Improving Health Outcomes of People with Diabetes Mellitus: Target Setting to Reduce the Global Burden of Diabetes Mellitus by 2030

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1.0 BACKGROUND AND RATIONALE

Diabetes mellitus is one of the world's most challenging public health problems due to its high and growing prevalence and the diverse and extensive morbidity it causes, impacting individuals, health systems and national economies[1]. Recent global estimates indicate that 463 million adults have the condition, of whom 80% reside in low- and middle-income countries (LMICs) [1,2]. Further, the global impact and costs of diabetes are expected to grow considerably, disproportionately affecting LMICs and the most economically disadvantaged segments of high-income countries (HICs)[3-5].

Diabetes is highly modifiable across a broad continuum of its pathogenesis. For people with diagnosed diabetes, delivery of essential medications, management of glycemic control and cardiometabolic risk factors, and early screening for complications via well-organized care reduces acute and chronic complications and extends life [6-9]. Further, type 2 diabetes can be prevented through intensive lifestyle interventions directed at high-risk individuals or through population-wide changes to dietary quality, physical activity levels, and levels of obesity [10-14].

Unfortunately, population-based studies have shown that the delivery of the full spectrum of evidence-based care is sub-optimal even in well-resourced health systems. Many countries have high proportions of their diabetes populations undiagnosed and lack timely care for extended periods[15,16]. In HICs, the achievement of recommended targets of risk factor control ranges from 50-70% and only about 20% meet all recommended targets [17-19]. Levels are worse in LMICs, where only about half have good glycemic control and about one-fourth have good blood pressure control[5,16,20,21]. However, multicomponent quality improvement initiatives have shown sustained beneficial effects with respect to the achievement of diabetes care goals and vascular complications, even in low resource settings[6,22,23]. Modelling studies also suggest that the application of integrated care to improve all three targets could reduce cardiovascular (CVD) complications of diabetes by half and for those with poor control across all, increase life expectancy by 5 years from age 40 [6].

In the context of a large and growing burden of diabetes-related morbidity and missed opportunities to employ evidence-based care and prevention, the World Health Organization (WHO) recently announced the *Global Diabetes Compact* [24]. Building on the Global Action Plan for the Prevention and Control of NCDs, lessons learned from successes in other conditions like HIV[25], and on resolution 74.4 of World Health Assembly (Reducing the burden of non-communicable diseases through strengthening the prevention and control of diabetes), the Global *Diabetes Compact* identifies sets targets for 2030 that are intended to serve as a stimulus for action and prioritization and an anchor for monitoring progress at the national, regional, and global level[26,27].

The aim of this report is to provide the scientific basis for the selection of key health objectives and target levels for the *Global Diabetes Compact.* Specific objectives of this report are to:

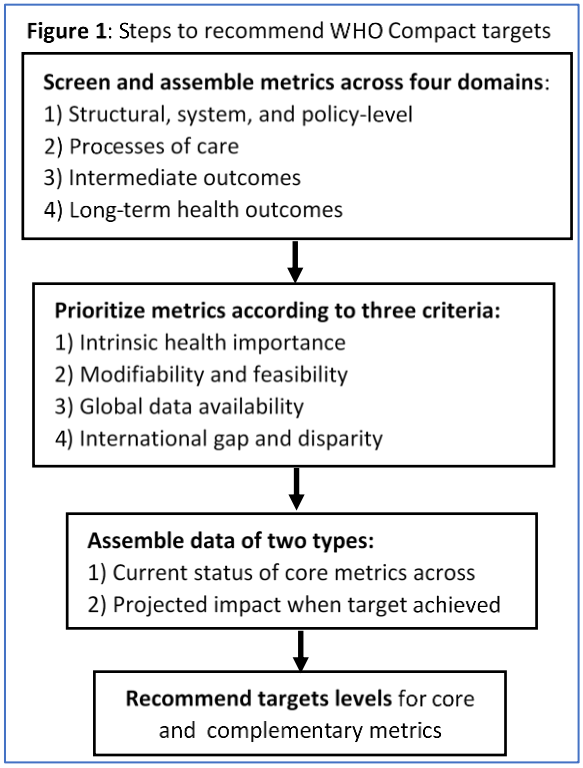
1) Review and describe the range of options for target metrics for the *Global Diabetes Compact*, including their general strengths, weaknesses, and feasibility.

2) Review and present the current global variation, levels, and trends and geographic coverage of selected metrics, and;

3) Propose core and complementary metrics, their definitions, and target levels for the *Global Diabetes Compact*.

2.0 SUMMARY OF METHODS AND APPROACH:

To prioritize metrics and target levels, we assembled an expert workgroup (listed above) and took the following steps. First, we developed a simple taxonomy for metrics organized across 4 domains (policy and system-level factors, intermediate outcomes, and long-term health outcomes) and risk tiers (diagnosed diabetes, high risk, whole population). Second, we developed key criterion for consideration of metrics (health importance, modifiability and feasibility, data availability, international gap and disparity). Third, the panel of experts to independently rate metrics across these criteria and other attributes, listing advantages and disadvantages. This led to a set of "core" and "complementary" metrics. The core metrics are intended for priority implementation and monitoring by the *Global Diabetes Compact*. The complementary metrics are intended for consideration of greater scale-up in population health data and surveillance systems, but currently lack adequate global data availability or consensus-based definitions to recommend as core *Compact* metrics. Additional "base" complementary metrics are noted as being essential to the calculation of core metrics or for the improved characterization of the global diabetes burden. Fourth, after the selection of core and complementary metrics, we conducted an in-depth literature review of the current levels of attainment of metrics, by region and country of the world. We also examined evidence from modeling-based studies to estimate the expected health impact of meeting different target levels. Finally, we used the information and evidence accumulated through these steps to propose a set of target levels for core metrics.



3.0 SCIENTIFIC RATIONALE AND OPTIONS FOR METRICS AND TARGETS

Taxonomy and Options for Health Metrics:

Target-setting for public health efforts is credited with influencing major successes in public health, ranging from vaccine delivery to the reductions in HIV and CVD-related mortality[25,28]. Numerous criteria have been used to establish health metrics and their targets; metrics can be health conditions, biomarkers, or behaviors measured in individuals, or they may be interventions, structures, policies, or processes, implemented by health care providers or health systems[29]. Metrics may also be evidence that actions or policies taken by broader institutions, or governments exist or are being implemented. For the *Global Diabetes Compact*, we have organized metrics across four domains: *health events and outcomes; intermediate biomarkers; processes of care;* and s*tructural, system- or policy-level factors.*

Diabetes-related *health events and outcomes* are those that have a direct impact on individual-level quality of life or health system burden and differentiate health outcomes in the diabetes population from those without diabetes. They may include basic indicators of disease burden like diabetes prevalence and incidence, as well as the incidence of diabetes-related complications like lower extremity amputations (LEAs), end-stage kidney disease (ESKD), or CVD mortality[30].

Intermediate outcomes include biomarkers of risk and control that have been shown to be independently associated with long-term diabetes-related health outcomes, ideally established through randomized controlled trials. For example, reducing HbA1c, blood pressure, and lipids (low-density lipoprotein cholesterol and triglycerides) through standardized treatment regimens are associated with reduced microvascular and macrovascular health outcomes and related mortality[6-8,31,32].

Processes of care are procedures conducted by health care providers or individuals or steps that are considered essential on the pathway to intermediate and long-term health outcomes[33]. For example, monitoring of cardiometabolic indices or conducting dilated eye exams or foot exams are crucial to the prevention of diabetes complications, even though they don't represent health outcomes per se. Similarly, achieving weight loss through structured lifestyle interventions to reduce weight and improve diet and physical activity reduces the incidence of diabetes [13].

Structural, system- or policy-level factors systematically address multiple aspects of care in groups of patients or can target the entire population. For example, systematic reviews have shown that the assembly of multi-disciplinary teams for care management and decision-support via patient registries, improves risk factors and management that should contribute to improved health outcomes [34-37].

Table 1: Domains, risk tiers, and potential metrics initially considered for the *Diabetes Compact*.

	Structural and system factors	**Processes of care**	**Intermediate outcomes**	**Long-term health outcomes**
Diagnosed diabetes	National diabetes registry Health system registries Guidelines and dissemination efforts Decision support tools	% of diabetes diagnosed % receiving treatment among diagnosed Availability of essential medicines Team-based care Statin use Diabetes education Vaccinations Foot exam Eye exam Renal testing	Glycaemic control Controlled blood pressure Controlled lipids Microalbuminuria	Lower extremity amputations Incidence of DM Prevalence of DM Acute complications CKD prevalence Retinopathy prevalence ESRD incidence CVD incidence DM-related mortality Hospitalisations CVD mortality
High risk	Presence of policy to reduce physical inactivity Support for nutritional counselling Support for structured lifestyle interventions Guidelines for testing and referral	% receiving to prevention intervention % receiving counselling for diet/exercise % tested for diabetes Metformin prescriptions Glycaemic assessments for gestational DM	Intermediate hyperglycaemia Controlled blood pressure Controlled Lipids Body mass index Microalbuminuria	Incidence of diabetes Prevalence of diabetes
Whole population	% of facilities with essential medicines Population-based survey with blood glucose Presence of a policy to increase physical activity Presence of incentives for healthy diet programmes Food policy taxation (sugar sweetened beverages)	Smoking cessation services Proportion of population with healthcare coverage for DM and CVD risk factors	Physical activity levels BMI Level of fruit and vegetable consumption	Incidence of diabetes Prevalence of diabetes

These four domains can also be organized according to the *risk tier* or stage of the disease that they primarily affect. For the *Compact* metrics assessment, we considered three general tiers: persons with *diagnosed diabetes*, persons at *high risk* (such as intermediate hyperglycemia, or non-glycemic categories of high predicted risk), or the *whole population*. The highest priority interventions and metrics vary according to these risk tiers. For example, managing glycemic control is likely most important in persons with diagnosed diabetes, reducing body weight is particularly pertinent in obese persons with intermediate hyperglycemia, and improving overall dietary quality and physical activity, or applying policies such as taxes or incentives may be particularly important in the general population. Table 1 describes a list of potential metrics organized across domains and risk tiers that were used for subsequent consideration and rating

Advantages and Disadvantages of Types of Metrics

The selection of any given metric has advantages, disadvantages, and trade-offs. For example, *health events and outcomes* are closest to the ultimate goals of clinical and public health practices, but can be more difficult to measure, difficult to change in the short term, and are uninformative about what factors are affecting change[38]. *Processes of care* may be immediately measurable and responsive to interventions in the short term but may not predict health changes well[33,39,40]. *Intermediate biomarkers*, such as HbA1c and blood pressure, are both modifiable and predictive of long-term outcomes and have the advantage of having generally standardized measurement approaches with reasonable global reach[32]. However, there is a lack of consensus on the appropriate target thresholds. *System and policy-level* targets have disadvantages of being difficult to implement in the short-term, have modest effect sizes, or not translate into health outcomes at the individual level when achieved[39,41]. However, when implemented they can have an efficient impact on multiple risk factors and a large segment of the population.

