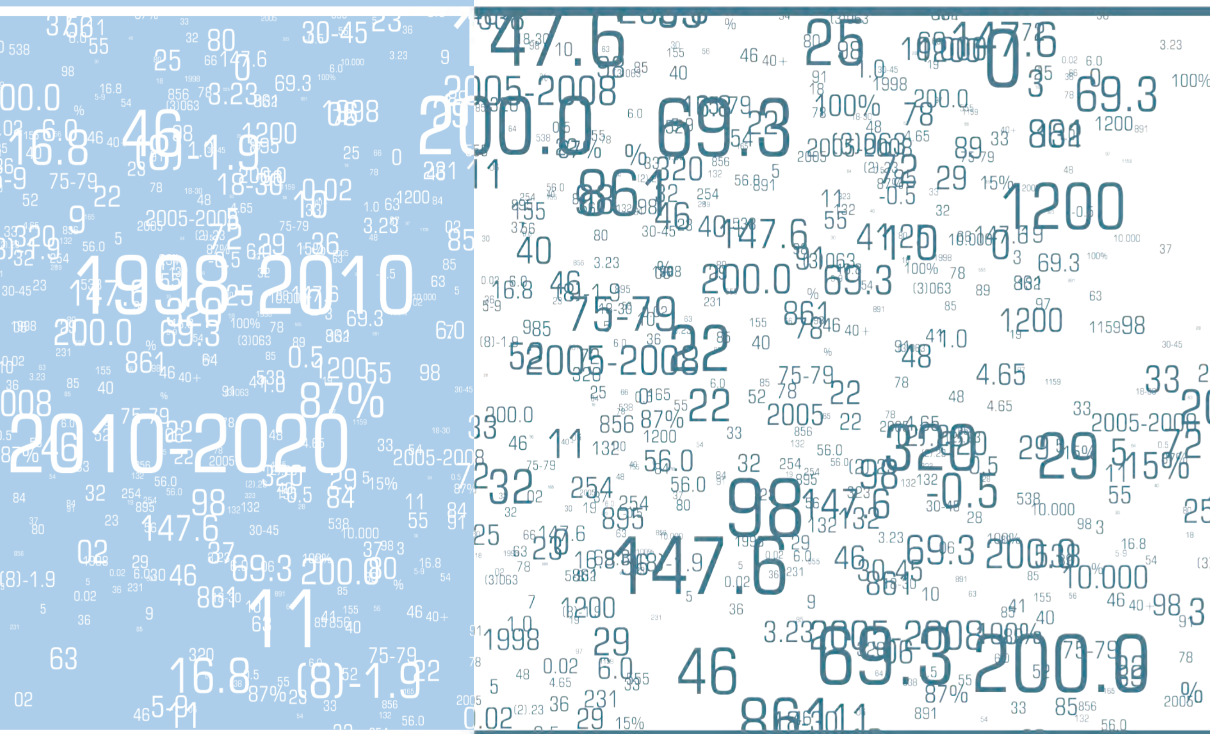
World Health Organization
REGIONAL OFFICE FOR Europe

Republic of Moldova
Health Policy Paper Series No. 15

A RETROSPECTIVE AND PROSPECTIVE ASSESSMENT OF MORTALITY IN THE REPUBLIC OF MOLDOVA



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Abstract

The main purpose of this study was to assess the national mortality data of the Republic of Moldova using standard approaches. The expected outcome was the generation of nationally and internationally comparable mortality indicators and a model for performance monitoring that could be used to inform policy development.

The assessment was conducted using data drawn from the official population and mortality statistics of the Republic of Moldova, including annual cause-of-death data coded according to the *International statistical classification of disease, tenth revision (ICD-10)*. The WHO Analysis of Cause-of-Death (ANACoD) tool facilitated a systematic assessment of the quality of data for the period 1998–2010. These data were then used to ascertain levels and trends of mortality over the same period, and to rank causes of death by absolute number and by years of life lost (YLL). The data were also the basis for projecting various scenarios to simulate the range of potential paths toward the targeted reduction in NCD deaths between 2010 and 2020.

The results of the study highlight several sound approaches to monitoring mortality: (1) to assess trends over time, it is necessary to standardize mortality measures in order to account for population shifts; (2) to assess mortality burden, it is important to rank causes of death by YLL in addition to absolute numbers of deaths; and (3) to set and monitor future targets, projected scenarios must include plausible assumptions about expected changes in mortality and in the population.

Keywords

BURDEN OF DISEASE
CAUSE OF DEATH
EPIDEMIOLOGY AND STATISTICS
LIFE EXPECTANCY
MORTALITY – TRENDS
REPUBLIC OF MOLDOVA
YEARS OF LIFE LOST

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Acknowledgments

This assessment of Moldovan mortality undertaken by WHO in August–November 2012 builds on the WHO cross-country assessment of mortality statistics in the Republic of Moldova and its neighbouring countries carried out in June–July 2012. It is the result of several months of collaboration between two national specialists: Anastasia Tomsa, Head, Division of Demographic Processes, National Center for Health Management, Chisinau, Republic of Moldova, who provided an interpretation of the annual mortality and population statistics, and Marcela Tirdea, Head, Division for Analysis, Monitoring and Evaluation Policies, Ministry of Health, Chisinau, Republic of Moldova, who defined the research questions for the assessment from the perspective of the policy priorities of the Ministry of Health of the Republic of Moldova; and three international analysts: Fern Greenwell, Independent Researcher in Demographic and Health Statistics, Tucson, Arizona, USA, who drafted the report; Connie Chung, Epidemiologist, School of Public Health, University of Arizona, USA, who undertook the major part of processing the data; and Enrique Loyola, Statistician/Epidemiologist, Division of Information, Evidence, Research and Innovation, WHO Regional Office for Europe, who framed the applicability of the analysis within the regional context.

The authors owe thanks to many people who made suggestions and gave feedback during the preparation of the report and wish, in particular, to express their appreciation to: Jarno Habicht, WHO Representative and Head of WHO Country Office in the Republic of Moldova, for advising on the content of the report with a view to rendering it relevant for use in monitoring national performance and further health-policy dialogue; Oleg Barba, Deputy Director, National Centre for Health Management, Chisinau, Republic of Moldova, for providing the data; Doris Ma Fat, Statistician in Mortality and Burden of Disease Unit, WHO headquarters, for assisting the team in using the new WHO Analysis of Cause-of-Death (ANACoD) tool; Taavi Lai, Senior Analyst, Department of Health Information and Analysis, Ministry of Social Affairs of Estonia, Tallinn, for his direction in the application of analytical methods; and the staff of the Moldovan Center for Health Management, Chisinau, Republic of Moldova, for sharing their expertise.

The report was produced through Biennial Collaborative Agreements between the Ministry of Health of the Republic of Moldova and WHO for the period 2010–2013. Financial assistance was provided by the European Union (EU) within the technical assistance programme coordinated by WHO, the objectives of which include strengthening the stewardship of health-sector investments, better monitoring of performance, and ensuring greater use of evidence in policy decisions. The views expressed in this report can in no way be taken to reflect the official opinion of the EU.

The support afforded by the Government of the Republic of Moldova and the WHO Country Office in connection with the production of the report is greatly appreciated.

Executive summary

The main purpose of this study, undertaken in August–November 2012, was to assess the national mortality data using standard methodologies and WHO tools and the combined knowledge and expertise of the study team, which comprised two national mortality specialists and three international analysts. The expected outcome was not only the generation of nationally and internationally comparable mortality indicators but also a model of further analysis that could be applied regularly in the future to inform performance monitoring and policy development. The analysis builds on the WHO cross-country assessment of mortality statistics in the Republic of Moldova and its neighbouring countries, Belarus, Romania and Ukraine, which took place in June–July 2012.

The reference period for the study is 1998-2010. The data, including cause-of-death data coded according to the *International statistical classification of disease, tenth revision (ICD-10) (1)*, were drawn entirely from the official population and mortality statistics of the Republic of Moldova. They are publicly available on the WHO Mortality Database website *(2)* from which they can be downloaded.

The report is organized in three chapters: (1) mortality trends; (2) causes of death and YLL; and (3) monitoring targeted reductions of NCD death rates.

Mortality trends

As a first step, an assessment of the quality of annual population and mortality statistics was conducted using the WHO Analysis of Cause-of-Death (ANACoD) tool[1] , which is a suite of electronic spreadsheets that automatically generates basic mortality measures, including completeness of reporting and plausibility of ICD-10 coding.

Given that the Transnistria region – known officially as the Autonomous territorial unit with special status Transnistria (hereafter Transnistria) and comprising the territory to the east of the River Dniester, the city of Bender and its surrounding localities located on the west bank of the river – has not been included in national mortality statistics since 1997, only 85% of deaths in the the Republic of Moldova have been represented in the annual statistics since that year. This study estimated reporting for the area to be 93% complete in 2010. Throughout the period of the study, the percentage of ill-defined death codes did not exceed 10% of all causes; the trend even decreased to about 3% or less over the last ten years of the period. A favourable data-quality review reflects effective practices of death certification and vital statistics' reporting. The data were deemed to be sufficiently accurate and complete for measuring levels of and trends in mortality. Therefore, no adjustments were made in connection with this study.

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1 The WHO Analysis of Cause-of-Death (ANACoD) tool was developed in 2011 by WHO in collaboration with the Queensland Health Information Systems Knowledge Hub and Health Metrics Network. This tool is available at http://www.who.int/healthinfo/topics_standards_tools_data_collection/en/index.html (accessed 4 April 2013)

Chapter I of the report presents standard measures of mortality over time, including age-specific death rates (ASDR), crude death rates (CDR), and standardized death rates (SDR). Differences in direction between the CDR and SDR trends highlighted the fact that the population of the Republic of Moldova is ageing, which confounds comparability of CDR. Thus, to interpret trends accurately, it was necessary to standardize the measure by applying standard population weights.

- Unlike CDR, SDR revealed that between 1998 and 2010 mortality had actually decreased from 13.9 per 1000 to 12.7 per 1000 (both sexes).
- Sex-specific SDR revealed a large gap between male and female mortality in 2010, viz. 16.6 and 5.1 per 1000, respectively.

A changing age structure, affecting especially adult mortality, means that infant and adult mortality, when calculated as rates, i.e., number of deaths per population by age group, are not strictly comparable over time either. Therefore, the probabilities of death under age one and between the ages of 15 and 59 years were used to compare the mortality trends of these age groups. Overall, the probability of infant death had begun to decrease at the start of the study period in 1998 but appeared to have stagnated at around 12 deaths per 1000 live births between 2005 and 2010. The probability of adult death remained largely flat over the study period with a slight increase for males and slight decrease for females. The significance of these minor changes is difficult to interpret because death in this age group is a rare event.

Life-expectancy measures derived from life tables are comparable over time. Life expectancy at birth for both sexes increased by about 1½ years over the study period, from 67.7 years in 1998–2000 to 69.3 years in 2009–2010. The increase for females was roughly twice that for males, i.e. just over 2 years and just over 1 year, respectively. Life expectancy at age 60 increased for both sexes by about one year, from 15.9 years in 1998–2000 to 16.8 years in 2009–2010. Again, the increase for females was about twice that for men.

Causes of death and YLL

The WHO global burden of disease (GBD) *(3)*, which categorizes about 150 major diseases and injuries, was used as a basis for summarizing the mortality results in this chapter. Causes of death were first assessed in three major groups: (1) communicable, maternal, perinatal and nutritional conditions; (2) noncommunicable diseases (NCD); and (3) injuries. In the Republic of Moldova, there was no shift in the distribution of deaths over the whole study period: 4% in group 1; 87% in group 2; and 9% in group 3.

The ratio between deaths due to NCD and those due to communicable diseases (19–20:1) also remained steady over the study period. This ratio was almost twice as high as the average for high-income countries but consistent with the relatively high averages in neighbouring countries. This pattern raises the question as to whether there might be a relatively higher propensity in the population towards exposure to risk factors for chronic diseases and/or a lack of preventive or treatment measures aimed at reducing chronic diseases.

The years-of-life-lost (YLL) measure sums YLL due to premature death (defined as death under 65 years of age). Ranking main causes of death according to YLL rather than absolute numbers of deaths changes the profile of the mortality burden. For example, in the Republic of Moldova, while the absolute numbers of deaths were highly concentrated among a few top causes, mostly in group 2, YLL were more evenly distributed, and the causes in groups 1 and 3 were more prominent. In 2009–2010, the top 10 causes of death in absolute numbers accounted for about 75% of all deaths, while the top 10 causes measured in YLL accounted for only about 50% of all YLL.

Ischaemic heart disease and cirrhosis of the liver remained in the top 2 YLL positions over the whole study period. In 2009–2010, they each accounted for about 10% of YLL. The second set of important causes of premature death included five conditions, each accounting for 4–6% of YLL. Two of these (lower respiratory infections and tuberculosis) were in group 1, one (cerebrovascular diseases) was in group 2 and two (other unintentional injuries and self-inflicted injuries) were in group 3.

An additional benefit of analysing YLL is that YLL is one of the two basic components for calculating disability-adjusted life years (DALY), the main measure used in the GBD study (3). The other basic component of DALY is the morbidity measure, healthy years lost due to disability (YLD), which draws on different data sources and assumptions. The additional work required to estimate this measure would warrant a separate study.

As is the case for comparability of CDR (Chapter 1), population shifts, mainly due to ageing, also confound the comparison of crude rates of YLL. It was, therefore, necessary to standardize YLL in order to observe that the average number of YLL per 10 000 persons had decreased over the study period. The impact of age-discounting on YLL per death was examined at an annualized 1.5% and 3%. However, it was concluded that meaningful evidence could be conveyed to decision-makers without the added complexity of computation and interpretation of age-discounting. Age-discounting was, therefore, not used further in the analysis.

In total, the average numbers of YLL due to premature deaths were eight for males and four for females. Each main cause of death, when assessed separately, accounted for less than one YLL per death. The numbers of YLL by age group for each main cause were ascertained separately for males and females. For males, there was a bimodal curve peaking at ages 20–24 and 45–59. This pattern, unique to males, is also observed in other countries and is attributable to the relatively high numbers of injuries and accidents among young adult men.

The causes of death that have the largest impact on YLL also have the largest impact on life expectancy. For males in the Republic of Moldova, eliminating all premature deaths resulted in potential gains of 10.2 years at birth and 2.4 years at age 60. The elimination of only seven of the main causes accounted for about half of the total potential years gained. For females, eliminating all premature deaths resulted in potential gains of 5.8 years at birth and 1.9 years at age 60. The elimination of only six of the main causes accounted for about half the total potential years gained.

Monitoring targeted reductions of NCD death rates

NCD-related causes accounted for a constant 87% of all deaths across all four periods of the study. One of the targets of the Ministry of Health of the Republic of Moldova is to reduce premature death from NCD by 17% in 2010–2020. In monitoring progress towards this goal, it is necessary to make assumptions about shifts in population size and age structure. If growth rates continue at the same pace as was the case in 2005–2010, and if 2010 mortality rates remain constant, then the number of deaths will increase over the target period; but, assuming a 17% reduction in NCD death rates over the 10-year period, and premature deaths defined as those in people under 65 years of age, the following improvements could be expected:

- decreases in the numbers of premature NCD deaths from about 8200 to 7000 for males and from 4900 to 4100 for females;
- decreases in the percentages of premature NCD deaths among all NCD deaths from 34% to 28% for males and from 22% to 19% for females;
- decreases in standardized YLL due to premature deaths from 590 to 440 years per 10 000 for males and from 290 to 210 years per 10 000 for females.

With a 17% reduction in premature NCD death rates, life expectancy at birth would increase by exactly one year for males – from 64.8 years in 2010 to 65.8 years in 2020 – and by less than one year for females owing to the occurrence of fewer premature deaths in those below 65 years of age. For life expectancy at age 60, males and females would gain less than half a year: life expectancy at this age in 2020 would be just under 15 years for males and about 18.5 years for females.

In conclusion, the Republic of Moldova has invested efforts over many years collecting, analysing and disseminating health and population data. These efforts have proved successful in terms of the consistency and completeness of the data and the availability of information thereon to outside users. In this study, the team applied international methods to assess mortality data, make rigorous comparisons of trends over time, and monitor progress towards declared targets. This model can be used by other countries and thus facilitate regional and international comparisons.

Introduction

A healthy population is a prerequisite for a country's economic and social development. The Government of the Republic of Moldova acknowledges the importance of this fact by monitoring population health and continually striving to strengthen the health system and provide opportunities for people to lead long and healthy lives. These intentions are spelt out in the national *Healthcare system development strategy for the period 2008–2017 (4)*. The WHO Regional Office for Europe, in the *Health 2020 policy framework and strategy*, endorses the use of evidence-based strategies to promote and protect health and the application of specific, measurable, achievable, relevant and time-bound (SMART) targets for measuring progress *(5)*. Among the priority actions of WHO are to provide support to ministries of health in generating quality data with the aim of producing reliable indicators, and in strengthening national capacities for monitoring health-system development in the countries *(6)*.

Using currently available data, this comprehensive study expounded on standard approaches to monitoring levels of and trends in mortality and causes of death. The results enhance the evidence already available in the periodic operational reports produced by the National Center for Health Management of the Moldovan Ministry of Health. As these results show, the quality of the mortality data collected in the Republic of Moldova is good; however, their potential use for monitoring trends and progress towards goals has not been fully utilized. The purpose of the study was to combine the knowledge and expertise of international analysts and national specialists in conducting a systematic assessment of Moldovan mortality data and establishing a further-analysis model that could be applied regularly to inform performance monitoring and policy development in the future.

The report is organized in three chapters. The first chapter is an analysis of mortality trends covering four periods over 13 years (1998–2010), the results of which are meaningful for policy-making and target-setting. It was initiated by a systematic review of the quality of the data to establish their reliability for use in accurately measuring levels and trends. Standard methodological approaches were used to summarize mortality measures that are comparable, not only at the national level but also regionally and internationally. The methodologies described provide details on standardized versus crude death rates, probabilities of infant and adult deaths, and comparison of relative improvements in life expectancy at birth versus at 60 years. These measures can be updated on a regular basis for use in monitoring progress towards national health-system-performance goals and in benchmarking exercises with neighbouring countries.

The second chapter of the report examines causes of death over the most recent period of the study (2009–2010), and ranks the main causes by absolute numbers and then by YLL. It also details the rationale and methodology used for computing YLL to quantify premature death, including the use of YLL standardized rates versus YLL crude rates and age-discounting for YLL. For specific major causes of death, both the number of YLL per person and the age distribution for YLL are presented. The impact of specific causes of death on life expectancy was quantified by eliminating premature deaths from each cause separately.

An additional benefit of analysing YLL is that this measure (the mortality measure) is one of the two basic components for calculating disability-adjusted life years (DALY), the main measure used in the GBD study *(3)*. The other basic component of DALY is the morbidity measure, YLD, which draws on different data sources and assumptions. While the scope of this study includes only the mortality component (YLL) of DALY, the work could be expanded in future to add the morbidity component (YLD). Measuring YLD often requires the collection of additional data, for example, through national household surveys, and careful consideration of assumptions about the incidence and average duration of specific diseases. WHO tools and resources exist to facilitate the generation of YLD and the final DALY measure.[2]

The third chapter of the report relates to the efforts of the Republic of Moldova to control NCD, which are in line with Objective 5 of the *2008–2013 action plan for the global strategy for the prevention and control of noncommunicable diseases*, i.e., to monitor NCD and their determinants and evaluate progress at the national, regional and global levels *(7)*. Specifically, this part presents a step-by-step simulation for monitoring progress towards the Ministry of Health's target to reduce premature deaths from NCD by 17% between 2010 and 2020 *(8)*. The methodology for each step is elaborated on, including population projections and estimations of numbers of premature deaths and impact on life expectancy.

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2 Information on national tools available: http://www.who.int/healthinfo/global_burden_disease/tools_national/en/index.html, accessed 27 January 2013.

Chapter I. Mortality trends

Based on a subjective interpretation of annual trends, four consecutive study periods of 2–4 years each were defined for assessing mortality levels and trends over the 13-year period, 1998–2010, as follows:

1. 1998–2000: a 3-year period marked by the stagnation of mortality indicators;
2. 2001–2004: a 4-year period during which mortality indicators began to improve;
3. 2005–2008: a 4-year period in which there was a steady improvement in mortality indicators (measured in life expectancy and other indicators); and
4. 2009–2010: a 2-year period during which the rate of improvement in mortality indicators appears to have been hampered.

This approach served to smooth year-to-year fluctuations in the annual figures, thereby simplifying the presentation and interpretation of trends.

1.1 Data and methods

WHO requests Member States to submit annual population and mortality statistics, including information on underlying causes of death coded according to the *International statistical classification of diseases and related health problems, tenth revision (ICD–10) (1)*. These data are freely available in the WHO Mortality Database (MDB) *(2)* and, for countries in the WHO European Region, also in the European Detailed Mortality Database (DMDB) *(9)*. Data for the Republic of Moldova are available for the period 1981–2010, including ICD-10 causes of death for which ICD-10 3-character detailed coding was used from 1996 to 2006 and ICD-10 4-character detailed coding from 2007 to the present.

