NICE National Institute for Health and Care Excellence

Type 2 diabetes: estimating the impact of different uptake scenarios of SGLT-2 inhibitors in individuals in UK primary care

Introduction

Economic evaluations are a key component of NICE's work, influencing decisions on the commissioning of treatments and interventions for effective NHS and public sector resource use. However, these often do not consider how treatments and interventions may affect health inequalities. To address this gap, methods like distributional cost-effectiveness analysis (DCEA) have been developed to analyse the impact of healthcare interventions on health inequalities related to socioeconomic factors and disadvantaged groups.

NICE is currently piloting a prototype health inequality impact calculation tool developed by the University of York (Prototype Health Equity Impact Calculator (york.ac.uk)). This tool assesses the potential impact of interventions on health inequalities by analysing health effects across indices of multiple deprivation (IMD) quintiles. It is designed to help committees consider how their recommendations may impact health inequalities. Further details regarding the tool are available in the associated report (CHE Research Paper 193).

This analysis explores the distributional health impact of different scenarios for uptake of SGLT-2 inhibitors on adults diagnosed with type 2 diabetes (T2DM). This report provides a brief overview of the methodology used to generate input parameters for the tool, results from the tool and interpretation of the findings for future decision-making.

Executive Summary

NICE's economic evaluations are important for informing decisions on the allocation of resources for NHS treatments. However, they often miss how these interventions may impact health inequalities. To address this, NICE is piloting a new tool developed by the University of York. It looks at how

interventions might affect health inequalities by analysing health effects across different levels of deprivation.

This document presents the results obtained from using the tool to analyse the uptake and health effects of SGLT-2 inhibitors in individuals aged 18 and over who have type 2 diabetes (T2DM) and a comorbidity.

Key findings:

Prevalence of T2DM and Comorbidities: The highest prevalence of T2DM and related comorbidities is found in the most deprived groups. Variation in prevalence is the key determinant of the estimated quality adjusted life years (QALYs) gained from SGLT-2 inhibitors assuming equal uptake, effectiveness and opportunity costs across deprivation groups.

SGLT-2 Inhibitor Uptake: Uptake of SGLT-2 inhibitors is low across most subgroups (around 22%), with slightly higher uptake in individuals with T2DM and congestive heart failure (CHF) (30%) and those with early onset T2DM (17-24%). Additionally, uptake is relatively uniform across different levels of deprivation.

Potential Health Benefits from Increased Uptake: A scenario analysis of individuals with T2DM, obesity, and a high risk of developing CVD suggests that increasing SGLT-2 uptake from 22% to 80% could substantially improve health outcomes, raising total QALYs from 62,836 to 228,496. However, high opportunity costs reduce the net gains to 30,380 QALYs at 22% uptake and 110,473 at 80%.

Impact on Health Inequalities: The most deprived groups gain the greatest health benefits in both absolute and relative terms. The absolute gains reflect their higher disease burden and larger population size while the relative gains arise from these factors and the assumption that opportunity costs are distributed equally across all deprivation groups. Overall, total health benefits are positive across all population groups and all deprivation levels. Although

opportunity costs reduce these benefits, they do not outweigh them, net health gains persist for most groups except for those with early onset T2DM and High Risk (H-R) CVD where net benefits become negative for the two least deprived groups (IMD 4 and 5).

Impact of Opportunity Cost Distribution: A scenario analysis of individuals with T2DM, obesity, and a high risk of developing CVD found that introducing a slight or moderate gradient in opportunity costs, where costs are highest in the most deprived groups and lowest in the least deprived, shifted net health benefits away from the most deprived and toward the least deprived. Despite this redistribution, total net health benefits remain positive and unchanged.

Cost-Effectiveness: The economic analyses found SGLT-2 inhibitors were cost effective for all seven populations analysed. Total health benefits were positive for all groups and all deprivation levels, and net benefits, which account for opportunity costs, were also positive for most groups. The only exceptions were those with early onset T2DM and H-R CVD where net benefits became negative for the two least deprived groups (IMD 4 and 5).

Limitations: The analysis has several limitations including assumptions related to distributional inputs, reliance on prescribing data as a proxy for uptake, adherence to treatment regimens, evaluating SGLT-2 inhibitors as a generic class, and the exclusion of other equality related factors such as age, gender and ethnicity.

Conclusion

The Health and Social Care Act 2012 mandates that the NHS and public bodies consider health inequalities in decision-making. These analyses provide insights into how interventions like SGLT-2 inhibitors can influence both overall health and health inequities. While increasing uptake can improve outcomes, especially for the most deprived, opportunity costs were high, accounting for over 60% of total health gains.

Overall, these findings confirm that SGLT-2 inhibitors deliver substantial health gains and represent good value for money across diverse populations. Importantly, the most deprived populations experience the greatest gains in both absolute and relative terms, reflecting higher disease burden, larger population size and the assumption of equal opportunity costs across groups. This highlights that prioritizing access in more deprived areas could enhance both overall health outcomes and advance equity.

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Methods

The prototype tool was used to estimate the distribution of net health benefits (measured in QALYs) on adults diagnosed with T2DM across five deprivation groups based on the [Index of Multiple Deprivation](#) (IMD). The IMD measures relative levels of deprivation in 32,844 small areas or neighbourhoods in England and comprises seven distinct domains of deprivation. This analysis explored various scenarios regarding the uptake of SGLT-2 inhibitors.

The four inputs needed for the tool for the present analysis are as follows:

1) Data on the number of people with T2DM and a given comorbidity in each deprivation quintile in England.

2) Data on the uptake of SGLT-2 inhibitors in people with T2DM and a given comorbidity in each deprivation quintile in the UK.

3) Data on the health effects (measured in QALYs) associated with uptake of an SGLT-2 inhibitor for people in each deprivation quintile.

4) Health opportunity costs: the foregone health benefits that could have been provided with alternative use of the resources used for the SGLT-2 inhibitors.

For items 1) and 2), we used data from a cross-sectional analysis of CPRD Aurum on 1st September 2023 to estimate counts of people with T2DM and a given comorbidity and uptake of SGLT-2 inhibitors in that population in primary care practices in the UK. The full details of the methods of analysis are included in this accompanying report, *Uptake of sodium-glucose cotransporter-2 inhibitors in patients with type 2 diabetes: a report for NICE committee members*. CPRD Aurum covers a representative sample of the UK population; we extrapolated from our counts to the population totals with T2DM+ in each IMD quintile in England. We assumed the treatment uptake observed in CPRD held nationally and multiplied the number of patients in

each IMD quintile by 5.29. This figure is the ratio of patients aged over 18 in CPRD (n= 8,406,225) to the Office for National Statistics (ONS) estimated population of adults aged 18 years and over in England in 2020 (n=44,456,850). For the analyses of people aged under 40 we recalculated the multiplier as follows. The ONS estimated population of adults aged 18 years to 39 years in England is 16,043,943, while the corresponding figure in CPRD is 2,899,019. Again, assuming that the treatment uptake observed in CPRD holds nationally, we multiplied the number of patients aged 18 years to 39 years in each IMD quintile by 5.53.

Item 3) was taken from the substantive health economic cost utility analysis conducted for 2024 T2DM guideline medicines update. This analysis was presented to the committee and is available in a separate report (Overview | Type 2 diabetes in adults: management | Guidance | NICE). A summary of the incremental QALYs, incremental costs and incremental cost effectiveness ratios (ICERs) for each population group considered in the base-case analyses are shown in Table 1 below.

Table 1: Economic outcomes of SGLT-2 inhibitors for individuals with T2DM by co-morbidity and age group

	Incremental costs	Incremental QALYs	ICER (cost per QALY gained)
T2DM + high risk CVD + living with obesity, age 18+	£2,908	0.2815	£10,334
T2DM + high risk CVD + living with overweight, age 18+ for	£2,535	0.2181	£11,619
Early onset (T2DM + high risk CVD, age 18-39 years)	£3,841	0.2983	£12,877
T2DM + aCVD, age 18+	£3,981	0.2627	£15,152
T2DM + CHF, age 18+	£2,038	0.1375	£14,817

T2DM + CKD stages 1-3, age 18+	£3,052	0.2874	£10,620
T2DM + CKD stage 4, age 18+	£2,764	0.2935	£9,416

For Item 4 we used the default values provided in the tool which assume the share of health opportunity costs are evenly distributed across the 5 IMD groups. These costs are calculated by multiplying the incremental costs from the economic analysis by the total number of recipients and converting them to health opportunity costs using a value of £20,000/QALY. These health opportunity costs are then apportioned equally among all IMD groups, with each group receiving 20%.

As noted earlier, opportunity costs represent the health losses associated with intervention costs, since resources allocated to fund the intervention could otherwise be used to improve health elsewhere. A recent update to the methodology for estimating these costs (CHE RP 197) indicates that assuming equality as the base-case in the analysis is a reasonable approach. This contrasts with the previous assumption that opportunity costs disproportionately affect more deprived populations (Cookson and Koh 2023).

In the following section we explore the distributional impact on health outcomes of T2DM medication treatments in the seven subgroups reported in the economic analyses (see Table 1 above). In addition, we explore the effects of increasing uptake of SGLT-2 inhibitors and different assumptions about the distribution of opportunity costs, which reflect the potential health losses that arise when resources are allocated to one intervention rather than others.

Results

Individuals with T2DM, living with obesity and high risk of cardiovascular disease (CVD)

The first set of analyses focus on people with T2DM, living with obesity and a high risk of developing CVD. A summary of the inputs to the tool and corresponding data sources are shown in Table 2.

In England the estimated population aged 18 and over is 44,456,850. The estimated total number of individuals with T2DM, obesity and high-risk of CVD is estimated to be 1,014,532 (ONS/CPRD) resulting in an overall prevalence of 2.3%.

Table 2 shows the gradient in the prevalence of T2DM, obesity and high-risk of CVD, with the highest prevalence found in the most deprived groups (3.0%) and the lowest in the least deprived groups (1.7%). Additionally, the uptake of SGLT-2 inhibitors in this population is relatively uniform, with only small differences between IMD groups.

