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REPORT

# The Burden of Disease in Singapore, 1990–2017

## An overview of the Global Burden of Disease Study 2017 results

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This report was prepared by the Institute for Health Metrics and Evaluation, in collaboration with the Singapore Ministry of Health, after the GBD 2017 results were released on November 8, 2018.

Estimates from the GBD study may differ from national statistics due to differences in data sources and methodology. The estimates are available from vizhub.healthdata.org/gbd-compare and http://ghdx.healthdata.org/gbd-results-tool.

This report is not intended to give a full explanation of the methodology of the GBD study. Those who are interested in methodological details are invited to read the GBD 2017 capstone papers (available at www.thelancet.com/gbd) and other relevant documents (available at ghdx.healthdata.org/gbd-2017).

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# About the Singapore Ministry of Health

The mission of the Singapore Ministry of Health (MOH) is to be an innovative and people-centred organisation to promote good health and reduce illness, ensure that Singaporeans have access to good and affordable health care that is appropriate to needs, and to pursue medical excellence. These are achieved through the following strategies:

## Promote good health and reduce illness

Good health is to a great extent the responsibility of the individual. MOH plays a major role in educating and providing information to the Singapore public on how they can maintain a healthy lifestyle. The Ministry also plays a key role in reducing illnesses in Singapore through the prevention and control of diseases and ensuring the appropriate allocation of health resources.

## Ensure access to good and affordable health care that is appropriate to needs

MOH is responsible for ensuring that health care in Singapore is characterised by professional standards and good clinical outcomes, and that the services delivered are appropriate to each patient's needs. While the principle of copayment is emphasised, the Ministry also ensures that health care remains affordable to Singaporeans through significant government subsidies and risk pooling via insurance, effectively balancing individual and collective responsibility.

## Pursue medical excellence

Singapore's health care system is well-regarded. The Ministry strives to promote a culture of medical excellence in public health care institutions, while ensuring affordable, cost-effective, and appropriate care, for the greater benefit of Singaporeans.

# About IHME

The Institute for Health Metrics and Evaluation (IHME) at the University of Washington in Seattle is an independent health research centre. IHME aims to improve health by making rigorous and comparable measurements of the world's health problems freely available to researchers, donors, policymakers, and other decision-makers.

# About the GBD study

The Global Burden of Diseases, Injuries, and Risk Factors Study (GBD) is an international collaboration, consisting of over 3,600 collaborators in more than 140 countries and territories, to measure the impact of health problems on people. GBD is coordinated by IHME and produced annually. GBD 2017, released on November 8, 2018, included over 38 billion health estimates on 359 causes of disease and injury and 84 health risk factors in 195 countries and territories. Its methods and metrics emphasise comparability among causes that kill and causes that disable, giving policymakers the most complete possible perspective on the causes of all health problems experienced by people.

# Acknowledgments

The findings in this report came from the 2017 Global Burden of Diseases, Injuries, and Risk Factors Study. The GBD 2017 study's findings were initially published in *The Lancet* on November 8, 2018. Those papers are freely available to the public at www.thelancet.com/gbd.

Within the Singapore MOH, Benjamin Er oversaw the creation of this report, with advice from Drs. Derrick Heng, Lyn James, and Stefan Ma, and support from Zheng Zhao, Yi-Xian Chua, and Wei-Liang Chaw. Within IHME, this report was written by Sean McKee. The analyses in this report were executed by Varsha Krish. Julia Gall provided overarching communications support in conjunction with the MOH team. Joan Williams managed the report's production support and content review. Adrienne Chew edited the report, and Pauline Kim fact-checked it. Michaela Loeffler served as the report's graphic designer.

# Foreword

The Singapore Ministry of Health (MOH) embarked on its inaugural burden of disease study in the 2000s to quantify the extent and distribution of health problems in Singapore. This resulted in the Singapore Burden of Disease (SBOD) studies for reference years 2004, 2007, and 2010, in which the Ministry produced its own set of disease burden estimates for the Singapore resident population using methods consistent with the World Health Organization's Global Burden of Disease (GBD) studies.

With the establishment of the Institute for Health Metrics and Evaluation (IHME) and the subsequent regular publication of IHME-coordinated GBD study estimates from 2012, it became clear to MOH that there were benefits in closer collaboration with IHME. First, it would resolve inconsistencies between MOH's independent set of estimates and those produced by the IHME-coordinated GBD that arose from the use of different data sources and methodologies. Second, it would reduce duplication of effort by both parties in quantifying disease burden for Singapore. Third, there has been sustained interest in benchmarking disease burden estimates for Singapore internationally, and thus estimates have to be standardised and produced within a systematic framework.

A memorandum of understanding between MOH and IHME was signed in August 2015 with the purpose of producing a single but comprehensive set of estimates of the burden of diseases, injuries, and risk factors for Singapore on a yearly basis, as part of the GBD study. Since then, MOH has been sharing the latest available data with IHME to ensure that estimates from the study are valid and explainable in the local context. The Ministry has performed intensive reviews of the data sources and methodologies used in the GBD 2016 and 2017 studies.

Findings from the most recent iteration of the GBD study for reference year 2017 were published in *The Lancet* on 8 November 2018. This report presents updated findings for Singapore from the GBD 2017 study and provides a comprehensive look at the burden of diseases and injuries in Singapore across time. It also gives an overview of the metrics used to quantify disease burden, zooms in on key findings, and benchmarks these findings for Singapore against other locations in a comparative framework.

We hope that the findings presented in this report will inform the general public on the state of health in Singapore and, perhaps even more importantly, help guide health care administrators and policymakers toward the informed formulation and implementation of national health policies.

**A/Prof Benjamin Ong**
DIRECTOR OF MEDICAL SERVICES, MOH

# Preface

When the Global Burden of Disease was initially published in 1993, several countries led the way in adopting the concept and applying it in their own setting. Singapore's Ministry of Health was one of those early adopters and, since the early 2000s, has trained many of its staff in burden concepts and embedded burden estimation into its decision-making culture. It is in part because of the strong emphasis that institutions like the MOH placed on GBD in its infancy that GBD has been able to grow to the size and impact that we see today. When the Institute for Health Metrics and Evaluation (IHME) began to revitalize the GBD enterprise with a wider-spread collaborator network, it was a natural fit to start working closely with the Ministry of Health. IHME has learned immensely from this institutional collaboration. Together IHME and Singapore's MOH have been able to strengthen the methods, expand the access to health data, and produce in partnership the most rigorous results to date estimating Singapore's burden of disease from 1990 to the present.

This report highlights the knowledge gained from our valuable partnership. On the one hand, the GBD 2017 estimates indicate that people in Singapore already live longer, healthier lives than most people around the world. But like people in many other relatively healthy, wealthy places, the gains Singaporeans have made in life expectancy have not been matched by improvements in rates of disability – which means that the years Singaporeans have gained are too often spent coping with age-related health problems. At the same time, we have been able to learn how to better present the GBD results and concepts to others by learning from the experience the MOH had within its own institution over many years.

This report is a testament to the continuing efforts by Singapore's government to help Singaporeans live longer lives with less time spent in ill health. The GBD estimates – including healthy life expectancy, which the Singapore MOH has adopted as a key health system indicator – are the most effective way for Singapore to compare the burden of disease within the country and over time, identify successes and challenges, and allocate resources effectively in the pursuit of better health for all its population. I celebrate this goal and congratulate the Ministry of Health in its efforts to improve the lives of all Singaporeans.

Christopher J.L. Murray
DIRECTOR, IHME

# Glossary of terms and concepts

**AGE-STANDARDISATION**
A statistical technique used to compare the health of populations with different age structures. It is useful because populations with different age structures (for example, more younger or older people than a comparison population) will naturally differ in their burdens of diseases that tend to affect people at certain ages (e.g., ischaemic heart disease, which kills in old age, or malaria, which kills mostly during early childhood). Age-standardisation reduces bias in comparisons between such groups. GBD uses a study-specific set of population weights that were originally derived from the World Health Organization standard and then refined over time.

**DISABILITY**
Non-fatal morbidity – that is, living in ill health. Within GBD, the term "disability" refers to all non-fatal health loss caused by disease (such as pneumonia or depressive disorder) or injury (such as chronic low back pain or acute trauma from a traffic accident). It is not synonymous with colloquial uses of "disability" to mean physical or mental handicaps.

**DISABILITY-ADJUSTED LIFE YEARS (DALYS)**
Years of healthy life lost to premature death and disability. DALYs are the sum of years of life lost (YLLS) and years lived with disability (YLDS).

**HEALTHY LIFE EXPECTANCY (HALE)**
The number of years that a person at a given age can expect to live in full health, taking into account mortality and disability.

**LIFE EXPECTANCY (LE)**
The number of years that a person at a given age can expect to live.

**RISK-ATTRIBUTABLE BURDEN**
The share of the burden of a disease that can be estimated to occur due to exposure to a particular risk factor.

**RISK FACTORS**
Potentially modifiable causes of disease and injury.

**YEARS OF LIFE LOST (YLLS)**
Years of life lost due to premature mortality.

**YEARS LIVED WITH DISABILITY (YLDS)**
Years lived in less than perfect health. YLDs take into account both the severity and the length of time lived with a disability, so they can measure health loss from short-term, acute periods of disability and long-term periods of chronic disability.

# Acronyms used

| | |
|---|---|
| **DALYs** | Disability-adjusted life years |
| **GBD** | Global Burden of Diseases, Injuries, and Risk Factors Study |
| **HALE** | Healthy life expectancy |
| **IHME** | Institute for Health Metrics and Evaluation |
| **LE** | Life expectancy |
| **MOH** | Ministry of Health (Singapore) |
| **OECD** | Organisation for Economic Co-operation and Development |
| **HK SAR** | Hong Kong Special Administrative Region of China |
| **YLDs** | Years lived with disability |
| **YLLs** | Years of life lost |

# Level 1 and 2 GBD causes and risk factors

The causes and risk factors studied by GBD are arranged in hierarchical nested categories, referred to as "levels." At the highest level, Level 1, causes are split into very large categories: communicable, maternal, neonatal, and nutritional causes; non-communicable diseases; and injuries. The Level 1 risk factors are behavioural; metabolic; and environmental or occupational risks. Each Level 1 cause or risk can be broken down into Level 2 causes or risks, and those, in turn, can be further broken down to Levels 3 and 4. Most of this report focuses on Level 1 and 2 causes and risks. Those are listed by cause and risk group in Table 1.

TABLE 1

GBD 2017 causes and risk factors, Levels 1 and 2

| Causes of disease and injury | |
|---|---|
| **Level 1** | **Level 2** |
| Communicable, maternal, neonatal, and nutritional diseases | Enteric infections |
| | HIV/AIDS and sexually transmitted infections |
| | Maternal and neonatal disorders |
| | Neglected tropical diseases and malaria |
| | Nutritional deficiencies |
| | Other infectious diseases[1] |
| | Respiratory infections and tuberculosis |
| Non-communicable diseases | Cardiovascular diseases |
| | Chronic respiratory diseases |
| | Diabetes and kidney diseases |
| | Digestive diseases |
| | Mental disorders |
| | Musculoskeletal disorders |
| | Cancers |
| | Neurological disorders |
| | Other non-communicable diseases[2] |
| | Sense organ diseases |
| | Skin and subcutaneous diseases |
| | Substance use disorders |
| Injuries | Self-harm and interpersonal violence |
| | Transport injuries |
| | Unintentional injuries |

[1] *"Other infectious diseases" includes diseases such as hepatitis, meningitis, and measles.*
[2] *"Other non-communicable diseases" includes several categories of disease, such as birth defects, gynaecological diseases, and oral disorders, such as cavities and periodontal diseases.*

| Risk factors affecting health | |
|---|---|
| **Level 1** | **Level 2** |
| Metabolic risks | High blood sugar |
| | Obesity and overweight |
| | High cholesterol |
| | High blood pressure |
| | Impaired kidney function |
| | Low bone mineral density |
| Environmental/occupational risks | Air pollution |
| | Occupational risks |
| | Other environmental risks[3] |
| | Unsafe water, sanitation, and handwashing |
| Behavioural risks | Alcohol use |
| | Child and maternal malnutrition |
| | Childhood maltreatment |
| | Dietary risks |
| | Drug use |
| | Intimate partner violence |
| | Low physical activity |
| | Tobacco |
| | Unsafe sex |

[3] *"Other environmental risks" is composed of lead exposure and residential radon exposure.*

# Report highlights

## Longer but not necessarily healther lives

Between 1990 and 2017, life expectancy at birth in Singapore rose 8.7 years, to 84.8 years. Healthy life expectancy at birth, however, rose only 7.2 years, to 74.2 years. Gains in the number of years expected to be spent in good health did not match gains in the number of years expected to be lived.

## The burdens of early death and disability

While Singapore's burden of early death (measured in years of life lost, or YLLs) has declined, the rates at which Singaporeans experience ill health (measured in years lived with disability, or YLDs) have remained relatively constant over time. This indicates that Singapore, like most places in the world, has not been as successful at preventing ill health as it has been in preventing early death.

The largest contributors to Singapore's combined burden of early death and disability (measured in disability-adjusted life years, or DALYs) were cardiovascular diseases (14.2% of total DALYs), cancers (13.4%), musculoskeletal disorders (12.6%), and mental disorders (10.2%).

The causes of DALYs that showed the largest increases between 1990 and 2017 were sense organ diseases, such as hearing loss and vision impairments (which increased in number of DALYs by 124.5%), neurological disorders, which includes Alzheimer's disease and other dementias (which increased by 104.6%), and musculoskeletal disorders (which increased by 99.8%). All of these increases were driven mainly by Singapore's ageing population.

The burden of YLLs was dominated by three causes which, when combined, accounted for approximately 70% of Singapore's YLLs: cancers (31.8% of total YLLs), cardiovascular diseases (28.5%), and lower respiratory infections, which includes pneumonia (10.1%).

The main causes of YLDs in Singapore were non-communicable diseases. The leading causes changed relatively little over time – in both 1990 and 2017, the four leading causes of YLDs were, in order, musculoskeletal disorders (which caused 20.7% of YLDs in 2017), mental disorders (17%), unintentional injuries (8.7%), and neurological disorders (7.7%).

## Risk factors affecting health

The leading risk factors affecting health in Singapore in 2017 were dietary risks, tobacco, high blood pressure, and high blood sugar.

Between 1990 and 2017, overweight and obesity rose from Singapore's eighth leading risk factor to its fifth. The number of DALYs caused by overweight and obesity rose 141% during that time. In 2017, overweight and obesity contributed to 6.4% of Singapore's DALYs, up from 3.9% in 1990.

## International comparisons

In 2017, people in Singapore had the highest life expectancy at birth (84.8 years) and healthy life expectancy at birth (74.2 years) among countries in the world.

Among a comparison group of peer locations composed of the Hong Kong Special Administrative Region of China (HK SAR) and the member nations of the Organisation for Economic Co-operation and Development (OECD), Singapore had significantly lower-than-average (i.e., better) rates of age-standardised DALYs in nine of Singapore's 10 leading causes of early death and disability. It had significantly higher-than-average rates of DALYs due to lower respiratory infections and tuberculosis, a category that includes pneumonia.

Compared to its peer locations in 2017, Singapore had significantly lower-than-average rates of age-standardised DALYs attributable to eight of the 10 leading risk factors affecting health in Singapore. It had average rates of early death and disability attributable to air pollution and impaired kidney function.

# Findings from GBD 2017

## Life expectancy and healthy life expectancy

One of the most common ways of assessing health within populations is life expectancy (LE), or the average number of years a person can expect to live from any given age. Singapore performs very well by this measure. In 1990, LE at birth in Singapore was 76.1 years. By 2017, Singapore's LE at birth had risen to 84.8 years.

While LE is a useful measure, however, it only measures the *quantity* of time spent alive. In order to assess the *quality* of health experienced by Singaporeans, the Singapore Ministry of Health (MOH) has adopted healthy life expectancy (HALE) as a key performance indicator. HALE is the average number of years a person can expect to live *in full health* from any given age. It is calculated by subtracting the number of years a person can expect to live in poor health from that person's LE.

Thus, HALE is equal to LE minus the number of years expected to be spent in poor health.

Figure 1 illustrates Singapore's LE and HALE at birth from 1990 to 2017. In 2017, HALE at birth in Singapore was 74.2 years, up from 67.1 in 1990. That means the average Singaporean born in 2017 could expect to live for 84.8 years, but that 10.6 of those years would be spent in poor health. In 1990, the difference between LE and HALE was 9.0 years. The difference between LE and HALE at birth, then, has grown by 1.5 years. That trend can be observed in Figure 1. It is due, in part, to an ageing population combined with the tendency for older people to have higher rates of chronic disease and disability than younger ones. Together, those trends result in more time spent in ill health across the population.

FIGURE 1

Life expectancy and healthy life expectancy at birth in Singapore, both sexes, 1990–2017

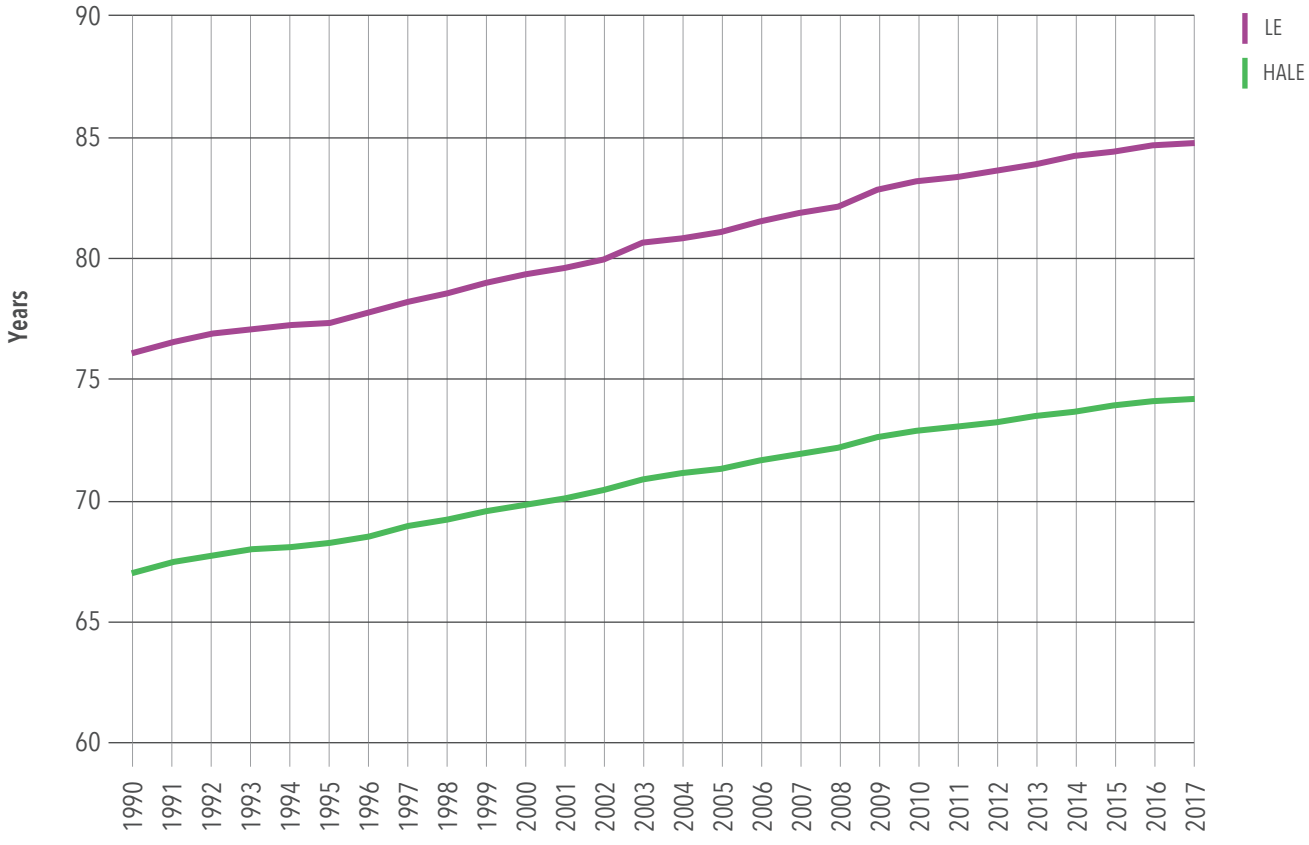


TABLE 2

Life expectancy and healthy life expectancy at birth, males and females, 1990 and 2017

| | LE at birth in years | | HALE at birth in years | | Difference LE–HALE in years | |
|---|---|---|---|---|---|---|
| | 1990 | 2017 | 1990 | 2017 | 1990 | 2017 |
| Males | 73.5 | 81.9 | 65.6 | 72.6 | 7.9 | 9.3 |
| Females | 78.8 | 87.6 | 68.5 | 75.8 | 10.3 | 11.8 |
| Difference females–males | 5.3 | 5.7 | 2.9 | 3.2 | 2.4 | 2.5 |

Information on the drivers of changes in Singapore's LE at birth between 1990 and 2017 is available in Appendix Figures 26 and 27. Those figures break down how changes in life expectancy at birth for males and females were driven by changes in Singaporean mortality rates for specific causes of disease.

LE and HALE vary by sex. In Singapore – as in most places in the world – females tend to live longer than males. Table 2 breaks down LE and HALE for females and males over time. In 2017, females in Singapore had a longer LE at birth (by 5.7 years) and HALE at birth (by 3.2 years) than males. Those differences have increased slightly since 1990, when they were 5.3 years for LE and 2.9 years for HALE.

While Singaporean females have had longer life expectancies, they have spent sizeable portions of that extra time coping with ill health. In 1990, the gap between LE and HALE (i.e., expected number of years spent in ill health) was 2.4 years larger for females than it was for males. In 2017, it was 2.5 years larger. Despite gains in female LE since 1990, females have continued to experience higher rates of disability than males.

Singapore faces a challenge shared by many nations: how to increase LE while simultaneously decreasing the amount of time people spend in poor health. This goal of longer lifespans and less time spent living with illness has not yet been achieved consistently by any country.

## Three key GBD metrics

The GBD study produces estimates describing many aspects of population health, but the study's most fundamental metrics are years of life lost (YLLs), years lived with disability (YLDs), and disability-adjusted life years (DALYs).

### YLLs

YLLs measure the years lost to premature death within a population. They are calculated by subtracting age of death from the age of ideal LE at the age of death. Therefore, the number of YLLs resulting from deaths at age 60 are much lower than those from deaths at age 2. For people tracking population health, YLLs are useful for assessing the burden of diseases whose effects are primarily fatal, not disabling. Causes of death such as cardiovascular diseases, suicide, and acute infectious diseases are effectively measured using YLLs.

### YLDs

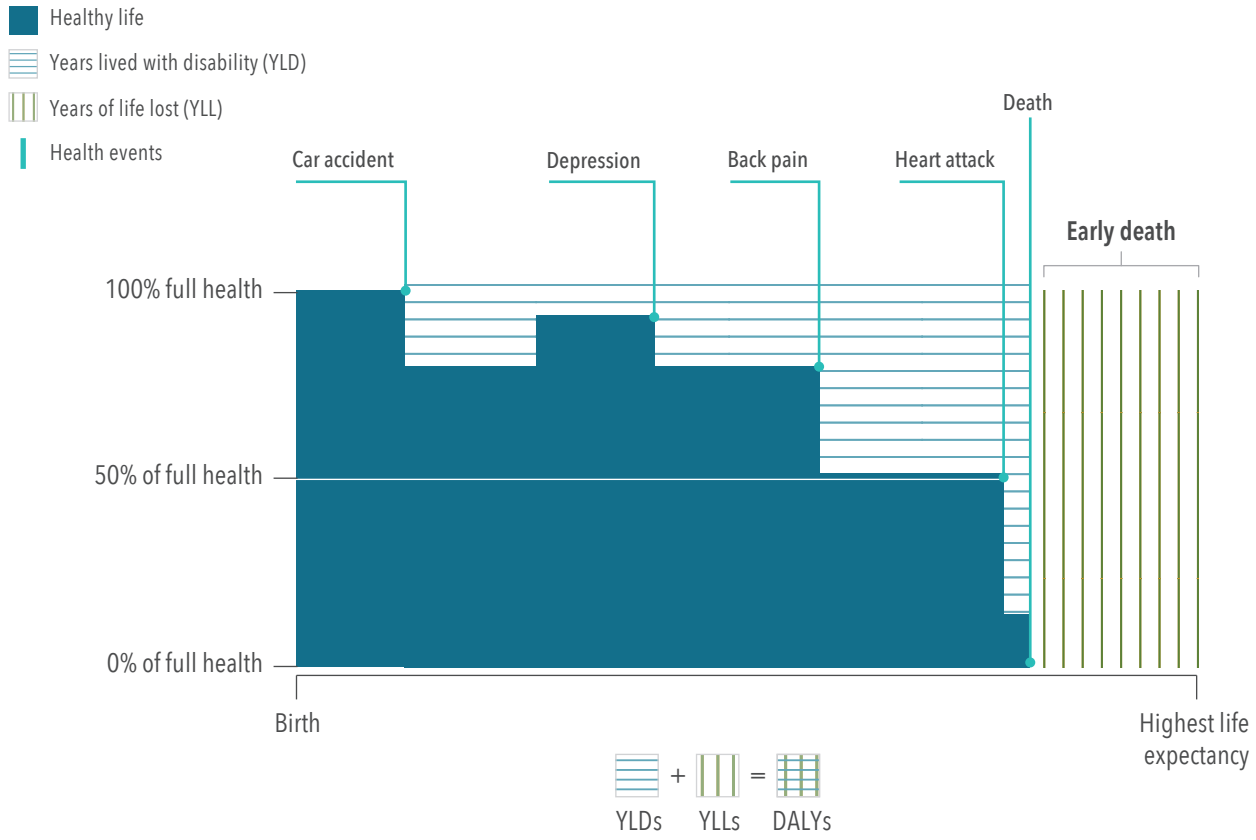
YLDs measure the years with health loss due to non-fatal causes of disease and injury, i.e., disability, within a population. Their calculation includes measuring both the time spent with a disability and the severity of that disability. A year spent coping with schizophrenia, therefore, results in more YLDs than a year spent with acne. YLDs recognise that good health is not just about being alive – it is about being alive *and well.* Diseases that debilitate people but do not generally kill them, such as anxiety disorders or back and neck pain, are effectively measured using YLDs.

### DALYs

DALYs are simply the sum of YLLs and YLDs. Therefore, DALYs are a composite measure of all health loss within a population, including that from non-fatal causes of poor health and from early death. Figure 2 illustrates the DALYs concept using a simplified, individual-level example. It shows non-fatal health loss (and some

FIGURE 2

Understanding disability-adjusted life years (DALYs)




recovery) after a car accident, then increasing disability due to depression and back pain, before a heart attack causes additional disability and then, shortly afterward, premature death. Adding together the YLLs and YLDs yields DALYs, or the total amount of health loss, expressed in years, experienced by this person. Adding up all the DALYs experienced by the people in a population yields a population-level view of overall health loss.

Because they combine the burden of both fatal and non-fatal health loss, DALYs are an excellent way to assess the overall health of a population or the overall impact of diseases that cause both early death and disability – diabetes, for example. Furthermore, they provide a way to compare the burden of diseases that kill and diseases that disable.

## All-cause YLLs, YLDs, and DALYs in Singapore

Considering the YLLs, YLDs, and DALYs due to all causes of ill health illustrates how YLLs, YLDs, and DALYs relate to each other and offers a high-level picture of health in Singapore over time.

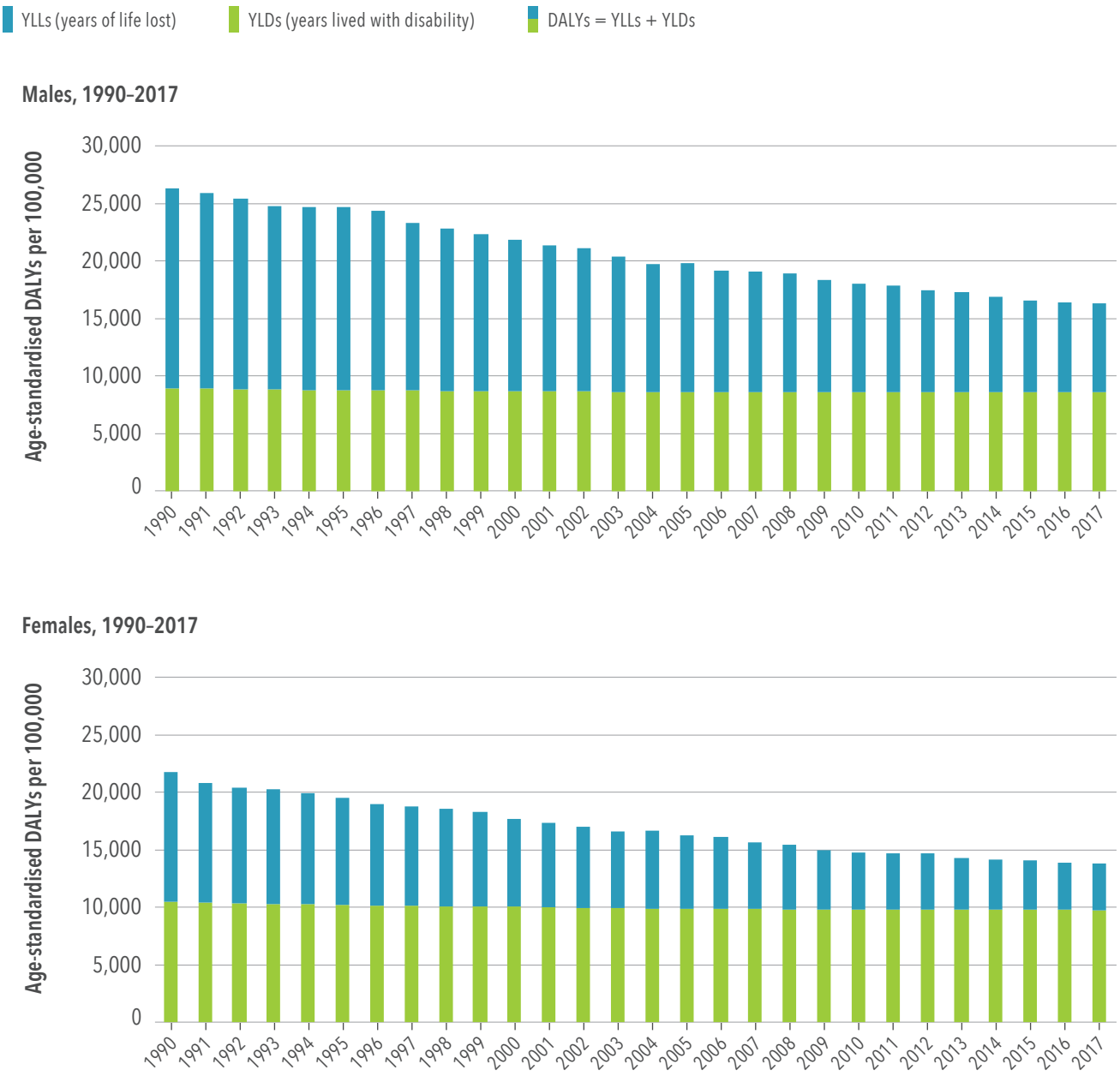
Figure 3 shows the male and female burdens of YLLs, YLDs, and, taken together, DALYs over time. It presents those metrics as age-standardised rates in order to control for changes in the age structure of Singapore's population between 1990 and 2017. Because Singapore's population grew older between 1990 and 2017, using rates that are not age-standardised would provide a biased picture of changes in Singapore's health.