The selection of different risk tiers also comes with advantages and disadvantages. Focusing on people with established disease or high risk may meet immediate health system demands and have more evidence for short-term effectiveness and cost-effectiveness but have no prevention effect on the condition itself. Interventions aimed at the whole population depend upon policy-level interventions that can be difficult to measure and have a less clear magnitude of effect but may have important benefits over longer time horizons[39].

Criteria for selection of metrics

To prioritize metrics of *the Compact*, we condensed these attributes into four main criteria. Table 2 summarizes these criteria and describes characteristics of strong, moderate, and poor metrics.

First, priority metrics should be of *intrinsic health importance* or else be a factor or intervention that strongly predicts major health events or outcomes. For example, a stroke has obvious intrinsic health importance and blood pressure levels strongly predict stroke risk, but the process of measuring blood pressure is less likely to be a specific predictor of later health outcomes. Thus, blood pressure levels would be a much higher priority metric than blood pressure measurement.

Table 2: Criterion and rating scale for potential metrics.

Criterion	Strong	Moderate	Fair
Intrinsic **health importance** or strong evidence for prediction or benefit on major health outcomes.	Major health outcome affecting QOL (e.g., MI, LEA).	Biomarker or intervention with clear causal linkage to health outcome.	Process, intervention, or factor with potential linkage.
Modifiable and **feasible** via scalable interventions across diverse settings.	Clearly efficacious and scalable via evidence-based means.	Moderately feasible and reasonable cost to implement.	Lacking clear scalability – or – clear health effect if scalable.
Strong global **data availability** with acceptable measurement properties.	Currently available for 75% of countries.	Currently available for 25 - 75% of countries.	Available for fewer than 25% of countries.
International **gap and disparity**	Large proportion of population affected and large international variation	Large proportion of population affected – OR - large international variation	Modest international gap or limited variation

Second, the ideal metric should be *changeable via recommended and scalable clinical or public health interventions*. For example, reducing blood pressure with low-cost, medications in primary care is

feasible and evidence-based, but providing ambulatory blood pressure monitoring to the population would likely not be feasible.

Third, priority metrics should have good global *data availability and measurement properties* and have reasonable consistency across settings, ease of measurement, and be either currently available or plausibly available through scale-up of practical surveillance approaches. For example, levels of undiagnosed diabetes can be assessed with cross-sectional population surveys but determining population-based rates of acute myocardial infarction is only available in a few countries of the world. Fourth, international disparities and needs represent the degree to which large population gaps and unmet needs exist and the degree to which there is modifiable variation in metrics. Thus, levels, where attainment is universally high, would be of low priority.

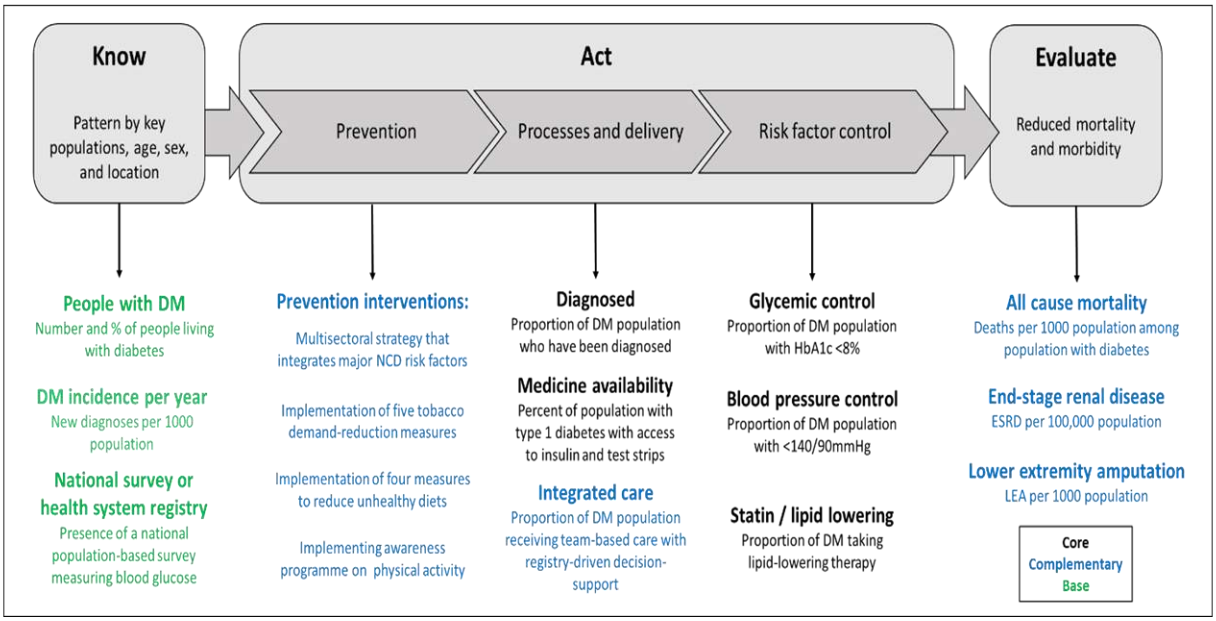
To be a core metric, it should have moderate to high quality on all three criteria (health importance/predictability; changeable/feasible; availability; international gap and disparity). Using this initial list of metrics and criteria, an expert group ranked a set of core and complementary metrics.

***Core Metrics*:**

We selected five core metrics (Figure 1, black print) based on the following rationale.

First, *the proportion of cases that are diagnosed out of the total number with diabetes defined by either self-reported prior diagnosis or tests of HbA1c or fasting glucose* was selected because it represents an important step to providing key early effective treatment. Although the effectiveness of community-based testing and population-wide screening remains unclear and not established by randomized controlled trials (RCTs)[42,43], opportunistic testing in clinical settings to identify undiagnosed cases and initiate early treatment has been shown to be cost-effective in some HICs, particularly if paired with identification of high-risk individuals for lifestyle change[9,44,45]. Further, in LMICs, the median percent diagnosed with diabetes out of the total number with diabetes is only 57%, representing the largest drop-off across the screening-to-control cascade, and is lower than in HICs[21].

Figure 2: Proposed core, complementary, and base metrics for the Global Diabetes Compact.



Second, *the proportion of adults with diagnosed diabetes with controlled HbA1c* is based on strong RCT evidence for the benefit of glycemic control on acute, microvascular and to a lesser extent, macrovascular complications[6-8]. Third and fourth, *the proportion of adults with diagnosed diabetes*

who have controlled blood pressure and *the proportion of adults with diagnosed diabetes who are at least 40 years of age taking lipid-lowering medications* are based on similarly strong RCT evidence for the reduction in CVD events in persons with diagnosed diabetes[6,46]. Fifth, the *availability of essential medications* was prioritized because of the recognized gap in life-sustaining medications for diabetes, including insulin bundled with test strips for people with type 1 diabetes[47].

In addition to being associated with major health outcomes, three of the metrics (glycemic control, blood pressure, statin use) are highly modifiable using affordable medications available in primary care, particularly if supported by team-based integrated care. Further, each of the core metrics except *medication availability* can be quantified through health surveys such as those implemented in STEPs or other nationally representative surveys[48]. If these data are collected from a source with both diagnosed diabetes and undiagnosed diabetes, countries will have the option of considering levels of delivery to the total population with diabetes. Medication availability is potentially available via other WHO surveillance systems such as the WHO biennial Country Capacity survey.

Complementary and Supporting Metrics:

We identified several complementary base metrics that serve as either denominators of core metrics, are important to monitor delivery of evidence-based interventions, or are long-term health outcomes of diabetes. Some complementary metrics are well-established in current surveys and systems, whereas others either lack appropriate surveys or data systems for measures and require further development or standardization. Having a population survey in place and measuring diabetes prevalence (Figure 1) with both self-report and a glycemic measures are essential base metrics for the calculation of core metrics, as well as for ongoing monitoring. Incidence of diagnosed diabetes is an important metric of the direction of the diabetes epidemic and is less affected by mortality than prevalence. However, its assessment requires either extremely large panel surveys or population-based registries that are at present available only in a few countries. Prevention interventions are recommended as a valuable complementary metric because of strong evidence that T2DM can be prevented or delayed through lifestyle changes aimed at improving diet and physical activity. Similarly, the provision of integrated care in the form of team-based care, decision support is important to facilitate attainment of the core targets. However, both metrics lack adequate data systems and agreement around standardized measurement approaches.

We also prioritized three sentinel *complementary metrics*: incidence of *all-cause mortality in people with diabetes, end-stage kidney disease (ESKD), lower-extremity amputations (LEAs)* among the population with diagnosed diabetes, and *incidence of diagnosed diabetes* among the general population because they each are intrinsically important health outcomes, highly modifiable via established evidence-based interventions, and lend themselves to standardized, objective, population-based monitoring. They also represent good sentinel metrics of diabetes because they are affected by multiple aspects of recommended care. Their primary drawback leading us to select them as complementary rather than core metrics is that they have limited global availability through population-based surveillance systems. The increasing data linkages of surveys, registries, and vital statistics in many settings make them increasingly viable as health metrics.