An initial assessment of the annual population and mortality statistics for 1998–2011 was conducted using the ANACoD tool, which automatically generates basic mortality measures. The input data for ANACoD consist of population totals by age and sex, numbers of deaths by age and sex, and underlying causes of death in ICD-10 3-character coding or ICD-10 4-character coding. ANACoD output provides several indicators that reveal potential data-quality issues, as well as standard indicators, including sex- and age-specific mortality rates, CDR, life expectancy at birth, causes of death distributed by three GBD categories, estimated coverage of deaths, the top 20 causes of death, and the percentage of ill-defined causes of death.

The ANACoD tool also compares the age and sex distributions of reported deaths with the expected age and sex distributions of estimated deaths by World Bank income-group averages. Departures from expected patterns can be indicative of underreporting of deaths at certain ages for males or females. The tool also compares reported distributions of leading causes of death with those of the World Bank income groups. Since the comparison estimates are representative of the average experience of all countries in each income group, it is unlikely that they will be matched exactly by any reported national distribution. However, they help to identify divergencies that may need to be explained or adjusted for in further analyses.

1.2 Data-quality review

A systematic review of the quality of the Moldovan annual population and mortality data served to determine the reliability of these data and establish their value in accurately measuring levels and trends in mortality. Such a review also helps to identify issues and anomalies that may need to be addressed. Although the results of trend analyses are presented mainly by aggregating annual data into the four study periods, it was important to perform basic data quality checks of the annual data before aggregation in order to be able more easily to detect inconsistencies that may otherwise have been hidden in the aggregation.

1.2.1 Population data

Accurate population figures are necessary to produce reliable mortality indicators because they constitute "risk of exposure to death" in the denominators of rates and proportions. Once the population data are entered into ANACoD by sex and age groups, the tool automatically generates a population pyramid, making it possible to ascertain at a glance whether the population distribution is as expected. The population pyramid for the Republic of Moldova in 2010 (Fig. 1), for example, shows an age and sex structure consistent with that of previous years, and demographic characteristics similar to those of other European countries, namely, a population consisting of more women than men at older ages (70+ years), a post-war baby-boom generation (50–65 years) and its "echo" generation (20–35 years), and the youngest generation (under 15 years) as a smaller cohort resulting from decreasing fertility levels.

Because population size and structure do not change radically in a short period, barring a *force majeure* or a significant change in the reporting of births, deaths or migration, the changes from year to year should be smooth. This was the case in the Republic of Moldova where the annual population figures for males and females for 1998–2010 showed a smooth decline over time with variations of not more than between -0.1% and -0.4% from one year to the next for each sex (Fig. 2). Furthermore, the annual data provided by the Ministry of Health to WHO were almost exactly the same as the official population data available on the website of the National Bureau of Statistics of the Republic of Moldova (NBS)[3] – a comparison that instills confidence in the figures.

[3] Information available: http://statbank.statistica.md/, accessed 7 December 2012.

Fig. 1. Population pyramid, Republic of Moldova, 2010

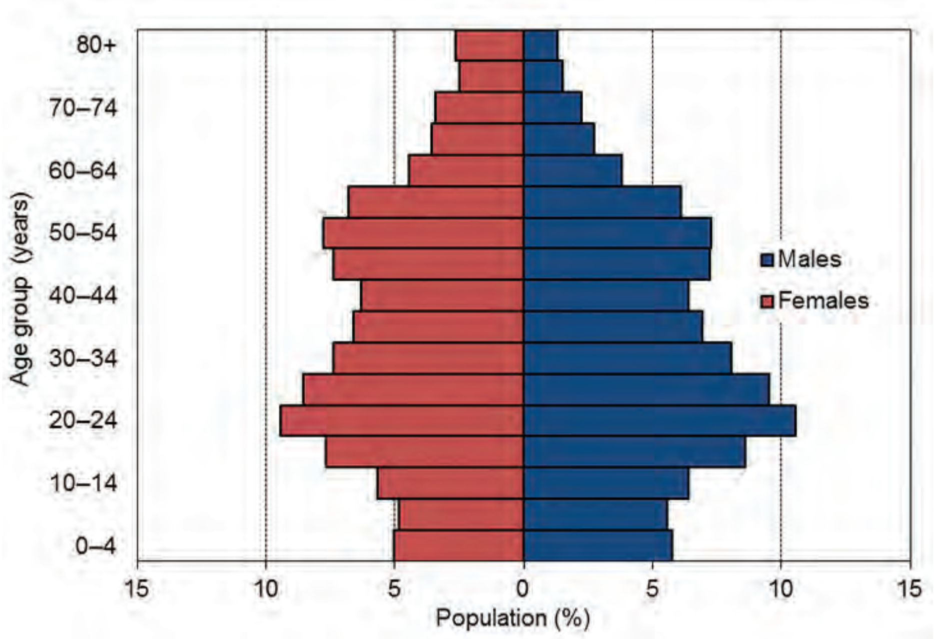
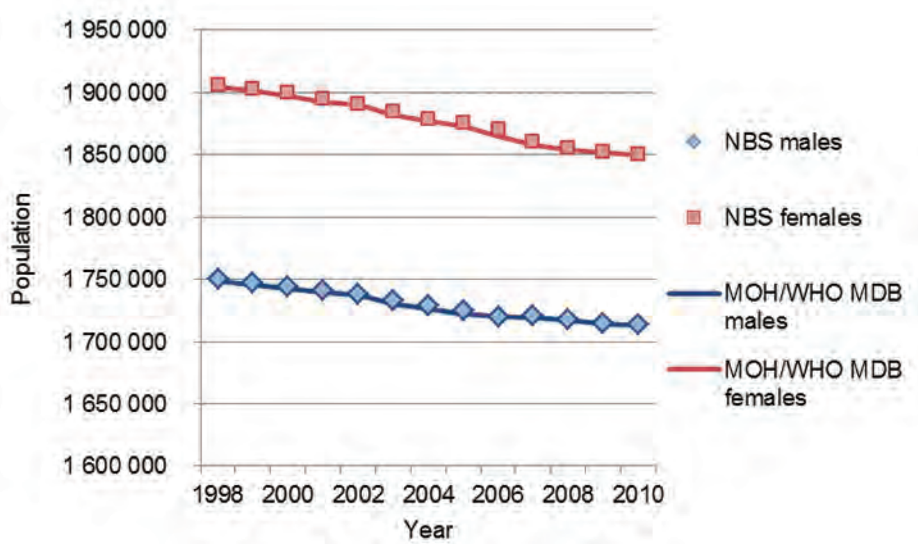


Fig. 2. Annual population, Republic of Moldova, official sources, 1998–2010



Notes: NBS = National Bureau of Statistics of the Republic of Moldova; MOH/WHO MDB = Ministry of Health/WHO Mortality Database.

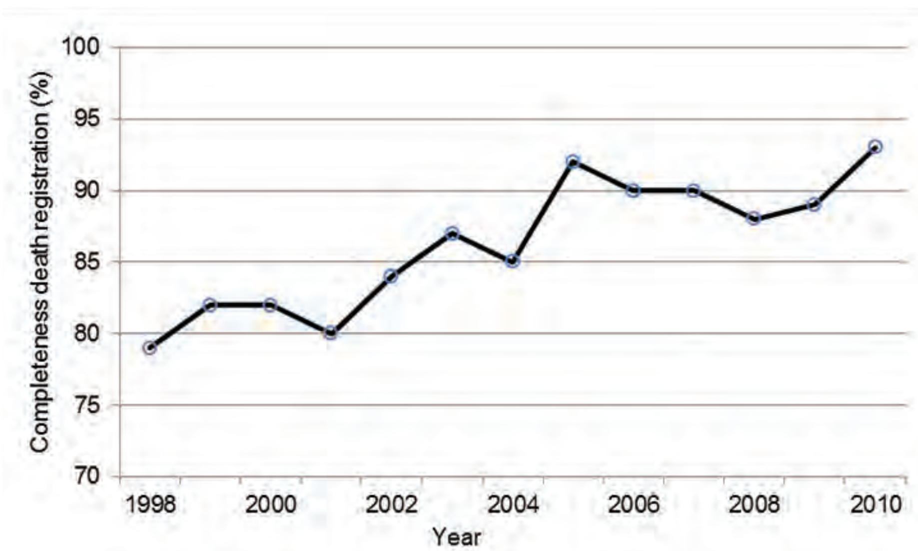
1.2.2 Death-registration data

High-quality mortality statistics are defined as those with ICD-9 or ICD-10 detailed coding, ≥90% completeness of death registration and <10% deaths coded as ill-defined symptoms and signs. The quality of the Moldovan mortality data has been considered high since 1981, reflecting the effective death certification and reporting practices of the civil registration and vital statistics system in the country *(10,11,12)*.

1.2.2.1 Completeness

The ANACoD tool provides an annual estimate (%) of the completeness of death registration by dividing the reported number of deaths in the country by the number estimated by the United Nations Population Division (UNPD) (Fig. 3) *(13)*. From these estimates, death registration in the Republic of Moldova in the 13-year period under review ranges from 79% in 1998 to 93% in 2010. Normally, in order to derive the most accurate levels of mortality, an adjustment factor would be applied to correct for incompleteness and this would be clearly documented in the results. Such an adjustment was considered for the Moldovan data but further evidence (described below) revealing a unique reporting situation suggested this to be unnecessary.

Fig. 3. Estimated completeness of death registration, 1998–2010



Note: Completeness of civil registration data is estimated by dividing the reported deaths by the UNPD estimates *(13)*.

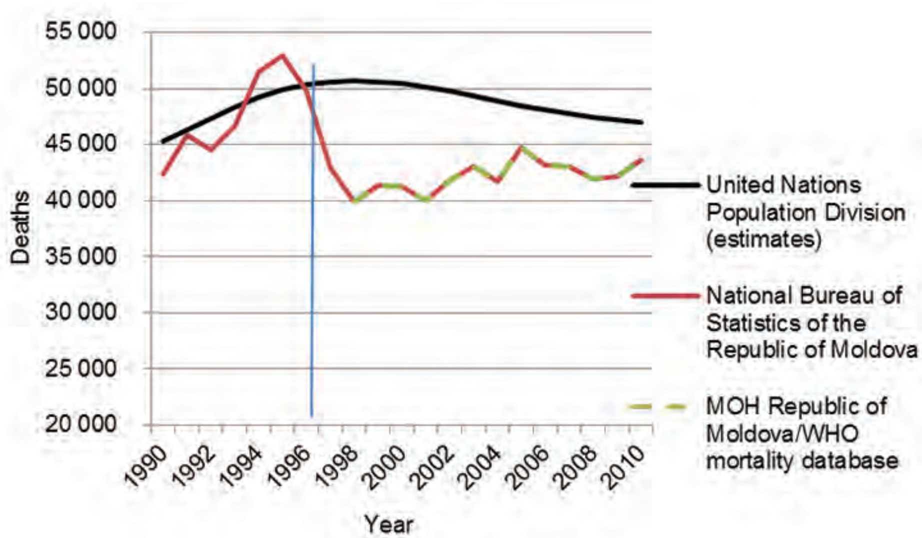
UNPD provides regular, updated estimates of demographic indicators for all countries. Since the independence of the Republic of Moldova in 1991, and until the late 1990s, UNPD estimates of population size and numbers of deaths were about the same as the national estimates (Figs 4 and 5). However, the UNPD estimates do not reflect the situation existing after the late 1990s. In 1997, an abrupt decision was made whereby

Transnistria ceased to report mortality data to the Moldovan authorities.[4] The same situation occurred the following year with respect to population data.

As shown by the vertical lines in Figs 4 and 5, the official NBS statistics reflect this abrupt reporting change but the UNPD estimates do not take it into account. The latter's estimates show a smooth decreasing trend in population size and number of deaths until near convergence with the Moldovan data in 2010. The result is that the UNPD estimates from 1998 until 2010 represent neither the situation in the country including Transnistria, nor the situation excluding Transnistria. They are misleading because they depict much sharper rates of population decline and mortality than was the case. By 2010, the UNPD and country estimates converge to more accurately reflect the situation in the Republic of Moldova, excluding Transnistria.

Given that data for Transnistria have not been included in the annual population and mortality figures since 1998 and 1997, respectively, those reported to WHO represent 85% of the Republic of Moldova (i.e. excluding the territory of Transnistria). According to UNPD estimates of numbers of deaths for the covered population, the level of completeness of the mortality data reported in 2010 was assessed at 93%. This level was considered sufficiently high (and the Moldovan specialists are confident that it is even higher) so no adjustments for incompleteness were made for this study.

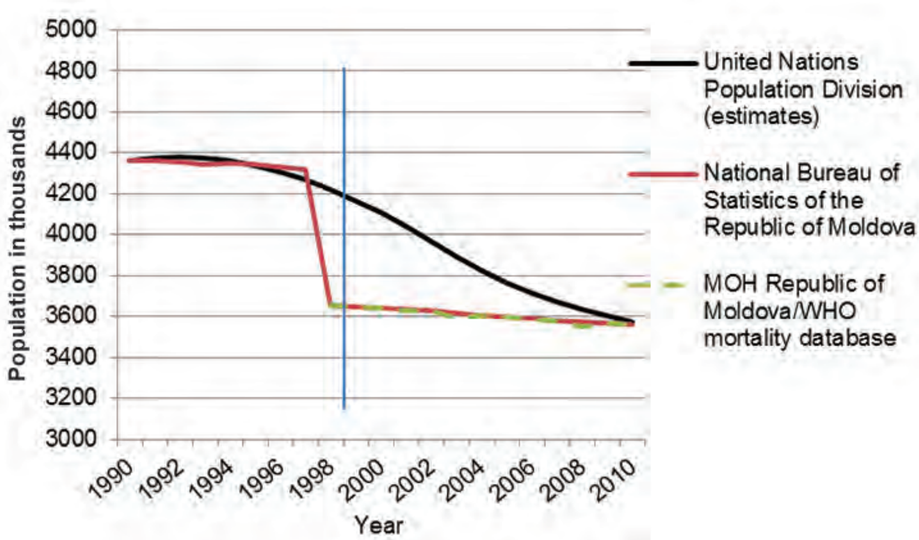
Fig. 4. Annual population, different sources, 1990–2010



Notes: Since 1998, official population data exclude Transnistria.
MOH = Ministry of Health
Sources: World Population Prospects, the 2010 Revision (13), WHO Mortality Database *(2)* and National Bureau of Statistics of the Republic of Moldova *(14)*.

[4] According to a census carried out by the Transnistrian authorities in 2004, the population in the area was about 555 000.

Fig. 5. Annual number of deaths, different sources, 1990–2010



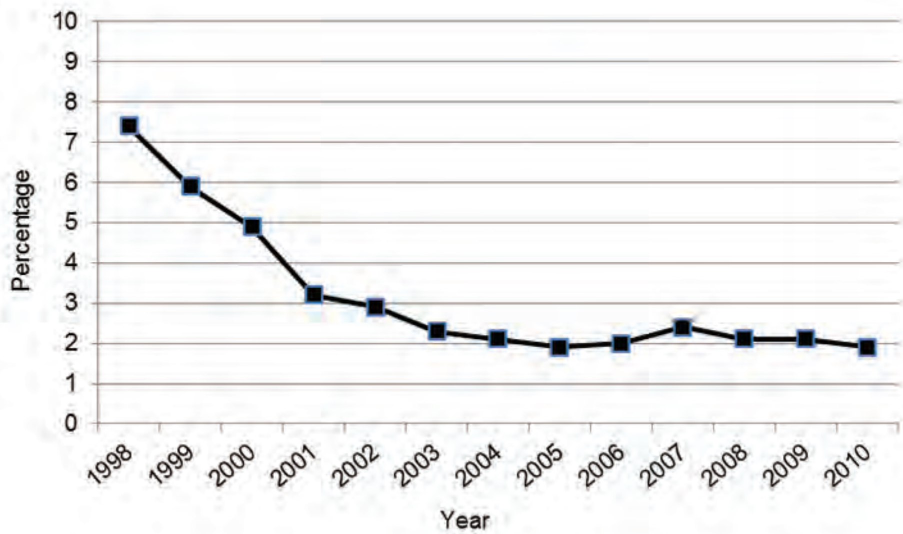
Notes: Since 1997, official mortality data exclude Transnistria.
MOH = Ministry of Health.
Sources: World Population Prospects, the 2010 Revision (13), WHO Mortality Database *(2)* and National Bureau of Statistics of the Republic of Moldova *(14)*.

1.2.2.2 Ill-defined causes of death

In order for cause-of-death information to be useful for planning and decision-making purposes, causes must be accurately diagnosed and correctly coded. Although it is not possible to avoid ill-defined codes altogether, coding should be monitored and, if they become too frequent, then measures should be taken to improve coding practices. There are two types of ill-defined causes of death: (1) symptoms, signs and abnormal clinical findings not defined elsewhere (ICD-10, Chapter XVIII); and (2) vague or unspecific diagnoses that may be found throughout most of the other ICD-10 chapters *(1)*. Overall, in the 13 years comprising the period of this study, ill-defined causes did not exceed 10% of the cause-of-death codes for the Republic of Moldova, and the trend decreased to about 3% or less over the last ten years of the period (Fig. 6).

Further examination of ill-defined causes of death by sex and age group helped to determine for which groups of causes it was difficult to accurately assign a detailed cause-of-death code. As a rule of thumb, acceptable proportions of ill-defined causes of death should not exceed 5% in the under-65-years age groups and 10% in the 65-years and older age groups *(15)*. In the Republic of Moldova, the overall percentage of ill-defined causes of death has been below 5% since 2000. However, there are a couple of age-specific exceptions: (1) in 1998–2000, about one-fifth of the causes of male and female deaths were ill-defined for the oldest of the old, i.e. 80 years and older (the coding accuracy has since been improved); (2) the proportion of ill-defined causes of death among young adult males and females aged 15–30 reached about 10%, including those in the most recent time period (2009–2010) (Figs 7 and 8).

Fig. 6. Percentage of ill-defined causes of death, 1998–2010



The study revealed that the types of ill-defined causes of death reported over the whole 13-year period fell under four main categories. The majority were classified under "symptoms, signs and abnormal clinical findings not elsewhere defined" (ICD-10, Chapter XVIII) and "external causes of mortality" (ICD-10, Chapter XX). The remainder fell under "diseases of the circulatory system" (ICD-10, Chapter IX) and, to a lesser extent, "neoplasms" (ICD-10, Chapter II). *(1)*

Fig. 7. Percentage of ill-defined causes of death in males, by age group and four study periods, 1998–2010

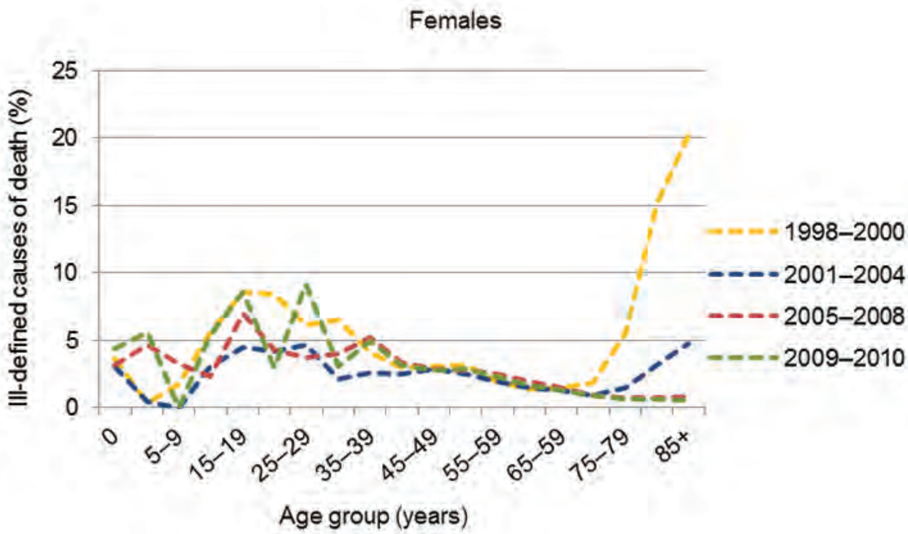
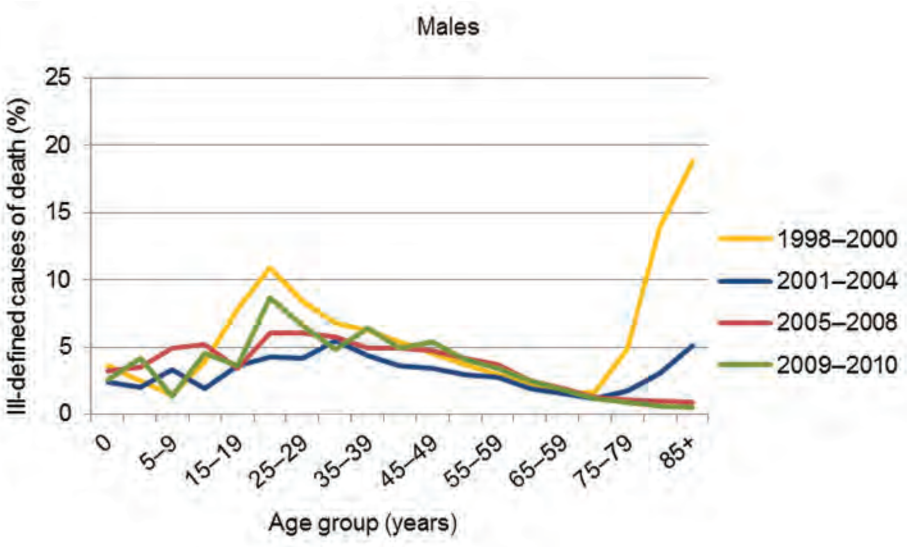


Fig. 8. Percentage of ill-defined causes of death in females, by age group and four study periods, 1998–2010



1.2.2.3 Invalid codes

An obstacle currently faced in most of the countries of the former USSR is the use of invalid codes resulting from referencing outdated versions of ICD-10, such as in the Republic of Moldova where the version used is from 1995. Revisions are regularly made to the English version of ICD-10 and countries may not always have the resources for frequent and timely translations, resulting – with each revision made – in an accumulation of outdated codes in the reported data. Because WHO systematically updates these invalid codes to the most recent ones before making the annual cause-of-death data available in the Mortality Database, the Moldovan data used for the duration of the13-year study (1998–2010) had no invalid codes. However, with respect to the Moldovan data for 2011 (not yet updated by WHO at the time of the study), 10% of the codes used were outdated and, thus, considered invalid in ANACoD. Therefore, in order to avoid introducing a bias, the data from 2011 have not been included in this study.

