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Prevention and control of noncommunicable diseases in Turkey

The case for investment

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Prepared for Ministry of Health of Turkey by
WHO Regional Office for Europe

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Abstract

Noncommunicable diseases (NCDs) such as cancer, cardiovascular diseases, diabetes and chronic respiratory diseases and their risk factors are an increasing public health and development challenge in Turkey. This report provides evidence through three analyses that NCDs reduce economic output, and discusses potential options in response, outlining details of their relative returns on investment. An economic burden analysis shows that economic losses from NCDs are equivalent to 3.6% of gross domestic product. An intervention costing analysis provides an estimate of the funding required to implement a set of policy interventions for prevention and clinical interventions. A cost–benefit analysis compares these implementation costs with the estimated health gains and identifies which policy packages would give the greatest returns on investment.

Keywords
CHRONIC DISEASE - ECONOMICS
CHRONIC DISEASE - PREVENTION AND CONTROL
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Abbreviations

ACSC	ambulatory care-sensitive condition
AMI	acute myocardial infarction
COPD	chronic obstructive pulmonary disease
CVD	cardiovascular disease
FCTC	Framework Convention on Tobacco Control [of WHO]
FMC	family medicine centre
GDP	gross domestic product
ICD-10	International Classification of Disease, 10th revision
IHD	ischaemic heart disease
MPOWER	monitor tobacco use and prevention policies; protect people from tobacco smoke; offer help to quit tobacco use; warn people about the dangers of tobacco; enforce bans on tobacco advertising, promotion and sponsorship; raise taxes on tobacco [WHO package]
NCD	noncommunicable disease
ROI	return on investment
SHAKE	surveillance; harness industry; adopt standards for labelling and marketing; knowledge; environment [WHO package]
SSI	Social Security Institute
STEPS	STEPwise approach to surveillance [of WHO]
TL	Turkish lira

Executive summary

Noncommunicable diseases (NCDs) such as cancer, cardiovascular disease (CVD), diabetes and chronic respiratory disease and their risk factors (tobacco use, harmful use of alcohol, unhealthy diet and physical inactivity) are an increasing public health and development challenge globally. In Turkey NCDs have a significant impact on the productivity of the workforce, causing disability and premature deaths; this has a negative impact on socioeconomic development. NCDs are responsible for 87.5% of all deaths in the country. The probability of premature death (death before the age of 70 years) from one of the four major NCDs for a person living in Turkey was around one in six (16.8%) in 2015.

The government was estimated to have spent 24.5 billion Turkish lira (TL) in 2015 on treatment of NCDs. A share of these funds could be redirected towards NCD prevention through implementation of national policies and more active primary care interventions, which are shown to be effective at boosting the economy and improving long-term health outcomes.

This report provides evidence that NCDs reduce economic output and discusses potential options in response, arriving at a set of interventions that are most suited to Turkey. Three analyses – each of which drew on the United Nations Interagency Working Group on Costing's strategic planning OneHealth Tool – were performed to arrive at these results.

- An economic burden analysis showed the scale of disruption to the economy from NCDs through assessment of their direct and indirect costs. Direct costs include government (public) health care costs for treating CVD, diabetes, cancer and respiratory disease. Indirect costs are based on disability payments, costs of absenteeism, costs of presenteeism and economic losses due to premature deaths among people of working age.
- An intervention costing analysis provided an estimate of the funding required to implement a set of NCD interventions. Costs of policy interventions were assessed using a WHO costing tool; costs for clinical interventions for CVD and diabetes were estimated using the WHO OneHealth Tool on the basis of prices of medications and supplies, as well as medical staff salaries.
- A return on investment (ROI) analysis compared the estimated implementation costs during the costing analysis with the estimated health gains and economic returns of a set of interventions. It measured the benefits that would be obtained for each sum spent on health intervention; for example, spending on salt reduction. As a preliminary step, the health benefits of these interventions were estimated using the OneHealth Tool and converted to monetary units.

In addition, a health care resources utilization analysis was performed on the ambulatory care-sensitive conditions (ACSCs) among the four main NCDs of interest.

The economic burden analysis found that government expenditure on health care for NCDs is just the tip of the iceberg: the hidden additional costs from lost productivity are higher than the health care costs. Altogether, the economic cost of NCDs to the Turkish economy in 2016 was TL 69.7 billion, which is equivalent to 3.6% of the country's annual gross domestic product.

Actions to prevent NCDs are relatively cheap and cost-effective. Their implementation requires engagement from sectors beyond health, such as finance, economy and agriculture, and benefits from the investments would accrue across the whole of government and society. The intervention costing analysis reviewed five packages of interventions for the prevention and control of NCDs which were considered priorities during the consultations with local experts: policy interventions for tobacco and alcohol use, salt intake and physical inactivity , and clinical interventions for CVD and diabetes in primary care. Policy packages to reduce consumption of tobacco, alcohol and salt and to increase physical activity were estimated to cost TL 384 million, TL 90.6 million,

TL 46.1 million and TL 124.3 million at five years, respectively. The CVD and diabetes interventions were found to be the most expensive options, costing TL 1619.0 million.

The ROI analysis was carried out for the same five packages of interventions. The results were generated over two scale-up periods: an initial five-year and a 15-year period. The analysis showed that the economic benefits of the interventions exceeded their implementation costs in both the shorter and longer time periods.

The most cost-effective interventions in Turkey were shown to be those for salt: the economic benefits of these packages far exceed their costs in the short and long term. The salt policy package achieved ROIs of 51 and 88 TL at five and 15 years, respectively. Reducing tobacco consumption – for example, through increased taxation – and increasing physical activity in the population would also be very cost-effective (with ROIs of 5.0 and 2.3 at 15 years, respectively), as would CVD and diabetes interventions in primary care – these achieved an ROI of 4.3 at 15 years.

Analysis of the ACSCs revealed that 942 047 hospitalizations occur annually for such conditions among the four main NCDs of interest (this figure represents those paid from social security funds; the number of hospitalizations for private clinics is unknown). This rate of hospitalizations relative to the number of registered patients is comparable to rates in other countries where such analysis has been performed. The analysis found signs of underuse of primary care among patients with some ACSCs.

1. Introduction

In 2012 noncommunicable diseases (NCDs) accounted for 87.5% of all deaths among people aged 30–70 years in Turkey – of these, 36.6% were due to cardiovascular disease (CVD), 38.9% to cancer, 7% to chronic respiratory diseases and 5.8% to diabetes (Turkish Statistical Institute, 2013). The latest WHO figures from 2015 show that a Turkish citizen has about a one-in-six chance (16.8%) of dying prematurely – that is, before the age of 70 years – from one of these four main NCDs, with a higher probability for men (22.5%) than women (11.6%) (WHO, 2017a). This highlights a significant opportunity to make progress on United Nations Sustainable Development Goal target 3.4, which aims to reduce premature mortality from NCDs by one third by 2030.

The impact of NCDs on human health is clear, but it is only one part of the story. NCDs also result in high economic costs, reaching far beyond direct health care costs. NCDs reduce productivity at a macro-economic level through interruption of full participation in the labour force and the subsequent impacts on individuals, their carers and the state. When individuals die prematurely, the labour output they would have produced in their remaining working years is lost. In addition, individuals who suffer from a disease are more likely to miss days of work (absenteeism) or to work at a reduced capacity while at work (presenteeism[1]). In low- and middle-income countries it is estimated that, between 2011 and 2030, NCDs will cause more than US$ 21 trillion in lost economic output, with nearly one third of that figure attributable to CVD alone (Bloom et al., 2011). For individuals and governments, spending on health can mean significant opportunity costs,[2] including decreased investment in education, transportation projects or other forms of human or physical capital that can produce long-term returns.

High human and economic costs highlight the need to reduce the burden of NCDs in Turkey. WHO recognizes that the risk of NCDs can be reduced by modifying four behaviours (tobacco use, harmful use of alcohol, an unhealthy diet and physical inactivity) and metabolic risk factors such as high blood pressure and cholesterol (WHO, 2013). Fig. 1 illustrates the determinants and risk factors that drive the development of NCDs, many of which are beyond the control of the health sector alone.

WHO developed a menu of policy options and cost-effective interventions to assist Member States to reduce the NCD burden within its global action plan for the prevention and control of NCDs 2013–2020 (WHO, 2013). These were recently updated at the World Health Assembly (WHO, 2017b) and include measures to reduce behavioural and metabolic risk factors for NCDs, as well as clinical interventions to prevent and treat disease. Given the high proportion of deaths caused by heart disease, stroke, myocardial infarction and other circulatory diseases in Turkey (estimated to be 47% in 2014 (WHO, 2014a)), the economic analysis detailed in this study focuses primarily on interventions that can reduce this burden of CVD.

Purpose of the economic analysis component of the case for investment

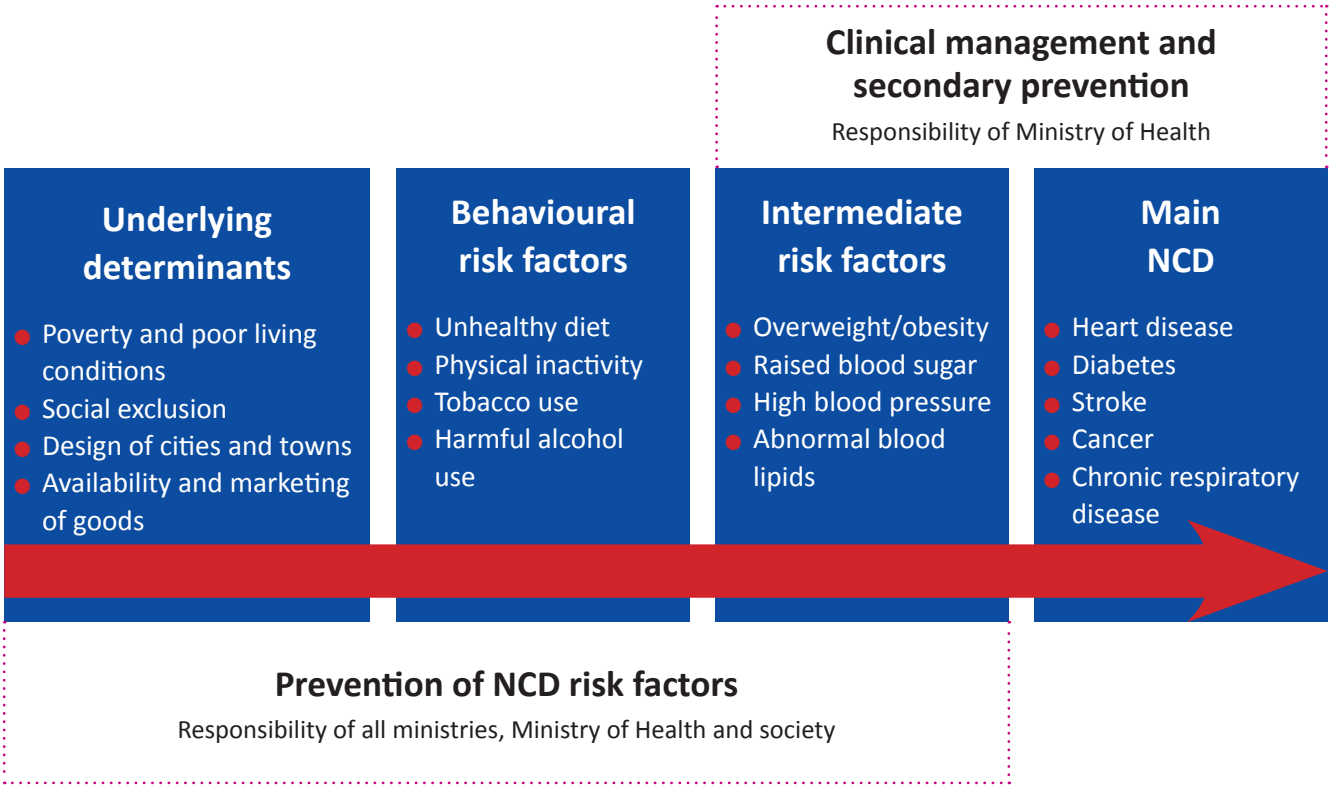
The negative economic impacts from NCDs are too often overlooked in budgetary allocation processes and in weighing the pros and cons of stronger fiscal and regulatory action. Quantifying the costs of NCD management and interventions to prevent and control NCDs, as well as their returns on investment (ROIs) in relation to the costs of inaction, has been a high-priority request from Member States. Investment cases are designed to help countries make their own economic rationales for action to prevent and control NCDs.

In April 2016, at the invitation of the Minister of Health, the United Nations Interagency Task Force on the Prevention and Control of NCDs led a joint United Nations team visit to Turkey (UNIATF, 2017). This aimed to promote a whole-of-government and whole-of-society response to NCDs and to support the government in putting NCDs at the forefront of the national development agenda.