Table 2: Summary of input parameters for individuals with T2DM, high-risk of CVD and living with obesity by IMD

Data source	IMD Quintile 1=most deprived				
	1	2	3	4	5
Age 18+ ONS 2020	8,416,780	9,129,081	9,196,807	8,989,415	8,724,767
Number of people with T2DM+obesity+high risk CVD (CPRD/ONS)	251,582	234,061	197,386	180,177	151,326

Data source	IMD Quintile 1=most deprived				
	1	2	3	4	5
Prevalence of T2DM+obesity+high risk CVD (%)	3.0	2.6	2.1	2.0	1.7
Share of T2DM+obesity+high risk CVD by IMD in total population of T2DM (CPRD)	0.248	0.2307	0.1946	0.1776	0.1492
Uptake of SGLT-2i (CPRD)	0.2218	0.223	0.2235	0.2297	0.2303
Average Incremental QALYs per person for SGLT-2i (economic analysis)	0.2815	0.2815	0.2815	0.2815	0.2815
Share of opportunity costs	0.2	0.2	0.2	0.2	0.2

Base-case results: Figure 1 shows the distribution of individuals in England with T2DM, obesity and high-risk CVD who have been prescribed SGLT-2 inhibitors. The total number of recipients is 228,373 with the highest number observed in the most deprived group (n=55,806) and the lowest in the least deprived group (n=34,860). Although these results combine both prevalence and uptake, the similar uptake rates across IMD groups mean these findings primarily reflect the prevalence of T2DM, obesity and high-risk of developing CVD.

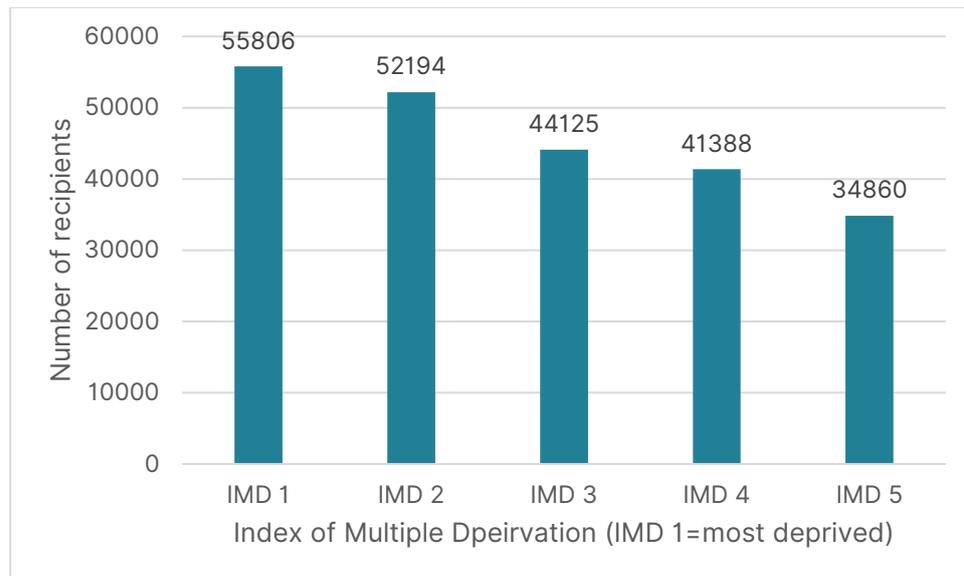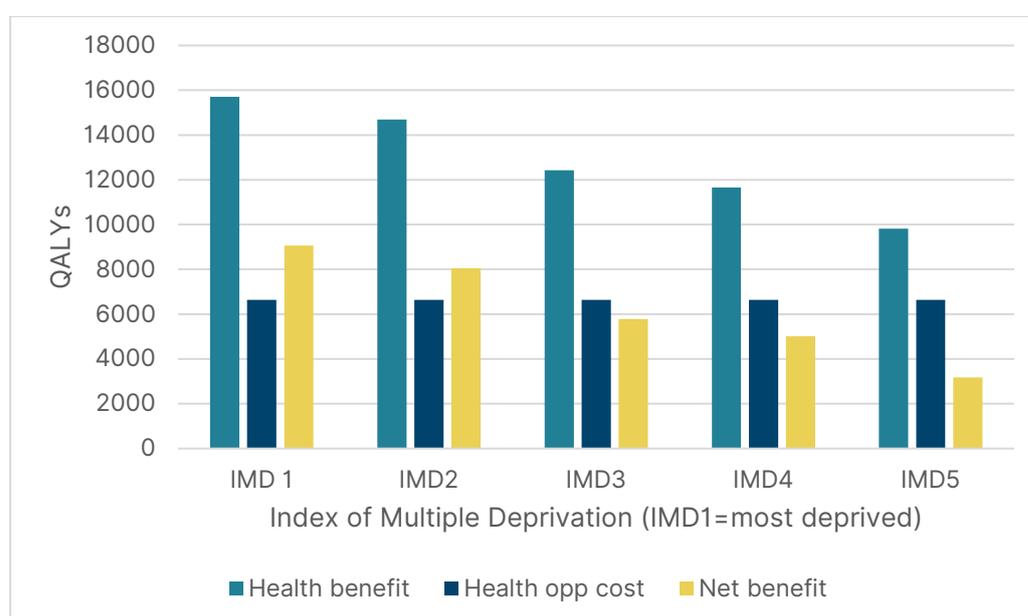**Figure 1: Uptake of SGLT-2 inhibitors by IMD (total n=228,373)**

Table 3 and Figure 2 show the distribution of health effects associated with receiving SGLT-2 inhibitors. Health benefits are quantified as QALY gains, while opportunity costs are represented by QALY losses. The net benefit combines these QALY gains and losses. This analysis is based on data from the economic analysis for the intervention and population, which estimated an incremental gain of 0.2815 QALYs, incremental costs of £2,908 and an ICER of £ £10,334/QALY. The results indicate that total health benefits are positive across all deprivation groups, with the highest benefits observed in the most deprived group (IMD1). Net health benefits, which factor in the potential health opportunities lost elsewhere in the system as a result of funding the intervention, remain positive for all groups. With equal opportunity costs of 6,641 QALYs applied to each group, the proportion of net benefit relative to total benefit is highest in the most deprived group (IMD1) (around 58%) and lowest in the most deprived group (IMD5) (around 32%) indicating that the intervention yields greater relative gains for more deprived populations.

Table 3: Distribution of health effects measured in QALYs of SGLT-2 inhibitors in individuals with living with T2DM, obesity and at high-risk of CVD (population totals)

	Index of multiple deprivation (IMD 1 = most deprived)					
Outcome	IMD 1	IMD2	IMD3	IMD4	IMD5	Total
Health benefit	15,709	14,693	12,421	11,651	9,813	64,287
Health opp* cost	6,641	6,641	6,641	6,641	6,641	33,205
Net benefit	9,068	8,052	5,780	5,010	3,172	31,082

*opp=opportunity (as in health opportunity cost)

Figure 2: Distribution of health effects (in QALYs) of SGLT-2 inhibitors in individuals with T2DM, obesity and high-risk of CVD (population totals)


Scenario 1: Impact of increasing the % of individuals with T2DM, obesity and high-risk of developing CVD who use SGLT-2 inhibitors

Figure 3 shows the effects of increasing the uptake of SGLT-2 inhibitors from 22% to 40%, 60% and 80%. For instance, at an uptake of 22% the total number of recipients in England is 223,220 which rises to 811,707 with an increase in uptake to 80%. Additionally, in line with the base-case analysis, the highest number of recipients is found in the most deprived group while the least deprived group consistently shows the lowest numbers across all levels

of increase in uptake. Note that this analysis applies a flat 22% uptake rate across IMD groups unlike the base-case results where 'actual' rates varied slightly between 22% and 23%.

Figure 3: Impact of increased SGLT-2 inhibitor uptake on number of recipients

Figure 3: Impact of increased SGLT-2 inhibitor uptake on number of recipients
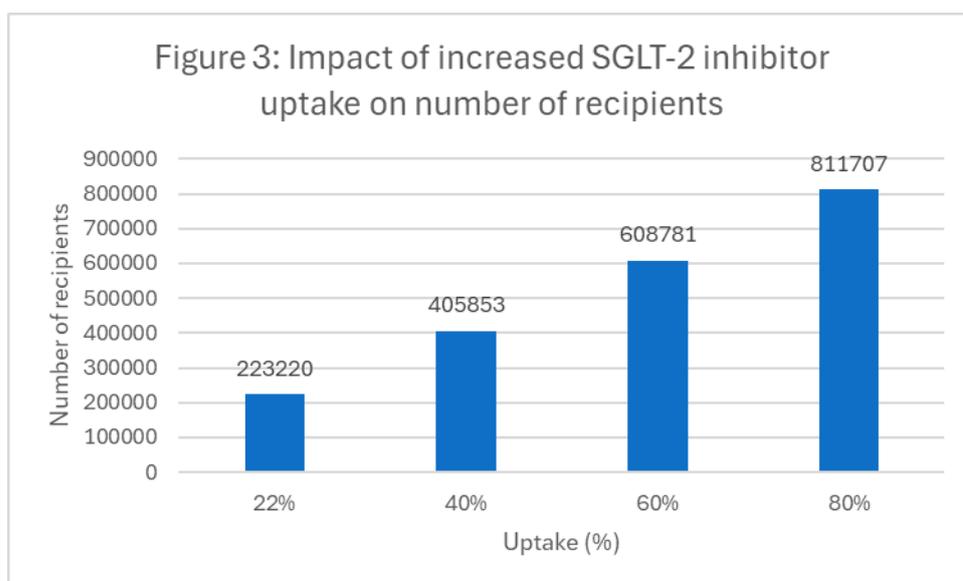
The health effects of these increases are shown in Table 4 and Figure 4. As expected, total health benefits rise sharply from 62,836 QALYs at 22% uptake to 228,496 QALYs at 80% uptake. Net health benefits follow the same trend but are lower due to opportunity costs which account for approximately 52% of the total benefits. Across all uptake levels, benefits follow a deprivation gradient with the most deprived group achieving the highest gains and the least deprived group the lowest (see Figure 5 for most and least groups).