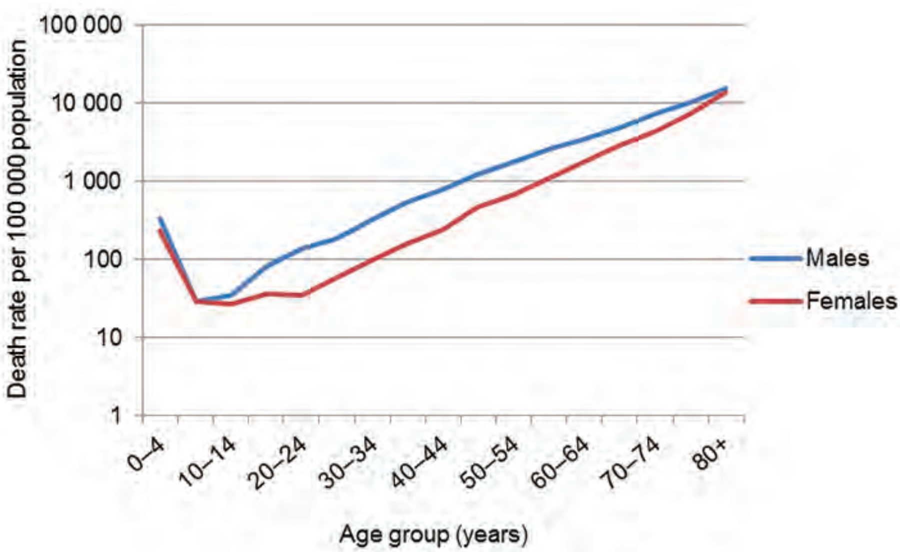
1.3 Mortality levels and trends

The favourable data-quality review described above indicates that the unadjusted mortality data should be precise enough to show accurate mortality trends. Using these data, this section presents the standard mortality measures and an interpretation of these.

1.3.1 General mortality rates

Variations by age in risk of dying can be assessed using ASDR, defined as number of deaths at an exact age, or in an exact age group, divided by population of that age or in that age group. Plotting the natural logarithm of ASDR on a log scale shows the relative variation of mortality rates across age groups and between subpopulations. The 2010 ASDR for males and females in the Republic of Moldova show a typical mortality pattern for countries in the region with higher male than female mortality except in the very youngest and oldest age groups. In Fig. 9, the steep upward slope between ages 0 and 4 years for both males and females shows the most rapid change of all age groups; the horizontal lines, roughly ages 5–10 years for males and 5–25 years for females, show no significant change in mortality; the straight, increasing lines throughout adulthood show a constant change in rates over time indicating an exponential rise in mortality with age, starting in young adulthood; the parallel lines show similar rates of change for males and females, with a divergence for young men (15+ years), indicating a higher rate of mortality than for young women.

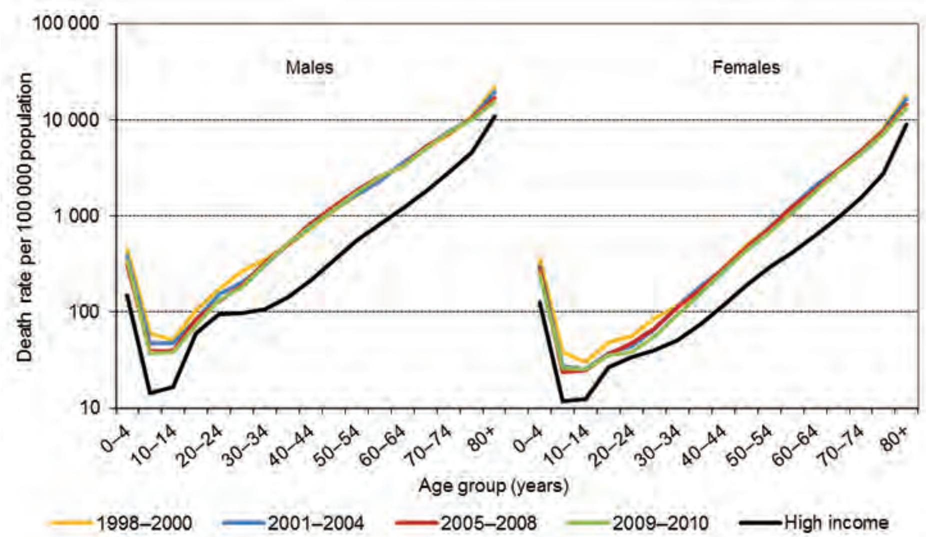
Fig. 9. Log of age-specific death rates, per 100 000 population, by age group, 2010



Patterns of age-specific death rates remained largely constant for both sexes across the four study periods with the exception of a small decrease in early adult mortality after the 1998–2000 period, especially among females (Fig. 10). Compared to mortality rates in high-income countries, the Moldovan mortality rates are higher at every age, particularly in adults after around 25 years of age. Unlike the pattern in high-income countries, there is not such a pronounced bulge for adult deaths from about age 15–35 years, which typically signifies an excess in injury-related deaths in this age group.

ASDR log scales sometimes reveal age heaping in the oldest age group by a slight bend in the right tip of curve. There was only a hint of heaping at 80+ years among Moldovan males in the earlier study periods.

Fig. 10. Log of age-specific death rates per 100 000 population, by age group and four study periods, 1998–2010



1.3.2 CDR and SDR

CDR is the most common, simplest measure of mortality. It is the total number of deaths divided by the total population, typically using the mid-year population figures in a calendar year as the number of persons at risk of death. The main disadvantage of CDR is that it does not account for changing or different population age structures and, therefore, cannot be used reliably to compare mortality levels over time or between population groups.

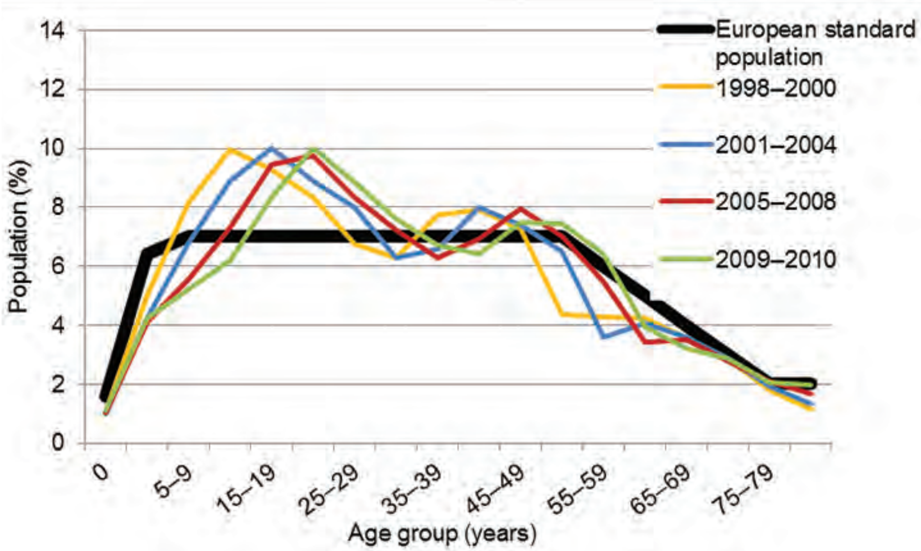
An appropriate single-figure indicator for comparison over time or between populations is SDR, which is a direct standardization comparing two or more sets of ASDR by examining their impact on the same age structure. SDR is obtained by dividing the total expected number of deaths in a standard population age structure by the total population. It can be understood as a weighted average of ASDR using the standard population as a weight.

The European standard population is a theoretical population commonly used to standardize rates for international comparison (e.g. European Health for All Database[5],

[5] Information available: http://www.euro.who.int/en/what-we-do/data-and-evidence/databases/european-health-for-all-database-hfa-db2 (accessed 27 January 2013).

Institut national d'études démographiques[6], West Midlands Public Health Observatory[7], Ahmad et al. (2001) *(16)*). It is based on experience with Scandinavian populations in the past two decades, which reflects a relatively lower proportion of adults aged 15–40 years and a relatively higher proportion aged 55–70 years than in the Republic of Moldova (Fig. 11). Taking into account the ageing trend of the Moldovan population over the four consecutive study periods, and the fact that this would confound the comparability of CDR, it was necessary to standardize the measures before making a direct comparison.

Fig. 11. Distribution of European standard and Republic of Moldova populations, by age group and four study periods, 1998–2010



Comparing the trends in CDR and SDR led to opposite conclusions. CDR trends show an increase in mortality from 10.9 per 1000 in 1998 to 12.2 per 1000 in 2010 (Fig. 12). However, after weighting age-specific mortality rates using the European standard population, SDR show that from 1998 to 2010 mortality actually decreased for both sexes from 13.9 per 1000 to 12.7 per 1000. The increasing CDR was, therefore, the result of an increase in death rates due to an ageing population. Thus, when monitoring mortality levels and the impact of policies and interventions, it is important to control for the dynamics of population size and structure by using a standard population.

SDR also allow a direct comparison of male and female mortality rates. Sex-specific SDR in the Republic of Moldova in 2010 revealed a large gap between male and female mortality: 16.6 and 5.1 per 1000, respectively.

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6 Information available (in French): http://www.ined.fr/fr/ressources_documentation/donnees_detaillees/causes_de_deces_depuis_1925/la_polulation_standars/ (accessed 27 January 2013).

7 Information available: http://www.wmpho.org.uk/localprofiles/metadata.aspx?id=META_EUROSTD (accessed 27 January 2013).

The imbalance between male and female mortality levels was examined more closely by plotting the distribution of male-to-female death ratios across age groups for the four study periods, using the world average as a comparison. The world ratios of male-to-female deaths varied from about 1.0 (no difference between sexes) to less than 2.0 (Fig. 13). The Moldovan ratios varied much more widely, reaching over 3.0 male deaths for every female death in the 20–40-years age group. The assessment of this indicator carried out by WHO in neighbouring countries (Belarus, Romania and Ukraine) in June–July 2012 revealed similarly high ratios for the period 2008–2009, indicating that substantially higher male mortality is not unusual in this region.

Fig. 12. CSR and SDR, 1998–2010

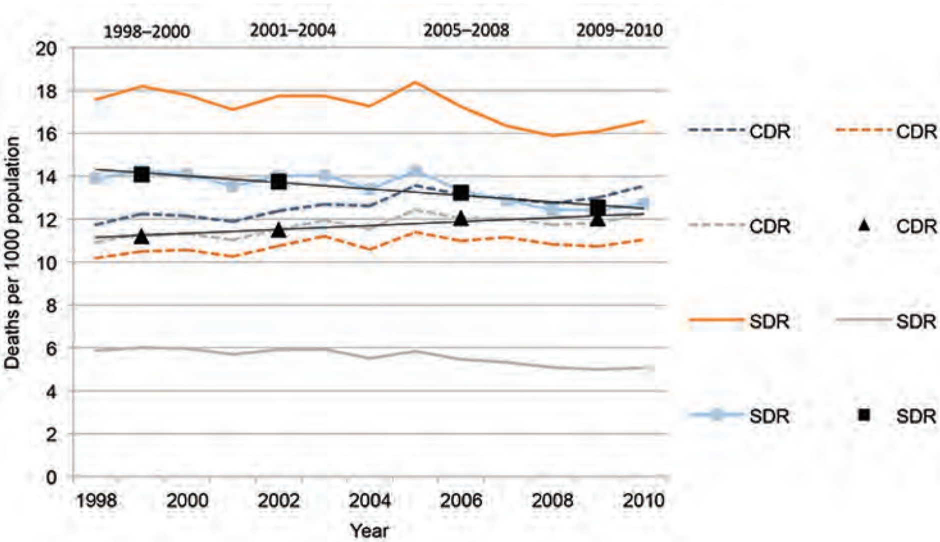
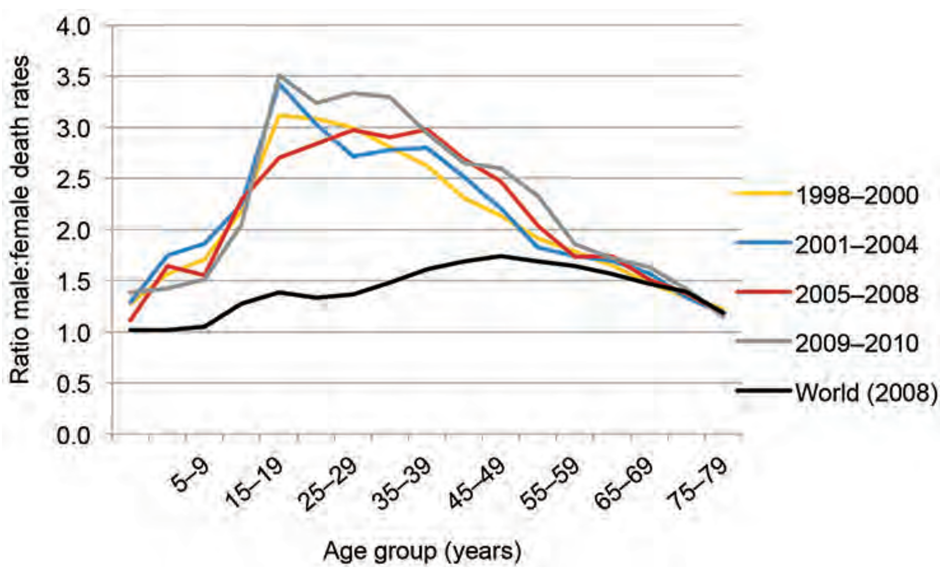


Fig. 13. Ratio of male-to-female death rates, by four study periods, 1998–2010

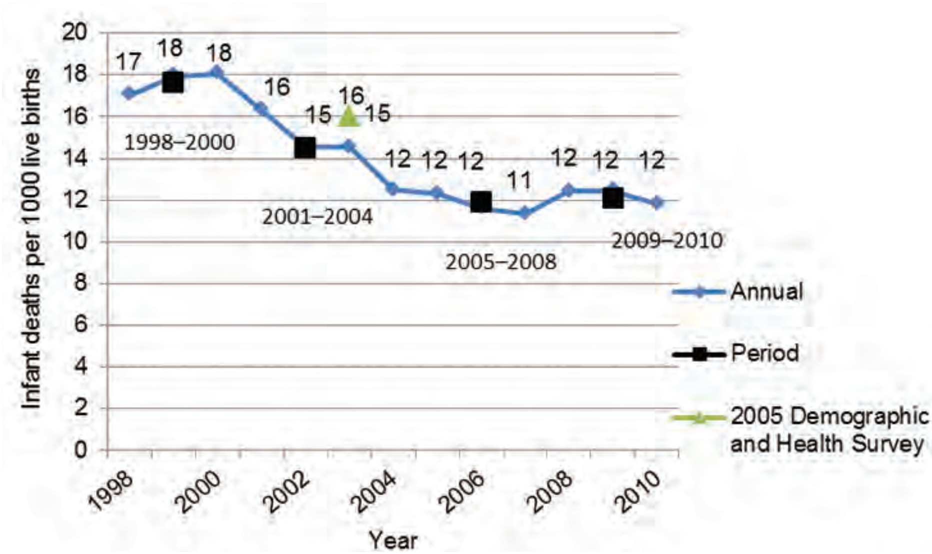


The sex ratios for the Republic of Moldova for 2009–2010 remained highest for the 20–60 year olds. This suggests that male death rates were increasing relative to female death rates, or that female death rates were decreasing at a faster pace than male death rates.

1.3.3 Adult and infant mortality rates

Adult mortality is best measured as the probability of dying between the ages of 15 and 59, that is, the probability of a 15 year-old dying before reaching age 60 if subject to current age-specific mortality rates between those ages.[8] In 2009–2010, Moldovan male adult mortality remained elevated while female adult mortality decreased slightly (Fig. 14).

Fig. 14. Probability of adult mortality per 1000 population, 15–59 years, by sex, four study periods, 1998–2010



Infant mortality is best measured as the probability of dying before 1 year of age, although the difference between the probability and the rate for this age group is usually minor. From 2000 to 2008, infant mortality in the Republic of Moldova was on a decreasing trend (Fig. 15). As hypothesized when defining the four periods of the study, the levels during the first and fourth periods (1998–2000 and 2009–2010) indicate a reversal or stagnation in the rate of decrease. Reducing infant mortality is Millennium Development Goal (MDG) 4 and substantial evaluation has already been made of the data quality, the significance of trends, and target-setting related to this indicator *(17)*.

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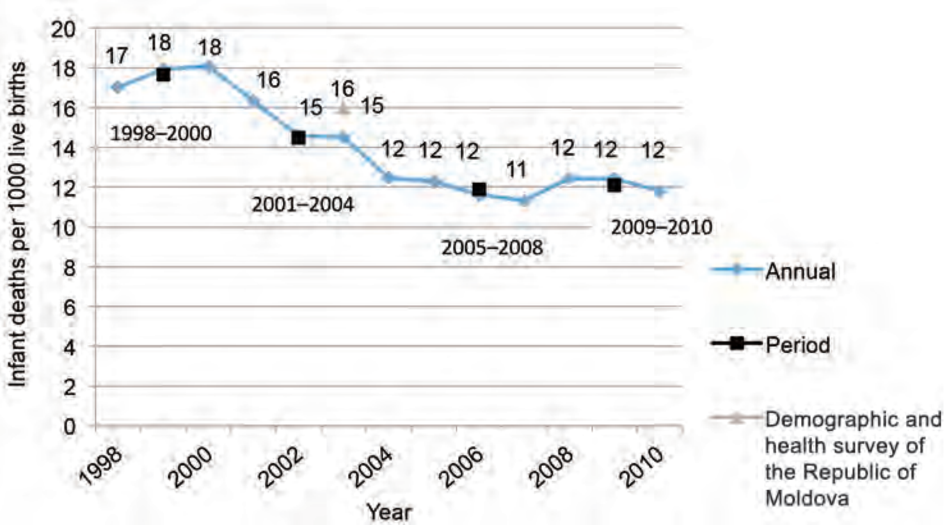
[8] The probability of adult mortality is different from the adult mortality rate, which is simply the total number of deaths per year per 1000 people between ages 15 and 59. Unlike the probability, the adult mortality rate is not strictly comparable over time because of the changing age composition within the age group.

Fig. 15. Probability of infant death (<1 year) per 1000 live births, annually and by four study periods, 1998–2010



1.3.4 Life expectancy

Life expectancy refers to the average number of years of life remaining at a given age, according to sex and age-specific mortality rates for a given period. It is a synthetic measure because it reflects the hypothetical experience of a cohort that is subject throughout life to prevailing mortality rates in a given period.

Life expectancy at birth for both sexes increased by about 1.5 years over the four study periods (i.e. from 67.7 years in 1998–2000 to 69.3 years in 2009–2010) (Fig. 16). The increase for females (over 2 years) was roughly twice that for males (just over 1 year).

Life expectancy at age 60 is a measure of the additional number of years that a person who has survived to age 60 can expect to live beyond that age. In countries, such as the Republic of Moldova, where infant mortality is already low and where targeted improvements to prevent and manage NCD are being made, life expectancy at 60 years is an important measure to track. Over the four study periods, life expectancy at age 60 increased by about 1 year for both sexes (from 15.9 years in 1998–2000 to 16.8 years in 2009–2010) (Fig. 17). Again, the increase for females was about twice as much as that for males.

