# OECD Reviews of Public Health: Korea

## A HEALTHIER TOMORROW

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# Foreword

This report is the third in the OECD's series of reports reviewing public health policies across selected OECD countries. Health care systems across OECD are increasingly under pressure from social changes – including demographic changes and aging populations – and emerging new health challenges – from a growing burden of chronic disease, to re-emerging and new communicable diseases, or a growing burden of mental ill-health – which demand a strong public health response.

The OECD Reviews of Public Health provide in-depth analysis and policy recommendations to strengthen priority areas of countries' public health systems, highlighting best practice examples that allow learning from shared experiences, and the spreading of innovative approaches. In particular, this series of Reviews of Public Health builds on the OECD's long-standing programme of work on the economics of public health, applying this extensive expertise to country-specific challenges. The OECD Reviews of Public Health are a tool to help countries to strengthen their national public health systems, and help countries to develop and implement innovative public health actions.

This OECD Public Health Review of Korea assesses the current scale of public health challenges in Korea, and efficacy of existing public health policies to respond to them. The time is now for Korea to turn greater policy attention towards strengthening its public health system, tackling key behavioural risks, and preparing for potential technological change in the health care sector – notably the changing importance of precision medicine – and preparing for public health emergencies. In relation to healthily lifestyles, this review recommends that Korea scales-up policies to prevent harmful alcohol consumption, and strengthen efforts to reduce rates of smoking. In light of Korea's rapidly aging population and the shift in burden of disease towards chronic conditions, Korea should also focus on strengthening the primary care capacity, for example in community or Public Health Centers. To prepare the health system for technological changes, the review recommends that the government continues its current cautions approach to genomic medicine and testing, ensuring that the benefits and harms for both the population and the health system are well-balanced. Finally, the review encourages Korea to build on recent reforms made to strengthen the response system for hazards and threats, and better align response capacity across all stakeholders.

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# Acronyms and abbreviations

| | |
|---|---|
| ABV | Alcohol by Volume |
| AMR | Anti-microbial Resistance |
| AVIESAN | Alliance national pour les sciences de la vie et de la santé, National alliance for human sciences and health |
| BMI | Body mass index |
| COPD | Chronic Obstructive Pulmonary Disorder |
| DDD | Daily Defined Dose |
| DKK | Danish Krone |
| DMAT | Local disaster Medical Assistance Teams |
| DNA | Deoxyribonucleic Acid |
| DSIS | Disaster Situation Information System |
| DTC | Direct-to-consumer |
| DTP | Diphtheria, Tetanus and Pertussis |
| EAP | Employee Assistance Programmes |
| EMR | Electronic Medical Record |
| EOC | Emergency Operations Center |
| FDA | United States Food and Drug Administration |
| GBP | British Pounds |
| GDP | Gross Domestic Product |
| GHFM | Genomics Health Futures Mission |
| GISAH | Global Information System on Alcohol and Health |
| HIRA | Health Insurance Review and Assessment Service |
| HRN | Human Rights Network |
| HuBIS | Human Biobank Information Systems |
| IHD | Ischemic Heart Disease |
| IHD | Ischaemic Heart Disease |
| IPCC | Intergovernmental Panel on Climate Change |
| ISP | Individualised Service Plan |
| JPN | Japanese Yen |
| KAPO | Korea Alliance of Patient Organizations |
| KARE | Korean Association REsource |
| KBN | Korean Biobank Network |
| KCDC | Korean Centers for Disease Control and Prevention |
| KHPI | Korea Health Promotion Institute |
| KHPI | Korean Health Promotion Institute |
| KIFTE | Korean Institute of Genetic Test Evaluation |
| KNHANES | Korea National Health and Nutrition Examination Survey |
| KoGAP | Korean Genome Analysis Project |
| KoGES | Korean Genome Epidemiology Study |
| KBP | Korea Biobank Project |
| KRG | Korean Reference Genome |
| KRW | Korean Won |