Table 4: Total health effects of increasing uptake of SGLT-2 inhibitors in individuals with living with T2DM, obesity and at high-risk of CVD

	Increasing uptake of SGLT-2 inhibitors			
Uptake %	22%	40%	60%	80%
Health benefit	62,836	114,248	171,372	228,496

Health opp cost	32,456	59,011	88,517	118,022
Net benefit	30,380	55,237	82,855	110,473

Figure 4: Impact of increasing uptake of SGLT-2 inhibitors (IMD groups combined)
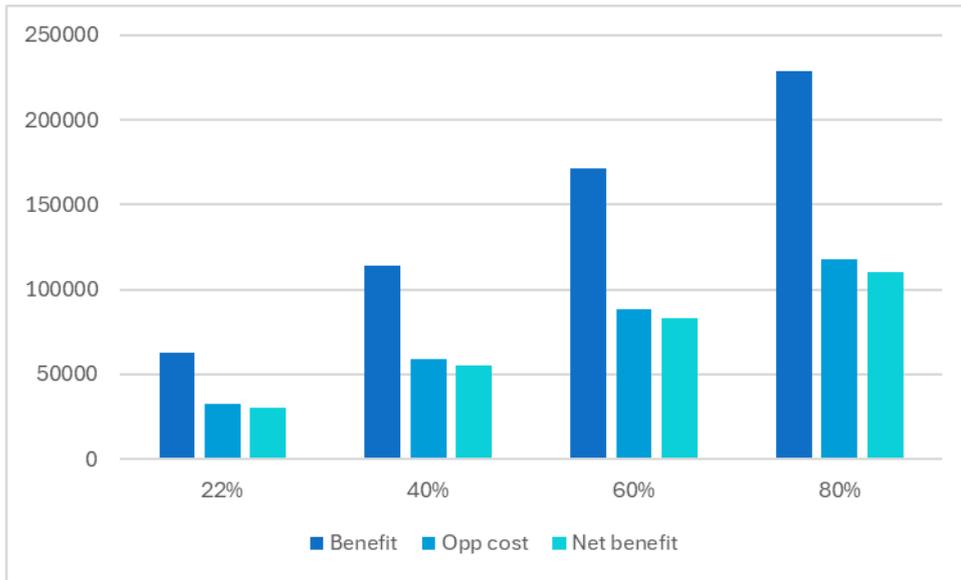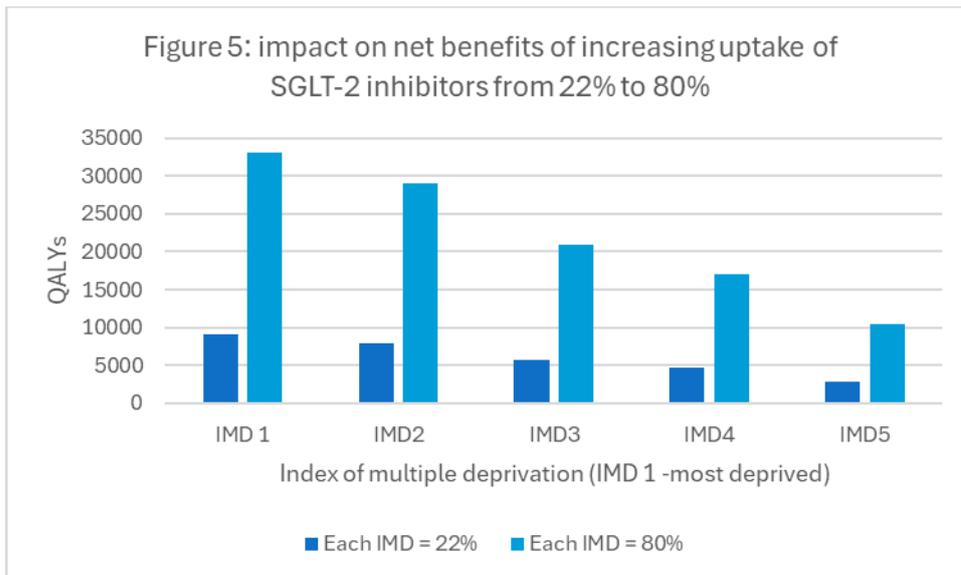

Figure 5: Impact on net benefits of increasing uptake of SGLT-2 inhibitors from 22% to 80%

Scenario 2: Health effects of adjusting the gradient in opportunity costs

In Scenario 2 we explore the impact of changing the assumption that opportunity costs are equally distributed across all IMD groups. This scenario uses the same incremental costs (£2,908) and QALYs (0.2815) as the base-case analysis. Table 5 shows how the opportunity costs are distributed across these groups under three different assumptions: a flat, slight or moderate gradient. The flat gradient assumes the opportunity costs are shared equally across the 5 groups with each group absorbing 20%. The slight gradient assumes a higher proportion of these costs fall on the most deprived group (22%) while the least deprived bears the smallest share (18%). The moderate gradient assumes the most deprived group faces an even greater burden, absorbing 24% of the opportunity costs.

**Table 5: Share of opportunity costs by IMD across 3 different gradients**

	Share of opportunity costs (IMD 1 = most deprived)				
Gradient	**IMD 1**	**IMD2**	**IMD3**	**IMD4**	**IMD5**
Flat	0.2	0.2	0.2	0.2	0.2
Slight	0.22	0.21	0.2	0.19	0.18
Moderate	0.24	0.22	0.2	0.18	0.16

The net health benefit across all deprivation groups under varying assumptions about the gradient in opportunity costs are shown in Table 6. Although the total net health benefits remain constant at 31,082 QALYs across all gradients, applying the slight and moderate gradients redistributes the opportunity costs: they increase for the most deprived groups and decrease for the least deprived. Consequently, net benefits decline for the two most deprived groups (IMD1 and 2) and rise for the two least deprived groups (IMD4 and 5), with the effect becoming more pronounced as the gradient steepens (see Figure 6).

Table 6: Effect on net health benefits of varying the gradient in opportunity costs

Gradient	Index of Multiple Deprivation (IMD1=most deprived)					
	IMD 1	**IMD2**	**IMD3**	**IMD4**	**IMD5**	**Total**
Flat	9,068	8,052	5,780	5,010	3,172	31,082
Slight	8,404	7,719	5,780	5,342	3,836	31,082
Moderate	7,740	7,387	5,780	5,674	4,500	31,082

Figure 6: Impact on net health benefits of changing the gradient in opportunity costs
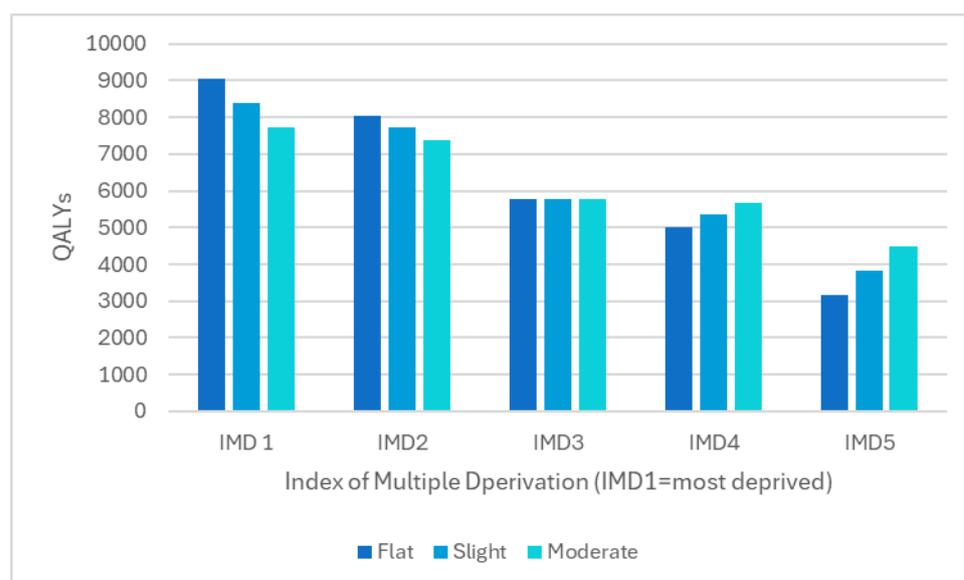
Individuals with T2DM, high risk CVD and living with overweight

These analyses focus on individuals with T2DM who are living with overweight and at high risk of developing CVD. Table 7 summarises the inputs to the tool and their corresponding data sources. An estimated 582,752 individuals age 18 and over in England have T2DM, are overweight and are at

high-risk of developing CVD, equating to an overall prevalence of approximately 1.3%. Table 7 also shows that SGLT-2 inhibitor uptake is similar across IMD groups.

Table 7: Summary of inputs for individuals with T2DM, high risk CVD and living with overweight (n=582,752)

Data source	Index of Multiple Deprivation Quintiles (IMD 1 = most deprived)				
	IMD 1	IMD 2	IMD 3	IMD 4	IMD 5
Age 18+ ONS 2020	8,416,780	9,129,081	9,196,807	8,989,415	8,724,767
Number of people with T2DM+Overweight + High-Risk CVD (CPRD/ONS)	114,539	126,061	116,597	115,904	109,651
Prevalence of T2DM + Overweight + H-R CVD	1.4%	1.4%	1.3%	1.3%	1.3%
Share of T2DM + Overweight + H-R CVD	0.1965	0.2163	0.2001	0.1989	0.1882
CPRD Uptake of SGLT-2i	0.2155	0.2123	0.2091	0.2103	0.21
Average Incremental QALYs per person SGLT-2i	0.2181	0.2181	0.2181	0.2181	0.2181
Share of opportunity costs	0.2	0.2	0.2	0.2	0.2

Base-case results: Figure 7 shows the distribution of individuals aged 18 and over in England with T2DM, overweight and high-risk CVD that have been

prescribed SGLT-2 inhibitors. The total number of recipients is 123,228 with the highest number observed in the second most deprived group (n=26,760) and the lowest in the least deprived group (n=23,032). IMD3, which is the second most populous group, has a similar number of recipients as IMD4.

