Health Transitions in Pakistan 3

Non-communicable diseases and injuries in Pakistan: strategic priorities

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Non-communicable diseases, including cardiovascular diseases, cancers, respiratory diseases, diabetes, and mental disorders, and injuries have become the major causes of morbidity and mortality in Pakistan. Tobacco use and hypertension are the leading attributable risk factors for deaths due to cardiovascular diseases, cancers, and respiratory diseases. Pakistan has the sixth highest number of people in the world with diabetes; every fourth adult is overweight or obese; cigarettes are cheap; antismoking and road safety laws are poorly enforced; and a mixed public–private health-care system provides suboptimum care. Furthermore, almost three decades of exposure to sociopolitical instability, economic uncertainty, violence, regional conflict, and dislocation have contributed to a high prevalence of mental health disorders. Projection models based on the Global Burden of Disease 2010 data suggest that there will be about 3·87 million premature deaths by 2025 from cardiovascular diseases, cancers, and chronic respiratory diseases in people aged 30–69 years in Pakistan, with serious economic consequences. Modelling of risk factor reductions also indicate that Pakistan could achieve at least a 20% reduction in the number of these deaths by 2025 by targeting of the major risk factors. We call for policy and legislative changes, and health-system interventions to target readily preventable non-communicable diseases in Pakistan.

Introduction

Pakistan is the sixth most populous country in the world, with about 185 million people. The demographic transition, increase in life expectancy to 65 years, and urbanisation are associated with increased and prolonged exposure to risk factors for non-communicable diseases.[1] According to the 2010 estimates by Lozano and colleagues[2] from their Global Burden of Disease (GBD) Study, there are more deaths from non-communicable diseases (eg, cardiovascular diseases, diabetes, respiratory diseases, and cancers) and injuries than from communicable diseases (eg, infectious, perinatal, maternal, and nutritional disorders). The epidemiological transition in Pakistan has led to a double burden of communicable and non-communicable diseases posing a huge challenge to the health systems that are unprepared for non-communicable diseases.[3] Moreover, Pakistan's recent socioeconomic and geopolitical problems have led to a high prevalence of disabilities from mental health disorders.[4] These circumstances further aggravate the effect of non-communicable diseases on the national economy.[5] Immediate interventions are needed urgently.

In the UN High-Level Meeting on Non-Communicable Diseases in New York, NY, USA, in September, 2011, countries were encouraged to prioritise non-communicable diseases on their national agenda.[6] An ambitious but realistic goal for Pakistan would be to confirm this priority by implementing evidence-based cost-effective strategies aimed at 20% reduction in the rate of premature mortality due to cardiovascular diseases, cancers, and respiratory diseases by 2025, coupled with programmes targeting reductions in the incidence of injuries and mental disorders.

The main objectives in this report are to provide an estimate of the burden of the leading non-communicable diseases (cardiovascular diseases, cancers, and respiratory diseases) and injuries in Pakistan based on the GBD 2010 data[2] and model projections for 2025; estimate the mortality rate attributable to several key risk factors for cardiovascular diseases, cancers, and respiratory diseases in individuals aged 30–69 years, and review the prevalence and distribution of determinants of non-communicable diseases including injuries and poor mental health; draw attention to the economic effect of non-communicable diseases and injuries in Pakistan; review existing and past health systems, policies, and initiatives for combating non-communicable diseases

Key messages

- The burden of non-communicable diseases and injuries is very high in Pakistan and is projected to increase.
- Pakistan needs to implement policy, legislation, and programmes and promote healthy diet and physical activity to achieve a 20% reduction in premature mortality rate from cardiovascular diseases, cancers, and respiratory diseases by 2025.
- The revenue generated by increasing excise tax on the sale of cigarettes could be directed towards prevention initiatives, largely mitigating the cost of the suggested measures.
- Surveillance of and research into non-communicable diseases must be national priorities supported with funding for programmes in Pakistan. International donor agencies must also reprioritise their portfolios to fund non-communicable diseases and injuries in Pakistan.

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Panel: Methods and limitations of data sources

- The National Health Survey of Pakistan, 1990–94, was undertaken by the Pakistan Medical Research Council, under the technical guidance and support of the US National Center for Health Statistics.[7] The nationally representative sample of 9442 individuals aged 15 years or older from 2400 urban and rural households in each of the four provinces of Pakistan, which were taken as strata, were surveyed. The overall response rate was 92·6%.

- The National Injury Survey of Pakistan, 1997, was undertaken on a nationally representative sample in rural and urban areas of the four major provinces in Pakistan and the capital Islamabad, with multistage cluster sampling of 4500 households and 28 926 individuals.[8] The overall response rate was 96%.[8] Although recent subnational studies are available, there are no recent national level data.

- The Pakistan National Diabetes Survey was initiated by the Diabetic Association of Pakistan in collaboration with WHO in 1994 and completed in 1998.[9–11] Cluster sampling was used in conveniently selected locations in the large urban cities and rural villages in each province: Baluchistan (n=1404), three villages in Khyber Pakhtunkhwa (n=1035), Shikarpur a rural town in Sindh (n=967), and rural Punjab (n=1852). Fasting plasma glucose was measured and oral glucose tolerance tests were done in individuals aged 25 years and older. The response rate in each province was greater than 75%. The sampling was not nationally representative.