| | |
|---|---|
| LTC | Long-term care |
| LTCI | Long-term care insurance |
| MERS/MERS-COV | Middle East Respiratory Syndrome Coronavirus |
| MFDC | Ministry of Food and Drug Safety |
| MOE | Ministry of Environment |
| MOEL | Ministry of Employment and Labor |
| MOHW | Ministry of Health and Welfare |
| MOIS | Ministry of Interior and Safety |
| MOTIE | Ministry of Trade, Industry and Energy |
| NCD | Non-communicable Disease |
| NCSP | National Cancer Screening Programme |
| NDMI | National Disaster Management Institute |
| NDSCC | National Disaster Safety Control Center |
| NDSCC | National Disaster and Safety Control Center |
| NECA | National Evidence-based Healthcare Collaborating Agency |
| NEMC | National Emergency Medical Center |
| NFA | National Fire Agency |
| NGS | Next-generation Sequencing |
| NHI | National Health Insurance |
| NHIS | National Health Insurance Service |
| NIP | National Immunization Programme |
| NNIDSS | National Notifiable Infectious Disease Surveillance System |
| NRA | National Risk Assessment |
| OECD | Organisation for Economic Cooperation and Development |
| PHIS | Public Health Information System |
| SARS/SARS-CoV | Severe acute respiratory syndrome coronavirus |
| SJK | Korean individual genome sequence |
| TB | Tuberculosis |
| USD | United States Dollar |
| WES | Whole Exome Sequencing |
| WGS | Whole Genome Sequencing |
| WHO | World Health Organization |

# Executive summary

The time is now for Korea to turn full policy attention towards strengthening its public health system, tackling key behavioural risks, and preparing for potential technological change in the health sector – notably the growing importance of precision medicine – and preparing for public health emergencies. At present Korea's population is relatively young, compared to OECD peers, but is aging very rapidly. Rates of tobacco and alcohol consumption are just below the OECD average, with Koreans consuming 8.7l of pure alcohol per capita in 2017 (about two bottles of wine per week), compared to the OECD average of 8.9l), and obesity rates well below the OECD average. These figures hide, however, a complex picture. Korean men are heavy smokers, alcohol consumption is relatively high and 'binge' drinking is a widespread and growing concern, with Korean men, and younger Korean women, drinking heavily at least once a month. Child overweight levels (at 31.8% of 5-9 year olds) are just above the OECD average of 31.4%. Compounding this potentially challenging picture is Korea's health care system design which is, for the moment, still strongly orientated towards specialist and hospital-centric care delivery. Korea's rapidly aging population, combined with risky health behaviour amongst some population groups, and high rates of obesity amongst children, now risk endangering many of the significant achievements Korea has made in increasing life expectancy and population health outcomes over the past decades.

Against this worrying backdrop, Korea has been taking some decisive policy action to better protect population health, and prevent and manage disease. To limit risky health behaviours, regulation was introduced to limit indoor smoking, and the tax on tobacco products reached 70% of the retail price already in 2015. Awareness campaigns about the danger of excessive alcohol consumption have been run nationally, and targeting key populations such as university students. Korea has a tax on alcohol beverages, varying from 5% to 72% depending on the type of beverage, with a volume-based tax for beer, makkoli and spirits.

In light of a series of slow and inadequate responses to recent public health emergencies, notably the 2014 Sewol Ferry accident and the 2015 Middle East Respiratory Syndrome Coronavirus (MERS-CoV), responsibilities for emergency preparedness have been transferred to the Ministry of Interior and Safety (MOIS) which now coordinates all emergency preparedness and response capacities under a dedicated Vice Minister, and significant investments in emergency preparedness. At the same time, Korea has taken a cautious and step-wise approach to genomic medicine, which is a field generating significant public attention in the country. There are clearly established limits on genomic diagnostic testing in the health system, while the decision on expanding the possibilities for direct-to-consumer genetic testing will follow a trial period focused on 13 diseases.

