Strengthening public health in South Africa: Building a stronger evidence base for improving the health of the nation

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An assessment of the relative burden attributable to selected risk factors[1] provides an important evidence base for prioritising risk factors that should be targeted for public health interventions. Selecting interventions should be based on a robust and transparent process of scientific evaluations of their effectiveness, as well as assessment of their cost-effectiveness, local applicability and appropriateness, and likely effects on health inequalities.[2,3] Establishing such an evidence base is an ongoing process that is still at an early stage in South Africa. A recent review of disease control priorities for developing countries (DCPP)[4] examined the global evidence regarding the effectiveness of interventions for major health burdens. Despite acknowledging the lack of intervention trials in developing countries, this DCPP review provides a unique resource for identifying interventions that might be useful in South Africa.

High-quality research into public health interventions has been growing steadily in South Africa. In the area of HIV prevention, for example, ground-breaking studies have been conducted on microbicides,[5] male circumcision,[6] and the gender transformative Stepping Stones programme.[7] The Intervention with Microfinance for AIDS and Gender Equity (IMAGE) study[8] is a unique trial that addressed structural gender and economic dependencies facing women and demonstrated the use of this as a means for reducing intimate partner violence. Further support for such innovative and rigorous research is needed.

Synthesising available evidence through systematic review is also an important process in harnessing knowledge as it develops. A major milestone in this process was the 10th anniversary of the South African Cochrane Centre, which has contributed to the systematic evaluation and synthesis of findings from clinical and public health trials.[9] This initiative is helping to develop a culture of evidence-informed decision-making in South Africa, but, as recently observed in a study of the World Health Organization recommendations,[3] much effort is needed to strengthen the use of evidence in policy making.[10] Ideally we would need to undertake methodologically rigorous research to refine understanding of each risk factor to health in South Africa; systematically seek evidence of effective, suitable and sustainable interventions; and ensure carefully considered, high-quality evaluation designs with sufficient power and follow-up and including data on costs, adverse events/harm, quality of life, morbidity and mortality. The reality is that the knowledge gaps remain enormous. Furthermore, little work has been done to assess the cost-effectiveness of interventions in the South African setting, with some exceptions such as the evaluation of hypertension guidelines[11] and the prevention of mother-to-child transmission of HIV.[12]

It is essential for South Africa to continue building the public health evidence base so that appropriate interventions can be identified to reduce the burden of disease. Health, disease and well-being are complex states influenced by a wide range of factors such as gender, socio-economic development, health care access and delivery, physical environment, and inequity; and identifying interventions will transcend the boundaries of many disciplines and involve the work of many professionals.[13] However, does South Africa have to wait for the knowledge gap to be filled before taking action on the findings of the South African Comparative Risk Assessment (SA CRA) and other burden of disease information? Drawing on the DCPP and other reviews, it is possible to begin the process of assessing where we are in the evidence chain; identifying

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where public health action can fruitfully be taken; and deciding where further studies are needed.

To facilitate this process, the findings and recommendations from 17 risk factor assessments for the SA CRA are consolidated in Table I. This lists the risk factors that were evaluated, the proportion of DALYs estimated to be attributable to the risk factor, and recommendations for intervention. The risk factors are organised into clusters that may share common causal pathways and are ranked according to their contributions to the burden of disease. The recommendations are informed by the international evidence, but also include interventions considered to have high potential or that address a particular need in the country. A grading of the strength of the evidence of the effectiveness for the identified interventions is provided by indicating whether a Cochrane review[14] has shown the intervention to be effective (*), or whether the DCPP[4] has recommended the intervention as effective (†) or cost-effective (‡). This review of the evidence cannot be considered exhaustive. Furthermore, limited data on the effectiveness of some of the interventions in the South African setting means that further work on local applicability and suitability will be needed. It must also be acknowledged that the more complex and structured the intervention, the less scope there is for assessing the effectiveness of interventions.

An integrated intervention framework

From Table I, it becomes clear that reducing exposure to many of these risk factors cannot be achieved by the health sector alone. Given the nature of the risk factors highlighted in this study, interventions will need to span three spheres: the social sphere, the health sphere, and the development sphere.