- The World Health Survey, 2002–03, was done on a nationwide household level in the four provinces in Pakistan, stratified by urban and rural areas, in adults aged 18 years and older. Federal Bureau of Statistics census was used for stratified, multistage cluster design.[12] 6830 (91%) households and 6473 (94%) individuals responded. The dietary and physical activity questionnaires were not validated and thus they should be interpreted with caution.

- Control of Blood Pressure and Risk Attenuation (COBRA),[13] 2004–05, was an intervention trial that was undertaken in Karachi, with cross-sectional data gathering. Multistage cluster sampling was used to choose 12 representative clusters of 3000 households from low-income to middle-income neighbourhoods in Karachi. 3143 (88·6%) adults aged 40 years and older consented to be enrolled in the study. Findings have restricted generalisability to rural areas.

- Data sources for the global burden of cardiometabolic risk factors were derived from the National Health Survey of Pakistan 1990–94,[7] National Diabetes Survey, COBRA[13] 2004–05 in urban Karachi, and other subnational studies representative of the mountainous rural north Pakistan.[14,15] Data would have restricted generalisability to other rural areas of Pakistan.

- The methods and data sources used for the Global Burden of Disease (GBD) 2010 Study by the Institute of Health Metrics and Evaluation (IHME) have been reported elsewhere.[2] However, country-level data have not yet been reported. National and subnational (urban and rural) data from Pakistan were used to generate mortality estimates. The number of studies was insufficient compared with that from developed countries. Therefore, all available data were assembled as sources for the mortality estimates. The data sources for the mortality rates in Pakistan are listed in the appendix pp 16–18. IHME provided confidence intervals, and the estimates for Pakistan have wider intervals than do those of more developed countries where more data are available. Moreover, data limitations preclude estimation of cause-specific mortality rates at subnational levels.

- Modelling and projections of mortality rates for Pakistan from IHME GBD 2010 to 2025 for the major cause clusters, cardiovascular diseases, cancers, chronic respiratory diseases, road traffic accidents (RTAs), and non-RTA unintentional injuries were projected according to the method reported by Mathers and colleagues (appendix p 1).[16] In addition to the inherent difficulty in prediction of the future, the accuracy of the estimates and projections are limited by the accuracy of the cause-specific

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and injuries; model risk factors to achieve a target of at least 20% reduction in the number of premature deaths due to cardiovascular diseases, cancers, and respiratory diseases by 2025; and recommend goals for the prevention of non-communicable diseases and injuries in Pakistan.

The methods and limitations of the main data sources are presented in the panel.

Burden

According to the GBD 2010 data,[2] non-communicable diseases and injuries accounted for 62% of crude deaths and 77% of age-standardised deaths in Pakistan. Cardiovascular diseases accounted for 18% of crude deaths and 26% of age-standardised deaths, making them the leading cause of age-standardised deaths.[2] Although country-wise comparisons are not available, data for regional trends indicate that disease burden in south Asia including Pakistan has transitioned from communicable diseases in the 1990s, with diarrhoea and lower respiratory tract infections as the two main causes of deaths, to non-communicable diseases in 2010, with ischaemic heart disease and chronic obstructive pulmonary disease being the two main causes.[2] Moreover, the number of deaths from stroke, diabetes, road traffic accidents, and self-harm have also increased substantially and are in the top ten causes of deaths. This pattern was consistent in individuals aged 30–69 years, showing non-communicable diseases as the leading cause of death in this productive age group.[2]

We undertook projections of the population-level mortality rates within age bands for Pakistan from the GBD 2010 estimates to 2025 for the major cause clusters, cardiovascular diseases, cancers, chronic respiratory diseases, road traffic accidents, and unintentional injuries unrelated to road traffic accidents using the methods reported by Mathers and colleagues (figure 1).[16] These estimates were calibrated to the corresponding Pakistan-specific major cause cluster mortality rates from GBD 2010. Use of this method accounts for time trends, population structure and growth, per-person income, human capital, and sex-specific smoking effect (details including sex-specific tables and age-standardised estimates are reported in the appendix pp 5–6). We noted that from 2010 to 2025, the projected increase in crude yearly mortality per 100 000 population due to cardio-vascular diseases was from 125·5 to 144·4, cancers 55·3 to 72·3, chronic respiratory diseases 42·4 to 47·3, and road traffic accidents 10·7 to 14·5. Accompanied by Pakistan's growing population, these rates correspond to the total number of yearly deaths due to cardiovascular diseases rising from 231 400 to 307 200, cancers 102 100 to 153 900, chronic respiratory diseases 78 200 to 100 700, and road traffic accidents 19 700 to 30 900 (appendix p 5). These projections indicate that in Pakistan from 2010 to 2025, the cumulative number of deaths from cardio-vascular diseases, cancers, and chronic respiratory

diseases in people aged 30–69 years is predicted to be 3·87 million.