In light of the magnitude and potential for rapid evolution of these challenges, the Korean government should build on these efforts to strengthen their public health policy package even more. To deliver health promotion, disease prevention, and effective disease management more effectively, strengthening primary care-equivalent services should be a priority. Public Health Centers are working to deliver some key services such as vaccinations, and Community Health Centers have a role in disease management, but are not particularly widespread. In light of Korea's rapidly aging population scaling up some of these services, using existing facilities or encouraging new roles for existing health professionals, would be highly

appropriate. When it comes to reducing harmful alcohol use, which is has damaging health effects and high cost in the country, Korea should consider whether alcoholic beverages are too easily available. Making changes to pricing policies – currently some beverages, for example soju, have relatively low prices compared to other drinks – and to points of sale – for example regulating alcohol sales in motorway service stations – could be a starting point. At the same time, more should be done to change the social acceptability of harmful alcohol consumption; few marketing restrictions means that exposure to images around alcohol is constant, which can be expected to normalise drinking culture. More limits on advertising, and stepping up educational efforts, could go hand-in-hand. There is scope, too, to strengthen Korea's smoking regulations further: limits to indoor smoking could be expanded, making all indoor public spaces totally smoke-free, and the tobacco tax could be raised to above 75% of the retail price, which the WHO has found to be the most effective rate to reduce smoking.

Genomic research, large-scale genome testing, genomic screening and diagnostic tests, personalised medicine, and direct-to-consumer genomic testing, are all significant areas of policy attention in Korea. Korea could take advantage of their sophisticated genomic medicine field, notably introducing the legislative and technical capacity to link genomic biobank information with health system information, for example the Health Insurance Review and Assessment Service (HIRA) or National Institute of Health (NIH) data systems. In terms of the use of genetic testing for diagnostics or precision treatment, access to testing is well-regulated in Korea, although additional quality assurance requirements should be introduced for private testing laboratories which process most of the tests prescribed by medical institutions. Korea should focus on ensuring assessing how many genomic medicine specialists are needed in the health system, and assuring that medical professionals have appropriate genomic literacy to respond to patients' questions and needs by providing appropriate education and training. Second, in assessing the value of genomic medicine services in the health system, cost-effectiveness should be a consideration, for example steps should be taken to balance the existing cost-effectiveness of cost-effectiveness of widespread use of genetic testing to personalise treatment against more 'traditional' prevention approaches from behaviour risk reduction policies through to increased cancer screening coverage. Direct-to-consumer genetic (DTC) testing is very popular in Korea, but allowing genetic DTCs to be widely available is not without risks – to individuals as well as to the health system – and the government's current cautious and stepwise approach to allowing a greater number of tests, and the current trail period for expanding DTC tests to cover 13 diseases including diabetes, several cancers, Parkinson's disease and macular degeneration, is a sensible route forwards.

Finally, when it comes to preparedness for public health emergencies, Korea has recently made several – commendable – changes to its response system for hazards and threats, notably following a series of disasters which revealed some key shortcomings in the system. While Korea can be assessed as having 'moderate' exposure to hazards and threats, a robust response system is nonetheless essential. Encouraging efforts have been made to change legal and institutional frameworks, centralising and clarifying the chain of command during emergencies, and significant investments have been made in emergency preparedness capacities. Korea is also using innovative technological approaches in some impressive ways, notably having set up sophisticated systems for risk related data collection and analysis with comprehensive information-sharing platforms across government agencies. Above all, Korea should maintain the clear prioritisation given to emergency preparedness seen in the last few years, and not allow attention to this area to wane. There is scope to streamline responsibilities amongst local actors, identifying key expectations for different stakeholders, and simplifying the current congested offer of more than 3 000 crisis response manuals. Additionally, undertaking regular multi-stakeholders emergency simulation exercises based on complex scenarios would also be a valuable additional way to prepare all actors, including helping actors to work well together, as would conducting a whole-of-government scenario-based National Risk Assessment.

