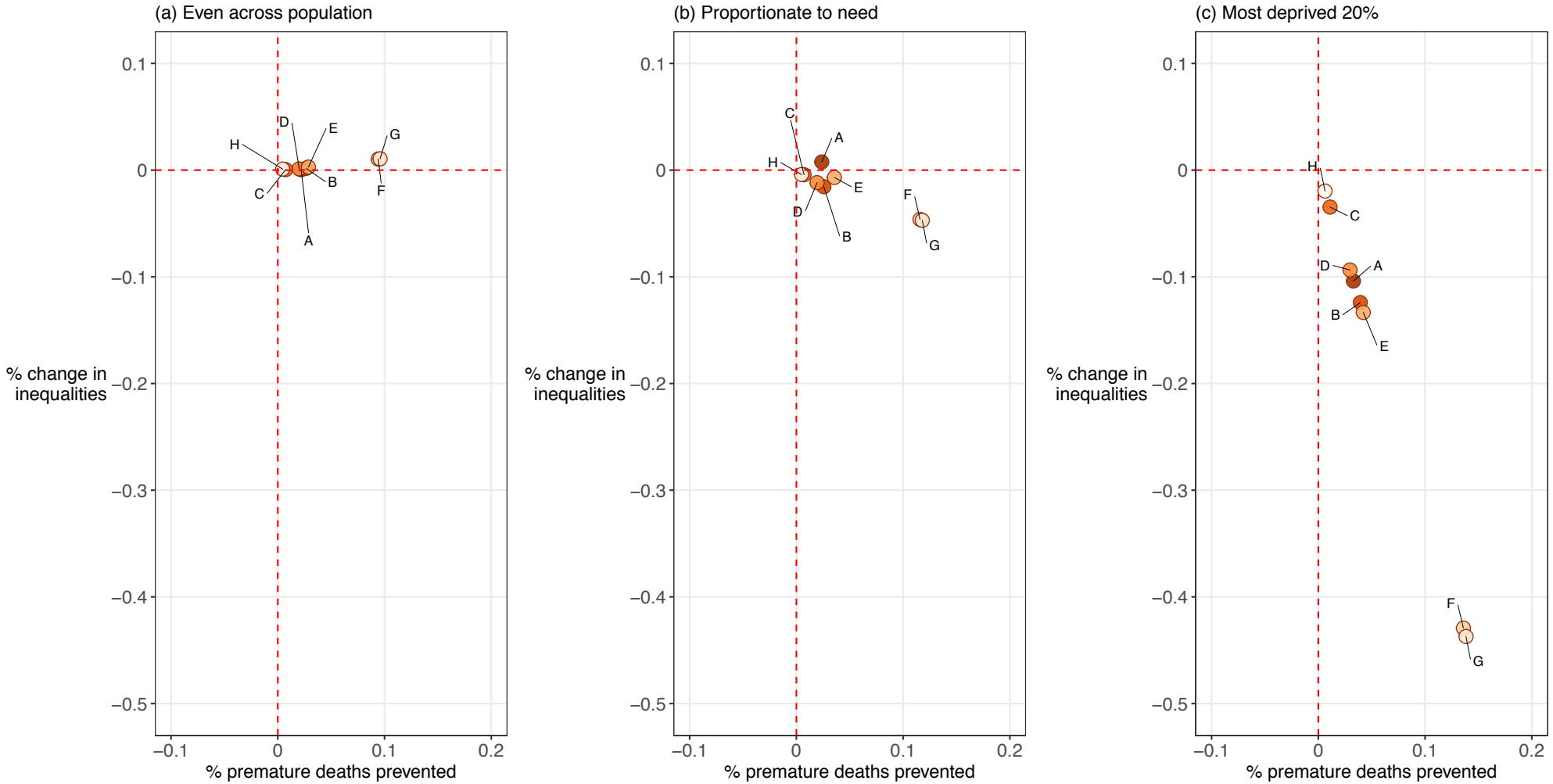


**Figure 5:** Impact of **mitigate** interventions on premature death in year five, based on £1 million investment with delivery targeted (a) evenly across the population, (b) proportionate to need, (c) to only the most deprived 20% of the population (please note different scale and level of investment to Figure 2).