Figure 7: Distribution of recipients of SGLT-2 inhibitors (n=123,228)
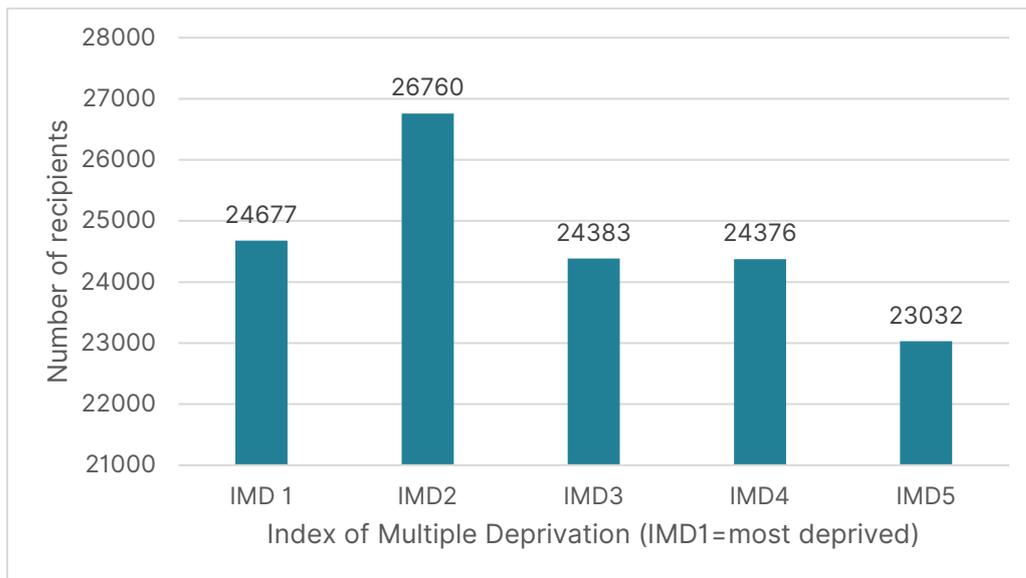
The health impacts of the SGLT-2 inhibitors are shown in Figure 8 and Table 8. These findings are based on the economic analysis conducted for this subgroup which estimated an incremental cost of £2,535 and incremental gain of 0.2181 QALYs leading to an ICER of £11,619 per QALY gained. The results show that total health benefits are positive across all groups, and net health benefits, which adjust for the opportunity costs of funding the intervention, are also positive.

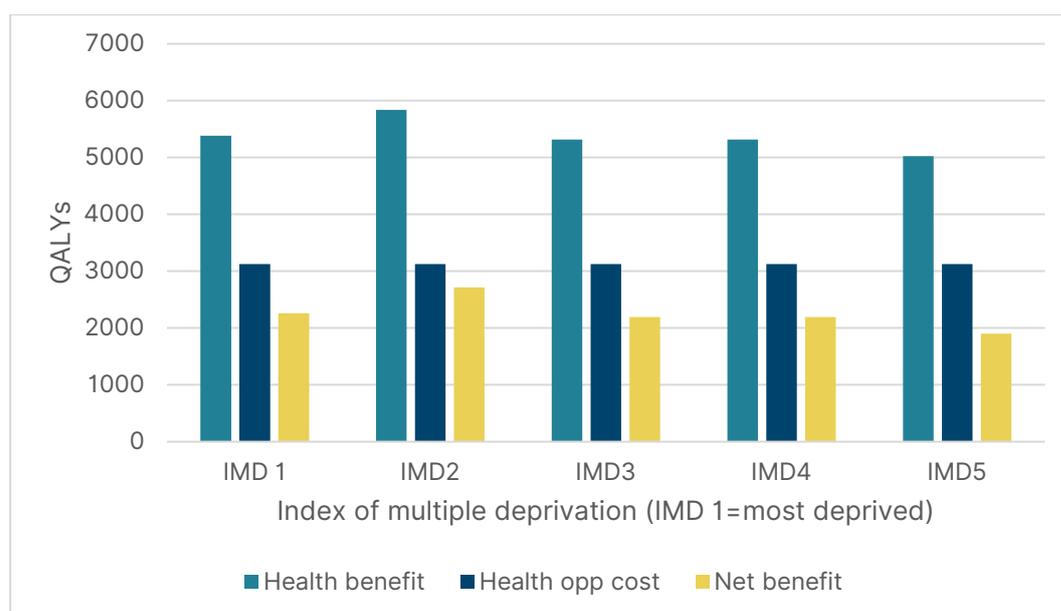**Figure 8: Health effects of SGLT-2 inhibitors by IMD**

Table 8: **Distribution of health effects of SGLT-2 inhibitors (IMD 1 = most deprived)**

Outcome	IMD 1	IMD2	IMD3	IMD4	IMD5	Total
Health benefit	5,382	5,836	5,318	5,316	5,023	26,876
Health opp cost	3,124	3,124	3,124	3,124	3,124	15,619
Net benefit	2,258	2,713	2,194	2,193	1,899	11,257

Individuals aged 18 to 39 with T2DM and high-risk CVD (early onset)

The estimated population in England of people aged 18 years to 39 years is 16,043,943. The estimated total number of individuals with T2DM and high-risk CVD in this age range is estimated to be 12,784 (ONS/CPRD) resulting in an overall prevalence of 0.07%.

Table 9 summarises the inputs to the tool and their corresponding data sources. It shows a gradient in prevalence which is highest in the most deprived group and lowest in the least deprived group. It also shows

differences in uptake, with the lowest uptake at 19% in the most deprived group and highest at 24%% in the least deprived group.

Table 9: Summary of input parameters for individuals age 18 to 39 with T2DM and high-risk CVD (n=12,784)

Data source	Index of Multiple Deprivation Quintiles (IMD 1 = most deprived)				
	IMD 1	IMD 2	IMD 3	IMD 4	IMD 5
Age 18-39 ONS 2020	3,607,589	3,764,352	3,310,463	2,871,162	2,490,377
Number of people with T2DM + H-R CVD + <40(CPRD/ONS)	5,058	3,326	2,081	1,367	952
Prevalence of T2DM + H-R CVD + <40 (CPRD/ONS)	0.14%	0.09%	0.06%	0.05%	0.04%
Share of T2DM + H-R CVD + <40 (CPRD)	0.396	0.260	0.163	0.107	0.074
Uptake of SGLT-2i (CPRD)	0.1871	0.2097	0.2207	0.2105	0.2442
Average Incremental QALYs per person SGLT-2i	0.2983	0.2983	0.2983	0.2983	0.2983
Opportunity costs	0.2	0.2	0.2	0.2	0.2

Base-case results: Figure 9 below shows the distribution of individuals in England aged 18-39 years with T2DM and high-risk CVD who have been prescribed SGLT-2 inhibitors. The total number of recipients is 2,624 with the greatest number in the most deprived group (n=946) and the lowest in the least deprived group (n=233). This reflects the population size within each IMD group which masks the difference in uptake of SGLT-2 inhibitors across these groups.

Figure 9: Distribution of recipients of SGLT-2 inhibitors (n=2,624)
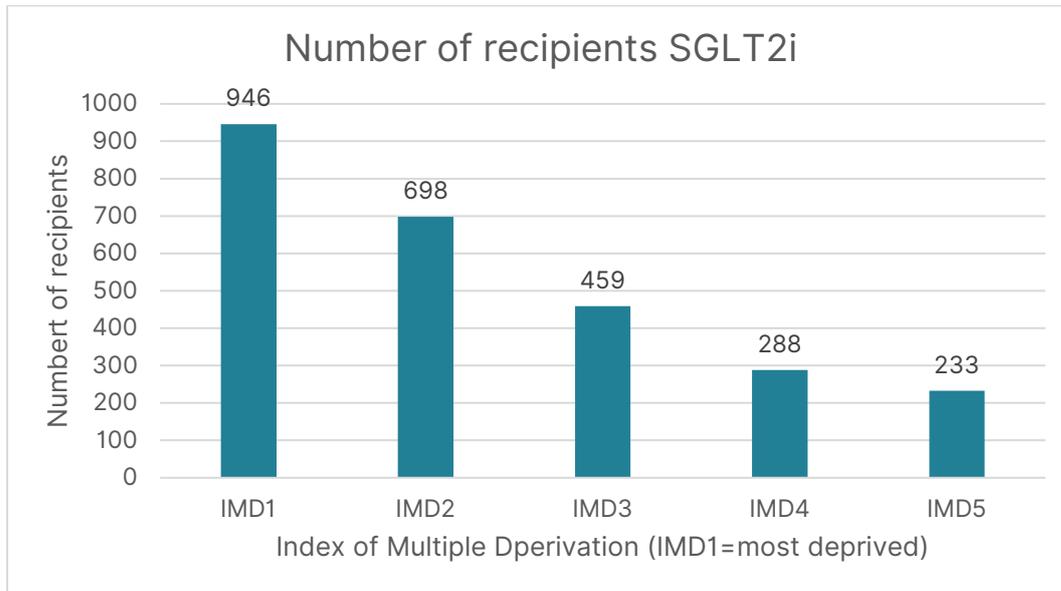
For this subgroup, the economic analysis found that SGLT-2 inhibitors offer greater health benefits but at a higher cost than the comparator, with incremental QALYs of 0.2983 and incremental costs of £3,841 resulting in an ICER of £12,877/QALY. Based on these findings, the current analysis shows that total health benefits are positive across all IMD groups (total 783 QALYs), but net health benefits, after accounting for equal opportunity costs, are very small overall (279 QALYs) and negative for the two least deprived groups (IMD4 and 5) (see Figure 10 and Table 10). This means that for younger individuals in the least deprived groups the health gains from SGLT-2 inhibitors are outweighed by the health losses caused by displacing other interventions.