The social sphere

The three leading risk factors to health in South Africa (unsafe sex, interpersonal violence and alcohol use) are related to complex social factors and behaviours. Their substantial contribution to the burden of disease highlights the urgent need to build social cohesion and the political, community, religious and economic leadership in building the rights-based vision embedded in the South African Constitution. A sense of humanity (*ubuntu*) and a culture of respecting human rights and valuing life need to be fostered between individuals, between individuals and communities, and between individuals and societal institutions. Research to develop effective interventions, including structural interventions, needs to be encouraged.

The health sphere

The health sector has a central role in ameliorating the risk factors through a population-based approach to promote healthy lifestyles on the one hand, and early diagnosis and cost-effective management of risk factors and disease on the other.[15] In the context of chronic disease prevention, the WHO refers to a healthy lifestyle in terms of no tobacco use, good nutrition and increased physical activity.[16] South Africa has made good progress on tobacco control at the macro-policy level.[17] This has included legislation on advertising and distribution, restrictions on smoking in public places, increased taxation, health warnings on cigarette packages, and health-promoting campaigns. Indications are that the prevalence of smoking has dropped, although not for middle-class young people. Lessons from this experience need to be used to develop strategies to influence eating habits, increase levels of physical activity, and reduce alcohol use. Interventions are needed to make healthy choices easier for individuals. For example, make smoking more costly to individuals and increase the availability and decrease the price of fresh fruit and vegetables. At an individual level, risk factors for chronic diseases tend to coexist and have a synergistic impact on health. Consequently, it is essential that a complete assessment of an individual's risk profile be taken into account to identify the absolute risk for disease based on a comprehensive risk profile. Moderate reductions in several risk factors can therefore be more effective than major reductions in one,[18] and this approach has been shown to be cost-effective for South Africa.[11]

The development sphere

Poverty results in the inequitable distribution of disease, and there is consensus that sustainable development cannot be achieved where rates of incapacitating illness are high. Consequently, health was singled out as one of the five priority areas in the implementation plan drawn up at the World Summit on Sustainable Development in Johannesburg in 2002.[19] The reduction of poverty is not an automatic consequence of development, particularly in the context of current globalisation trends in which the incomes of the rich continue to grow at a faster rate than those of the poor. Reducing poverty is a critical up-stream strategy for reducing risk factors for poor health such as undernutrition and unsafe water and sanitation. Specific policies and strategies in this regard are therefore needed, including the provision of basic services. It is also essential to ensure that development is sustainable so as to avoid harmful health effects such as pollution, and so ensure that the environment can provide for future generations. Noticeable efforts to extend the provision of water have been made in South Africa in recent years, and legislation regarding the lead content in petrol has been introduced. However, action is still needed to expand water and sanitation provision to marginal communities and rural areas, and to reduce exposure to indoor smoke from solid fuels. Efforts to reduce air pollution, particularly from industrial and motor vehicle emissions, are also needed. Poverty reduction strategies are complex and need careful monitoring and evaluation, inclusive of their impact on health. However, the importance of even small-scale intervention in this sphere should not be underestimated, as highlighted by the findings of several recent trials.[8,20]

Intersectoral and multi-pronged approaches that operate at multiple levels will be required, including the individual and family level; the community level involving institutional or organisational structures; and the macro level, including public policy and legislation. At the macro level, it is also important to consider the negative effects of globalisation and how these might be mitigated. The health services can play an important role in the context of intersectoral interventions. Szreter has alluded recently to the important redistributive role of the social provision of health care in the context of progressive public health approaches.[21] However, the publicly funded health services in South Africa, which provide health care to the majority of the population, face enormous challenges. These include human resource deficits; access to health facilities in some areas; the management of health services, including the provision of drugs and other consumables, staff training, etc.; the poor integration of services provided by vertical programmes; and the financing of health care, including the maldistribution of health care resources in South Africa. These challenges need to be addressed in order to improve risk management in primary care, let alone deliver the health promotion activities needed, particularly for the poor. Review[22] of our efforts to prevent mother-to-child transmission of HIV, for example, suggests that unless concerted and focused actions are taken, reductions in child mortality and meeting the Millennium Development Goals will remain elusive.