Figure 3 shows several key trends in Singaporean health over the past 27 years. Overall, people in Singapore have become healthier, but most of that improvement was due to reductions in YLLs. By contrast, the rate of YLDs was nearly constant. People in Singapore are living longer, but they have been experiencing similar rates of non-fatal health loss since 1990.

Males experienced greater overall disease burden, but that was due primarily to males having higher levels of YLLs than females. Females had lower overall disease burden than males, but they experienced higher rates of disability than males. This pattern is a common one to find all over the world.

FIGURE 3

All-cause disease burden in Singapore, 1990–2017



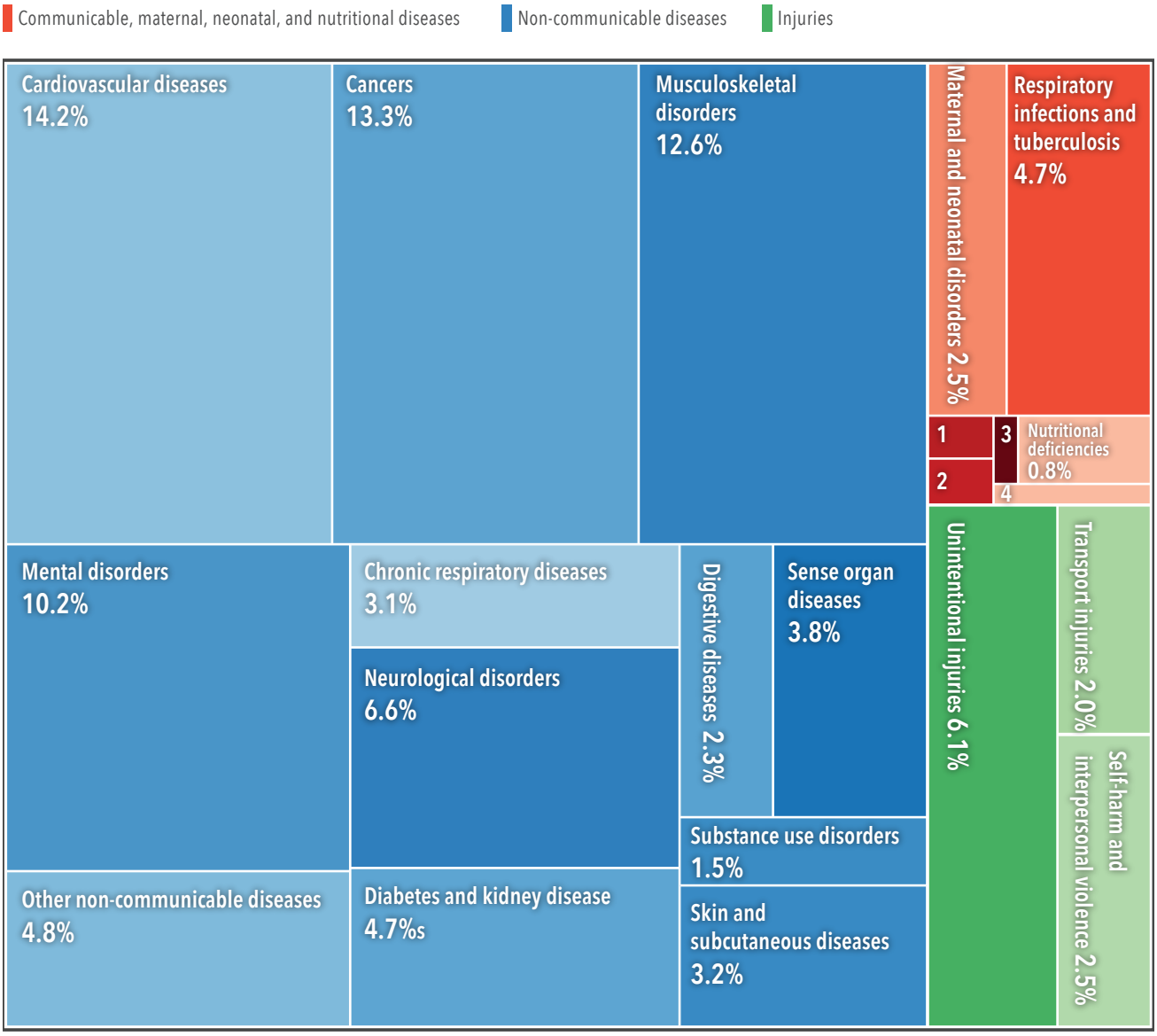

## DALYs

Because they summarise the burden of both early death and time spent with disability, DALYs provide an overview of Singapore's overall population health.

Figure 4 shows Singapore's total DALYs in 2017, broken down by cause. The largest contributors, by far, to Singapore's disease burden were non-communicable diseases (80.3% of the total burden). Of those non-communicable causes of disease, the largest burdens were for cardiovascular diseases (14.2% of total DALYs – not just DALYs due to non-communicable causes), cancers (13.4%), musculoskeletal disorders (12.6%), and mental disorders (10.2%). It is notable that the top four causes of DALYs in Singapore included both primarily fatal (cardiovascular diseases and cancers) and primarily disabling (musculoskeletal disorders and mental disorders) causes of disease.

FIGURE 4

## Distribution of total DALYs by cause, Singapore, both sexes, 2017




1. Enteric infections **0.3%**
2. HIV/AIDS and sexually transmitted infections **0.3%**
3. Neglected tropical diseases and malaria **0.2%**
4. Other infectious diseases **0.3%**

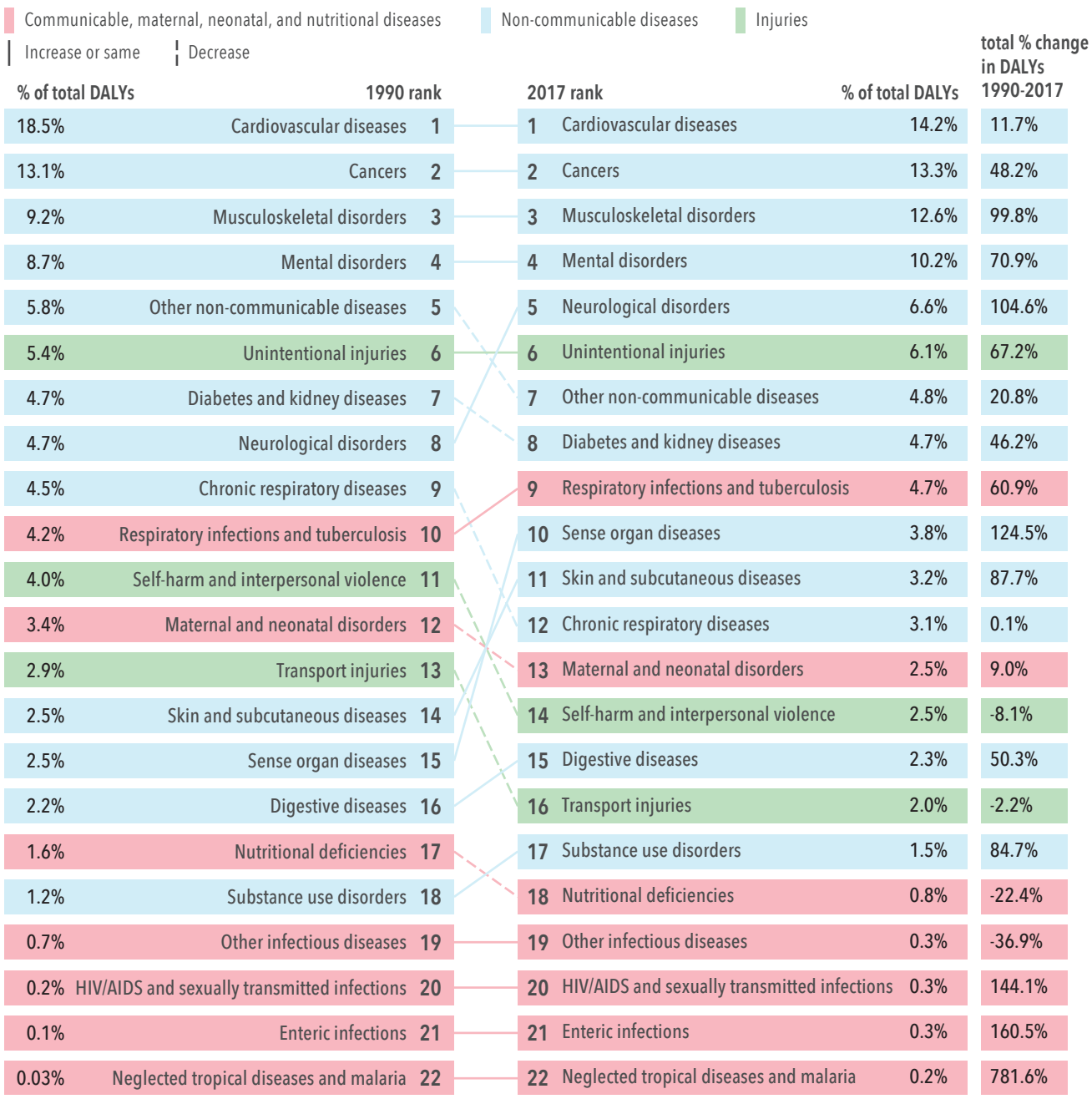
Injuries caused 10.7% of total DALYs in Singapore in 2017. The largest contributor within that category was unintentional injuries (6.2%), which includes falls and other non-transportation-related accidents. Communicable, maternal, neonatal, and nutritional diseases caused 9% of total DALYs in Singapore in 2017, with over half of that amount, 4.7% of total DALYs, due to respiratory infections and tuberculosis (the majority of which was lower respiratory infections, which includes pneumonia).

In addition to showing a one-year picture of disease burden, GBD metrics allow population health policy-makers to understand trends over time.

Figure 5 shows how the leading causes of DALYs in Singapore ranked in 1990 and 2017. There was stability in Singapore's disease burden over time, with both the top and bottom of the lists showing no changes in rankings. Cardiovascular diseases, cancers, musculo-skeletal disorders, and mental disorders were the four leading causes of DALYs in both 1990 and 2017.

FIGURE 5

## Leading causes of DALYs, Singapore, both sexes, 1990–2017




There were some significant changes in the middle of the rankings, however. Neurological disorders (which includes Alzheimer's disease and other dementias) rose from the eighth to the fifth leading cause while increasing in number of DALYs by 104.6%. Sense organ diseases (which includes vision and hearing impairments) and skin diseases rose to the 10th and 11th ranks while increasing the number of DALYs by 124.5% and 87.7%, respectively. Chronic respiratory diseases, self-harm and interpersonal violence, and transport injuries all declined by three positions in ranking.

The burden of disease within a population varies across age groups, as different diseases are more likely to affect children, middle-aged adults, or older adults.

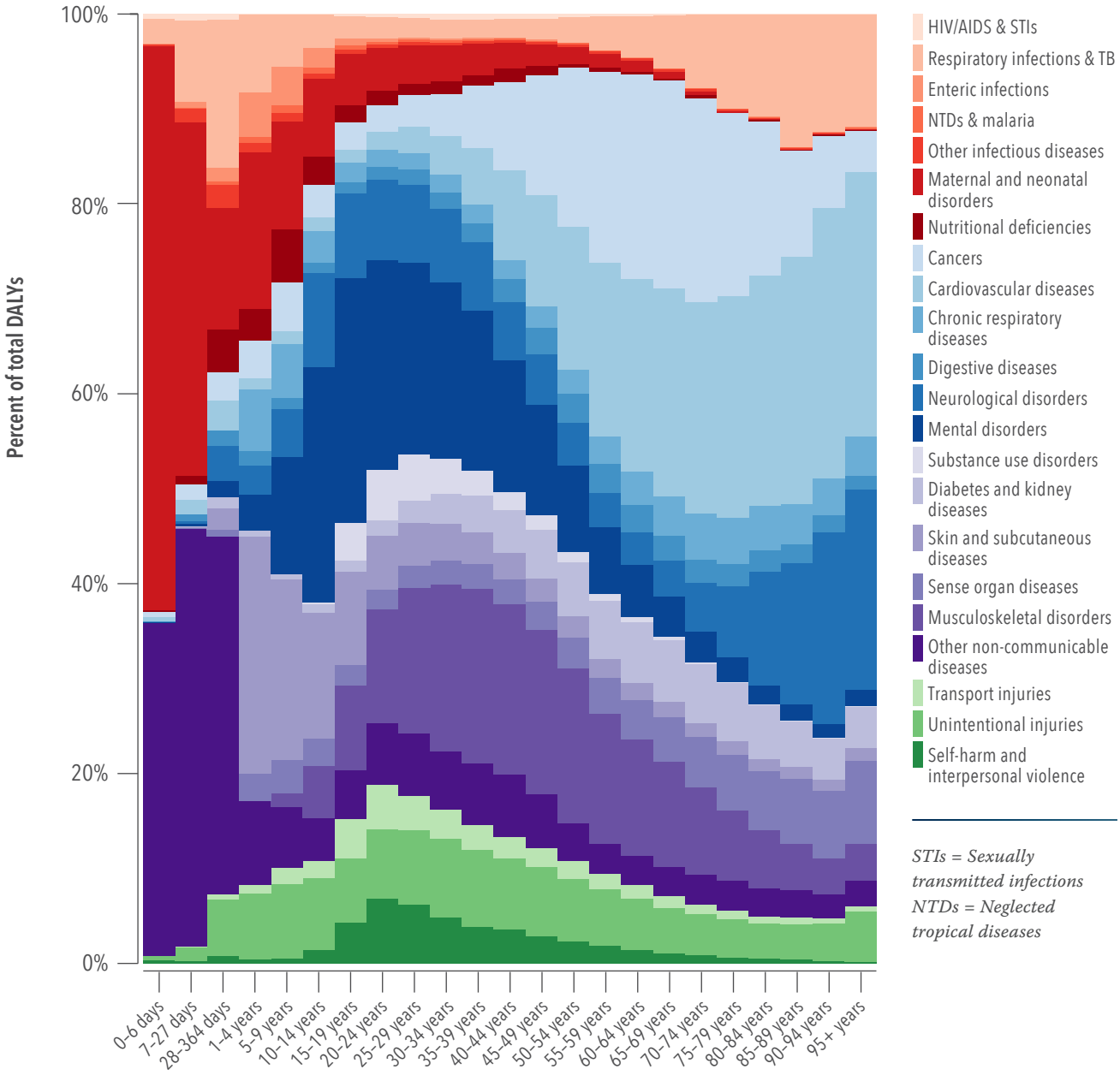
Figure 6 breaks down the overall burden of disease in Singapore in 2017 by age group. At the highest level, it shows that the burden of communicable, maternal, neonatal, and nutritional diseases was highest among young people, but that non-communicable diseases quickly became the main cause of disease burden as people entered late childhood, adolescence, and

adulthood. Disease burden due to injuries peaked in young adults and then tapered off over the lifespan.

Neonatal disorders (within the maternal and neonatal disorders category) and birth defects (within the other non-communicable diseases category) were the drivers behind the large red and purple bars present in the under-1-year age brackets of Figure 6. Among children, skin diseases (driven by eczema) were a substantial cause of DALYs. Mental disorders represented the largest single contributor to disease burden for Singaporeans between the ages of 10 and 34, peaking for 15- to 19-year-olds, for whom mental disorders represented 25.8% of total DALYs. Musculoskeletal disorders caused the largest proportion of burden in middle-aged adults, peaking at ages 35–39, when they represented 18.4% of total DALYs. Cardiovascular diseases and neurological disorders grew as a proportion of total burden as people aged. The burden of cancer as a proportion of total DALYs was highest for 65- to 69-year-olds, when it represented 21.9% of total disease burden.

FIGURE 6

## Percentage breakdown of DALYs by age group, Singapore, both sexes, 2017




*STIs = Sexually transmitted infections*
*NTDs = Neglected tropical diseases*

Further information on the burden of DALYs in Singapore is available in the Appendices. Appendix Figure 28 shows the proportion of the DALYs for each cause, in both 1990 and 2017, composed of fatal burden (YLLs) and non-fatal burden (YLDs). Appendix Figure 29 breaks down the changes in each cause's burden that were driven by population growth, population ageing, and other factors.

## Breaking down causes of DALYs

Because the GBD study organises causes of disease and risk factors for disease into a nested hierarchy (see Table 1, "GBD 2017 causes and risk factors, Levels 1 and 2," on page 14), the disease burdens discussed in the report section above can be broken down for further analysis. For example, "cardiovascular diseases" can be broken down into ischaemic heart disease, rheumatic heart disease, hypertensive heart disease, and so on. This allows health policymakers to understand the big picture of disease burden and then "zoom in" for more detail as needed. This report section – and others like it that appear later in the report – "zoom in" to examine certain causes of disease burden in more detail. (More information on the GBD cause list can be found at www.healthdata.org/gbd/faq. Users can also explore the GBD estimates at different levels of the GBD cause and risk hierarchy at https://vizhub.healthdata.org/gbd-compare.)

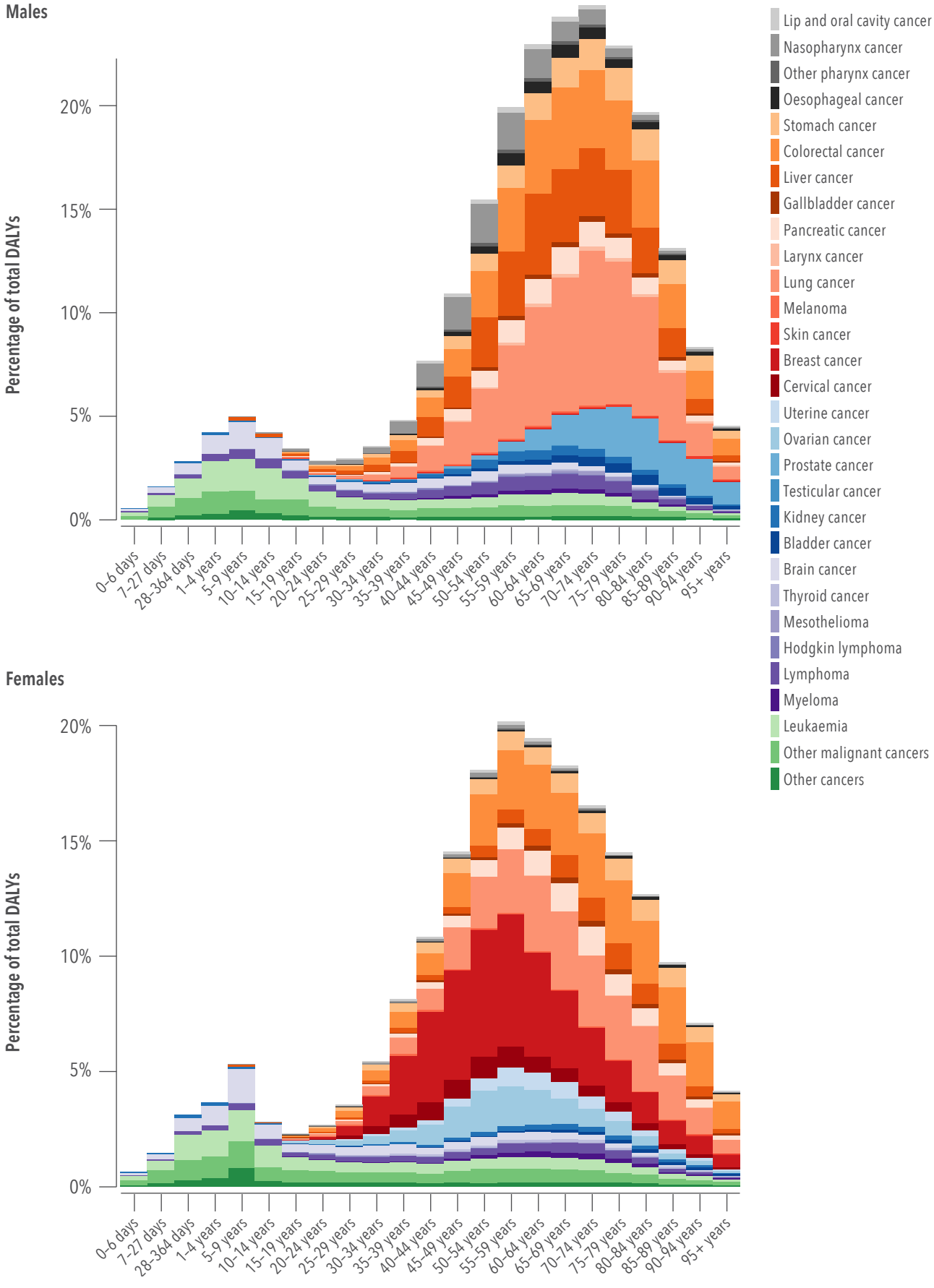
DALYs are a particularly useful way to examine overall disease burden, but they are also very useful for more detailed consideration of diseases that cause both early death and non-fatal disability. Cancers, for example, can certainly kill people, but they also debilitate people and prevent them from living full, healthy lives – even when they survive. DALYs illustrate the full spectrum of the burdens of such diseases.

### CANCERS

Figure 7 shows the proportion of Singapore's overall 2017 disease burden that was caused by specific types of cancer, broken down by sex. Essentially, it "zooms in" on the bars in Figure 6 that represent cancers, to show the particular types of cancer that make up Singapore's overall cancer burden among males and females. Figure 7 shows that breast and reproductive system cancers drove female cancer burden, peaking at 9.2% of total DALYs among females aged 55 to 59. The cancer burden among males was driven more by lung, colorectal, liver, and prostate cancer, with both lung and prostate cancer, especially, primarily affecting males of older age groups. Because the types of cancer that tended to affect males and females differ, the age patterns of cancer burdens also differed, with males affected later in life than females. Overall cancer burden among females peaked among those 55 to 59 years old (at 20.2% of total DALYs), while in males that peak occurred later, among those aged 70 to 74 (at 16.6% of total DALYs).

FIGURE 7

Proportion of total DALYs caused by cancers, males versus females, Singapore, 2017



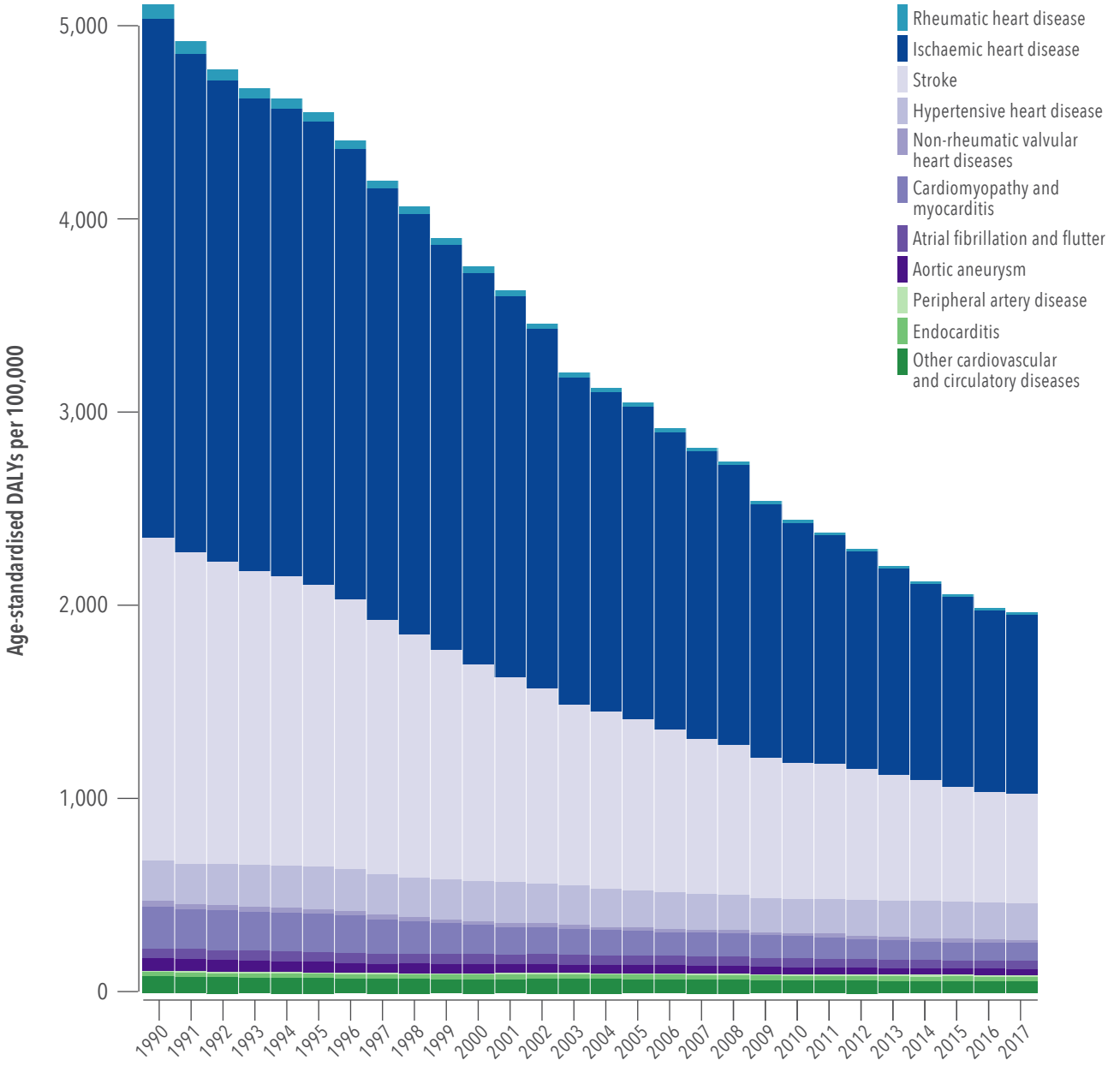
### CARDIOVASCULAR DISEASES

Figure 8 breaks down the components of Singapore's cardiovascular disease burden from 1990 to 2017. It uses age-standardised DALYs per 100,000 to account for the ageing of Singapore's population between 1990 and 2017. Figure 8 shows a substantial decline in the age-standardised burden of cardiovascular diseases during that time, mostly due to large reductions in the rates of ischaemic heart disease (which declined by over 60%, from 2,683 to 923 age-standardised DALYs per 100,000) and stroke (which also declined by over 60%, from 1,672 to 568 age-standardised DALYs per 100,000). Several other causes of cardiovascular disease burden, such as cardiomyopathy and myocarditis, hypertensive heart disease, and rheumatic heart disease, registered less dramatic declines.

It is important to note the interplay between the absolute size of the disease burden due to cardiovascular diseases and the rates at which Singaporeans experienced them. The age-standardised rate of DALYs has declined, which means that the amount of ill health

FIGURE 8

Breakdown of DALYs due to cardiovascular diseases, both sexes, age-standardised, Singapore, 1990–2017



experienced by any given group of Singaporeans due to cardiovascular diseases went down. That indicates some success in preventing and treating cardiovascular diseases. At the same time, however, Singapore's population grew and became older, which increased the number of people who were vulnerable to cardiovascular disease and, correspondingly, the total amount of cardiovascular disease in Singapore as a whole. This is why cardiovascular disease has remained the leading cause of DALYs in Singapore (as illustrated by Figure 5, on page 24) despite the decline in age-standardised rates shown in Figure 8.

### DIABETES AND KIDNEY DISEASES

Singapore's 46.2% increase in the number of DALYs due to diabetes and kidney diseases between 1990 and 2017 (as shown in Figure 5) was driven by increases in the prevalence of two of that category's underlying causes: diabetes mellitus[4] and chronic kidney disease. (The burden of the third cause in the category, acute glomerulonephritis, also rose during that time, but it affected very few people and its overall effects on disease burden were small.) In addition to increases in prevalence of both diabetes and chronic kidney disease, Figure 9 shows that both causes also increased substantially in DALY burden from 1990 to 2017, by 36.3% and 65.8%, respectively. While chronic kidney disease has been more prevalent during that time, the burden of DALYs due to diabetes has dwarfed that due to chronic kidney disease.