## Coronavirus COVID-19

This review was carried out before the start of the outbreak of the coronavirus COVID-19. The COVID-19 outbreak started at the end of 2019 in China, and rapidly spread to neighbouring countries and across the globe. As of early March 2020, all OECD countries report active cases of coronavirus COVID-19.

Korea and other OECD countries are implementing policy actions to contain and mitigate the impact of this global health threat.

# Assessment and recommendations

Compared to the OECD average, the Korean population is relatively young and rate of behavioural risk factors relatively low. The system has, up until now, been focused on curative, rather than preventive care. However, rapid demographic shift, emerging risk factors linked to lifestyle, and an increasing burden of chronic diseases mean that prevention and public health should be a decisive policy priority sooner rather than later. The proportion of frail elderly is still low compared to OECD peers, with just 13.8% of the population over 65, and 3.0% over 80, in 2017. But Korea's population is aging very rapidly, and by 2050 Korea is projected to have the largest over-65 population in the OECD, with 38% of people aged 65 years or over up from 13.8% in 2017, and 15.1% of the population 80 or over, up from 3.0% in 2017. While alcohol consumption and tobacco use are both slightly below the OECD average, and adult obesity is well below the OECD average, men are both heavy smokers and drinkers and child obesity rates are above the OECD average.

Following a dramatic increase over the past four decades, the average life expectancy in Korea is now 82.7 years, an increase of 8 years from 1977 to 2017. Non-communicable diseases account for the majority of Korea's disease burden in Korea – the leading causes of mortality in Korea are cerebrovascular disease, Alzheimer disease, ischaemic heart disease, lung and liver cancer – although the prevalence of some infectious diseases – notably tuberculosis – remains high compared to OECD peers. A high rate of death by suicide also marks Korea out as an outlier, even as suicide rates have begun to fall in recent years.

Korea is also an outlier when it comes to health care consumption, with far higher rates of doctor consultations, an average 16.6 visits per population per year in 2017, than the OECD average of 6.8 in 2017. However, these health care consumption patterns do not necessarily support efforts to prevent disease or promote good health, as public health interventions are not prioritised during outpatient or hospital visits. Indeed, between 2000 and 2017, at a time when other OECD countries were shifting focus to care out of hospitals and reducing bed numbers, hospital bed numbers in Korea increased, and Korea had the second-highest number of hospital beds in 2017 with 12.3 beds per 1 000 population more than double the OECD average of 4.7 .

Korea relies on Public Health Centers to deliver some primary and preventive care, for example vaccinations, and relies on national campaigns and vertical prevention programmes to tackle unhealthy behaviours. To reduce smoking rates, Korea has introduced regulation limiting indoor smoking, increased the tobacco tax to 70% of the retail price in 2015, and introduced a warning image on tobacco products. Smoking cessation efforts are centralised, for example with national campaigns and some 'Quit Smoking Centers', although some programmes are also delivered at local public health centers. Targeted national programmes are also used to target other areas of public health, for example cancer screening is delivered through Korea's National Cancer Screening Program, and there are some chronic disease management programmes being piloted, led by the Ministry of Health and Welfare. In the absence of a strong primary

care system, Community Health Centers have, traditionally, been the main locus of non-communicable disease (NCD) management, and have sought to identify high-risk groups, but there is only one Center for every 300-500 000 population. In light of Korea's aging population, and the current rate of risky health behaviour, strengthening primary care services, including disease prevention and early detection as well as chronic disease management, should be a priority, which could mean increasing the number of Community Health Centers, or equivalent service providers. Reducing child obesity – which is already above the OECD average – should also be a priority, with policy options including healthy meals in schools, educational programmes, and clear mandatory food labels especially on products targeted at children.