[1] "Presenteeism" is defined as reduced productivity at work.

[2] "Opportunity cost" is a term used in economics, defined as the cost of something in terms of an opportunity forgone: "opportunity cost is given by the benefits that could have been obtained by choosing the best alternative opportunity" (Oxford Dictionary of Economics [online]).

Fig. 1. Determinants of NCDs and responsibilities for response



In February 2017 the Minister of Health first raised the possibility of carrying out an NCD investment case study during a policy forum in Ankara, Turkey, on strengthening health financing to promote the country's health system goals (WHO Regional Office for Europe, 2017a). This was followed by a request from the Director-General of Public Health of the Ministry of Health to the WHO Regional Office for Europe for assistance in scaling up core NCD services in primary health care. This study was requested as evidence-based support for improvement of NCD interventions through employment of human resources, payments and incentives, as Turkey plans to strengthen the national model of chronic disease monitoring and to reduce the number of people registered at each family health centre.

A WHO visit to Turkey was undertaken in April 2017 to discuss the methodology and collect data. To support the overarching economic analysis, the team also carried out a desk review of published materials to develop a situation analysis and help identify policy strengths and areas for further development. Following the initial analysis, preliminary results were discussed at a national workshop in September 2017. It was agreed to expand the policy packages modelled to include policy interventions for all four risk factors and a package of clinical interventions, all of which were based on the WHO "best buys".

The investment case allows scaled-up action – and the costs of inaction – to be modelled in short-term (five years) and long-term (15 years) time frames. One scenario used is a continuation of the status quo, in which no new policies are implemented and current coverage levels remain in place – i.e. the costs of inaction. The other scenario is one in which selected policies and clinical interventions are scaled up over the next 15 years. The analysis used the WHO OneHealth Tool, an epidemiology-based population model developed by United Nations partners to enable strategic planning and costing of interventions and projection of the health benefits expected from their implementation. Health benefits are generated in terms of natural units (cases or deaths averted) but also monetized using the human capital approach to enable benefit–cost ratios (the primary ROI metric) to be evaluated and reported for each package of interventions.

Section 2 provides an analysis of NCD behavioural risk factors in Turkey, including current levels of tobacco, alcohol and salt consumption, as well as physical inactivity levels and prevalence of metabolic risk factors such as raised total cholesterol and raised blood pressure within the population. Section 3 outlines evidence-based policies and clinical interventions that can contribute to reducing the burden of disease – CVD in particular – and details the current implementation level of policies and interventions in Turkey. Section 4 describes the methods and tools used in the analysis. Section 5 presents the results, including total costs, and the expected health and economic benefits (such as healthy life-years gained, mortality averted and productivity gains) of implementing the policy packages described, as well as the clinical interventions. Section 6 outlines the conclusions to be drawn from these.

2. Situation analysis: NCDs and risk factors

This section sets out the background information used in preparation of the investment case analysis. It addresses NCDs as a whole and the extent to which behavioural risk factors – such as tobacco use, harmful alcohol consumption, physical inactivity and high salt intake – are present in Turkey, as well as the prevalence of metabolic risk factors such as raised blood pressure, cholesterol, obesity and diabetes.

The age-standardized premature mortality rate from the four major NCDs (cancer, CVD, diabetes and chronic respiratory disease) for those aged 30–69 years in Turkey in 2013 was 442 per 100 000 population for males and 211 per 100 000 for females; these rates are lower than the averages for the WHO European Region of 548 and 266, respectively (WHO Regional Office for Europe, 2017b). As of 2013, Turkish life expectancy at birth (81.71 years for women; 76.09 years for men) was above the average for the Region (80.86 years for women; 74.19 years for men).

Tobacco use

Findings from the 2012 Global Adult Tobacco Survey indicated that there were 14.8 million smokers in Turkey (Ministry of Health, 2014). Smoking prevalence declined between 2008 and 2012 for both men and women to become 41.5% for men and 13.1% for women by 2012. By 2017, however, 43.6% of men (aged 15 years and over) had become current smokers, with prevalence also rising among women (aged 15 years and over) to reach 19.7% (Ministry of Health, 2017a).

An estimated 10.4% of youths (12.1% of boys; 8.3% of girls) aged 13–15 years currently smoke cigarettes and 10.5% (13.6% of boys; 7.0% of girls) use other tobacco products (CDC, 2012). Almost half the students surveyed lived in homes where others smoked, and two thirds were around others who smoked in their presence outside the home.

According to a survey of chronic diseases and risk factors undertaken in 2011 (Ministry of Health, 2013), smoking was more prevalent in urban than rural areas, and was permitted in one in three houses (37%) and one in four workplaces (23%).

Key facts are summarized in Box 1.

Box 1. Tobacco snapshot

Tobacco use is of major concern as two fifths of Turkish men smoke – three times the proportion of women – and rates appear to have increased in the last five years, particularly for women.

Attributable NCDs include multiple forms of cancer; ischaemic heart disease (IHD), stroke and other CVD and circulatory diseases; chronic obstructive pulmonary disease and pneumoconiosis; and peptic ulcer disease, diabetes, cataract, macular degeneration and rheumatoid arthritis.

Harmful alcohol use

Already relatively low compared with the average in the WHO European Region, the rate of alcohol consumption appears to have reduced between 2004 and 2016 (WHO, 2018). Men are estimated to consume almost nine times (3.7 litres) as much pure alcohol per capita as women (0.4 litres) on average annually. In 2017, 13.1% of men (aged 15 years and over) and 3% of women (aged 15 years and over) are current alcohol drinkers – that

is, they had consumed alcohol in the previous 30 days (Ministry of Health, 2017a).

Harmful use of alcohol is higher among men than women. Among alcohol users, 8.7% of male drinkers binged (consumed six or more drinks in one sitting) during the month before the survey compared to 1.8% of female drinkers (Ministry of Health, 2017a).

Key facts are summarized in Box 2.

Box 2. Alcohol snapshot

Alcohol use is relatively low and appears to be reducing, but men drink almost nine times as much as women and have riskier drinking patterns.

Attributable NCDs include multiple forms of cancer, pancreatitis, epilepsy, diabetes, cirrhosis and IHD, stroke and other cardiovascular and circulatory diseases.

Physical inactivity

In 2017, the STEPwise approach to surveillance (STEPS) survey found that 33.1% of men and 53.9% of women were not meeting WHO recommendations on physical activity[3] (Ministry of Health, 2017a). Rates of inactivity are higher for women than men; men do three times as many minutes of physical activity per day as women.

Around four fifths (81.3%) of adults do not engage in vigorous activity, particularly women.

Around a quarter (29%) of physical activity is work-related; over half (59.5%) is transport-related and an eighth is recreational (12.5%).

Key facts are summarized in Box 3.

Box 3. Physical inactivity snapshot

Activity levels are of concern as one in three men and one in two women do not meet WHO recommendations on physical activity, and men do three times as much physical activity per day as women.

Attributable NCDs include coronary heart disease, type 2 diabetes and breast and colon cancers (Lee et al., 2012).

Unhealthy diet (salt)

Salt/sodium consumption in Turkey is high. In 2008 salt intake was estimated to be 18 g a day (compared with the WHO recommendation to consume less than 5 g of salt per day), but this had reduced to 14.8 g per day in 2012 according to the SALTurk studies (Erdem et al., 2010; 2017). The STEPS survey (using a different method for estimation) found a level of 9.9 g per day in 2017 (Ministry of Health, 2017a).

The main source of salt is bread (34%). This is followed by salt added during cooking and preparing food before serving (30%), salt from various processed foods (21%) and salt added at the table during food consumption (11%) (Erdem et al., 2017). Around a quarter (26.0%) of the population add salt always or often when cooking or preparing food at home, and around a quarter (28.1%) add salt always or often before eating or when eating (Ministry of Health, 2017a).

Just under a fifth (17.1%) of cardiovascular deaths among 20–69-year-olds in 2010 were attributed to sodium consumption of more than the WHO recommendation to consume less than 2 g per day – a greater proportion for stroke than coronary heart disease (Mozaffarian et al., 2014).

Key facts are summarized in Box 4.

Box 4. Salt snapshot

Salt consumption is high, at around two to three times the WHO recommendation, but it is reducing. A quarter of people add salt to food before/when eating it or when cooking.

Attributable NCDs include stomach cancer and increased risk of IHD, stroke and other cardiovascular and circulatory diseases due to hypertension.

The proportion of cardiovascular deaths attributable to high sodium is 17.1%.

[3] 150 minutes of moderate-intensity physical activity per week, or equivalent

Metabolic risk factors

High levels of metabolic factors significantly increase the risk of having a cardiovascular event. Table 1 displays the prevalence of raised blood pressure,[4] raised total cholesterol,[5] raised blood sugar/diabetes[6] and obesity within the Turkish population reported by the 2017 STEPS survey (Ministry of Health, 2017a). The prevalence of obesity (body mass index of 30 kg/m^2 or more) was found to be 28.8 (21.6 for men and 35.9 for women) in the population aged 15 years and over, for both sexes.

Table 1. Crude prevalence of metabolic risk factors, by age and gender

Factor	Men			Women		
	30–44 years	45–59 years	60-69 years	30–44 years	45–59 years	60-69 years
Raised blood pressure	16.3%	36.6%	54.8%	16.3%	41.8%	61.9%
Raised total cholesterol	21.8%	28.2%	34.1%	22.5%	50.9%	51.3%
Diabetes	7.8%	14.5%	30.6%	8.9%	18.4%	21.8%
Obesity	19.7%	32.5%	40.6%	30.1%	55.9%	66.9%

Source: Ministry of Health (2017a).

While elevated levels of any one factor can increase the risk of a cardiovascular event, the risk is compounded for individuals with multiple metabolic risk factors. WHO risk prediction charts assess the likelihood of an individual having a cardiovascular event and/or dying within 10 years by combining six factors: gender, age, blood pressure, cholesterol, smoking status and whether or not they have diabetes (WHO, 2016a). The prevalence of high cardiovascular risk among the Turkish population can be estimated from the 2017 STEPS survey according to the presence of risk factors or history of CVD or diabetes (Ministry of Health, 2017a). This suggests that 10.5% of Turkish adults aged 40–69 years have a probability of 30% or higher of having a fatal or nonfatal cardiovascular event within 10 years; this rises with age but differences between men and women are not statistically significant (Table 2).

Table 2. Crude prevalence of high cardiovascular risk, by age and gender

Factor	Men		Women	
	40–54 years	55–69 years	40–54 years	55–69 years
10-year cardiovascular risk ≥30%, or with existing CVD	7.2%	22.5%	5.4%	11.6%

Source: Ministry of Health (2017a).

[4] Systolic blood pressure ≥140 mmHg and/or diastolic blood pressure ≥90 mmHg or currently on medication for raised blood pressure.

[5] Raised total cholesterol ≥5.0 mmol/L or >=190 mg/dl or currently on medication for raised cholesterol.

[6] Raised blood glucose (defined as either plasma venous value of ≥7.0 mmol/L (126 mg/dl) or capillary whole blood value of >=6.1 mmol/L (110 mg/dl)) or currently on medication for diabetes.

3. Policies and treatments to reduce the NCD burden

Endorsed in 2017, the Multisectoral action plan of Turkey on noncommunicable diseases 2017–2025 (Ministry of Health, 2017b) is a framework document encompassing the following current programmes:

- Republic of Turkey, Ministry of Health strategic plan 2013–2017;
- National cancer control programme 2013–2018;
- Prevention and control of chronic airway disease programme of Turkey 2014–2017;
- Prevention and control of cardiovascular disease programme of Turkey 2015–2020;
- Turkey diabetes programme 2015–2020;
- Prevention and control of kidney diseases programme of Turkey 2014–2017;
- Prevention and control of musculoskeletal system diseases programme of Turkey 2015–2020;
- National tobacco control programme action plan 2015–2018;
- Healthy nutrition and physical activity programme of Turkey 2014–2017;
- Programme for reducing high salt consumption in Turkey 2017–2021.

As highlighted in Section 1, WHO has published a menu of policy options and cost-effective interventions to prevent and treat NCDs (WHO, 2013; WHO, 2017b). The economic analysis for this investment case focuses on selected interventions for NCD prevention (policies on tobacco, alcohol, physical inactivity and salt) and management of cardiovascular risk and disease. The following sections summarize national efforts in implementing interventions for specific areas, drawing on the relevant published national and international documents.

Tobacco

Turkey ratified the WHO Framework Convention on Tobacco Control (FCTC) in 2004 and has committed to implementing a comprehensive tobacco control policy (WHO, 2017c; 2017d).