Table I. Selected risk factors, their rank, attributable DALYs as a percentage of total DALYs and potential interventions and recommendations, SA CRA 2000

Risk factor	Rank (% total DALYs)	Potential interventions and recommendations
Sexual and reproductive health		
Sexually transmitted disease burden/Unsafe sex	**1** (31.5%)	• Strengthen the prevention of mother-to-child transmission programme,*‡ and improve antenatal screening for syphilis. • Strengthen population-based interventions that target risky sexual behaviour, particularly among youth.† • Maintain promotion and distribution of condoms.*‡ • Promote voluntary counselling and testing (e.g. through mass media*) and provider-initiated testing and counselling for HIV. • Strengthen STI control by promoting syndromic management‡ including the private sector (and review guideline). • Strengthen screening for cervical cancer, and promote regular utilisation of screening services. • Consider the promotion of male circumcision. • Improve access to highly active antiretroviral treatment,* placing particular emphasis on the current lack of human resources and infrastructure. • Improve access to cotrimoxazole in adults and children with HIV.* • Support research into microbicide and vaccine development. • Better understand underlying determinants to develop more effective interventions.
Violence		
Interpersonal violence: child sexual abuse, intimate partner violence	**2** (8.4%)	• Seek effective strategies to change cultural norms regarding violence, gender and sexual relations through interventions such as working with young men, reducing media violence and establishing adult recreational programmes. • Increase positive adult involvement through family mentoring programmes to develop positive role models and build skills for non-violent conflict resolution,*† set up home-school partnership programmes to promote parental involvement for primary school children and after-school programmes, to extend adult supervision of children. • Early interventions such as increasing preschool enrichment programmes,† and reducing unwanted teenage pregnancy may also be important. • Strengthen communities through education and child care (e.g. school-based programmes to reduce aggressive behaviour,*† provide incentives to youth to complete secondary schooling,‡ academic enrichment programmes for children aged 12 to 19 years, etc.). Initiate social development programmes including social development training aimed at nurturing community cohesion and strengthening social capital.† Multi-sectoral efforts to reduce alcohol and substance abuse.‡ • Reduce income inequalities through job-creation programmes and initiatives such as micro-financing projects (particularly targeting women).

Table I. (continued) Selected risk factors, their rank, attributable DALYs as percentage of total and potential interventions and recommendations, SA CRA 2000