Several commonly used metrics were not recommended based on our review of available data. Gestational diabetes is an important contributor to the diabetes burden and a key target for prevention of morbidity but there remains little global consensus on definition and diagnostic criteria and uncertainty over benefits of screening and long-term benefits of treatment. Although *treatment with blood pressure- and glucose-lowering medications* are clearly important, available data suggests that the primary gap in treatment is in people who have not been diagnosed. Thus, if the treatment is being delivered appropriately in countries, it should be captured in proportions meeting the target of control. Further, the accuracy of treatment status using self-report is unclear and is complicated by

the increasing number of medications and drug classes available. Further, some individuals may be appropriate for treatment using lifestyle interventions only, for which the assessment using standardized approaches is also of unclear accuracy. *Processes of care*, including HbA1c tests, foot and eye exams are considered essential elements of high-quality diabetes care. However, they were not prioritized because they are often insufficient or non-predictive of later health outcomes [39,40]. Additional *policy or system-level factors* such as policies to increase physical activity were not prioritized because of difficulties in measurement and lack of agreement about intervention effectiveness. *Upstream risk factors* such as body mass index, physical activity levels, and dietary behaviors were also considered but not prioritized, largely because of limitations in measurements, lack of agreement about how to alter them, or else being not specific or predictive of diabetes-related outcomes.

Approaches to Target Setting

Once metrics are identified, the selection of appropriate target levels presents an additional challenge. Targets should ultimately be "SMART", or specific, measurable, achievable, realistic, and time bound. Many approaches have been used to set targets in public health efforts [29]. Some approaches start with a static baseline level of the metric and then assign a percentage improvement, percentage point improvement (used when the baseline itself is a percentage) or calculated based on the minimally statistically significant change from baseline. Other methods evaluate the baseline trend and then aim to either maintain the current trend or else add a percentage improvement to the slope. Others assign targets to be consistent with organizational or national guidelines. Finally, others set fixed targets to be applied universally across settings, using the best current level across the subgroups or else by simply setting an optimal level based on consensus and multiple criteria. If biomarkers are to be expressed as dichotomous targets, they also require a decision about the threshold to be used. This is typically based on clinical guidelines but sometimes aims to identify a level of risk that represents poor care or high risk for which virtually all settings should aim to reach. We considered each of these methods and data summarized below to arrive at consensus-based recommendations.

4.0 Current global status of metrics: variation, levels, trends, and coverage.

Informative data for core metrics: Region and country-specific estimates.

Selection and specification of metrics and targets for the *Compact* were informed by three types of information and evidence: 1) Recent and current population-based national estimates to provide realistic baseline; 2) Estimates of trends in rates of metrics over time from various settings to identify a plausible and realistic magnitude of change over time; 3) Estimates of projected health benefit and costs associated with meeting vs not meeting targets.

To determine the current levels and variation in core metrics, we assembled data from recent systematic reviews[16,49], unpublished systematic reviews[21] and additional literature searches. This literature search assembled data for 99 LMICs and 56 HICs. Of those, 66 LMICs and 7 HICs had complete data on diagnosis proportion, glycemic, and blood pressure control. More complete data were available for LMICs because of the availability of a pooled dataset of individual-level STEPs surveys[21]; for high-income countries we relied on a search of published sources containing the metrics specified as selected for *the Compact*. These estimates are derived from a combination of STEPs and other nationally representative surveys conducted between 2009-2019 with strong response rates (74-96%) and sample sizes of ~2000-5000 in most surveys[16,21]. For the complementary metrics, we have also assembled data from previously published reviews of diabetes incidence, all-cause and CVD mortality, and incidence of diabetes-related complications[50-52].

Tables 3-4 and appendix table 1 and appendix Figures 1-6 present regional and country-specific estimates for core metrics. Among 67 LMICs and 12 HICs, the median percent diagnosed was 57%,

with an interquartile range of 18%. Of diagnosed individuals, the ean percent with HbA1c <8%, blood pressure <140/90, and using statins were 68%, 53%, and 6% respectively. Few studies exist on trends in the attainment of these targets over time. Where they exist, they tend to find large increases during the 1990s and 2000s but generally flat or increasing trends since 2010. In the U.S., for example, the proportion meeting targets increased 12-13 percentage points (PPTs) from 1999-2009 but have been relatively stagnant since [17,19,53,54].

Table 3: Summary prevalence of core metrics by region of the world.

Region		Prevalence	Diagnosed / Total DM	HbA1c <8% / Diagnosed DM	BP 140/90 / Diagnosed DM	Statin / Diagnosed DM
All regions	Mean	9.5	55.1	67.6	50.2	16.2
All regions	Median	8.3	57.1	68.2	52.6	6.2
All regions	IQR	5.7	17.8	16.3	21.8	18.2
East Asia & Pacific	Median	10.9	46.9	60.7	54.7	3.1
Europe & Central Asia	Median	8.0	63.7	70.5	33.3	7.7
Latin America & Caribbean	Median	9.4	63.3	68.2	65.4	11.0
Middle East & North Africa	Median	10.2	59.3	67.3	50.8	12.9
North America	Median	11.7	74.1	75.4	70.4	56.3
South Asia	Median	8.1	45.0	80.2	52.7	1.7
Sub Saharan Africa	Median	4.2	40.3	69.3	47.1	3.4

Estimating health impact of meeting core metrics

A comprehensive study using STEPs data and microsimulation modelling estimated the expected impact of meeting different targets on deaths and disability-adjusted life-years associated with macrovascular and microvascular complications [49]. This analysis was based upon data on access to diagnosis, treatment, and control for diabetes, hypertension, and lipids from 23,678 people with diabetes living in 67 LMICs. The analysis yielded several key findings relevant to the selection of metrics and target levels for the Compact.

- At current levels of treatment and control, an estimated 1,161 disability-adjusted life years (DALYs) per 1,000 population are lost over 10 years due to diabetes and its complications.
- Most of the DALYs and costs lost are due to ESKD but increasing access to care has its greatest impact on CVD-related DALYs due to improved hypertension management.
- *Increasing the percentage of the diabetes population that is diagnosed by 10* PPTs from country baseline levels decreases 10-year risk of microvascular outcomes (neuropathy, ESKD, retinopathy) by 7-17% but has a negligible effect on CVD. The negligible effect on CVD is because people identified by screening are of lower risk than those with diagnosed disease.
- *Increasing the percentage of people with diabetes who achieve glycemic control by 10 PPT* decreases 10-year risk of microvascular outcomes by 6-15% but has a negligible effect on CVD likely due to the modest effect of glycemic control on macrovascular outcomes.
- *Increasing blood pressure achievement by 10 PPT* decreases 10-year risk of CVD events and CHF by 8-10% while also decreasing ESRD and retinopathy by 11-18%.

- *Increasing statin use by 10 PPT from current country baselines* decreases 10-year CVD risk by 10% but has no projected effect on other outcomes.
- In most regions, *improving treatment and control without screening* reduces CVD deaths by 25-35%, and *improving diagnosis, treatment, and control* reduces CVD deaths by > 40%.
- *Achieving a level of diagnosis, treatment, and control of all 3 targets* (glycemia, blood pressure, and statin use) of 60% results in a gain in median DALY of 38 per 1000 persons over 10 years.

Overall, these analyses support the implementation of all core metrics, as the benefits of glycemic control, blood pressure, and statin use affect different outcomes and have a balanced effect on a wide range of diabetes-related complications.

Informative data for Complementary Metrics

Published data for complementary metrics, LEAs, CVD and all-cause mortality, and incidence of diagnosed diabetes, is mostly limited to high-income countries[50,52,55,56]. (See Table 4 and Appendix Figures 7-10). Where data exist, absolute rates vary considerably due to variation in both the sampling approach and outcome definition. For example, rates of LEAs across most countries range from 5 to 34 per 10,000 per year with an average of about 18 per 1000 per year. Annual rates of all-cause mortality vary from 10 to 60 per 1000, with an average of about 23. The annual incidence of diagnosed diabetes tends to range from 1 to 10 per 1000, with an average of roughly 7 per 1000. Estimates for diabetes-related ESKD use the overall population as the denominator. Thus, the increase in incidence observed across most countries is affected by the increasing prevalence of diabetes in addition to ESKD.

These metrics ultimately lend themselves to international standardization. However, existing published estimates are difficult to compare across countries because of variations in sampling methods and denominators, outcome definitions, and population standardization approaches. For these reasons, as well as the lack of availability in current surveillance systems, the *Compact* does not set global targets for these conditions.

Table 4: Summary of developmental metrics among people with diabetes by country.

Country	Income	DM IR†	All-cause mortality rate§		ESRD IR†	LEA IR†
			Male	Female		
East Asia & Pacific						
Australia	HIC	-	79*	-	-	-
Japan	HIC	88	-	-	-	-
South Korea	HIC	-	94*	-	-	-
Data unavailable for 26 countries						
Europe & Central Asia						
Denmark	HIC	6.2	407	368	-	-
Finland	HIC	35	426*	-	-	4.8
France	HIC	96	-	-	-	15.8
Germany	HIC	87	-	-	16.7	4.8
Ireland	HIC	-	-	-	-	17.6
Italy	HIC	40	345*	-	10.4	15.3
Latvia	HIC	-	547	438	-	-
Netherlands	HIC	37.3	97	88	-	25.1
Norway	HIC	39.8	450	476	-	-
Spain	HIC	-	-	-	5.9	34.4
Sweden	HIC	-	338*	-	-	-
UK	HIC	36.9	210	224	-	17.6
Russia	UMIC	-	232	-	-	-
Data unavailable for 36 countries						
Latin America & Caribbean						
Chile	HIC	-		-	-	-
Brazil	UMIC	200	-	-	-	-
Mexico	UMIC	140	-	-	-	-
Peru	UMIC	194.9	-	-	-	-
Data unavailable for 29 countries						
Middle East & North Africa						
Israel	HIC	108	107*	-	-	-
Data unavailable for 18 countries						
North America						
Canada	HIC	61.6	122*	-	13.3	-
USA	HIC	71	640*	-	20	28.4
South Asia: Data unavailable						
Sub-Saharan Africa: Data unavailable						

†Incidence Rates per 10,000 person-years; § Mortality rate per 10,000 people; *Total for both sexes