Table 3 summarizes a comparison of Turkey's current tobacco control measures against the MPOWER intervention package (monitor tobacco use and prevention policies; protect people from tobacco smoke; offer help to quit tobacco use; warn people about the dangers of tobacco; enforce bans on tobacco advertising, promotion and sponsorship; raise taxes on tobacco) as reported in the WHO report on the global tobacco epidemic (WHO, 2017e), supplemented by available national and international information.

Table 3. The current state of tobacco control measures in Turkey

Policy	Achievements (maximum of 4)	Current state of implementation
Monitor tobacco use and prevention policies	4	Recent and representative data are available for both adults and youths – for example, from the Global Youth Tobacco Survey (CDC, 2012), the Global Adult Tobacco Survey (Ministry of Health, 2014), the survey of chronic diseases and risk factors (Ministry of Health, 2013) and the STEPS survey (Ministry of Health, 2017a).
Protect people from tobacco smoke	4	For eight categories of public place[a] WHO reports that complete smoke-free laws exist (WHO, 2017d). Smoking violations incur fines for the smoker and the establishment and there are dedicated funds for enforcement.

Table 3 contd

Policy	Achievements (maximum of 4)	Current state of implementation
Offer to help to quit tobacco use	4	Nicotine replacement therapy is on the national essential medicines list and costs are fully covered. It is available without prescription in pharmacies. Tobacco cessation services are available in some health clinics and hospitals with costs fully covered. A toll-free telephone quit line exists.
Warn about the dangers of tobacco	4	Large health warnings on tobacco packages with all appropriate characteristics exist, covering 65% of the front and rear of the package combined. A national anti-tobacco campaign was aired during 2014–2016.
Enforce bans on tobacco advertising, promotion and sponsorship	4	WHO reports a ban on national television, radio and print media, as well as other forms of direct and/or indirect advertising. A point-of-sale ban on advertising is not in place.
Raise taxes on tobacco	4	WHO reports that total taxes comprised 82.4% of the retail price for most sold brands in 2016 and that cigarettes have become less affordable since 2008. Of the total taxes, 1.9% comprised specific excise tax, 65.3% was ad valorem excise tax and 15.3% was value added tax. According to WHO recommendations, the amount of total tax per pack should comprise at least 75% of the retail price including a 70% specific excise tax.

[a] Legislation was assessed to determine whether smoke-free laws provided for a complete indoor smoke-free environment at all times, in all the facilities of each of the following eight categories of place: health care facilities; educational facilities other than universities; universities; government facilities; indoor offices and workplaces not considered in any other category; restaurants or facilities that serve mostly food; cafés, pubs and bars or facilities that serve mostly beverages; and public transport.
Source: WHO (2017d).

Most of these policy interventions are also WHO "best buys" (WHO, 2017b); that is, effective interventions with cost–effectiveness analysis ≤100 international dollars per disability-adjusted life-year averted in low/middle-income countries. This list largely corresponds with those listed within the OneHealth Tool that can be modelled as part of the ROI analysis:

- monitor tobacco use/prevention policies
- protect people from tobacco smoke
- offer to help quit tobacco use: mCessation
- warn about danger: warning labels
- warn about danger: mass-media campaign
- enforce bans on tobacco advertising
- enforce youth access restriction
- raise taxes on tobacco
- plain packaging of tobacco products.

Alcohol

The global strategy and European action plan to reduce the harmful use of alcohol, as well as the updated Appendix 3 of WHO's global action plan for the prevention and control of NCDs 2013–2020, list core policy options for alcohol control (WHO, 2010; 2017b; WHO Regional Office for Europe, 2012). These are reproduced in Table 4, alongside some of the achievements in reducing alcohol consumption in Turkey. This assessment draws on various national and international sources.

Table 4. The current state of alcohol control interventions in Turkey

Policy	Policy options	Current state of implementation
Taxation	Increase excise taxes on alcoholic beverages	Regular twice-yearly excise tax increases adjusted to the consumer price index were introduced on beer, wine and spirits in 2012. There are no taxes, however, to make alcohol products less attractive to young people. This area was scored as "limited" in one WHO report (WHO Regional Office for Europe, 2014) but as "fully achieved" by 2017 in another (WHO Regional Office for Europe, 2017c).
Advertising	Enact and enforce bans or comprehensive restrictions on exposure to alcohol advertising (across multiple types of media)	A full ban on alcohol marketing is well enforced. The law restricts the advertisement and promotion of alcohol. Alcohol manufacturers cannot advertise or sponsor organizations. This area was scored as "extensive" in one WHO report (WHO Regional Office for Europe, 2014), and as "fully achieved" in another (WHO Regional Office for Europe, 2017c).
Availability	Enact and enforce restrictions on the physical availability of retailed alcohol (via reduced hours of sale)	A decree restricting the sale and service of alcohol products entered into force in 2011. Retail sales are banned between 10pm and 6am. Alcohol cannot be displayed in shop windows and cannot be sold in the vicinity of schools and places of worship. All governmental and educational institutions are free of alcohol. Sale to children aged under 18 years is banned; this is effectively enforced. Any establishment that violates the regulation is punished severely, although it does not lose its licence. This area was scored as "moderate/extensive" in a WHO report (WHO Regional Office for Europe, 2014) and as only "partially achieved" in another (WHO Regional Office for Europe, 2017c).
Drink–driving	Enact and enforce drink–driving laws and blood alcohol concentration limits via sobriety checkpoints	In 1997, 0.50g/litre was set as the maximum blood alcohol content for drivers. With a new regulation introduced in 2013 the limit was decreased to 0.21 g/litre for all drivers except for private car drivers. This area was scored as "limited/moderate" in a WHO report (WHO Regional Office for Europe, 2014).

Table 4 contd

Policy	Policy options	Current state of implementation
Brief interventions	Provide brief psychosocial intervention for persons with hazardous and harmful alcohol use	Training for health care staff in screening and brief interventions for alcohol use is available.

The first three interventions listed in Table 4 are also WHO "best buys". The fourth and fifth are WHO "effective interventions" with cost–effectiveness analysis >100 international dollars per disability-adjusted life-year averted in low/middle-income countries. These policy interventions largely correspond with those listed within the OneHealth Tool that can be modelled as part of the ROI analysis:

- enforce restrictions on availability of retailed alcohol
- enforce restrictions on alcohol advertising
- enforce drink–driving laws (sobriety checkpoints)
- raise taxes on alcoholic beverages.

Physical inactivity

The updated Appendix 3 of WHO's global action plan for the prevention and control of NCDs 2013–2020 lists several policy options for improving physical activity levels (WHO, 2017b). These are reproduced in Table 5, alongside some of the achievements in increasing physical activity in Turkey.

Table 5. The current state of physical activity interventions in Turkey

Policy	Policy options	Current state of implementation
Knowledge	Implementation of public awareness and motivational communications for physical activity, including mass-media campaigns for physical activity behaviour	Turkey has implemented at least one recent national public awareness programme on physical activity. Special days and weeks are celebrated in all 81 provinces to create awareness of nutrition, obesity, diabetes and physical activity. This intervention area was assessed as "moderate" in one WHO report (WHO Regional Office for Europe, 2014) and as "fully achieved" in another (WHO Regional Office for Europe, 2017c).
Health system	Provision of physical activity counselling and referral as part of routine primary health care services through the use of a brief intervention	Initiatives for workforce development for nutrition and physical activity are under way, with nutrition and physical activity considered a priority element in primary care.
Environment	Ensuring that macro-level urban design incorporates the core elements of residential density, connected street networks that include sidewalks, easy access to a diversity of destinations and access to public transport	National guidelines on physical activity, which include national recommendations, have been completed. The Turkish Association of Healthy Cities (49 members covering 30 million people) is active in healthy urban planning and designing cities to promote active living (WHO Regional Office for Europe, 2015a).
	Provision of convenient and safe access to high-quality public open space and adequate infrastructure to support walking and cycling	

Table 5 contd

Policy	Policy options	Current state of implementation
Setting	Implementation of a whole-of-school programme that includes high-quality physical education, availability of adequate facilities and programmes to support physical activity for all children	Measures have been taken to promote physical activity in schools, including developing a physical education curriculum.
	Implementation of multicomponent workplace physical activity programmes	
Promotion	Promotion of physical activity through organized sport groups and clubs, programmes and events	Physical activity is actively promoted in cities (WHO Regional Office for Europe, 2015a).

The OneHealth Tool can model the following policy change as part of the ROI analysis:

- public awareness campaigning on physical activity.

Unhealthy diet

Policies on diet, physical activity and counteracting obesity were reviewed by WHO in 2016 (WHO Regional Office for Europe, 2016a). As the OneHealth Tool is not yet able to calculate the impact of interventions on fats and sugar, this section focuses on salt only.

Salt-reduction policies have been assessed overall as partially implemented (WHO Regional Office for Europe, 2017c). Table 6 compares Turkey's current state against SHAKE, a set of WHO measures that outline steps countries can take to reduce salt intake (surveillance; harness industry; adopt standards for labelling and marketing; knowledge; environment) (WHO, 2016b). Salt-reduction strategies in Turkey were assessed as "moderate/extensive" in a 2014 WHO report (WHO Regional Office for Europe, 2014) and as "fully achieved" in a 2017 WHO report (WHO Regional Office for Europe, 2017c).

Table 6. The current state of policies to reduce salt consumption in Turkey

Policy	Description[a]	Current state of implementation
Surveillance: measure and monitor salt use	Measure and monitor population salt consumption patterns and the sodium content of food	Turkey is one of the few countries that have conducted two nationally representative studies of 24-hour sodium urinary excretion (in 2008 and 2012). Further, the 2017 STEPS survey (Ministry of Health, 2017a) asked about salt consumption patterns and included urine spot tests for estimating salt consumption (see details in Section 2). Analysis of the nutritional composition of commonly available, widely consumed foods was carried out through an unpublished WHO survey. Better monitoring of the food supply has been recommended by WHO (WHO Regional Office for Europe, 2016a).

Table 6 contd

Policy	Description[a]	Current state of implementation
Harness industry: promote reformulation of foods and meals to contain less salt	Set target levels for the amount of salt in foods and meals and implement strategies to promote reformulation	In 2012 a regulation to reduce the salt content of bread to 1.5 g/100 g was passed, and a 25% reduction of salt in bread was achieved. In addition, during 2012–2015 the regulation was extended beyond bread to limit the salt content of pastrami (reduction from 8.5 g to 7 g/100 g achieved), dried red pepper (22% reduction achieved), tomato paste (64% reduction achieved) and cheese (35–61% reduction achieved, depending on type) (WHO Regional Office for Europe, 2016a).
Adopt standards for labelling and marketing: implement standards for effective and accurate labelling and marketing of food	Adopt front-of-pack nutrition labelling systems (e.g. colour-coded for salt content level, "high salt" warning)	There is a compulsory message on salt packages: "Reduce salt, maintain your health".
Knowledge: educate and communicate to empower individuals to eat less salt	Implement integrated education and communication strategies to raise awareness about the health risks and dietary sources of salt in order to change behaviour	There are education and awareness-raising campaigns for the public about salt and health; these focus more on the discretionary addition of salt by consumers, notably in cooking at home, rather than the "hidden" salt content of processed foods.
Environment: support settings to promote healthy eating	Implement multicomponent salt-reduction strategies in community settings (e.g. schools, workplaces, hospitals)	Salt shakers have been removed from the cafeterias and food facilities of all public institutions.

[a] Information in the Description column is derived from the SHAKE technical package for salt reduction (WHO, 2016b).

Four of these interventions are assessed as WHO "best buys" (reformulation; environment; knowledge; labelling). These policy interventions correspond with those listed within the OneHealth Tool that can be modelled as part of the ROI analysis:

- surveillance
- harness industry for reformulation
- adopt standards: front-of-pack labelling
- adopt standards: strategies to combat misleading marketing
- knowledge: education and communication
- environment: salt-reduction strategies in community-based eating spaces.

CVD and diabetes

The updated Appendix 3 of WHO's global action plan for the prevention and control of NCDs 2013–2020 lists multiple clinical interventions for CVD and diabetes (WHO, 2017b). A selection of those most relevant to this analysis is reproduced in Table 7, alongside an assessment of the situation in Turkey.