**Mitigate interventions**

- (A) Alcohol Brief Intervention
- (B) Computerised CBT for depression
- (C) Group physical activity for depression
- (D) Individual guided self–help for depression
- (E) Lifestyle weight management services
- (F) Pedometer–based interventions
- (G) Physical activity brief intervention
- (H) Smoking cessation services

## Costing interventions to improve health and reduce health inequalities

Some of the interventions may have a greater cost or impact simply because they need to be delivered on a population-wide basis with costs that are fixed and indivisible. In contrast, individual-level interventions can be flexibly delivered at various scales and reach requiring different levels of investment. For example, most tax or benefit changes would cost substantially more than the maximum investment possible for **mitigate** interventions.

Therefore, Triple I also gives an indication of the cost-effectiveness of each intervention by dividing the cost of the intervention by the percentage change in the intended outcome (for example, 1% fewer hospitalisations). This is a measure of how much resource needs to be invested for each percentage-point of improvement in the intended outcome. The lower the ratio, the better the investment in cost-effectiveness terms.

Based on the limited cost-effectiveness analysis that it was possible to do for the modelled interventions, we found that:

- Interventions that aim to **undo** the fundamental causes of health inequalities are estimated to achieve the greatest population impact, both in terms of improved population health and reduction in health inequalities. This is in part due to them having a greater reach than other interventions. Interventions that aim to **undo** the fundamental causes of health inequalities are estimated to achieve the greatest population impact, both in terms of improved population health and reduction in health inequalities. However, they also had comparatively high, fixed costs that increased the cost per percentage-point improvement achieved.
- Interventions that aim to **mitigate** health inequalities typically cost less per percentage-point improvement achieved. But, even with recruitment of 100% of the eligible population, the estimated impact of each individual intervention on population health and health inequalities is comparatively limited.

Our approach to cost-effectiveness analysis is simplistic and has important limitations:

- We estimated costs from a health sector perspective, so only direct costs associated with delivering and/or enforcing each intervention have been estimated. This limits comparisons being drawn, especially across the different types of action (**undo**, **prevent** and **mitigate**).
- For individual-level interventions, we estimated the cost-effectiveness based on the maximum possible effect by assuming all of the eligible population were reached (consistent with **Figure 2**). This was to avoid specific and arbitrary choices about the level of investment in each intervention, but also means the results for individual-level interventions are based on implausible scenarios because in practice it would be difficult to treat the entire eligible population.

The results, presented in **Appendix 2** of this report, should therefore be viewed as illustrative. It does not always make sense to compare the impacts of different types of interventions with a similar amount of investment because in practice the cost to deliver them optimally would be very different. Hence, comparisons between interventions should be interpreted in light of the different scale of the investment rather than comparing the results of different interventions directly. In practice, improving population health and tackling health inequalities requires a careful blend of interventions across all three types of action presented in this report (**undo**, **prevent** and **mitigate**).

# Strengths of this research

This research has a number of strengths:

- Modelling different interventions as we have done provides a flexible and efficient way of estimating their effects without implementing them.
- By modelling a range of interventions which operate at an individual or structural level we can estimate the effects of interventions that aim to improve health and **undo**, **prevent** or **mitigate** health inequalities.
- The results in this report are applicable to Scotland as a whole. In addition, our **interactive modelling tools** can be downloaded and used to produce detailed results for different geographies (Scotland, local authorities, NHS Boards, city regions or Integrated Joint Boards) and health outcomes (premature mortality, years of life lost or hospital stays).
- The Triple I modelling tools are based on robust data and evidence.
- This work can inform discussions about resource allocation and policy formulation.

# Key assumptions and limitations

## Addressing complexity

All models are a simplification of how the real world works. The following aspects of Triple I should be considered when interpreting the findings:

- Triple I adopts a closed cohort approach whereby individuals do not move in or out of the cohort (other than due to death). In real life the effect of interventions would be affected by the movement of individuals in and out of the cohort.
- Triple I also adopts a static system approach whereby single interventions are implemented in isolation and not combined in any way with other interventions or policies. In real life it would be hard to disentangle the influence of any one intervention from all the influences on a population; however, Triple I may help guide the choice of interventions to add to a mix.
- Owing to its focus on population impact, Triple I is designed to model outcomes such as hospitalisation or death which are consistent and meaningful at a population level. There are other outcomes which will be important to individuals and organisations, such as person-centred outcomes for recovery services, but are not suitable for modelling using Triple I.
- We assumed a causal relationship between each modelled risk factor and our outcomes of hospitalisation and death. Although there is good evidence that each of the modelled risk factors influence health, the size and timing of the effect will vary depending on the position of the risk factor on the causal pathway, the potential for reverse causality (for example, poor health resulting in the risk factor) and the extent to which the relationship is confounded by other factors. These issues may be more important for **undo** interventions. For example, lower levels of income (including benefits) are associated with poorer health, but the link between increased income and improved health depends on assuming that this link is causal and that confounding is minimal.

## Availability of evidence

- Although Triple I uses robust evidence, we are reliant on the strength of the current evidence base to inform the expected effects. Effectiveness evidence tends to be more readily available for interventions that operate at an individual level. This means that modelling interventions which aim to **mitigate** health harms tends to be easier than those which aim to **prevent** those harms occurring or **undo** their fundamental causes.
- This phase of Triple I has seen methodological developments that have allowed us to model a wide range of income interventions; however, other fundamental causes of health inequality and wider determinants of health remain outside Triple I's suite of interventions.

## Sensitivity to assumptions

We consider the data and evidence used in Triple I to be the most robust available for our purposes. These are described in detail in the accompanying **technical report** and **interactive modelling tools**. However, all modelling is subject to various assumptions and uncertainties, which can affect the results produced. We performed a range of sensitivity analyses to assess the impact of changing certain key assumptions and parameters in our modelling approach. For example, for some interventions there were alternative evidence sources to inform:

- The size of the intervention effect.
- The relationship between the risk factor and mortality/hospitalisation.
- The size of the population at risk.
- The population at risk that was eligible for the intervention.

We therefore tested the impact of using alternative estimates.

The sensitivity analyses performed responded to the specific assumptions made for each intervention. Thus, they were varied and gave diverse results. As expected, the size and direction of the impact of the sensitivity analyses on the results was proportionate to the size and direction of the change in the assumption. For interventions that were estimated to produce more modest impacts on population health and health inequalities (**mitigate** and **prevent** interventions), certain changes to underlying assumptions and model parameters produced large relative changes when compared to the original results. However, the absolute change in impact on population health was small when considered alongside the estimated impact of **undo** interventions. This remained the case even when compared to the sensitivity analyses of **undo** interventions that produced the most conservative results, supporting our key finding that **undo** interventions are likely to have the largest potential impact on population health and health inequalities in Scotland, albeit at a higher cost.

A full description of the sensitivity analyses performed for each intervention and the results produced is provided in the accompanying **technical report**.

# How might Triple I be used to inform decision-making?

As part of the current phase of Triple I, we met with a range of stakeholders to improve our understanding of how Triple I could better inform decision-making. Feedback indicated a number of ways that local decision-makers could make use of Triple I:

- As a discussion aid to inform inequalities-focused planning and decision-making.
- To model interventions for their own local areas using our interactive Triple I modelling tools which accompany our Triple I reports on the **NHS Health Scotland website**.
- As part of a wider set of decision-making tools. Triple I will not be the right tool for every job. NHS Health Scotland and ScotPHO produce a range of decision-making tools that could complement Triple I or be more appropriate for specific needs (for example the **Scottish Burden of Disease Study**, **Place Standard**, **ScotPHO profiles**, **Economics of Prevention**, **Health Inequalities briefings**, or Maximising the role of **NHSScotland** and **Health and Social Care Partnerships** in reducing health inequalities).

The effects of a wide range of interventions on health and health inequalities can be modelled for different geographies and different health outcomes using our **interactive modelling tools**. Our findings highlight the importance of applying an inequalities lens to intervention options.

# Summary

Our Triple I modelling findings reinforce the importance of interventions that aim to **undo** the fundamental causes of health inequalities. Income-based policies that disproportionately redistribute income to those with the lowest incomes appear to have the largest potential impact on both population health and health inequalities. However, they are also typically expensive to implement.

Although we highlight the potential impact of **undo** interventions, we note that actions to **prevent** and **mitigate** the effects of things that reinforce health inequalities and harm individuals' health are also required to improve population health and reduce health inequalities in Scotland. In particular, we have shown the importance of considering how **mitigate** interventions are targeted to maximise their impact on these two objectives.