A comparison of the percentage increase in life expectancy between the 1998–2000 and the 2009–2010 periods reveals the following trends: (1) the percentage change is greater at 60 years of age than at birth, and the largest and smallest increases (7% for females at age 60 and 2% for males at birth, respectively) both occurred in the last study period, 2009–2010 (Table 1); (2) the largest increases for both measures, and for both sexes, occurred during the last two study periods (2005–2008 and 2009–2010). Life expectancy

Fig. 16. Life expectancy at birth, annually and by four study periods, 1998–2010

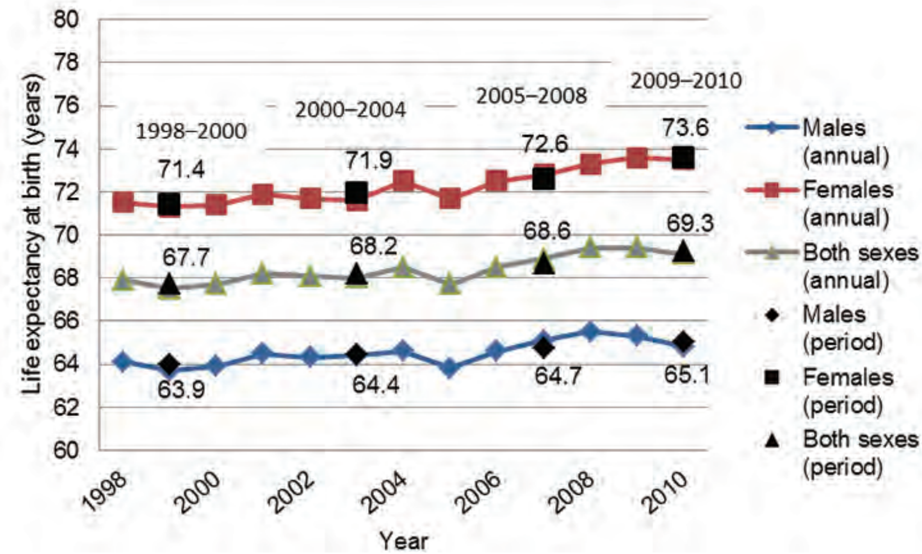
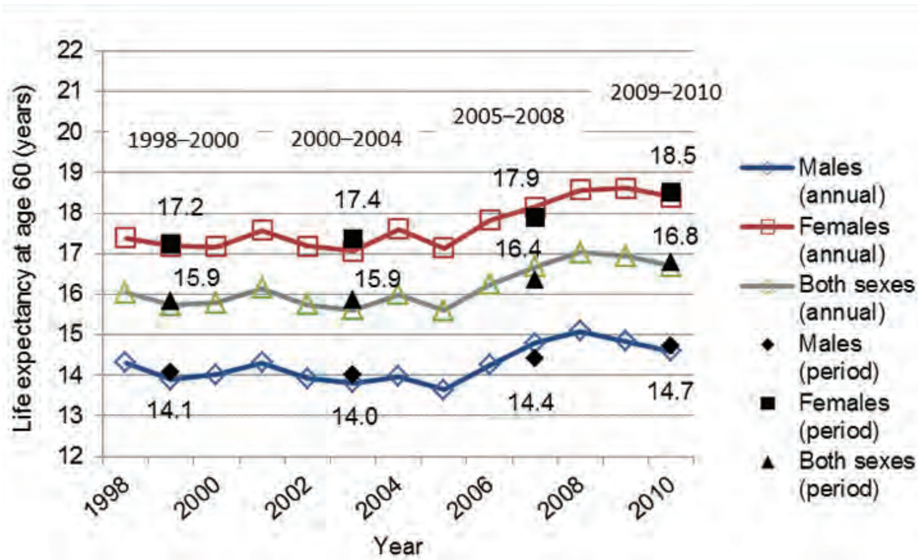


Fig. 17. Life expectancy at age 60, annually and by four study periods, 1998–2010



for males at age 60 had actually declined during the 2001–2004 period before starting to increase, and the ensuing gains for older males were weak compared to those for older females (2.5% and 3.8%, respectively).

Table 1. Percentage increase in life expectancy since 1998–2000, at birth and at 60 years, by four study periods, 1998–2010

Sex	1998–2000	2001–2004	2005–2008	2009–2010
Life expectancy at birth, % increase				
Male	–	0.8	1.2	1.7
Female	–	0.8	1.7	3.1
Both	–	0.8	1.4	2.3
Life expectancy at 60 years, % increase				
Male	–	-0.5	2.5	4.5
Female	–	0.6	3.8	7.3
Both	–	0.1	3.3	6.0

It is worth mentioning that aggregate population measures for the oldest old (people aged 80+ years) are also improving. In 1998–2000, 43% of all female deaths and 26% of all male deaths occurred at 80+ years. By 2009–2010, about *half* of all female deaths occurred at 80+ years, while the percentage of male deaths in this age group has stayed about the same (data not shown).

Chapter 2. Causes of death

Indicators related to causes of death in this section refer to the most recent reference period, 2009–2010, and address questions pertaining to the:

- main causes of death;
- number of YLL as a result of the disease or injury; and
- impact of premature mortality on life expectancy.

2.1 Causes of death according to GBD categories

Since 1990, the WHO GBD study[9] *(3)* has been measuring the burden of disease using a comprehensive and comparable list of about 150 major categories of disease and injury. This list was also the basis for summarizing the mortality results in this study. All categories of causes and ICD-10 codes were further divided into the three major groups: (1) communicable, maternal, perinatal and nutritional conditions; (2) NCD; and (3) injuries.

The relative patterns of these three groups are similar across countries within epidemiological regions and do not change radically over a short time. However, the proportional distribution of each group varies significantly according to age and, to a lesser extent, sex.

For both sexes, the proportion of deaths categorized in group 1 was highest during infancy, rising moderately again during early adulthood (Figs. 18 and 19). In 2009–2010, for example, infant deaths were due mainly to conditions existing in the prenatal period, and deaths in young adults were caused by lower respiratory infections and tuberculosis. Group 2, consisting of the most common causes of death, reflects the increasingly large share of ageing males and females dying from chronic diseases. As will be seen below in more detail, the major causes of death in this group for both sexes were ischaemic heart disease, cerebrovascular disease, and cirrhosis of the liver. Deaths categorized in group 3 were due to unintentional injuries (mainly road traffic accidents and poisonings) and intentional injuries (mainly self-inflicted injuries and homicides).

According to Omran (1971), developments in health services and trends in health behaviours lead to more chronic diseases, gradually replacing infectious diseases as the main source of ill-health *(18)*.

[9] Information available: http://www.who.int/healthinfo/global_burden_disease/publications/en/index.html, accessed 8 December 2012.

Fig. 18. Proportion of male deaths due to communicable diseases (group 1), NCD (group 2) and injuries (group 3), by age group, 2009–2010

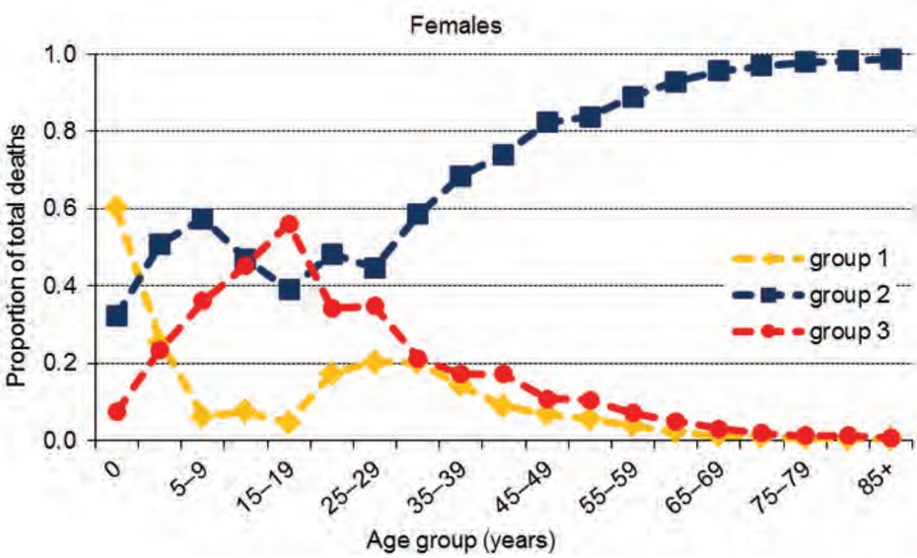
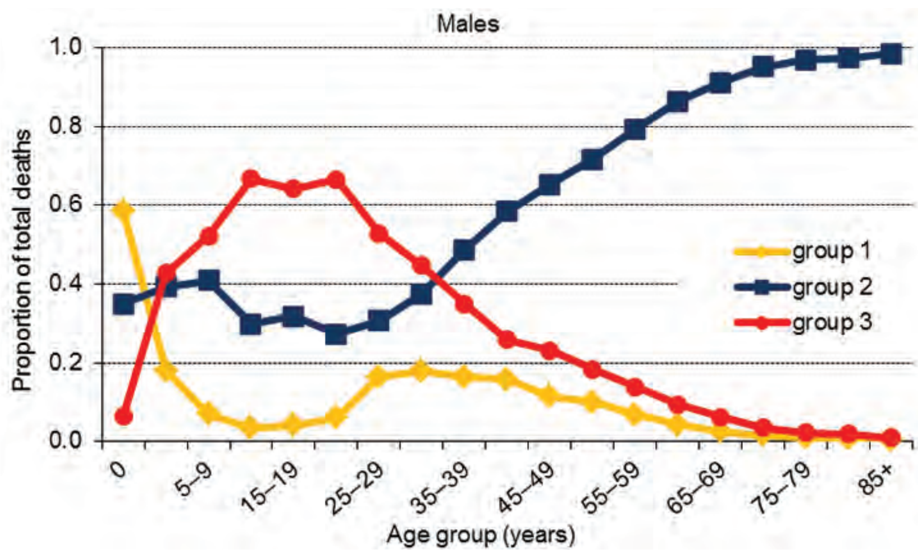


Fig. 19. Proportion of female deaths due to communicable diseases (group 1), NCD (group 2) and injuries (group 3), by age group, 2009–2010



This transition appears to have taken place in the Republic of Moldova well before the earliest study period (1998–2000) since no shift was observed in the distribution of the major causes of death across all four time periods (Table 2). Comparing the Moldovan distributions with the WHO model-based distribution for life expectancy of 70 years, only the percentages of deaths from injuries are at about the same level (9% and 11%, respectively); the percentages of deaths due to NCD (group 2) are substantially higher in the Republic of Moldova (87% and 78%), resulting – logically - in group 1 percentages being proportionally lower in Moldova (4% and 11%) (Table 2).

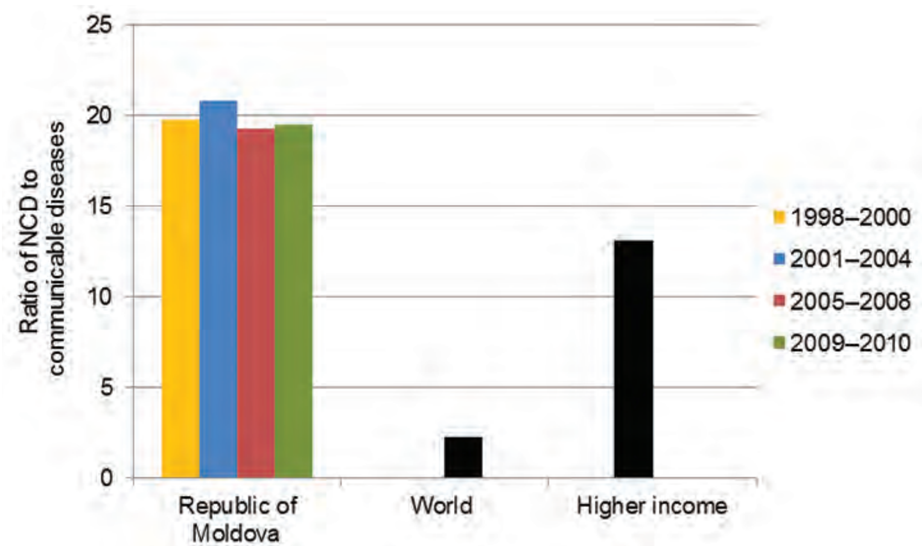
Table 2. Distribution of causes of death by three disease groups according to life expectancy (70 years) and by four study periods, 1998–2010

Causes of death	Standard distribution of life expectancy at 70 years[a] (%)	Distribution of causes of death			
		1998–2000 (%)	2001–2004 (%)	2005–2008 (%)	2009–2010 (%)
Communicable, maternal, perinatal and nutritional conditions	11	4	4	5	4
NCD	78	87	87	87	87
Injuries	11	9	9	9	8

Note: distribution figures may not add up to 100% due to rounding error.
[a] Model-based percentage distributions derived from the WHO Mortality Database *(2)* published in *Mortality Statistics: a tool to enhance understanding and improve quality (15).*

Quantifying the relationship between deaths from NCD and those from communicable diseases shows a steady ratio of 19–20:1 over the study periods, which is well above the world average and almost twice as high as the high-income country average (Fig. 20). The averages in neighbouring countries show even higher ratios: 45:1 in Belarus (2002–2003 and 2007–2009); 23:1 and 26:1 in Romania (2003–2007 and 2008–2010, respectively), and 25–26:1 in Ukraine (2005–2006 and 2008–2009) (data not shown). This pattern raises the question as to whether there might not be a relatively higher propensity in the population towards exposure to risk factors leading to chronic diseases and/or a lack of preventive or treatment measures aimed at reducing chronic diseases.

Fig. 20. Ratio of deaths from NCD (group 2) to deaths from communicable diseases (group 1), by four study periods and two comparison groups, 1998–2010

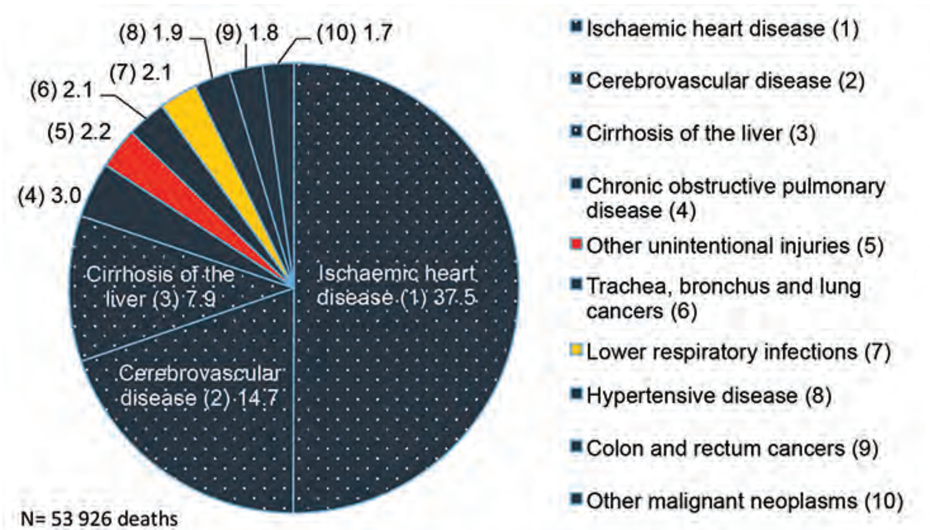


2.2 Top causes of death

2.2.1 Causes of death in absolute numbers

Deaths from the top 10 causes represented about half of all deaths in each study period, including 53% in 2009–2010 (Annex 1). The majority of these top causes, measured in absolute numbers, were in group 2, the main cause by far being ischaemic heart disease, which accounted for 38% of all deaths (Fig. 21). (NB: the top 3 disease categories are depicted as dotted pie slices. The top 10 causes are color-coded using gold for group 1, dark blue for group 2, and red for group 3. This color scheme is used throughout the report to designate the three GBD categories.)

Fig. 21. Top 10 causes of death by percentage of total deaths, both sexes, 2009–2010



Over the four study periods, there was no change in the top 4 causes ranked by absolute numbers (ischaemic heart disease, cerebrovascular disease, cirrhosis of the liver, and chronic obstructive pulmonary disease), each accounting for 3–4% of all deaths. This also applies to most of the other diseases in the top 10, each accounting for 2% or less of deaths. The top 10 causes of death and their percentages of the total number of deaths in each of the four periods are listed in Annex 1.

2.3 YLL

YLL rankings of top causes of death differ from the usual rankings by absolute numbers of deaths because, although the majority of deaths occur at older ages, overall, more years of life are lost from premature deaths. This approach has a strong intuitive appeal to policy-makers because preventing deaths in younger persons is often more amenable to public-health interventions than to preventing death in older age groups.

An additional benefit to analysing YLL (the mortality measure) is that it is one of the two basic components for calculating DALY (the main measure of the GBD study *(3)*), the other basic component being YLD (the morbidity measure). Since YLD draws from different data sources and requires different assumptions from those for YLL, estimating YLD would require a separate study.

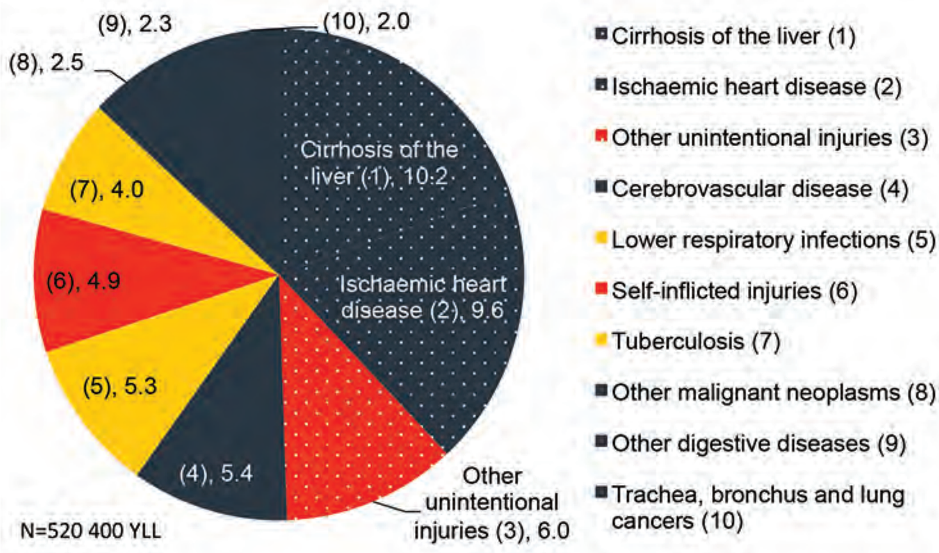
The analysis of YLL presented below was informed by several sources, including Lai and Kohler (2009) *(19)*, Garner and Sanborn (1990) *(20)* and the SISA research paper, *Discounting and mortality adjusting years of potential life lost (YPLL) (21)*.

2.3.1 Causes of death ranked by YLL

YLL due to premature death sums YLL by the leading causes of death and then ranks the results to show the causes with the highest numbers of YLL. Different reference ages defining premature death can be used for calculating YLL and, while the choice of measure is arbitrary, it must be clearly documented. For example, 65 years, considered the age of productivity (used, for example, by the Centers for Disease Control and Prevention (CDC), Atlanta, Georgia, USA *(22)*), 70 years (used, for example, by the Organisation for Economic Co-operation and Development *(23)*), 75 years, considered to be close to life expectancy in developed countries (used, for example, by the National Center for Health Statistics, Washington, DC, USA *(24)*), or the years of life expectancy for each age group based on the highest observed life expectancy (used, for example, in WHO GBD methodology *(3,25)*). For this study, the reference age group was 65 years. This cut-off was selected mainly because life expectancy in the Republic of Moldova, especially for men, lags behind life expectancy in more developed countries. This measure, therefore, quantifies the years of productivity lost due to premature deaths. For some indicators, the 70- and 75-year cut-offs are presented for comparison.

Ranking the main causes of death by YLL rather than by absolute numbers of deaths changes the profile of the mortality burden. In this study, in 2009–2010, while the absolute numbers of deaths were highly concentrated around a few top diseases, mostly in group 2, YLL (<65 years) were more evenly distributed and the causes in groups 1 and 3 became more prominent (Fig. 22). In 2009–2010, the top 10 causes in absolute numbers accounted for about three-quarters of all deaths, while the top 10 causes measured in YLL accounted for only about half of all YLL due to premature deaths. This relationship stayed the same throughout all four study periods (Annex 1).

Fig. 22. Top 10 causes of premature death (<65) by YLL, both sexes, 2009–2010



The top-ranking diseases in terms of YLL were ischaemic heart disease and cirrhosis of the liver, both accounting for just 10%. Five diseases comprised the second set of important causes of premature death, each accounting for 4–6% of YLL, two in group 1 (lower respiratory infections and tuberculosis), two in group 3 (other unintentional injuries and self-inflicted injuries) and one in group 2 (cerebrovascular diseases). Three causes (chronic obstructive pulmonary disease (COPD), hypertensive disease, and cancers of the colon and rectum) dropped out of the top 10 completely. These were replaced by three causes that tend to claim the lives of younger people, i.e., self-inflicted injuries, other digestive diseases, and tuberculosis (Annex 1).