5.0 RECOMMENDED TARGET LEVELS FOR CORE METRICS

Table 5 presents recommended target levels for the core metrics. Our review suggests that target levels of 80% for the proportion of persons with diabetes who are diagnosed and among those with diagnosed diabetes, 80%, 80%, and 60% meeting targets for HbA1c (<8%), blood pressure (<140/90), and statin use, respectively, are ambitious but achievable and would have enormous global health in many countries of the world. These target levels are generally consistent with the top 85 to 90th percentile of countries of the world that currently have data. The gaps between current levels of attainment and the proposed targets vary considerably by region and country of the world. Our review suggests that for the percent diagnosed metric, meeting the 80% target is imminently obtainable in North America and will require increases of 16 to 21 PPTs in Latin America and the Caribbean, Europe and Central Asia, and the Middle East and North Africa. For regions of South Asia, East Asia and the Pacific, and Sub-Saharan Africa, 33 to 42 PPT increases will be required to meet the target for percent diagnosed. Thus, in some countries, incremental country-specific targets of 10 to 20 PPT increases over 10 years may be appropriate. Meeting the target of 80% of persons with diagnosed diabetes having HbA1c levels <8% will require an average 12 PPT increase, ranging from 6 to 18 PPT across countries. Current levels of attainment of 80% of patients with diagnosed diabetes having blood pressure <140/80 are highly variable and will require a 27 PPT increase globally; current gaps range from 10 PPT in North America to ~30 PPT in most regions, to 48 PPT in Europe Central Asia. Current levels of attainment of the statin target are considerably below 60%, ranging from 5% to 27% across all regions outside of North

Table 5: Specification of Definitions and Targets for Core and Developmental Metrics

Core Metrics	Definition	Global median (%)	Global 90th percentile (%)	Proposed Global Target (%)
Percent diagnosed	Number diagnosed divided by number with clinical diabetes	57	76	**80**
Glycaemic control	Number controlled (HbA1c < 8%) divided by total diagnosed diabetes	68	84	**80**
Blood pressure control	Number controlled (BP < 140/90) divided by total diagnosed diabetes	53	70	**80**
Lipid treated	Treated with statin divided by total with diagnosed diabetes	6	47	**60**
Medicine availability	Availability of glucose test-strips and insulin for persons with type 1 diabetes	N/A	N/A	**100**

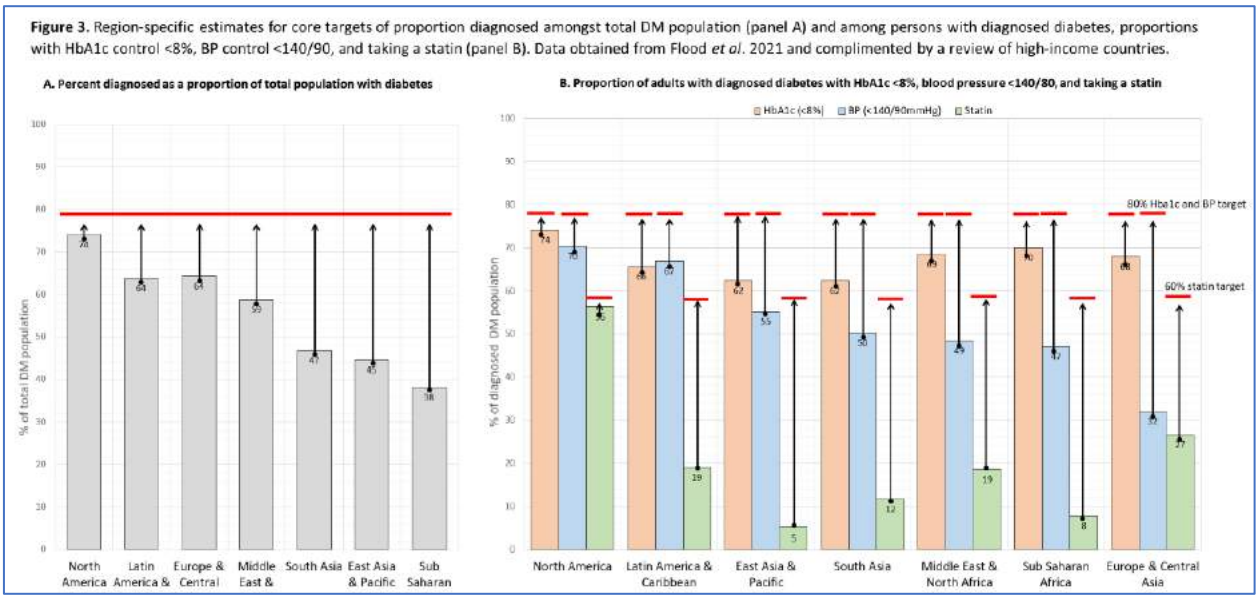


Figure 3. Region-specific estimates for core targets of proportion diagnosed amongst total DM population (panel A) and among persons with diagnosed diabetes, proportions with HbA1c control <8%, BP control <140/90, and taking a statin (panel B). Data obtained from Flood *et al*. 2021 and complimented by a review of high-income countries.

America, where it is 56%. Thus, meeting the statin target will likely require significant country-level policy actions, and country-specific target setting may again be appropriate.

We have not set targets for the complementary targets of incidence of diagnosed diabetes, and among persons with diagnosed diabetes, lower extremity amputations, end-stage renal disease, and mortality rates because of the high degree of baseline variability and the further needs in standardization of metrics. However, preliminary data suggests that country-level relative reductions of 50% over 10 years may be appropriate. Similarly, we have not set targets for the additional complementary metrics of prevention interventions and integrated work, pending more consensus-based development of metric definitions and development of data sources.

6.0 Pathways and Complementary Approaches to Achieve Targets

Achieving the overarching goals of the *Global Diabetes Compact* will require multi-sectoral efforts applied to individuals, health systems, policies, and country-level actions. The metrics and targets of the *Global Diabetes Compact* are not intended to cover the full range of health objectives and actions to address the needs of the diabetes epidemic. Rather, they are intended to capture areas of missed opportunity where attention to goals will be both clearly measurable and have strong impact on health outcomes. Thus, the *Global Diabetes Compact* should be viewed in the context of broader approaches to reduce the burden of diabetes through prevention as well as through efforts to ensure health care access and strengthening of health systems. The *Compact* builds on and complements recommendations of the WHO *Global Action Plan (GAP) for the Prevention and Control of Non-Communicable Diseases* and its soon-to-be-released *Roadmap for 2023 to 2030* and the *World Health Assembly Resolution 74.4* related to *reducing the burden of non-communicable diseases through strengthening prevention and control of diabetes*[26,27]. The Compact is also supported by recent a Lancet Commissions addressing the global challenges of using data to transform diabetes care and a Lancet Commission on diabetes in Sub-Saharan Africa[5,6] .

Efforts to optimize target achievement

The *Global Diabetes Compact* is intended to drive country-level efforts to strengthen national capacity, leadership and multi-sectoral action to prevention and control diabetes, with a particular focus on achieving universal health coverage, strengthening and orienting health systems around NCDs through primary care, reducing modifiable risk factors for diabetes and underlying social determinants of health, and strengthening surveillance and monitoring. The *Global Action Plan* for NCD prevention and control emphasizes orienting health systems around NCDs to influence attainment of targets in several ways:

- Scaling up diagnosis of diabetes to initiate cost-effective medical and behavioral risk factor management.
- Improving availability, affordability and equitable access to essential medicines, including life-saving insulin, and technologies.
- Enhancing skills and capacity of health care providers to provide team-based comprehensive care for diabetes management.
- Establishing continuous quality improvement systems for disease management and prevention with an emphasis on evidence-based guidelines, treatment protocols and decision tools.
- Development of facility- or health-system level diabetes registries where feasible to assist in both patient care and population monitoring.

Complementary efforts in prevention

Although the Global Diabetes Compact targets focus on diagnosis and complications risk factor control for persons with diabetes, the breadth of the diabetes challenge calls for efforts to reduce

diabetes incidence through a combination of individual-targeted and population-wide approaches. Effective lifestyle-based prevention will relieve the burden on health systems while improving metabolic and cardiovascular risk factor profiles. The NCD Global Action Plan emphasizes creating and sustaining health promoting environments to reduce diabetes risk with several strategies.

Implications for Monitoring

Long-term success of the Global Diabetes Compact will also depend upon consistent and accurate monitoring of the *Compact* targets as well as continued support and strengthening of comprehensive NCD surveillance systems. The assessment of core targets can generally be conducted via population-based surveys such as STEPs with inclusion of HbA1c measurement, but in some cases inadequate sample sizes of persons with diagnosed diabetes may lead to imprecise estimates of proportions achieving the HbA1c, blood pressure, and statin targets. Thus, it will be important for member states to evaluate sample sizes and consider additional strategies (e.g., aggregating over surveys; over-sampling) or monitoring systems in their evaluation plans. Adoption of the complementary targets related to long-term health outcomes (i.e, diabetes complications) will generally require new surveillance systems as well as additional consensus-based development of metric definitions. The proposed metrics for prevention interventions and integrated care are conceivably attainable through modification of current surveys and surveillance systems but require further consensus-based development of definitions, methods of assessment, and target levels.