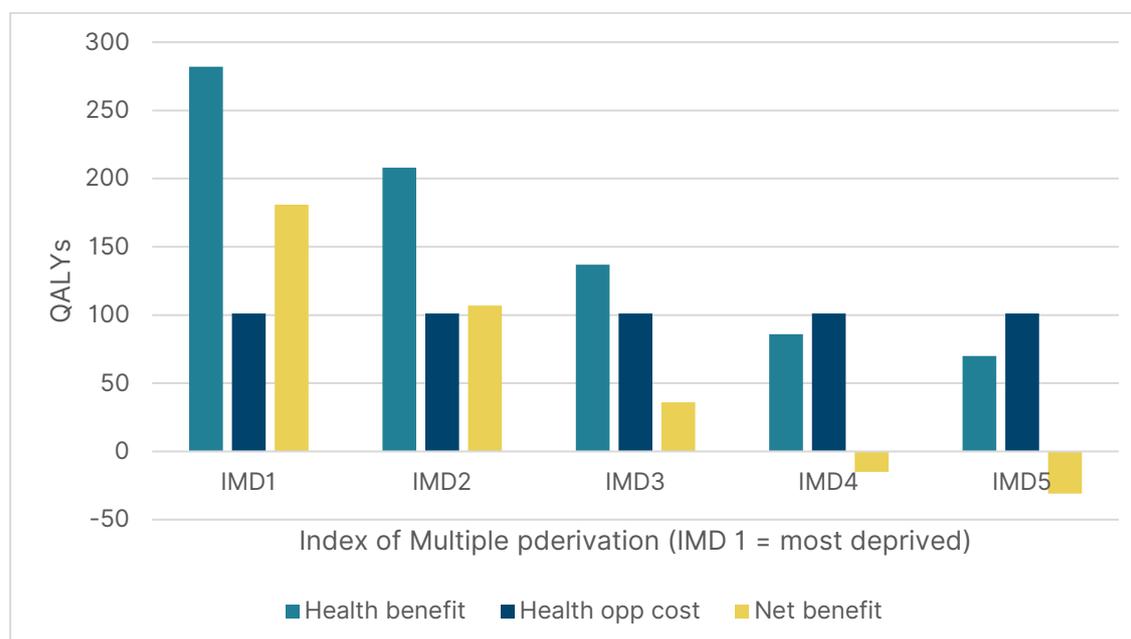**Figure 10: Health effects (QALYs) of SGLT-2 inhibitors in individuals age 18-39 with T2DM and high-risk CVD**

Table 10: Distribution of health effects (QALYs) of SGLT-2 inhibitors in individuals aged 18-39 years with T2DM and high risk CVD

	IMD1	IMD2	IMD3	IMD4	IMD5	Total
Health benefit	282	208	137	86	70	783
Health opp cost	101	101	101	101	101	504
Net benefit	181	107	36	-15	-31	279

Individuals with T2DM and atherosclerotic cardiovascular disease (aCVD)

The next set of analyses focus on individuals with T2DM and aCVD. A summary of the inputs and corresponding data sources are shown in Table 11.

The estimated total number of individuals with T2DM and aCVD is 870,586. With a total population of 44,456,850, this results in an overall prevalence of 1.95%. Table 11 shows a gradient in the prevalence of T2DM and aCVD, with

the highest rates found in the most deprived groups (2.5%) and the lowest in the least deprived groups (1.6%). The uptake of SGLT-2 inhibitors, estimated using CPRD data, indicates a very slight gradient within this population with the highest uptake in the most deprived group and the lowest in the least deprived group.

Table 11: Summary of input parameters by IMD for individuals with T2DM and aCVD

	Index of Multiple Deprivation Quintiles (IMD 1 = most deprived)				
Data source	IMD 1	IMD 2	IMD 3	IMD 4	IMD 5
Age 18+ ONS 2020	8,416,780	9,129,081	9,196,807	8,989,415	8,724,767
Number of people with T2DM + aCVD (CPRD/ONS)	208,987	191,768	166,741	162,387	140,703
Prevalence of T2DM + aCVD	2.5	2.1	1.81	1.81	1.61
Share of T2DM + aCVD	0.2401	0.2203	0.1915	0.1865	0.1616
CPRD Uptake of SGLT-2i	0.2264	0.2208	0.2148	0.2175	0.2114
Average Incremental QALYs per person SGLT-2i	0.2627	0.2627	0.2627	0.2627	0.2627
Share of opportunity costs	0.2	0.2	0.2	0.2	0.2

Base-case: Figure 11 shows the distribution of the number of individuals with T2DM and aCVD who are prescribed SGLT-2 inhibitors. The total number of

recipients is 190,537 and the results show that the number of recipients is largest in the most deprived group and smallest in the least deprived group. These results are primarily a function of the prevalence of T2DM and aCVD across deprivation groups and to a lesser extent the uptake of the intervention which is marginally higher in the most deprived group and lower in the least deprived group.

Figure 11 : Number of T2D & aCVD Recipients of SGLT2 inhibitors
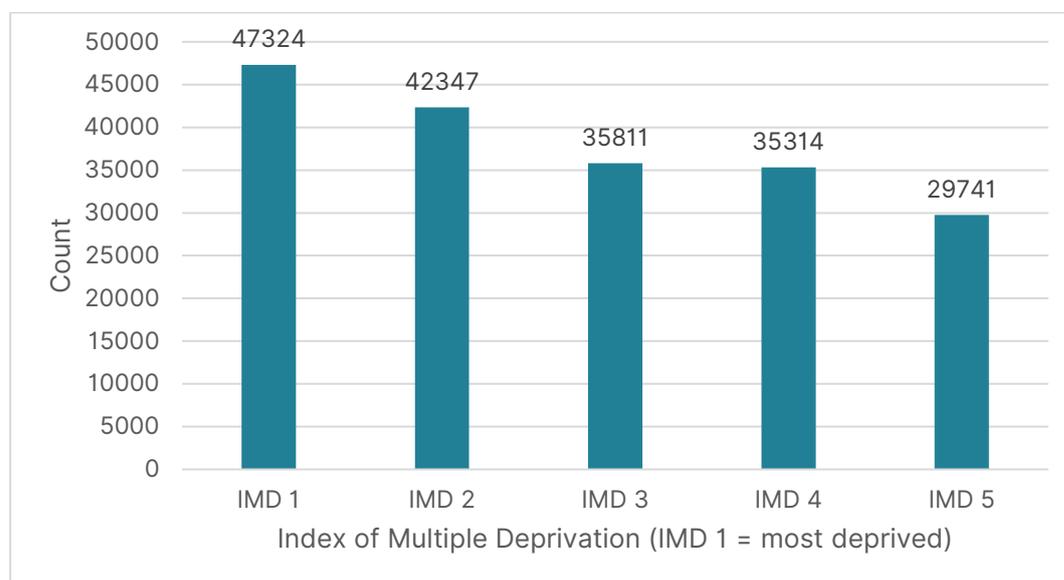

Figure 12 and Table 12 show the distribution of health effects of SGLT-2 inhibitors across IMD groups. These findings are based on the economic analysis for this subgroup which estimated an incremental cost of £3,981 and incremental gain of 0.2627 QALYs resulting in an ICER of £15,152 per QALY gained. The results indicate positive total health benefits across all IMD groups with the greatest benefits observed in the most deprived. When opportunity costs are considered, net health benefits remain positive for all IMD groups.

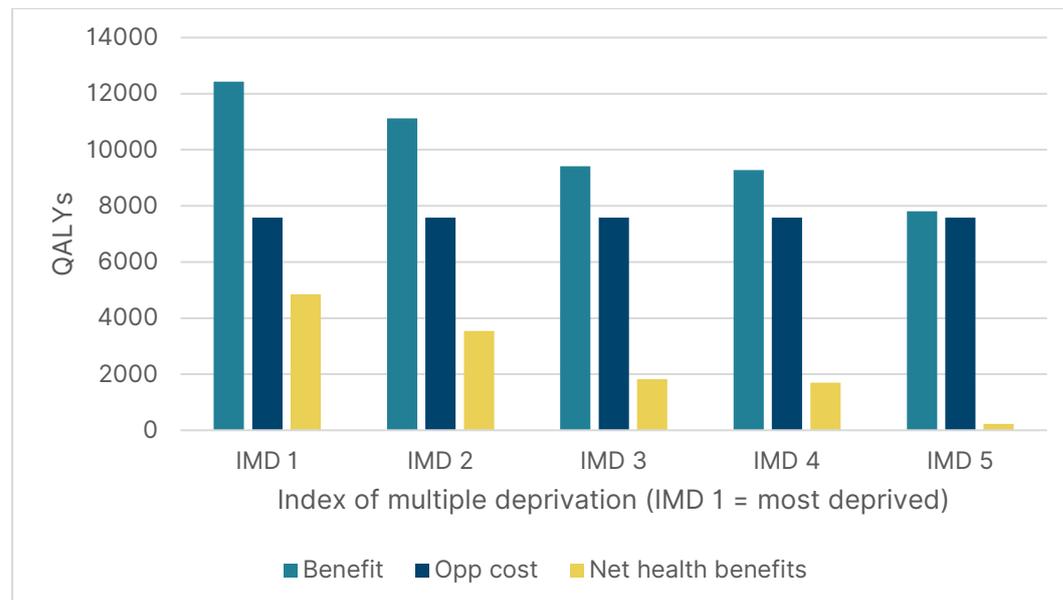**Figure 12: Distribution of health effects of SGLT-2 inhibitors across IMD groups (IMD1 = most deprived)**

Table 12: Distribution of health effects (QALYs) of SGLT-2 inhibitors in individuals with T2DM and aCVD

	IMD 1	IMD 2	IMD 3	IMD 4	IMD 5	Total
Benefit	12,432	11,125	9,408	9,277	7,813	50,054
Opp cost	7,585	7,585	7,585	7,585	7,585	37,926
Net benefits	4,847	3,539	1,822	1,692	228	12,128

Individuals with T2DM and chronic heart failure (CHF)

This next set of analyses focus on individuals with T2DM and CHF. A summary of the inputs to the tool and corresponding data sources is shown in Table 13.

The total number of individuals with T2DM and CHF is estimated to be 258,993 (ONS/CPRD). Given a total population of 44,456,850 this leads to an overall prevalence of 0.58%. Table 13 shows a gradient in the prevalence of

T2DM and CHF, with the highest rates found in the most deprived groups (0.81%) and the lowest in the least deprived groups (0.53%). The uptake of SGLT-2 inhibitors, estimated using CPRD data, indicates a relatively uniform distribution within this population, showing no significant patterns across the IMD groups.