Attributable risk of non-communicable diseases

The percentage of deaths in the population aged 30–69 years attributable to each of the seven important risk factors (smoking, systolic blood pressure, glucose, fruit and vegetable intake, body mass index [BMI], physical inactivity, and total cholesterol) under both counterfactual and interventional risk factor distributions according to category of non-communicable disease were calculated using relative risks extracted from Danaei and colleagues[17] and, for the interventional risk factor distributions, achievable population-wide risk factor modifications consistent with Ford and colleagues.[18] Sensitivity to robustness of estimates was evaluated in pessimistic and optimistic scenarios by a 10% down or up shift in the relative risk, respectively. Further details, including the detailed cause relative risks and assumed population-wide risk factor modifications, are provided in the appendix pp 1–6.[16]

Leading attributable risk factors for deaths from cardiovascular diseases, cancers, and respiratory diseases in individuals aged 30–69 years in Pakistan in 2010 and projections for 2025 are shown in figure 2.[20] Tobacco use and high blood pressure are the leading risk factors followed by low intake of fruits and vegetables, and suboptimal blood glucose concentrations.

Prevalence and distribution of key risk factors

According to the World Health Survey 2002–03, 29% of men and 4% of women were current smokers, consistent with estimates from other national and subnational surveys.[12,21] More recent estimates of tobacco use are needed because the prevalence is likely to be higher with an even greater contribution to death and disability.

The results of Danaei and colleagues' study[17] show that the prevalence of hypertension (systolic blood pressure >140 mm Hg or diastolic blood pressure >90 mm Hg, or on antihypertensive medications) in Pakistan has increased from 17% in 1980 to 35% in 2008 in adults aged 18 years and older, affecting about 40 million adults. According to the results of the representative National Health Survey of Pakistan 1990–94, 18% (22% in urban areas) of all adults aged 15 years and older had hypertension (mean of two readings).[7] Although prevalence was high even in rural areas, the greater risk of hypertension in urban areas was attributable to the greater prevalence of overweight and obesity, central obesity, and diabetes in individuals living in urban areas.[22]

The prevalence of determinants of hypertension is also high. Of the people in Pakistan aged 15 years and older who were surveyed during the National Health Survey of Pakistan 1990–94, one in four was overweight or obese, with the Asian-specific BMI threshold of 23 kg/m².[22] The prevalence was twice as high in urban areas than in the rural areas. At age 25 years and older,

mortality rate projection model of Mathers and colleagues[16] and its inputs, per person income, human capital, and smoking effect. Additionally, estimates and projections of attributable and avoidable mortality depend on the accuracy of the risk factor distribution estimates for Pakistan, relative risk estimates of Danaei and colleagues,[17] and post-intervention risk factor distributions, consistent with Ford and colleagues.[18] Although of fairly high quality, the data used to build the mortality rate projection model are largely from high-income countries. The accuracy, typically reported as explaining 50% or more of the variation in log mortality rates, could be lower in Pakistan. Similarly, the data reported by Danaei[17] and Ford[18] and their colleagues were of fairly high quality, but restricted to the USA. Perhaps, relative risks or achievable population-level risk factor shifts would be larger or smaller in Pakistan. The Pakistan-specific data came from a range of sources, but represent the best available information. An additional check for robustness was done by calibration of the mortality rates for the age categories to those reported in GBD 2008. Cause-specific mortality, attributable mortality, and avertable deaths both overall and by sex are reported in the appendix pp 11–13, 15–16.

- Importantly, our estimates of loss of national productivity are conservative because they do not account for the economic burden resulting from morbidity. Indeed, due to the lack of reliable data, we have not assessed the effect of health expenditures related to cardiovascular diseases, cancers, and respiratory diseases on investment in productive factors for the economy. This is likely to have an effect because data from south Asia indicate high catastrophic health spending with 40–50% of these expenditures financed by household borrowing and sale of assets.[19] Furthermore, we did not account for the productivity loss of ill (but living) workers. Our estimates do not capture the substantial effect on society of welfare loss caused by death.
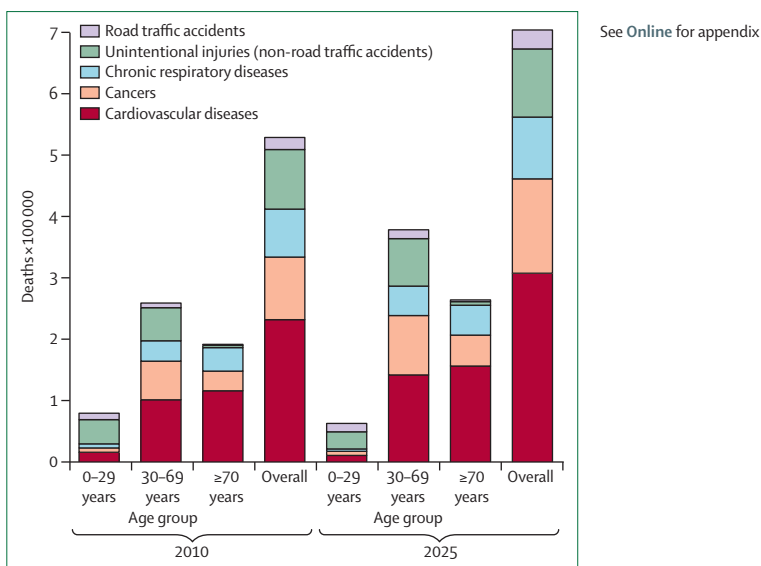