Risk factor	Rank (% total DALYs)	Potential interventions and recommendations
Interpersonal violence (continued)		• Improve the criminal justice and social welfare systems. Strengthen police and judicial systems to ensure more equitable access, protection and legal recourse. This must include better services for victims, witnesses and suspects as well as more streamlined and efficient investigation and judicial procedures. Set up temporary foster care programmes for chronic delinquents and therapeutic foster care for young children,[†] and home visitation services aimed at reducing child maltreatment.[*†‡] Prioritise community policing to develop safe environments and enforce the Firearms Control Act to decrease the number of guns in society.[‡] • Develop capacity for an appropriate health sector response – train health professionals to screen, examine, assist, support and refer victims of intimate partner violence or child sexual abuse[*] and adults abused as children. • Better understanding of the underlying determinants of violence to develop more effective interventions.
Addictive substances		
Alcohol harm	**3** (7.0%)	• Regulate coherent liquor outlet policy including reduced hours for sales.[*‡] • Increase alcohol excise tax.[‡] • Improve the enforcement of existing legislation/regulation regarding drinking and driving (e.g. random breath testing[*†‡]), minimum purchase age of alcohol (to address under-age drinking). • Restrict alcohol marketing, e.g. banning alcohol advertisements, and increase active forms of alcohol counter-advertising.[*†‡] • Universal abolition of the 'dop' system. • Strengthen the institutional support structures for recovering alcoholics including brief interventions[*‡] at primary health care. • Programmes to prevent drinking during pregnancy.
Tobacco smoking	**4** (4.0%)	• Tobacco legislation includes all recommendations of the WHO Framework Convention on Tobacco Control – but there is a need to further tighten, enforce and monitor the impact of tobacco regulation.[*†‡] • Implement smoking cessation programmes in primary care clinics.[*†‡] Target pregnant women[†] – particularly coloured women, who have among the highest female smoking prevalence in the world.
Physical inactivity and nutrition-related risk factors related to chronic diseases		
Excess body weight (high BMI)	**5** (2.9%)	• Develop policies, legislation and action around the supply, availability, manufacturing, processing, marketing, advertising and pricing of food,[†] e.g. ensure wide availability and affordability of healthy foods; limit the salt content of manufactured foods through legislation and accompanying population-wide education;[†‡] reduce the saturated fat content of food;[†‡] limit the promotion of unhealthy food to children.[†] • Develop locally suitable health messages about preventing and reducing excess body weight, and ensure consistent messages on television, radio, and the print media.[†] • Implement community programmes to educate people about safe and effective prevention and management methods, and create environments that facilitate behaviour change towards healthier body weights.[†] • Promote regular and suitable exercise (including walking, callisthenics, stair stepping, stationary cycling, jogging, ball games) combined with dietary change for weight loss and improved health in persons with excess body weight.[*†] • Recognise the risks of obesity and the extent of excess body weight in children and adolescents. Prioritise research for effective prevention and reduction programmes in children and adolescents.[*] • Develop school programmes that integrate nutrition and physical activity into core curricula and/or lifestyles programmes, and healthy nutrition into school food/snack services.[†]

Table I. (continued) Selected risk factors, their rank, attributable DALYs as percentage of total and potential interventions and recommendations, SA CRA 2000

Risk factor	Rank (% total DALYs)	Potential interventions and recommendations
High blood pressure	**8** (2.4%)	• Consider population-based approaches such as reduced salt* in bread and other commonly consumed food products. • Improve the diagnosis and management of high BP in primary care, as part of an absolute risk management approach. • Incorporate BP control into healthy lifestyle interventions. • Reduce alcohol intake. • Reduce overweight and obesity amongst hypertensives.*
Diabetes	**9** (1.6%)	• Develop and evaluate healthy lifestyle programmes with emphasis on good nutrition, reduced overweight and obesity and increased physical activity. • Optimise primary care diagnosis and management of raised blood sugar included in absolute risk management,†‡ including organisational interventions.* • Provide cost-effective care for complications of diabetes.†‡
High cholesterol	**10** (1.4%)	• Consider population-based approaches to reduce dietary fat,* such as food information and awareness. • Improve the diagnosis and management of high cholesterol in primary care – as part of a total risk management.
Low fruit and vegetable intake	**11** (1.1%)	• Tax and agricultural policies to promote production and availability of fruit and vegetables.† • School programmes that integrate nutrition in curricula and healthy nutrition into school feeding schemes.† • Develop and evaluate social marketing strategies to promote regular eating of fruit and vegetables. • Promote home and community vegetable/produce gardens.
Physical inactivity	**12** (1.1%)	• Promote school, workplace, health care provider, and community physical activity programmes through educational interventions reaching large populations.† • Promote physical activity within a total risk management approach in primary care, and as part of secondary prevention after cardiovascular events or diabetes diagnoses.* • Develop locally-suitable health messages related to physical activity in co-operation with stakeholders so that consistent messages can be used on television, radio, and the print media.† • Promote professional advice and guidance with continued support to encourage people to be more physically active.* • Modify town, road and building designs to promote physical activity through safe walking, cycling, and use of stairs, and to improve access to public transportation.† • Assess and address the role of crime, violence and cultural beliefs as potential inhibitors of physical activity.
Childhood and maternal undernutrition		
Undernutrition	**6** (2.7%)	• Strengthen poverty alleviation programmes. • Promote food gardens. • Strengthen clinic-based and community-based nutrition interventions. • Growth monitoring linked with education of mothers about healthy nutrition, particularly in poor settings.† • National monitoring of nutritional status and identification of 'at risk' communities. • Promote exclusive breastfeeding for first 6 months for HIV-negative mothers.*† Avoid mixed feeding for HIV-positive mothers – exclusive breastfeeding for first 3 months if formula feeding is not a safe and sustainable option.
Iron deficiency	**13** (1.1%)	• Identify communities that remain at risk and would benefit from iron supplementation, and in the context of high HIV prevalence, it is essential to assess the individual woman as iron supplementation should not be given to HIV-positive pregnant women. • Monitor impact of food fortification programme.†