Harmful alcohol use is a key public health issue in Korea, especially for Korean men, who drink considerably more than the OECD average. Heavy episodic and high risk drinking are common and seem to be increasing; in Korea the average number of drinks consumed in one sitting has almost tripled in four years, from 2.2 cups in 2013 to 6.0 cups in 2016. Healthcare expenditure associated with alcohol use disorders also tripled between 2002 and 2013, from KRW 120 billion to KRW 375 billion (USD 101 million to USD 320 million), and it has been estimated that Korea faces KRW 1.0 trillion (USD 800 million) in medical expenses to treat conditions associated with alcohol use. Korea has already implemented a range of policies to try to reduce harmful alcohol consumption, for example running national awareness campaigns and targeted campaigns for instance in universities. However, there is significant scope for strengthening some of the Korea's policies, and regulating alcohol availability. At present, relatively low prices of some alcoholic drinks like soju compared to other drinks, limited marketing restrictions, and few restrictions on points of sale make alcoholic beverages widely accessible. A comprehensive policy package is needed, strengthening some existing policies and introducing new efforts in other areas. Specifically, Korea should consider stronger advertising and sales restriction to reduce the normalisation of harmful alcohol consumption that occurs through constant exposure and availability, for example restricting billboard advertising and sales at petrol stations. Korea should also step-up education efforts in schools, universities and workplaces, and tweak alcohol pricing including reviewing existing policies across the full range of alcohol products.

The field of genomic medicine is booming and demand-driven by the population. Genomic research, large-scale genome genetic testing, genomic screening and diagnostic tests, personalised medicine, and direct-to-consumer genomic testing, are all significant areas of policy attention in Korea. There are, however, risks associated with the field of genomics, for example around the effective regulation of sensitive genetic information, ensuring equal access to cutting edge therapies, or ensuring that the use of genomics in health care is driven by the evidence-base, rather than potentially costly consumer or provider demand. When it comes to direct-to-consumer tests (DTC), ensuring that commercial tests do not expose consumers to inadvertent harm, and do not create additional strain to the health system, should be priorities, as should engaging the public in a discourse about risks and opportunities related to genetic testing.

In light of these risks, there are some further areas where governance of public health genomics should be strengthened. To maximise the potential positive impact of Korea's extensive genomic research infrastructure for health care and public health interventions, capacity for data linkage between Korean biobank data and Health Insurance Review and Assessment Service (HIRA) or National Institute of Health (NIH) data systems could be facilitated. Regarding use of genomics by the health system, quality assurance for private testing laboratories should be introduced, and some basic training for health professionals in genomics would be a positive step. To anticipate potential demand for more personalised approaches to diagnosis and treatment, Korea should look to include cost-effectiveness assessments in deciding what tests should and should not be reimbursed. The area which generates the most concern when it comes to genomic medicine in Korea is the booming field of DTC genetic tests. At present, the Korean Government has been tightly regulating DTC use especially when linked to disease risk. This cautious approach is appropriate – and ought to be encouraged also when assessing whether or not to allow a further suite of DTC genetic tests for 13 diseases. When evaluating which DTC tests to allow, the Government should consider both potential impact on demand for health care – for instance follow up tests,

or requests for (potentially unnecessary) treatment – as well as its capacity to give consumers enough information to responsibly interpret the results of their tests, and capacity for DTC companies to ensure data security and privacy. Overall, while genomic medicine may be a game changing force in health care in the decades to come, at present from a public health perspective 'traditional' approaches to preventing ill-health – such as regulation, education, screening and proactive disease managements – still have the strongest evidence-based.

Similarly to the shape of Korea's population health risk profile, at first glance, Korea does not have a significant exposure to public health hazards and threats, but rather can be assessed as having a moderate exposure. However, just as a health system turned towards hospital-centric curative care will struggle in putting together a robust approach to preventing chronic disease and promoting good health, Korea's risk and hazard system has – at least until recently – appeared ill-prepared for major crises. Indeed, the 2014 Sewol Ferry accident and the 2015 Middle East Respiratory Syndrome Coronavirus (MERS-CoV) in Korea revealed important shortcomings in public health emergency preparedness and response, causing significant human losses and a large disarray within Korea society. Since these events, public health emergency preparedness has become a priority in Korea, and the government has engaged in important reforms. Specifically, legal and institutional frameworks have been revised, investments have been made to reinforce emergency preparedness capabilities across the board, and Korea is using innovative technological approaches to timely detection, enable information-sharing from authorities to citizens, and facilitate decision-making.