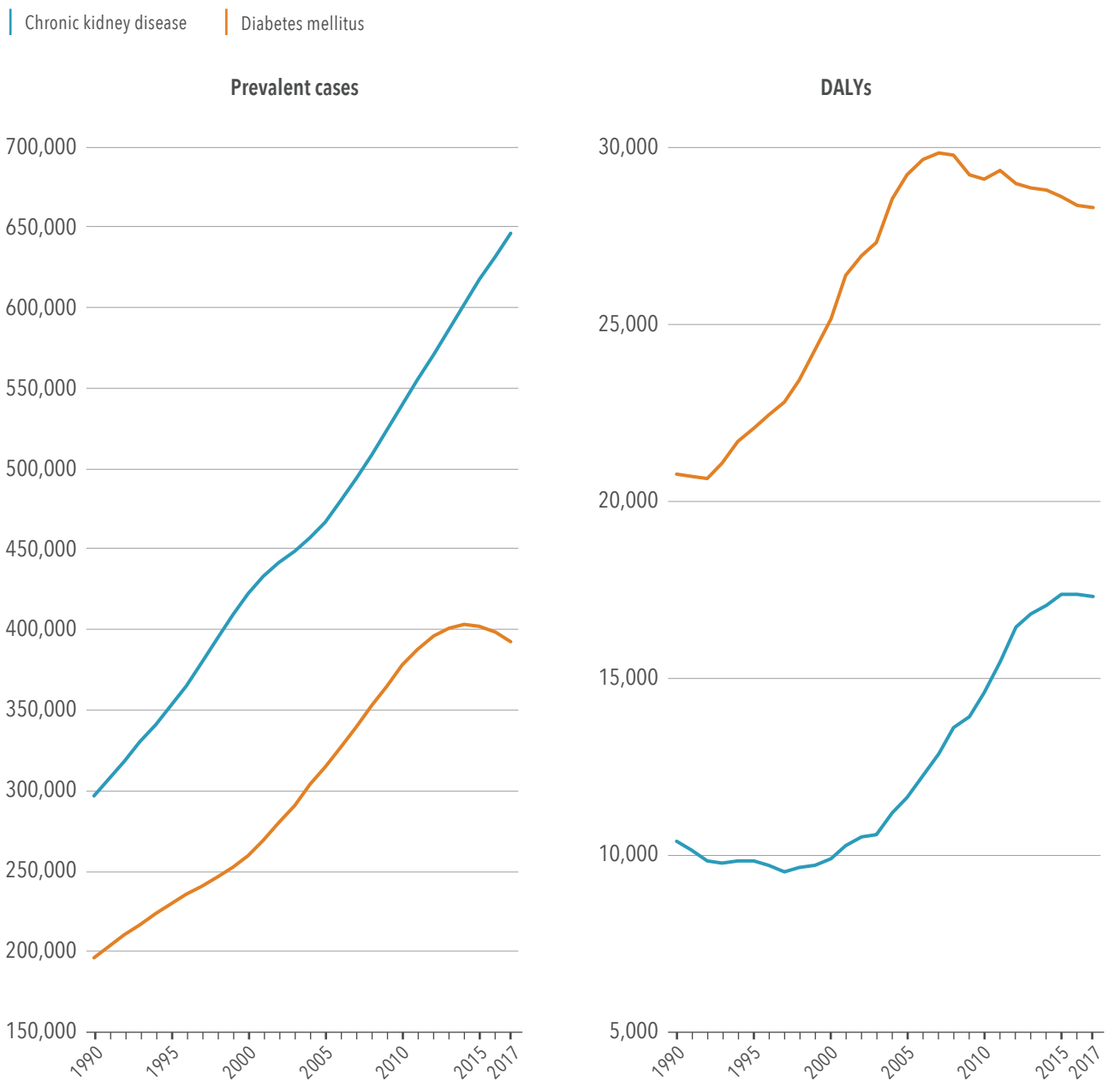
These divergent trends are due to the types of burden caused by diabetes and chronic kidney disease, and the ages at which they affected people. Chronic kidney disease caused many more YLLs than YLDs, especially among Singaporeans aged 65 and older. Diabetes, by contrast, was much more likely to cause YLDs than deaths, and to do so earlier in life, starting in middle age and lasting for many years. The latter effect was much larger than the former.

Considered in relation to the increasing gap between Singapore's LE and HALE, which is due mostly to the growing overall burden of chronic and non-fatal health problems in Singapore's ageing population (see the discussion of Figure 1, above), diabetes represents an important challenge for Singapore. While the country has succeeded in reducing the loss of life from causes like diabetes, its success in increasing HALE will depend on its ability to reduce the chronic, non-fatal health problems they cause.

*[4] The GBD study defines disease burden due to diabetes mellitus as 1) a death due to diabetes, as defined under International Classification of Disease standards (which contributes to YLL burden); and 2) a prevalent case, defined as someone either receiving diabetes treatment or having a fasting blood plasma glucose level greater than 7 mmol/L (which contributes to YLD burden). Prevalent cases include those with diabetic foot or amputation due to neuropathy or vision loss due to retinopathy as a direct consequence of diabetes. Cardiovascular diseases and kidney diseases resulting from diabetes are excluded from the computation of diabetes disease burden, but are included in the computation of high blood sugar as a risk factor affecting health (please refer to this report's "Risk factors affecting health in Singapore" section, below, for more).*

FIGURE 9

Prevalent cases (left) and number of DALYs (right) due to diabetes mellitus and chronic kidney disease, both sexes, Singapore, 1990–2017




## YLLS

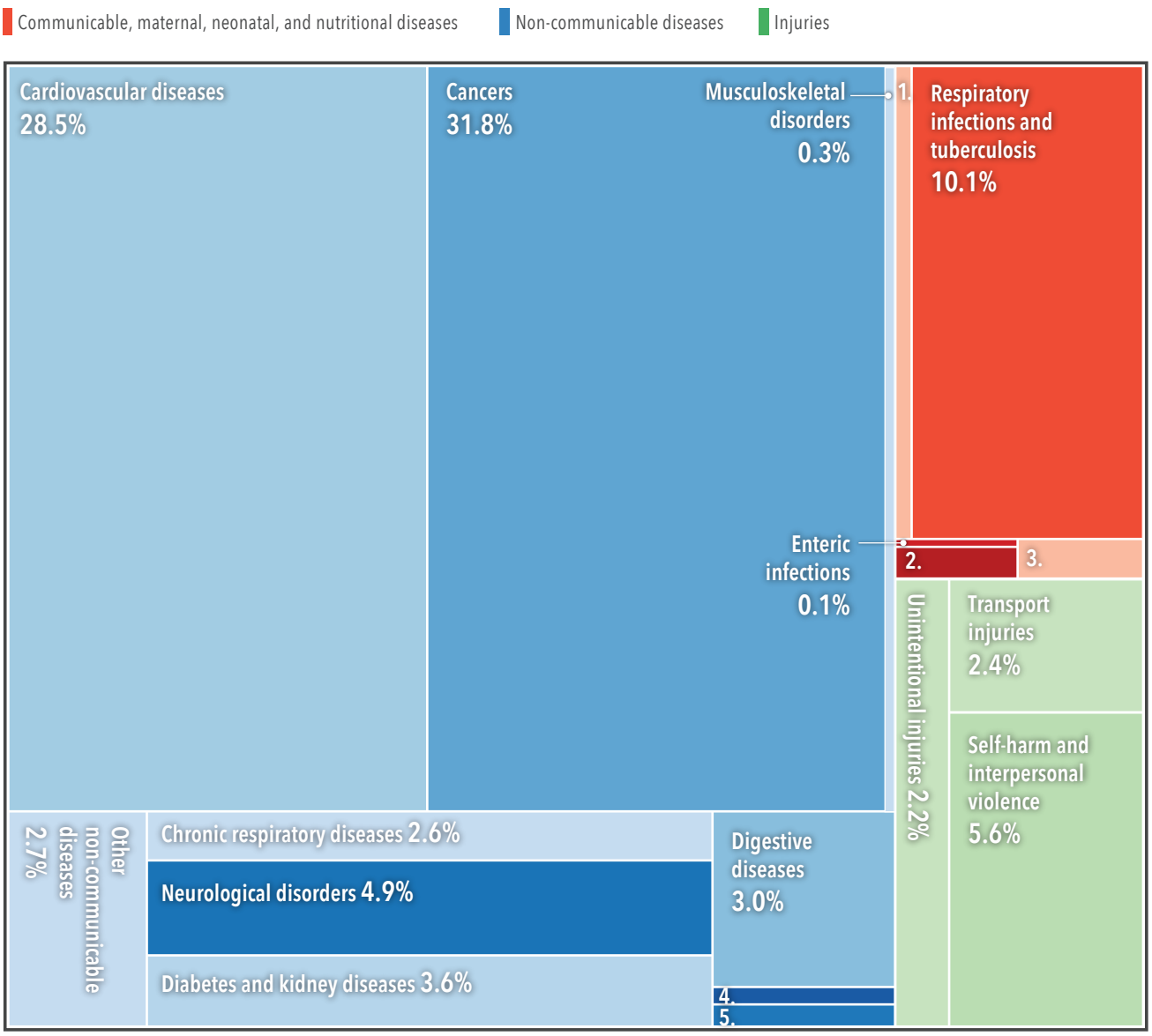
By examining YLLs, policymakers gain insight into the causes of early death among Singaporeans.

Figure 10 shows Singapore's total YLLs in 2017, broken down by cause. As was the case for DALYs, non-communicable diseases, taken together, were the largest contributor to YLLs in Singapore – they caused 78.1% of Singapore's fatal disease burden in 2017. YLLs due to non-communicable causes of disease in Singapore were dominated by two causes: cancers (31.8% of total YLLs) and cardiovascular diseases (28.5% of total YLLs). Neurological disorders (4.9% of total YLLs), diabetes and kidney diseases (3.6%), digestive diseases (3%), and chronic respiratory diseases (2.6%) also caused a significant portion of Singapore's YLLs.

Communicable, maternal, neonatal, and nutritional diseases caused 11.7% of YLLs in Singapore in 2017. The vast majority of that category of burden – 10.1% of total

FIGURE 10

Distribution of total YLLs by cause, Singapore, both sexes, 2017




1. Maternal and neonatal disorders **0.7%**
2. HIV/AIDS and sexually transmitted infections **0.4%**
3. Other infectious diseases **0.4%**
4. Substance use disorders **0.3%**
5. Skin and subcutaneous diseases **0.4%**

YLLs – was caused by respiratory infections and tuberculosis (mostly lower respiratory infections, which includes pneumonia). Injuries caused 10.2% of YLLs in Singapore in 2017. Self-harm and interpersonal violence were the largest contributors to that burden, at 5.6% of total YLLs. Transportation injuries and other unintentional injuries caused 2.4% and 2.3% of Singapore's total YLLs, respectively.

The causes of YLLs in Singapore have changed over time. Figure 11 shows, for example, that neurological disorders rose from the 12th leading cause of YLLs in Singapore in 1990 to the fifth leading cause in 2017. Digestive diseases rose in rank from 11th to seventh. By contrast, several causes showed notable declines in rank, with the most notable, perhaps, being chronic respiratory diseases (from sixth to ninth).

Aside from the changes in rankings, it is also significant that the four leading causes of YLLs in 1990 remained the leading causes of YLL burden in 2017. Despite the many changes in Singapore's health care system over those 27 years, cancers and cardiovascular disease remained the first and second leading causes of YLLs,

while respiratory infections and tuberculosis (mostly lower respiratory infections, which includes pneumonia) and self-harm and violence remained the third and fourth leading causes.

The nature of YLL burden varies across age groups, as illustrated in Figure 12. There are some striking similarities between the overall contours of Figure 12 and Figure 6, on page 25, which shows DALYs broken down by age group. Figure 12 shows the impact of communicable, maternal, neonatal, and nutritional diseases on both younger and older Singaporeans – in particular neonatal disorders (within the maternal and neonatal disorders category) and birth defects (within the other non-communicable diseases category) among the young and respiratory infections among young and old alike.

Figure 12 also shows the impact of injuries among Singaporeans in adolescence and young adulthood: injuries caused just over 60% of YLLs among 20- to 24-year-olds. Self-harm and interpersonal violence caused the largest share of YLLs due to injuries, comprising 10% or more of total YLLs for Singaporeans from age 10 through age 44. Self-harm and interpersonal

FIGURE 11

## Leading causes of YLLs, Singapore, both sexes, 1990–2017

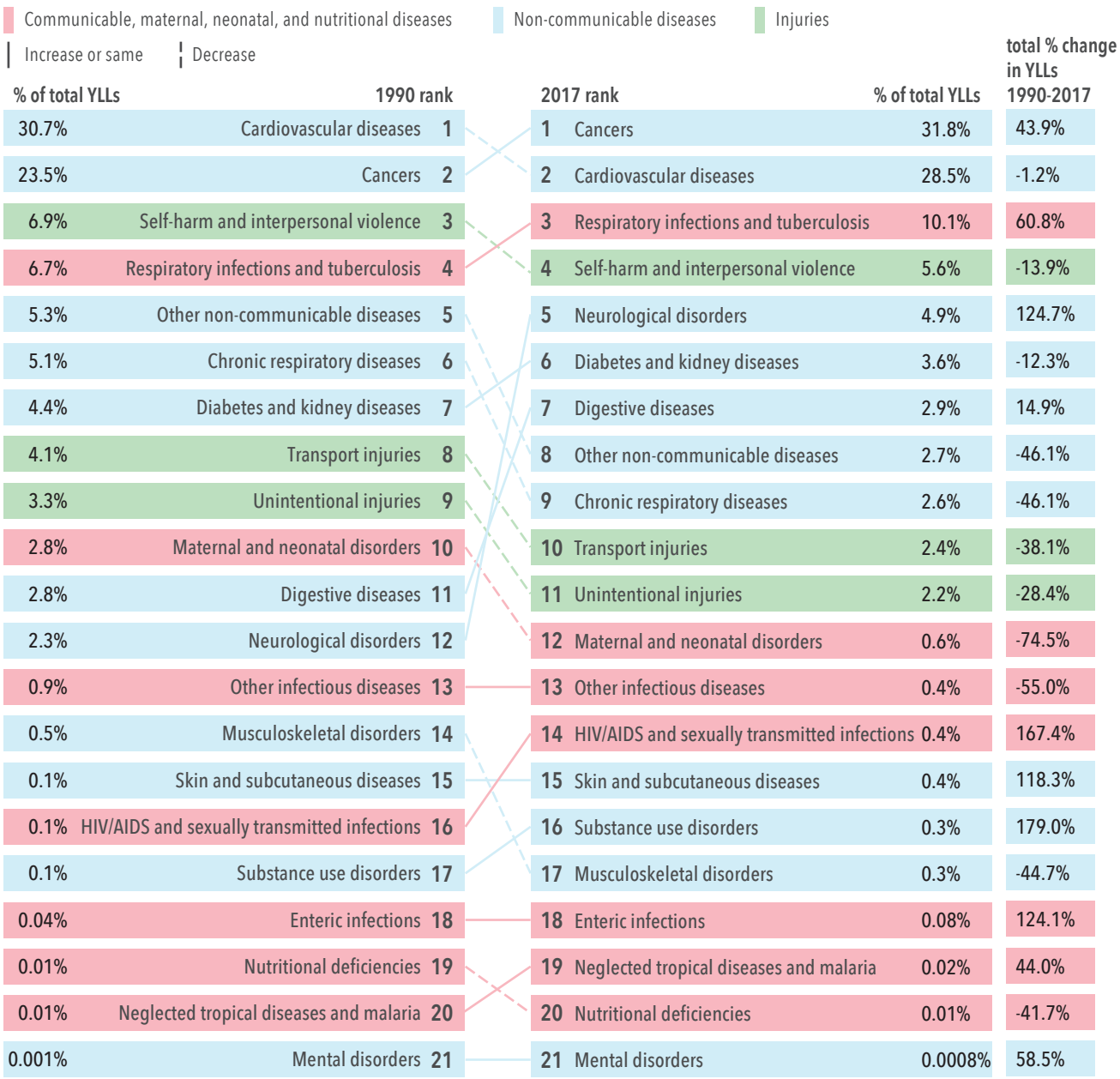
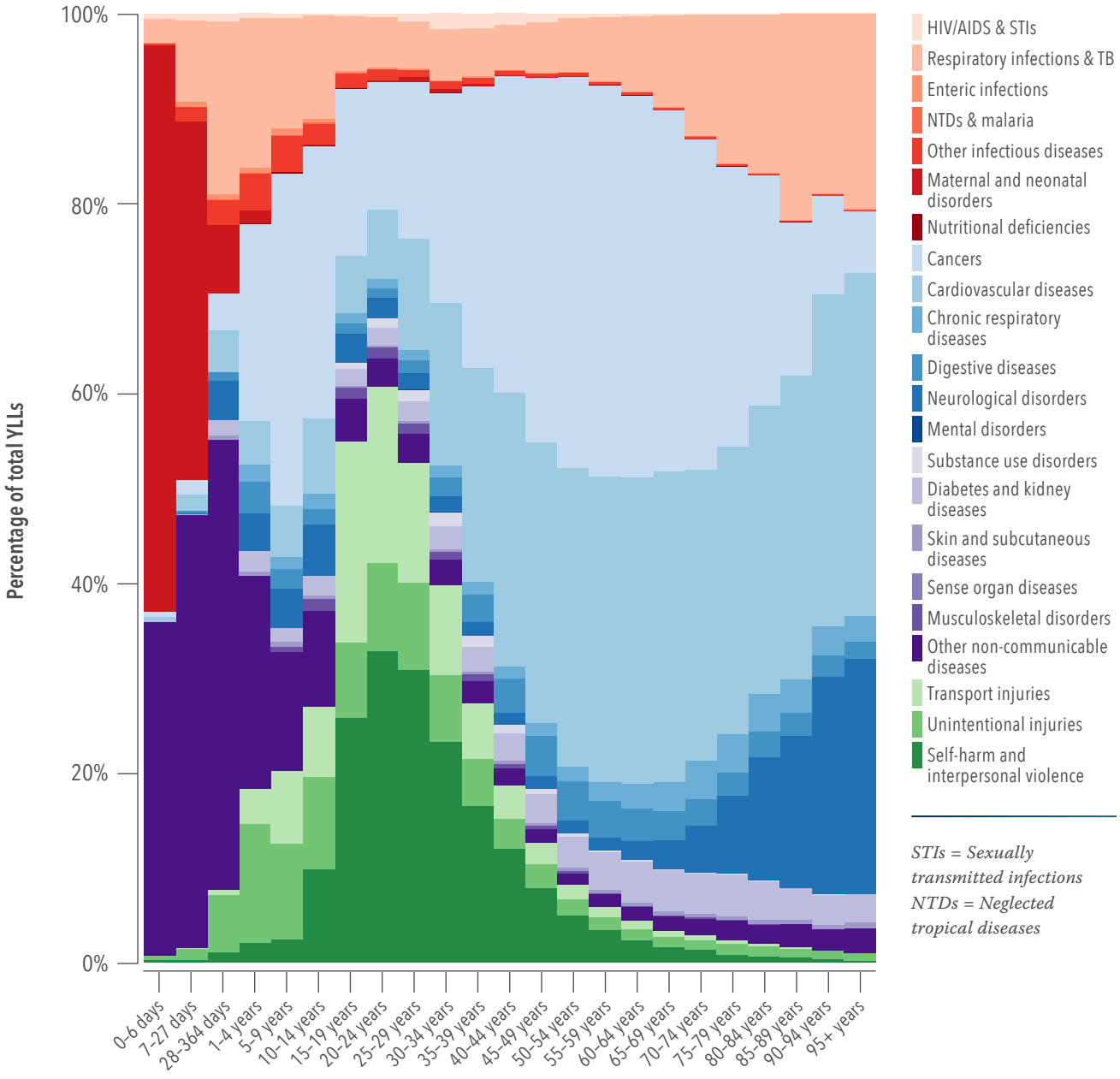


FIGURE 12

## Percentage breakdown of YLLs by age group, Singapore, both sexes, 2017




*STIs = Sexually transmitted infections*
*NTDs = Neglected tropical diseases*

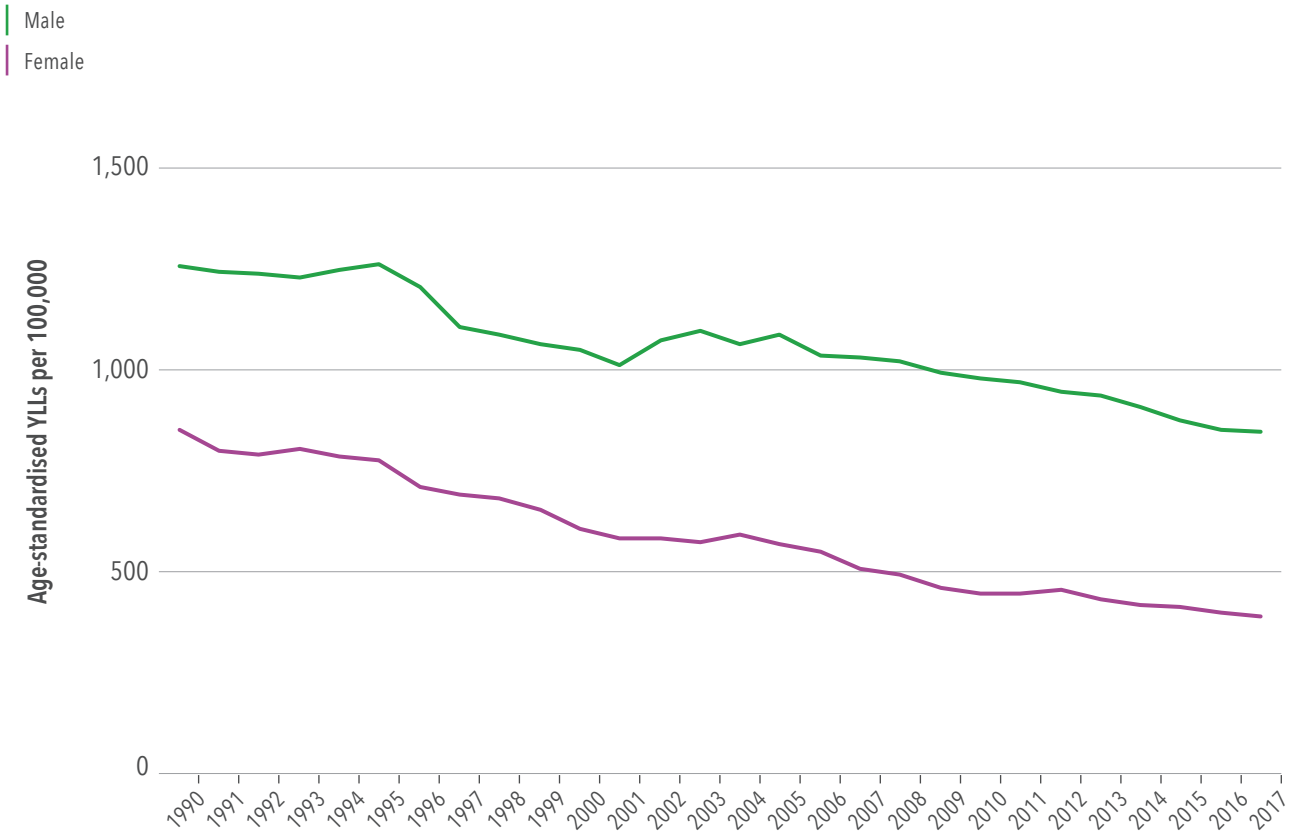
violence caused 32.9% of total YLLs for those aged 20–24. Other key contributors to injury burden among young Singaporeans included transport injuries among those in their teens and twenties (highest among 15- to 19-year-olds at 21.3% of YLLs) and unintentional injuries among children aged 1–4 (primarily due to falls and drowning).

Starting around age 30, YLLs from injuries rapidly declined and YLLs from non-communicable diseases rapidly increased. For middle-aged and older adults, cancers, cardiovascular diseases, and neurological disorders caused the majority of YLLs. Respiratory infections accounted for an increasing proportion of YLLs as people aged.

Further information on the burden of YLLs in Singapore is available in the Appendices. Figure 30 shows the drivers of change in the burden of the 10 leading causes of YLLs among both sexes in Singapore between 1990 and 2017.

FIGURE 13

YLLs due to lower respiratory infections and tuberculosis, Singapore, males versus females, age-standardised, 1990–2017




## Breaking down causes of YLLs

YLLs tend to be highest for causes of death that affect very large numbers of people (cardiovascular diseases, for example) and causes of death that affect fewer people but do so when those people are young or middle-aged (self-harm, for example). Both of these types of death impact societies in different ways: the former by making frequent, widespread demands on health systems and families, the latter by cutting short lives with many potential years ahead of them – years of economic productivity, caring for families, and other societal contributions.

### RESPIRATORY INFECTIONS AND TUBERCULOSIS

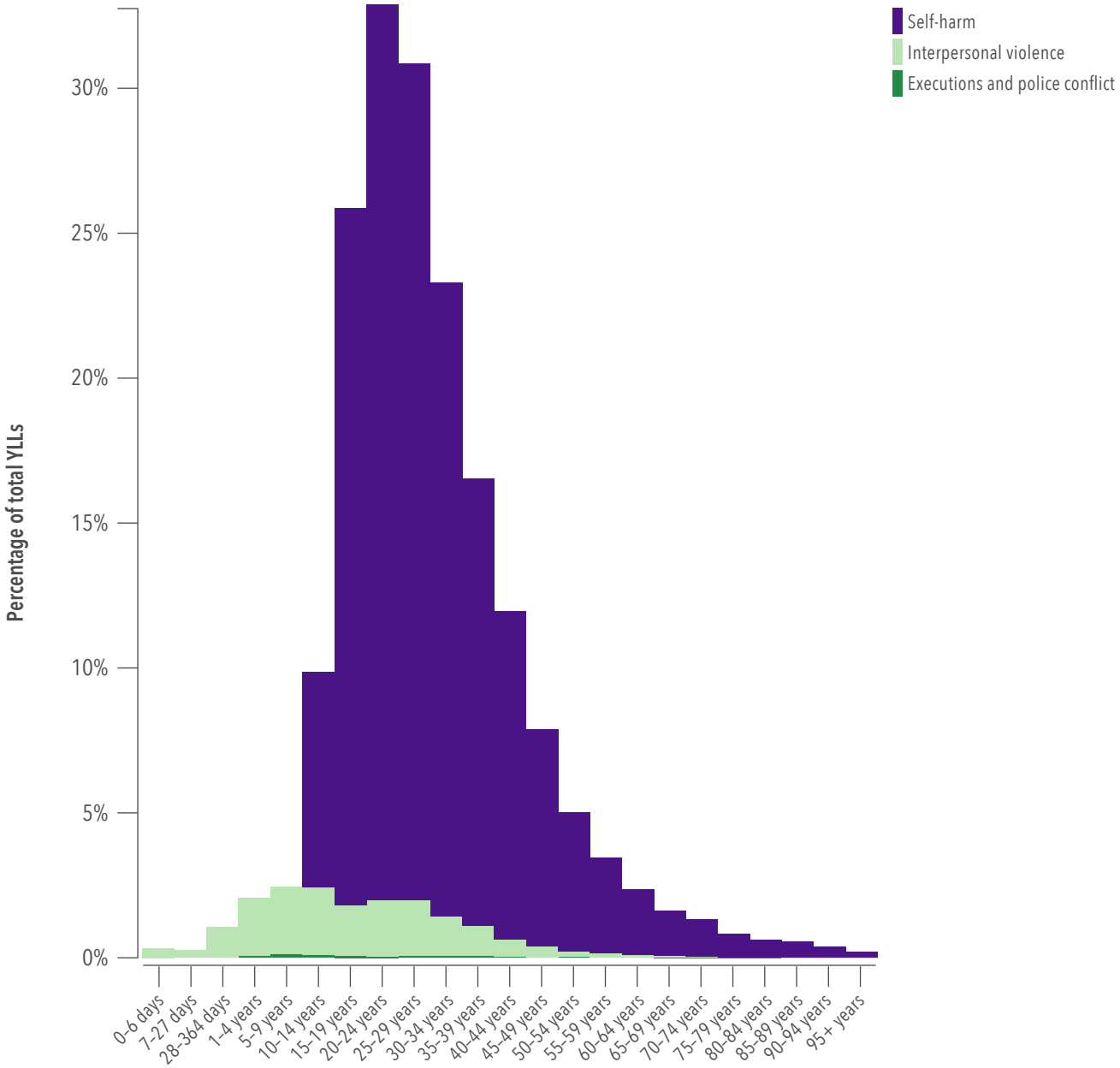
Respiratory infections and tuberculosis, taken together, were the third leading cause of YLLs in Singapore in 2017, but nearly all of that burden comes from lower respiratory infections, which includes pneumonia. Figure 13 indicates that, over time, Singapore has experienced a decline in its age-standardised rate of YLLs due to lower respiratory infections. It also shows a distinct variation in disease burden in lower respiratory infections by sex. Between 1990 and 2017, the age-standardised burden of lower respiratory infections declined for both sexes (from 1,256 YLLs per 100,000 to 845 per 100,000 for males, and from 853 per 100,000 to 391 per 100,000 for females), but the burden was substantially higher among males during the entire time period.

### SELF-HARM AND INTERPERSONAL VIOLENCE

Figure 12 on page 33 makes clear that self-harm and interpersonal violence disproportionately affect young adults in Singapore. Figure 14 "zooms in" on the green bars in Figure 12 that represent self-harm and interpersonal violence to show that this disease burden in Singapore was composed overwhelmingly of self-harm. In 2017, self-harm peaked as a proportion of YLL burden among Singaporeans who were 20–24 years old, for whom it accounted for 30.9% of YLLs.