Table 7. The current state of clinical policies to reduce cardiovascular risk in Turkey

Policy	Description	Current state of implementation
Cardiovascular risk assessment and management	Screening for risk of CVD/ diabetes	Detection of diabetes, hypertension and cardiovascular risk stratification is done at the primary health care level. The national programme aims to measure arterial blood pressure for everyone aged 18 years and over to identify hypertensive individuals and those at risk of diabetes. A pilot project to implement cardiovascular risk assessment and diabetes screening has been piloted in 88 family health units and evaluated to help inform national scale-up.
	Provision of drug therapy (including glycaemic control for diabetes mellitus and control of hypertension using a total risk approach) and counselling to individuals who have had a heart attack or stroke and to people with high risk (≥30%) of a fatal or nonfatal cardiovascular event in the next 10 years	The national programme plans cardiovascular risk assessment for everyone aged 40 years and over, using the European Society of Cardiology's Systematic Coronary Risk Evaluation charts (ESC, 2012) and providing health recommendations according to identified risk. National guidelines for diabetes, hypertension and CVD risk assessment have been prepared, as well as simplified primary care protocols for hypertension and CVD risk assessment. Availability of cardiovascular risk assessment and management was assessed (based on self-reported data) as "not achieved" in 50% or more of primary health care facilities in a WHO survey in 2017 (WHO Regional Office for Europe, 2017c). Nevertheless, an estimated 50.7% of men and 46.8% of women at high cardiovascular risk were receiving drug therapy and counselling to prevent heart attacks and strokes according to the 2017 STEPS survey (Ministry of Health, 2017a), just short of the 50% global target. This also found that 72.9% of men and 77.5% of women with diagnosed hypertension were taking regular medication prescribed by a doctor.

Table 7 contd

Policy	Description	Current state of implementation
Acute myocardial infarction (AMI) and stroke	Treatment of new cases of AMI with either acetylsalicylic acid or acetylsalicylic acid and clopidogrel, or thrombolysis or primary percutaneous coronary interventions	Acute care of heart attacks and strokes appears to be relatively strong, following international practice and achieving international standards in places. Turkey participated in the Stent for Life project and increased the frequency of primary percutaneous coronary interventions dramatically (Ural and Kayıkçıoğlu, 2014). According to 2012 data, there are 215 percutaneous coronary intervention-capable centres in Turkey, giving a crude number of centres per 1 million inhabitants of 2.86.
	Treatment of acute ischaemic stroke with intravenous thrombolytic therapy	The frequency of intravenous thrombolysis for stroke has been growing steadily in Turkey. Between 2006 and 2013 there was a fourfold increase in registered cases (Kutluk et al., 2016).
	Treatment of cases with established IHD and post myocardial infarction	Measures to prevent a further AMI or stroke (secondary prevention) exist in principle. Nevertheless, it has been suggested that cardiac rehabilitation is not achieving its full potential (Ural and Kayıkçıoğlu, 2014). The STEPS survey indicated that 5.6% of adults (aged 15 years and over) were taking aspirin to prevent or treat heart disease and 1.8% were taking statins.
Diabetes	Glycaemic control	The national programme aims to measure blood glucose for everyone aged 40 years and over to identify diabetic individuals. Insulin and diabetic medication are available with full reimbursement.
	Diabetic retinopathy screening and foot care to avoid complications	Foot care and eye checks are included as part of the standard follow-up of diabetic patients. A diabetes register monitors complications. Dilated fundus examination and foot vibration perception by tuning fork are basic technologies available in primary care (WHO, 2016c).

The OneHealth Tool is able to model the following package of interventions as part of the ROI analysis:

- screening for risk of CVD/diabetes
- treatment for those with high absolute risk of CVD/diabetes (>30%)
- treatment of new cases of AMI with aspirin
- treatment of cases with established IHD and post myocardial infarction
- treatment for those with established cerebrovascular disease and post stroke
- treatment of cases with rheumatic heart disease (with benzathine penicillin)
- standard glycaemic control
- intensive glycaemic control
- retinopathy screening and photocoagulation
- neuropathy screening and preventive foot care.

Summary

This review of current NCD interventions at the policy and individual service levels uncovered gaps in implementation of the WHO-recommended cost-effective NCD preventive and clinical interventions and drew attention to areas that need strengthening and scale-up to achieve 100% coverage. It also highlighted ways to increase the level of intensity if coverage was already 100%. The estimation of current levels of coverage based on the assessment above is summarized in Table 8. This shows the current status of coverage; the current level of intensity is assumed to be level 2. In the next section, the OneHealth Tool models 100% coverage for all interventions and the highest level (4) of intensity.

Table 8. Estimation of current level of coverage of NCD interventions to be costed within the OneHealth Tool

Tobacco	
Monitor tobacco use/prevention policies	100%
Protect people from tobacco smoke	100%
Offer to help quit tobacco use: mCessation	100%
Warn about danger: warning labels	100%
Warn about danger: mass-media campaign	100%
Enforce bans on tobacco advertising	100%
Enforce youth access restriction	100%
Raise taxes on tobacco	100%
Plain packaging of tobacco products	N/A
Harmful alcohol use	
Enforce restrictions on availability of retailed alcohol	100%
Enforce restrictions on alcohol advertising	100%
Enforce drink–driving laws (sobriety checkpoints)	100%
Raise taxes on alcoholic beverages	100%
Physical activity	
Public awareness campaigning on physical activity	100%
Salt	
Surveillance	100%
Harness industry for reformulation	70%
Adopt standards: front-of-pack labelling	40%
Adopt standards: strategies to combat misleading marketing	50%
Knowledge: education and communication	50%
Environment: salt-reduction strategies in community-based eating spaces	40%
Clinical interventions: CVD	
Screening for risk of CVD/diabetes	25%
Treatment for those with high absolute risk of CVD/diabetes (>30%)	25%
Treatment of new cases of AMI with aspirin*	90%
Treatment of cases with established IHD and post myocardial infarction*	90%

Table 8 contd

Treatment for those with established cerebrovascular disease and post stroke*	50%
Clinical interventions: diabetes	
Standard glycaemic control	47%
Intensive glycaemic control	28%
Retinopathy screening and photocoagulation	0.1%
Neuropathy screening and preventive foot care	44.1%

Notes: Coverage of policy interventions was estimated by the national team of experts at the Directorate-General of Public Health except for those interventions marked with an asterisk, which were estimated by the authors. Although coverage for the intervention "plain packaging of tobacco products" was not estimated separately, the OneHealth Tool calculates the whole effect of a tobacco control policy package that includes plain packaging.

4. Methods

To make informed decisions about which policies and clinical interventions to implement to reduce the burden of NCDs, it is essential that policy-makers understand the expected benefits from and costs of investing in NCD interventions in their countries. Against this background, a WHO team visited Turkey in April 2017 to conduct an investment case analysis, with a focus on salt reduction and clinical intervention policy packages. A national team was appointed to assist WHO in data collation and analysis. The preliminary analysis was discussed at a meeting of epidemiologists, statisticians, health economists and other staff of the Directorate-General of Public Health and Ministry of Health on 29 September 2017. The decision was taken to expand the work to the full scope of policy and clinical packages. The full analysis was completed in December 2017.

This section outlines the different methods and economic models applied at different stages in the economic analysis:

- calculation of economic burden of NCDs in terms of direct costs and indirect costs (absenteeism, presenteeism and premature death);
- costing of interventions (clinical and policy interventions);
- assessment of health impacts; and
- ROI analysis.

At the request of the national team, an additional calculation included a health care resources utilization analysis of the ambulatory care-sensitive conditions (ACSCs) among the four main NCDs covered by social security funds, hospitalizations and primary care visits.

Calculation of economic burden of NCDs

The NCD economic burden model applied was developed by WHO and the United Nations Development Programme, and provides estimates of the current direct and indirect costs of NCDs in Turkey. Data sources for calculation of the economic burden are listed in Annex 2. The data used on population by age and sex for the period 2016–2031 were based on the intermediate population growth scenario of the Turkish Statistical Institute (2013) (Table A3 in Annex 3) and the cohort method with most recent data. Details incorporated were incidence rates by age and sex for heart attack and stroke; and prevalence rates by age and sex for diabetes, hypertension and chronic respiratory disease. Mortality rates by age and sex were applied for each condition. The model calculated projections for incidence, prevalence and mortality for diabetes, CVD and chronic respiratory disease

between 2016 and 2031, holding current rates constant.[7] These projections were summarized as total incidence, prevalence and mortality for both the entire population and the working-age population, defined as those aged 15–64 years.

The following steps were carried out to calculate the economic costs.

- As only total government health expenditure data are available in Turkey, the share of total health expenditure on NCDs was calculated on the basis of a WHO analysis covering 13 countries (Garg & Evans, 2011; see Table A4.1 in Annex 4).
- The annual value (in terms of economic output) of each full-time worker in Turkey was calculated. This is based on gross domestic product (GDP) per employed person, defined as the country's GDP divided by its total employed labour force. To arrive at the total employed labour force for Turkey, National Statistical Office data on the total labour force aged 15 years and over, the unemployment rate and the labour force participation rate were used.
- Data were incorporated on the extent to which NCDs reduce worker productivity. From the academic literature (Anesetti-Rothermel & Sambamoorthi, 2011; Wang et al., 2003), rates were found to describe (a) the reduction in labour force participation due to hypertension, stroke, AMI and diabetes; (b) the reduction in full-time hours worked due to absenteeism; (c) the reduction in productivity due to presenteeism; and (d) the total time taken to replace a worker (see Table A4.2 in Annex 4).
- The exact number of people with NCDs working in Turkey in 2016 was determined. Using the labour force participation, unemployment and mortality rates, the model began with Turkish people of working age with NCDs; subtracting those who chose not to participate in the labour force or were unemployed; subtracting those who could not participate in the labour force specifically because of their NCD; and finally, subtracting those who died. The result was an estimate of active workers with NCDs.
- The final steps were to calculate the costs of absenteeism and presenteeism for surviving active workers with NCDs. The model applied the relevant productivity figures found in the second step to the populations determined in the third step and multiplied this by GDP per employed person. This calculation resulted in the total indirect costs of each NCD.

Calculation of policy and interventions costs

- Costs of policy interventions were calculated using the WHO Costing Tool (WHO, 2012). This identifies, quantifies and values each resource required for the intervention as follows:
  - for each policy, the Tool costs human resources, training, external meetings, mass-media campaigns (e.g. television and radio time, newspaper ads) and other miscellaneous equipment needed to enact policies and programmes;
  - each policy contains assumptions, set by WHO experts, about the quantity of inputs required to implement and enforce it – the Tool estimates the quantity of resources needed at the national, regional and district levels;
  - unit costs for resource items are taken from the WHO-CHOICE database (WHO, 2017f).
- The costs of clinical interventions were calculated using the OneHealth Tool, which conveniently has built-in functionality that works out expected costs of treatment interventions. For each intervention, the OneHealth Tool takes as input data points such as the salaries of medical staff and the quantities of drugs and supplies needed, as well as their prices.

[7] The model estimates growth in prevalence, incidence and mortality due to population growth only – not growth in disease rates.

ROI

ROI is a performance measure used to evaluate the efficiency of health care investment. It compares the magnitude and timing of benefits from health intervention directly with the magnitude and timing of investment costs. ROI is the ratio of the discounted (present) value of the benefits to the investment costs. Future benefits are discounted since a unit of currency in the future is worth less than a unit today owing to time value of money.

An ROI analysis, based on an Excel model developed by WHO for this analysis, provided estimates for economic gains that accrue from investing in the set of cost-effective interventions identified during the visit. The policy-based interventions included in this calculation are listed in Table 7 above.

The methodology used is the NCD ROI model developed in 2015 for use by the United Nations Development Programme/WHO Joint Programme on Governance of NCDs using the OneHealth Tool and WHO Costing Tool. More detail on use of the tool is available from the OneHealth Tool Manual (Avenir Health, 2017) and it is discussed in detail in the technical appendix to the forthcoming RTI International report, *The investment case for noncommunicable disease prevention and control* (RTI International, in press).

To determine the overall impact of the set of interventions, productivity measures were assessed using the following steps.

- Data on the amount by which NCDs reduce worker productivity were incorporated, as noted for the NCD economic burden model. As interventions reduce the projected incidence of IHD and stroke, there is an associated increase in the number of healthy life-years of the population. By considering the increase in healthy life-years, GDP per employed person and the reduction in rates for absenteeism and presenteeism, an increase in GDP can be determined, attributed to the value of avoided absenteeism and presenteeism.
- By considering the labour force participation rate in Turkey and the projected number of Turkish deaths avoided, the increase in labour force participation due to avoided deaths was calculated. An increase in economic output was therefore attributed to the value of avoided mortality.
- The final economic gain came from the reduced time spent having to seek new workers for replacement. The academic literature estimates the time taken to replace workers to be around 10 weeks, on average. The worker replacement rate, applied to both the total deaths avoided and the increase in healthy life-years due to avoided IHD and stroke, gives the increase in GDP resulting from not having to replace staff so frequently.

ROI rates were calculated for the interventions listed above in Table 7. These were selected on the basis of data availability to ensure sufficient data for calculations of costs and health impacts.

The projected economic gains from implementing the cost-effective interventions were therefore the value of avoided presenteeism, the value of avoided absenteeism and the value of avoided mortality. The impact of an intervention, measured as the total increase in GDP, was calculated by combining the three types of gain.