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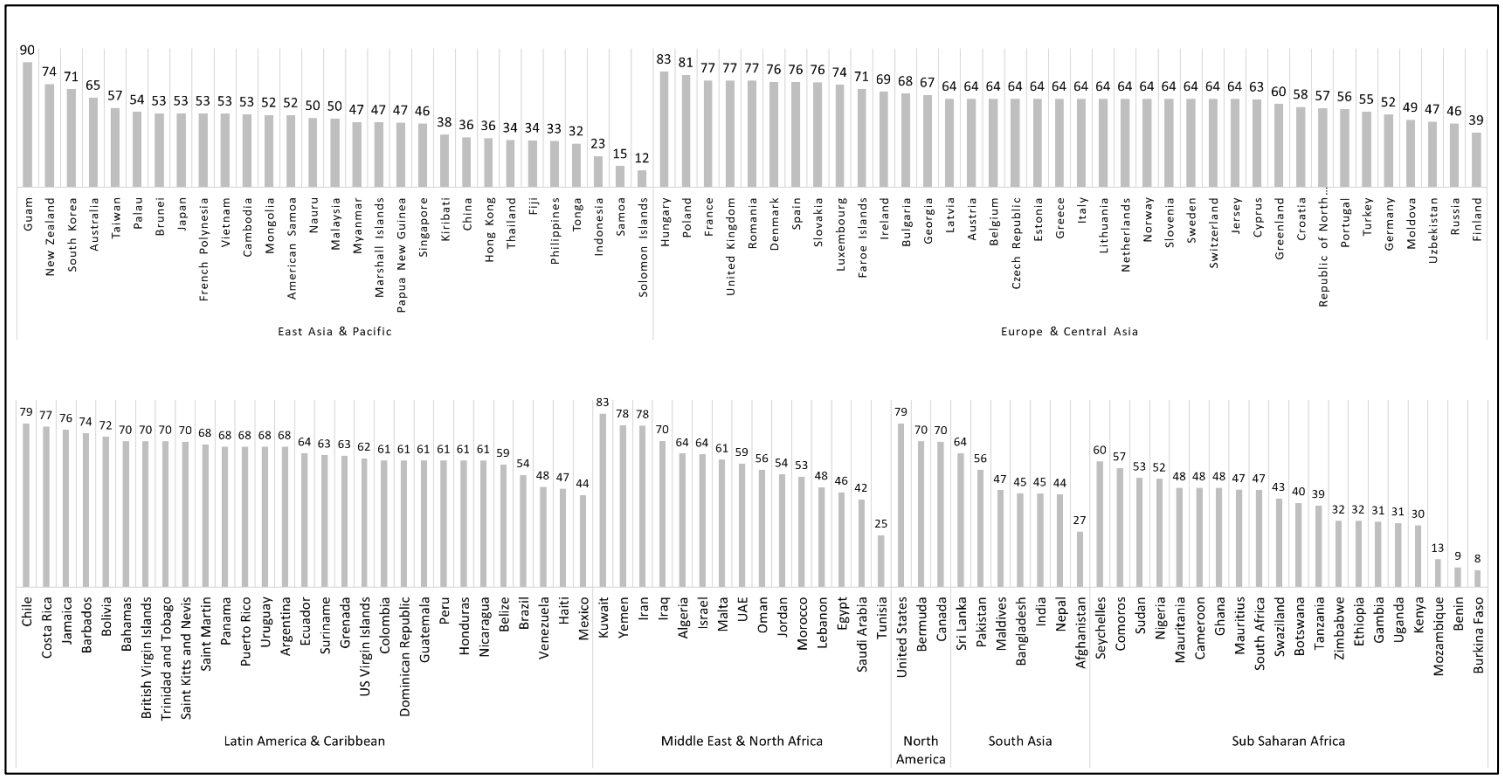
Appendix Table 1: Proportions achieving diabetes care goals by country (Obtained from David Flood* and Jennifer Manne-Goehler, for the Global Health and Population Project on Access to Care for Cardiometabolic diseases (HPACC) collaborators).

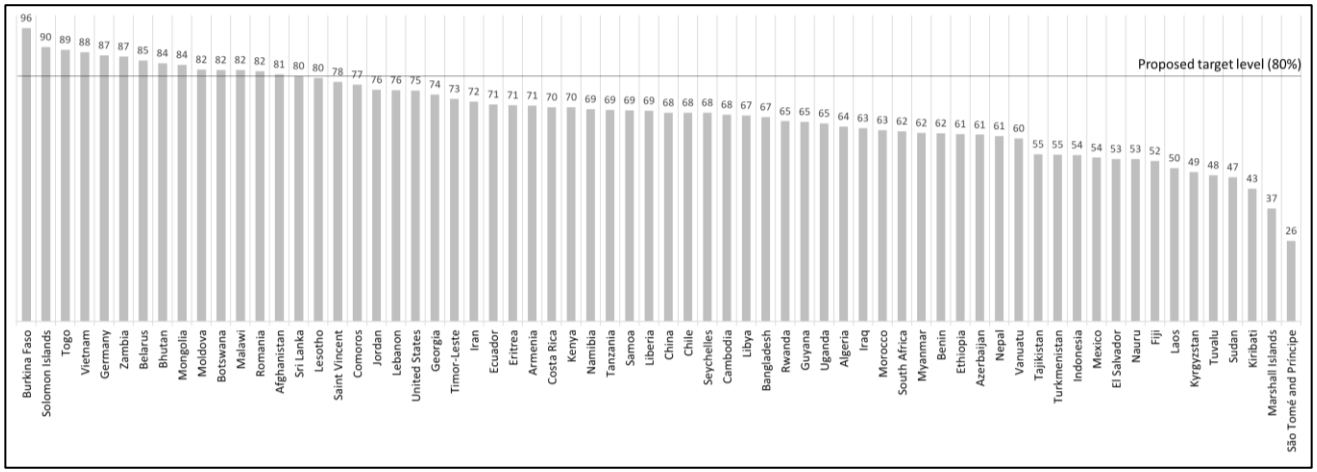
Country	% (95% Confidence Interval) [i]							
	Diagnosed[ii]	Glycaemic control (HbA1c <8%)[iii]	Glycaemic control (HbA1c <7%)[iv]	Blood pressure control (<140/90) [v]	Blood pressure control (<130/80) [vi]	Statin use (among diagnosed) [vii]	Statin use (among CVD risk >20%)[viii]	Glycaemic control, blood pressure control, and statin[ix]
Afghanistan	51.6 (40.8-62.2)	80.7 (66.6-89.7)	70.3 (56.7-81.1)	30.1 (16.9-47.6)	13.4 (7.5-22.7)	17.3 (7.4-35.4)	16.8 (4.1-48.8)	3.7 (0.6-20.6)
Algeria	67.7 (63.6-71.6)	63.7 (58.6-68.6)	52.1 (46.9-57.2)	50.9 (45.9-55.9)	27.8 (23.4-32.7)	22.3 (18.6-26.5)	31.8 (24.5-40.1)	5.1 (3.4-7.5)
Armenia	52.0 (37.0-66.6)	70.5 (55.9-81.8)	61.1 (46.1-74.2)	35.1 (23.5-48.9)	7.6 (3.4-16.4)	4.8 (1.7-12.9)	8.3 (2.7-23.0)	N/A
Azerbaijan	63.1 (55.2-70.3)	61.0 (52.0-69.3)	46.1 (37.5-54.9)	37.4 (29.0-46.7)	16.0 (10.3-24.0)	11.0 (6.2-18.7)	8.9 (3.4-21.6)	1.6 (0.6-4.7)
Bangladesh	60.9 (55.8-65.7)	66.7 (59.6-73.1)	60.9 (53.6-67.7)	60.7 (54.9-66.1)	32.4 (26.7-38.7)	10.5 (6.7-16.2)	10.0 (1.6-43.3)	3.6 (1.6-8.2)
Belarus	81.9 (76.4-86.4)	85.2 (80.3-89.0)	79.7 (74.6-83.9)	24.2 (18.9-30.4)	8.6 (5.4-13.5)	11.3 (7.4-16.8)	13.1 (6.8-23.5)	1.4 (0.6-3.2)
Benin	12.5 (7.8-19.4)	61.5 (42.7-77.5)	55.3 (37.4-71.9)	39.4 (21.0-61.4)	22.9 (8.8-47.7)	8.9 (1.3-41.9)	N/A	N/A
Bhutan	54.3 (42.0-66.1)	84.4 (70.2-92.6)	73.9 (54.2-87.1)	38.9 (23.9-56.3)	13.4 (6.6-25.4)	1.5 (0.2-10.1)	N/A	1.5 (0.2-10.1)
Botswana	59.2 (45.9-71.2)	82.2 (68.3-90.8)	80.0 (66.0-89.2)	44.5 (31.4-58.4)	25.5 (13.6-42.7)	4.5 (1.3-14.2)	N/A	2.3 (0.3-15.3)
Burkina Faso	11.5 (5.5-22.5)	95.8 (74.7-99.4)	62.2 (25.7-88.6)	54.4 (21.1-84.2)	33.0 (9.1-71.0)	27.4 (5.5-71.2)	N/A	N/A
Cambodia	60.3 (50.9-69.1)	67.5 (57.1-76.5)	58.8 (47.8-68.9)	74.1 (64.9-81.7)	49.8 (39.4-60.2)	N/A	N/A	N/A
Chile	70.7 (64.5-76.3)	68.2 (60.2-75.2)	59.5 (50.6-67.9)	62.0 (53.2-70.2)	37.8 (29.2-47.4)	N/A	N/A	N/A
China	37.9 (33.1-43.0)	75.4 (68.7-81.1)	72.8 (65.9-78.7)	48.4 (41.9-55.0)	17.9 (12.7-24.7)	N/A	N/A	N/A
Comoros	70.4 (61.4-78.0)	77.3 (68.8-84.0)	68.2 (57.7-77.1)	47.1 (37.9-56.5)	29.5 (21.2-39.5)	N/A	N/A	N/A
Costa Rica	75.3 (65.0-83.4)	70.0 (57.1-80.3)	66.2 (55.0-75.9)	78.4 (70.0-85.0)	40.1 (25.5-56.7)	N/A	N/A	N/A
Ecuador	64.3 (58.6-69.7)	70.9 (63.4-77.5)	65.1 (57.6-71.9)	78.9 (71.9-84.5)	51.4 (43.7-59.0)	10.1 (5.6-17.6)	N/A	3.4 (1.0-11.1)
El Salvador	75.1 (69.8-79.7)	53.1 (46.7-59.5)	44.3 (38.1-50.7)	68.3 (61.9-74.1)	38.5 (32.5-44.9)	N/A	N/A	N/A
Eritrea	57.6 (47.9-66.7)	70.6 (59.1-80.0)	61.1 (47.0-73.5)	60.9 (48.2-72.3)	38.1 (26.9-50.7)	N/A	N/A	N/A
Eswatini	55.8 (44.6-66.5)	75.1 (64.1-83.6)	62.4 (49.2-73.9)	45.5 (29.4-62.6)	21.3 (9.6-41.0)	4.3 (0.9-18.6)	N/A	N/A
Ethiopia	35.4 (25.7-46.5)	61.2 (45.9-74.5)	53.3 (38.6-67.3)	52.6 (38.1-66.8)	25.8 (15.1-40.4)	6.5 (1.1-30.5)	N/A	6.4 (1.0-31.3)
Fiji	57.7 (53.4-61.8)	52.4 (45.8-58.9)	40.8 (34.6-47.2)	40.1 (33.9-46.7)	16.2 (11.8-21.7)	N/A	N/A	N/A
Georgia	74.4 (67.6-80.2)	74.1 (66.0-80.9)	60.7 (52.0-68.8)	37.0 (30.0-44.7)	22.1 (16.1-29.6)	12.1 (7.3-19.4)	9.2 (4.1-19.2)	5.5 (2.4-11.8)
Guyana	72.9 (61.8-81.7)	65.2 (52.3-76.2)	56.7 (43.9-68.6)	65.4 (52.5-76.3)	38.3 (27.1-51.0)	7.5 (3.3-16.3)	N/A	4.6 (1.7-11.9)
India	49.7 (47.9-51.5)	2.0 (1.3-2.9)	57.2 (41.2-71.8)	66.9 (64.6-69.1)	29.8 (27.6-32.0)	N/A	N/A	N/A
Indonesia	31.3 (22.8-41.3)	54.4 (40.6-67.6)	54.4 (40.6-67.6)	38.4 (32.7-44.4)	20.9 (15.1-28.2)	N/A	N/A	N/A
Iran	85.1 (83.1-86.9)	71.8 (69.1-74.4)	69.0 (66.3-71.7)	59.1 (56.3-61.8)	32.8 (30.1-35.6)	27.9 (25.2-30.7)	35.8 (29.9-42.1)	10.1 (8.5-12.1)
Iraq	76.7 (72.0-80.8)	63.1 (56.9-69.0)	50.2 (43.9-56.6)	40.4 (34.6-46.4)	6.3 (4.2-9.2)	8.1 (5.2-12.4)	9.9 (4.5-20.7)	1.2 (0.5-2.8)
Jordan	84.6 (79.3-88.7)	75.7 (69.6-80.9)	66.8 (60.1-72.8)	61.5 (54.6-68.0)	24.0 (18.9-29.9)	37.1 (30.1-44.7)	57.3 (45.2-68.5)	14.3 (9.5-21.1)
Kenya	48.9 (32.6-65.4)	70.0 (48.5-85.2)	56.2 (34.0-76.1)	24.6 (13.7-40.2)	11.6 (4.8-25.5)	0.7 (0.1-4.8)	N/A	N/A
Kiribati	43.2 (33.3-53.7)	43.3 (18.5-72.0)	40.9 (17.4-69.5)	42.6 (31.8-54.2)	24.5 (13.7-40.0)	1.1 (0.2-5.4)	N/A	0.7 (0.1-5.7)
Kyrgyzstan	57.5 (46.6-67.6)	48.8 (32.8-65.1)	44.3 (29.5-60.1)	31.5 (22.3-42.6)	5.8 (2.1-15.4)	5.9 (2.1-15.6)	18.9 (5.8-46.7)	0.6 (0.1-4.1)
Laos	59.3 (49.5-68.4)	50.1 (38.3-62.0)	42.4 (30.3-55.5)	55.7 (43.3-67.4)	25.5 (16.5-37.1)	N/A	N/A	N/A
Lebanon	50.3 (34.2-66.3)	75.6 (62.9-85.0)	63.6 (48.7-76.3)	50.8 (38.8-62.8)	29.5 (18.7-43.3)	45.2 (34.0-56.8)	43.5 (29.4-58.8)	19.3 (11.4-30.6)