FIGURE 14

Proportion of total YLLs caused by self-harm and interpersonal violence, both sexes, Singapore, 2017



### NEUROLOGICAL DISORDERS

Breaking down YLLs due to neurological disorders reveals that the vast majority of those YLLs were caused by Alzheimer's disease and other dementias. Figure 15 shows that the number of YLLs due to Alzheimer's disease and other dementias has increased over time – as we would expect given Singapore's ageing population. It also shows the burden of YLLs was generally more than 50% higher among females than among males. In 1990, Alzheimer's disease and other dementias caused 2,048 YLLs in males and 3,387 YLLs among females. In 2017, those figures were 5,787 for males and 8,069 for females. Like lower respiratory infections, Alzheimer's disease and other dementias strike large numbers of Singaporeans, mostly during old age.

## YLDs

YLDs measure the non-fatal burden of disease. The causes of ill health that debilitate people, but do not kill them, are effectively measured using YLDs. While the trend over time for DALYs and YLLs in Singapore has been one of decline, the rates at which Singaporeans experience YLDs has remained relatively constant, indicating that Singapore (like most places in the world) has not been as successful at preventing ill health and disability as it has been in preventing early death.

Figure 16 shows Singapore's total YLDs in 2017, broken down by cause. Just as in the case of DALYs and YLLs, non-communicable diseases were the largest contributor to YLDs in Singapore – they caused 81.8% of Singapore's non-fatal disease burden in 2017. Within non-communicable diseases, musculoskeletal disorders were the largest contributor, at 20.7% of total YLDs, followed by mental disorders, which caused 17% of Singapore's YLDs. Other non-communicable diseases such as sense organ diseases (6.3% of total YLDs), skin diseases (5.1%), and cardiovascular diseases (4.7%) also contributed to a significant portion of Singapore's YLDs.

Communicable, maternal, neonatal, and nutritional diseases caused 7.3% of Singapore's non-fatal disease burden in 2017. Major contributors to that category of disease burden were maternal and neonatal disorders (3.8% of total YLDs), nutritional deficiencies (1.4%), and respiratory infections and tuberculosis (1.1%). However, unlike in the case of DALYs and YLLs, the YLDs within

FIGURE 15

YLLs due to Alzheimer's disease and other dementias, Singapore, males versus females, 1990–2017

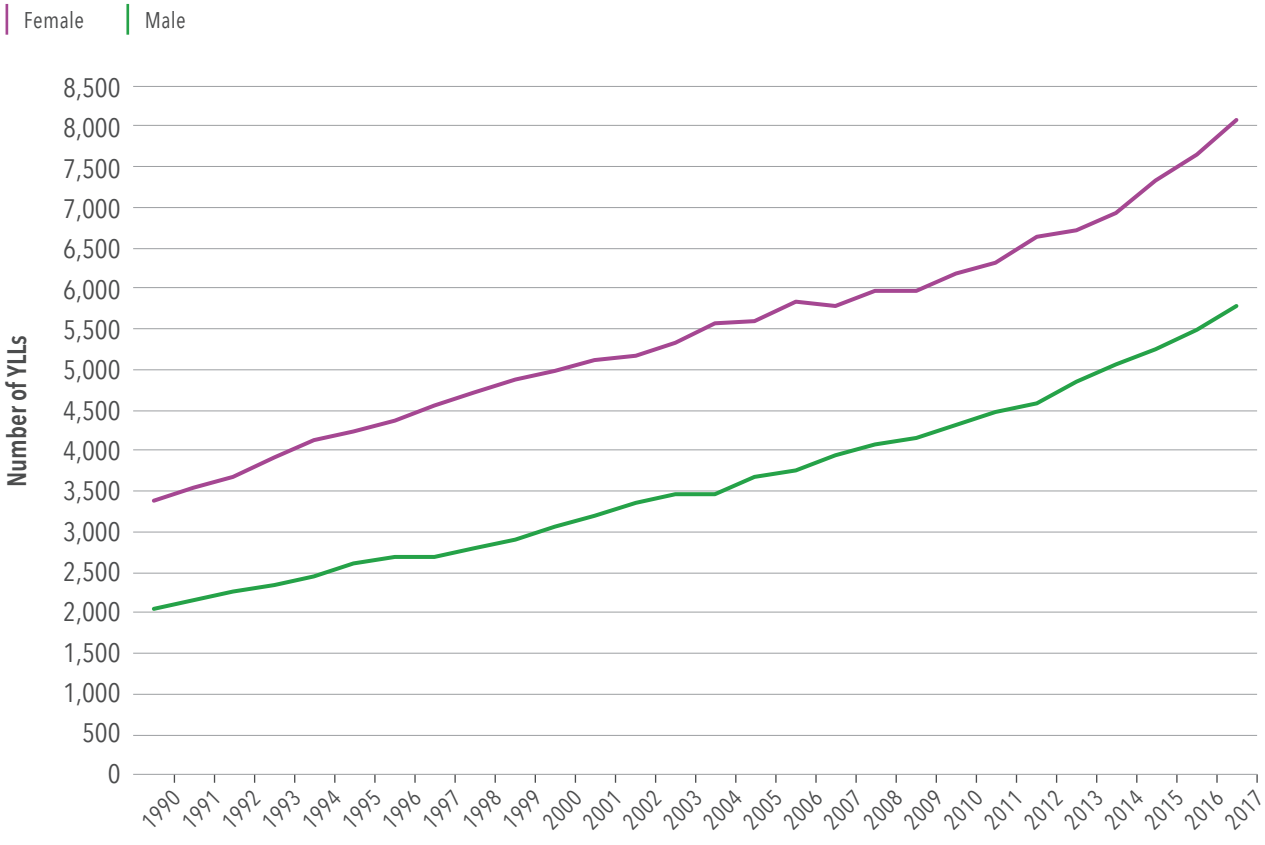
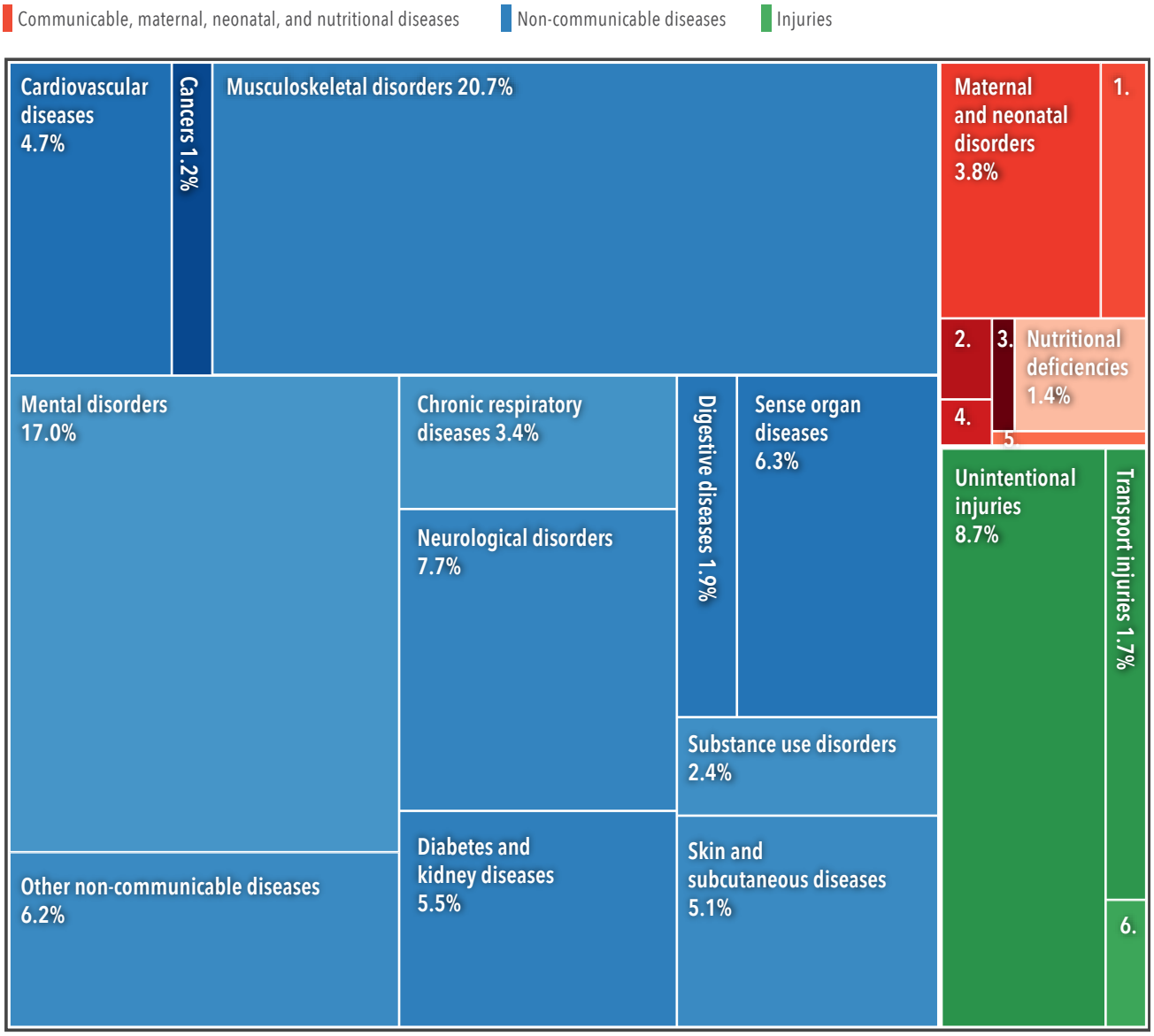


FIGURE 16

## Distribution of total YLDs by cause, Singapore, both sexes, 2017



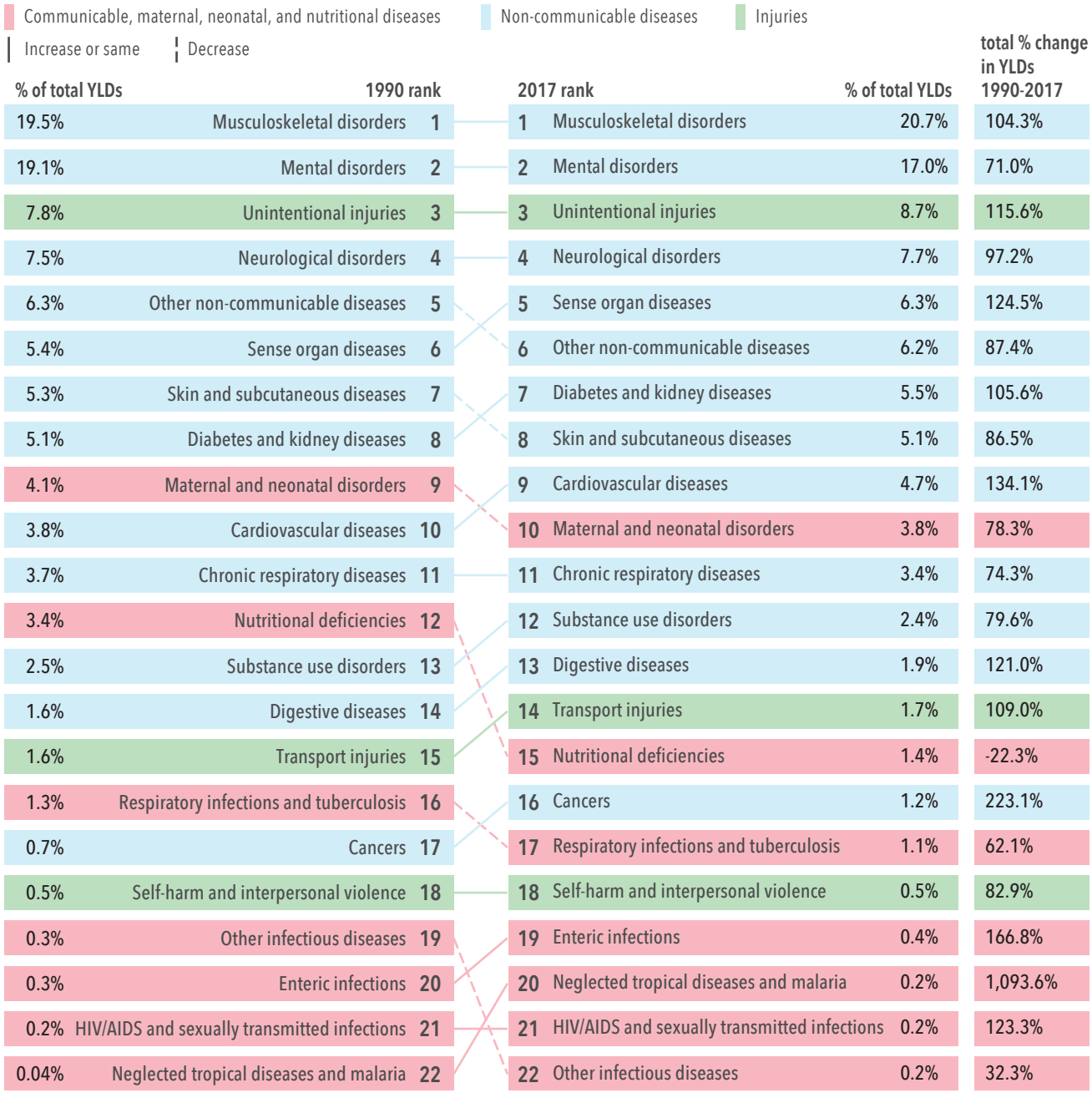

1. Respiratory infections and tuberculosis **1.1%**
2. Enteric infections **0.4%**
3. Neglected tropical diseases and malaria **0.2%**
4. HIV/AIDS and sexually transmitted infections **0.2%**
5. Other infectious diseases **0.2%**
6. Self-harm and interpersonal violence **0.5%**

the latter category were *not* caused mostly by lower respiratory infections, but by upper respiratory infections and otitis media (middle ear infections). Injuries caused 10.9% of Singapore's YLDs in 2017. The majority of those YLDs were caused by unintentional injuries (8.7% of total YLDs), which includes falls and other non-transportation-related accidents.

The causes of YLDs in Singapore have remained relatively unchanged over time. Figure 17 shows that the top four leading causes – musculoskeletal disorders, mental disorders, unintentional injuries, and neurological disorders – did not change between 1990 and 2017. Most of the changes in rankings during that time were slight, with causes moving up or down in the lists by one spot. The only exceptions were nutritional deficiencies, which dropped from 12th to 15th place between 1990 and 2017, and neglected tropical diseases and malaria (almost entirely dengue fever), which rose from 22nd to 20th place.

FIGURE 17

## Leading causes of YLDs, Singapore, both sexes, 1990–2017

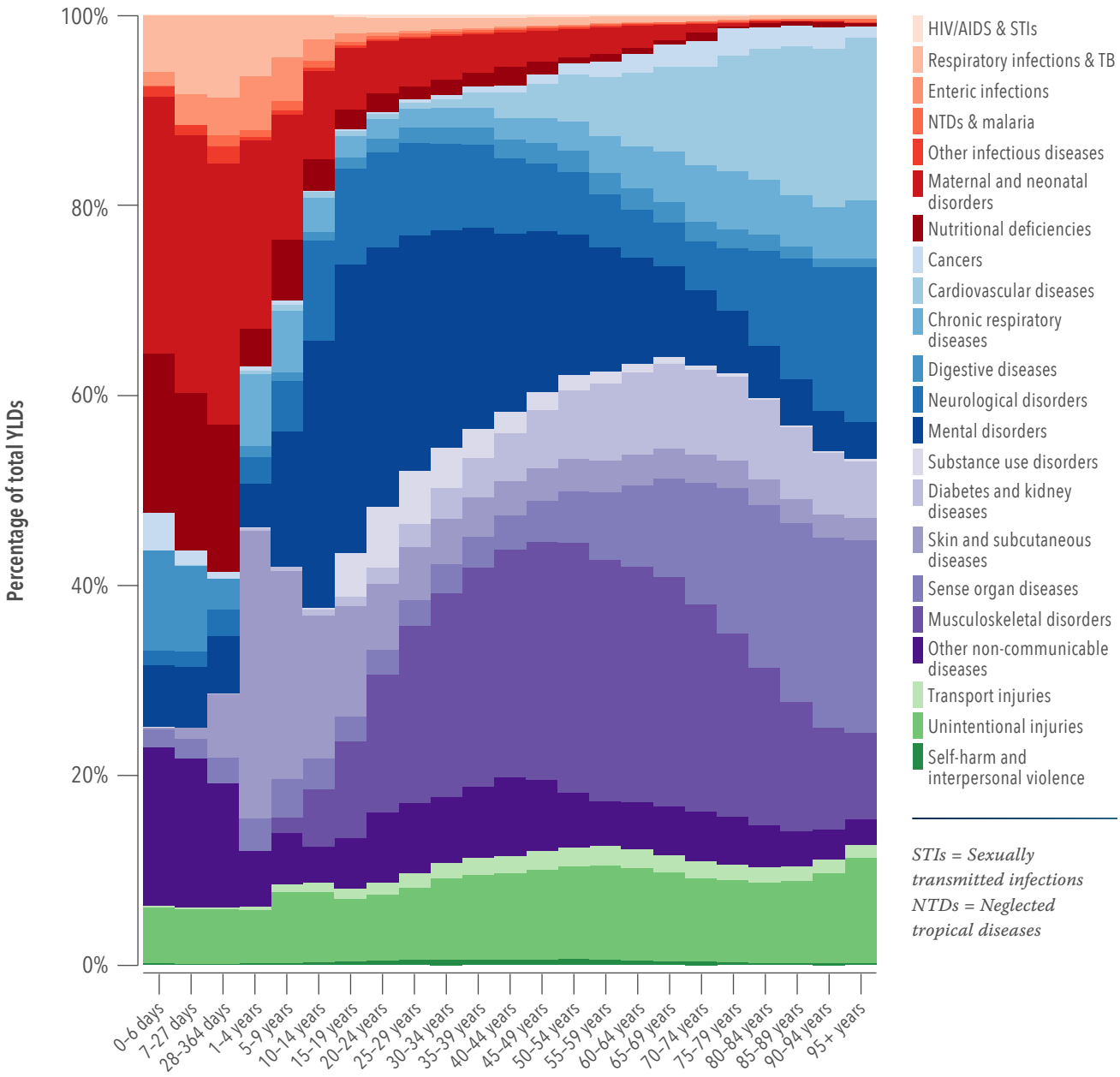


The causes of YLDs in Singapore showed substantial variation across age groups. Several broad patterns emerge from Figure 18. The proportion of YLDs due to communicable, maternal, neonatal, and nutritional diseases was significant in childhood, particularly within the under-1 age groups. The proportion of YLDs due to skin diseases was also significant in childhood, particularly for children aged 1 to 14. The main driver of that burden was dermatitis.

Non-communicable diseases contributed the majority of YLDs for adolescents and adults. Mental disorders were the largest driver of YLDs for Singaporeans aged 10 to 34 in 2017. They spiked at ages 10–14 and 15–19, when they caused 28.1% and 30.4%, respectively, of total YLDs, and then gradually tapered in proportion of YLDs as people aged. Musculoskeletal disorders grew in proportion of YLDs gradually with age, starting in adolescence and peaking in middle age before tapering off in older age groups. YLDs due to cardiovascular diseases and sense organ diseases had similar patterns, presenting in middle age and growing in proportion of YLDs as people aged.

FIGURE 18

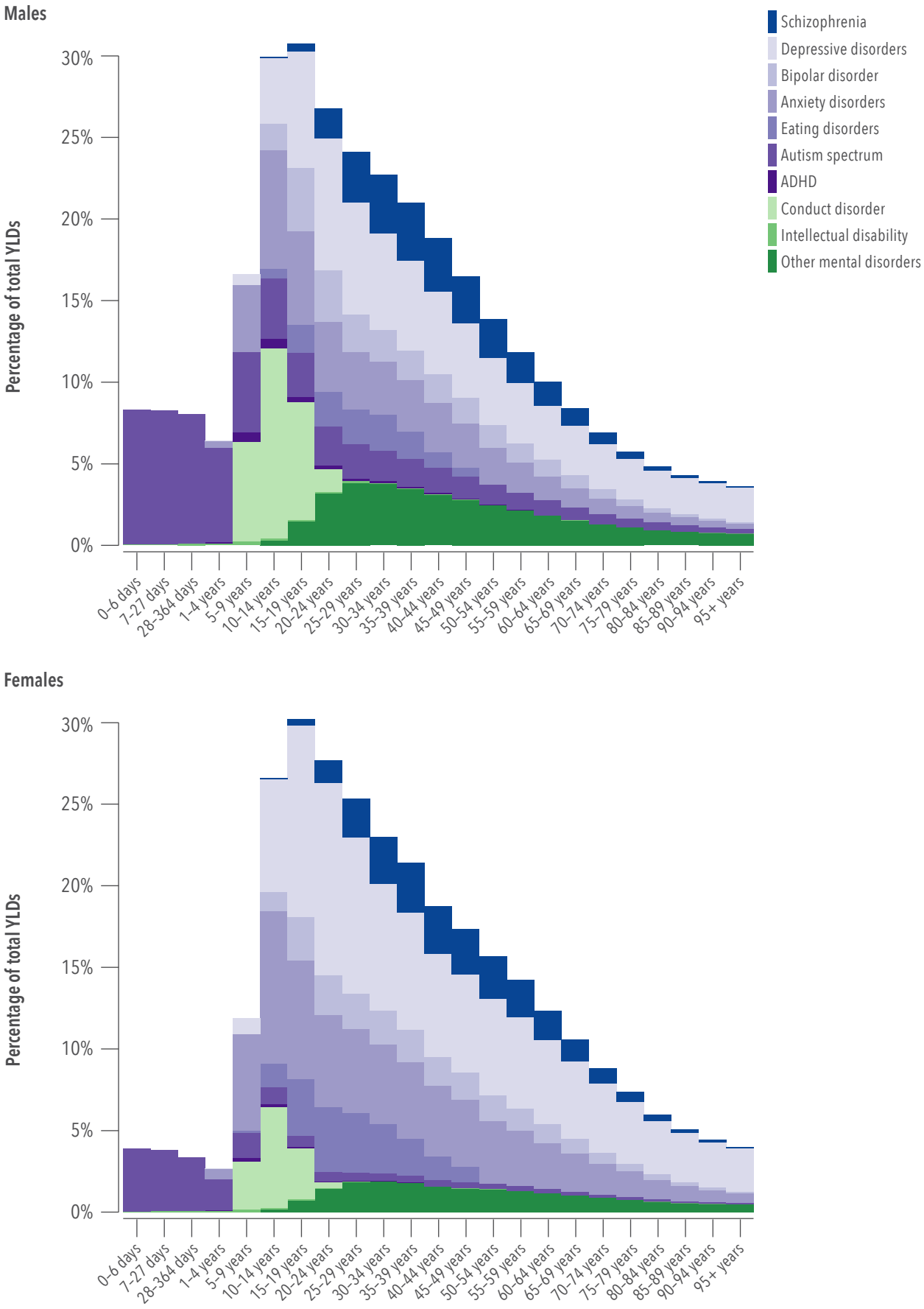
## Percentage breakdown of YLDs by age group, Singapore, both sexes, 2017




*STIs = Sexually transmitted infections*
*NTDs = Neglected tropical diseases*

FIGURE 19

Proportion of total YLDs caused by mental disorders, males versus females, Singapore, 2017



Injuries as a proportion of YLDs were relatively constant across all age groups, ranging from a low of 6.1% of total YLDs for children aged 28 to 364 days to a high of 12.6% of total YLDs for adults aged 95 or more.

Further information on the burden of YLDs in Singapore is available in the Appendices. Appendix Figure 31 shows the drivers of change in the burden of the 10 leading causes of YLDs among both sexes in Singapore between 1990 and 2017.

## Breaking down causes of YLDs

YLDs measure the burden of disability by taking into account both the time spent with disability and the severity of that disability. Like YLLs, YLDs tend to be largest for causes that are either very common (such as sense organ diseases) or that tend to affect people at younger ages and last for a long time (such as mental disorders).

### MENTAL DISORDERS

Mental disorders were the second largest contributor to YLDs in Singapore in 2017. Figure 19 breaks down Singapore's 2017 YLD burden due to mental disorders by age group and sex. In general, mental disorders accounted for a slightly larger percentage of YLDs for males than for females. Males experienced higher percentages of YLDs due to autism spectrum disorders than females in each age group. Between the ages of 5 and 24, males also experienced a greater proportion of YLD burden due to conduct disorders than females. Anxiety disorders, depressive disorders, and eating disorders had similar patterns of age-group burden among males and females, but all three causes made up a substantially higher percentage of YLDs among females than among males in all age groups.

### UNINTENTIONAL INJURIES

Unintentional injuries were the third leading cause of YLDs in Singapore in 2017. Just over half of the disability burden due to unintentional injuries was caused by falls, with the remaining amount split among several other causes. The distribution of YLDs due to these causes varied by age and sex, as shown in Figure 20. Across age groups, males generally experienced higher YLDs due to unintentional injuries than females, with the exceptions being ages 0–4 and 90 and older. YLDs from both falls and exposure to mechanical forces (particular types of physical trauma) were much higher for males than females. The proportion of total YLDs caused by unintentional injuries for males was lowest among young children before rising to a high point in middle age and then declining. For females, unintentional injuries caused the greatest proportion of YLDs at older ages, with significantly lower rates than males during adolescence and early adulthood.