The ROI for Turkey was arrived at by comparing the impact (increase in GDP) of the interventions with the total costs of setting up and implementing the interventions. It was calculated using the net present value approach to future costs and economic gains, with 3% discounting.

Resource utilization for ACSCs

The aim of this analysis was to identify the elements of primary care that need strengthening to avoid unnecessary hospitalization of ACSCs. ACSCs are health conditions for which hospitalization or emergency care can be avoided by addressing them effectively in primary care. WHO developed a methodology of analysis; this

has already been applied in several countries, including Germany, Kazakhstan, Latvia, Portugal and the Republic of Moldova (WHO Regional Office for Europe, 2015b; 2015c; 2015d; 2015e; 2016b). The analysis here used only one component of the methodology, in a similar approach to that taken in Kazakhstan, to calculate the costs of potentially avoidable hospitalizations.

Data for this analysis include the number of hospitalizations, number of outpatient visits and costs of both types of care covered by the social security fund. The analysis did not included hospitalizations in private clinics, nor did the social security fund cover all costs of hospitalizations. The data were obtained from a joint study by the Public Hospitals Authority and the Social Security Institute (SSI) of Turkey. The data provided by the Ministry of Health indicate that about 30% of all patients in 2015 were served by university and private hospitals. Thus, the total health care payments by the SSI are multiplied by 1.3 in order to obtain total hospitalization costs.

The analysis included diseases considered to be ACSCs that are associated with the NCDs of interest; these are listed in Table 9, along with their International Classification of Disease, 10th revision (ICD-10) codes.

Table 9. Diseases used within the ACSC analysis

Disease	ICD-10 codes
Hypertension	I10.0–I13.0
Angina	I20.0–I20.9
Heart Failure (congestive)	I50.0–I50.9
Diabetes	E11
Bronchial asthma	J45.0–J45.9
Chronic bronchitis and unspecified emphysema	J40.0–J43.9
Chronic obstructive pulmonary disease (COPD)	J44.0–J44.9

5. Results

This section provides an assessment of the economic burden of NCDs before summarizing the components of the ROI analysis – including health benefits, economic benefits and total costs – and discussing the ROI for each package of interventions.

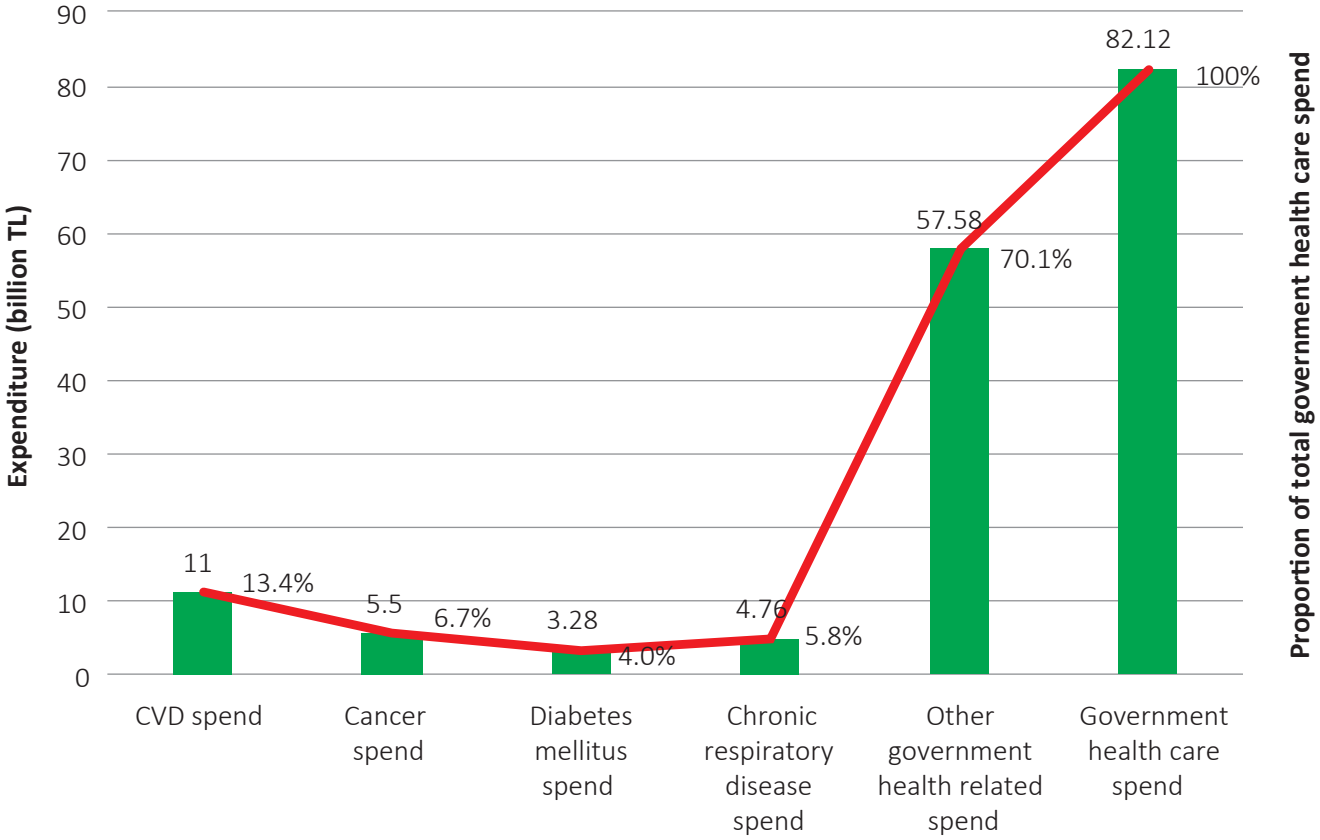
Economic burden assessment

Direct costs

The estimate of direct costs of the economic burden considered only government health care expenditure, not non-health care costs such as transportation.

Total government health expenditure for Turkey in 2016 was TL 82.1 billion. As noted above, government health care spending on NCDs in Turkey was estimated based on National Health Account data on NCD spending in 13 other countries (Garg & Evans, 2011). Assuming consistency with these countries (all have a similarly high NCD disease burden, although some are high-income countries), 30% of government expenditure on health would be attributable to NCDs (13.4% on CVD; 7% on cancer; 6% on chronic respiratory disease; 4% on diabetes). Using international rather than country-specific numbers is a limitation of this study, considering the wide variability of the share of health care expenditure per disease group. Total health care expenditure on the four main NCDs is estimated to be TL 24.6 billion for 2016 (Fig. 2).

Fig. 2. Government health care expenditure, 2016



Indirect costs

For Turkey, indirect economic losses due to NCDs were modelled from reduced labour force participation, increased absenteeism and presenteeism and losses due to premature death.

The calculation of absenteeism and presenteeism is based on the surviving workforce. Results are shown in Fig. 3 and details of underlying numbers are given in Table A4.2 in Annex 4. Indirect costs could only be calculated for CVD and diabetes. The costs of absenteeism were TL 1.2 billion for CVD and TL 0.4 billion for diabetes. The total burden of presenteeism reached TL 2.8 billion.

Indirect costs of premature death in Turkey were estimated using the human capital method. This assumes that forgone economic output is equivalent to the total output that would have been generated by workers through the course of their life until reaching retirement age. The net present value approach was used. The cost of premature death was calculated by multiplying GDP per worker by the labour force participation rate, by the age-specific employment rate. Total cost of premature death was estimated at TL 21.7 billion (Fig. 4).

Cancer is the costliest of the four NCDs in terms of economic losses resulting from premature mortality. Diabetes does not appear to be a leading cause of premature death, despite the productivity losses in presenteeism; nevertheless, many people with diabetes may die rematurely of a cardiovascular event.

Total economic costs

Table 10 summarizes the total direct and indirect costs of NCDs in Turkey. Economic losses due to indirect costs are almost four times larger than those due to direct costs. The government's estimated spending on the four main NCDs is already TL 24.6 billion, but additional losses to the economy (absenteeism, presenteeism, premature death) amount to TL 45.1 billion. This would be even larger had it been possible to estimate the costs of absenteeism and presenteeism for cancer and respiratory diseases.