Table 13: Summary of input parameters for individuals with T2DM and CHF

Data source	Index of multiple deprivation (IMD 1 = most deprived)				
	1	2	3	4	5
Age 18+ ONS 2020	8416780	9129081	9196807	8989415	8724767
Number of people with T2DM + CHF (CPRD/ONS)	62,316	56,799	49,869	48,208	41,802
Prevalence of T2DM + CHF	0.74%	0.62%	0.54%	0.54%	0.48%
Share of T2DM + CHF	0.2406	0.2193	0.1925	0.1861	0.1614
CPRD Uptake of SGLT-2i	0.3014	0.3043	0.2921	0.3116	0.3009
Average Incremental QALYs per person SGLT-2i	0.1375	0.1375	0.1375	0.1375	0.1375
Share of opportunity costs	0.2	0.2	0.2	0.2	0.2

Base-case results: Figure 13 shows the distribution of the number of individuals in England with T2DM and CHF who are prescribed SGLT-2 inhibitors. The total number of recipients is 78,224 and the results show that the number of recipients is largest in the most deprived group and smallest in

the least deprived group. These results are a function of both the prevalence of T2DM and CHF as well as the uptake of the intervention which is relatively flat.

Figure 13: Distribution of health effects of SGLT-2 inhibitors in individuals with T2DM and CHF across IMD groups (IMD1 = most deprived)
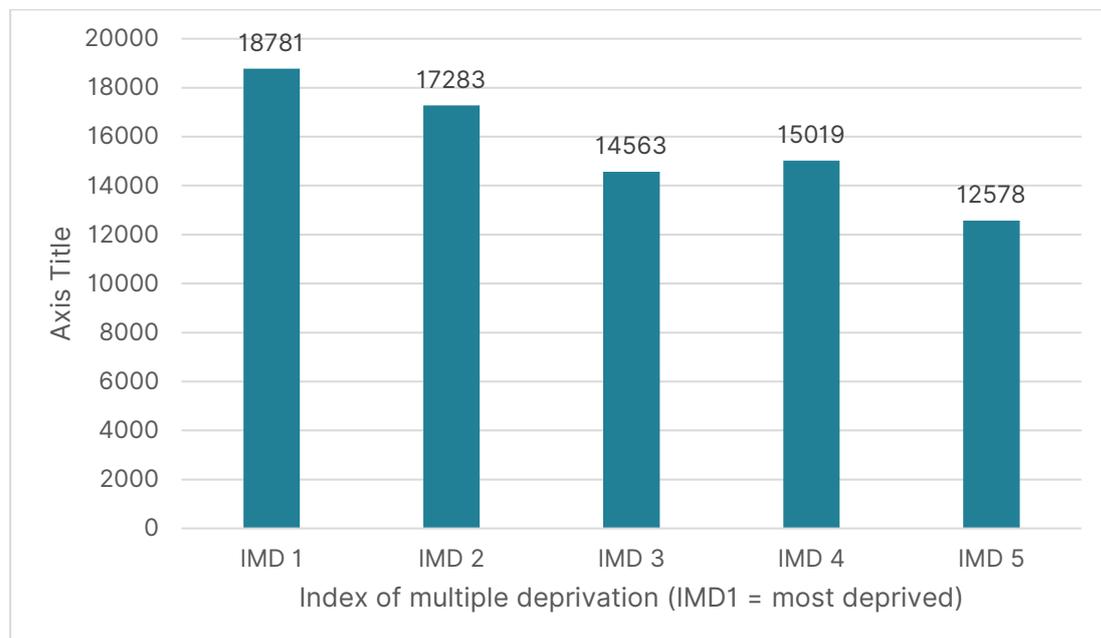

Figure 14 and Table 14 show the health effects SGLT-2 inhibitors based on the economic analysis for this population and intervention which estimated an incremental gain of 0.1375 QALYs, incremental costs of £2,038 and an ICER of £14,817 per QALY gained. The results demonstrate that total health benefits are positive across all IMD groups. When opportunity costs associated with funding the intervention are considered, net health benefits remain positive for all IMD groups.

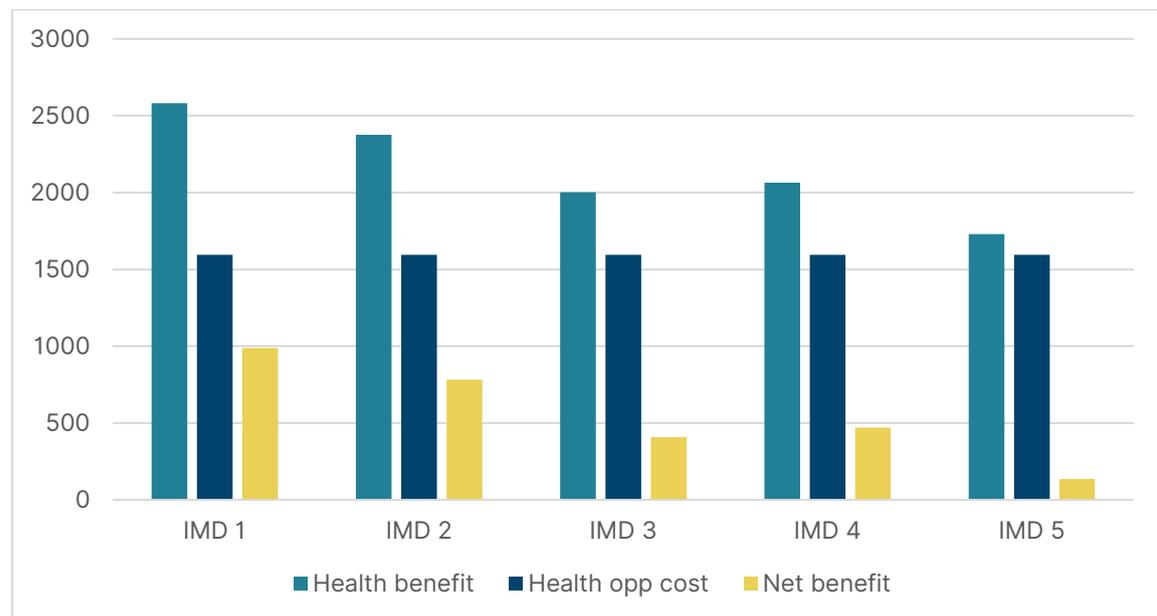**Figure 14: Distribution of health effects (QALYs) of SGLT-2 inhibitors in individuals with T2DM and CHF**

Table 14: Distribution of health effects (QALYs) of SGLT-2 inhibitors in individuals with T2DM and CHF

	IMD 1	IMD 2	IMD 3	IMD 4	IMD 5	Total
Health benefit	2,582	2,376	2,002	2,065	1,729	10,756
Health opp cost	1,594	1,594	1,594	1,594	1,594	7,972
Net benefit	988	782	408	471	135	2,785

Individuals with T2DM and CKD stages 1-3

A total of 991,965 individuals aged 18 and over have T2DM and CKD stages 1-3, representing a prevalence of 2.0% within the overall population of 44,456,850. Table 15 shows the inputs to the health inequalities tool for this population and shows that prevalence is highest in the most deprived group (IMD 1) and lowest in the least deprived group (IMD 5). Additionally, the uptake of SGLT-2 inhibitors is slightly higher among the more deprived groups compared to the less deprived groups.

Table 15: Summary of input parameters by IMD for individuals with T2DM and CKD stages 1-3

Data source	Index of Multiple Deprivation Quintiles (IMD 1 = most deprived)				
	IMD 1	IMD 2	IMD 3	IMD 4	IMD 5
Age 18+ ONS 2020	8,416,780	9,129,081	9,196,807	8,989,415	8,724,767
Number of people with T2DM + CKD1-3 (CPRD/ONS)	218,853	222,037	196,899	185,928	168,248
Prevalence of T2DM + CKD1-3	2.6%	2.4%	2.1%	2.1%	1.9%
Share of T2DM + CKD1-3	0.2206	0.2238	0.1985	0.1874	0.1696
CPRD Uptake of SGLT-2i	0.2272	0.223	0.2158	0.2147	0.2083
Average Incremental QALYs per person SGLT-2i	0.2874	0.2874	0.2874	0.2874	0.2874
Share of opportunity costs	0.2	0.2	0.2	0.2	0.2

Figure 15 shows the distribution of the number of individuals with T2DM and CKD stages 1-3 who have been prescribed SGLT-2 inhibitors. A total of 216,671 are recipients, with the largest number found in the most deprived group and the lowest in the least deprived group. These results reflect both the prevalence of T2DM and CKD stages 1-3 and the uptake of the intervention which both show a decreasing gradient from the most deprived to the least deprived groups.

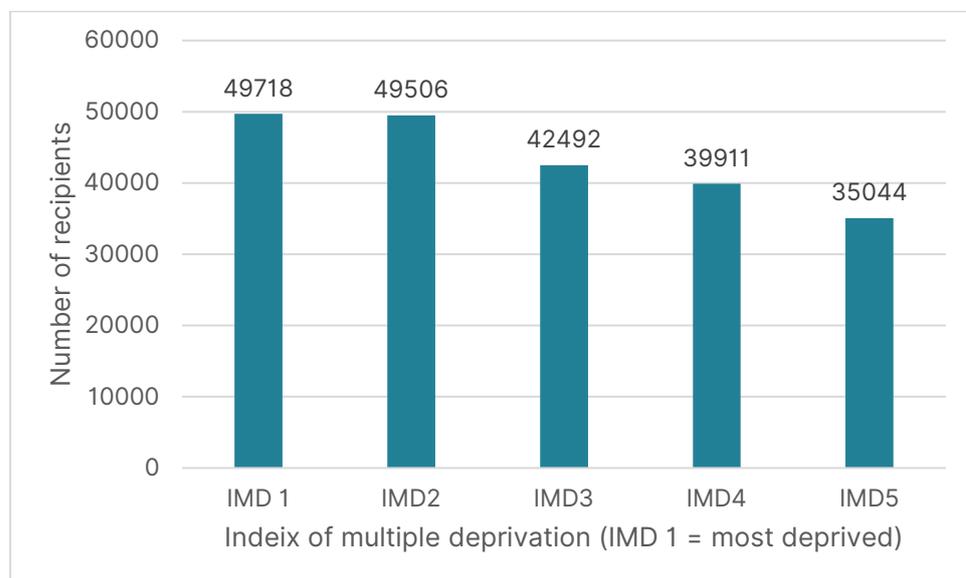**Figure 15: Number of recipients of SGLT2 inhibitors (n=216,671)**

Figure 16 and Table 16 show the health effects SGLT-2 inhibitors for individuals with T2DM and CKD stages 1-3. They are based on the economic analysis which estimated an incremental gain of 0.2874 QALYs and incremental costs of £3,052 resulting in an ICER of £10,620 per QALY gained. Both total and net health benefits are positive across all IMD groups, with the greatest benefits observed in the most deprived group and the lowest in the least deprived group, consistent with the deprivation gradient. The overall totals for health benefit and net benefit indicate that opportunity costs reduce but do not eliminate the gains.