Among the deaths ranked by YLL, ischaemic heart disease and cirrhosis of the liver remained in the top 2 positions over all four study periods. COPD, a top-ranking cause in absolute numbers, consistently dropped out of the top 10 ranking by YLL, and two new causes surfaced: self-inflicted injuries and tuberculosis. These two causes were most prominent among men and were consistently among the top 10 causes of death in absolute numbers when analysed by sex-specific causes. The top sex-specific causes among women included breast cancer in every study period. (Data for sex-specific rankings are not shown.)

2.3.2 Rates of YLL and age-discounting

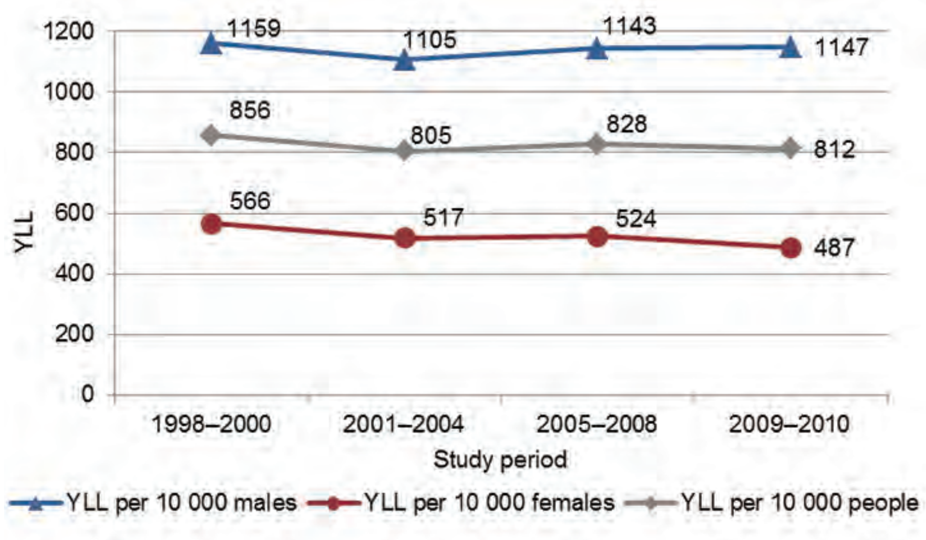
YLL rates are important for making comparisons and several methods can be used to measure them. The three used to summarize the Moldovan trends in YLL across the study periods are presented below. As with the crude and standard mortality rates discussed earlier, the directions of the trends differ depending on the measure used, which underscores the necessity to standardize the rates in order to draw a valid conclusion. All of the results, regardless of the measure used, showed YLL rates for males that were almost twice as high as those for females. Rates for premature deaths in the under-75 age group were almost twice as high as those in the under-65 age group.

2.3.2.1 Crude YLL

The crude YLL rate is the number of YLL divided by number of those under 65 years and expressed per 10 000 population. It is commonly used in evaluation and research (e.g. by the Minnesota Department of Health *(26)*); however, as is the case for CDR, the trends may be misleading because of changes or differences in population structures. It is, therefore, recommended to use a standardized measure.

The curve showing the crude YLL rates across all periods for both sexes (<65 and <75 years) in the Republic of Moldova is relatively flat with a slight incline for males and a slight decline for females (Fig. 23; Annex 2, Table 2.1).

Fig. 23. Crude YLL from premature deaths, <65 years, per 10 000 population, by four study periods, 1998–2010

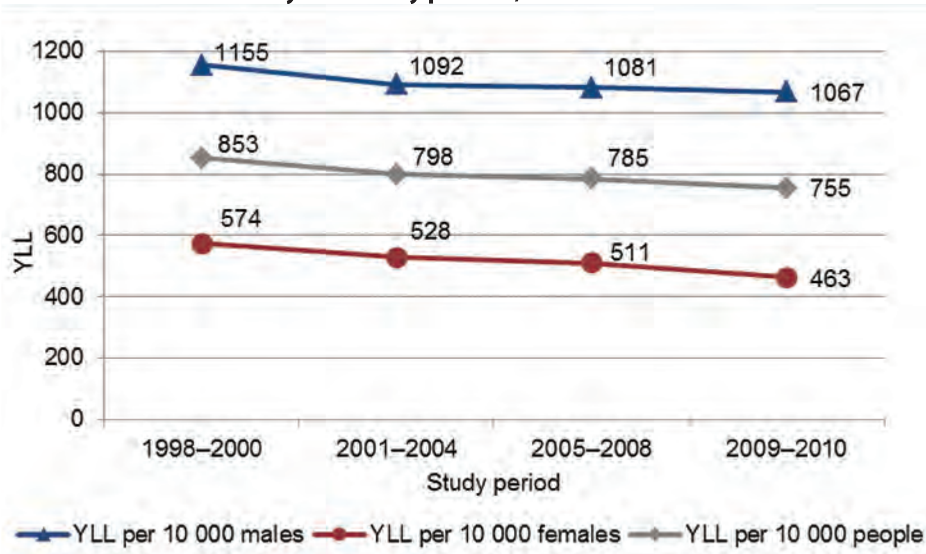


2.3.2.2 Standardized YLL

The standardized YLL rate is used in the GBD study *(3)* and frequently in other research using the YLL measure (e.g. Aragon et al (2008) *(27)*). It is computed by dividing the number of YLL by the number of people in the corresponding age group, weighted by the standard population. It is important to ensure that the same standard population (such as, Segi (world), Scandanavian (European) and Year 2000 (US standard million population)) is used throughout to allow for valid comparison. The same European standard population that was applied for standardizing CDR was also applied to obtain standardized YLL.

Unlike the crude rates, the standardized trends show a slight decline over time for both males and females (Fig. 24). This is because the crude rates are sensitive to population ageing and, as the population grows older, the numbers of deaths naturally increase. The standardized rates, on the other hand, hold population structure constant and, therefore, reveal the effect of other determinants on age at death, such as improved health services and/or a decline in exposure to risk factors.[10]

Fig. 24. Standardized YLL from premature deaths, <65 years, per 10 000 persons, by four study periods, 1998–2010



2.3.2.3 YLL per death

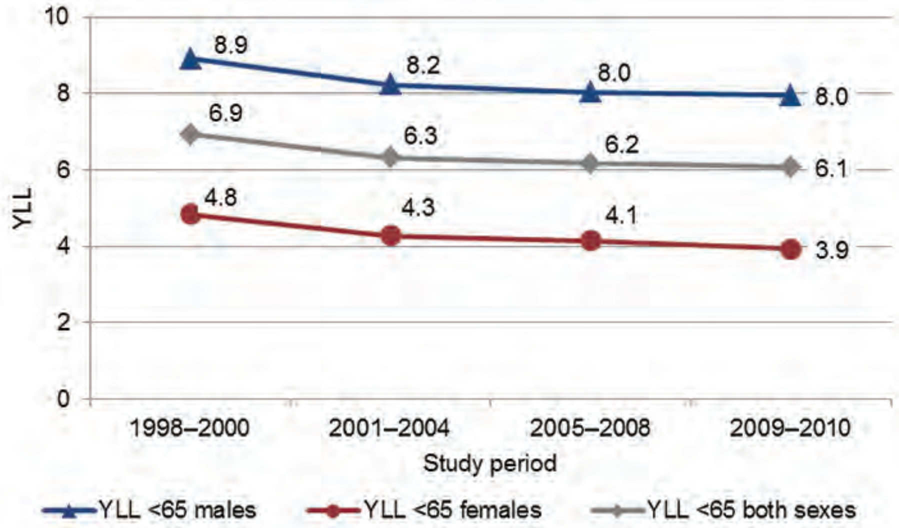
YLL may also be measured by dividing the number of YLL by the number of *all* deaths (not just by the number of deaths at <65 years), which is expressed as YLL per death. This measure is less frequently used in the literature (e.g. Marshall (2004) *(28)*; however, it is easy to calculate and has intuitive appeal. In looking at Fig. 25, the interpretation is straightforward: for every person who died in the Republic of Moldova between 1998 and 2010, an average of 6–7 years of life was lost due to premature death (defined as deaths occurring under age 65). Males who died lost twice as many years as females: 8–9 and 4–5, respectively. If the cut-off used for premature death had been 75 years, then about twice as many years would have been lost in each case.

The trends indicated by rate of YLL per death show a decline over time, similar to those shown for the standardized rates.[11] It should be noted that the rate of YLL per death is not strictly a standardized rate.

[10] Table 2.2 of Annex 2 includes comparison results for YLL at <75 years.

[11] Table 2.3 of Annex 2 includes comparison results for YLL at <75 years.

Fig. 25. YLL per death, from premature deaths, <65 years, both sexes, by four study periods, 1998–2010



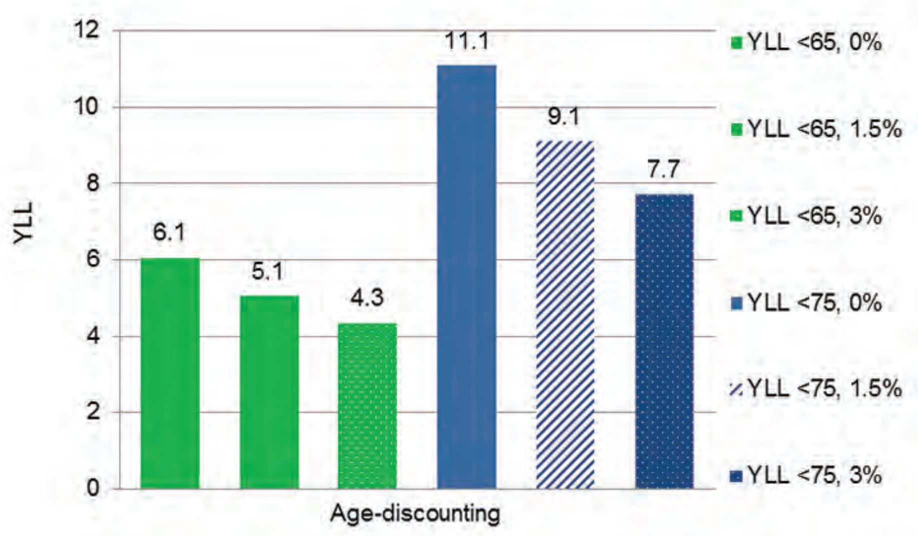
2.3.2.4 Discounting YLL

It could be argued that, in measuring YLL, a disproportional amount of importance is placed on early deaths, especially those occurring in infants under 1 year of age when the risk of dying is high *(25)*. The accumulated sum of years lost from early deaths, especially when infant mortality is high, tends to hide the impact of deaths due to chronic diseases occurring in adulthood. This potential problem can be addressed in two ways: (1) by defining measures of YLL at the lower threshold of 15 years, thus excluding infant and child deaths; and (2) by discounting deaths, as is done in the GBD (3) and other studies, which justify discounting deaths. The discounting level normally used is an annualized 1.5% or 3%.

For the period 2009–2010, the result of discounting YLL for premature death (defined as <65 years) was a one-year difference per death between no discounting of deaths and 1.5% discounting and an additional 0.8 years per death between 1.5% and 3% discounting (Fig. 26). When premature death was defined as <75 years, there was a difference of two years between no discounting and 1.5% discounting, and an additional 1.4 years between 1.5% and 3% discounting.

The magnitude of these discounts is shown only for illustrative purposes since, in this study, we retained the definition of premature death as any death before 65 years and we did not discount for age for two reasons. Firstly, infant mortality is low so there is no danger of veiling the problem of premature adult mortality and, secondly, discounting makes it more complex to produce the estimates, as well as to interpret them for policy purposes. Simplicity is the preferred approach as long as it produces meaningful evidence that can be understood by decision-makers. (Annex 2, Tables 2.1–2.3.)

Fig. 26. Comparison of effects of discounting YLL per death, <65 and <75 years, both sexes, 2009–2010



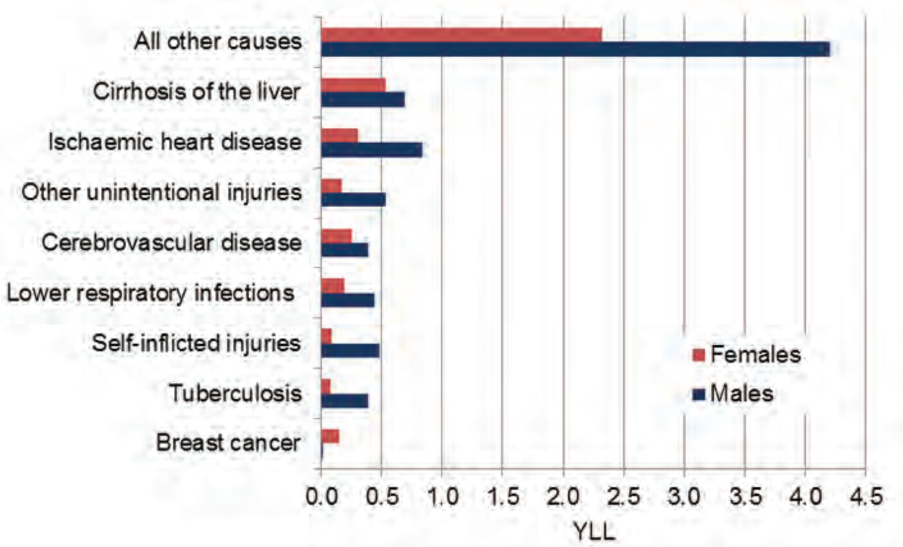
2.3.3 YLL by top causes of premature death

The YLL rates for the top causes of death varied according to sex. For both sexes, the top 7 causes of death each accounted for 4–10% YLL in 2009–2010, the proportion of YLL for all seven causes together being 45%. Breast cancer, although not among the top 10 causes for both sexes, was included because it is consistently one of the top 10 causes of female death in absolute numbers. As mentioned earlier, the top causes by YLL were more evenly distributed across the causes of death than was the case for top causes by absolute numbers, which tend to be concentrated among fewer causes. For this reason, the all-other-causes group accounted for a relatively large share of all YLL, about 55%.

Each cause of death accounted for less than one YLL per death when premature death was defined as <65 years (Fig. 27). For males, each cause accounted for roughly half a year lost per death, and slightly more in the case of ischaemic heart disease and cirrhosis of the liver. For women, who on average live for more than 65 years, very few years of life were lost per disease (the life expectancy for females during this period was 73.6 versus only 65.1 for males). In total, males lost an average of eight years of life and females an average of four. Annex 3 contains the exact figures for YLL, rate of YLL per death, and sex ratios of YLL.

YLL rates for males are higher than those for females in relation to every cause of death (except breast cancer). The overall male-to-female ratio for YLL due to premature death (<65 years) was 1.8, or almost twice as many years lost for males than for females. The highest male-to-female YLL ratios were for self-inflicted injuries and tuberculosis – 5.0 and 5.5, respectively; cirrhosis of the liver and cerebrovascular disease – 1.3 and 1.5, respectively – accounted for the lowest YLL ratios.

Fig. 27. YLL, <65 years, by cause of death, 2009–2010



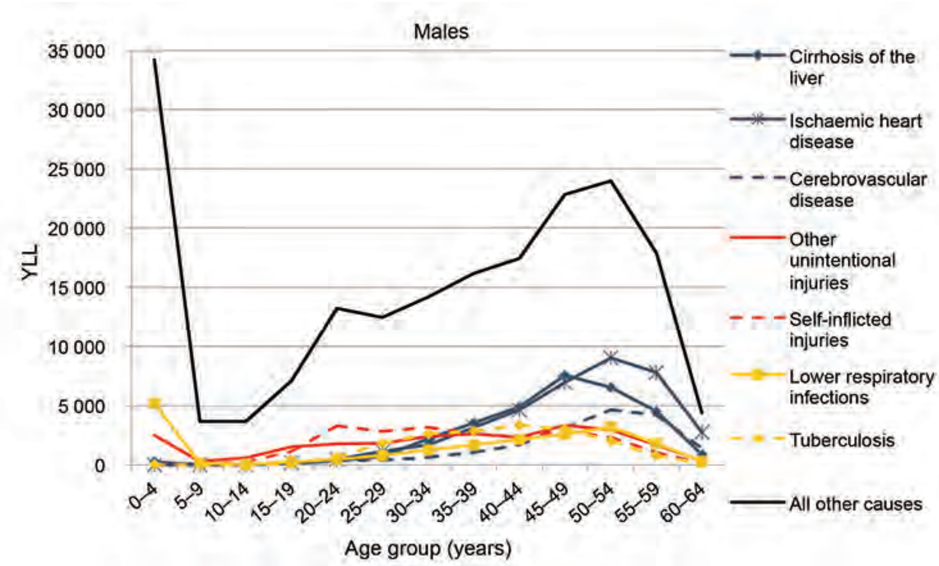
2.3.4 YLL age distribution by top causes of premature death

A total of 520 400 years of life were lost due to premature death (<65 years) in 2009–2010. Among these, more than twice as many were among males (362 078) than among females (158 323). Seven causes of death in males and five in females were each responsible for 4% or more of total YLL. The distribution of these causes, in addition to breast cancer among women (accounting for less than 1% of YLL but included because of its public health importance), are shown in Figs 28 and 29. The ranking, number and percentage of YLL, by sex, are presented in Annex 4.

Both for men and women, the aggregated all other causes accounted together for over half of all YLL: if considered individually, these causes would have contributed to total YLL with only a small percentage. The distinct bimodal curve for males, peaking at ages 20–24 and 45–59 for all other causes, is not a unique pattern (Fig. 28). A similar curve was demonstrated for males in Slovenia in 1998 *(29)*.

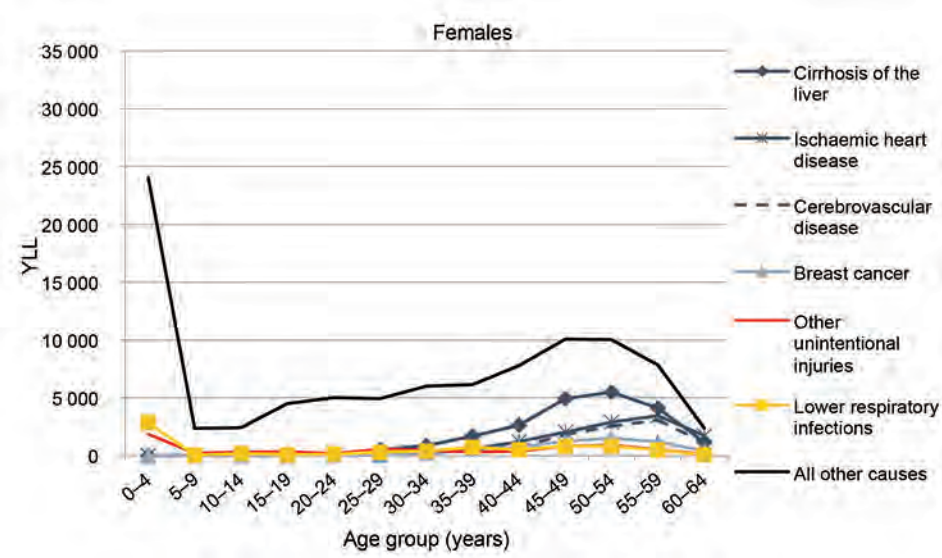
Self-inflicted injuries were responsible for the greatest number of YLL in males aged 19–35 years. The curve for years lost from tuberculosis shows an elevation between the ages of 30 and 50, overtaken thereafter by cirrhosis of the liver, ischaemic heart disease and cerebrovascular disease. Among infants and children under five years, lower respiratory infections and other unintentional injuries accounted for the largest share of YLL.

Fig. 28. Age distribution of YLL, <65 years, by leading causes of death, males, 2009–2010



Total YLL for females in 2009–2010 was less than half of that for males, and it was relatively rare that years of life were lost prior to age 40–44 (Fig. 29). After age 45, total YLL for females started to rise as they began to succumb to the same diseases causing YLL in males – cirrhosis of the liver, ischaemic heart disease and cerebrovascular disease. Lower respiratory infections and other unintentional injuries accounted for most YLL in infants and children under the age of five, as was also the case for males.