Ideally, we want to achieve a win–win situation where interventions both make the Scottish population healthier and reduce health inequalities. Achieving this costs money and often involves trying new things. Triple I provides a tool to inform decision-makers about the likely impact of different interventions before discussing and deciding on how best to invest public money.

# Appendix 1

## Intervention definitions

More detailed definitions are available in the **technical report**.

Type of action on inequalities: **Undo**

- **Citizen's Basic Income (CBI):** An income from the state received by every citizen, not dependent on need. Most other benefits withdrawn, and Income Tax increased.
- **Citizen's Basic Income Plus:** As CBI, with additional payments for disabled adults and children.
- **Council Tax increase (bands E–H):** Increase of 7.5% for band E, 12.5% for band F, 17.5% for band G and 22.5% for band H.
- **Devolved benefits +50%:** 50% increase in rates of benefits devolved to the Scottish Government.
- **Income Tax rates +1p:** Rates increased to 21p basic rate, 41p higher rate and 46p additional rate.
- **Income Tax rates -1p:** Rates decreased to 19p basic rate, 39p higher rate and 44p additional rate.
- **Living Wage:** Mandatory payment of the real Living Wage (£8.25 per hour for 2016/17) to all employees.
- **Local Income Tax:** Council Tax removed, and all Income Tax rates increased by 3p.
- **Means-tested benefits +50%:** 50% increase in benefits paid to those who pass an income test.
- **Personal Allowance -£1,000:** Income Tax Personal Allowance (ITPA) decreased from £11,000 to £10,000.
- **Personal Allowance +£1,000:** ITPA increased from £11,000 to £12,000.

Type of action on inequalities: **Prevent**

- **Job provision:** Moving individuals into sustained employment (notional intervention).
- **Benefit uptake +1%:** A 1% increase in the number of claimants of means-tested benefits (e.g. through income maximisation services).
- **20 mph speed limits:** 20 mph speed limits (without physical traffic calming) on all minor roads and local streets within urban settlements.
- **Tobacco tax +10%:** 10% increase in the retail price of tobacco.

Type of action on inequalities: **Mitigate**

- **Alcohol Brief Intervention:** A short, structured conversation with a patient to motivate and support reduced consumption.
- **Computerised cognitive behavioural therapy (CBT) (for depression):** 9–12 weeks of low-intensity therapy provided via computer, with limited support from trained practitioner.
- **Group physical activity (for depression):** Group sessions up to one hour delivered by competent practitioner, over 10–14 weeks.
- **Individual guided self-help (for depression):** Self-administered intervention based on cognitive behavioural therapy (CBT), using books or manuals.
- **Physical activity brief intervention:** A short conversation with a patient to motivate and support them to increase or maintain their activity level.
- **Pedometer-based intervention:** 12-week pedometer-based intervention to increase walking among adults delivered in a primary care setting.
- **Smoking cessation:** NHS smoking cessation services (Scotland) programme.
- **Lifestyle weight management service:** Lifestyle weight management services, delivered by trained staff over 3+ months.

# Appendix 2

**Additional table 1:** Cost and cost per percentage-point improvement of maximum effects of cost-incurring **undo** interventions on (a) hospitalisation and (b) premature death in year five.

| Intervention | Cost (£m) | Cost per 1% reduction in hospitalisations (£m) | Cost per 1% reduction in relative inequalities in hospitalisations (£m) | Cost per 1% reduction in premature deaths (£m) | Cost per 1% reduction in relative inequalities in premature deaths (£m) |
|---|---|---|---|---|---|
| Means-tested benefits +50% | 8,691 | 2,353 | 694 | 1,842 | 1,092 |
| Local Income Tax | 5,152 | 2,707 | x | 2,302 | 402,616* |
| Real Living Wage | 5,056 | 2,588 | 1,751 | 2,110 | 2,871 |
| Devolved benefits +50% | 3,094 | 2,219 | 884 | 1,766 | 1,438 |
| Citizen's Basic Income Plus | 2,141 | 2,477* | 211 | 1,579 | 361 |
| Personal Allowance +£1,000 | 2,052 | 2,999* | x | 2,584* | x |
| Citizen's Basic Income | 1,768 | 4,621* | 275 | 2,616* | 485 |
| Income Tax rates -1p | 1,714 | 3,245* | x | 2,878* | x |

**Notes:**

Interventions are sorted by cost.