### SENSE ORGAN DISEASES

Between 1990 and 2017, Singapore's growing, ageing population drove an increase in the burden of sense organ diseases, both in aggregate YLDs (from 16,281

FIGURE 20

Percentage breakdown of YLDs due to unintentional injuries by age group, Singapore, males versus females, 2017

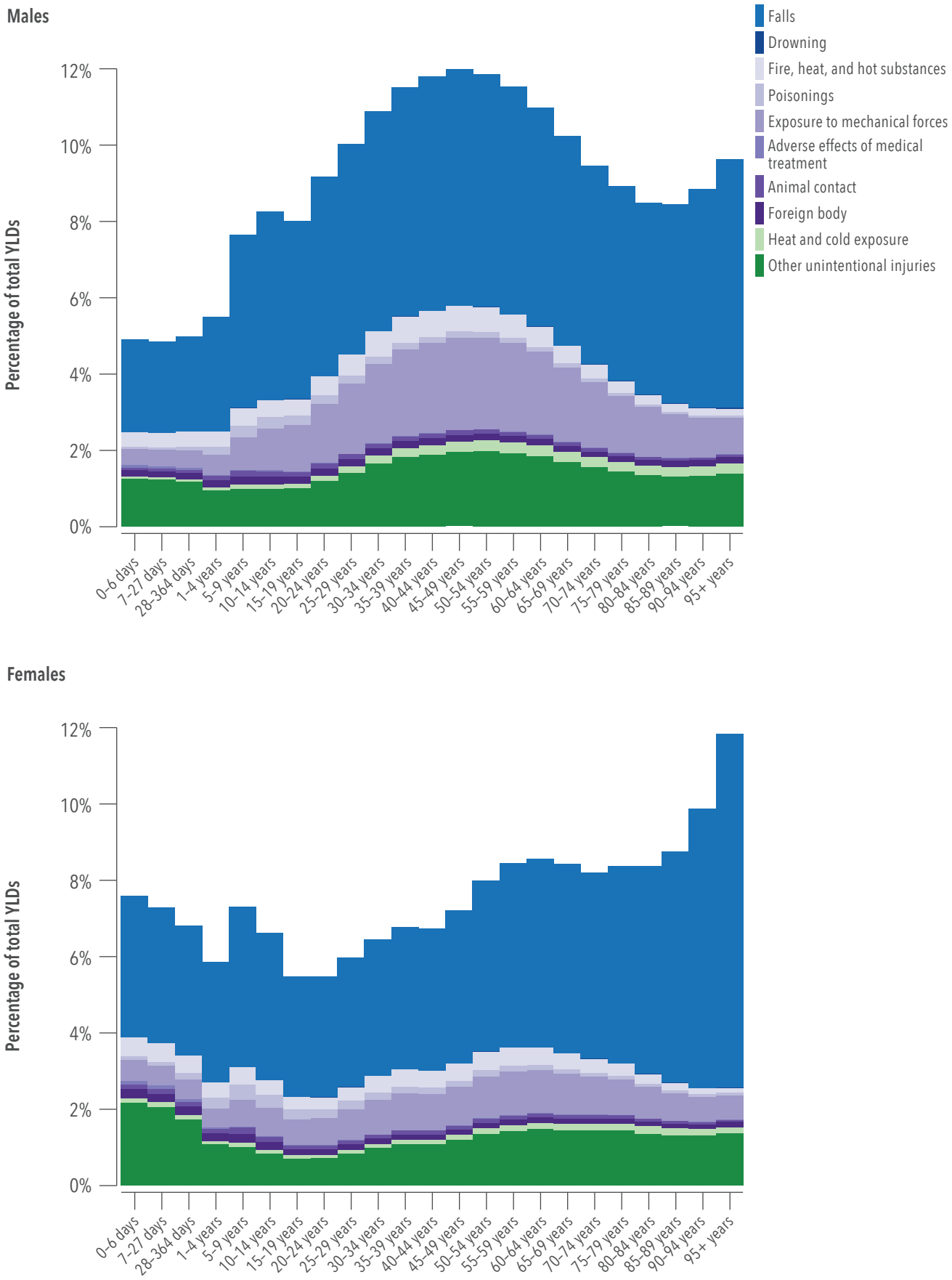
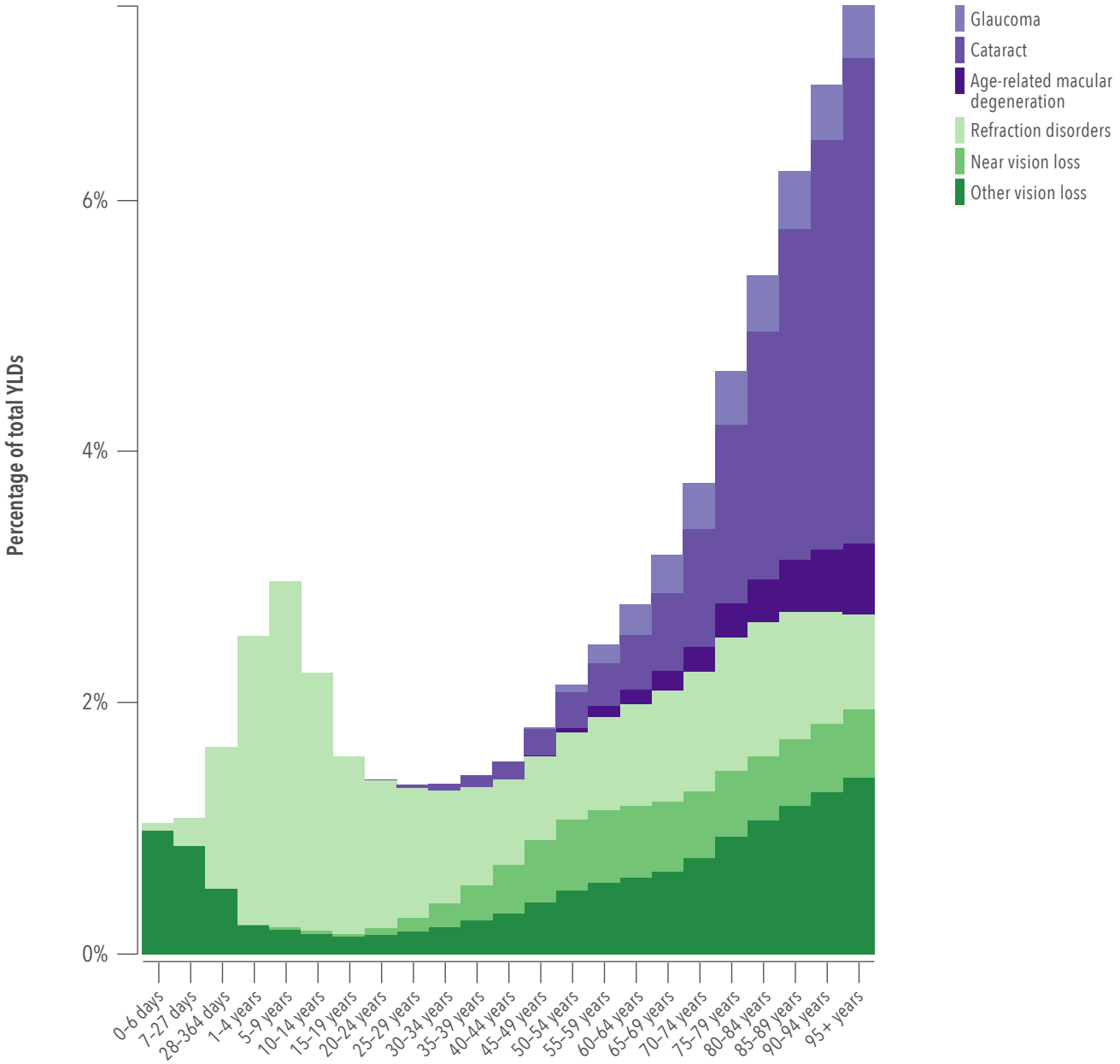


FIGURE 21

Percentage breakdown of YLDs due to blindness and vision impairment by age group, Singapore, both sexes, 2017




YLDs in 1990 to 36,555 YLDs in 2017) and as a proportion of Singapore's disability burden (from 5.4% of total YLDs in 1990 to 6.3% of total YLDs in 2017). The majority of the burden from sense organ diseases in 2017 – 57% of it – was due to age-related and other types of hearing loss, which increased steadily as Singaporeans progressed in age. The other major cause of sense organ disease burden, blindness and vision impairment (37% of sense organ diseases YLD burden in 2017) showed more variation by age group. Figure 21 breaks down the 2017 YLD burden of blindness and vision impairment into its constituent parts and by age. It shows that vision impairment due to causes such as glaucoma, cataracts, and macular degeneration affected primarily older adults, accounting for 2.1% of the YLD burden for those aged 50–54 and steadily growing in percentage to 7.6% of the YLD burden for those aged 95 or more. Figure 21 also shows that blindness and vision impairment caused a substantial percentage of total YLDs among children as well. Blindness and vision impairment caused nearly 3% of total YLDs among children aged 5–9 in 2017, mostly due to refractive disorders, or myopia.

# Risk factors affecting health in Singapore

Risk factors are potentially modifiable causes of disease and injury. The GBD study measures the effects of three types of risk factors on human health: metabolic, behavioural, and environmental or occupational risk factors. Just as with causes of disease or injury, GBD organises risk factors into a nested hierarchy. For example, behavioural risk factors may be broken down into poor diet or low physical activity, and poor diet can be further broken down into risk factors such as consuming high amounts of sodium or sugar-sweetened beverages.

GBD researchers estimate "risk-attributable burden" – how much of the burden of any given disease was caused by particular risk factors. That involves establishing the frequency and intensity of people's exposure to health risk factors, along with the likelihood that people exposed to a given risk factor will go on to develop a given disease as a result. The researchers also consider how risk factors affect each other (think, for example, of the ways that smoking and high blood pressure work in concert to contribute to cardiovascular diseases) so that they do not "double count" the effects of any individual risk factor.

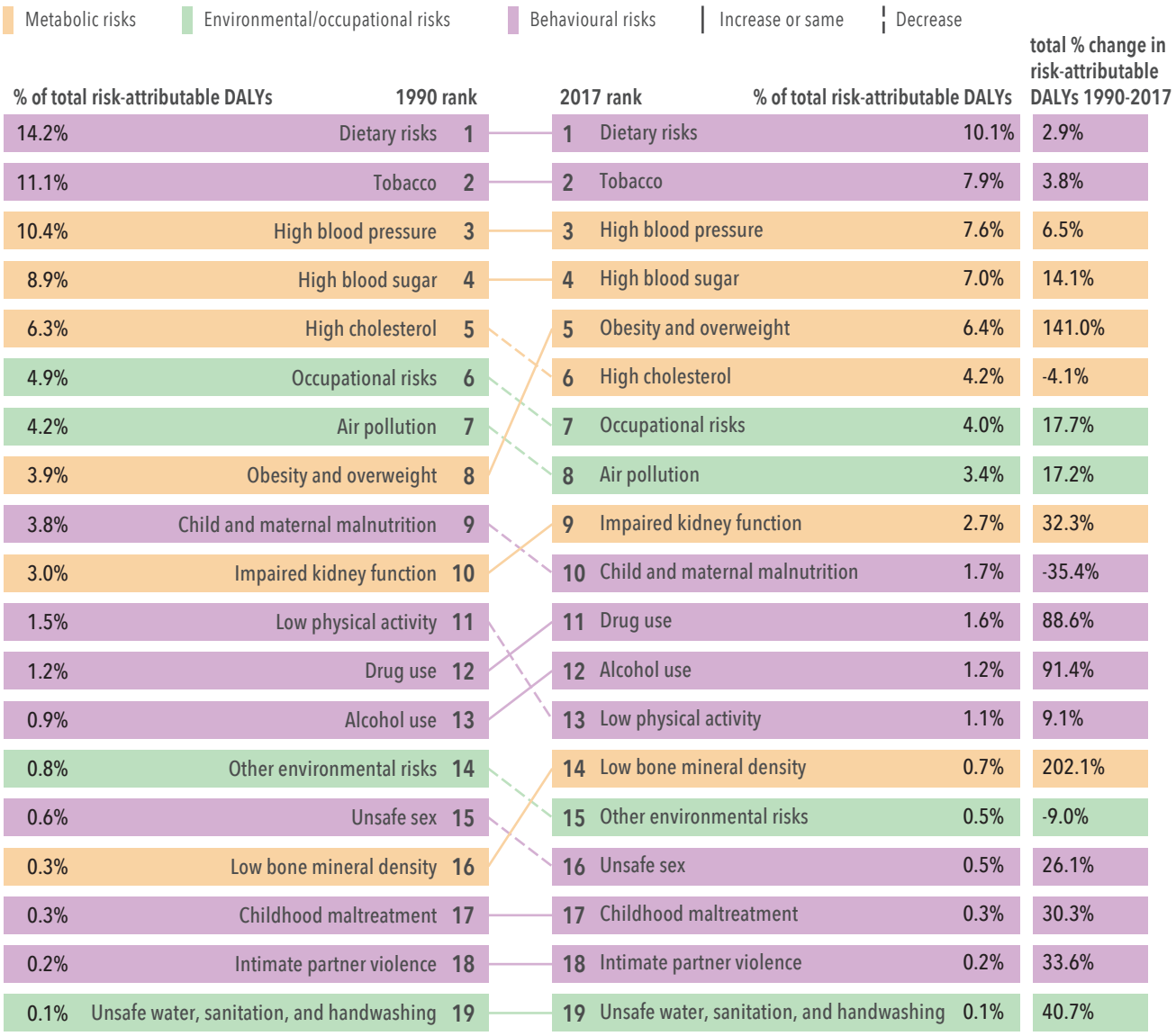
Understanding the risk factors that drive trends in disease burden is important to policymakers hoping to reduce disease burden. With estimates of the disease burden caused by specific risk factors, health policymakers can determine which programmes have been effective in reducing risk and prioritise risk-reduction efforts likely to have the largest population health payoff.

The leading risk factors in Singapore in 2017 were behavioural (for example, dietary risks and tobacco) and metabolic (for example, high blood pressure, high blood sugar, obesity and overweight, and high cholesterol). Behavioural risk factors accounted for 22.4% of total DALYs in Singapore, while metabolic risk factors accounted for 17.8% of total DALYs. Environmental and occupational risk factors accounted for 7.8% of Singapore's total disease burden.

The specific risk factors affecting health in Singapore – in particular the leading risk factors – have remained fairly steady over time. Figure 22 shows that the four leading risk factors, dietary risks, tobacco, high blood pressure, and high blood sugar, remained unchanged between 1990 and 2017. Overweight and obesity moved up from the eighth leading risk factor in 1990 to the fifth leading risk factor in 2017. Dietary risks alone accounted for 10.1% of Singapore's overall disease burden in 2017. Tobacco, high blood pressure, and high blood sugar accounted for 7.9%, 7.6%, and 7.0%,

FIGURE 22

## Leading risk factors contributing to DALYs, Singapore, both sexes, 1990–2017




*Percentages of total risk-attributable burden cannot be summed across risk factors due to the overlap among them.*

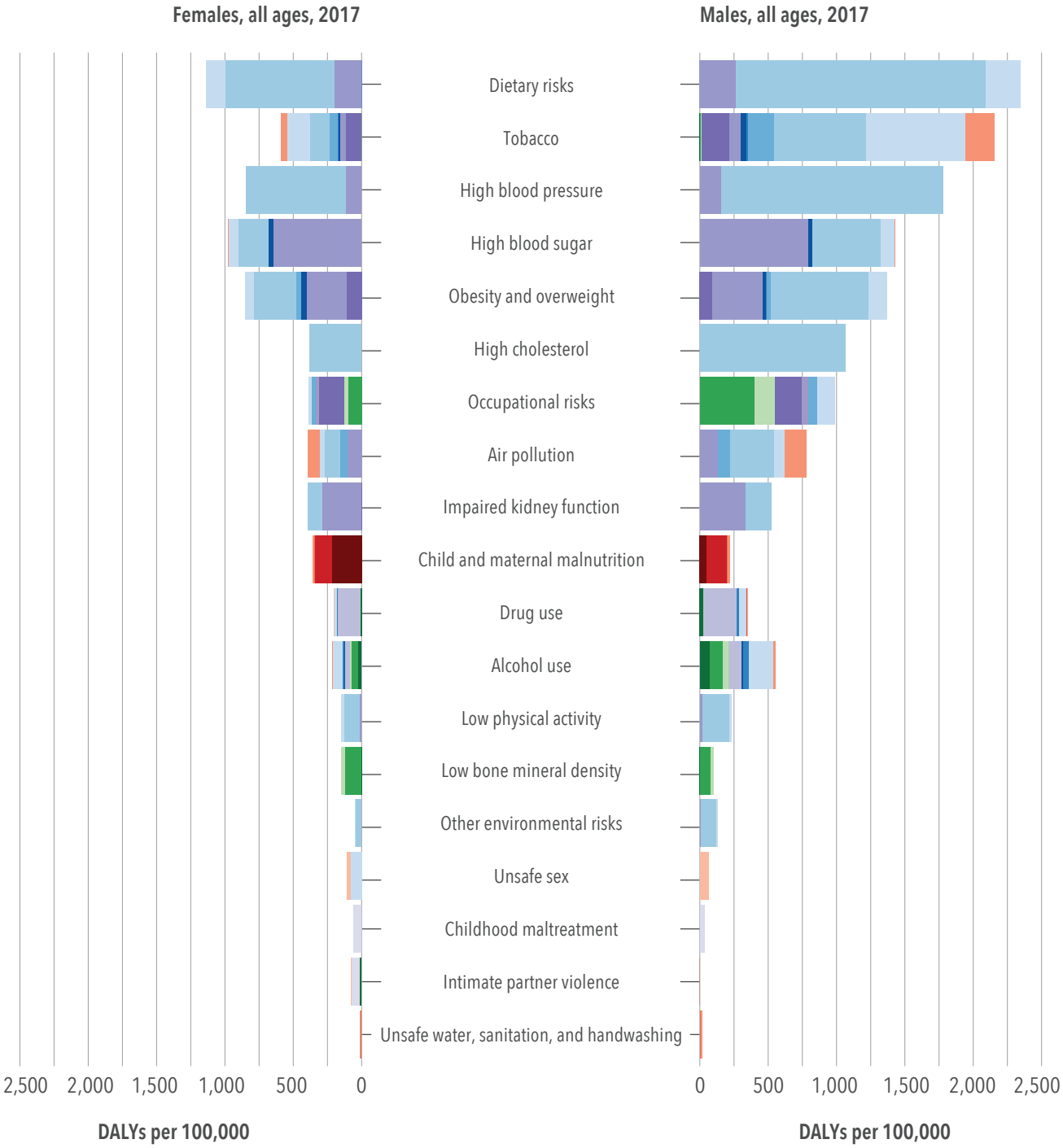
respectively, of total disease burden. Most environmental and occupational risk factors dropped in ranking between 1990 and 2017.

Just as there are differences in LE and disease burden among females and males in Singapore, there are also notable differences in their disease burdens attributable to risk factors. Figure 23 breaks down the disease burden caused by specific risk factors for males and females in 2017. (Risk factors are arranged from largest to smallest attributable DALYs for both sexes combined.) At the highest level, Figure 23 indicates that the disease burden due to exposure to risk factors in Singapore was much higher among males than females in 2017. It also indicates that the leading risk factors for males and females were different – for females, for example, the leading three risk factors were dietary risks, high blood sugar, and overweight and obesity, but for males they were dietary risks, tobacco, and high blood pressure. For females, tobacco was the fifth leading risk factor in 2017.

Certain risk factors showed notable differences in magnitude between males and females. For instance,

FIGURE 23

## Breakdown of DALYs attributable to specific risk factors, Singapore, males versus females, 2017




HIV/AIDS and sexually transmitted infections
Respiratory infections and tuberculosis
Enteric infections
Other infectious diseases
Maternal and neonatal disorders
Nutritional deficiencies
Cancers
Cardiovascular diseases
Chronic respiratory diseases
Digestive diseases
Neurological disorders
Mental disorders
Substance use disorders
Diabetes and kidney diseases
Sense organ diseases
Musculoskeletal disorders
Other non-communicable diseases
Transport injuries
Unintentional injuries
Self-harm and interpersonal violence

Risk factors are arranged from highest to lowest rates of all-ages risk-attributable DALYs per 100,000 for both sexes combined.

males had much higher disease burdens attributable to tobacco, occupational risks, and alcohol and drug use. Females had much higher disease burdens attributable to child and maternal malnutrition, low bone mineral density, unsafe sex, childhood maltreatment, and intimate partner violence.

While the leading risk factors and the magnitude of disease burden they caused were different for males and females in 2017, the specific diseases caused by those risk factors tended to be similar for both sexes. The burden caused by dietary risks, for example, was primarily composed of cardiovascular diseases, followed by diabetes and kidney diseases and cancers, for both males and females. The burden caused by high blood pressure, for both males and females, was mostly cardiovascular diseases, followed by diabetes and kidney diseases.

Further information on the risk factors contributing to the burden of disease in Singapore is available in the Appendices. Appendix Figure 32 shows the drivers of change in the burdens of the 10 leading causes of risk-attributable DALYs among both sexes in Singapore between 1990 and 2017. Appendix Figures 33 and 34 analyse the risk factors that contributed to YLLs in Singapore from 1990 to 2017. Appendix Figures 35 and 36 analyse the risk factors that contributed to YLDs in Singapore from 1990 to 2017.

TABLE 3

## Table of LE and HALE rankings, males and females, Singapore and comparison group locations, 2017

**LE, males, 2017**

| Rank | Location | Years |
|---|---|---|
| 1 | Switzerland | 82.12 |
| 2 | Singapore | 81.94 |
| 3 | Israel | 81.28 |
| 4 | Hong Kong SAR | 81.15 |
| 5 | Japan | 81.08 |
| 6 | Italy | 80.85 |
| 7 | Sweden | 80.79 |
| 8 | Norway | 80.47 |
| 9 | Australia | 80.23 |
| 10 | Spain | 80.22 |
| 11 | Luxembourg | 80.04 |
| 12 | Ireland | 80.00 |
| 13 | Netherlands | 79.89 |
| 14 | Canada | 79.87 |
| 15 | Iceland | 79.83 |
| 16 | France | 79.82 |
| 17 | New Zealand | 79.66 |
| 18 | South Korea | 79.52 |
| 19 | Austria | 79.41 |
| 20 | United Kingdom | 79.18 |
| 21 | Belgium | 78.88 |
| 22 | Denmark | 78.82 |
| 23 | Finland | 78.55 |
| 24 | Portugal | 78.51 |
| 25 | Greece | 78.45 |
| 26 | Germany | 78.26 |
| 27 | Slovenia | 77.92 |
| 29 | Chile | 77.21 |
| 30 | Czech Republic | 76.32 |
| 31 | United States | 76.09 |
| 32 | Turkey | 75.21 |
| 33 | Slovakia | 74.09 |
| 34 | Poland | 74.07 |
| 35 | Estonia | 73.67 |
| 36 | Hungary | 73.19 |
| 37 | Mexico | 72.56 |
| 38 | Latvia | 70.15 |
| 39 | Lithuania | 69.63 |

**LE, females, 2017**

| Rank | Location | Years |
|---|---|---|
| 1 | Singapore | 87.55 |
| 2 | Japan | 87.21 |
| 3 | Hong Kong SAR | 86.11 |
| 4 | Iceland | 85.94 |
| 5 | Spain | 85.83 |
| 6 | France | 85.73 |
| 7 | Switzerland | 85.67 |
| 8 | South Korea | 85.49 |
| 9 | Italy | 85.31 |
| 10 | Australia | 84.59 |
| 11 | Israel | 84.58 |
| 12 | Finland | 84.28 |
| 13 | Slovenia | 84.23 |
| 14 | Portugal | 84.22 |
| 15 | Sweden | 84.18 |
| 16 | Norway | 84.17 |
| 17 | Austria | 84.04 |
| 18 | Canada | 84.00 |
| 19 | Belgium | 83.82 |
| 20 | Ireland | 83.68 |
| 21 | New Zealand | 83.58 |
| 22 | Greece | 83.57 |
| 23 | Luxembourg | 83.26 |
| 25 | Netherlands | 83.06 |
| 26 | Turkey | 83.05 |
| 27 | Germany | 83.03 |
| 28 | United Kingdom | 82.72 |
| 29 | Denmark | 82.69 |
| 30 | Chile | 82.13 |
| 31 | Estonia | 82.10 |
| 32 | Czech Republic | 81.96 |
| 33 | Poland | 81.85 |
| 34 | United States | 81.09 |
| 35 | Slovakia | 80.58 |
| 36 | Hungary | 80.21 |
| 37 | Lithuania | 80.21 |
| 38 | Latvia | 79.87 |
| 39 | Mexico | 78.50 |

**HALE, males, 2017**

| Rank | Location | Years |
|---|---|---|
| 1 | Singapore | 72.58 |
| 2 | Hong Kong SAR | 72.34 |
| 3 | Japan | 71.41 |
| 4 | Switzerland | 71.19 |
| 5 | Italy | 70.63 |
| 6 | Israel | 70.60 |
| 7 | Spain | 70.47 |
| 8 | Sweden | 70.37 |
| 9 | France | 69.98 |
| 10 | South Korea | 69.74 |
| 11 | Canada | 69.60 |
| 12 | Iceland | 69.60 |
| 13 | Netherlands | 69.56 |
| 14 | Ireland | 69.40 |
| 15 | Norway | 69.27 |
| 16 | Austria | 69.13 |
| 17 | Australia | 69.08 |
| 18 | Luxembourg | 68.95 |
| 19 | Greece | 68.61 |
| 20 | Denmark | 68.60 |
| 21 | Portugal | 68.60 |
| 22 | United Kingdom | 68.54 |
| 23 | Belgium | 68.29 |
| 24 | Germany | 68.26 |
| 25 | New Zealand | 68.02 |
| 26 | Finland | 68.00 |
| 28 | Chile | 67.12 |
| 29 | Slovenia | 66.28 |
| 30 | Turkey | 65.68 |
| 31 | United States | 65.26 |
| 32 | Czech Republic | 65.15 |
| 33 | Mexico | 64.24 |
| 34 | Estonia | 63.79 |
| 35 | Poland | 63.70 |
| 36 | Slovakia | 63.65 |
| 37 | Hungary | 63.10 |
| 38 | Latvia | 60.95 |
| 39 | Lithuania | 60.39 |

**HALE, females, 2017**

| Rank | Location | Years |
|---|---|---|
| 1 | Singapore | 75.81 |
| 2 | Hong Kong SAR | 75.01 |
| 3 | Japan | 74.65 |
| 4 | Spain | 73.62 |
| 5 | South Korea | 73.45 |
| 6 | France | 73.42 |
| 7 | Iceland | 73.10 |
| 8 | Italy | 72.97 |
| 9 | Switzerland | 72.67 |
| 10 | Israel | 72.10 |
| 11 | Australia | 71.69 |
| 12 | Austria | 71.66 |
| 13 | Portugal | 71.58 |
| 14 | Finland | 71.54 |
| 15 | Sweden | 71.44 |
| 16 | Canada | 71.39 |
| 17 | Ireland | 71.31 |
| 18 | Greece | 71.28 |
| 19 | Slovenia | 71.19 |
| 20 | Norway | 71.15 |
| 21 | Belgium | 70.91 |
| 22 | Germany | 70.83 |
| 23 | Netherlands | 70.69 |
| 25 | Denmark | 70.64 |
| 26 | Luxembourg | 70.42 |
| 27 | Turkey | 70.32 |
| 28 | Chile | 70.21 |
| 29 | New Zealand | 70.07 |
| 30 | United Kingdom | 70.04 |
| 31 | Estonia | 69.96 |
| 32 | Poland | 69.90 |
| 33 | Czech Republic | 69.63 |
| 34 | Slovakia | 68.91 |
| 35 | Hungary | 68.31 |
| 36 | Mexico | 68.22 |
| 37 | Lithuania | 68.14 |
| 38 | Latvia | 67.98 |
| 39 | United States | 67.85 |

# International comparisons

People in Singapore generally experience longer, healthier lives than most people around the world. Even when comparing Singapore's health performance to that of its peers – locations that are generally wealthy, allow people access to quality health care, and have disease burdens dominated by non-communicable diseases – Singapore does very well in the comparison.

To examine Singapore's performance in more detail, this report compares LE, HALE, disease burden, and risk factors that drive disease burden among a defined comparison group of locations. These locations are Singapore, the Hong Kong Special Administrative Region of China (HK SAR), and each member country of the Organisation for Economic Co-operation and Development (OECD). The full list of comparison locations can be found in the "Comparison group locations" box on the right.

## Life expectancy and healthy life expectancy

In 2017, Singapore had the highest LE at birth (84.8 years) and healthy life expectancy (HALE, defined as LE minus years expected to be lived with disability) at birth (74.2 years) in the world.

Table 3 shows LE and HALE at birth in the comparison group locations in 2017, broken down by sex. Females in Singapore had the highest LE at birth in the world, at 87.6 years, followed by Japan, Hong Kong SAR, Iceland, and Spain. For males, Singapore had the second highest LE at birth, at 81.9 years. Only in Switzerland did males have a higher LE at birth, at 82.1 years.

The rankings for HALE among the comparison group locations were similar. Singapore's males and females had the highest HALE at birth in 2017, at 72.3 and 75.8 years, respectively, followed in each case by Hong Kong SAR and Japan. Switzerland and Italy had the fourth and fifth highest HALE for males, while Spain and South Korea had the fourth and fifth highest HALE among females.

Further information on life expectancy and healthy life expectancy in Singapore and the comparison locations is available in the Appendices. Appendix Table 4 shows LE at birth and HALE at birth in 1990 and 2017, along with the total percentage change in each metric between 1990 and 2017. Appendix Figures 26 and 27 show the changes in disease burden responsible for changes in LE at birth from 1990 to 2017.

## DALYs

Given its performance in LE and HALE, it should come as no surprise that Singapore has low rates of overall disease burden when compared to its peers. Singapore performed better than the comparison group location averages on most of its leading causes of DALYs.

### COMPARISON GROUP LOCATIONS

Singapore

Hong Kong SAR

**OECD MEMBER COUNTRIES:**

Australia
Austria
Belgium
Canada
Chile
Czech Republic
Denmark
Estonia
Finland
France
Germany
Greece
Hungary
Iceland
Ireland
Israel
Italy
Japan
Korea
Latvia
Lithuania
Luxembourg
Mexico
Netherlands
New Zealand
Norway
Poland
Portugal
Slovakia
Slovenia
Spain
Sweden
Switzerland
Turkey
United Kingdom
United States

Figure 24 shows the age-standardised DALY rates (per 100,000 population) in each of the comparison group locations, for each of the 10 leading causes of age-standardised DALYs in Singapore. Singapore's 10 leading causes of age-standardised DALYs are represented in the figure's columns, from the leading cause, cardiovascular disease, on the left, to the 10th leading cause, skin diseases, on the right. Within each column, comparison group locations are arranged according to their age-standardised DALY rates due to that cause, with the highest burden at the top of each column and the lowest at the bottom. Therefore, being situated lower in each column is better – it means that fewer people in that location died prematurely or experienced disability due to that cause in 2017. Within each column, the locations are identified by whether their DALY rates were significantly lower than, similar to, or higher than the comparison group's average rate for that cause.

Figure 24 shows that Singapore performed significantly better than the comparison group average in nine of the 10 leading causes of its overall disease burden. Although cancers were the second leading cause of disease burden in Singapore, Singapore had the lowest rate of age-standardised DALYs due to cancers among the comparison group locations. It also had the second lowest rate due to neurological disorders (a category that includes Alzheimer's disease and other dementias), the third lowest rate due to other non-communicable diseases (most of the burden in that category was due to birth defects), and the fourth lowest rate due to musculoskeletal disorders. The clear outlier for Singapore in Figure 24 is respiratory infections and tuberculosis, a cause driven primarily by the burden due to lower respiratory infections, particularly pneumonia. For that cause, Singapore had the second highest burden of age-standardised DALYs among the comparison group locations, faring better than Mexico alone.

Further information on how Singapore's burden of disease compares to these locations is available in the Appendices. Appendix Figure 37 examines the burden of YLLs in Singapore compared to these locations, and Appendix Figure 38 examines the burden of YLDs in Singapore compared to these locations.

## Risk factors affecting health

As was the case with LE and disease burden, Singapore generally performed well in limiting the burden of disease due to risk factors. Singapore's age-standardised rates of DALYs attributable to risk factors tended to be lower than the comparison group location averages in 2017.

Figure 25 shows the risk-attributable age-standardised DALY rates (per 100,000 population) in each of the comparison group locations, for each of the 10 leading risk factors contributing to age-standardised DALYs in Singapore. Singapore's 10 leading risk factors are represented in the figure's columns, from the leading risk factor, dietary risks, on the left, to the 10th leading risk factor, child and maternal malnutrition, on the right. Comparison group locations are arranged within each column according to their risk-attributable age-standardised DALY rates due to that risk factor, with the highest burden at the top and the lowest at the bottom. Within each column, the locations are identified by whether their rates were significantly lower than, similar to, or higher than the comparison group's average rate for that cause.

Figure 25 shows that Singapore performed significantly better than the comparison group average on eight of the 10 leading risk factors contributing to overall disease burden in Singapore. Despite tobacco being the second leading risk factor in Singapore, Singapore had the lowest rate of risk-attributable age-standardised DALYs due to tobacco among the comparison group locations. It also had the fourth lowest rates due to overweight and obesity, which contributes to many health problems, as well as in child and maternal malnutrition, a key factor in birth defects. It had the fifth lowest rate due to high blood sugar. For two risk factors, Singapore recorded average levels of risk-attributable age-standardised DALYs in 2017: air pollution (which contributes to cardiovascular diseases, cancers, pneumonia, and other diseases) and impaired kidney function (a potential precursor to chronic kidney disease).