Fig. 29. Age distribution of YLL, <65 years, by leading causes of death, females, 2009–2010



2.4 Impact of main causes of premature death on life expectancy

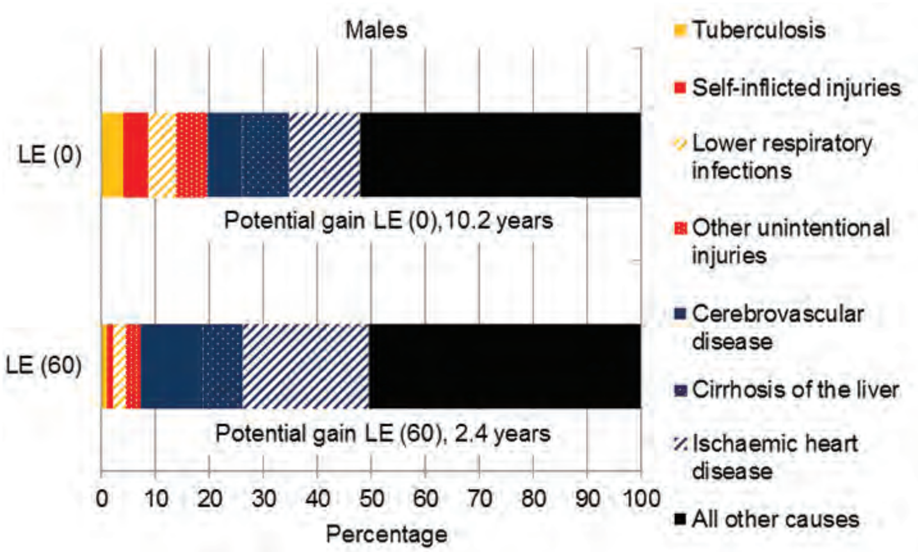
The causes of death that have the largest impact on YLL also have the largest impact on life expectancy. In order to quantify the impact of specific causes of death on life expectancy at birth and at age 60, sex- and age-specific causes of death were eliminated one by one and life expectancy was recalculated. Although eliminating all deaths related to a specific cause does not reflect a realistic scenario, it is useful in policy-making as it illustrates the relative importance of specific causes in impeding more favourable life expectancy. (In contrast, Chapter 3 of the study illustrates simulated scenarios in which selected causes were not eliminated but, more realistically, postponed until later ages.)

For males, each of the seven causes mentioned in section 2.3 as having contributed to the highest number of YLL in 2009–2010, as well as all other causes, were eliminated. Doing so resulted in a potential gain of 10.2 years of life expectancy at birth, and of 2.4 years at age 60; for both sexes, the seven causes together contributed about half of the total potential years gained and all other causes contributed the other half (Table 3, Fig. 30). Regarding life expectancy at birth, about 20% of the potential years gained resulted from eliminating causes in the GBD categories of groups 1 and 3, and about 30% from eliminating diseases in group 2. For life expectancy at age 60, however, about 45% of the potential years gained was due to eliminating diseases in group 2; only about 7% resulted from eliminating diseases in groups 1 and 3. This reflects the growing impact on mortality of chronic diseases (group 2) in later years and the diminishing impact of communicable diseases and injuries (groups 1 and 3), which tend to occur at earlier ages.

Table 3. Potential years gained in life expectancy, males, by cause, 2009–2010

Causes	Potential years gained in life expectancy	
	at birth	at 60 years
Tuberculosis	0.4	0.0
Self-inflicted injuries	0.5	0.0
Lower respiratory infections	0.5	0.1
Other unintentional injuries	0.6	0.1
Cerebrovascular disease	0.6	0.3
Cirrhosis of the liver	0.9	0.2
Ischaemic heart disease	1.3	0.6
All other causes	5.3	1.2
Total	10.2	2.4

Fig. 30. Percentage of total potential years gained in life expectancy, males, specific causes of premature death (<65 years) eliminated, 2009–2010



For females, each of the five causes of death contributing to the highest number of YLL in 2009–2010, plus breast cancer and all other causes, were eliminated independently to ascertain the effect of each on life expectancy. The sums of potential years of life expectancy gained at birth and at 60 years were 5.8 and 1.9 years, respectively. The five causes and breast cancer together contributed about half of the total potential years gained and all other causes contributed the other half (Table 4, Fig. 31). Causes in the GBD categories of groups 1 and 3 played a much smaller role in decreasing female life expectancy than was the case for males: they represent less than 10% of the potential gain at birth, and only about 2% at age 60. The same three NCD, namely ischaemic heart disease, cerebrovascular disease and cirrhosis of the liver, represent the most important diseases for potential gains in life expectancy and added almost two years at birth and almost one year at age 60. Breast cancer was responsible for a small proportion of the potential gains in life expectancy, i.e. four months for females at birth.

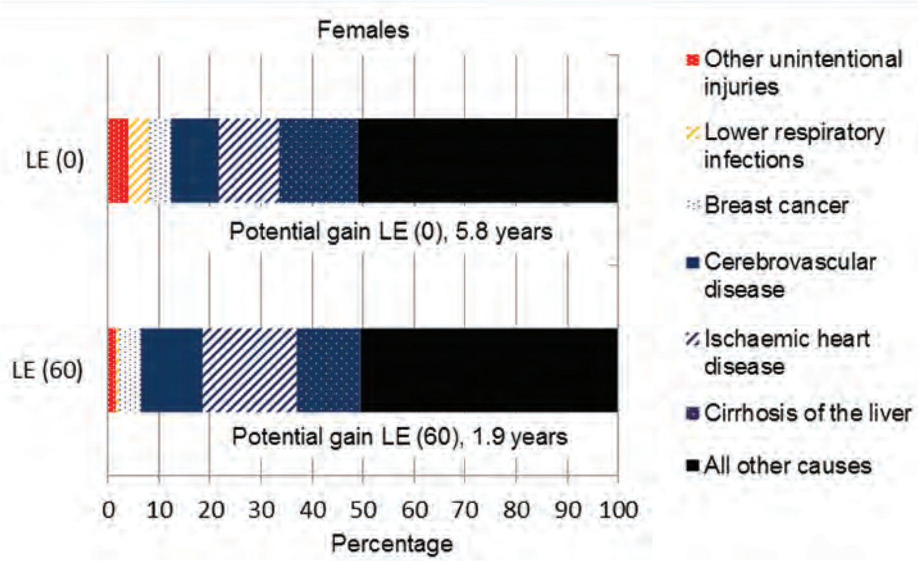
Table 4. Potential years gained in life expectancy, females, by cause, 2009–2010

Causes	Potential years gained in life expectancy	
	at birth	at 60 years
Other unintentional injuries	0.2	0.0
Lower respiratory infections	0.2	0.0
Breast cancer	0.3	0.1
Cerebrovascular disease	0.5	0.2
Ischaemic heart disease	0.7	0.4

Table 4 contd.

Cirrhosis of the liver	0.9	0.2
All other causes	2.9	1.0
Total	5.8	1.9

Fig. 31. Percentage of total potential years gained in life expectancy, females, specific cases of premature death (<65 years) eliminated, 2009–2010



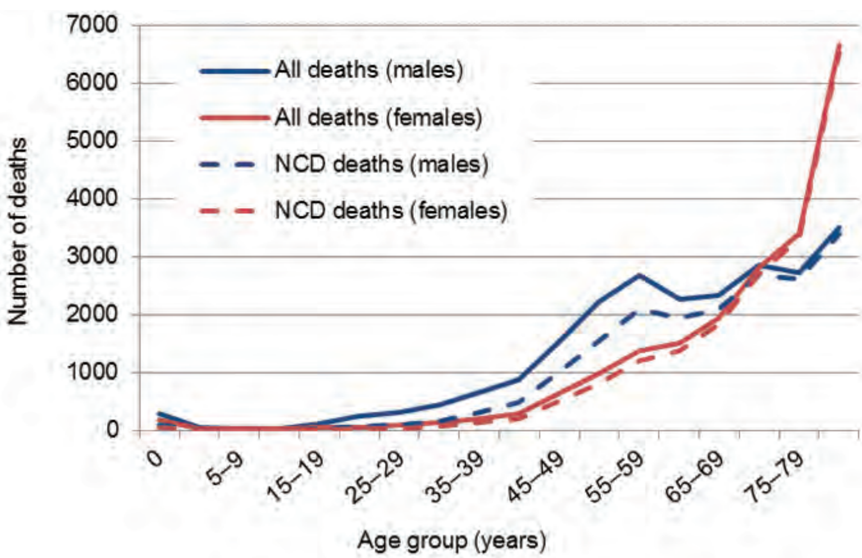
Note: the presentation of potential gains in life expectancies was inspired by Fig. 4, p. 52 in *Estonia: health system performance assessment. 2009 snapshot (30).*

Chapter 3. Monitoring targeted reduction of NCD death rates

The Republic of Moldova has gathered substantial support for its programme to promote healthy lifestyles from intersectoral stakeholders at the national level *(31)*. Its national reporting system includes the collection of cause-specific information on NCD mortality, morbidity and risk factors. It has not, however, specifically invested in rigorous NCD surveillance, monitoring and evaluation *(32)*. As stated in the *National strategy of prevention and control of noncommunicable diseases for 2012–2020*, it is the aim of the Ministry of Health to reduce the number of deaths caused by NCD by 17% between 2010 and 2020 *(8)*. The purpose of this section is to highlight several assumptions that need to be considered in monitoring progress towards the target and in simulating scenarios that portray potential paths to reduction.

As seen in Table 2, deaths from NCD-related causes, for both sexes together, accounted for a constant 87% of all deaths in the Republic of Moldova across the four study periods. Fig. 32 shows the distribution of all male and female deaths and, of those, deaths from NCD in the baseline year, 2010. The converging lines indicate a much higher proportion deaths from NCD among females than among males, especially after age 70 when NCD accounts for virtually 100% of female deaths; the percentage for males after age 70 was noticeably less except for those in the very oldest age group.

Fig. 32. Distribution of all deaths and NCD deaths, by age group, 2010

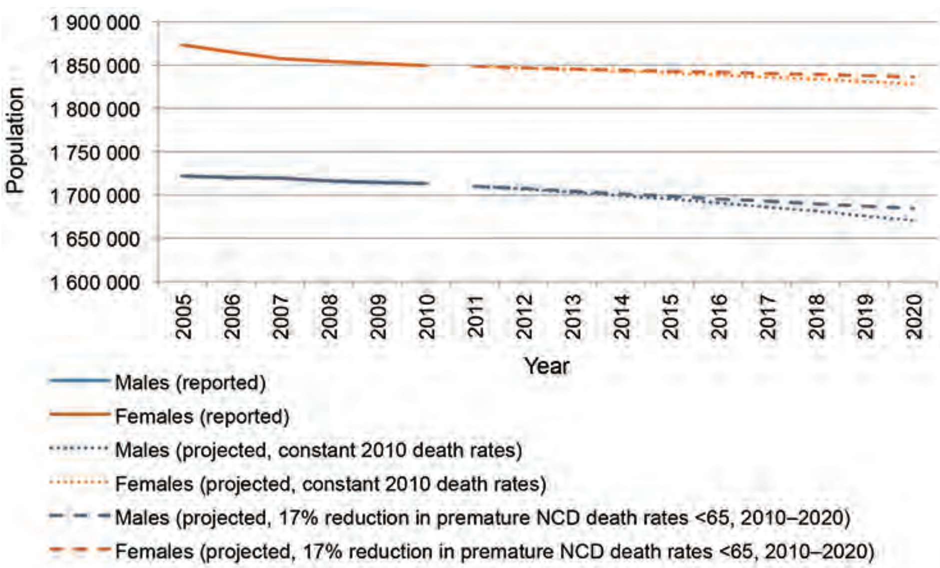


3.1 Population and projections of deaths

When setting mortality targets, it is important to consider assumptions related to future population shifts. Births, deaths and migration all determine the size and age/sex structure of a population. During the period under review, there was a smooth population decline in the Republic of Moldova (Fig. 2). From 2005 to 2010, the most recent five-year time period of this study, the annual percentage decline was -0.11% for males and -0.26% for females.

The projected annual population figures are the result of advancing a portion of the population in each age group from year to year, from the base year of 2010 to the target year of 2020, and subtracting the number of estimated deaths in each age group, depending on the NCD reduction scenario. The projected number of new births each year was computed by increasing the number of births in 2010 by a constant annual percentage that matches the average annual increase in the number of births from 2005 to 2010 (1.47% and 1.40% for males and females, respectively). Net migration was assumed to be zero, mainly because of a lack of readily available reliable information. Computing in this fashion, and keeping the 2010 death rates constant, the overall projected population would include approximately 42 000 fewer males and 21 000 fewer females by the end of the projection period (2020) (Fig. 33). In connection with actual monitoring, it will be important to correct the projected population figures for the target decade (2010–2020) on the basis of the 2014 Population and Housing Census results (the previous census was conducted in November 2004). Annex 5 contains the projected population figures.

Fig. 33. Reported annual population, 2005–2010, projected population, 2011–2020, males and females, by constant death rates (2010) and 17% reduction in premature NCD death rates (<65 years) (2010–2020)



The projected population by age group shows that between 2010 and 2020 a much smaller proportion of the population will constitute the low mortality intervals (ages 10 to 35 years) and a larger proportion will enter into the highest mortality age groups (60 years and above) (Figs 34 and 35).

Fig. 34. Population 2005 and 2010, projected population 2011–2020 (2010 death rates held constant), males, by age group

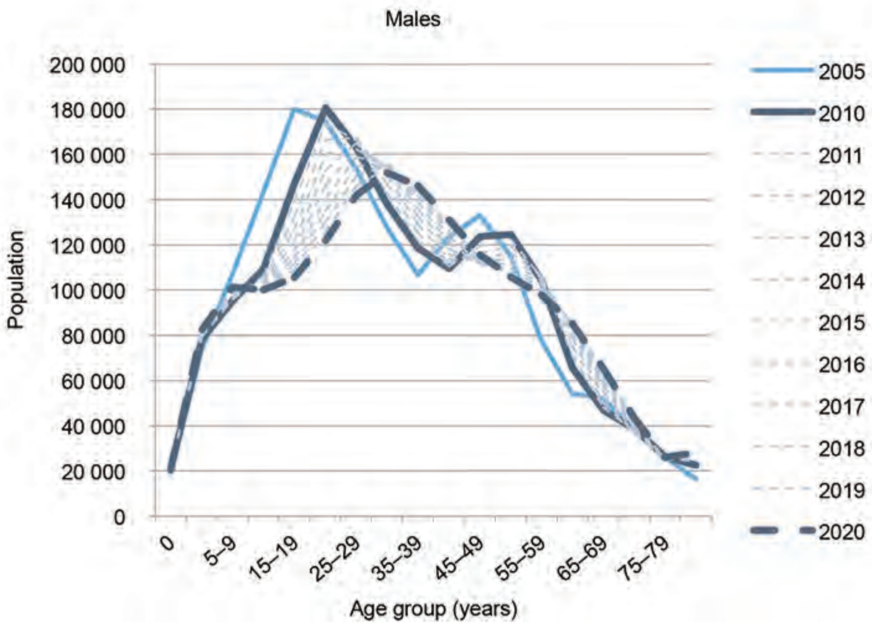
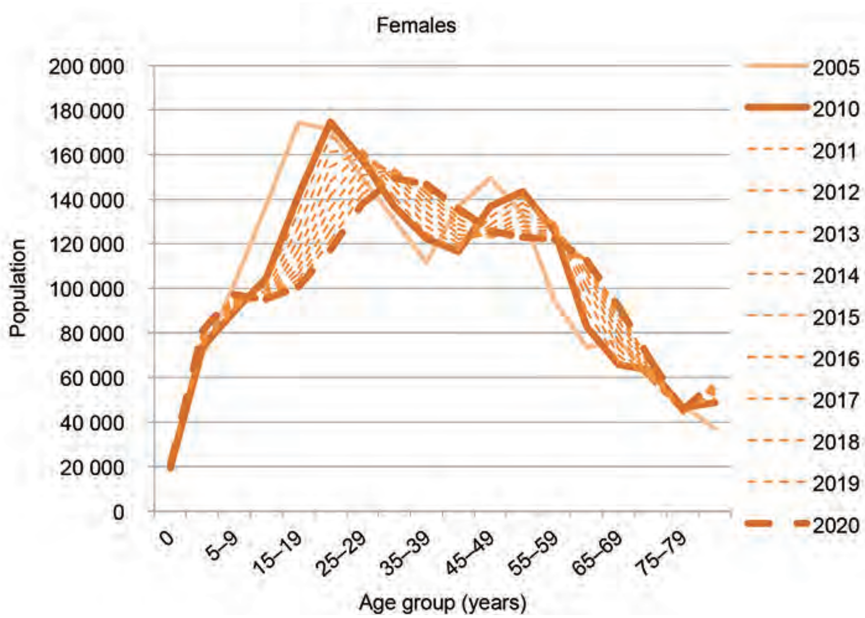


Fig. 35. Population 2005 and 2010, projected population 2011–2020 (2010 death rates held constant), females, by age group



As expected from the ageing-population pattern, and despite the overall decline in population size, the annual number of deaths, for males and females, will increase by an average of 230–250 every year after 2010. The projected numbers of deaths shown in Fig. 36 were derived by applying the age-specific death rates for 2010 to the projected annual populations; they do not take any targeted reductions into account.

Fig. 36. Annual deaths, 2005–2010, and projected deaths, 2011–2020

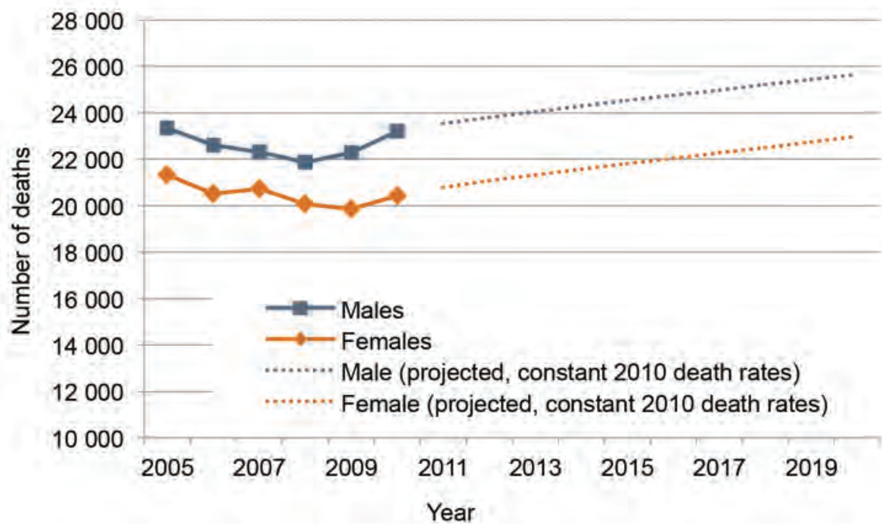
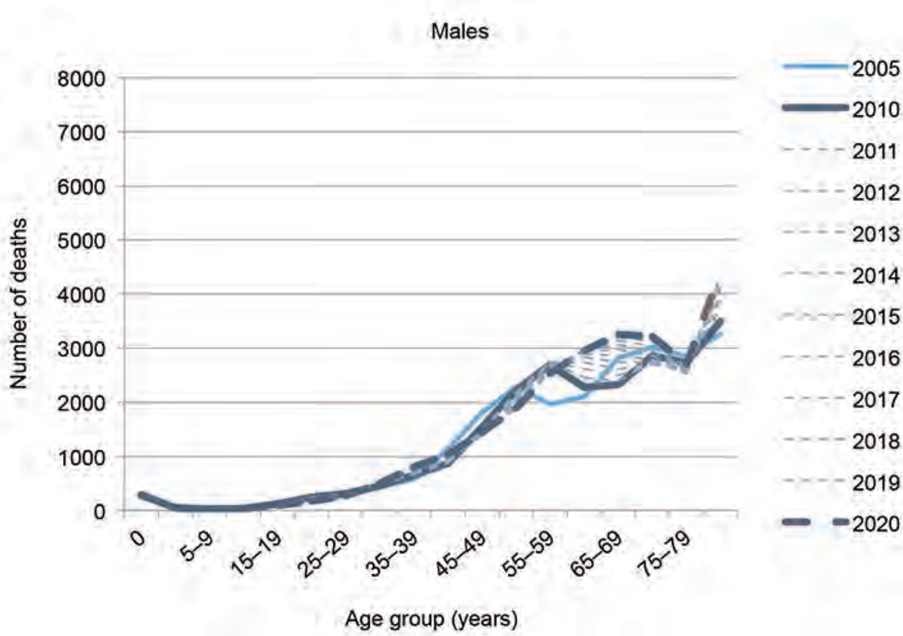
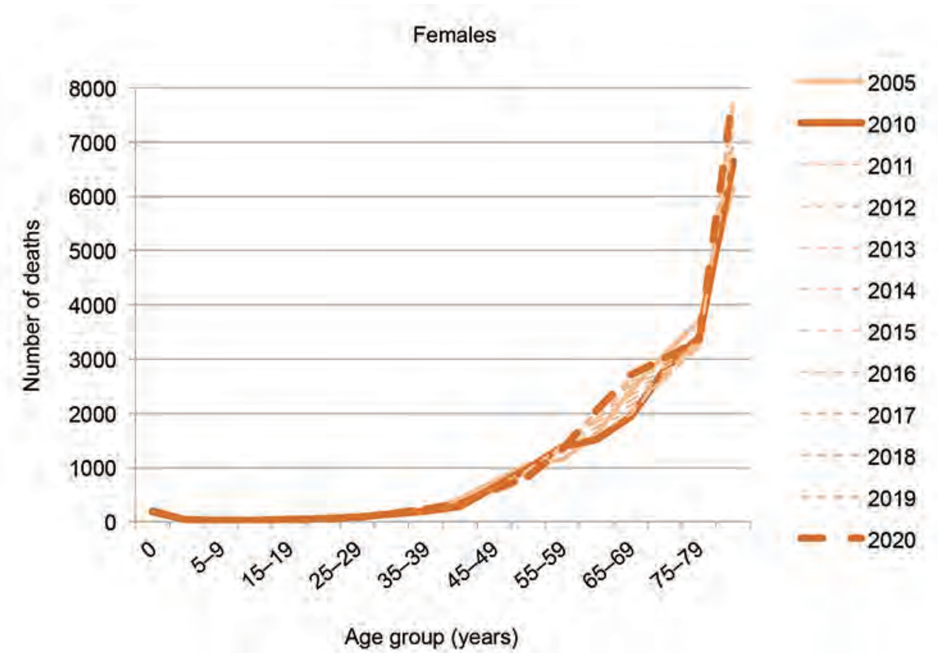


Fig. 37. Number of deaths, 2005 and 2010, and projected number of deaths 2011–2020 (2010 death rates held constant), males, by age group



Examining the number of deaths observed in 2010 by age group shows where the numbers of deaths are expected to grow most. Assuming no reduction in 2010 death rates, the greatest increase in the number of deaths will occur after age 60 and before age 80 for both sexes (Figs 37 and 38). Stagnation in the number of deaths reported in the 75–79 age group was evident for both sexes but especially for males. Several theories were discussed that might explain the deficit but no conclusion was reached as to whether this is a data artifact (e.g. age transfer to older ages) or merely an anomaly (e.g. related to the echo effect of excess premature deaths during the Second World War).