* indicates that 1% improvement in outcome would not be achievable for this intervention.

x indicates that the intervention did not improve the specified outcome.

All **undo** interventions are based on recurring costs.

Due to differences in rounding, slightly different figures may appear in our Triple I results browser.

**Additional table 2:** Cost and cost per percentage-point improvement of maximum effects of **prevent** interventions on (a) hospitalisation and (b) premature death in year five.

| Intervention | Cost (£m) | Cost per 1% reduction in hospitalisations (£m) | Cost per 1% reduction in relative inequalities in hospitalisations (£m) | Cost per 1% reduction in premature deaths (£m) | Cost per 1% reduction in relative inequalities in premature deaths (£m) |
|---|---|---|---|---|---|
| Job provision | 1,096 | 8,478* | 6,782* | 542 | 884 |
| Benefit uptake +1% | 143 | 2,096* | 389* | 1,543* | 583* |
| 20 mph speed limits (urban) | 35 | 1,469* | 1,705* | 1,482* | 3,032* |

**Notes:**

Interventions are sorted by cost.

* indicates that 1% improvement in outcome would not be achievable for this intervention.

Benefit uptake +1% is based on recurring costs, other prevent interventions are based on one-off costs in year one.

Job provision is targeted proportionate to need.

Due to differences in rounding, slightly different figures may appear in our Triple I results browser.

**Additional table 3:** Cost and cost per percentage-point improvement of maximum effects of **mitigate** interventions on (a) hospitalisation and (b) premature death in year five.

| Intervention | Cost (£m) | Cost per 1% reduction in hospitalisations (£m) | Cost per 1% reduction in relative inequalities in hospitalisations (£m) | Cost per 1% reduction in premature deaths (£m) | Cost per 1% reduction in relative inequalities in premature deaths (£m) |
|---|---|---|---|---|---|
| Smoking cessation services | 72 | 364* | 206* | 207* | 240* |
| Lifestyle weight management services | 68 | 268* | x | 28 | 142* |
| Group physical activity for depression | 34 | 66* | 54* | 140* | 230* |
| Individual guided self-help for depression | 19 | 25* | 20* | 52* | 85* |
| Alcohol Brief Intervention | 13 | 53* | x | 42* | x |
| Pedometer-based interventions | 5 | n/a | n/a | 9* | 22* |
| Physical activity brief intervention | 5 | n/a | n/a | 8* | 21* |
| Computerised CBT for depression | 5 | 18* | 15* | 39* | 64* |

Notes:

Interventions are sorted by cost.

* indicates that 1% improvement in outcome would not be achievable for this intervention.

x indicates that the intervention did not improve the specified outcome.

n/a indicates that the intervention could not be modelled for the specified outcome.

All **mitigate** interventions are based on one-off costs (one year of delivery) and targeted proportionate to need.

Due to differences in rounding, slightly different figures may appear in our Triple I results browser.

**Additional table 4:** Saving and saving per percentage-point improvement of maximum effects of **revenue-generating** interventions on (a) hospitalisation and (b) premature death in year five.

| Intervention | Type of action | Saving (£m) | Saving per 1% reduction in hospitalisations (£m) | Saving per 1% reduction in relative inequalities in hospitalisations (£m) | Saving per 1% reduction in premature deaths (£m) | Saving per 1% reduction in relative inequalities in premature deaths (£m) |
|---|---|---|---|---|---|---|
| Tobacco tax +10% | Prevent | 283 | 2,991* | 1,695* | 1,691* | 1,967* |
| Council Tax increase (bands E–H) | Undo | 542 | x | 892* | x | 1,548* |
| Income Tax rates +1p | Undo | 1,714 | x | 2,181* | x | 3,650* |
| Personal Allowance –£1,000 | Undo | 2,163 | x | 6,497* | x | 10,473* |

Notes:

* indicates that 1% improvement in outcome would not be achievable for this intervention.

x indicates that the intervention did not improve the specified outcome.

All **revenue-generating** interventions are based on recurring costs.

Due to differences in rounding, slightly different figures may appear in our Triple I results browser.

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