FIGURE 24

# Leading causes of age-standardised DALYs per 100,000 in Singapore and comparison group locations, 2017

Less than comparison group average | Same as comparison group average | Greater than comparison group average

| Cardiovascular diseases | Cancers | Musculoskeletal disorders | Mental disorders | Neurological disorders | Unintentional injuries | Other non-communicable diseases | Respiratory infections and tuberculosis | Diabetes and kidney diseases | Skin and subcutaneous diseases |
|---|---|---|---|---|---|---|---|---|---|
| Latvia [6,475] | Hungary [4,079] | Switzerland [2,770] | Australia [2,247] | Belgium [1,811] | Lithuania [2,436] | Turkey [1,765] | Mexico [782] | Mexico [3,656] | Canada [900] |
| Lithuania [6,028] | Poland [3,676] | Chile [2,650] | New Zealand [2,192] | Finland [1,793] | Latvia [2,241] | Mexico [1,628] | **Singapore [728]** | Turkey [1,368] | United States [884] |
| Hungary [4,950] | Lithuania [3,504] | Denmark [2,602] | United States [2,133] | Italy [1,778] | Slovenia [2,077] | Chile [1,341] | Lithuania [690] | United States [1,173] | Sweden [871] |
| Slovakia [4,837] | Slovakia [3,486] | Netherlands [2,501] | France [2,022] | Luxembourg [1,774] | Czech Republic [2,077] | Lithuania [1,230] | Slovakia [532] | Portugal [1,136] | Norway [871] |
| Estonia [4,320] | Latvia [3,422] | Germany [2,499] | Sweden [2,011] | Spain [1,729] | Slovakia [2,020] | United States [1,222] | Latvia [529] | Chile [1,110] | Iceland [821] |
| Poland [4,072] | Netherlands [3,303] | United Kingdom [2,421] | Netherlands [2,003] | Norway [1,717] | Poland [1,920] | Austria [1,197] | Portugal [503] | Israel [1,042] | France [820] |
| Czech Republic [3,803] | Denmark [3,258] | New Zealand [2,403] | Norway [1,962] | Greece [1,708] | Estonia [1,875] | Latvia [1,178] | Turkey [484] | Czech Republic [978] | Denmark [804] |
| Turkey [3,418] | Czech Republic [3,135] | Belgium [2,364] | Ireland [1,956] | Netherlands [1,697] | Hungary [1,791] | United Kingdom [1,123] | United Kingdom [470] | Denmark [963] | United Kingdom [802] |
| United States [3,030] | Estonia [3,076] | Portugal [2,303] | Greece [1,944] | United Kingdom [1,662] | New Zealand [1,789] | Poland [1,122] | Chile [454] | South Korea [931] | Finland [796] |
| Greece [3,001] | Slovenia [3,038] | Norway [2,299] | Portugal [1,904] | Iceland [1,645] | Australia [1,475] | Ireland [1,121] | Poland [453] | Hungary [920] | Luxembourg [782] |
| Mexico [2,862] | Germany [3,027] | Luxembourg [2,294] | Spain [1,897] | Sweden [1,639] | Finland [1,180] | Hungary [1,120] | Japan [437] | Latvia [886] | Netherlands [770] |
| Germany [2,570] | United Kingdom [3,023] | United States [2,287] | Chile [1,888] | Ireland [1,628] | Norway [1,152] | Slovakia [1,117] | Estonia [427] | Estonia [868] | Switzerland [767] |
| Finland [2,564] | France [3,018] | Iceland [2,279] | Finland [1,875] | Germany [1,607] | Belgium [1,125] | Belgium [1,088] | Hong Kong SAR [423] | Luxembourg [840] | New Zealand [759] |
| Slovenia [2,502] | Luxembourg [2,963] | Italy [2,265] | Belgium [1,873] | Austria [1,591] | Japan [1,121] | New Zealand [1,067] | United States [421] | Slovakia [802] | Ireland [749] |
| Chile [2,385] | New Zealand [2,943] | Israel [2,262] | Germany [1,860] | Estonia [1,577] | France [1,073] | Denmark [1,062] | South Korea [405] | Poland [787] | Israel [715] |
| Austria [2,269] | United States [2,942] | Canada [2,261] | Canada [1,857] | United States [1,574] | Chile [1,032] | Greece [1,058] | Belgium [404] | Ireland [781] | Belgium [695] |
| United Kingdom [2,202] | Belgium [2,917] | Finland [2,214] | United Kingdom [1,849] | Latvia [1,565] | South Korea [1,016] | Israel [1,051] | Czech Republic [391] | Canada [760] | Australia [693] |
| New Zealand [2,175] | Greece [2,917] | Japan [2,209] | Italy [1,824] | Turkey [1,557] | Sweden [1,015] | Netherlands [1,047] | Israel [389] | Netherlands [759] | Chile [660] |
| Luxembourg [2,171] | Portugal [2,870] | Greece [2,202] | Luxembourg [1,816] | Israel [1,547] | Mexico [1,013] | Canada [1,047] | Greece [374] | Italy [750] | Germany [658] |
| Sweden [2,152] | Chile [2,820] | Ireland [2,162] | Switzerland [1,807] | Lithuania [1,538] | Austria [990] | Germany [1,043] | Denmark [355] | Greece [747] | Austria [647] |
| Ireland [2,075] | Canada [2,816] | Turkey [2,158] | Iceland [1,747] | Portugal [1,533] | Luxembourg [989] | Norway [1,040] | Iceland [344] | Austria [747] | Italy [645] |
| Portugal [2,072] | Ireland [2,808] | France [2,130] | Austria [1,742] | Mexico [1,518] | Iceland [964] | Slovenia [1,015] | Netherlands [341] | Belgium [730] | Portugal [637] |
| Belgium [2,001] | Australia [2,746] | Australia [2,122] | Denmark [1,734] | France [1,518] | United States [962] | Switzerland [1,004] | Ireland [338] | Finland [730] | Japan [637] |
| Canada [1,978] | Turkey [2,720] | Sweden [2,082] | Turkey [1,657] | Canada [1,499] | Greece [941] | Estonia [996] | Germany [322] | Lithuania [712] | Greece [610] |
| **Singapore [1,967]** | Iceland [2,697] | Austria [2,060] | Israel [1,624] | Poland [1,489] | Germany [924] | Sweden [982] | Luxembourg [313] | Sweden [695] | **Singapore [601]** |
| Iceland [1,930] | Italy [2,677] | South Korea [2,033] | Japan [1,588] | Slovakia [1,484] | Switzerland [922] | Australia [975] | Norway [310] | Norway [681] | South Korea [600] |
| Denmark [1,884] | Spain [2,676] | Spain [1,971] | **Singapore [1,586]** | Denmark [1,467] | **Singapore [919]** | France [966] | Canada [307] | Slovenia [674] | Spain [599] |
| Norway [1,846] | Austria [2,674] | Hungary [1,951] | Lithuania [1,529] | Czech Republic [1,454] | United Kingdom [908] | Czech Republic [943] | France [294] | Germany [673] | Estonia [584] |
| Netherlands [1,804] | Norway [2,664] | Slovakia [1,949] | South Korea [1,519] | Hungary [1,437] | Canada [888] | Finland [931] | Spain [293] | Switzerland [664] | Latvia [545] |
| Australia [1,783] | Hong Kong SAR [2,523] | Slovenia [1,885] | Estonia [1,473] | Switzerland [1,429] | Denmark [888] | Japan [917] | Sweden [289] | **Singapore [658]** | Hungary [542] |
| Hong Kong SAR [1,774] | Israel [2,469] | Latvia [1,844] | Hong Kong SAR [1,443] | New Zealand [1,397] | Ireland [883] | Spain [907] | Slovenia [257] | Iceland [657] | Hong Kong SAR [539] |
| Italy [1,764] | Sweden [2,441] | Lithuania [1,820] | Mexico [1,400] | Slovenia [1,394] | Israel [855] | Portugal [907] | Hungary [253] | New Zealand [649] | Poland [538] |
| Spain [1,746] | South Korea [2,423] | Czech Republic [1,787] | Slovenia [1,399] | Australia [1,371] | Spain [850] | Luxembourg [906] | Australia [252] | Spain [628] | Czech Republic [525] |
| Japan [1,619] | Finland [2,393] | Poland [1,749] | Latvia [1,398] | Chile [1,324] | Portugal [831] | Italy [881] | Italy [251] | Australia [622] | Slovakia [517] |
| France [1,595] | Japan [2,340] | **Singapore [1,749]** | Hungary [1,378] | South Korea [1,313] | Turkey [803] | Iceland [840] | Switzerland [236] | United Kingdom [582] | Mexico [515] |
| Israel [1,584] | Switzerland [2,253] | Estonia [1,687] | Czech Republic [1,365] | Japan [1,120] | Netherlands [767] | **Singapore [780]** | New Zealand [233] | Hong Kong SAR [556] | Slovenia [506] |
| South Korea [1,516] | Mexico [2,149] | Hong Kong SAR [1,407] | Slovakia [1,315] | **Singapore [1,008]** | Italy [758] | South Korea [771] | Finland [216] | Japan [527] | Turkey [503] |
| Switzerland [1,505] | **Singapore [1,846]** | Mexico [1,263] | Poland [1,282] | Hong Kong SAR [914] | Hong Kong SAR [645] | Hong Kong SAR [728] | Austria [213] | France [498] | Lithuania [488] |

FIGURE 25

## Leading risk factors contributing to age-standardised DALYs per 100,000, Singapore and comparison group locations, 2017

Less than comparison group average | Same as comparison group average | Greater than comparison group average

| Dietary risks | Tobacco | High blood pressure | High blood sugar | Obesity and overweight | High cholesterol | Occupational risks | Air pollution | Impaired kidney function | Child and maternal malnutrition |
|---|---|---|---|---|---|---|---|---|---|
| Latvia [3,986] | Hungary [4,008] | Lithuania [4,004] | Mexico [4,295] | Mexico [3,236] | Lithuania [2,074] | South Korea [920] | Turkey [1,220] | Mexico [1,743] | Turkey [1,605] |
| Lithuania [3,877] | Latvia [3,457] | Latvia [3,906] | Latvia [2,263] | Latvia [2,903] | Latvia [1,967] | New Zealand [844] | Mexico [1,190] | Turkey [775] | Mexico [1,405] |
| Hungary [3,417] | Poland [3,307] | Hungary [3,379] | Hungary [2,246] | Hungary [2,681] | Slovakia [1,564] | Switzerland [831] | Hungary [996] | Latvia [744] | Chile [873] |
| Slovakia [3,293] | Lithuania [3,238] | Slovakia [3,061] | Czech Republic [2,127] | Lithuania [2,613] | Hungary [1,514] | Turkey [830] | Poland [857] | Lithuania [688] | United States [827] |
| Poland [2,687] | Greece [3,017] | Estonia [3,026] | Poland [1,970] | Estonia [2,414] | Estonia [1,248] | France [826] | Latvia [851] | United States [596] | Slovakia [717] |
| Czech Republic [2,614] | Slovakia [2,960] | Poland [2,292] | Turkey [1,929] | Slovakia [2,411] | Czech Republic [1,183] | Czech Republic [764] | Slovakia [809] | Slovakia [540] | United Kingdom [702] |
| Estonia [2,534] | Czech Republic [2,956] | Czech Republic [2,289] | Lithuania [1,892] | Turkey [2,374] | Poland [1,166] | Denmark [758] | Lithuania [793] | Estonia [540] | Hungary [679] |
| Mexico [2,377] | Turkey [2,748] | Turkey [2,136] | Estonia [1,887] | United States [2,355] | Greece [926] | Slovenia [756] | Czech Republic [727] | Chile [531] | Canada [648] |
| United States [2,067] | Estonia [2,634] | Mexico [2,134] | United States [1,856] | Poland [2,215] | Turkey [904] | Poland [729] | Greece [624] | Hungary [518] | Poland [622] |
| Turkey [1,901] | Belgium [2,444] | Chile [1,641] | Portugal [1,830] | Czech Republic [2,093] | Mexico [888] | Netherlands [727] | Hong Kong SAR [615] | Israel [426] | Switzerland [578] |
| Chile [1,782] | Denmark [2,399] | Greece [1,558] | Slovakia [1,729] | Chile [1,816] | United States [795] | Japan [726] | Chile [586] | Czech Republic [411] | Greece [576] |
| Greece [1,768] | Netherlands [2,357] | Slovenia [1,537] | Denmark [1,689] | Slovenia [1,611] | Germany [720] | Chile [718] | South Korea [520] | Greece [402] | New Zealand [543] |
| Finland [1,614] | Slovenia [2,339] | United States [1,532] | Chile [1,650] | Greece [1,503] | Finland [716] | Canada [705] | Slovenia [498] | Poland [380] | Israel [531] |
| Slovenia [1,590] | Germany [2,240] | Finland [1,527] | Israel [1,525] | Canada [1,485] | Austria [650] | Iceland [693] | Israel [496] | **Singapore [376]** | Portugal [527] |
| Germany [1,559] | United States [2,128] | Germany [1,444] | Luxembourg [1,510] | Portugal [1,433] | New Zealand [627] | Germany [686] | United States [480] | Germany [343] | Denmark [523] |
| Hong Kong SAR [1,556] | Luxembourg [1,998] | Austria [1,361] | Finland [1,470] | New Zealand [1,416] | Slovenia [620] | Hong Kong SAR [675] | Belgium [474] | Portugal [341] | Australia [520] |
| Portugal [1,407] | Ireland [1,993] | Luxembourg [1,283] | Ireland [1,460] | Luxembourg [1,413] | United Kingdom [606] | Australia [672] | **Singapore [470]** | New Zealand [336] | Latvia [515] |
| New Zealand [1,391] | Spain [1,989] | Ireland [1,278] | South Korea [1,394] | Finland [1,410] | Iceland [606] | Hungary [659] | Germany [457] | Austria [330] | South Korea [512] |
| United Kingdom [1,387] | Austria [1,961] | Sweden [1,197] | Greece [1,380] | Australia [1,389] | Sweden [578] | United Kingdom [659] | Denmark [456] | Hong Kong SAR [314] | Germany [509] |
| Sweden [1,368] | Canada [1,957] | Portugal [1,161] | Netherlands [1,362] | United Kingdom [1,377] | Ireland [573] | Portugal [643] | Netherlands [443] | Canada [311] | Netherlands [504] |
| **Singapore [1,364]** | United Kingdom [1,870] | Belgium [1,141] | Austria [1,315] | Germany [1,357] | **Singapore [559]** | Belgium [642] | United Kingdom [418] | Japan [308] | Italy [498] |
| Canada [1,354] | Portugal [1,777] | New Zealand [1,139] | Sweden [1,301] | Iceland [1,340] | Canada [554] | Austria [632] | Austria [414] | Australia [293] | Spain [492] |
| Ireland [1,323] | France [1,769] | Denmark [1,136] | Germany [1,284] | Ireland [1,280] | Chile [538] | Latvia [616] | Estonia [405] | South Korea [287] | Belgium [474] |
| Austria [1,321] | Norway [1,675] | United Kingdom [1,131] | Belgium [1,273] | Denmark [1,254] | Norway [526] | Lithuania [613] | Luxembourg [405] | Denmark [274] | Austria [468] |
| Belgium [1,262] | Switzerland [1,671] | Norway [1,087] | Iceland [1,265] | Austria [1,250] | Australia [514] | Norway [611] | Italy [395] | Ireland [273] | Lithuania [464] |
| Iceland [1,256] | Chile [1,658] | Netherlands [1,069] | Norway [1,245] | Belgium [1,183] | Luxembourg [489] | Italy [587] | Portugal [380] | Luxembourg [273] | Ireland [446] |
| Denmark [1,248] | Iceland [1,642] | Canada [1,041] | Slovenia [1,209] | Israel [1,174] | Belgium [488] | United States [581] | Ireland [351] | Belgium [255] | Slovenia [433] |
| Norway [1,237] | New Zealand [1,625] | **Singapore [1,039]** | Italy [1,208] | Netherlands [1,170] | Portugal [478] | Luxembourg [566] | Spain [325] | Slovenia [255] | Czech Republic [424] |
| Luxembourg [1,208] | Italy [1,625] | Iceland [1,038] | Canada [1,207] | Sweden [1,169] | Denmark [466] | Ireland [561] | Switzerland [298] | Sweden [248] | France [410] |
| Japan [1,193] | South Korea [1,623] | Israel [1,024] | United Kingdom [1,121] | Spain [1,134] | Netherlands [451] | Greece [561] | France [286] | Finland [246] | Estonia [407] |
| South Korea [1,170] | Israel [1,609] | Spain [1,019] | Switzerland [1,107] | Norway [1,105] | Hong Kong SAR [450] | Slovakia [553] | Japan [279] | Netherlands [243] | Japan [407] |
| Netherlands [1,158] | Japan [1,575] | Italy [1,012] | Spain [1,034] | Italy [1,055] | Spain [428] | Sweden [541] | Norway [252] | Spain [234] | Sweden [382] |
| Italy [1,096] | Sweden [1,545] | Hong Kong SAR [961] | New Zealand [1,024] | Switzerland [950] | Italy [424] | **Singapore [539]** | Australia [248] | Italy [232] | Norway [376] |
| Australia [1,079] | Australia [1,538] | Japan [947] | **Singapore [967]** | France [919] | Switzerland [417] | Finland [537] | Canada [246] | United Kingdom [228] | Luxembourg [362] |
| Spain [1,028] | Hong Kong SAR [1,480] | Australia [936] | Australia [924] | **Singapore [860]** | Israel [402] | Mexico [528] | Iceland [240] | Switzerland [222] | **Singapore [349]** |
| Switzerland [1,007] | Finland [1,389] | France [864] | France [811] | Hong Kong SAR [805] | France [384] | Estonia [520] | Sweden [220] | Norway [218] | Finland [343] |
| France [977] | Mexico [1,357] | Switzerland [763] | Japan [726] | South Korea [666] | Japan [356] | Spain [503] | Finland [217] | Iceland [209] | Hong Kong SAR [336] |
| Israel [954] | **Singapore [1,067]** | South Korea [712] | Hong Kong SAR [708] | Japan [538] | South Korea [291] | Israel [494] | New Zealand [199] | France [190] | Iceland [325] |

# Conclusion

Between 1990 and 2017, health in Singapore improved. Life expectancy and healthy life expectancy increased. When taking into account Singapore's ageing population, rates of disease burden declined – primarily through reductions in the years of life lost to fatal, non-communicable diseases such as cardiovascular diseases, cancers, and chronic respiratory diseases. As of 2017, the Singapore population was one of the healthiest in the world, with lower-than-average rates of disease burden and exposure to risk factors that can jeopardise health.

At the same time, Singapore still has important health challenges. Gains in LE have not been matched by gains in HALE. Even as the burden of early death has declined, Singapore's rates of non-fatal, disabling health conditions have remained almost constant since 1990. This has resulted in longer lives, but lives containing more time – especially toward the end of life – spent with disability.

Singapore also faces challenges due to its ageing population. The increase in the amounts of early death and disability due to causes associated with ageing – such as cardiovascular diseases, cancers, diabetes, neurological disorders, and sense organ diseases – will require vigilance in assuring the capacity of Singapore's health system to cope with those problems.

Going forward, Singapore's primary challenges will be how to continue increasing LE while also making progress in further reducing the burden of disability and enhancing the abilities of its health system to care for its ageing population. Succeeding in those goals would, in human terms, result in more Singaporeans advancing deep into old age in good health, allowing them to enjoy fully the time they spend with work, family, and friends.

# Appendices

## Life expectancy and healthy life expectancy

Table 4 shows LE at birth and HALE at birth for Singapore and all comparison group locations in 1990 and 2017, along with the total percentage change in each metric between 1990 and 2017. The list is ordered according to HALE at birth in 2017, from greatest to least.

## Breaking down changes in life expectancy, 1990–2017

Figures 29, 30, 31, and 32 illustrate the factors that drove changes in the burdens of DALYs, YLLs, YLDs, and risk-attributable DALYs, respectively, among both sexes in Singapore between 1990 and 2017. They show the 10 leading causes and risk factors among both sexes in 2017, arranged from highest to lowest burden. The figures sort the many drivers of changes in population health into three categories: population growth, population ageing, and all other remaining factors. "All other remaining factors" includes changes in treatment modalities, access to health care, exposure to risk factors, and so on. (Figure 32, which addresses risk-attributable DALYs, splits changes in exposure to each of the 10 risk factors from the "other factors" category, thus Figure 32 contains four categories.) The black dot for each cause represents the total percentage change in the number of DALYs, YLLs, YLDs, or risk-attributable DALYs due to that cause or risk. For example, in Figure 29, the number of DALYs due to cardiovascular disease increased by 12% between 1990 and 2017. Population growth and ageing put upward pressure on the burden of cardiovascular disease. Those two factors would have driven up the number of DALYs by more than 125%. However, all other factors combined put downward pressure on disease burden, which nearly balanced out the effects of population growth and ageing.

## Breaking down DALYs into YLLs and YLDs

Figure 28 shows the proportion of the DALYs for each cause, in both 1990 and 2017, composed of fatal burden (YLLs) and non-fatal burden (YLDs). The trend of a decreasing proportion of YLLs and an increasing proportion of YLDs within causes of Singaporean disease burden is evident throughout Figure 28. These cause-specific trends are in line with the overall changes in Singaporean disease burden reflected in Figure 3, on page 22, of declining age-standardised rates of YLLs and steady age-standardised rates of YLDs from 1990 to 2017.

## Breaking down changes in causes of disease burden, 1990–2017

Figures 29, 30, 31, and 32 show the drivers of change in the burden of the 10 leading causes of DALYs, YLLs, YLDs, and risk-attributable DALYs, respectively, among both sexes in Singapore between 1990 and 2017. The causes and risks in each figure are arranged according to their burden in 2017, from highest to lowest. For each cause and risk factor, the figures illustrate how much of the change in burden recorded between 1990 and 2017 was due to each of three factors: population growth, population ageing, and the age- and cause-specific rate of disease burden. (Figure 32, on risk-attributable DALYs, also shows change due to exposure to risk factors.) The black dot for each cause represents the total percentage change in the number of DALYs, YLLs, YLDs, or risk-attributable DALYs due to that cause or risk. For example, in Figure 29, the number of DALYs due to cardiovascular disease increased by a total of 12% between 1990 and 2017. Population growth and population ageing put upward pressure on the burden of cardiovascular disease – those two factors would have driven up the number of DALYs by more than 125%. However, reductions in the rates of early death and disability due to cardiovascular disease (due to improvements in prevention and treatment) nearly balanced out the effects of population growth and ageing.

## Risk factors affecting health

The body of this report analyses the risk factors contributing to Singapore's overall disease burden in terms of DALYs (see Figures 22 and 23 on pages 45 and 46, respectively). This section of the report presents figures similar to Figures 22 and 23, but showing risk factors contributing to YLLs (Figures 33 and 34) and YLDs (Figures 35 and 36).

## International comparisons

The body of this report analyses the burden of disease in Singapore relative to its peers, defined as the Hong Kong SAR and the member countries of the OECD, in terms of DALYs (see Figure 24). This section of the report presents figures similar to Figure 24, but showing the comparison in terms of YLLs (Figure 37) and YLDs (Figure 38).

TABLE 4

Life expectancy and HALE at birth in 1990 and 2017, and percentage change for Singapore and comparison group locations, both sexes

| | LE (years) | | Total percentage change in LE (%) | HALE (years) | | Total percentage change in HALE (%) |
|---|---|---|---|---|---|---|
| Location | 1990 | 2017 | 1990–2017 | 1990 | 2017 | 1990–2017 |
| Singapore | 76.10 | 84.79 | 11.42 | 67.06 | 74.22 | 10.68 |
| Japan | 79.28 | 84.19 | 6.19 | 69.65 | 73.07 | 4.90 |
| Switzerland | 77.82 | 83.96 | 7.88 | 67.13 | 71.98 | 7.23 |
| Hong Kong Special Administrative Region of China | 78.12 | 83.61 | 7.04 | 69.47 | 73.64 | 6.01 |
| Italy | 77.07 | 83.17 | 7.92 | 66.96 | 71.87 | 7.32 |
| Spain | 77.00 | 83.06 | 7.87 | 67.20 | 72.08 | 7.27 |
| Israel | 77.41 | 82.97 | 7.18 | 67.04 | 71.38 | 6.47 |
| France | 77.03 | 82.84 | 7.55 | 67.24 | 71.75 | 6.70 |
| Iceland | 77.84 | 82.75 | 6.30 | 67.40 | 71.26 | 5.73 |
| South Korea | 72.23 | 82.60 | 14.36 | 63.15 | 71.68 | 13.51 |
| Sweden | 77.73 | 82.50 | 6.14 | 67.42 | 70.93 | 5.21 |
| Australia | 76.87 | 82.39 | 7.19 | 66.35 | 70.37 | 6.05 |
| Norway | 76.65 | 82.34 | 7.42 | 66.02 | 70.24 | 6.38 |
| Canada | 77.33 | 81.96 | 5.99 | 67.15 | 70.51 | 5.01 |
| Ireland | 74.86 | 81.85 | 9.34 | 65.16 | 70.35 | 7.98 |
| Austria | 75.83 | 81.77 | 7.84 | 66.02 | 70.44 | 6.70 |
| Luxembourg | 75.40 | 81.66 | 8.31 | 64.87 | 69.70 | 7.45 |
| New Zealand | 75.35 | 81.64 | 8.34 | 64.69 | 69.05 | 6.75 |
| Netherlands | 77.00 | 81.52 | 5.86 | 66.70 | 70.16 | 5.18 |
| Portugal | 74.13 | 81.44 | 9.87 | 64.16 | 70.13 | 9.31 |
| Finland | 75.14 | 81.42 | 8.36 | 64.94 | 69.78 | 7.45 |
| Belgium | 76.04 | 81.38 | 7.02 | 65.89 | 69.62 | 5.67 |
| Slovenia | 73.88 | 81.10 | 9.77 | 63.34 | 68.74 | 8.52 |
| Greece | 77.51 | 80.99 | 4.49 | 67.33 | 69.93 | 3.86 |
| United Kingdom | 75.77 | 80.97 | 6.87 | 65.74 | 69.30 | 5.42 |
| Denmark | 75.00 | 80.76 | 7.68 | 65.30 | 69.63 | 6.63 |
| Germany | 75.54 | 80.63 | 6.74 | 65.62 | 69.55 | 5.98 |
| Chile | 73.16 | 79.70 | 8.95 | 63.58 | 68.69 | 8.03 |
| Czech Republic | 71.46 | 79.17 | 10.79 | 61.71 | 67.40 | 9.23 |
| Turkey | 68.64 | 78.94 | 15.01 | 58.95 | 67.88 | 15.14 |
| United States | 75.58 | 78.59 | 3.99 | 64.71 | 66.57 | 2.86 |
| Estonia | 69.97 | 78.09 | 11.61 | 60.50 | 67.03 | 10.80 |
| Poland | 71.21 | 77.99 | 9.53 | 61.46 | 66.81 | 8.70 |
| Slovakia | 70.95 | 77.41 | 9.10 | 61.31 | 66.33 | 8.18 |
| Hungary | 69.50 | 76.81 | 10.51 | 59.72 | 65.78 | 10.16 |
| Mexico | 71.40 | 75.52 | 5.77 | 62.81 | 66.23 | 5.43 |
| Latvia | 69.79 | 75.17 | 7.70 | 60.24 | 64.58 | 7.21 |
| Lithuania | 71.39 | 75.02 | 5.08 | 61.57 | 64.33 | 4.49 |