Fig. 3. Costs of absenteeism and presenteeism for CVD and diabetes, 2016

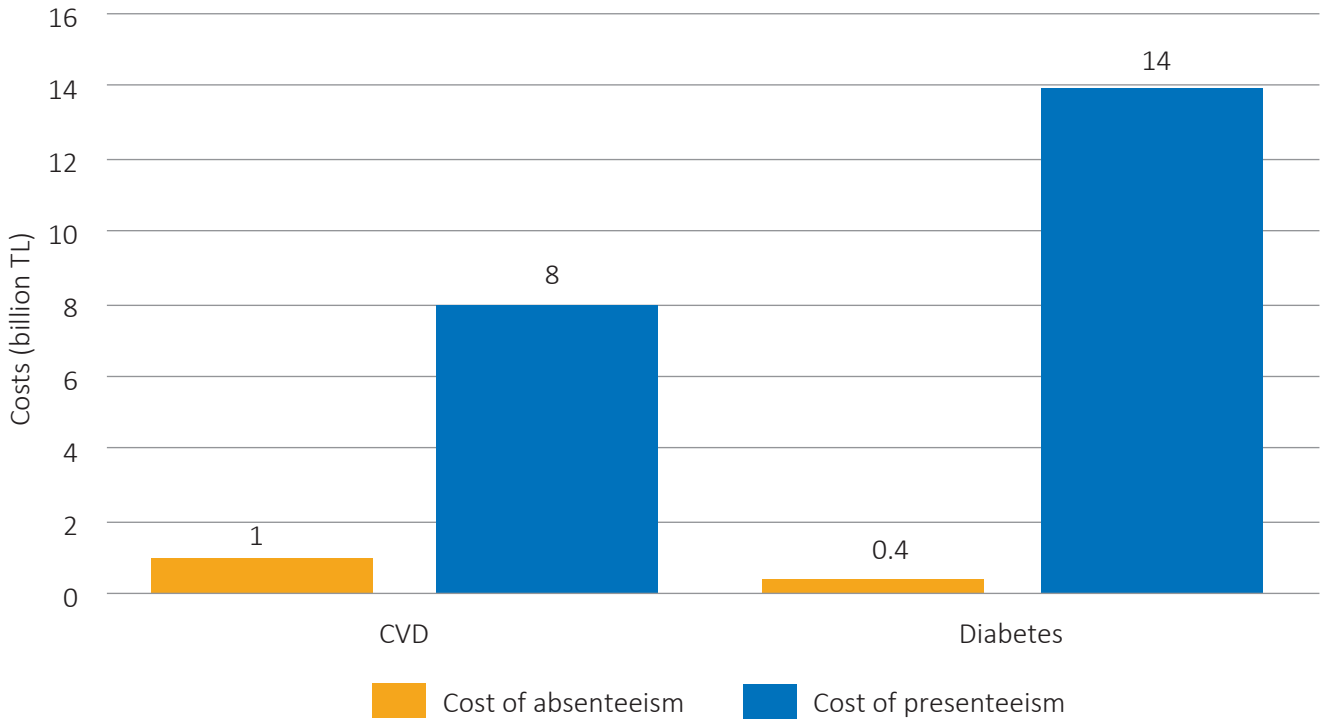


Fig. 4. Costs of premature death, 2016

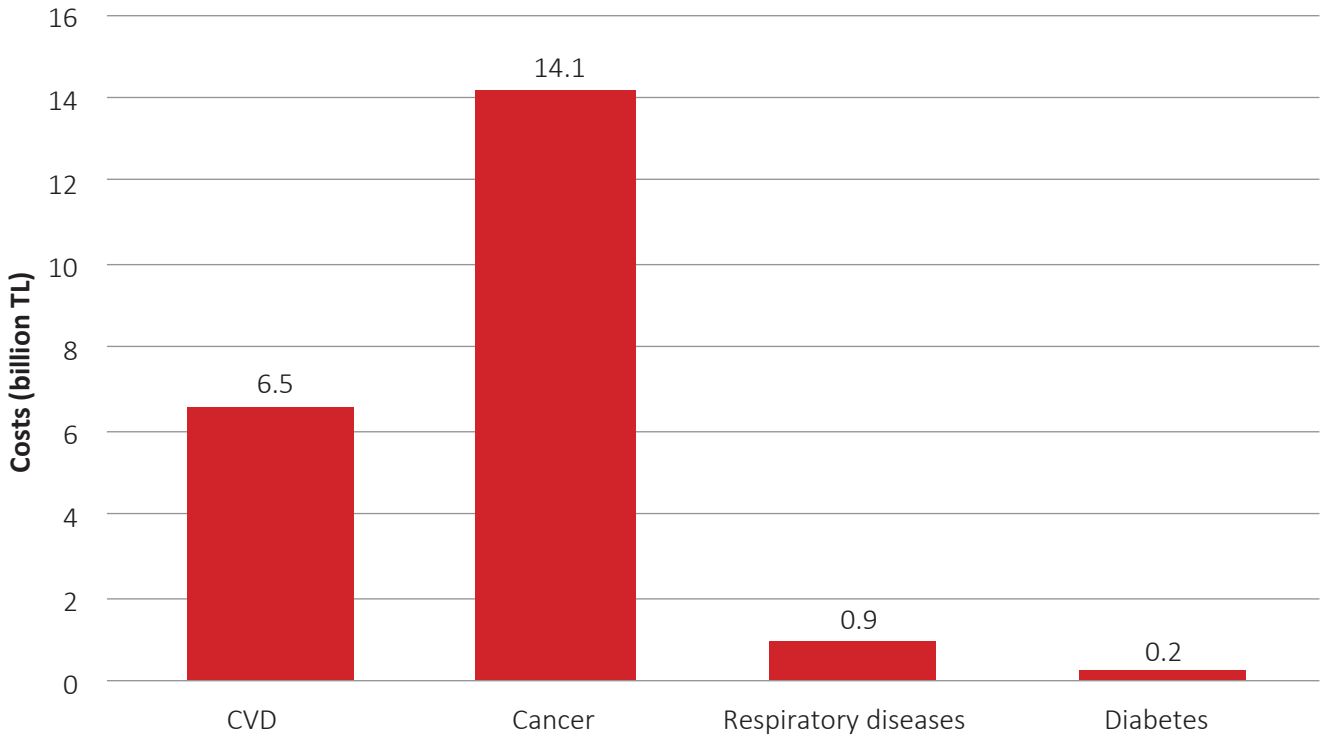


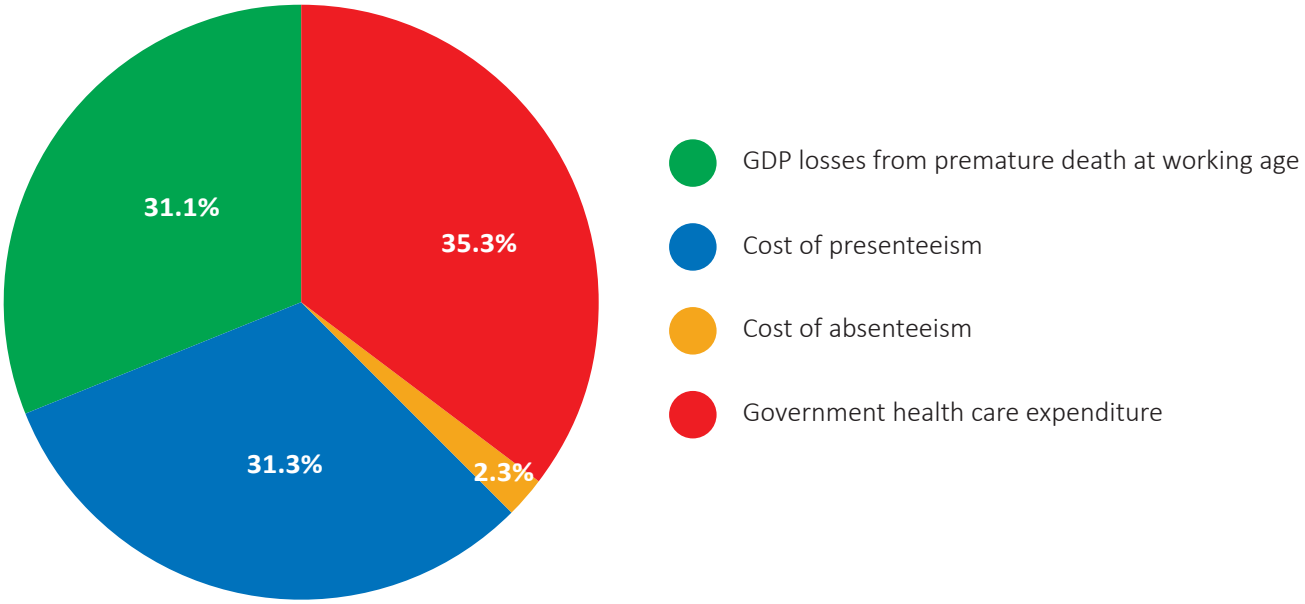
Table 10. Economic burden of NCDs in Turkey (billion TL), 2016

Cost	CVD	Cancer	Diabetes	Chronic respiratory diseases	Total for all NCDs
Direct costs					
Health care: government expenditure	11.0	5.5	3.3	4.8	24.6
Indirect costs					
Absenteeism	1.2	N/A	0.4	N/A	1.6
Presenteeism	7.9	N/A	13.9	N/A	21.8
Premature deaths	6.5	14.1	0.2	0.9	21.7
Total indirect costs	15.5	14.8	14.5	0.94	45.1
Total burden	26.5	19.6	17.8	5.7	69.7

The total drag on the economy of Turkey is TL 69.7 billion, which is equivalent to 3.6% of GDP annually.

Fig. 5 shows the structure of the NCD economic burden in Turkey in 2016. Government health care expenditure represents 35.3% of all NCD-related costs, but these are just the tip of the iceberg for the NCD economic burden.

Fig. 5. Structure of the NCD economic burden in Turkey, 2016



Intervention cost assessment

Incremental intervention costs were estimated for the period 2018–2032. Table 11 shows costs for each of the first five years of this period, plus the five-year and 15-year totals for packages of interventions included in the analysis.

The CVD and diabetes clinical interventions produced the largest cost estimates. Treating those at high absolute risk of CVD and with clinical forms of CVD and diabetes costs TL 222.6 million in the baseline year and increases

to TL 443.3 million in 2022. Implementing the entire CVD and diabetes clinical intervention package over the five-year scale-up period would cost TL 1619 million; over 15 years it would cost TL 15 794 million.

Table 11. Cost overview of packages of policy and clinical interventions (million TL), 2018–2022

Intervention package	2018	2019	2020	2021	2022	Total 5 years	Total 15 years
Tobacco control package	69.1	70.5	78.1	81.7	84.1	383.5	1 443.4
Alcohol control package	19.6	17.7	17.7	17.9	17.7	90.6	252.1
Physical activity awareness package	0.4	12.4	11.1	11.1	11.1	46.1	165.6
Salt-reduction package	13.6	26.1	26.8	28.2	29.6	124.3	527.6
All policy interventions, total	*102.7*	*126.7*	*133.7*	*138.9*	*142.5*	*644.5*	*2 388.7*
CVD and diabetes clinical intervention package	222.6	246.6	317.1	389.6	443.3	1 619	15 794.0
All interventions (policy + clinical), total	**325.3**	**373.3**	**450.8**	**528.5**	**585.8**	**2 263.7**	**18 183.1**

The total costs per year for the tobacco, physical activity and salt packages were twice as cheap as those for the clinical package in the initial five years. The most costly policy package is tobacco: its total cost based on MPOWER guidelines is TL 69.1 million for the first year (2018).

Health benefit assessment

All interventions provide significant reductions in the number of lives lost to CVD-related causes. CVD clinical interventions have the greatest impact in terms of mortality cases (509 000 deaths averted), but the number of healthy life-years gained and numbers of strokes and acute IHD cases averted was highest in the salt-reduction package (Table 12). Alcohol control interventions had the smallest effect.

Table 12. Estimated health benefits over a 15-year time horizon

Intervention package	Strokes averted	IHD events averted	Mortality averted	Healthy life-years gained
CVD and diabetes clinical intervention package	99 871	34 751	509 624	1 136 560
Tobacco control package	59 443	70 607	66 375	567 316
Alcohol control package	1 856	388	1 332	10 233
Physical activity awareness package	1 935	5 805	3 382	29 224
Salt-reduction package	481 971	394 646	437 572	3 582 908

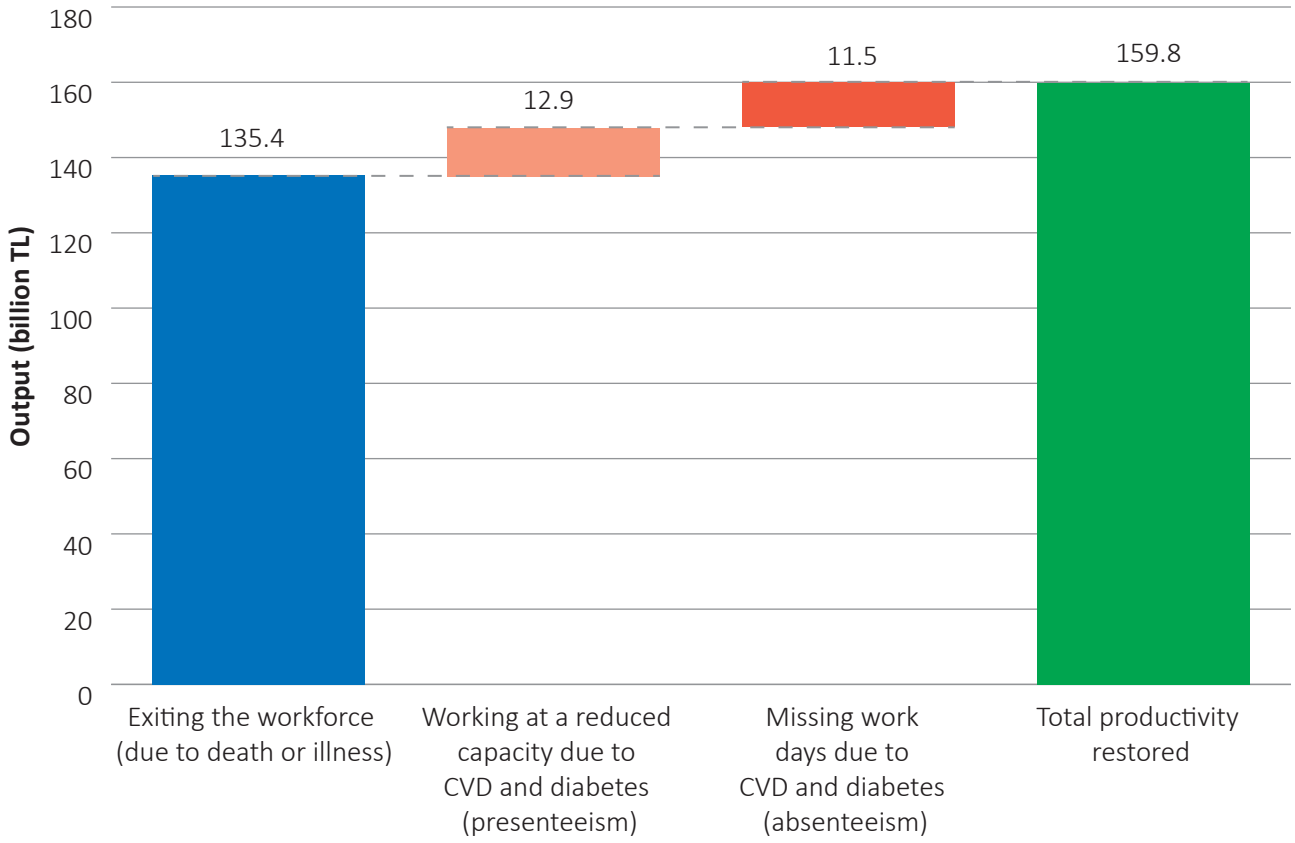
Each set of interventions also restores healthy life-years to the population. The CVD clinical interventions and tobacco control and salt reduction packages prevent strokes and cardiovascular events, and thus individuals avoid disabling states (such as partial paralysis from stroke) that can increase pain and suffering, reduce mobility and impair speech and thought.

Economic benefit assessment

NCDs included in this analysis are associated with a reduction in labour workforce and productivity due to premature mortality, fewer days of work (absenteeism) and reduced productivity while at work (presenteeism).

Fig. 6 demonstrates the labour productivity gains that result from the prevented deaths and disease cases over a 15-year period, as described in Table 12.

Fig. 6. Recovered economic output from the policy and clinical intervention packages, 15-year time frame



The biggest positive impact on productivity is from decreased mortality (84.7% of total productivity gains), followed by reduced presenteeism (8.1%) and absenteeism (7.2%). Policy packages and interventions in CVD and diabetes in primary care result in net present value TL 159.8 billion in labour productivity gains over 15 years (equivalent to 8.2% of Turkey's 2015 GDP).[8]

ROI assessment

Comparing the costs and benefits of packages of interventions shows that most of the NCD prevention interventions included in the analysis – for tobacco control, salt reduction and increasing physical activity – have positive ROIs in both the five-year and the 15-year periods (Table 13). The alcohol-control package did not demonstrate a positive ROI overall.