Fig. 38. Number of deaths, 2005 and 2010, and projected number of deaths, 2011–2020 (2010 death rates held constant), females, by age group



3.2 Scenarios simulating the targeted reduction of NCD deaths

In monitoring targets related to reducing death, it is important to define, a priori, methods and assumptions to ensure consistent, systematic measurement throughout the target period. Primarily, since death in reality can never actually be eliminated, the reduction of deaths from NCD implies the transfer of these deaths to one of the other causal groups, communicable diseases or injuries, or their postponement to later ages. Since, as in other European countries, deaths in the Republic of Moldova are, as they have been for many years, largely related to NCD, it is most probable that their reduction would be the result of the latter implication rather than the former. Therefore, the simulation scenarios below assume that the Ministry of Health's target is to reduce *premature* death from NCD.

- *Scenario I* presents observed values for the baseline year, 2010, with premature NCD deaths defined as those occurring under age 65.
- *Scenario II* presents projected values for 2020, assuming *no reduction* in death rates (including NCD death rates), with premature NCD deaths defined as those occurring under age 65. The 2010 sex- and age-specific death rates are held constant through 2020.
- *Scenario III* presents projected values for 2020, assuming a *17% reduction* in premature NCD deaths from 2010 to 2020, with premature NCD deaths defined as those occurring under age 65. Non-NCD death rates for 2010 are held constant for males and females through 2020. Allowing for a range of uncertainty in the outcome indicators, this scenario is replicated for a *17%+5% (12% and 22%) reduction*.
- *Scenario IV* (comparison) presents projected values for 2020, assuming a *17% reduction* in premature NCD deaths from 2010 to 2020, with premature NCD deaths defined as those occurring under age 70. Non-NCD death rates for 2010 are held constant for males and females through 2020.
- *Scenario V* (comparison) presents projected values for 2020, assuming a *17% reduction* in premature NCD deaths from 2010 to 2020, with premature NCD deaths defined as those occurring under age 75. Non-NCD death rates for 2010 are held constant for males and females through 2020.

The indicators selected for tracking the simulated reduction of deaths from NCD include: the numbers of NCD deaths and premature NCD deaths; the percentage of premature NCD deaths among all NCD deaths and among total deaths; the number of YLL due to premature NCD deaths; and the average number of YLL due to premature NCD deaths, per NCD death and per death. Expected gains in life expectancy at birth and at age 60 are presented in the following section. Table 5 shows the results for scenarios I–V.

Table 5. NCD mortality indicators, 2010 (baseline) and 2020 assuming 0% and 17% reductions in premature deaths from NCD (<65, <70 and <75 years), by sex

Cause	Sex	I	II	III			IV	V
		2010 baseline (<65)	2020 0% (<65)	2020 -17% (<65)	2020 -17% (-5%) (<65)	2020 -17% (+5%) (<65)	2020 -17% (<70)	2020 -17% (<75)
All NCD deaths	Male	18 725	21 023	19 812	20 172	19 451	19 433	19 078
	Female	18 923	21 400	20 636	20 862	20 411	20 271	19 892
Premature NCD deaths	Male	7 915	8 211	6 942	7 320	6 564	9 450	12 090
	Female	4 539	4 900	4 110	4 344	3 877	6 274	8 762
% premature NCD deaths among total deaths	Male	34.1	32.0	28.4	29.5	27.2	39.2	51.0
	Female	22.2	21.3	18.5	19.3	17.6	28.7	40.8

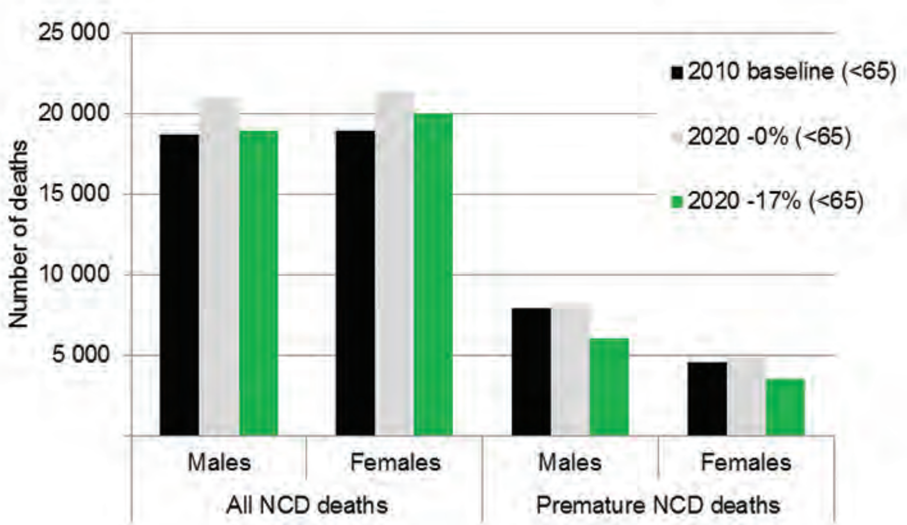
Table 5 contd.

% premature NCD deaths among all NCD deaths	Male	42.3	39.1	35.0	36.3	33.7	48.6	63.4
	Female	24.0	22.9	19.9	20.8	19.0	30.9	44.0
YLL due to premature NCD deaths	Male	99 904	99 150	90 279	88 611	79 146	133 221	189 204
	Female	52 644	52 592	46 453	46 740	41 632	73 100	111 475
Standardized YLL due to premature NCD death, per 10 000	Male	590.7	588.9	441.1	482.5	401.5	651.9	930.7
	Female	290.0	289.2	212.0	233.5	191.6	318.7	467.2

3.1.1 Number of NCD deaths and premature NCD deaths

Due to population ageing, the overall number of NCD deaths would increase after 2010 even if the 17% reduction in death rates were achieved (Fig. 39). In terms of the number of premature deaths (<65 years), however, the 17% reduction would result in approximately 600 fewer premature NCD deaths among males and 300 fewer among females.

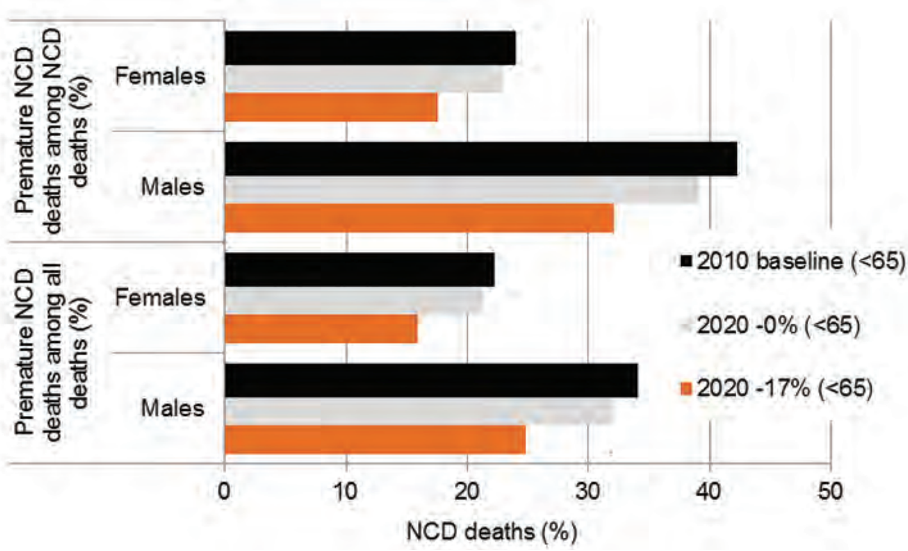
Fig. 39. Numbers of NCD deaths and premature NCD deaths, 2010 (baseline) and 2020 assuming 0% and 17% reductions in premature deaths (<65 years)



3.2.1 Percentage of premature NCD deaths

The percentage of premature NCD deaths (<65 years), among all deaths and among NCD deaths, declines slightly by 1–3 percentage points by 2020 even when there is no reduction in 2010 death rates over the target period (Fig. 40). This is because an ageing population results in a larger proportion of people aged 65 or over when death, by definition, is not considered premature. Assuming the 17% reduction is achieved, a decrease of 4–6 percentage points of premature deaths from NCD among all NCD deaths can be expected from 2010 to 2020.

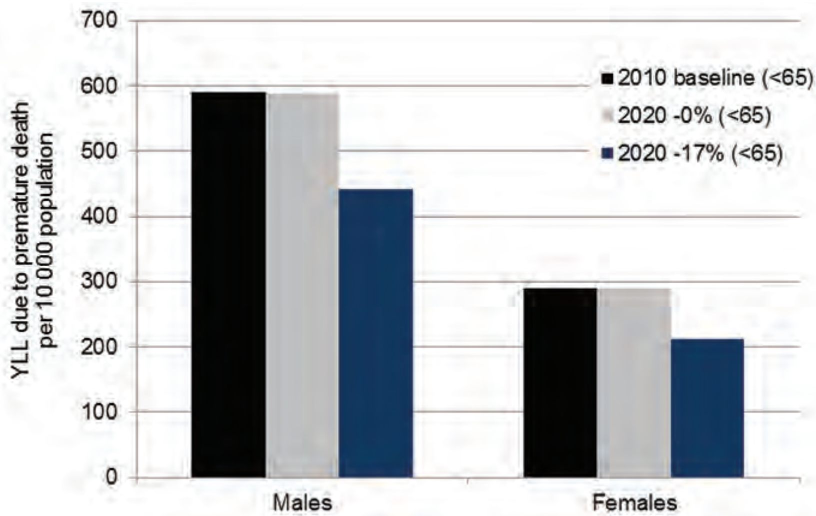
Fig. 40. Percentage of premature NCD deaths among all NCD deaths and among all deaths, 2010 (baseline) and 2020 assuming 0% and 17% reductions in premature deaths (<65 years)



3.2.2 Standardized YLL

Although standardized YLL is not as intuitive a measure of premature NCD death as the above-mentioned numbers and percentages, this measure and measures of life-expectancy (Section 3.3) are the only indicators that can be used to make a strict comparison across time, including a comparison between the 2020 values and the baseline value in this study (Fig. 41). The reason for this is that these measures control for the effects of population ageing over time (Section 1.3.2). There was, as expected, no change in standardized YLL between 2010 and 2020 when the reduction in death rates was zero. When the reduction was 17% over the same period, the expected net decrease in YLL is 25% and 27% for males and females, respectively.

Fig. 41. Standardized YLL due to premature NCD deaths, per 10 000, 2010 (baseline) and 2020 assuming 0% and 17% reductions in premature deaths (<65 years)



3.3 Gains in life expectancy

Life expectancy at birth is a widely accepted measure of health and development and, as populations age, it is increasingly common to include life expectancy at age 60 in reporting. Life expectancies at birth and at age 60 refer to the average number of years that a newborn and a 60-year-old person are expected to live assuming that the prevailing sex- and age-specific death rates are constant. Life expectancy at birth and at other ages are derived from life tables that tabulate death rate, the probability of dying and the number of survivors, by age group.

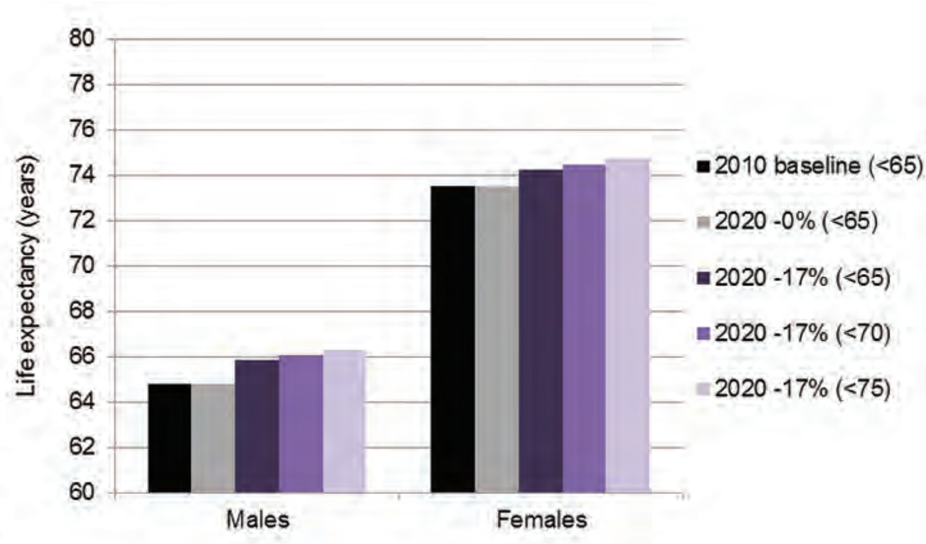
Table 6 presents life-expectancy gains according to reductions in premature NCD death rates.

Table 6. Life expectancy at birth and age 60, for 2010 (baseline) and 2020 assuming 0% and 17% reductions in NCD premature deaths (<65, <70 and <75 years), by sex

Life expectancy	Sex	Scenarios						
		I	II	III			IV	V
		2010 Baseline (<65)	2020 0% (<65)	2020 -17% (<65)	2020 -17% (-5%) (<65)	2020 -17% (+5%) (<65)	2020 -17% (<70)	2020 -17% (<75)
At birth	Male	64.8	64.8	65.8	65.5	66.1	66.1	66.3
	Female	73.5	73.5	74.2	74.0	74.5	74.5	74.7
At age 60	Male	14.6	14.6	14.9	14.8	15.0	15.2	15.5
	Female	18.4	18.4	18.6	18.6	18.7	18.9	19.2

Life expectancy at birth increased by exactly one year for males when a 17% reduction was made in premature NCD death rates (<65 years), from 64.8 in 2010 to 65.8 years in 2020 (Fig. 42). There was an increase of 1½ years when death rates were reduced by 17% for premature NCD deaths under the age of 75. For females, the gain in life expectancy at birth was smaller because fewer premature deaths occurred: there was a gain of one year, from 73.5 in 2010 to 74.5 in 2020, only when the death rates were reduced by 17% for NCD deaths in those under the age of 70.

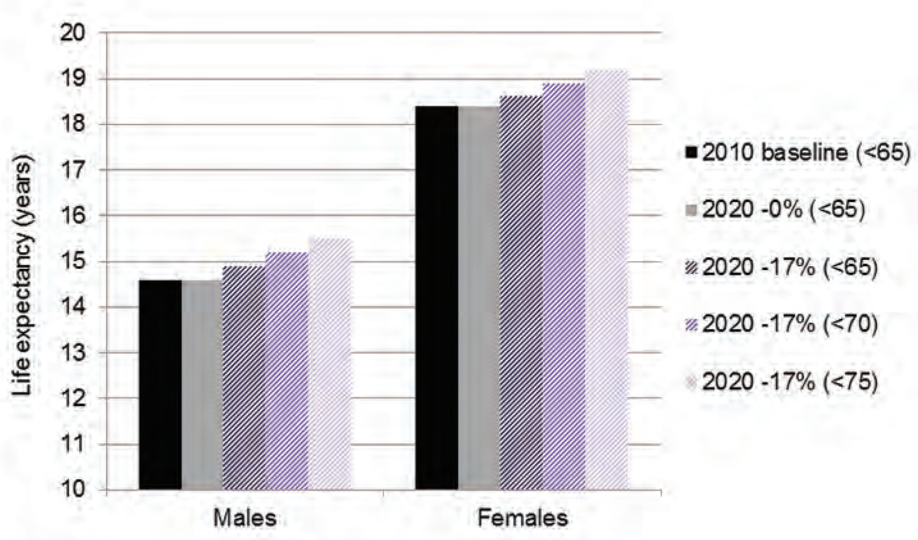
Fig. 42. Life expectancy at birth for 2010 (baseline) (<65 years) and 2020 assuming 0% (<65 years) and 17% reductions in NCD premature deaths (<65, <70 and <75 years)



For life expectancy at age 60, both males and females gain less than half a year given a 17% reduction in premature death rates under 65 years. For males, life expectancy at this age is just under 15 years, and for females under 19 years (Figure 43). The gain for each sex is almost a year when death rates are reduced for premature deaths under 75 years.

In summary, the most reliable indicators for monitoring progress are standardized YLL due to premature NCD death and life expectancy at any age. These indicators are comparable across time because they control for changes in population structure. The other indicators presented are intuitive and straightforward to calculate.

Fig. 43. Life expectancy at age 60, for 2010 (baseline) (<65 years) and 2020 assuming 0% (<65 years) and 17% reductions in NCD premature deaths (<65, <70 and <75 years)



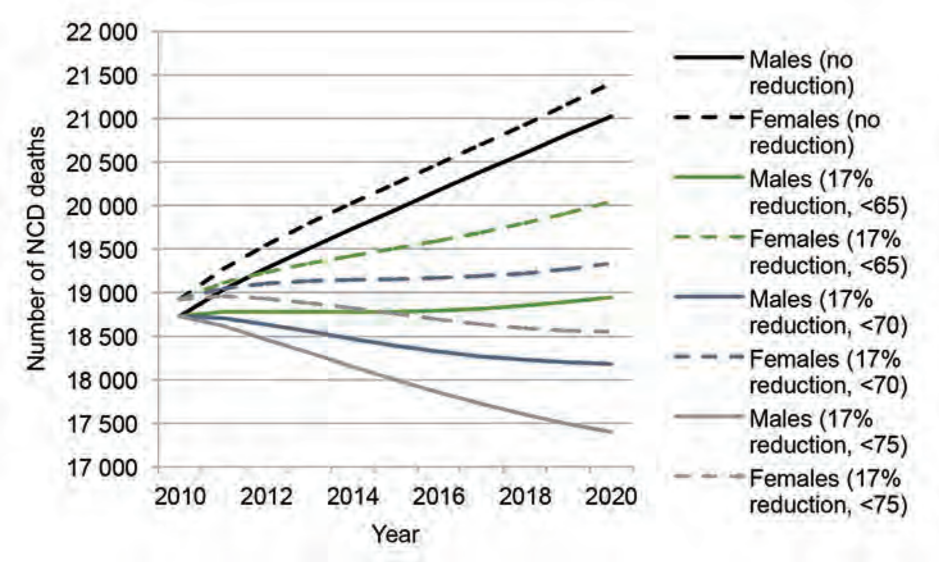
3.4 Meeting the target

A useful result of the simulation exercise was the possibility of plotting the expected total numbers of deaths from NCD each year over the target period (2010–2020) that would lead to the goal of a 17% reduction in NCD deaths by 2020. The estimates can serve as benchmarks, or interim objectives for monitoring progress towards the goal.

For males, when premature deaths were defined as those occurring in people under 65 years of age, the annual number of NCD deaths from 2010 to 2020 remained just below 19 000. On the other hand, if there were no reduction by 2020, the numbers would increase to 21 000 (Fig. 44). If the 17% reduction were applied to premature NCD death rates for those under 70 and 75 years, the number of annual NCD deaths would decrease to around 18 200 and 17 400, respectively, by 2020. Annex 6 presents the numbers of NCD-related deaths and non-NCD deaths.