Country	% (95% Confidence Interval) [i]							
	Diagnosed[ii]	Glycaemic control (HbA1c <8%)[iii]	Glycaemic control (HbA1c <7%)[iv]	Blood pressure control (<140/90) [v]	Blood pressure control (<130/80) [vi]	Statin use (among diagnosed) [vii]	Statin use (among CVD risk >20%)[viii]	Glycaemic control, blood pressure control, and statin[ix]
Lesotho	57.5 (43.8-70.2)	79.5 (66.3-88.5)	76.8 (63.3-86.4)	31.6 (18.1-49.1)	20.6 (9.5-39.0)	N/A	N/A	N/A
Liberia	9.1 (5.6-14.5)	68.8 (46.6-84.7)	68.8 (46.6-84.7)	21.4 (5.2-57.8)	21.4 (5.2-57.8)	N/A	N/A	N/A
Libya	58.9 (50.7-66.5)	67.3 (57.8-75.6)	56.7 (46.9-66.0)	28.8 (21.7-37.1)	10.8 (7.0-16.5)	N/A	N/A	N/A
Malawi	43.2 (23.6-65.1)	82.1 (49.9-95.5)	82.1 (49.9-95.5)	79.9 (50.7-93.9)	33.0 (13.7-60.3)	N/A	N/A	N/A
Mexico	61.5 (57.3-65.6)	53.5 (48.8-58.1)	44.1 (39.5-48.8)	56.5 (51.9-60.9)	34.1 (29.9-38.5)	12.2 (9.5-15.6)	17.6 (8.0-34.3)	3.3 (1.9-5.7)
Moldova	66.3 (59.9-72.2)	82.3 (76.9-86.7)	73.4 (67.4-78.7)	25.1 (18.9-32.5)	8.0 (4.5-13.8)	11.8 (7.3-18.5)	9.4 (5.3-16.1)	1.5 (0.6-3.8)
Mongolia	61.8 (53.3-69.6)	83.8 (78.1-88.3)	81.5 (75.4-86.3)	57.9 (50.2-65.3)	29.7 (22.8-37.7)	4.6 (2.9-7.2)	9.0 (3.6-20.8)	0.9 (0.4-2.0)
Morocco	58.9 (54.6-63.1)	62.5 (56.9-67.8)	51.9 (46.2-57.5)	48.3 (42.7-54.0)	18.5 (14.6-23.2)	7.4 (5.0-10.8)	5.7 (2.5-12.8)	1.6 (0.6-3.8)
Myanmar	52.1 (34.2-69.5)	61.6 (55.9-67.1)	49.0 (42.9-55.1)	52.2 (45.7-58.6)	19.8 (16.0-24.2)	6.1 (3.8-9.6)	3.9 (0.6-20.3)	3.0 (1.4-6.1)
Namibia	49.8 (41.6-58.0)	69.4 (57.9-78.9)	60.3 (48.6-70.9)	47.0 (37.6-56.7)	19.9 (13.1-29.1)	N/A	N/A	N/A
Nauru	72.7 (62.4-81.0)	53.0 (46.5-59.3)	42.5 (35.1-50.3)	63.3 (53.2-72.3)	38.0 (30.8-45.9)	12.3 (5.6-24.9)	N/A	1.1 (0.1-9.3)
Nepal	34.7 (24.8-46.3)	60.6 (49.0-71.1)	41.4 (29.7-54.2)	52.8 (40.1-65.1)	14.0 (6.6-27.2)	1.8 (0.6-5.2)	10.2 (1.1-54.4)	1.1 (0.3-3.6)
Romania	80.4 (74.4-85.3)	81.7 (75.0-86.9)	78.0 (71.1-83.7)	57.4 (49.7-64.8)	24.5 (18.5-31.7)	3.9 (1.8-8.5)	2.4 (0.3-15.1)	2.0 (0.6-6.0)
Rwanda	25.3 (16.3-37.0)	65.4 (44.5-81.7)	54.3 (29.7-77.0)	54.4 (34.3-73.1)	5.1 (0.7-29.1)	N/A	N/A	N/A
Samoa	29.1 (22.6-36.6)	68.9 (58.3-77.9)	60.7 (45.5-74.1)	51.3 (30.0-72.2)	34.9 (17.7-57.3)	N/A	N/A	N/A
Sao Tome & Principe	57.7 (46.1-68.5)	26.3 (14.1-43.7)	20.2 (14.8-27.0)	30.4 (18.2-46.3)	24.3 (13.7-39.4)	N/A	N/A	N/A
Seychelles	62.8 (55.0-70.1)	68.2 (58.7-76.4)	64.0 (54.4-72.5)	54.1 (44.4-63.5)	28.8 (20.8-38.4)	N/A	N/A	N/A
Solomon Islands	41.5 (32.0-51.6)	89.6 (79.0-95.1)	83.2 (68.6-91.8)	61.6 (46.2-75.0)	38.4 (25.5-53.1)	0.7 (0.1-5.5)	N/A	N/A
South Africa	59.6 (47.4-70.8)	62.1 (43.5-77.7)	62.1 (43.5-77.7)	36.4 (25.1-49.5)	14.1 (8.1-23.5)	N/A	N/A	N/A
Sri Lanka	81.1 (76.7-84.7)	80.2 (75.6-84.1)	73.2 (68.4-77.6)	52.6 (47.7-57.5)	21.2 (17.4-25.5)	27.4 (22.9-32.5)	39.0 (18.5-64.3)	9.6 (7.0-12.9)
St. Vincent & the Grenadines	82.4 (71.8-89.5)	78.3 (68.5-85.6)	65.9 (52.6-77.1)	58.7 (35.4-78.6)	36.7 (21.6-55.0)	9.8 (3.4-25.2)	N/A	3.3 (0.7-14.4)
Sudan	59.3 (53.5-64.8)	47.1 (41.6-52.7)	40.4 (35.2-45.8)	42.6 (35.7-49.9)	14.0 (9.3-20.6)	8.2 (4.8-13.5)	6.5 (1.9-20.4)	0.8 (0.2-3.8)
Tajikistan	81.6 (69.1-89.8)	54.6 (38.1-70.2)	39.8 (26.4-54.9)	17.7 (9.8-29.8)	4.3 (1.6-10.9)	10.1 (3.8-24.1)	15.8 (4.1-45.0)	N/A
Tanzania	51.7 (38.2-65.0)	69.1 (52.0-82.2)	58.4 (38.9-75.6)	56.4 (36.8-74.1)	13.2 (6.4-25.4)	N/A	N/A	N/A
Timor-Leste	17.2 (9.2-29.9)	72.7 (44.2-90.0)	63.6 (36.3-84.3)	54.5 (28.8-78.0)	9.1 (1.2-44.9)	0.0	N/A	0.0
Togo	31.8 (21.2-44.7)	88.8 (63.4-97.3)	83.3 (58.2-94.7)	59.8 (35.4-80.1)	6.8 (0.9-35.9)	N/A	N/A	N/A
Turkmenistan	26.9 (20.2-34.7)	54.5 (39.1-69.1)	40.2 (25.5-56.9)	23.7 (13.3-38.7)	2.3 (0.6-7.7)	26.9 (14.2-45.1)	19.5 (7.4-42.0)	5.4 (2.0-13.6)
Tuvalu	65.7 (56.0-74.3)	47.7 (33.2-62.6)	40.7 (24.7-58.8)	44.2 (33.9-55.1)	19.2 (10.9-31.6)	1.1 (0.3-3.2)	N/A	N/A
Uganda	40.7 (24.1-59.6)	64.7 (36.8-85.3)	55.6 (31.6-77.2)	32.0 (14.2-57.2)	16.2 (5.8-38.1)	4.7 (0.7-24.8)	N/A	N/A
Vanuatu	17.8 (13.4-23.3)	59.8 (48.3-70.3)	53.9 (42.6-64.7)	54.8 (42.0-66.9)	20.0 (12.8-30.0)	N/A	N/A	N/A
Vietnam	57.0 (47.1-66.4)	88.0 (77.2-94.1)	83.1 (71.7-90.5)	69.5 (57.4-79.3)	41.6 (29.4-54.8)	12.9 (7.2-22.2)	10.9 (1.3-53.2)	7.6 (3.6-15.2)
Zambia	23.4 (16.7-31.7)	86.5 (71.6-94.2)	74.5 (57.0-86.6)	60.5 (40.8-77.3)	28.3 (15.5-46.0)	1.8 (0.4-7.9)	12.1 (1.2-60.4)	1.4 (0.2-9.5)
Overall[x]	54.1 (52.5-55.8)	66.2 (64.1-68.1)	58.5 (56.2-60.7)	49.2 (47.2-51.2)	23.4 (21.7-25.2)	10.3 (9.2-11.6)	12.0 (9.6-14.9)	3.1 (2.5-3.8)