Table I. (continued) Selected risk factors, their rank, attributable DALYs as percentage of total and potential interventions and recommendations, SA CRA 2000

Risk factor	Rank (% total DALYs)	Potential interventions and recommendations
Vitamin A deficiency	**14** (0.7%)	• Identify clinics/districts where vitamin A supplementation is low and improve implementation of this intervention. • Monitor impact of the food fortification programme.†
Environmental risks		
Unsafe water, sanitation and hygiene	**7** (2.6%)	• Improve access to safe and sustainable sanitation† and water facilities,†‡ particularly in poorly served urban and rural communities. • Promote hand-washing and improved hygiene.†‡ • Research the effectiveness of deworming programmes.

Indoor air pollution	**15** (0.4%)	• Move to cleaner burning fuels† such as electricity and gas, improved stoves,†‡ housing design with improved ventilation† and behavioural changes such as:
		  • Improve stove maintenance practices.†
		  • Open ventilation for longer periods of time during burning of fossil fuels.
		  • Move children to a location away from the stove during burning.†
		  • Reduce the duration of solid fuel burning.
		  • Reverse ignition process for coal (place coal underneath the easier burning material).
		  • Promotion of outdoor burning in poor rural areas.

Lead	**16** (0.4%)	• Implement and monitor the regulation of lead content of paint and petrol.† • Improve public awareness of the sources and hazards of lead in homes, industry, 'cottage industries', cultural/traditional practices. • Set standards in South Africa for children's blood lead levels and develop protocols to respond to children with elevated blood lead levels.‡ • Reduce occupational exposure (including para-occupational exposure and lead use in the informal sector).
Urban air pollution	**17** (0.3%)	• Create awareness of the health risks of urban air pollution. • Promote the use of public transport including land use strategies. • Move away from dirty fuels such as coal, wood and paraffin to cleaner fuels such as liquefied petroleum gas (LPG) and electricity and expand use of environmentally benign energy sources such as solar or wind power. • Air pollution control regulation to reduce the emissions from power plants† and industry† as well as volatile organic compounds at petrol filling stations. • Regulation on the use of two-stroke engines, open burning of wastes and the uncontrolled burning of forests and agricultural fields. • Monitoring and regulation of emissions from industry and traffic.†

*Supported by a Cochrane systematic review of effectiveness.
†Recommended by DCPP as effective.
‡Recommended by DCPP as cost-effective.

Strengthening public health through evidence and information

National efforts to develop and institutionalise public health in South Africa, and to monitor health outcomes, are necessary to improve the promotion of population health. The first South African National Burden of Disease (SA NBD) study synthesised extensive population health data and highlighted the substantial quadruple burden of disease comprising the simultaneous burden of chronic diseases, conditions related to underdevelopment, injuries and HIV/AIDS. Such information has been important in prioritising the conditions that should be addressed in order to improve the health of the nation and was used in the SA CRA to quantify the contribution of selected modifiable risk factors that drive the burden of disease. The challenge now is to identify appropriate interventions to address these risk factors and where effective interventions have already been adopted, for example, prevention of mother-to-child transmission, to ensure that they are implemented appropriately. Table II outlines the steps that are required for policy makers, researchers and wider society to engage with the evidence and information and to work in partnership to improve the health of individuals, households and communities. The Western Cape Burden of Disease Reduction Project[23] of the provincial government has initiated a process that will provide an important model on translating research and evidence into policy and practice. This project is using an ecological model of the determinants of health, divided