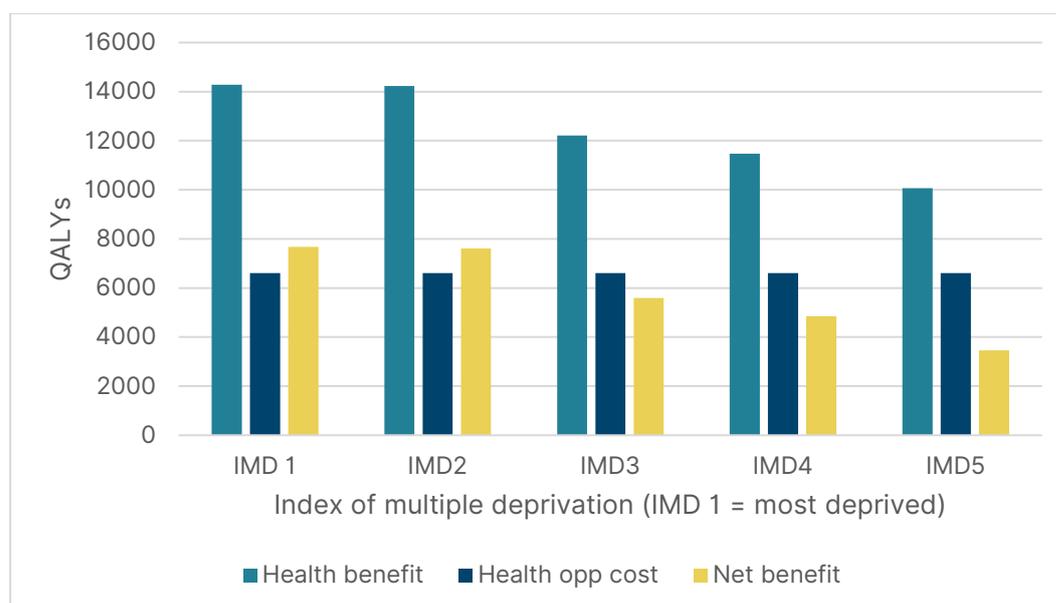**Figure 16: Health effects (QALYs) of SGLT-2 inhibitors in individuals with T2DM and CKD stages 1-3**

Table 16: Distribution of health effects (QALYs) of SGLT-2 inhibitors (IMD 1 = most deprived)

	IMD 1	IMD2	IMD3	IMD4	IMD5	Total
Health benefit	14,289	14,228	12,212	11,470	10,072	62,271
Health opp cost	6,613	6,613	6,613	6,613	6,613	33,064
Net benefit	7,676	7,615	5,599	4,858	3,459	27,207

Individuals with T2DM and CKD stage 4

A total of 65,247 individuals aged 18 and over in England are estimated to have T2DM and CKD stage 4, representing a prevalence of 0.15% within the overall population of 44,456,850. Table 17 shows the inputs to the health inequalities tool for this population. It shows that prevalence is similar across IMD groups 1-5 with no clear pattern in the uptake of SGLT-2 inhibitors across these groups.

Table 17: Summary of input parameters by IMD for individuals with T2DM and CKD stage 4

| Data source | Index of Multiple Deprivation Quintiles (IMD 1 = most deprived) | | | | |
	IMD 1	IMD 2	IMD 3	IMD 4	IMD 5
Age 18+ ONS 2020	8,416,780	9,129,081	9,196,807	8,989,415	8,724,767
Number of people with T2DM + CKD4 (CPRD/ONS)	14,050	14,114	13,241	12,167	11,675
Prevalence of T2DM + CKD4	0.2%	0.2%	0.2%	0.1%	0.1%
Share of T2DM + CKD4	0.2153	0.2163	0.2029	0.1865	0.1789
CPRD Uptake of SGLT-2i	0.227	0.2425	0.2557	0.26	0.2374
Average Incremental QALYs per person SGLT-2i	0.2935	0.2935	0.2935	0.2935	0.2935
Share of opportunity costs	0.2	0.2	0.2	0.2	0.2

Figure 17 shows the number of recipients of SGLT-2 inhibitors across the 5 IMD groups. There is no clear discernible pattern among the groups, with the largest number of recipients found in the second most deprived group (IMD2) and the lowest number in the least deprived group (IMD5).

Figure 17: Number of recipients of SGLT-2 inhibitors in individuals with T2DM and CKD stages 4
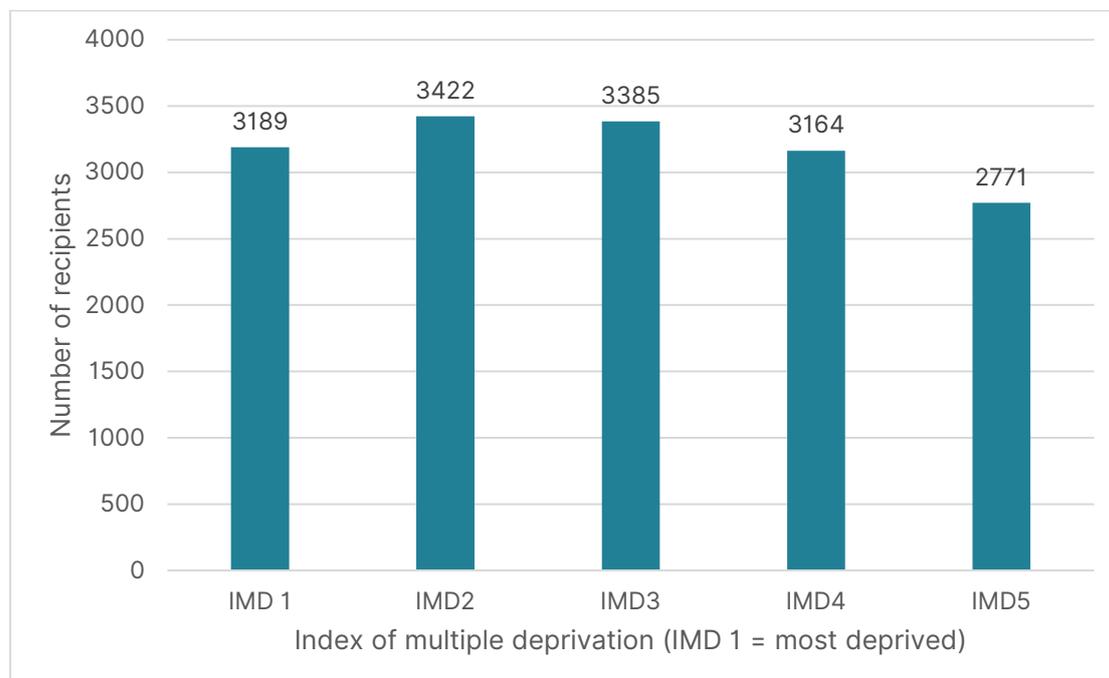

Figure 18 and Table 18 show the health effects SGLT-2 inhibitors for individuals with T2DM and CKD stage 4. They are based on the economic analysis which estimated an incremental gain of 0.2935 QALYs and incremental costs of £2,764 resulting in an ICER of £9,416 per QALY gained. Both total and net health benefits are positive across all IMD groups, even after accounting for opportunity costs, which reduce but do not eliminate overall gains. Unlike CKD stages 1-3, there is no clear deprivation gradient for CKD Stage 4: IMD groups 2 and 3 show the greatest benefits while the least deprived groups show the lowest gains. However, these differences are modest, indicating a relatively equitable distribution of benefits. Aggregate benefits for CKD stage 4 are smaller than for CKD stages 1-3 because of the smaller population size (around 65,247 for stage 4 vs 216,693 for stages 1-3), rather than differences in per person effectiveness.

Figure 18: Health effects (QALYs) of SGLT-2 inhibitors in individuals with T2DM and CKD stages 4
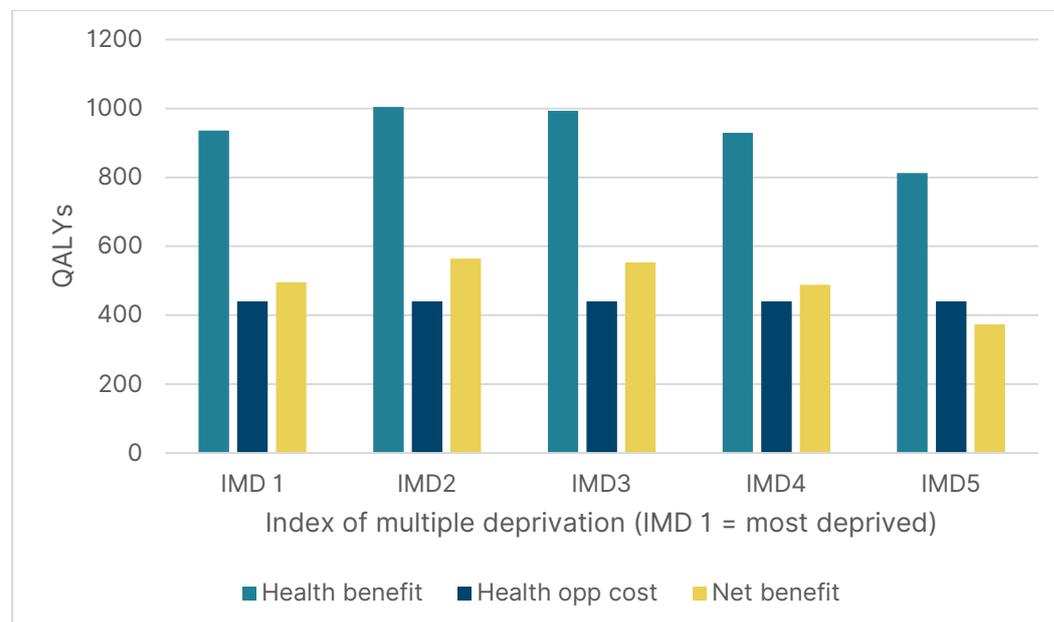

Table 18: Distribution of health effects of SGLT-2 inhibitors in individuals with T2DM and CKD stage 4 (IMD 1 = most deprived)

Outcome	IMD 1	IMD2	IMD3	IMD4	IMD5	Total
Health benefit	936	1,004	993	929	813	4,676
Health opp cost	440	440	440	440	440	2,202
Net benefit	496	564	553	488	373	2,474

Summary of key findings

Table 19 provides a high-level summary of key findings across the seven population groups. The economic analysis indicated that SGLT-2 inhibitors are cost effective for all populations analysed, with all ICERs falling below the £20,000/QALY threshold. Total health benefits were positive across all populations and IMD groups. Net benefits, which account for opportunity costs, also remained positive for every group except the early onset population with comorbid high-risk CVD, where they were positive in IMD groups 1 to 3 but negative in the two least deprived groups (IMD4 & 5).