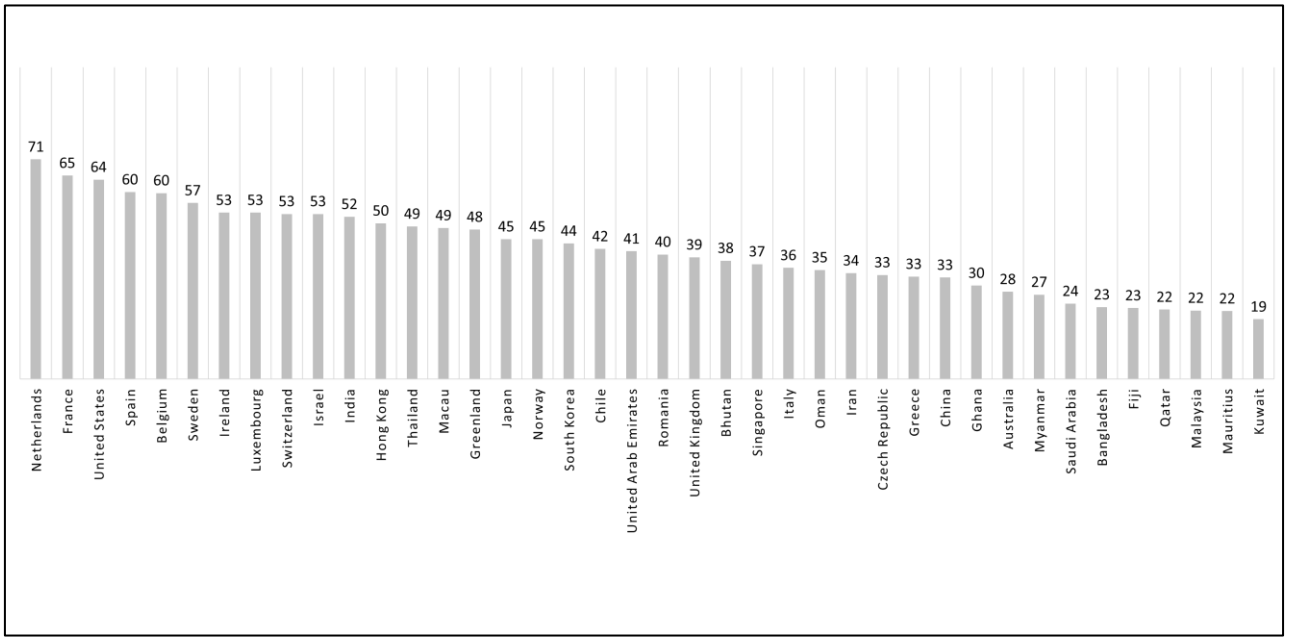
Appendix figure 1: Proportion of total diabetes population that are diagnosed by country. Data obtained from Flood *et al*. 2021 and complimented by a review of high-income countries.



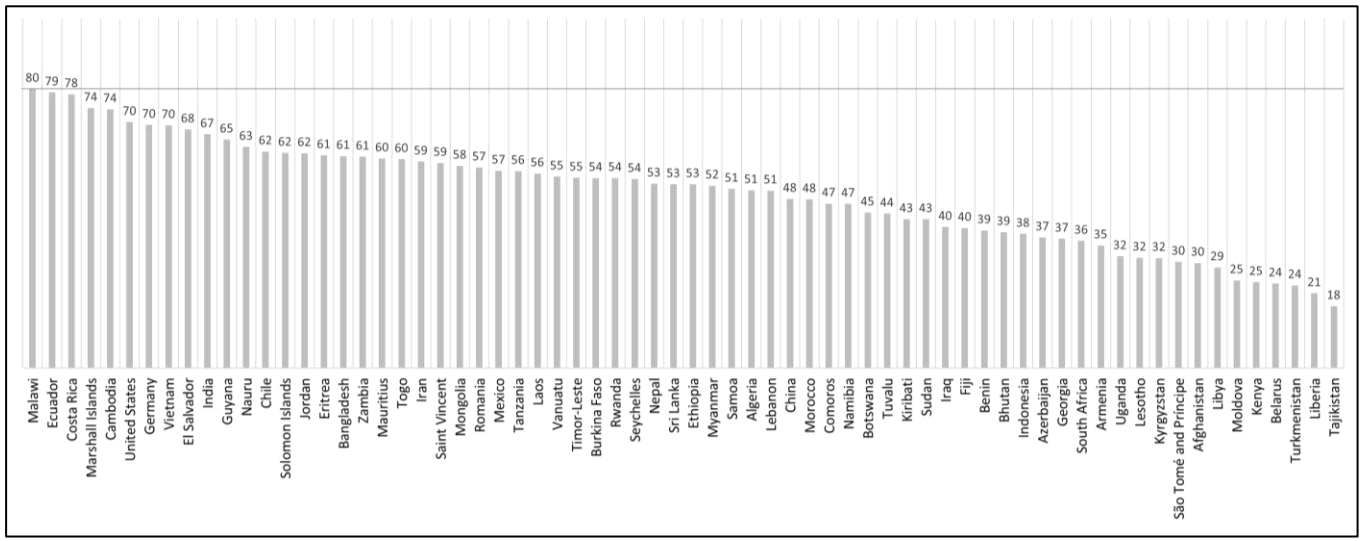
Appendix figure 2: Proportion of diagnosed DM population with glycaemic control <8% by country. Data obtained from Flood *et al*. 2021 and complimented by a review of high-income countries.



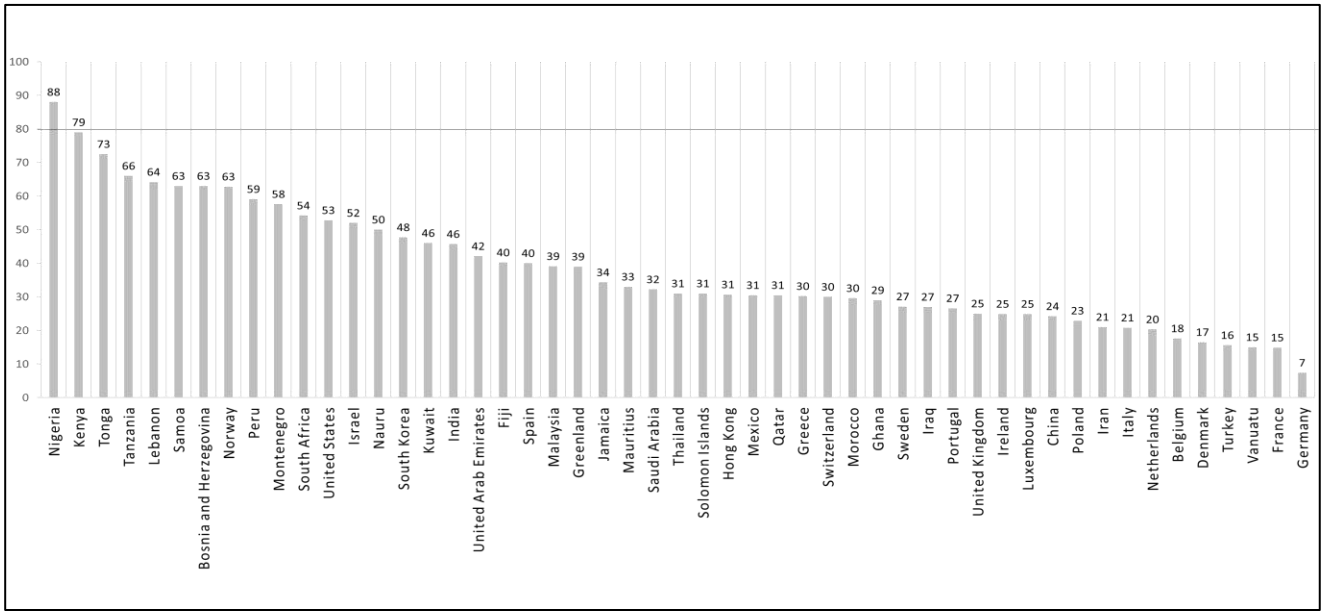
Appendix figure 3: Proportion of diagnosed DM population with glycaemic control <7% by country. Data obtained from Flood *et al*. 2021 and complimented by a review of high-income countries.