Despite the usefulness of these necessary policy reforms, and Korea's new capabilities in the area of public health emergencies, there is still more work to be done. While the steps taken to ensure that the Ministry of Interior and Safety (MOIS) now centrally coordinates all emergency preparedness and response capacities, with a dedicated Vice Minister, seems to be a positive step, it could be further strengthened by introducing greater clarity over the different responsibilities of local governments, and their expected response when emergencies unfold. Equally, somewhat streamlining the expectations of stakeholders when it comes to developing emergency response plans – currently Korea has nearly 3 000 different crisis response manuals – would make it easier for key actors to understand their responsibilities, and create greater coherence in response when crises occur. Undertaking regular multi-stakeholders emergency simulation exercises based on complex scenarios would also be a valuable additional way to prepare all actors, including helping actors to work well together. At present, simple exercises and drills are performed regularly, but may not be sufficient to prepare for complex, unpredictable, and fast-moving emergency situations. Korea should also take advantage of its rich information-base on risk and emergencies to conduct a whole-of-government scenario-based National Risk Assessment. Many OECD countries conduct such an assessment, which helps to anticipate scenarios based on greatest likelihood and potential impact, and allocate resources accordingly.

## Policy recommendations for improving public health in Korea

When it comes to reducing harmful alcohol use, developing genetic medicine to strengthen public health and preventive care, and ensuring public health emergency preparedness, Korea has many strong policies in place. However, the challenge of both changing demographics and disease burden, means that more action is needed now to keep the population health, and the health system functioning smoothly. Ensuring that effective prevention and public health policies reach the whole population should now be a key policy priority. In order to improve the public health system, Korea should:

- Continue to strengthen efforts to reduce tobacco consumption, including expanding smoke free zones to all inside public spaces, and consider expanding both existing packaging warning labels to cover more than half of cigarette packages;
- Promote healthy eating for children – who have a higher rate of overweight than the OECD average – including through healthy meals in schools, educational programmes, and clear mandatory food labels especially on products targeted at children;
- Maximise the capacity of primary-care health care providers, such as Public Health Centers, to effectively manage chronic diseases and deliver key public health functions;

To reduce harmful alcohol use, Korea should:

- Reduce the normalisation of alcohol consumption by restricting marketing and media portrayal, in particular restricting print, television and outdoor advertising and setting guidelines on the content of alcohol advertisements and depictions of alcohol use in the media;
- Decrease the availability of alcohol by restricting sales and consumption, by reducing the density of alcohol vendors, banning alcohol sales at petrol stations and other highway establishments, restricting the time at which alcohol is available for sale, and banning consumption in certain public places;
- Invest in education to change behaviours and reduce social pressure to consume alcohol through dedicated educational programmes for high-risk groups such as school students and employees;
- Review existing pricing policies to better align the retail price of alcoholic beverages with public health priorities, in particular for the currently inexpensive and popular soju.

Korea should ensure that public health genomics strengthens public health and preventive care, by:

- Maximising the contribution of its extensive genomic research network to population health outcomes by increasing data linkages, in particular considering the potential contribution of linking biobank data with HIRA or NIH data systems which is currently not possible;
- Managing the demand for genetic testing from patients and clinicians, assessing the cost-effectiveness of genetic testing for diagnostics and personalising treatments, issuing clear guidelines on testing to health professionals and consumers, and ensuring that health coverage for testing is well-aligned;
- Ensuring that appropriate safeguards are in place around the booming field of direct-to-consumer genetic testing, including continuing in the Government's current stepwise approach to potential DTC market expansion, and sources of reliable educational information on genetic testing for the public;
- Taking account of precision medicine as an expanding field in Korea, and Korea's extensive research infrastructure, develop an overarching strategy focused on harnessing the potential of precision medicine, increasing its positive impact on public health, or managing impacts on the

health system, giving attention to cost-effectiveness, access, and education and workforce requirements.