Table II. Taking forward the SA CRA – steps for policy makers

- Promote discussion of the findings and recommendations of the CRA within national, provincial and local government departments, civil society and the private sector.
- Identify cost-effective interventions to reduce exposures to risk factors responsible for substantial disease burden and initiate reviews or primary research where evidence for the effectiveness of interventions is lacking.
- Prioritise interventions based on local applicability and acceptability. Key questions to address here include:
  - whether the interventions could work in the South African setting (feasibility)
  - what it would take to make them work
  - their impacts on equity, and
  - cost of sustaining such interventions.
- Formulate intersectoral policies for risk reduction at individual, community and macro-levels and across the social, health and development spheres.
- Develop national, provincial and district level implementation plans for interventions within programmes and allocate resources to achieving these.
- Develop strategic alliances to champion and advocate the processes at multiple levels.
- Monitor and evaluate policy and programme implementation and their effects on key health determinants and indicators.

Source: Adapted from Epping-Jordan *et al.*, 2005,[24] and Lavis *et al.*, 2004.[2]

into the up-stream and down-stream factors, and is currently focused on the more up-stream factors such as multiple deprivation. It has used the burden of disease methodology as an aid to prioritise and will use the public health approach of monitoring any interventions that are adopted.

Government needs to consider establishing and financing a mechanism, for example, a Public Health Foundation, to lead a public health initiative with the specific objective of improving population health through reducing the underlying risks to health. Underpinning any effort to improve the health of the nation is the institutional capacity to collect, analyse and utilise population health data at national, provincial and local levels, and to draw on the available evidence in the process of identifying appropriate interventions. Stronger capacity to review and synthesise such information, including modelling, is also required. For future risk factor assessments, for example, it would be useful to model the avoidable burden so as to assess the potential gains in health from reducing particular risk exposures, as well as the cost-effectiveness of doing so. Building such technical capacity needs to be done systematically and should be accompanied by strong advocacy for health and equity and co-ordination of concerted efforts in the various spheres. Such an investment in the health of the nation, in tandem with appropriate health services, should deliver positive returns beyond the health realm.

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Glossary

AFR-E

In the Global Burden of Disease Study, the Member States of the WHO World Health Organization were divided into five mortality strata (A - E) on the basis of their levels of child mortality (< 5 years) and 15 - 59-year-old male mortality. When these mortality strata are applied to the six WHO regions, they produce 14 epidemiological sub-regions. Sub-Saharan Africa is divided into two regions, AFR-D and AFR-E. South Africa falls in the AFR-E region, comprising countries that have comparatively high levels of both adult and child mortality. Other AFR-E countries included in the Global CRA 2000 Study were Botswana, Burundi, Central African Republic, Congo, Côte d'Ivoire, Democratic Republic of the Congo, Eritrea, Ethiopia, Kenya, Lesotho, Malawi, Mozambique, Namibia, Rwanda, Swaziland, Uganda, United Republic of Tanzania, Zambia, and Zimbabwe.

Categorial attribution

A death (or any other event) can be categorically attributed to a single cause such as a disease or risk factor according to a set of rules. For example, the ICD-10 classification system is used for the categorical attribution of causes of death in national burden of disease studies. Categorical attribution can be used in the causal attribution of burden of disease to risk factors such as in the attribution of motor vehicle accidents to alcohol consumption where linked data are available capturing both the risk factor exposure and the health outcome of individuals.

Counterfactual analysis

This approach is particularly useful as many diseases do not have a single cause but have multiple causes. Furthermore, deaths (or any other event) are generally not classified according to risk factors. In counterfactual analysis, the disease burden attributable to a particular risk factor is estimated by comparing the current health status with a hypothetical alternative scenario, which is referred to as the counterfactual. In this analysis the estimates of burden of disease attributable to risk factors were based on the counterfactual of lowest population risk (see theoretical minimum exposure distribution). As death or disability from many diseases can result from several exposures acting simultaneously, the sum of attributable fractions, for any subset of causes, can be greater than 100%.