See **Online** for appendix

***Figure 1:* Projected deaths in Pakistan in 2010 and 2025 by age group and cause**
Mortality rates for 2010 and projections for 2025 for the major cause clusters cardiovascular diseases, cancers, chronic respiratory diseases, road traffic accidents, and non-road traffic accident unintentional injuries were generated using the method reported by Mathers and colleagues,[16] and calibrated to Pakistan-specific 2010 WHO major cause cluster values.

the prevalence was 27% in women and 19% in men, with the conventional western BMI cutoff of 25 kg/m².[23] The consumption of fruits and vegetables was identified
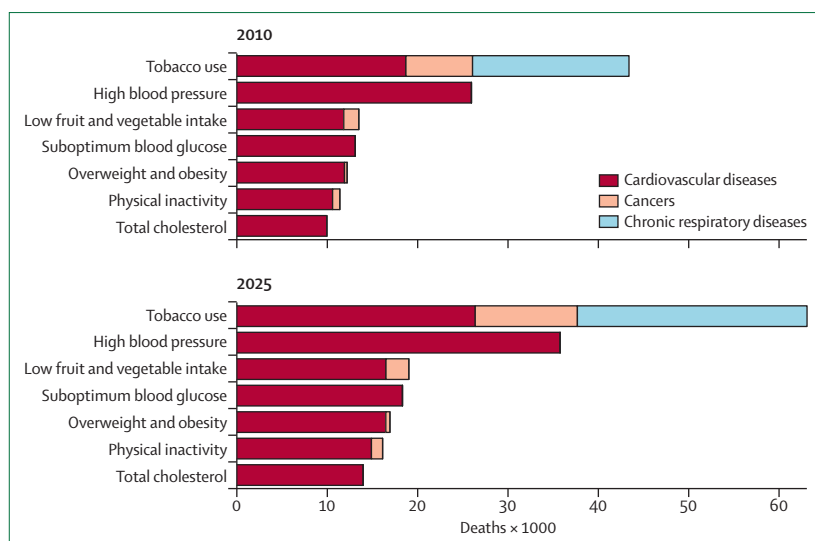
Figure 2: Main attributable risk factors for deaths due to non-communicable diseases in Pakistan in 2010 and projections for 2025

The mortality rates in the population aged 30–69 years for each of the major categories of non-communicable diseases—cardiovascular diseases, cancers, and respiratory diseases—attributable to the seven important risk factors smoking, systolic blood pressure, glucose, intake of fruits and vegetables, body-mass index, physical inactivity, and total cholesterol were calculated using relative risks extracted from Danaei and colleagues' report.[17]

as most inadequate in Pakistan compared with the other countries in the World Health Survey 2002–03.[12] More than 90% of the population in both urban and rural areas in Pakistan did not achieve the target recommended daily consumption of five servings of fruit and vegetables.[24] These estimates are consistent with other community-based surveys.[7,9,25,26] These shared risk factors also contribute to other non-communicable diseases.

Pakistan has the sixth highest burden of diabetes in the world.[9,27] In the Pakistan Diabetes Survey, the prevalence of diabetes (fasting plasma glucose ≥7 mmol/L or on antidiabetic medications) plus impaired glucose tolerance (2 h glucose concentrations of 7·8–11·0 mmol/L on the 75 g glucose challenge test) was 22·0% in urban areas and 17·2% in rural areas in adults aged 25 years and older.[9–11] Furthermore, the prevalence of complications of diabetes, including chronic kidney disease, are increasingly being recognised.[28]

Mental disorders and associated risk factors

The results of a systematic review of 20 studies showed that the mean prevalence of anxiety and depressive disorders (common mental disorders) in the general population was 34% (range 29–66 for women and 10–33 for men).[4] However, most data were gathered from conveniently sampled villages and urban settlements from the Punjab and Sindh provinces and cannot be generalised to all of Pakistan.

Mental disorders are associated with indicators of poverty. The findings of studies in Pakistan show that common mental disorders are more prevalent in women,

and people who have a low socioeconomic status, have poor education, are unemployed, have financial difficulties, and are living in poor housing.[29–33] In the tribal areas where the Pakistani army is engaged in war against the Taliban, 65% of women and 45% of men had severe mental distress.[34] In the context of conflict, natural disaster, and fragile health systems, the most vulnerable groups are women, children, and individuals directly exposed to conflict and displacement.[35]

Injuries and associated risk factors

The results from the National Injury Survey of Pakistan[8] showed that most injuries occur in people aged 16–45 years. Generally, young men from low social classes (labourers and vendors) are at the highest risk of both intentional and unintentional injuries.[8,36] More than 70% of all injured road users are either pedestrians or individuals riding two-wheel vehicles without wearing helmets[37] and are often injured in a few high-risk locations on a road network.[38] Burns and attempted self-harm are more likely in women, and have similar risk profiles as for mental disorders.[29,36]

Economic effect of non-communicable diseases

We estimated loss in national productivity associated with the 3·87 million deaths caused by cardiovascular diseases, cancers, and respiratory diseases in people aged 30–69 years in Pakistan during 2010–25 using an economic growth model (details provided in the appendix pp 2–3) similar to that reported by Abegunde and colleagues.[5] We compared the predicted gross domestic product (GDP) associated with a workforce reduced as a result of the deaths projected by GBD 2010 (baseline scenario) to 2025 with the GDP predicted by use of the assumption that no deaths arise from cardiovascular diseases, cancers, and respiratory diseases in people aged 30–69 years (counterfactual). With this approach, the cumulative production loss during 2010–25 was US$3·47 billion, using 2010 currency to control for inflation. A salient point is this economic burden is projected to rise sharply, from $152 million in 2010 (0·084% of GDP) to $296 million in 2025 (0·091% of GDP).