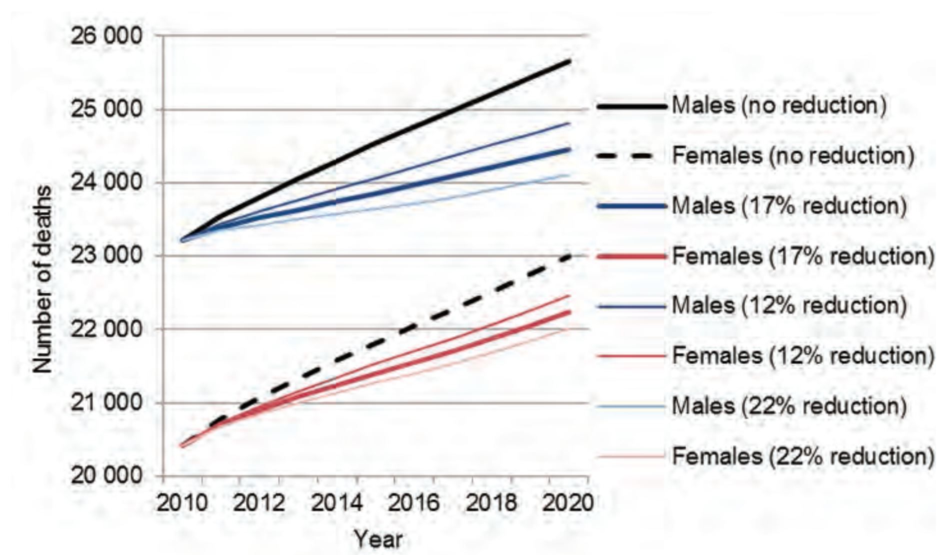
For females, a 17% reduction in premature NCD death rates for the under 65 year-olds resulted in 19 000–20 000 annual deaths from NCD over the 10-year period, instead of up to 21 500 by 2020 in case of no reduction. Reducing NCD death rates by 17% in the under-70 age group translated into 19 000–19 500 NCD deaths from 2010 to 2020; in the under-75 age group, the number was 18 500.

Fig. 44. Number of expected annual NCD-related deaths assuming no reduction and 17% reduction in premature NCD deaths (<65, <70 and <75), 2010–2020, by sex



Regarding the expected total number of deaths, when a reduction of 17% in premature NCD death rates from 2010 to 2020 was made, with premature deaths defined as those occurring in people under 65 years of age, about 1200 fewer male deaths were expected overall by 2020, and about 800 fewer females deaths (Fig. 45).

Fig. 45. Total number of expected deaths assuming 0%, 12%, 17% and 22% reduction in premature NCD deaths (<65), 2010–2020, by sex



For many years, the Republic of Moldova has invested efforts in collecting, tabulating and disseminating health and population data, which are evident from the consistency and completeness of the data and from their availability to outside users. The information that these data produce is routinely used by national specialists in policy-making, target-setting and monitoring progress towards the targets. This report has illustrated standard approaches to systematically reviewing the quality of the data, computing standard indicators, and operationalizing various assumptions made in monitoring the targets, such as those set by the Moldovan Ministry of Health to reduce NCD.

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Annex 1. Rankings of top 10 causes of death, Republic of Moldova, by absolute numbers of deaths and YLL (<65 years), four study periods, 1998–2010

Table 1.1. Top causes of death, by absolute number of deaths and YLL (<65 years), both sexes, 2009–2010

Cause	Rank by no. of deaths	% of total deaths	Rank by YLL	% of total YLL
Ischaemic heart disease	1	37.5	**2**	**9.6**
Cerebrovascular disease	2	14.7	**4**	**5.4**
Cirrhosis of the liver	3	7.9	**1**	**10.2**
Chronic obstructive pulmonary disease	4	3.0	-	-
Other unintentional injuries	5	2.2	**3**	**6.0**
Trachea, bronchus and lung cancers	6	2.1	**10**	**2.3**
Lower respiratory infections	7	2.1	**5**	**5.3**
Hypertensive disease	8	1.9	-	-
Cancer of colon and rectum	9	1.8	-	-
Other malignant neoplasms	10	1.7	**8**	**2.5**
Self-inflicted injuries	11	1.5	**6**	**4.9**
Other digestive diseases	12	1.5	**9**	**2.3**
Tuberculosis	13	1.3	**7**	**4.0**
Total top 10 deaths and YLL (% of total)		75.0		**52.7**
Total no. of deaths and YLL		85 774		**520 400**

Table 1.2. Top causes of death by absolute number of deaths and YLL (<65 years), both sexes, 2005–2008

Cause	Rank by no. of deaths	% of total deaths	Rank by YLL	% of total YLL
Ischaemic heart disease	1	36.8	**2**	**9.3**
Cerebrovascular disease	2	16.2	**5**	**5.7**
Cirrhosis of the liver	3	7.9	**1**	**9.5**
Chronic obstructive pulmonary disease	4	3.4	-	-
Lower respiratory infections	5	2.2	**3**	**5.9**
Other unintentional injuries	6	2.1	**4**	**5.8**
Trachea, bronchus and lung cancers	7	2.0	**10**	**1.8**

Table 1.2 contd.

Other malignant neoplasms	8	1.8	**6**	**2.7**
Other digestive diseases	9	1.7	**8**	**2.8**
Colon and rectum cancers	10	1.6	**-**	**-**
Tuberculosis	11	1.4	**6**	**4.5**
Self-inflicted injuries	12	1.4	**7**	**4.3**
Total top 10 deaths and YLL (% of total)		78.5		**52.4**
Total no. of deaths and YLL		172 824		**1 066 525**

Table 1.3. Top causes of death by absolute number of deaths and YLL (<65 years), both sexes, 2001–2004

Cause	Rank by no. of deaths	% of total deaths	Rank by YLL	% of total YLL
Ischaemic heart disease	1	38.0	**1**	**8.5**
Cerebrovascular disease	2	16.1	**5**	**5.6**
Cirrhosis of the liver	3	7.7	**2**	**7.8**
Chronic obstructive pulmonary disease	4	3.8	**-**	**-**
Other unintentional injuries	5	2.1	**-**	**-**
Trachea, bronchus and lung cancers	6	1.9	**3**	**6.4**
Lower respiratory infections	7	1.9	**10**	**1.9**
Other malignant neoplasms	8	1.8	**4**	**5.8**
Other digestive diseases	9	1.6	**8**	**2.9**
Self-inflicted injuries	10	1.5	**9**	**2.8**
Colon and rectum cancers	11	1.4	**7**	**4.3**
Tuberculosis	14	1.3	**6**	**4.4**
Total top 10 deaths and YLL (% of total)		76.3		**50.5**
Total no. of deaths and YLL		166 676		**1 052 613**

Table 1.4. Top causes of death by absolute number of deaths and YLL (<65 years), both sexes, 1998–2000

Cause	Rank by no. of deaths	% of total deaths	Rank by YLL	% of total YLL
Ischaemic heart disease	1	36.5	**1**	**7.1**
Cerebrovascular disease	2	15.1	**5**	**5.6**
Cirrhosis of the liver	3	6.9	**2**	**6.8**
Ill-defined diseases (ICD10 R00–R99)	4	4.3	-	-
Chronic obstructive pulmonary disease	5	3.6	-	-
Other unintentional injuries	6	1.9	**3**	**6.6**
Trachea, bronchus and lung cancers	7	1.9	**10**	**1.6**
Lower respiratory infections	8	1.9	**4**	**6.6**
Other malignant neoplasms	9	1.7	**8**	**2.7**
Other digestive diseases	10	1.6	**9**	**2.7**
Self-inflicted injuries	11	1.4	**7**	**3.6**
Tuberculosis	14	1.3	**6**	**3.8**
Total top 10 deaths and YLL (% of total)		75.3		**47.1**
Total no. of deaths and YLL		122 460		**849 140**

Annex 2. Rates of YLL due to premature deaths (<65 and <75 years), with 0%, 1.5% and 3% discounting, crude and standardized YLL per 10 000 population and YLL per death, Republic of Moldova, by four study periods, 1998–2020

Table 2.1. Crude YLL rates per 10 000 population (<65 and <75 years), with effects of discounting (1.5% and 3%), four study periods, 1998–2020

YLL (<75 years)	1998–2000	2001–2004	2005–2008	2009–2010
Male	1851.5	1812.2	1898.7	1921.6
Female	976.3	931.0	939.8	888.6
Both	1399.0	1357.5	1405.5	1391.4
YLL (<75 years) 1.5% discount				
Male	1473.3	1461.9	1547.0	1566.9
Female	789.2	765.1	775.0	735.5
Both	1119.6	1102.3	1149.9	1140.2
YLL (<75 years) 3% discount				
Male	1222.7	1224.1	1303.0	1321.2
Female	666.3	652.9	662.3	630.4
Both	935.1	929.3	973.5	966.6
YLL (<65 years)				
Male	1159.1	1105.0	1143.2	1147.1
Female	566.3	517.4	523.6	487.1
Both	856.4	805.3	828.3	812.3
YLL (<65 years) 1.5% discount				
Male	935.4	907.0	954.1	957.4
Female	453.4	423.4	432.3	404.0
Both	689.2	660.3	688.9	676.7
YLL (<65 years) 3% discount				
Male	783.7	769.5	819.8	823.3
Female	379.3	359.9	370.0	347.2
Both	577.1	560.6	591.2	581.7

Table 2.2. Standard rates of YLL per 10 000 persons (<65 and <75 years), with effects of discounting (1.5% and 3%), four study periods, 1998–2020

YLL (<75 years)	1998–2000	2001–2004	2005–2008	2009–2010
Male	2068.5	2005.9	2006.9	1973.8
Female	1052.2	1001.2	970.9	888.6
Both	1526.9	1469.9	1455.8	1400.3
YLL (<75 years) 1.5% discount				
Male	1672.3	1636.0	1648.5	1617.8
Female	845.4	813.6	790.0	724.8
Both	1229.0	1194.7	1189.6	1143.3
YLL (<75 years) 3% discount				
Male	1406.4	1384.3	1400.4	1372.8
Female	711.1	689.8	670.1	615.9
Both	1031.8	1009.8	1008.5	968.9
YLL (<65 years)				
Male	1155.1	1091.9	1081.4	1066.9
Female	574.5	527.7	511.1	463.1
Both	852.8	798.3	784.8	755.0
YLL (<65 years) 1.5% discount				
Male	942.3	899.3	901.3	886.1
Female	458.2	426.0	413.4	375.1
Both	689.2	651.9	646.7	621.1
YLL (<65 years) 3% discount				
Male	798.1	767.2	775.3	760.5
Female	382.9	359.3	349.2	317.1
Both	580.3	553.3	552.4	529.8

Table 2.3. YLL per death (<65 and <75 years), with effects of discounting (1.5% and 3%), four study periods, 1998–2020

YLL (<75 years)	1998–2000	2001–2004	2005–2008	2009–2010
Male	15.1	14.3	14.1	14.1
Female	9.0	8.3	8.1	7.7
Both	12.1	11.4	11.2	11.1
YLL (<75 years) 1.5% discount				
Male	12.0	11.5	11.5	11.5
Female	7.3	6.8	6.6	6.4
Both	9.7	9.3	9.2	9.1
YLL (<75 years) 3% discount				
Male	9.9	9.7	9.7	9.7
Female	6.2	5.8	5.7	5.5
Both	8.1	7.8	7.8	7.7
YLL (<65 years)				
Male	8.9	8.2	8.0	8.0
Female	4.8	4.3	4.1	3.9
Both	6.9	6.3	6.2	6.1
YLL (<65 years) 1.5% discount				
Male	7.2	6.8	6.7	6.6
Female	3.9	3.5	3.4	3.3
Both	5.6	5.2	5.1	5.1
YLL (<65 years) 3% discount				
Male	6.0	5.7	5.8	5.7
Female	3.2	3.0	2.9	2.8
Both	4.7	4.4	4.4	4.3

Annex 3. YLL of life lost (<65 years), rate of YLL per death and male-to-female (M:F) ratio of YLL, by top causes, Republic of Moldova, 2009–2010

Causes of death	YLL (<65)			Rate YLL per death			Ratio YLL M:F
	Males	Females	Both	Males	Females	Both	
Ischaemic heart disease	37 868	12 335	50 203	0.83	0.31	0.59	2.7
Cirrhosis of the liver	31 563	21 613	53 175	0.69	0.54	0.62	1.3
Other unintentional injuries	24 240	7 008	31 248	0.53	0.17	0.36	3.1
Self-inflicted injuries	22 108	3 540	25 648	0.49	0.09	0.30	5.5
Lower respiratory infections	19 925	7 478	27 403	0.44	0.19	0.32	2.4
Cerebrovascular disease	17 795	10 313	28 108	0.39	0.26	0.33	1.5
Tuberculosis	17 453	3 178	20 630	0.38	0.08	0.24	4.9
Breast cancer	143	6 028	6 170	0.00	0.15	0.07	0.0
All other causes	190 985	86 833	277 818	4.20	2.16	3.24	1.9
Total	362 078	158 323	520 400	7.96	3.93	6.07	2.0

Annex 4. Top 10 causes of death by YLL (< 65 years) and percentage of top 10 YLL of YLL for all causes, Republic of Moldova, 2009-2010

YLL rank	Male			Female			Both		
	Cause (ranking in absolute nos)	YLL <65	% of total	Cause (ranking in absolute nos)	YLL <65	% of total	Cause (ranking in absolute nos)	YLL <65	% of total
1	Ischaemic heart disease (1)	37 868	10.5	Cirrhosis of the liver (3)	21 613	13.7	Cirrhosis of the liver (3)	53 175	10.2
2	Cirrhosis of the liver (3)	31 563	8.7	Ischaemic heart disease (1)	12 335	7.8	Ischaemic heart disease (1)	50 203	9.6
3	Other unintentional injuries (5)	24 240	6.7	Cerebrovascular disease (2)	10 313	6.5	Other unintentional injuries (5)	31 248	6.0
4	Self-inflicted injuries (8)	22 108	6.1	Lower respiratory infections (10)	7 478	4.7	Cerebrovascular disease (2)	28 108	5.4
5	Lower respiratory infections (7)	19 925	5.5	Other unintentional injuries (5)	7 008	4.4	Lower respiratory infections (7)	27 403	5.3
6	Cerebrovascular disease (2)	17 795	4.9	Other malignant neoplasms (9)	4 045	2.6	Self-inflicted injuries (11)	25 648	4.9
7	Tuberculosis (9)	17 453	4.8	Other digestive diseases (8)	3 605	2.3	Tuberculosis (13)	20 630	4.0
8	Other malignant neoplasms (10)	9 133	2.5	Self-inflicted injuries (>20)	3 540	2.2	Other malignant neoplasms (10)	13 178	2.5
9	Trachea, bronchus and lung cancers (6)	8 775	2.4	Tuberculosis (>20)	3 178	2.0	Other digestive diseases (12)	12 223	2.3
10	Other digestive diseases (12)	8 618	2.4	Colon and rectum cancers (7)	2 495	1.6	Trachea, bronchus and lung cancers (6)	10 245	2.0
	Chronic obstructive pulmonary disease (4)	3 168	0.9	Trachea, bronchus and lung cancers (6)	1 470	0.9	Colon and rectum cancers (9)	5 605	1.1
	Colon and rectum cancers (9)	3 110	0.9	Hypertensive disease (4)	690	0.4	Chronic obstructive pulmonary disease (4)	3 850	0.7
	Hypertensive disease (14)	1 058	0.3	Chronic obstructive pulmonary disease (5)	683	0.4	Hypertensive disease (8)	1 748	0.3
	Breast cancer (>20)	143	0.0	Breast cancer (6)	423	0.3	Breast cancer (14)	423	0.1
	Total for top 10 causes	197 475	54.5		75 608	47.8		272 058	52.3
	Total YLL for all causes	362 078	100.0		158 323	100.0		520 400	100.0

Annex 5. Reported annual population 2005–2010 and projected annual population 2011–2020, Republic of Moldova, assuming 0% and 17% reduction in premature NCD death rates (<65 years)

Year	Reported population 2005-2010		Projected population 2011-2020			
			0% reduction		17% reduction	
	Male	Female	Male	Female	Male	Female
2005	1 722 105	1 873 080				
2006	1 720 139	1 865 070				
2007	1 719 246	1 857 664				
2008	1 716 195	1 853 913				
2009	1 714 209	1 851 395				
2010	1 712 783	1 849 262				
2011			1 710 181	1 848 302	1 710 106	1 848 258
2012			1 707 194	1 846 902	1 706 746	1 846 646
2013			1 704 228	1 845 486	1 703 111	1 844 847
2014			1 701 297	1 844 080	1 699 213	1 842 885
2015			1 698 406	1 842 699	1 695 063	1 840 777
2016			1 695 557	1 841 353	1 690 666	1 838 530
2017			1 692 750	1 840 042	1 686 024	1 836 149
2018			1 689 984	1 838 765	1 681 142	1 833 631
2019			1 687 257	1 837 513	1 676 023	1 830 972
2020			1 684 571	1 836 281	1 670 670	1 828 167

Annex 6. Number of expected non-NCD- and NCD-related deaths, Republic of Moldova, assuming 0% and 17% reduction of premature NCD death rates (<65, <70 and <75), by sex, 2010–2020

Year	0% reduction in NCD death rates				17% reduction in NCD death rates (<65)			
	NCD	non-NCD	NCD	non-NCD	NCD	non-NCD	NCD	non-NCD
	Males		Females		Males		Females	
2010	18 725	4 486	18 923	1 501	18 725	4 486	18 923	1 501
2011	19 030	4 512	19 269	1515	18 780	4 616	19 114	1 585
2012	19 276	4 532	19 545	1 526	18 782	4 739	19 236	1 666
2013	19 509	4 550	19 797	1 537	18 778	4 858	19 336	1 745
2014	19 734	4 566	20 032	1 547	18 776	4 970	19 423	1 820
2015	19 954	4 581	20 257	1 556	18 780	5 076	19 507	1 891
2016	20 172	4 593	20 479	1 564	18 793	5 175	19 594	1 958
2017	20 388	4 604	20 701	1 572	18 818	5 268	19 689	2 022
2018	20 603	4 613	20 929	1 580	18 853	5 355	19 795	2 081
2019	20 815	4 620	21 162	1 587	18 896	5 437	19 915	2 137
2020	21 023	4 626	21 400	1 594	18 945	5 513	20 047	2 189

Year	17% reduction in NCD death rates (<70)				17% reduction in NCD death rates (<75)			
	NCD	non-NCD	NCD	non-NCD	NCD	non-NCD	NCD	non-NCD
	Males		Females		Males		Females	
2010	18 725	4 486	18 923	1 501	18 725	4 486	18 923	1 501
2011	18 707	4 650	19 049	1 617	18 618	4 695	18 957	1 662
2012	18 635	4 810	19 104	1 730	18 464	4 895	18 930	1 816
2013	18 553	4 966	19 134	1 842	18 307	5 090	18 884	1 966
2014	18 469	5 118	19 149	1 952	18 150	5 281	18 824	2 114
2015	18 391	5 265	19 158	2 059	17 997	5 469	18 759	2 260
2016	18 323	5 406	19 169	2 164	17 853	5 652	18 694	2 403
2017	18 268	5 540	19 188	2 264	17 720	5 830	18 637	2 544
2018	18 226	5 667	19 221	2 359	17 601	6 002	18 592	2 681
2019	18 198	5 787	19 270	2 450	17 494	6 168	18 562	2 814
2020	18 180	5 901	19 336	2 535	17 401	6 327	18 551	2 942

World Health Organization

REGIONAL OFFICE FOR **Europe**

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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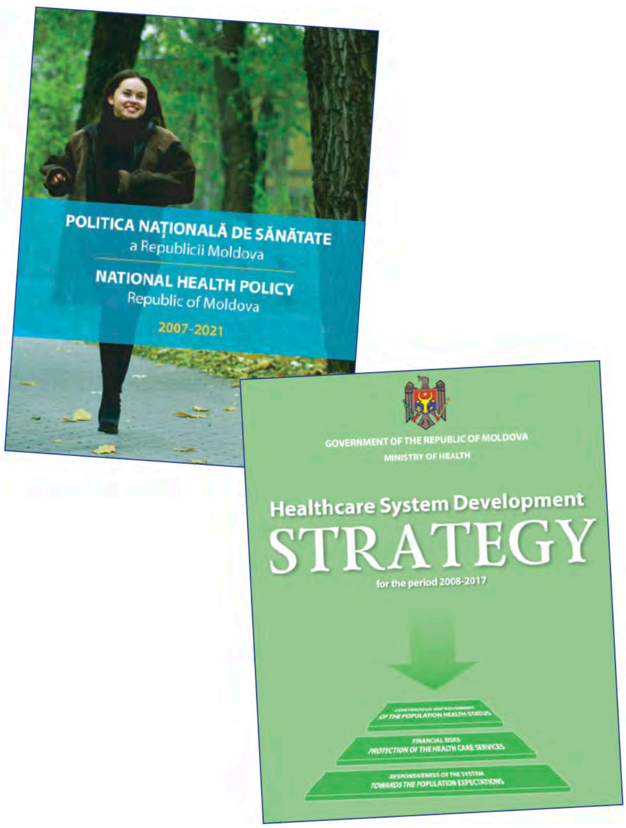

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