Comparative risk assessment (CRA)

A comprehensive, standardised demographic and epidemiological conceptual and methodological framework to estimate the relative contribution of selected risk factors to the disease and injury burden of a country or region, making use of comparable data on risk factor exposure and effects in populations.

Disability-adjusted life year (DALY)

The DALY is a population measure of the health gap calculated by adding the years of life lost due to premature mortality to the number of years of life lived with disability or illness, weighted according to the severity, and using time as the common measure.

Global burden of disease (GBD)

A comprehensive demographic and epidemiological framework to estimate health gaps for an extensive set of disease and injury causes, and for major risk factors, using all available mortality and health data and standardised methods to ensure internal consistency and comparability of estimates.

Group I causes of death

Pre-transitional causes: Communicable diseases, maternal causes, perinatal conditions, and nutritional deficiencies. HIV/AIDS is usually part of group I causes. In the South African National Burden of Disease Study, however, HIV/AIDS was treated as a group on its own owing to the extent of the estimated HIV- and AIDS-related burden in the country.

Group II causes of death

Non-communicable diseases, including malignant neoplasms, cardiovascular diseases, chronic respiratory diseases, digestive, musculoskeletal and genitourinary conditions, as well as mental disorders and neurological conditions.

Group III causes of death

Unintentional and intentional injuries.

Hazard rate

The instantaneous rate of increased risk associated with exposure to a health harm.

Health gap

Measures the difference between the actual and a normative measure of population health. This extends the concept of a mortality gap such as years of life lost (see below) to include time lived experiencing ill-health (see years lived with disability).

Incidence rate

The total number of new cases with a condition within a specified period of time in a population, divided by the number of individuals without the condition.

National burden of disease study (NBD)

A comprehensive demographic and epidemiological framework to estimate health gaps for a country for an extensive set of disease and injury causes, and for major risk factors, using all available mortality and health data and methods to ensure internal consistency and comparability of estimates.

Population-attributable fraction (PAF)

This is defined as the proportion of the disease cases in a population that would be prevented if population exposure to a risk factor was absent, assuming the exposure was causal. The PAF of disease burden in a population is determined by the prevalence of exposure to the risk factor in the population, and the relative risk of disease occurrence given exposure. It is a subtype of a more general measure – the potential impact fraction (PIF).

Population impact fraction (PIF)

The PIF measures the proportional reduction in disease or injury burden experienced by a population that would occur if the population were subjected to an alternative counterfactual distribution of exposure to the health risk. For health risks measured on a continuous scale such as blood pressure, a discrete formulation that is mathematically equivalent to the multiple category extension of the PAF can be used to approximate the PIF.

Prevalence rate

The total number of cases with a condition in a population, divided by the number of individuals in the population.

Risk factor

A risk factor is an attribute or exposure that is causally associated with increased risk of a disease or injury.

Relative risk (RR)

The risk of developing a disease/being injured in an exposed population relative to the risk in an unexposed population. It is calculated as a ratio of the probability of the event occurring among those exposed to a risk factor divided by the probability of the event occurring among those not exposed.

Theoretical-minimum-risk exposure distribution

This is the distribution of exposure to a risk factor that would confer the lowest risk of disease. In some cases it might be zero, such as in the case of tobacco use, where zero exposure was the minimum risk, while in others it may be a distribution or level having the lowest functional/observed overall risk, such as in the case of excess body weight and high blood pressure. In the case of low fruit and vegetable intake, the theoretical-maximum is of interest.

Uncertainty analysis

An estimate of the range of the result using simulation methods to incorporate uncertainty or confidence intervals for each source of data, including prevalence of exposure and relative risk estimates. In contrast to confidence intervals that estimate the margin of error based on sampling variation, an uncertainty interval should include the possible margin of error arising from systematic biases and measurement error.

Years lived with disability (YLDs)

The loss of healthy life through non-fatal health conditions, calculated from the incidence, duration and severity of the condition.

Years of life lost (YLLs)

The years of life lost, compared to a normative standard, due to premature mortality. This is a measure of the mortality gap.