Aggregate benefits vary substantially due to differences in population size across groups, not differences in per-person effectiveness. For example, CKD stages 1–3 account for 62,271 QALYs compared to 783 QALYs for early-onset T2DM with high-risk CVD. Despite these variations in aggregate outcomes, per-person cost-effectiveness remains strong across all groups.

Table 19: Key findings across seven populations analysed

Population	ICER	Total health benefits	Opportunity costs	Total net benefits	IMDs with negative net benefits
T2DM + H-R CVD + obesity	£10,334	64,287	33,205	31,082	None
T2DM + H-R CVD + overweight	£11,619	26,876	15,619	11,257	None
T2DM + H-R CVD + ,<40 years (early onset)	£12,877	783	504	279	IMD4 & IMD5
T2DM + aSCVD	£15,152	50,054	37,926	12,128	None
T2DM + CHF	£14,817	10,756	7,971	2,785	None
T2DM + CKD stages 1-3	£10,620	62,271	33,064	29,207	None
T2DM + CKD stage 4	£9,416	4,676	2,202	2,474	None

Discussion

These analyses assess the equity impacts of SGLT-2 inhibitors across seven population subgroups with T2DM and selected comorbidities. They show that the prevalence of T2DM and associated conditions is highest among the most deprived groups. In addition, uptake of SGLT-2 inhibitors is generally low and relatively uniform across IMD groups, averaging around 22% with slightly higher uptake among individuals with T2DM and CHF (30%) and lower uptake among the most deprived individuals with early onset T2DM and high-risk CVD (19%).

Assuming equal effectiveness across IMD groups, scenario analyses of individuals with T2DM, obesity and high-risk CVD showed that increasing uptake could lead to substantial health gains. For example, raising uptake from 22% to 80% increased total QALYs from 62,836 to 228,496. However, opportunity costs were significant, accounting for 52% of total health gains, reducing net benefits to 30,380 QALYs at 22% and 110,473 QALYs at 80% uptake. This suggests that although the treatment is beneficial at the individual level, its overall efficiency at the population level is constrained by the high opportunity costs, i.e. the health benefits that could be achieved if those resources were used elsewhere. Nevertheless, the ICER of £10,334/QALY is below the threshold of £20,000 per QALY gained indicating that the treatment provides health benefits at an acceptable cost.

Across all populations evaluated, total health benefits were positive across deprivation levels. Net benefits were also positive for all groups, except one. For individuals with early-onset T2DM and high-risk CVD, net benefits were negative in IMD groups 4 and 5. Individuals with aCVD, CKD (both stages 1–3 and stage 4), and those with overweight or obesity with high CVD risk, had positive net benefits across all IMD groups, with ICERs below the cost-effectiveness threshold.

These findings suggest that SGLT-2 inhibitors generally represent good value for money across most high-risk T2DM populations, particularly when opportunity costs are carefully considered. However, in subgroups where net benefits are marginal or negative in less deprived IMDs, alternative resource allocations may yield greater overall health gains.

Balancing individual efficacy with population-level efficiency requires careful consideration of opportunity costs and equitable resource allocation. Given finite healthcare resources, broader impacts should be assessed to optimise overall health outcomes

When uptake rates are similar and effectiveness is assumed to be equal across groups, the key driver of health outcomes by IMD is the prevalence of the condition. The greater health improvements observed in more disadvantaged groups mainly reflect their larger population size. To address the highest burden of disease and reduce health inequalities, strategies should focus on mitigating impact within these groups, such as prioritizing targeted interventions tailored to their needs.

However, if opportunity costs in disadvantaged groups are underestimated, interventions may not deliver the expected benefits as displaced health gains elsewhere could be greater. Therefore, it is also important to consider approaches that support and promote uptake among these groups. Outreach to under-represented groups, if shown to be effective and cost-effective, could help ensure equitable access and maximise health benefits.

A scenario analysis explored how changing the value assigned to the health opportunity costs affected outcomes. It focussed on the largest subgroup, people with T2DM, high-risk CVD and obesity, and found that these changes influenced the distribution of net benefits. Shifting from a flat distribution to a slight or moderate gradient, where health opportunity costs were highest in the most deprived group and lowest in the least deprived, led to reduced net benefits for the most deprived group and increased net benefits for the least

deprived. However, this shift did not outweigh the impact of the steep gradient in disease prevalence which continued to drive higher positive net benefits for IMD groups 1 and 2. These findings suggest that while assumptions about opportunity costs can influence distributional outcomes, the underlying burden of disease in the most deprived groups remains a key driver of health gains—reinforcing the importance of targeting interventions where prevalence is highest, even when opportunity costs are high.

The economic analyses for the guideline showed that SGLT-2 inhibitors are cost effective in all seven populations considered, each with T2DM and varying co-morbidities. While total health benefits were positive for all populations, the distributional analysis incorporating opportunity costs showed that net benefits were positive across most population and IMD groups with one exception. For individuals with early onset T2DM and high-risk CVD, net benefits were negative in the two least deprived groups (IMD4 & 5).

This indicates that, at the population level, the health gains from SGLT-2 inhibitors in these groups do not fully offset the health losses incurred elsewhere in the healthcare system due to the reallocation of resources. However, this does not mean the intervention is ineffective or harmful at the individual level. Total health benefits remain positive, and the ICER of £12,887/QALY falls below the cost effectiveness threshold, indicating acceptable value for money. This distinction highlights the importance of evaluating both individual-level benefits and population-level efficiency when making resource allocation decisions.

These findings highlight a trade-off at the population level, necessitating decisions that balance the maximisation of health benefits with the minimisation of health losses across different deprivation groups.

The Health and Social Care Act 2012 introduced legal duties for the NHS and other public bodies to consider health inequalities when making decisions. By showing the health impacts and opportunity costs across different levels of

deprivation quintiles, these analyses can help identify both positive and negative effects on health inequalities. Ultimately, they aim to support decisions that ensure new investments deliver greater benefits for the most disadvantaged groups compared to current practices.

Importantly, the prevalence of T2DM and its comorbidities follow a clear gradient across deprivation groups, with the highest rates in the most deprived populations. While targeting this condition may not fully close the gap between the most and least deprived, it will positively impact all groups, particularly the most deprived, which also represent the largest population cohort.

Limitations

One of the key limitations of the analyses reported here concern the assumptions surrounding the distributional inputs used in the tool. The tool uses 4 main inputs. The first two inputs - prevalence of the condition and uptake of the intervention - were estimated using data from CPRD. Consequently, any limitations within that dataset and corresponding analyses are applicable here as well. The third input, effectiveness, was taken from the network meta-analysis and comprehensive economic model, so any limitations associated with those sources are also relevant. Lastly, the input for opportunity costs was assumed to be evenly distributed across IMD groups; however, the evidence base regarding this distribution is relatively limited and is still evolving.

A second limitation arises from the use of prescribing data from CPRD as a proxy for actual intervention uptake. Although prescription data indicate that a medication has been prescribed, we do not know whether it was dispensed and, even if dispensed, we do not know whether the recipient has actually taken the medication. Additionally, other factors such as the number of patients who start the treatment but subsequently stop it, as well as the reasons behind these choices are unknown. In the absence of other evidence,

evaluating how accurately prescribing data represents real intervention uptake is challenging.

A third limitation, closely related to the second, concerns adherence to treatment regimens. Simply receiving a prescription does not guarantee the medication has been taken or that the patient is adhering to the prescribed regimen. Both adherence and actual medication intake influence the effectiveness of interventions and variations in these factors might differ widely among populations.

A fourth limitation relates to the consideration of SGLT-2 inhibitors as a generic class rather than evaluating the individual treatments within that class. The economic analysis indicated that the individual treatments differed in their risk and benefit profiles. These differences may impact the distribution of health effects reported in the current analyses.

The final limitation concerns other equality related characteristics of the population that were found to differ across groups, including factors such as age, gender and ethnicity. An overarching analysis of uptake data (ref PM report) identified these factors as significant but they have not been explored in the current analysis which focuses on social distribution.

Annex 1: Examples of health inequality related recommendations

What are the most effective and cost-effective methods to promote increased access to, and uptake of, treatments for people with depression who are under-served and under-represented in current services? [NG222 Depression]

1.6.26 Commissioners, providers and healthcare professionals should address inequalities in CGM access and uptake by:
- monitoring who is using CGM
- Identifying groups who are eligible but who have lower uptake
- Making plans to engage with these groups to encourage them to consider CGM. [2022]

Be aware of the impact of health inequalities (for example deprivation), on outcomes for people with spinal metastases or MSCC. Ensure that:
- information is collected and analysed by local services to identify any health inequalities
- education is provided within services on reducing local health inequalities
- reasonable adjustments are made by local services to address any health inequalities. (draft)

2 Adherence and satisfaction to interventions to reduce arm and shoulder problems

What is the adherence to, and satisfaction with, different intervention formats (for example individual, group, virtual, and face to face) to reduce arm and shoulder problems after breast cancer surgery or radiotherapy, and what is the impact of greater adherence on effectiveness for different groups, such as:

- women, men, trans people and non-binary people
- people from minority ethnic family backgrounds
- people with disabilities
- neurodiverse people?