FIGURE 26

## Breakdown of changes in life expectancy at birth, males, Singapore and comparison group locations, 1990–2017

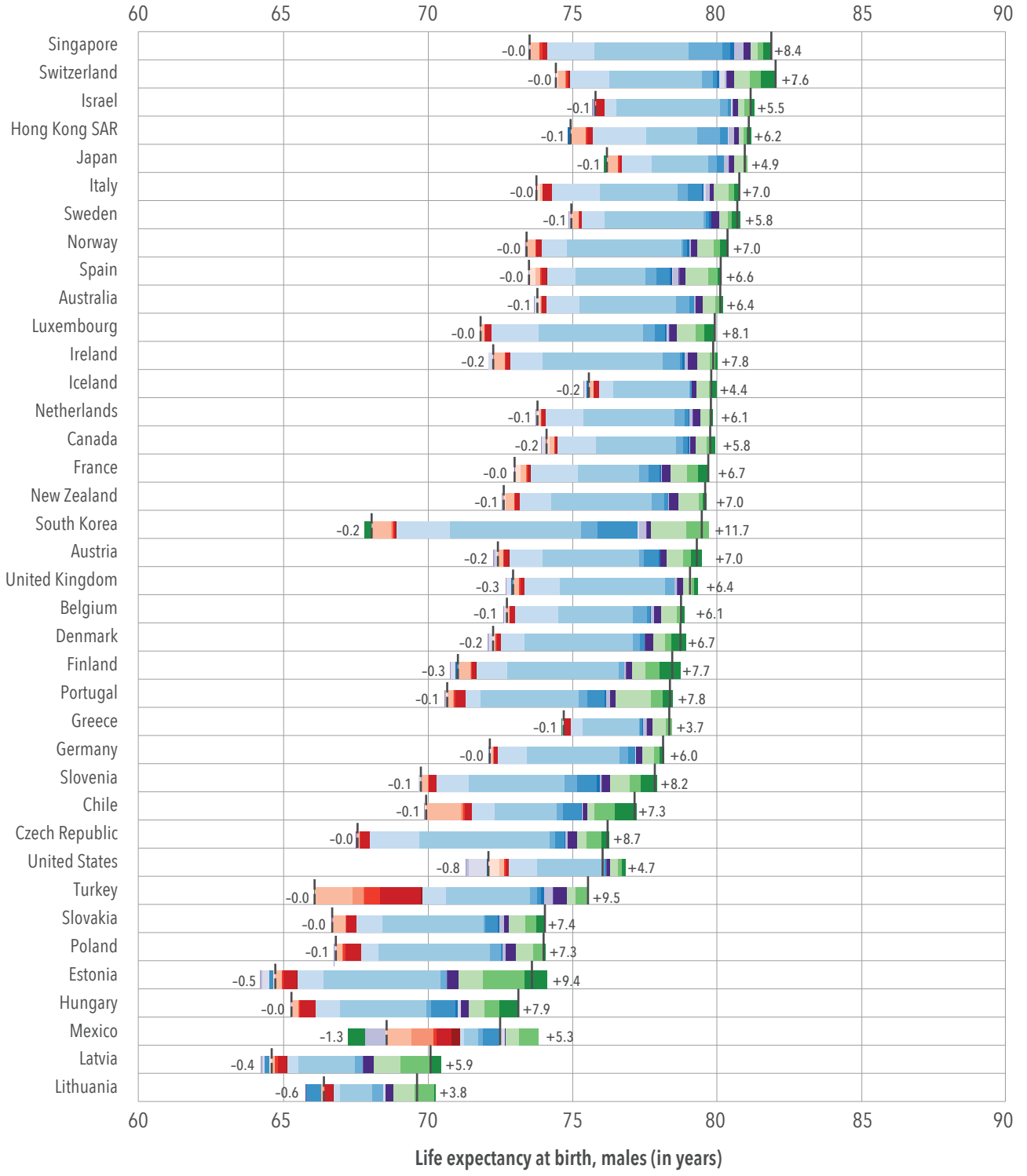


FIGURE 27

## Breakdown of changes in life expectancy at birth, females, Singapore and comparison group locations, 1990–2017

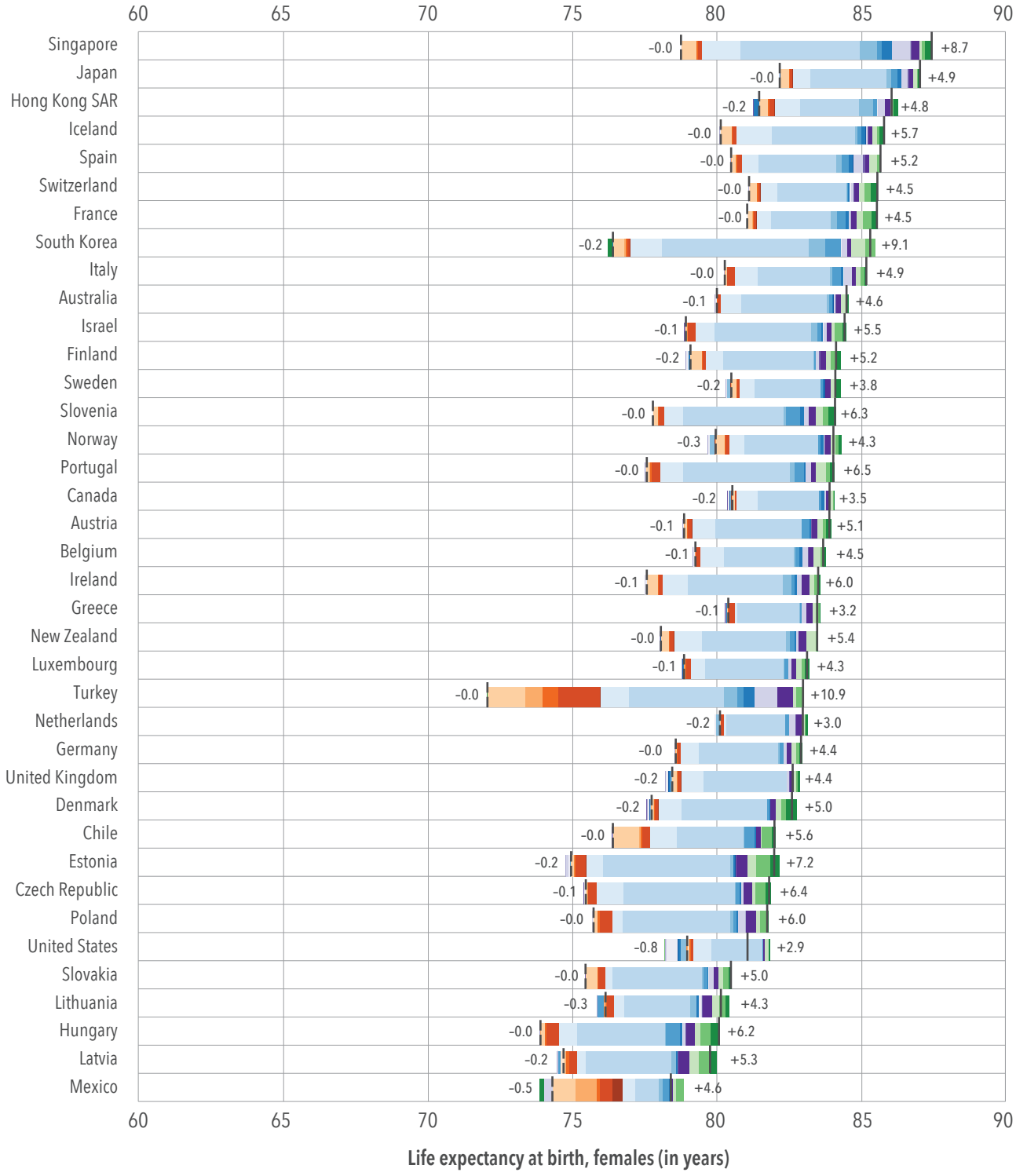


FIGURE 28

## Proportion of YLLs and YLDs within leading causes of DALYs, Singapore, both sexes, 1990–2017

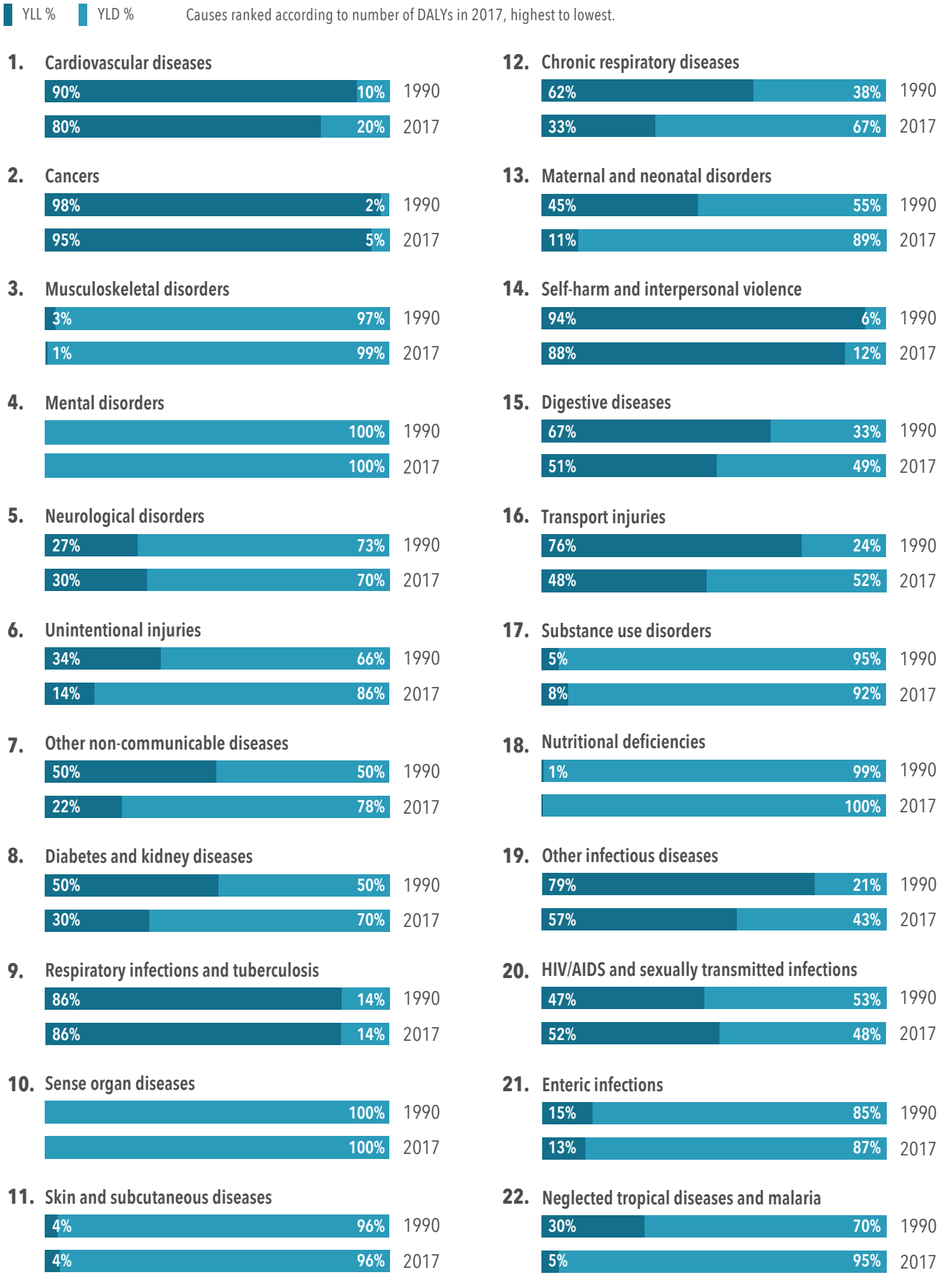
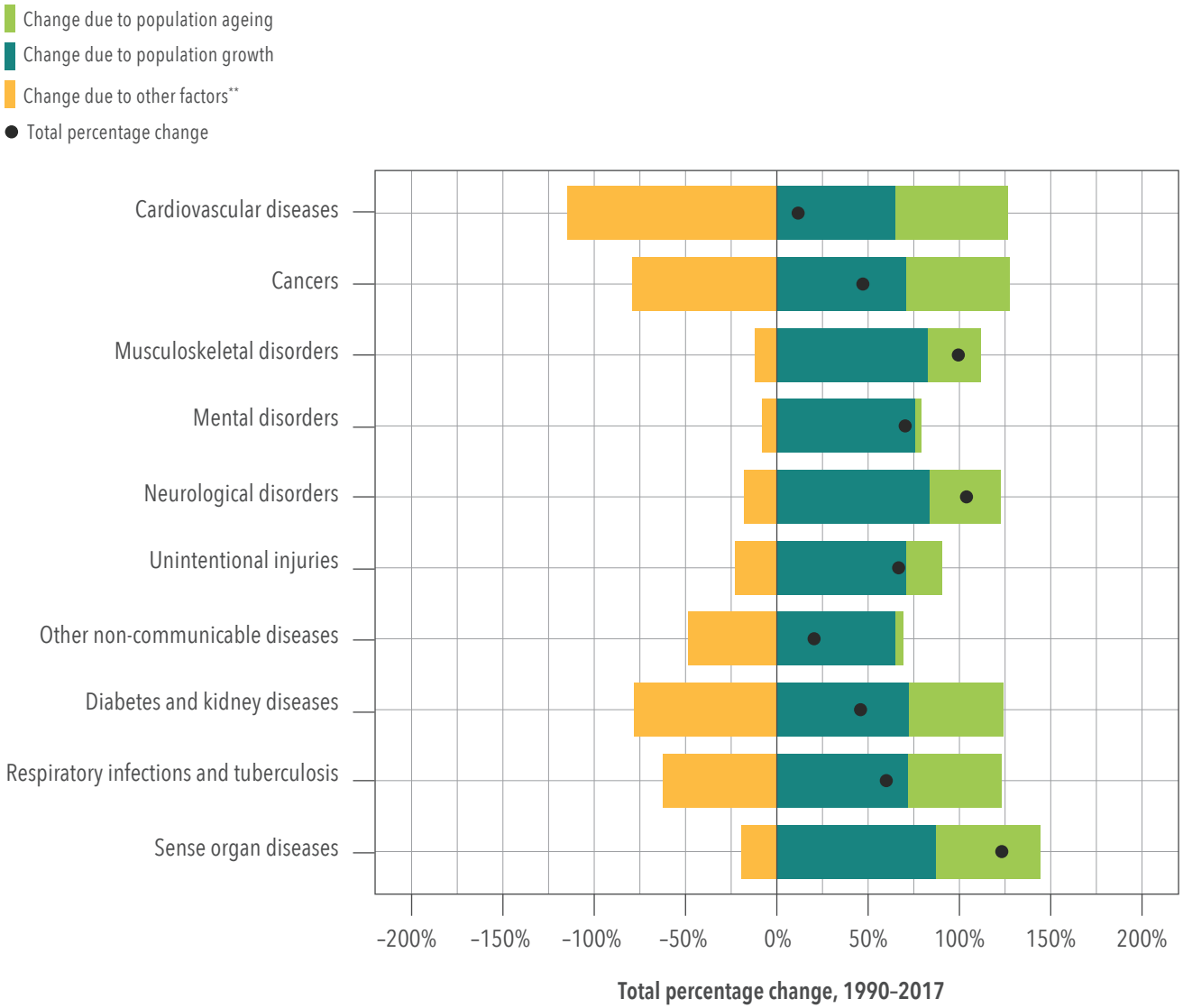


FIGURE 29

## Drivers of changes in the 10 leading causes* of DALYs, both sexes, Singapore, 1990–2017

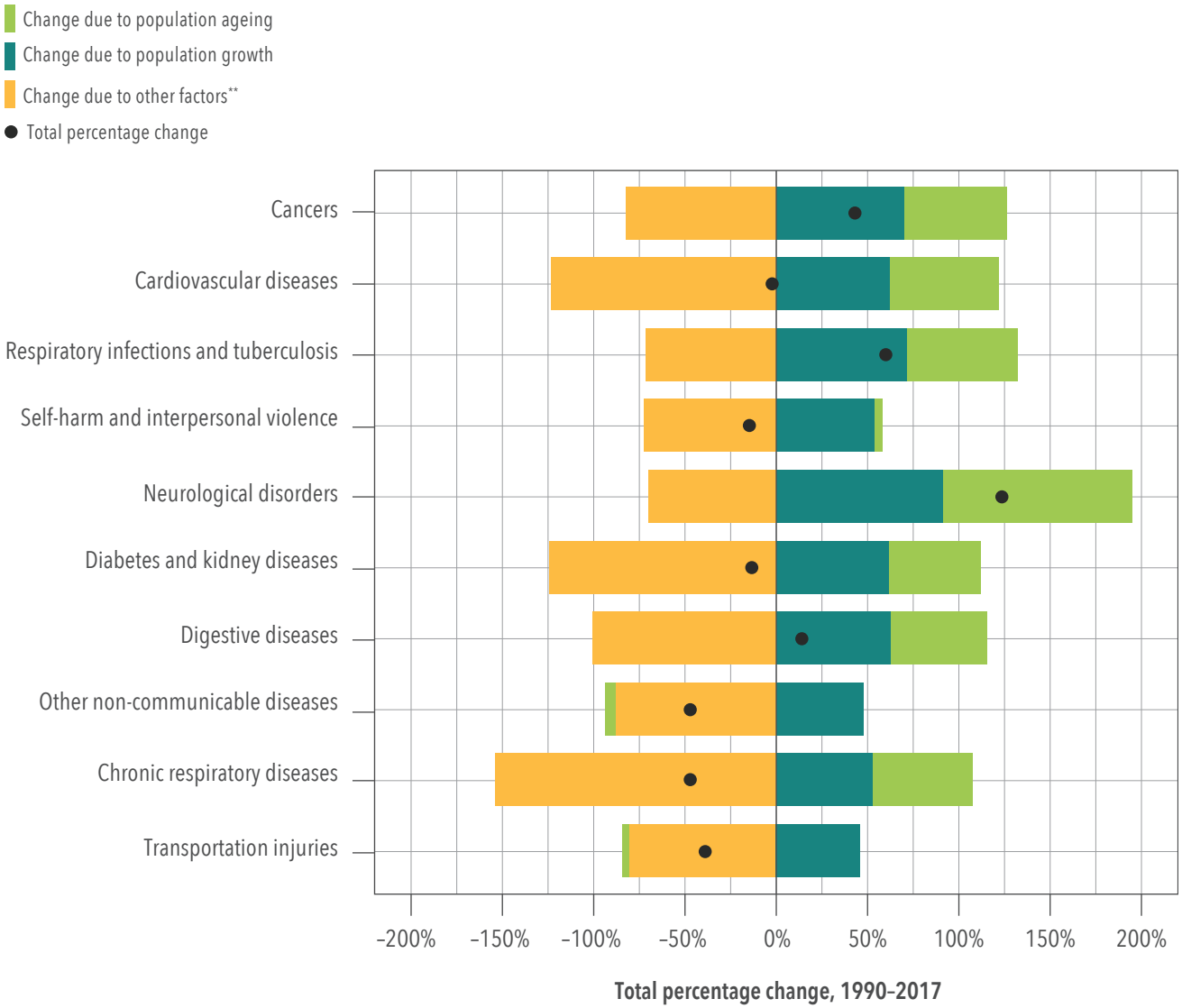



*Causes arranged by number of 2017 all-ages DALYs, greatest to least.

**"Other factors" include changes in treatment modalities, access to health care, exposure to risk factors, and other factors not quantified in GBD analyses.

FIGURE 30

## Drivers of changes in the 10 leading causes* of YLLs, both sexes, Singapore, 1990–2017

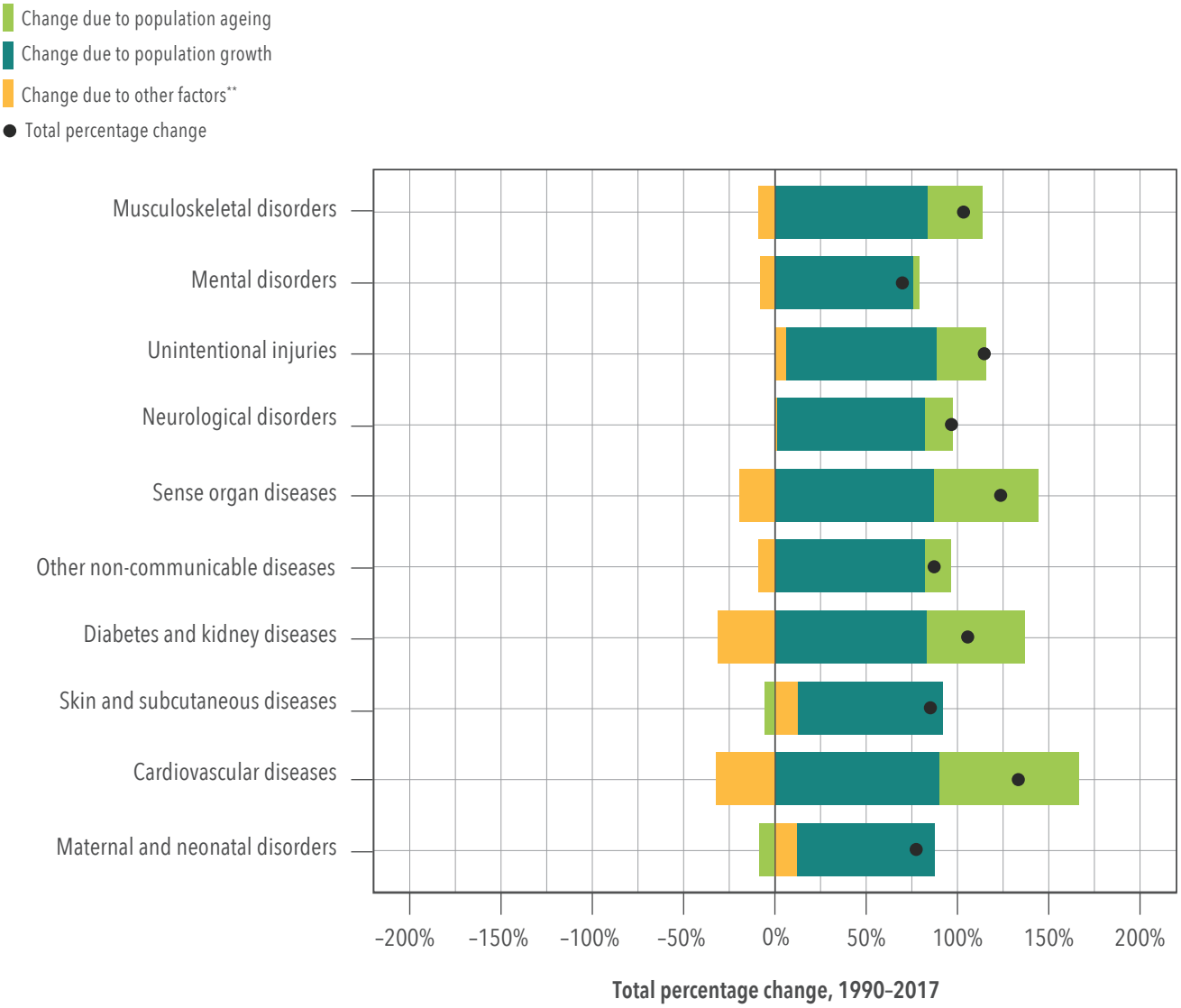



*Causes arranged by number of 2017 all-ages YLLs, greatest to least.

**"Other factors" include changes in treatment modalities, access to health care, exposure to risk factors, and other factors not quantified in GBD analyses.

FIGURE 31

## Drivers of changes in the 10 leading causes* of YLDs, both sexes, Singapore, 1990–2017

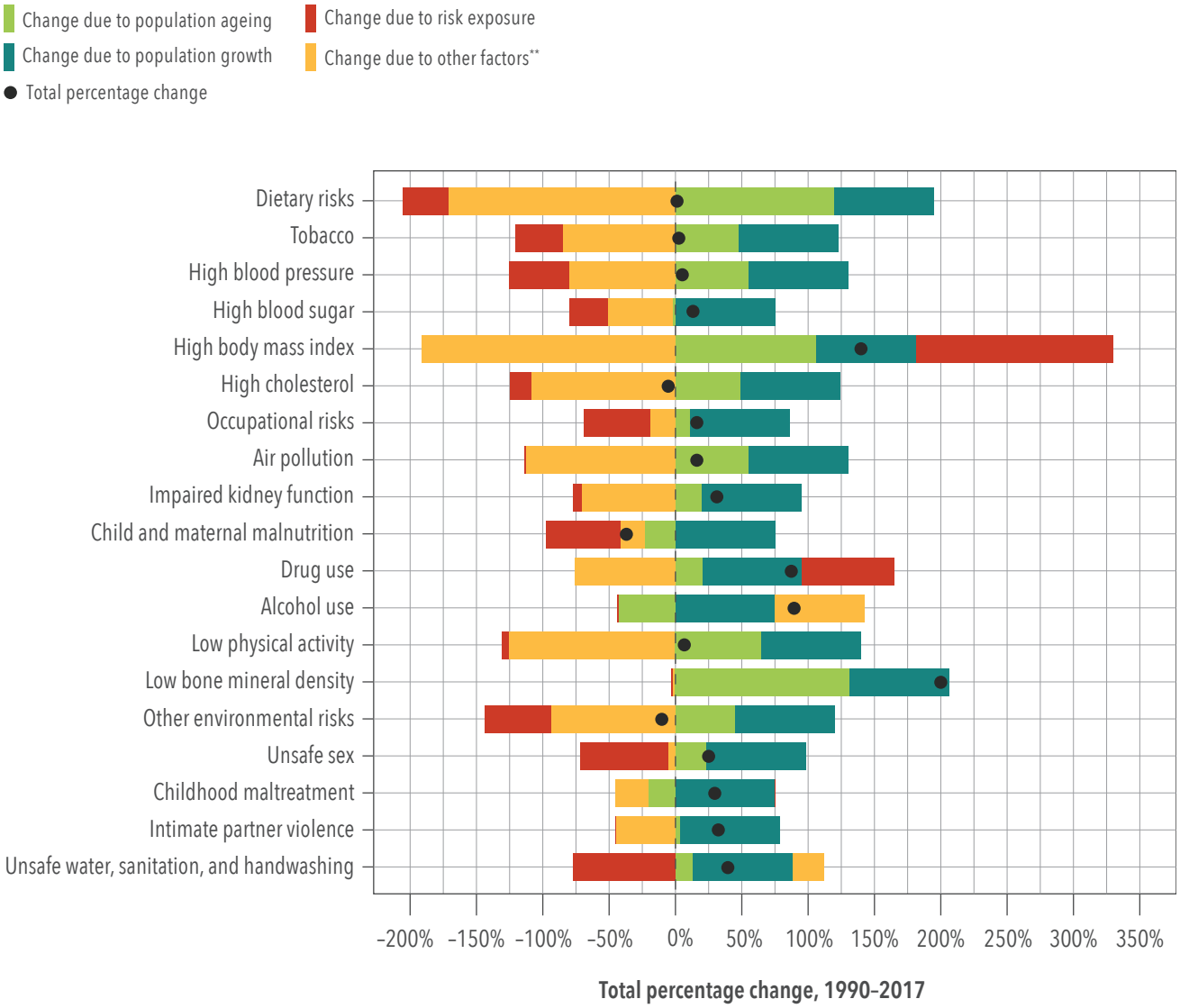



*Causes arranged by number of 2017 all-ages YLDs, greatest to least.

**"Other factors" include changes in treatment modalities, access to health care, exposure to risk factors, and other factors not quantified in GBD analyses.

FIGURE 32

## Drivers of changes in the 10 leading causes* of risk-attributable DALYs, both sexes, Singapore, 1990–2017

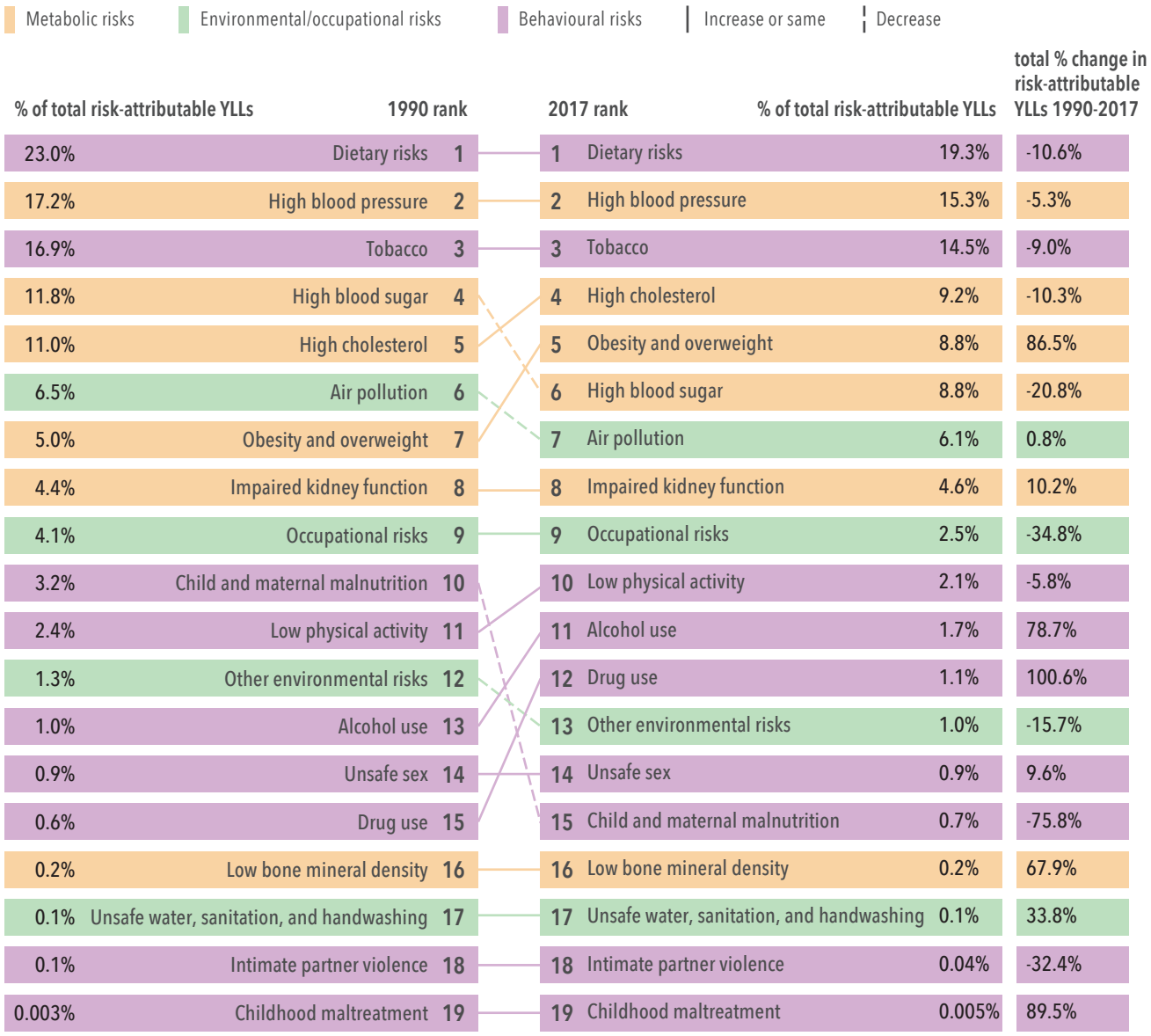



*Causes arranged by number of 2017 all-ages risk-attributable DALYs, greatest to least.

**"Other factors" include changes in treatment modalities, access to health care, and other factors not quantified in GBD analyses.