According to Rafiq's evaluation[39] of the compensating wage differential among blue-collar industrial workers in Lahore, the value of statistical life (VSL) was estimated at $321813 to $775193 per person. Assuming the estimated VSL is valid in a nationally representative median-age population, we computed the economic loss associated with each death as

$$\frac{(\text{life-expectancy at birth} - \text{age at death})}{(\text{life-expectancy at birth} - \text{median age})} \times \text{VSL}^{40}$$

Using the projected life expectancy at birth and median age for each year and keeping the VSL constant, we

estimated the cumulative welfare loss associated with the 3·87 million premature deaths to be $358 billion to $862 billion. This estimate focuses on the economic effect of cardiovascular diseases, cancers, and respiratory diseases for which we propose policy interventions. However, notably injuries constitute a substantial additional economic effect. The estimated cost of death and disability from road traffic injuries in Pakistan, for example, is $1·6 billion per year, which is 1·3% of its total GDP. A mean of 17 work days is lost per injury, and 15% of injuries required prolonged hospital stay with additional medical and indirect costs.[8]

Although there are no reliable estimates of the effect of mental disorders in Pakistan, they are likely to be high when lost earnings, burden of care on other family members, and cost of treatment are taken into account.[41] Moreover, decades of exposure to sociopolitical instability, economic uncertainty, violence, regional conflict, and dislocation have led to a decline in Pakistan's human development index. Thus, the increase in disability and premature deaths from non-communicable diseases will have even more serious consequences for the individual patients, their families, health systems, and national productivity in Pakistan.

Health systems and existing policies

Health systems in Pakistan cannot manage the rising burden of non-communicable diseases. The total per person expenditure on health from public and private sectors is less than $18 per year, which is lower than in many other south Asian countries (eg, India and Sri Lanka). A separate budget does not exist for preventive services or programmes for non-communicable diseases; and disease-specific investments are negligible—eg, estimates for prevention of road injuries reported investments of only $0·07 per person for Pakistan.[42] The public system plays a huge part in rural areas. However, rural areas have a shortage of qualified staff. About 100 000 non-physician lady health workers are employed by the government to provide immunisation and basic maternal and preventive child-care services, covering about 60% of the population.[43] None of these cadres of health workers are being trained for delivery of care to people with non-communicable diseases. In the urban areas, private family physicians are primary care providers for 75% of the population seeking medical attention.[44] However, there are serious deficiencies in family physicians' knowledge, management, and prevention of hypertension and cardiovascular diseases.[45]

Pakistan was one of the first developing countries to have an integrated national action plan (NAP) for non-communicable diseases, led by the non-governmental organisation Heartfile, that was accompanied by a formal memorandum of understanding with the government of Pakistan and WHO.[46] The NAP was a comprehensive strategy with an integrated approach, multisectoral action, whole of government approaches, public–private synergy, and government–WHO–civil society partnership for the prevention of non-communicable diseases.[47,48] Initially, the government had high-level commitment to the NAP, but later withdrew its support. Although the reasons are not entirely clear, political and other vested interests became the main hindrances in moving the agenda forward for non-communicable diseases. For example, an effective policy for non-communicable diseases cannot be favourable to the influential tobacco and food and beverage indus-tries—the government, responsible for facilitating the NAP had conflicts of interest, due to a huge reliance on revenue generated from tobacco.[49,50] Additionally, although there was wide international representation for NAP, non-communicable diseases did not feature on the Millennium Development Goals. Hence, by contrast with communicable diseases, donor assistance targeting prevention of non-communicable diseases remained poor in Pakistan, similar to the situation in other low-income and middle-income countries.[51]

Globally, there is evidence of a strong effect of legislative action, especially taxation, on tobacco control.[52] However, tobacco control policies in Pakistan remain less than optimum. Although Pakistan ratified the Framework Convention on Tobacco Control (FCTC) in November, 2004, progress on several key commitments to the FCTC is pending. Cigarettes in Pakistan are cheap. The most popular brands cost PKR28 per pack of 20 cigarettes ($0·29 at the current exchange rate).[53]

Further, a WHO-sponsored study on cigarette taxation in Pakistan identified several flaws with the current three-tier excise classification system that imposes a fixed excise on the lowest priced, and most widely used, cigarettes that is only about 35% of the current retail price.[53,54]

The enforcement of existing laws related to road traffic safety is weak. Despite a helmet law, more than 90% of riders wear no helmet according to hospital-based surveillance data from Karachi.[55] Seat belts and speeding laws are present, but reported enforcement is poor (self-reported score 4 [low or poor] of 10 [high or best]). However, there is no legislation for vehicle standards, road safety audits, and promotion of safer transport systems.[55]