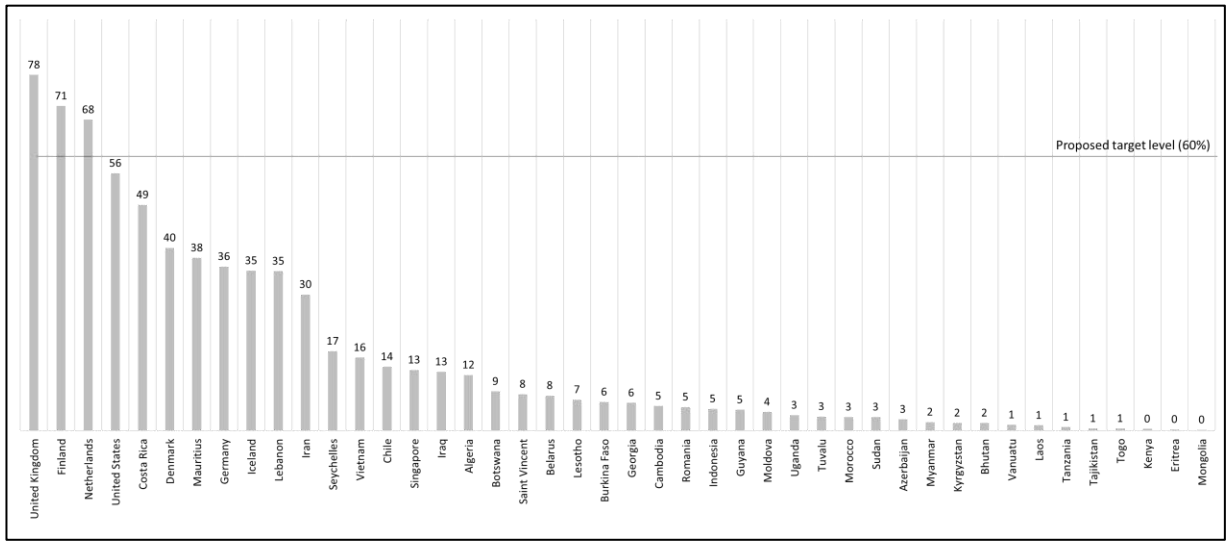
Appendix figure 4: Proportion of diagnosed DM population with blood pressure control <140/90 by country. Data obtained from Flood *et al*. 2021 and complimented by a review of high-income countries.



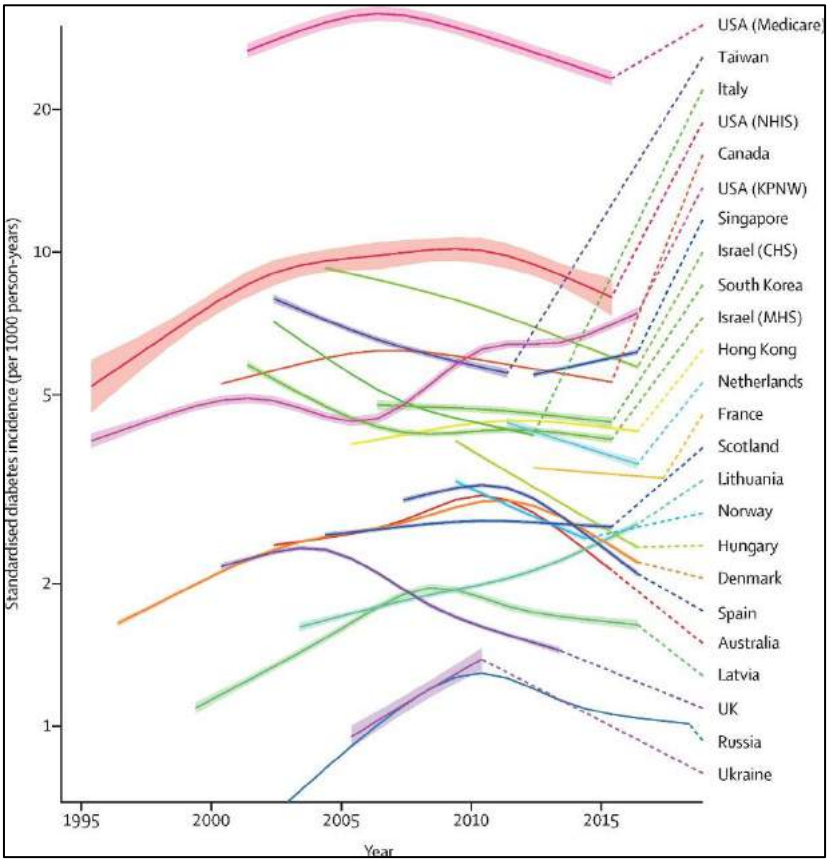
Appendix figure 5: Proportion of diagnosed DM population with blood pressure control <130/80 by country. Data obtained from Flood *et al*. 2021 and complimented by a review of high-income countries.



Appendix figure 6: Proportion of diagnosed DM population on a statin by country. Data obtained from Flood *et al*. 2021 and complimented by a review of high-income countries.



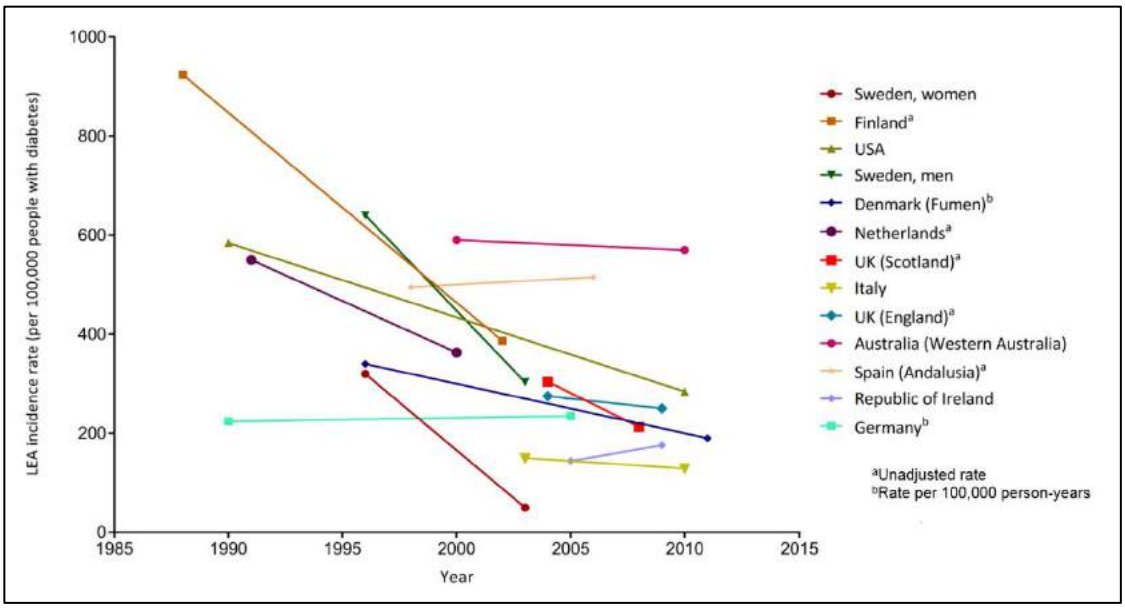
Appendix figure 7: Age-standardised and sex-standardised incidence rates of diagnosed diabetes per 1000 person-years (Obtained from Magliano *et al.* 2020)



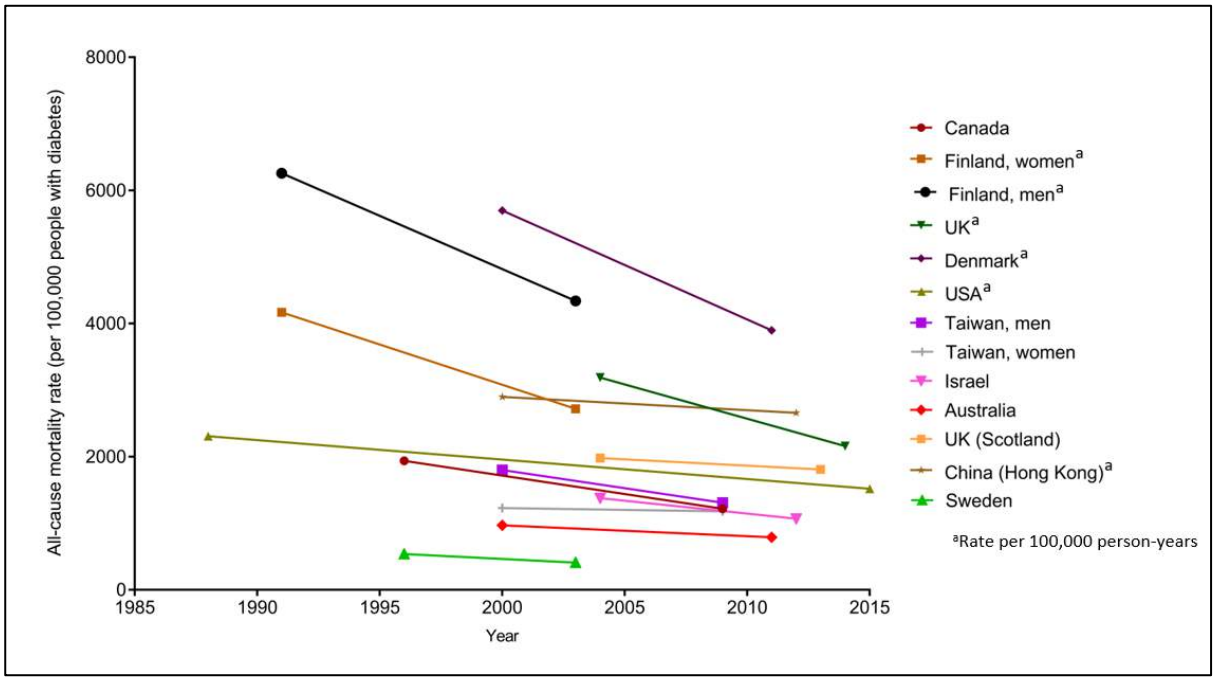
EU standard population 2010, with equal weights for men and women. Standardisation is based on annual age-specific incidence rates from age–period–cohort models fitted separately for each data source and sex. Shaded areas represent 95% CIs around incidence trends.

CHS = Clalit Health Services. KPNW=Kaiser Permanente Northwest. MHS = Maccabi Healthcare Services. NHIS = National Health Interview Survey.

Appendix figure 8: Trends in lower extremity amputations among people with diabetes, by country, between 1988 and 2011. (Obtained from Harding *et al.* 2018)



Appendix figure 9: Trends in all-cause mortality among people with diabetes, by country, between 1988 and 2015**.** (Obtained from Harding *et al.* 2018)



Appendix figure 10: Trends in the incidence rate (per million people in the general population/year) of diabetes related end stage renal disease, by country, between 2002 and 2015. (Obtained from Harding *et al.* 2018)