FIGURE 33

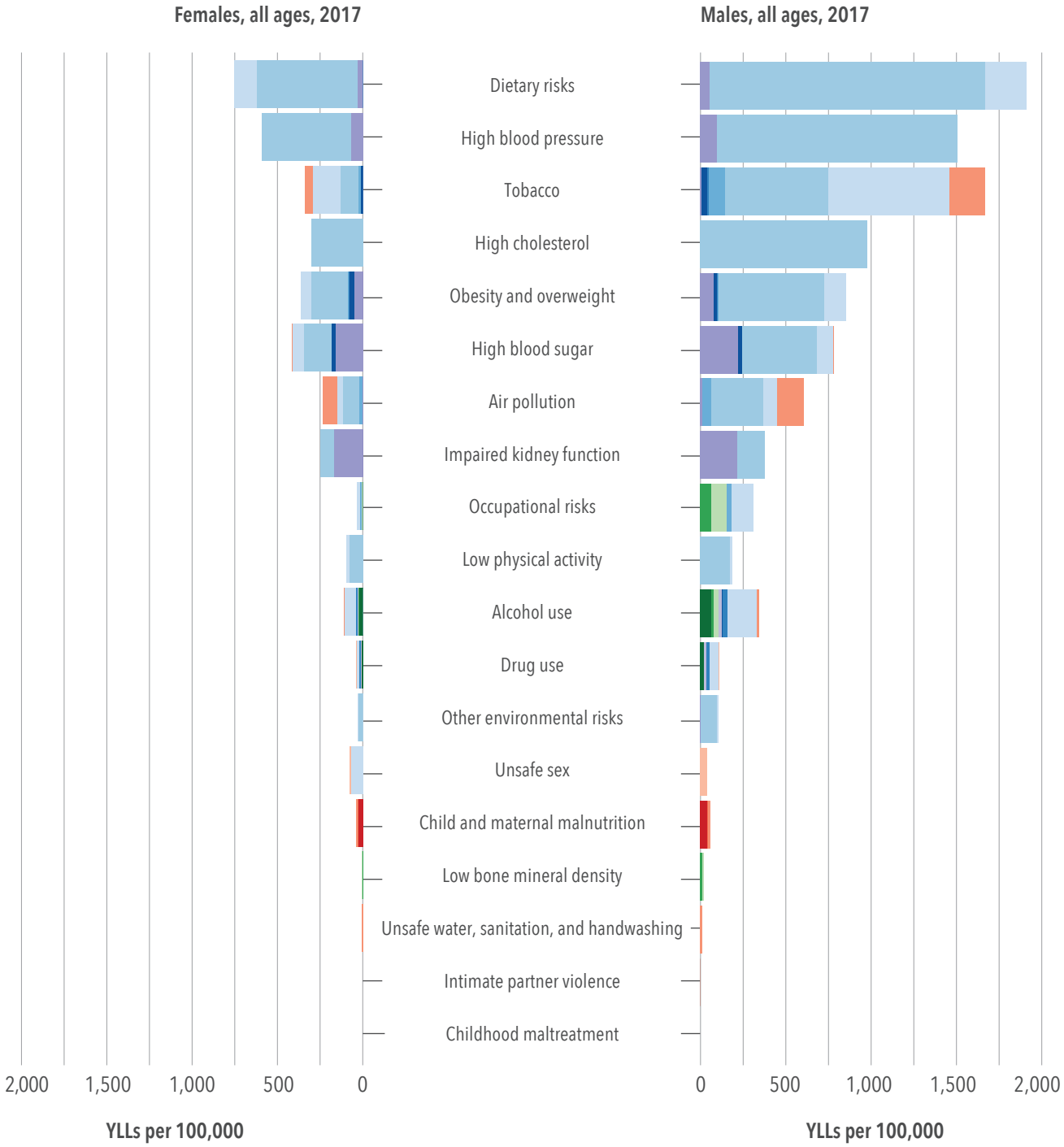
## Leading risk factors contributing to YLLs, Singapore, both sexes, 1990–2017




*Percentages of total risk-attributable burden cannot be summed across risk factors due to the overlap among them.*

FIGURE 34

## Breakdown of YLLs attributable to specific risk factors, Singapore, males versus females, 2017

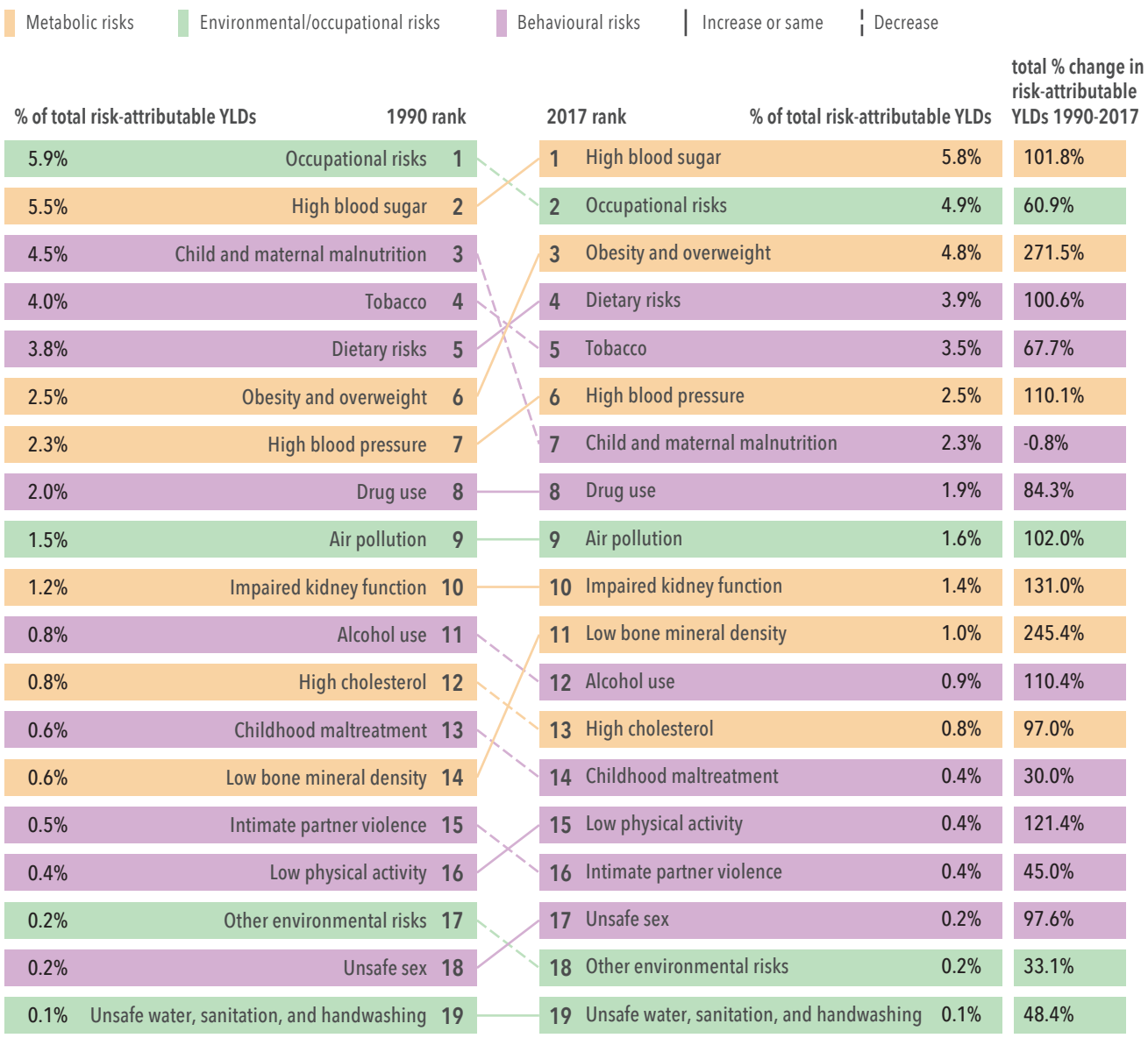



HIV/AIDS and sexually transmitted infections
Respiratory infections and tuberculosis
Enteric infections
Other infectious diseases
Maternal and neonatal disorders
Nutritional deficiencies
Cancers
Cardiovascular diseases
Chronic respiratory diseases
Digestive diseases
Neurological disorders
Mental disorders
Substance use disorders
Diabetes and kidney diseases
Sense organ diseases
Musculoskeletal disorders
Other non-communicable diseases
Transport injuries
Unintentional injuries
Self-harm and interpersonal violence

Risk factors are arranged from highest to lowest rates of all-ages risk-attributable YLLs per 100,000 for both sexes combined.

FIGURE 35

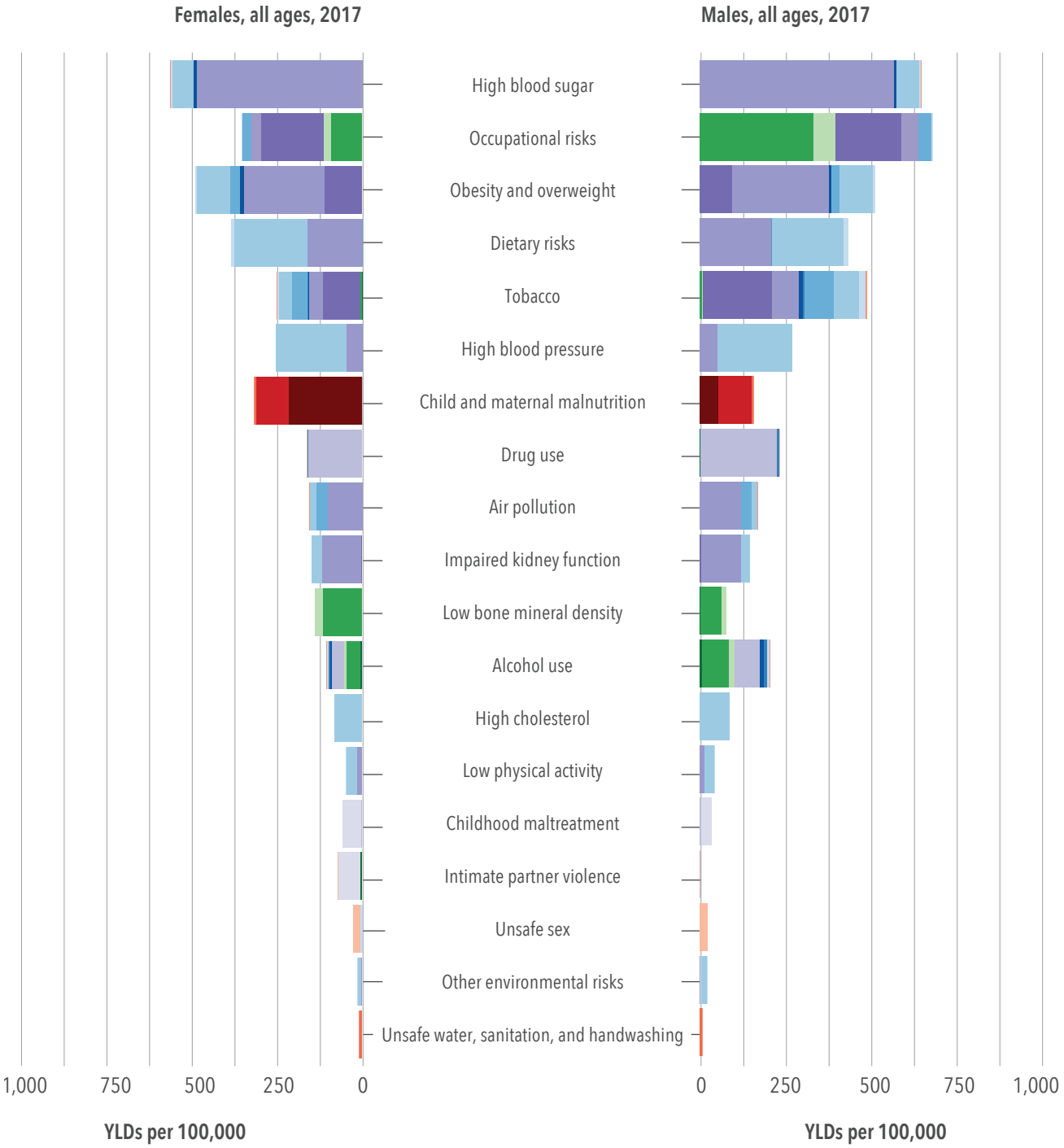
## Leading risk factors contributing to YLDs, Singapore, both sexes, 1990–2017




*Percentages of total risk-attributable burden cannot be summed across risk factors due to the overlap among them.*

FIGURE 36

## Breakdown of YLDs attributable to specific risk factors, Singapore, males versus females, 2017




HIV/AIDS and sexually transmitted infections
Respiratory infections and tuberculosis
Enteric infections
Other infectious diseases
Maternal and neonatal disorders
Nutritional deficiencies
Cancers
Cardiovascular diseases
Chronic respiratory diseases
Digestive diseases
Neurological disorders
Mental disorders
Substance use disorders
Diabetes and kidney diseases
Sense organ diseases
Musculoskeletal disorders
Other non-communicable diseases
Transport injuries
Unintentional injuries
Self-harm and interpersonal violence

Risk factors are arranged from highest to lowest rates of all-ages risk-attributable YLDs per 100,000 for both sexes combined.

FIGURE 37

## Leading causes of age-standardised YLLs per 100,000 in Singapore and comparison group locations, 2017

Less than comparison group average | Same as comparison group average | Greater than comparison group average

| Cancers | Cardiovascular diseases | Respiratory infections and tuberculosis | Self-harm and interpersonal violence | Neurological disorders | Other non-communicable diseases | Diabetes and kidney diseases | Digestive diseases | Chronic respiratory diseases | Transport injuries |
|---|---|---|---|---|---|---|---|---|---|
| Hungary [3,956] | Latvia [5,910] | Mexico [667] | Mexico [2,044] | Finland [687] | Turkey [1,064] | Mexico [2,497] | Mexico [1,360] | Turkey [587] | Mexico [790] |
| Poland [3,567] | Lithuania [5,415] | **Singapore [608]** | Lithuania [1,441] | United Kingdom [582] | Mexico [955] | Turkey [667] | Lithuania [1,184] | United States [574] | United States [638] |
| Lithuania [3,365] | Hungary [4,348] | Lithuania [573] | Latvia [979] | Netherlands [556] | Chile [730] | Chile [530] | Hungary [834] | Hungary [513] | Turkey [547] |
| Slovakia [3,335] | Slovakia [4,164] | Slovakia [435] | United States [961] | United States [540] | United States [621] | United States [526] | Slovakia [828] | Denmark [510] | Chile [537] |
| Latvia [3,293] | Estonia [3,824] | Latvia [414] | South Korea [817] | Norway [534] | Canada [488] | Israel [501] | Latvia [796] | United Kingdom [496] | Greece [504] |
| Netherlands [3,094] | Poland [3,508] | Portugal [366] | Estonia [722] | Luxembourg [533] | Lithuania [469] | South Korea [343] | Chile [779] | Mexico [482] | Latvia [495] |
| Denmark [3,068] | Czech Republic [3,150] | Poland [356] | Chile [695] | Turkey [532] | Latvia [463] | Portugal [337] | Estonia [724] | New Zealand [407] | Lithuania [470] |
| Czech Republic [2,990] | Turkey [2,981] | Turkey [355] | Japan [689] | Iceland [525] | Austria [445] | Hungary [324] | Poland [675] | Ireland [384] | Poland [459] |
| Estonia [2,920] | Greece [2,641] | Chile [347] | Poland [684] | Germany [524] | Ireland [443] | Czech Republic [315] | Czech Republic [570] | Netherlands [378] | New Zealand [452] |
| Slovenia [2,900] | United States [2,579] | United Kingdom [328] | Finland [668] | Estonia [509] | New Zealand [443] | Latvia [304] | Finland [565] | Belgium [376] | Canada [391] |
| France [2,865] | Mexico [2,521] | Estonia [315] | Belgium [656] | South Korea [502] | United Kingdom [442] | Austria [303] | Slovenia [559] | Chile [363] | Slovakia [391] |
| Germany [2,852] | Germany [2,171] | Japan [314] | New Zealand [641] | Poland [500] | Hungary [440] | Denmark [300] | United States [521] | Norway [360] | Czech Republic [361] |
| United Kingdom [2,813] | Finland [2,170] | Hong Kong SAR [306] | Slovenia [611] | Latvia [496] | Slovakia [435] | Slovakia [300] | Germany [509] | Australia [351] | South Korea [350] |
| Greece [2,776] | Chile [2,050] | Czech Republic [297] | Hungary [605] | Mexico [496] | Germany [402] | New Zealand [289] | United Kingdom [487] | Germany [332] | Belgium [345] |
| Luxembourg [2,775] | Slovenia [1,997] | United States [296] | Canada [600] | Australia [493] | Israel [402] | Canada [282] | Denmark [457] | Spain [324] | Slovenia [332] |
| Belgium [2,759] | New Zealand [1,863] | South Korea [281] | Australia [584] | Belgium [492] | Greece [398] | Germany [280] | Luxembourg [455] | Canada [313] | Australia [324] |
| United States [2,745] | Austria [1,862] | Belgium [268] | Sweden [542] | New Zealand [491] | Australia [398] | Poland [268] | Portugal [452] | Czech Republic [308] | Portugal [322] |
| Portugal [2,737] | United Kingdom [1,847] | Israel [254] | France [541] | Slovakia [491] | Poland [398] | Estonia [264] | South Korea [421] | Luxembourg [304] | Estonia [317] |
| New Zealand [2,729] | Portugal [1,734] | Greece [234] | Czech Republic [501] | Denmark [490] | Netherlands [389] | Australia [252] | Belgium [418] | Portugal [284] | Hungary [313] |
| Chile [2,727] | Ireland [1,723] | Denmark [221] | Slovakia [488] | Chile [488] | Denmark [378] | Greece [250] | Austria [418] | Hong Kong SAR [270] | France [303] |
| Canada [2,648] | Sweden [1,719] | Iceland [209] | Austria [480] | France [485] | Switzerland [363] | Italy [244] | France [386] | Poland [269] | Italy [281] |
| Turkey [2,642] | Luxembourg [1,683] | Netherlands [207] | Turkey [475] | Ireland [484] | France [362] | Hong Kong SAR [241] | Spain [369] | Austria [260] | Luxembourg [271] |
| Ireland [2,635] | Belgium [1,588] | Ireland [204] | Norway [457] | Spain [473] | Belgium [358] | **Singapore [203]** | Canada [328] | Iceland [260] | Israel [263] |
| Australia [2,536] | Iceland [1,575] | Germany [187] | Germany [437] | Czech Republic [472] | Portugal [320] | Netherlands [201] | Italy [306] | Sweden [251] | Iceland [241] |
| Austria [2,525] | **Singapore [1,571]** | Luxembourg [180] | Iceland [434] | Sweden [466] | Spain [313] | Luxembourg [195] | Ireland [301] | Greece [251] | Finland [240] |
| Spain [2,521] | Canada [1,566] | Canada [178] | Ireland [431] | Canada [460] | Sweden [300] | Sweden [191] | Japan [279] | Lithuania [216] | Germany [239] |
| Iceland [2,512] | Denmark [1,540] | Norway [168] | Netherlands [426] | Lithuania [456] | Italy [297] | Lithuania [191] | Turkey [268] | Israel [215] | Austria [236] |
| Italy [2,512] | Norway [1,486] | Slovenia [161] | Switzerland [404] | Austria [453] | Finland [283] | Spain [186] | Australia [266] | Slovakia [214] | Spain [211] |
| Norway [2,455] | Australia [1,477] | France [158] | Luxembourg [387] | Switzerland [453] | Estonia [280] | Belgium [176] | Greece [265] | Finland [207] | Denmark [202] |
| Hong Kong SAR [2,422] | Netherlands [1,460] | Spain [155] | Denmark [387] | Italy [452] | Norway [274] | Ireland [172] | Netherlands [263] | South Korea [207] | Norway [202] |
| Israel [2,362] | Italy [1,449] | Hungary [154] | United Kingdom [366] | Greece [450] | Japan [267] | Norway [169] | Sweden [262] | Switzerland [193] | United Kingdom [182] |
| South Korea [2,315] | Spain [1,409] | Sweden [150] | Israel [363] | Hungary [449] | Iceland [253] | France [164] | Israel [259] | Italy [189] | Japan [182] |
| Sweden [2,271] | Hong Kong SAR [1,362] | Australia [139] | Portugal [325] | Israel [442] | Slovenia [247] | Slovenia [161] | Switzerland [253] | Latvia [178] | Ireland [174] |
| Finland [2,223] | Israel [1,261] | Italy [114] | **Singapore [323]** | Portugal [437] | Czech Republic [246] | Switzerland [153] | Norway [233] | Estonia [175] | Netherlands [171] |
| Japan [2,196] | Japan [1,226] | New Zealand [112] | Hong Kong SAR [270] | Slovenia [421] | Luxembourg [242] | Japan [141] | Hong Kong SAR [229] | Slovenia [174] | Switzerland [167] |
| Switzerland [2,102] | France [1,204] | Switzerland [102] | Spain [247] | Hong Kong SAR [393] | South Korea [224] | United Kingdom [132] | Iceland [221] | France [169] | Hong Kong SAR [166] |
| Mexico [2,078] | Switzerland [1,194] | Austria [79] | Italy [225] | Japan [387] | **Singapore [222]** | Finland [128] | New Zealand [211] | Japan [160] | Sweden [165] |
| **Singapore [1,748]** | South Korea [1,146] | Finland [78] | Greece [194] | **Singapore [299]** | Hong Kong SAR [117] | Iceland [119] | **Singapore [164]** | **Singapore [148]** | **Singapore [147]** |

FIGURE 38

# Leading causes of age-standardised YLDs per 100,000 in Singapore and comparison group locations, 2017

Less than comparison group average | Same as comparison group average | Greater than comparison group average

| Musculoskeletal disorders | Mental disorders | Unintentional injuries | Neurological disorders | Skin and subcutaneous diseases | Sense organ diseases | Other non-communicable diseases | Diabetes and kidney diseases | Maternal and neonatal disorders | Cardiovascular diseases |
|---|---|---|---|---|---|---|---|---|---|
| Switzerland [2,749] | Australia [2,246] | Slovenia [1,701] | Italy [1,327] | Canada [888] | Israel [848] | Slovenia [767] | Mexico [1,158] | Lithuania [612] | Slovakia [672] |
| Chile [2,608] | New Zealand [2,192] | Czech Republic [1,659] | Belgium [1,318] | United States [861] | Mexico [829] | Norway [765] | Portugal [799] | Finland [600] | Czech Republic [652] |
| Denmark [2,568] | United States [2,132] | New Zealand [1,472] | Greece [1,259] | Norway [857] | Latvia [742] | Lithuania [761] | Turkey [701] | Estonia [587] | Lithuania [614] |
| Germany [2,484] | France [2,020] | Slovakia [1,431] | Spain [1,256] | Sweden [856] | Hong Kong SAR [738] | Austria [752] | Czech Republic [663] | Poland [550] | Hungary [602] |
| Netherlands [2,472] | Sweden [2,010] | Poland [1,405] | Luxembourg [1,241] | Iceland [817] | Poland [720] | Belgium [730] | Denmark [663] | Latvia [541] | Latvia [566] |
| United Kingdom [2,384] | Netherlands [2,000] | Hungary [1,374] | Norway [1,183] | France [806] | Lithuania [713] | Poland [725] | United States [647] | Mexico [488] | Poland [564] |
| New Zealand [2,364] | Norway [1,961] | Australia [1,228] | Sweden [1,173] | Denmark [793] | Hungary [702] | Estonia [716] | Luxembourg [644] | Austria [482] | Slovenia [505] |
| Belgium [2,344] | Ireland [1,956] | Lithuania [1,208] | Ireland [1,144] | Finland [789] | Slovakia [700] | Latvia [715] | Ireland [609] | Hungary [473] | Estonia [496] |
| Portugal [2,283] | Greece [1,943] | Estonia [1,143] | Netherlands [1,141] | United Kingdom [781] | Czech Republic [675] | Turkey [701] | Estonia [604] | **Singapore [407]** | Luxembourg [489] |
| Luxembourg [2,278] | Portugal [1,904] | Latvia [1,142] | Austria [1,138] | Luxembourg [772] | Slovenia [672] | Czech Republic [697] | Finland [602] | South Korea [398] | United States [451] |
| Norway [2,271] | Spain [1,897] | Japan [856] | Iceland [1,121] | Switzerland [758] | Turkey [647] | Denmark [684] | Hungary [596] | Japan [397] | Turkey [437] |
| Iceland [2,262] | Chile [1,888] | Norway [841] | Finland [1,106] | Netherlands [750] | Chile [646] | Sweden [683] | South Korea [589] | Luxembourg [386] | Sweden [433] |
| Italy [2,246] | Finland [1,873] | Finland [805] | Israel [1,105] | New Zealand [742] | Estonia [570] | Slovakia [682] | Latvia [582] | Slovenia [382] | Belgium [413] |
| United States [2,242] | Belgium [1,872] | Belgium [778] | Portugal [1,096] | Ireland [737] | Japan [564] | United Kingdom [682] | Chile [580] | Slovakia [362] | Canada [412] |
| Israel [2,241] | Germany [1,858] | **Singapore [777]** | Germany [1,083] | Israel [678] | **Singapore [561]** | Hungary [680] | Netherlands [558] | Chile [362] | Hong Kong SAR [411] |
| Canada [2,229] | Canada [1,856] | Sweden [773] | Lithuania [1,082] | Australia [678] | South Korea [561] | Ireland [678] | Belgium [554] | New Zealand [358] | Austria [406] |
| Greece [2,192] | United Kingdom [1,848] | South Korea [719] | United Kingdom [1,080] | Belgium [678] | Italy [559] | Mexico [673] | Israel [541] | United Kingdom [352] | Germany [399] |
| Finland [2,189] | Italy [1,823] | France [714] | Latvia [1,069] | Germany [646] | Spain [532] | Luxembourg [664] | Iceland [538] | Norway [349] | **Singapore [395]** |
| Japan [2,189] | Luxembourg [1,813] | Luxembourg [709] | Estonia [1,068] | Austria [642] | New Zealand [520] | Greece [659] | Lithuania [521] | Israel [343] | Finland [394] |
| Turkey [2,131] | Switzerland [1,804] | Austria [697] | Canada [1,039] | Italy [637] | Portugal [517] | Netherlands [659] | Poland [519] | Germany [331] | Japan [394] |
| Ireland [2,129] | Iceland [1,747] | Switzerland [690] | United States [1,034] | Chile [636] | United Kingdom [517] | Japan [651] | Slovenia [513] | Czech Republic [325] | France [390] |
| France [2,104] | Austria [1,739] | Iceland [689] | France [1,033] | Japan [630] | Belgium [514] | Israel [649] | Norway [511] | Australia [309] | South Korea [371] |
| Australia [2,091] | Denmark [1,734] | United Kingdom [682] | Turkey [1,026] | Portugal [624] | Australia [510] | Finland [649] | Switzerland [511] | Greece [308] | Greece [360] |
| Sweden [2,057] | Turkey [1,657] | Germany [682] | Mexico [1,023] | Greece [606] | Germany [499] | Switzerland [641] | Italy [506] | Iceland [304] | Norway [360] |
| Austria [2,043] | Israel [1,624] | Denmark [678] | Slovakia [994] | South Korea [592] | Austria [495] | Germany [640] | Sweden [504] | Netherlands [302] | Iceland [355] |
| South Korea [2,012] | **Singapore [1,586]** | Ireland [673] | Poland [989] | Spain [585] | Ireland [488] | New Zealand [623] | Slovakia [503] | United States [299] | United Kingdom [355] |
| Spain [1,956] | Japan [1,586] | Israel [651] | Hungary [988] | **Singapore [581]** | Luxembourg [479] | Chile [611] | Greece [497] | Hong Kong SAR [298] | Ireland [352] |
| Slovakia [1,936] | Lithuania [1,529] | Greece [641] | Czech Republic [981] | Estonia [570] | United States [477] | Hong Kong SAR [610] | Canada [477] | Switzerland [294] | Netherlands [345] |
| Hungary [1,925] | South Korea [1,517] | Spain [639] | Denmark [977] | Hong Kong SAR [532] | Switzerland [467] | France [604] | **Singapore [455]** | Sweden [271] | Denmark [344] |
| Slovenia [1,860] | Estonia [1,469] | Canada [579] | Switzerland [976] | Hungary [531] | Greece [466] | United States [601] | United Kingdom [451] | Turkey [267] | Mexico [341] |
| Latvia [1,819] | Hong Kong SAR [1,443] | Italy [578] | Slovenia [973] | Poland [531] | Canada [464] | Spain [594] | Austria [444] | Ireland [256] | Portugal [337] |
| Lithuania [1,794] | Mexico [1,400] | Chile [575] | New Zealand [906] | Czech Republic [515] | France [449] | Iceland [587] | Spain [442] | Spain [255] | Spain [337] |
| Czech Republic [1,772] | Slovenia [1,399] | Netherlands [561] | Australia [878] | Latvia [514] | Finland [437] | Portugal [587] | Germany [393] | France [236] | Chile [334] |
| **Singapore [1,733]** | Latvia [1,398] | Portugal [549] | Chile [836] | Slovakia [511] | Iceland [435] | Italy [584] | Japan [386] | Denmark [231] | Israel [323] |
| Poland [1,730] | Hungary [1,378] | United States [537] | South Korea [810] | Slovenia [500] | Norway [427] | Australia [577] | Australia [370] | Italy [229] | Italy [315] |
| Estonia [1,660] | Czech Republic [1,365] | Hong Kong SAR [403] | Japan [733] | Turkey [491] | Netherlands [412] | Canada [559] | New Zealand [360] | Portugal [217] | New Zealand [313] |
| Hong Kong SAR [1,390] | Slovakia [1,315] | Turkey [393] | **Singapore [708]** | Mexico [470] | Denmark [398] | **Singapore [558]** | France [334] | Canada [207] | Switzerland [311] |
| Mexico [1,192] | Poland [1,281] | Mexico [313] | Hong Kong SAR [521] | Lithuania [463] | Sweden [327] | South Korea [547] | Hong Kong SAR [315] | Belgium [194] | Australia [306] |

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