Projected attainable fall in mortality rate in 2025

WHO and the Non-Communicable Disease Alliance recommend 25% reduction in overall mortality rate from cardiovascular diseases, cancers, diabetes, and chronic respiratory diseases aimed at individuals aged 30–70 years.[56] This target was established at the 65th World Health Assembly in May, 2012, after the September, 2011, UN High-Level Meeting on Non-Communicable Diseases.[49]

Because the health systems in Pakistan are being restructured at the provincial level after the 18th Constitutional Amendment (a huge change in the

Constitution of Pakistan by Parliament that provides greater autonomy to the provinces), a 20% reduction in premature non-communicable disease mortality relative to projected mortality by 2025 would be a reasonable target. This reduction translates into 57 240 deaths averted of 286 200 projected deaths per year from cardiovascular diseases, cancers, and chronic respiratory diseases in adults aged 30–69 years in 2025. Figure 3
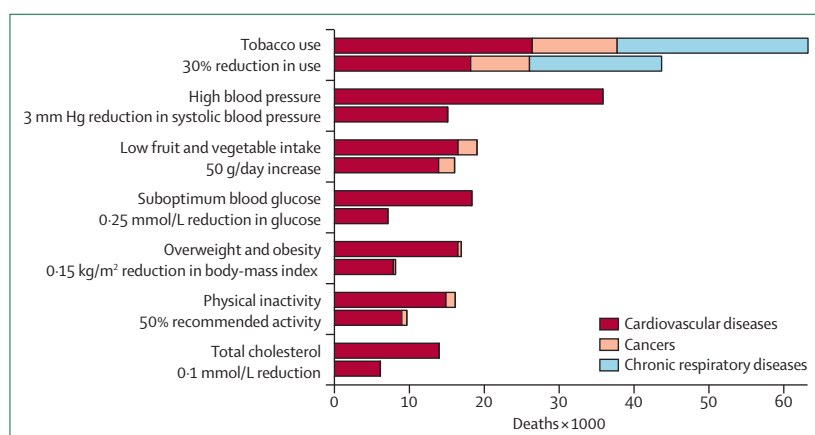

Figure 3: **Residual projected attributable mortality rates in adults aged 30–69 years from cardiovascular diseases, cancers, and respiratory diseases in 2025 with modification of population-wide risk factors consistent with Ford and colleagues[18]**

	Number of deaths averted in 2025 from cardiovascular diseases, cancers, and chronic respiratory diseases	Cumulative number of deaths averted from 2015 to 2025 from cardiovascular diseases, cancers, and chronic respiratory diseases
30% reduction in tobacco use	19 500	193 100
Reduction in systolic blood pressure by 3 mm Hg	20 700	207 100
Increase in intake of fruits and vegetables by 50 g/day	3000	25 800
Reduction in fasting blood glucose level by 0·25 mmol/L	11 200	111 500
Reduction in body-mass index by 0·15 kg/m²	8800	87 600
Increase in physical activity to 50% of recommended level	6500	64 100
Reduction in serum total cholesterol by 0·1 mmol/L	7800	78 000
Tobacco and blood pressure	38 600	384 100
Tobacco, blood pressure, and cholesterol	44 600	443 300
Tobacco, blood pressure, cholesterol, and glucose	53 900	536 200
Tobacco, blood pressure, cholesterol, glucose, and physical inactivity	56 200	559 000
Tobacco, blood pressure, cholesterol, glucose, physical inactivity, and body-mass index	61 100	607 700
All seven risk factors	62 700	623 900

The target thresholds for risk factors in the combination risk factors are the same as for the individual risk factors. The 20% reduction translates into 57 240 averted deaths of 286 200 projected deaths from cardiovascular diseases, cancers, and chronic respiratory diseases in 2025. The risk factor reductions are modelled individually and in combination.

Table 1: **Projected deaths averted from cardiovascular diseases, cancers, and chronic respiratory diseases by reduction of key risk factors in people aged 30–69 years in Pakistan in 2025 and cumulatively from 2015 to 2025**

shows the residual projected attributable deaths from these non-communicable diseases in 2025 in all adults aged 30–69 years if key risk factors were reduced by the specified levels. The number of deaths averted if key risk factors were reduced, alone and in combination, is shown in table 1 (sex-specific and age-standardised tables are provided in the appendix pp 8–10). Of the modelled risk factor interventions, the most substantial reduction in the number of deaths was noted with the reduction of mean systolic blood pressure by 3 mm Hg and the next was noted with reduction in the prevalence of tobacco use by 30%, which was more pronounced in men than in women (appendix pp 8–9). Importantly, to achieve the target minimum 20% reduction in mortality rate from cardiovascular diseases, cancers, and chronic respiratory diseases, the additional risk factors have to be addressed. A slight reduction in mean blood cholesterol of 0·1 mmol/L and also in fasting blood glucose by 0·25 mmol/L would reduce the cumulative deaths from non-communicable diseases by 15% and 20%, respectively. Successful reductions of greater magnitude than proposed for Pakistan in tobacco, blood pressure, and blood cholesterol concentrations have been achieved in many high-income countries.[18] Moreover, efforts to promote physical activity, intake of fruits and vegetables, and reduction of overweight and obesity would lead to additional, sustained reductions in the number of deaths from non-communicable diseases in Pakistan.