Salt interventions have the highest ROI: for every TL invested in the package of salt interventions, the expected return is TL 88 over a 15-year period (considering that interventions in this package need to increase in both coverage and intensity, while other policy interventions already have 100% coverage and mainly need to increase intensity). The tobacco package has the next highest ROI for 15 years (5), followed by the CVD and diabetes clinical intervention package (4.3). In the five-year period CVD and diabetes clinical interventions have the second highest ROI (3.3), followed by the tobacco package (2.6).

[8] 2015 GDP was TL 1.95 trillion.

Table 13. Costs, benefits and ROI at 5 and 15 years, by intervention package (million TL)

Intervention package	5 years			15 years		
	Total costs	Total productivity benefits	ROI	Total costs	Total productivity benefits	ROI
Tobacco control package	383.4	961.1	2.6	1 443.4	14 351.6	5.0
Alcohol control package	90.6	20.1	0.2	252.1	282.6	0.6
Physical activity awareness package	46.1	59.0	1.1	156.6	732.8	2.3
Salt-reduction package	124.3	6 815.9	51.0	527.2	93 873.7	88.0
CVD and diabetes clinical intervention package	1 619.0	4 931.8	3.3	7 877.0	47 527.6	4.3

The package of alcohol interventions effectively provides no ROI for either the five-year or 15-year assessment periods. This may be because any interventions would need to cover the whole population, even though the problem of harmful alcohol consumption in Turkey affects a relatively small number of people.

Salt is the clear "best buy", offering the highest ROI over both five- and 15-year periods.

Hospitalizations and ambulatory care analysis

The cost analyses of hospitalizations (Table 14) and ambulatory care (Table 15) include only SSI data. The costs paid from other sources (out-of-pocket and so on) are not included in the analysis since no data are available on these in Turkey.

Table 14 presents the hospitalization costs and rates for the different NCDs identified to be included in the analysis. These include hypertension, angina, heart failure (congestive), diabetes, bronchial asthma, chronic bronchitis and unspecified emphysema, and COPD. The number of SSI-funded hospitalizations for these NCDs is 942 047. For each NCD, the proportion of registered cases hospitalized with SSI funding is generally not very high (range 0.3–3.3%).

According to different estimates, 60–80% of hospitalizations due to ACSCs are potentially preventable; thus, of 942 047 hospitalizations, an estimated 565 000–750 000 could be prevented. As the cost of SSI-funded hospitalizations for NCDs totals TL 420 649 702, preventing ACSCs when possible would deliver substantial savings.

Table 14. Hospitalization rates and costs (2016)

Disease	ICD-10 codes	Total number of cases (registered)	Total number of hospitalizations paid by SSI	Proportion of hospitalizations (%)	Cost of hospitalizations (TL)
Hypertension	I10.0–I13.0	10 413 033	345 355	3.3	78 913 380
Angina	I20.0–I20.9	635 832	12 683	2.0	16 509 975
Heart failure (congestive)	I50.0–I50.9	1 308 476	32 706	2.5	36 382 225
Diabetes	E11–E11.9	4 085 461	130 624	3.2	45 076 864
Chronic bronchitis and unspecified emphysema	J40–J43.9	1 325 959	22 412	1.7	7 773 592
COPD	J44.0–J44.9	3 399 544	209 675	6.2	164 912 492
Bronchial asthma	J45.0–J45.9	7 251 746	188 604	2.6	71 081 174
Total		**28 420 051**	**942 059**		**420 649 702**

Table 15 gives the breakdown of costs for ambulatory care. The rate of ambulatory care for some NCDs is relatively low – for example, 19.1% of registered patients had ambulatory visits during 2016 for diabetes, including 4.5% visited family medicine centres (FMCs) (considering that the data show the total the number of visits and some patients had multiple visits, the actual proportion of patient could be even lower). For bronchial asthma 28.8% of registered patients visited primary care physicians (just 7.5% had ambulatory visits to FMCs); for angina only 8% visited primary care physician and for congestive heart failure it was 12.7%. A substantial share (79%) of hypertensive patients had primary care visits, however, so those with concurrent conditions (co-morbidities) – such as diabetes, angina and so on– might be in this group, since the primary reason for the visit would be coded as hypertension. Once again, the data show only those patients whose visits were covered by the SSI; the costs for those visiting private primary care physicians are not included. Nevertheless, the data seem to show underuse of primary care by patient with some ACSCs.

Table 15 shows the total costs of ambulatory care in both in hospitals and FMCs. This is estimate at TL 2.1 billion, of which only one third (0.7 trillion, 34%) is in the FMCs. From the whole costs of ambulatory care 51.9% is due to hypertension, 20.8% to bronchial asthma 17.4% to COPD, 1.1% to chronic bronchitis and unspecified emphysema, 7.1% to diabetes, 1.4% to heart failure and remaining 0.3% to angina.

Table 15. Ambulatory care rates and costs (2016)

Disease	ICD-10 codes	Ambulatory care in hospitals				Ambulatory care in FMCs			Total proportion of ambulatory visits (%)	Total costs (TL)
		Total number of cases (registered)	Number of visits to hospitals	Proportion of ambulatory visits to hospitals (%)	Costs of visits (TL)	Number of visits to FMCs	Proportion of ambulatory visits to FMCs (%)	Costs of visits (TL)		
Hypertension	I10.0–I13.0	10 413 033	3 730 862	35.8	565 399 406	4 499 721	43.2	505 465 369	79.0	1 070 864 775
Angina	I20.0–I20.9	635 832	48 343	7.6	6 406 635	2 328	0.4	265 961	8.0	6 672 596
Heart failure (congestive)	I50.0–I50.9	1 308 476	129 200	9.9	24 753 797	36 899	2.8	3 180 076	12.7	27 933 873
Diabetes	E11-E11.9	4 085 461	593 152	14.5	123 033 838	185 209	4.5	24 036 093	19.1	147 069 932
Chronic bronchitis and unspecified emphysema	J40–J43.9	1 325 959	156 309	11.8	17 328 155	90 788	6.8	5 864 245	18.6	23 192 401
COPD	J44.0–J44.9	3 399 544	1 003 684	29.5	283 556 885	295 159	8.7	74 693 206	38.2	358 250 091
Bronchial asthma	J45.0–J45.9	7 251 746	1 545 289	21.3	334 545 951	544 187	7.5	94 365 282	28.8	428 911 233
Total		**28 420 051**	**7 206 839**		**1 355 024 668**	**5 654 291**		**707 870 233**		**2 062 894 901**

6. Conclusion

NCDs pose a significant threat to Turkish health and economic development. This report sets out the case for further investment in action against NCDs. It assesses the economic burden of NCDs for the country, costs specific interventions and presents a cost–benefit analysis for five intervention packages to demonstrate cost-effective solutions.

Analysis of the economic burden of NCDs in 2016 estimates that total economic losses to the economy are TL 69.7 billion annually, which is equivalent to 3.6% of GDP. Of the total costs 35.3% are from direct health expenditure but the majority of the economic burden results from indirect costs, predominantly due to presenteeism and premature mortality.

Five packages of interventions were economically evaluated – four to reduce the prevalence of NCD behavioural risk factors and one for clinical interventions. For the intervention packages on tobacco, alcohol and physical inactivity, the impact and costs of increasing intensity levels were estimated. For the salt reduction package, for which coverage is not yet 100%, the costs of increasing both coverage and intensity were estimated. Increasing the intensity of policy packages to reduce the consumption of tobacco, alcohol and to increase physical activity was estimated to cost TL 383.5 million, TL 90.6 million, TL 46.1 million at five years, respectively. The cost of increasing the intensity and coverage of the salt-reduction package at 5 years would be TL 124.3 million. The CVD and diabetes clinical interventions were found to be the most expensive options, costing TL 1619.0 million at five years.

The ROI analysis found an ROI greater than one at both five and 15 years (i.e. a good investment from an economic perspective) for every intervention package assessed, except that for alcohol control. By far the most cost-effective interventions in Turkey are those for salt. The economic benefits of this package far exceed implementation costs in the short (five years) and long term (15 years). The salt reduction policy package achieved an ROI of 51 and 88 TL at five and 15 years, respectively. Nevertheless, the WHO “best buys” interventions for tobacco, physical activity and clinical interventions remain cost-effective, despite lower ROIs in Turkey relative to salt. Only the alcohol control package did not achieve an ROI greater than one at five or 15 years: this may be because the problem of harmful alcohol consumption in Turkey is relatively low scale.

Analysis of the ACSCs revealed that 942 047 hospitalizations occur annually for such conditions among the four main NCDs of interest (paid by SSI; the number of hospitalizations for private clinics is unknown). The rate of hospitalizations relative to the number of registered patients is comparable with other countries where such analysis has been performed. Preventing ACSC hospitalizations when possible would deliver substantial savings.

In conclusion, there is much to be gained in terms of health and economic benefits from a focus on NCD prevention. This would require maintenance of the already high levels of implementation of policy packages such as that for tobacco control, with increased attention to intensity – for example, with enforcement of existing regulations – as well as further investment in areas of relatively low current coverage, such as salt reduction. Such actions are cost-effective and relatively cheap compared to the indirect and direct costs NCDs cause under status quo conditions. While implementation of the intervention packages will require engagement from sectors beyond health – such as finance, economy and agriculture – the benefits from the investments would accrue across the whole of government and of society.

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Annex 2. Data sources used for the economic burden analysis

- Population by age and sex for the period 2015–2031, projected based on the intermediate growth scenario of the Turkish Statistical Institute
- Mortality statistics by age and sex groups and causes of death (2013–2015)
- Registered morbidity statistics by disease groups (2013–2015)
- Economic data (GDP, employment and unemployment rates and other)
- Epidemiology data on NCDs, prevalence of risk factors and incidence in age and sex groups (mainly based on a chronic diseases and risk factors survey undertaken in Ankara, Turkey, in 2013)

Annex 3. Population projections: detailed methodology and results

The cohort component method was used for population projection. This takes the components of demographic change and projects population figures in a way that reproduces how populations grow or decline over time. The components of change include mortality, fertility and net migration. Alternative methods such as the application of constant population growth yield much less satisfactory results than the cohort component method.

In this population projection, to calculate the mortality component, each "cohort" or age group is carried forward in time, assuming that it is subject to the standard mortality rate this age group is exposed to. Thus, the mortality rate used as the age group is carried forward is the rate that group is exposed to under demographic change characteristics. For example, the group aged 10–14 years is carried forward subject to relatively low mortality rates, whereas the 70–74-year age group is naturally subject to much higher rates. These calculations are performed on a by-sex basis, as there may be significant variations in mortality by sex.

In order to calculate the probability of death, the Coale-Demeny-West model life tables were used,[1] which are considered the most suitable for the mortality rates in Turkey, adjusted for the significant improvement in Turkey's mortality level in recent years. The updated model life tables were obtained from the Turkish Statistical Institute (TURKSTAT) for each age from 0 to 99 years and for 100 years and above as the highest age group.

The second component of the cohort component method is fertility, or the number of births among women of reproductive age at an assumed birth rate. Projected births fill the youngest age group in each period of time and, in turn, are subject to infant mortality rates.

The third and final component is migration by age and gender in each period. Migration can be either positive net immigration or net emigration. Migration is almost always the component of the project most difficult to estimate. Using 2010, 2011 and 2012 data on international migration, the residual method was used to obtain annual net migration magnitudes by sex and age. This estimates net migration as the net population change between two time points minus the difference between births and deaths between the points. Thus, the residual method does not require any statistics on migrants or emigrants and estimates net migration indirectly.

Population projections by age and sex used in the analysis are given in Table A3 for the period 2016 to 2031.

[1] Coale AJ, Demeny P (1983). Regional model life tables and stable populations, 2nd edition. New York: Academic Press.