To strengthen capacity to respond to public health emergencies, Korea should:

- Engage further with local governments to make sure that the on-going effort at the national level to improve public health emergency preparedness is complemented with resilience and capability improvements locally;
- Mobilise all available risk-related data and information systems to develop a National Risk Assessment, enabling Korea to prioritise on-going capability improvement for public health emergency preparedness where the greatest needs are;
- Reduce the number of emergency preparedness plans and crisis management manuals at the central and local levels and adopt a more streamlined and flexible approach to crisis management based on inter-agency cooperation;
- Closely monitor safety improvements in hospitals, and adjust the regulatory framework accordingly. Korea should also make efforts to strengthen its primary care system and nudge behaviour changes favouring a better risk culture within Korean society;
- Clarify responsibilities and strengthen collaboration between the National Disaster Safety Control Center and the KCDC Emergency Operation Center, through regular exchanges and jointly organised emergency drills.

## Korea's public health system

OECD Reviews of Public health examine the core public health architecture in place in countries to prevent disease, detect disease early, prevent secondary complications from diseases, and promote good population health and wellbeing. The public health architecture includes all the public, private, and voluntary entities dealing with the organisation of core public health functions such as public health programme delivery and institutional capacity to respond to public health emergencies, workforce such as public health specialists, knowledge development and epidemiological surveillance, formal and informal public health partnerships, financial resources for disease prevention and health promotion, and leadership and governance in the system.

### *Like other OECD countries, in Korea non-communicable diseases account for the majority of the disease burden*

After a dramatic increase over the past four decades, the average life expectancy in Korea has gone from nearly eight years less than the OECD average, to nearly two years more than the OECD average. In 2017, average life expectancy at birth was 82.7 years, higher than the OECD average of 80.8, and 79.7 years for Korean men and 85.7 years for women. Nevertheless, while life expectancy is higher than average, these years may not be all spent in good health. Korea has the lowest perceived health status of all OECD countries, with only a third of people reporting that they are in good or very good health.

Like in many other OECD countries, NCDs account for the majority of the disease burden in Korea. The top five causes of mortality in Korea are cerebrovascular disease, Alzheimer disease, ischaemic heart disease, lung and liver cancer. Diseases of the circulatory system only account for 23% of mortality in Korea – compared to an OECD average of 35% - while cancers on the other hand account for 26% of mortality, the same as the OECD average.

While the majority of the disease burden comes from non-communicable diseases, when it comes to the burden of morbidity and mortality Korea is an outlier in at least two respects. First, Korea has a high burden of tuberculosis as compared to other OECD countries, with 6.0 deaths per 100 000 population per year, compared to an OECD average of 1.0 death per year. This public health issue has been on the radar of the Korean government, and disease management and control plans have reduced the incidence from 100 cases per 100 000 population in 2011 to 77 per 100 000 population in 2016.

Secondly, and concerning, Korea has by far the highest suicide rate among OECD countries. Intentional self-harm was the number one cause of premature death in 2016 in Korea. Moreover, while in other OECD countries suicide rates have been decreasing, in Korea the rate has increased over the past three decades, until 2009. In the last few years a drop in deaths by suicide can be observed, dropping from a high of 33.8 deaths by suicide per 100 000 population in 2009, to 24.6 deaths per 100 000 population in 2016. The Korean government is also clearly committed to efforts to reduce death by suicide. The 2018 National Action Plan on Suicide Prevention is a comprehensive strategy, including targeting of high-risk groups, strengthening mental health care, case management and prevention and updated press guidelines.

### *A mixed and evolving picture when it comes to risky health behaviours*

Korea has one of the lowest obesity rates of the OECD, at 5.5%, with 33.7% of the population overweight or obese, and the average number of daily smokers – at 17.5% of the population – is a little below the OECD average of 18%. Average alcohol consumption, too, is around the OECD average.