We also computed the cumulative reduction in mortality in individuals aged 30–69 years, assuming that the interventions are effective at different timepoints in Pakistan: 2010, 2015, and 2020 until 2025. Accounting for shifts in age-distribution and age-specific averted deaths due to intervention, the combined reduction in the risk factors tobacco, systolic blood pressure, cholesterol, and diabetes is projected to avert 730 000, 530 000, and 310 000 deaths of 3 870 000, 2 840 000, and 1 660 000 cumulative deaths from cardiovascular diseases, cancers, and chronic respiratory diseases, respectively. Thus, the urgency of implementation cannot be overstated.

The interventions to target these risk factors have been identified as best buys by WHO in terms of cost-effectiveness and feasibility in low-income and middle-income countries.[57] The yearly estimated cost of tobacco control in south Asia is $0·06 per person and medications (including statins) for individuals at high risk of cardiovascular disease is $0·92 per person.[57] There is empirical evidence that blood pressure control would cost $0·43 per person.[25] Thus, the priority interventions would be achievable at about $2 per person per year (about $180 million for the adult population in 2012). Equally important is reduction in disability and socioeconomic burden associated with injuries and mental illness. Therefore, we propose the strategies summarised in table 2 as high priority interventions.

Way forward

The projected attributable risks for non-communicable diseases in Pakistan, especially in the productive age group 30–69 years, indicate that one of the highest priority interventions for reduction in the prevalence of these diseases is tobacco control. According to the Disease Control Priorities Project, price increase in tobacco by 33% is estimated to cost between $4 and $84 per disability-adjusted life year (DALY) in low-income and middle-income countries, and is thought to be one of the most cost-effective strategies for prevention of non-communicable diseases.[62] Pakistan should aim for 30% reduction in smoking by 2025 relative to current rates through an increase in excise duty of the cheaply sold cigarettes, as has been achieved in other Asian countries with similar strategies.[63–65] Furthermore, the returns from doubling the excise duty on cigarettes despite 30% reduction in prevalence could generate about $367 million per year in excess of the current tax revenues from sales of cigarettes (appendix p 13) in Pakistan that could be channelled into initia-tives for prevention of non-communicable diseases,

	Strategies	Target reductions, metrics, and timeline	Process indicator and timeline	Leaders or coordinators	Evidence level
Legislative					
Tobacco	Simplify to two-tier excise structure; increase excise duty to at least 50% of the total price of cigarettes in tier 1 cigarettes (retail price per pack of less than PKR28), and to at least 63% for tier 2 cigarettes (or double the current excise duty)[53]	Increase the price of the most popular brands by 50% by 2015; 30% reduction in prevalence of current smokers by 2025	100% increase in the government's revenue from cigarette excise duty	Ministry of Finance, Government of Pakistan	Policy intervention evidence in low-income and middle-income countries
Injury	Speed reductions through construction of speed bumps for the top 10% of the most dangerous road junctions[58]; Legislation and enforcement of helmet wearing for all motorcyclists	Construct speed bumps by 2015; Strong enforcement of the helmet law by 2015; 50% reduction in deaths from road traffic injuries by 2025; 20% reduction in head injuries from motorbike accidents by 2025	10% reduction in average speeds by 2018; 75% of motorcyclists wearing helmet by 2018	Ministry of Communication and Transportation; Law or justice and police	Policy intervention evidence in low-income and middle-income countries
Overweight or obesity and physical inactivity, and unhealthy diets	Mandate regular physical education in all schools; Limit access to unhealthy food choices; Wider availability of healthy products by food and beverage industry; Promote intake of seasonal fruit and vegetables	Mandatory physical education in all schools by 2018; Provide subsidised seasonal produce to families of children attending schools by 2018	50% of all schools implementing physical education at least three times per week by 2020; Policy of no carbonated soft drinks on school premises by 2018; Serial monitoring of body-mass index of children	Ministry of Education, private foundations and donor agencies with Ministry of Education	Policy intervention evidence in low-income and middle-income countries
Health-systems interventions					
High blood pressure	Health promotion through Lady Health Worker Programme plus training of family physicians in updated management of hypertension using low-cost generic antihypertensive medications[13,25]	3 mm Hg reduction in population mean systolic blood pressure by 2025; Improvement in blood pressure control to 50% by 2025, especially in people with hypertension in low-income and middle-income communities	Delivery of at least one training session by lady health workers to most households by 2018; One training session attended by most of the family physicians in the communities by 2018	Health promotion to be delivered by the federally administered Lady Health Worker Programme with contracting to non-governmental organisations, and training of private family physicians by non-governmental organisations in partnership with academia and funded by international donors	Primary randomised controlled trial in Pakistan
Overall cardiovascular risk reduction	Combination of drugs for adults at high risk of cardiovascular diseases	Increase in use of aspirin, antihypertensive drugs, and statins by 50% by individuals at high risk of cardiovascular disease by 2020, especially in low-income and middle-income communities	Training of family physicians in the communities and availability of high-quality, low-cost aspirin, antihypertensive drugs, and statins in pharmacies in the communities by 2018	Training of family physicians should be government-led and contracted to non-governmental organisations with technical assistance from academia; Pharmacy supplies to be ensured by local industry with government oversight on quality	Policy intervention evidence in low-income and middle-income countries
Diabetes prevention	Behavioural intervention for individuals at high risk of diabetes	5% weight loss over 5 years, and at least 90 min of physical activity per week by 2025	Delivery of at least one training session by lady health workers to high risk individuals screened at primary care centres by 2018	The training of family physicians and allied health staff should be government-led, contracted to non-governmental organisations with technical assistance from academia	Primary randomised controlled trial in south Asia
Mental health	Integration of psychosocial interventions for common mental disorders at primary care level[59–61]	20% reduction in prevalence of anxiety and depressive disorders by 2025	100 primary health-care workers trained per 100 000 population by 2020	Ministry of Health, non-governmental organisations, academia, and donors	Primary randomised controlled trial in Pakistan