Table A3. Population projections

Population by sex and age (0–4 years, 5–9 years, 10–14 years, … 75–79 years, 80+ years) for 2016 and projecting upwards to 2031, inclusive

Gender and age (years)	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
Females 0–4	3 305 566	3 261 383	3 187 798	3 109 143	3 049 342	2 979 369	2 949 523	2 951 542	2 960 846	2 955 388	2 947 606	2 931 074	2 905 558	2 877 997	2 856 016	2 837 538
Females 5–9	3 241 101	3 247 496	3 261 310	3 273 411	3 270 858	3 249 402	3 211 190	3 159 567	3 105 868	3 063 278	3 033 380	3 006 773	2 985 287	2 965 759	2 943 722	2 920 136
Females 10–14	3 250 027	3 238 569	3 228 528	3 221 642	3 219 969	3 223 399	3 228 234	3 230 919	3 223 697	3 203 435	3 181 719	3 151 107	3 116 486	3 082 776	3 052 600	3 024 894
Females 15–19	3 273 830	3 272 294	3 265 283	3 253 500	3 241 921	3 231 400	3 215 201	3 198 760	3 186 435	3 176 210	3 174 655	3 178 358	3 181 077	3 177 599	3 163 493	3 147 784
Females 20–24	3 134 982	3 165 168	3 201 706	3 234 584	3 252 897	3 264 404	3 260 316	3 244 988	3 225 711	3 206 460	3 191 810	3 176 340	3 162 910	3 152 380	3 143 331	3 142 747
Females 25–29	3 133 990	3 118 549	3 107 334	3 104 165	3 111 207	3 132 388	3 163 068	3 195 746	3 221 683	3 233 685	3 236 211	3 227 815	3 212 363	3 193 739	3 175 591	3 161 886
Females 30–34	3 180 603	3 176 079	3 166 937	3 154 939	3 141 141	3 131 388	3 118 955	3 106 305	3 101 839	3 106 636	3 120 163	3 144 041	3 173 003	3 195 757	3 206 843	3 209 228
Females 35–39	3 059 608	3 095 735	3 128 195	3 151 952	3 166 087	3 175 393	3 173 093	3 162 582	3 149 172	3 134 869	3 119 154	3 102 659	3 088 228	3 081 767	3 083 852	3 096 412
Females 40–44	2 802 739	2 858 670	2 911 635	2 960 804	3 005 438	3 050 378	3 088 878	3 120 374	3 143 130	3 156 044	3 158 509	3 152 116	3 140 708	3 125 144	3 108 047	3 092 383
Females 45–49	2 445 703	2 512 495	2 584 809	2 657 158	2 723 054	2 788 345	2 846 260	2 898 280	2 945 740	2 989 671	3 028 334	3 063 295	3 093 274	3 114 047	3 124 177	3 126 631
Females 50–54	2 174 950	2 213 932	2 256 989	2 305 724	2 360 845	2 424 300	2 492 357	2 563 631	2 633 542	2 698 266	2 757 893	2 812 983	2 863 171	2 909 269	2 951 787	2 989 639
Females 55–59	1 958 744	1 994 721	2 030 495	2 066 789	2 104 405	2 143 265	2 182 567	2 223 958	2 270 989	2 325 188	2 383 514	2 449 627	2 519 025	2 587 474	2 651 366	2 709 612
Females 60–64	1 659 230	1 718 971	1 774 200	1 823 871	1 869 917	1 910 236	1 946 966	1 981 764	2 016 195	2 052 941	2 087 845	2 125 634	2 166 806	2 213 223	2 266 263	2 323 820
Females 65–69	1 203 016	1 282 533	1 369 889	1 455 513	1 532 654	1 599 198	1 656 224	1 706 408	1 752 338	1 794 811	1 830 523	1 865 229	1 900 370	1 935 814	1 973 907	2 007 530
Females 70–74	898 543	925 447	958 624	1 002 532	1 059 686	1 124 139	1 201 063	1 284 328	1 366 622	1 440 890	1 496 508	1 545 274	1 590 538	1 635 203	1 678 527	1 710 380
Females 75–79	655 559	675 487	700 342	729 748	760 340	784 097	809 064	839 134	880 197	936 730	991 954	1 060 799	1 135 378	1 209 505	1 277 293	1 323 580
Females 80+	764 654	793 524	819 549	843 242	867 107	906 112	944 409	979 828	1 015 147	1 048 654	1 094 883	1 140 535	1 188 867	1 241 786	1 304 513	1 386 032
Males 00–04	3 469 208	3 423 064	3 341 774	3 255 491	3 190 035	3 113 385	3 081 861	3 086 206	3 098 818	3 096 553	3 089 890	3 072 379	3 045 840	3 018 215	2 995 137	2 975 537
Males 05–09	3 378 957	3 388 347	3 406 345	3 422 746	3 423 525	3 401 421	3 360 571	3 305 285	3 246 860	3 202 427	3 169 609	3 143 032	3 122 542	3 102 951	3 081 835	3 058 135
Males 10–14	3 381 933	3 369 501	3 359 655	3 352 061	3 352 680	3 358 416	3 366 587	3 370 607	3 365 697	3 345 608	3 321 985	3 290 393	3 254 750	3 219 967	3 189 705	3 160 878
Males 15–19	3 391 850	3 393 306	3 388 464	3 378 941	3 368 645	3 357 416	3 341 523	3 324 379	3 312 321	3 303 259	3 302 812	3 308 561	3 314 294	3 311 765	3 299 590	3 283 768
Males 20–24	3 216 307	3 252 456	3 296 078	3 334 141	3 357 669	3 372 417	3 370 597	3 357 543	3 340 520	3 322 417	3 307 857	3 292 412	3 278 971	3 269 397	3 263 298	3 263 622
Males 25–29	3 173 661	3 163 185	3 157 003	3 160 913	3 173 072	3 201 396	3 238 259	3 276 142	3 307 286	3 323 425	3 330 058	3 324 710	3 311 267	3 295 624	3 279 428	3 266 644
Males 30–34	3 176 636	3 177 071	3 173 891	3 166 886	3 159 102	3 155 391	3 148 029	3 142 483	3 144 137	3 155 036	3 173 646	3 204 601	3 239 612	3 267 379	3 283 460	3 289 812
Males 35–39	3 008 036	3 051 099	3 089 453	3 119 099	3 138 148	3 152 390	3 156 050	3 151 528	3 144 137	3 135 878	3 125 209	3 115 780	3 108 412	3 109 004	3 118 128	3 136 703
Males 40–44	2 678 768	2 743 609	2 809 316	2 871 204	2 925 612	2 978 369	3 023 712	3 061 082	3 088 747	3 107 645	3 116 127	3 115 780	3 110 431	3 101 942	3 092 925	3 083 317
Males 45–49	2 312 805	2 373 628	2 439 773	2 506 828	2 572 383	2 641 327	2 708 909	2 772 661	2 831 939	2 886 822	2 933 478	2 975 484	3 011 527	3 038 390	3 056 632	3 065 186
Males 50–54	2 005 357	2 051 259	2 100 033	2 152 407	2 207 181	2 267 281	2 328 940	2 391 784	2 457 301	2 522 819	2 586 345	2 650 482	2 712 796	2 772 077	2 825 772	2 871 786
Males 55–59	1 699 892	1 749 720	1 799 035	1 848 761	1 897 856	1 945 241	1 991 078	2 038 041	2 088 706	2 142 682	2 196 829	2 256 846	2 319 199	2 384 713	2 449 742	2 511 176
Males 60–64	1 342 855	1 400 570	1 457 308	1 514 251	1 568 575	1 617 200	1 665 247	1 713 442	1 761 402	1 808 927	1 852 723	1 897 527	1 943 767	1 994 322	2 048 508	2 102 216
Males 65–69	954 082	1 005 792	1 065 911	1 127 973	1 189 403	1 244 154	1 297 309	1 348 645	1 399 856	1 449 965	1 493 480	1 539 218	1 586 501	1 636 211	1 685 583	1 727 504
Males 70–74	701 181	713 180	731 137	758 619	796 261	836 103	884 255	939 630	997 020	1 053 695	1 096 901	1 141 544	1 186 848	1 233 716	1 283 342	1 323 580
Males 75–79	507 786	510 831	516 564	525 657	538 823	549 068	560 429	575 837	600 226	634 234	668 030	708 545	754 900	801 966	849 849	887 423
Males 80+	423 485	448 341	465 901	476 875	480 950	508 063	529 350	543 679	551 886	554 576	583 265	605 594	624 710	643 590	663 346	712 155

Annex 4. Data used for calculations of NCD burden

This annex includes the figures from different literature sources used in the NCD burden calculations, including the details of the share of government health care expenditure on NCDs per country (Table A4.1) and of the reduction in productivity by disease (Table A 4.2).

Table A4.1. Share of major NCDs in total health care expenditure

Category		Australia	Canada	Czechia	Germany	Estonia	France	Georgia	Hungary	India	Republic of Korea	The Netherlands	Slovenia	United States of America
World Bank income group		High	High	High	High	High	High	Low-middle	High	Low-middle	High	High	High	High
Proportion of health expenditure by disease group	CVD	8.6%	9.0%	9.2%	16.2%	22.0%	12.0%	0.8%	18.4%	15.6%	13.4%	11.1%	13.6%	17.0%
	Cancers (neoplasm)	4.7%	3.1%	5.5%	7.9%	9.4%	7.1%	1.9%	8.2%	4.7%	7.7%	5.5%	6.7%	7.2%
	Endocrine and metabolic diseases	4.4%	2.1%	2.0%	4.0%	5.4%	3.9%	0.0%	6.1%	4.8%	4.1%	2.7%	2.4%	4.4%
	Respiratory diseases	4.8%	4.5%	3.2%	5.4%	7.2%	7.3%	0.4%	5.8%	8.9%	10.8%	4.9%	6.2%	6.6%
Total for four NCDs		22.5%	18.7%	19.9%	33.5%	44.0%	30.3%	3.1%	38.5%	34.0%	36.0%	24.2%	28.9%	35.2%

Source: Garg CC, Evans DB (2011). What is the impact of noncommunicable diseases on national health expenditures: a synthesis of available data. Geneva: World Health Organization (NCD discussion paper no. 3; http://www.who.int/healthsystems/NCDdiscussionpaper3.pdf, accessed 23 August 2017).

Table A4.2. Productivity data

Disease	Parameter value	Year	Source of data	Details of data source
Labour force participation rate reduction				
Hypertension	11.0%	2009	Institute for Research and Information in Health Economics	Barnay T, Debrand T (2006). Effects of health on the labour force participation of older persons in Europe. Questions d'économie de la Santé. 109 (http://www.irdes.fr/english/2006/issues-in-health-economics.html, accessed 8 September 2017).
Stroke	11.0%	2009	Institute for Research and Information in Health Economics	Barnay T, Debrand T (2006). Effects of health on the labour force participation of older persons in Europe. Questions d'économie de la Santé. 109 (http://www.irdes.fr/english/2006/issues-in-health-economics.html, accessed 8 September 2017).
AMI	11.0%	2009	Institute for Research and Information in Health Economics	Barnay T, Debrand T (2006). Effects of health on the labour force participation of older persons in Europe. Questions d'économie de la Santé. 109 (http://www.irdes.fr/english/2006/issues-in-health-economics.html, accessed 8 September 2017).
Type 2 diabetes	11.0%	2009	Institute for Research and Information in Health Economics	Barnay T, Debrand T (2006). Effects of health on the labour force participation of older persons in Europe. Questions d'économie de la Santé. 109 (http://www.irdes.fr/english/2006/issues-in-health-economics.html, accessed 8 September 2017).
Reduction in full-time hours due to absenteeism				
Hypertension	0.5%	2011	Population Health Management	Mitchell RJ, Bates P (2011). Measuring health-related productivity loss. Popul Health Manag. 14(2): 93–8.
Stroke	5.5%	2011	Population Health Management	Mitchell RJ, Bates P (2011). Measuring health-related productivity loss. Popul Health Manag. 14(2): 93–8.
AMI	1.1%	2011	Population Health Management	Mitchell RJ, Bates P (2011). Measuring health-related productivity loss. Popul Health Manag. 14(2): 93–8.
Type 2 diabetes	0.3%	2011	Population Health Management	Mitchell RJ, Bates P (2011). Measuring health-related productivity loss. Popul Health Manag. 14(2): 93–8.
Reduction in productivity due to presenteeism				
CVD/stroke	3.7%	2011	Wang PS, Beck A, Berglund P, Leutzinger JA, Pronk N, Richling D et al. (2003). Chronic medical conditions and work performance in the health and work performance questionnaire calibration surveys. J Occup Environ Med. 45(12):1303–11.	

Table A4.2 contd

Disease	Parameter value	Year	Source of data	Details of data source
Diabetes	11%	2011	Holden L, Scuffham PA, Hilton MF, Ware RS, Vecchio N, Whiteford HA (2011). Which health conditions impact on productivity in working Australians? J Occup Environ Med.53(3):253–7. doi:10.1097/JOM.0b013e31820d1007.	
Time it takes to replace workers (percentage of a year)	20%	2012	Center for American Progress	Boushey H, Glynn SJ (2012). There are significant business costs to replacing employees. Washington, DC: Center for American Progress (https://www.americanprogress.org/issues/labor/report/2012/11/16/44464/there-are-significant-business-costs-to-replacing-employees/, accessed 8 September 2017).

The WHO Regional Office for Europe

The World Health Organization (WHO) is a specialized agency of the United Nations created in 1948 with the primary responsibility for international health matters and public health. The WHO Regional Office for Europe is one of six regional offices throughout the world, each with its own programme geared to the particular health conditions of the countries it serves.

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