Table 2: Evidence-based priority interventions for prevention and control of non-communicable diseases and injuries in Pakistan

potentially and largely mitigating the costs of the proposed programmes.

The Disease Control Priorities Project also advocates injury prevention and emergency care provided by trained, lay respondents as a cost-effective public health intervention, costing less than $100 per DALY averted.[62] For Pakistan, construction of speed reducing features (eg, speed bumps) for the 10% most lethal junctions should be a priority in addition to effective implementation of helmet laws for motorcyclists. There is evidence that these actions would lead to a 55% reduction in the number of road traffic injury fatalities by 2025.[58,66]

Empirical data for Pakistan from the Control of Blood Pressure and Risk Attenuation (COBRA) trial[13] indicate that delivery of effective interventions and reduction of systolic blood pressure by 5 mm Hg are possible in individuals with hypertension in the general population by use of the existing platform of mixed health-care systems infrastructure through private care providers, non-specialist health professionals, and community-based agents.[13]

Such a model for hypertension control was estimated to cost $0·43 per person per year, $115 per cardiovascular disease DALY averted at the policy-maker level, and $1226 per cardiovascular disease DALY averted at the societal level. Hence, the strategies are potentially both affordable and cost effective, but need evaluation after integration into the public health sector in rural areas.[13,25]

Importantly, WHO recommends combination drug treatment (low-dose antihypertensive drugs, statins, and aspirin) for management of the overall cardiovascular risk profile of patients.[67] Moreover, according to WHO, reduction of dietary salt through policy action for the food industry, and behaviour change campaigns with respect to domestic use are priorities for prevention of cardiovascular disease.[68]

Consistent with the key priorities identified by Collins and colleagues,[69] several examples exist of mental health interventions delivered by lay workers in rural and urban Pakistan with promising results.[59–61] Furthermore, there is evidence that primary-care and community-based interventions are cost effective.[13]

Reliable data for cancer in Pakistan and appropriate screening and preventive efforts are needed. The health systems must be strengthened such that delivery of care for people with non-communicable diseases can be integrated for a synergistic effect on several outcomes.[70] Methods to overcome impediments in health systems have been described by Nishtar and colleagues in this Series.[71]

Global organisations including WHO, UNICEF, UN Food and Agriculture Organization, and development agencies and foundations must also focus on non-communicable diseases in Pakistan, as per recommendations by the Institute of Medicine's report[72] for low-income countries. Pledges by the International Food and Beverage Alliance to self-regulate access and improve nutritional content of products must be implemented in Pakistan.[73] These efforts require independent monitoring by a formal group that is representative of the relevant sectors including government and non-government organisations, academia, and WHO.[74]

The federal health institutions are in the process of evolving after the 18th Constitutional Amendment, so there is a good opportunity to redistribute national resources from tertiary to primary care in Pakistan and assess efficiency.[71,75] Also important is that well resourced centres for prevention and control of non-communicable diseases should be established in each provincial health department and an individual should be appointed for stewardship of the agenda for non-communicable diseases in Pakistan. These centres should be linked with research academies and leading non-governmental organisations for technical support and capacity strengthening in programme planning and implementation for non-communicable diseases. The provincial centres should take the agenda for non-communicable diseases forward and report the disease indicators to the public. At the same time, steps should be taken to strengthen the existing programmes, avoid creation of parallel structures, and integrate delivery of prevention and management of high blood pressure, diabetes, and mental disorders with services for family planning, common infectious diseases, and maternal and child health.

Additionally, intersectoral collaborations should be established with relevant organisations for key policy interventions. These organisations include the Tobacco Control Unit and the departments for revenue (cigarette taxation), education, food and safety standards (physical education and promotion of healthy food at schools), agriculture and trade municipal planning, and road safety and transportation (construction of speed bumps and enforcement of the helmet law). Leadership of the centres must not have any conflicts of interest. The guidance from NAP would be useful in the assignment of roles and responsibilities to the collaborating partners.

Non-communicable diseases and injuries require huge investment in human resources and surveillance of the risk factors in Pakistan; elucidation of programmes for monitoring and assessment of these diseases and their risk factors, especially in rural areas, is a research priority. National and international donors and developmental agencies must also step forward and reprioritise their mandate to include public health research and programmes for non-communicable diseases and injuries.

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