However, with further unpacking, a more mixed picture emerges. There are significant differences by gender, with a much higher rate of tobacco consumption and alcohol consumption amongst Korean men than women. Nearly 31.6% of Korean men are daily smokers, compared to an OECD average of 22.5%.

When it comes to levels of obesity, too, the picture is somewhat more mixed, and there are some reasons for concern. While Korea has one of the lowest obesity rates for adults in the OECD, in 2016 31.8% of Korean children age 5-9 were overweight, just above the OECD average of 31.4%. The increase in rates of childhood obesity has also been rapid; in 1990 just 16.6% of Korean 5-9 year olds were overweight or obese. Given this, reducing childhood obesity should be a policy priority in Korea. There is scope for Korea to do more to promote healthy eating for children, for instance through healthy meals in schools, educational programmes, and clear, mandatory, front-of-pack food labels on energy-dense, nutrition-poor packaged foods, especially on products targeted at children.

In addition to behavioural risk factors, the health system in Korea will face further challenges as its relatively young population starts to age. While Korea currently has one of the youngest populations among OECD countries, with only 13% aged 65 or over, this is expected to increase considerably in the next decades. By 2050, over 35% of the population is projected to be 65 or over, which would make Korea's population one of the oldest in the OECD. This change in demographics creates a new public health challenge, with a need to support health aging, and diagnose and treat chronic conditions associated with advanced age.

### *Efforts to reduce tobacco consumption are comprehensive, though some policies should be strengthened*

Since the Health Promotion Act was introduced in Korea in 1995, non-smoking areas have gradually expanded. The smoke-free laws exist in health care facilities, educational facilities except for universities, and restaurants. However, indoor spaces with smoking zones are not considered (by the WHO) as completely smoke-free facilities. Korea's *Health Promotion Act* allows the installation of smoking zones in indoor spaces, including in indoor workplaces, cafes and bars. Indoor spaces in public transportation such as bus, taxi, and train are completely smoke-free pursuant to *the Passenger Transport Service Act and Railroad Safety Act*.

In 2015 the Tobacco tax was increased, and is currently at 70% of the retail price (the WHO finds that the a tobacco tax above 75% of the retail price to be most effective at reducing smoking), significantly increasing the price of tobacco products. A warning image on tobacco products was also introduced three years ago, with a warning statement, and the banning of misleading terms on tobacco products. Currently the image and text cover about half of the package, although the specific pack coverage has not been agreed.

Following the new smoking legislation in 2015, the smoking rate amongst men dropped, but then it increased in 2016. The smoking rate amongst women is low and stable. In 2017, the smoking rate decreased again, with male smoking dropping from 40.7% to 38.1% of men between 2016 and 2017, below the 2015 rate of 39.4%. Female smoking rate was 6.0% in 2017, down from 6.4% in 2016.

Part of the taxes on tobacco going towards the Health Promotion Levy, which funds smoking cessation programs. In 2015, NHIS started a smoking cessation support programme that covered consultation and medication costs. In 2016 more than 400 000 smokers had received medical support, with a cessation success rate of approximately 40%. There are some provincial 'Quit Smoking Centers', which have been recently established, some including a residential smoking cessation programme. Smoking cessation support programs are also provided through local public health Centers across the country.

### *Vertical prevention programmes are used to deliver public health interventions*

Targeted programmes, in many cases led by the Ministry of Health and Welfare, are used to target key areas of public health risk. Vertical programmes – often run by central authorities, and as a stand-alone initiative – are in place for some public health functions such as screening and chronic disease management, rather than integration of these functions across primary or community care equivalent services. For example, Korea's National Cancer Screening Program has been in place since 1999 and targets gastric, liver, colorectal, breast and cervical cancers. Medical Aid Program recipients and National Health Insurance beneficiaries in the lower 50% income bracket are eligible for free cancer screening, and the screening rate for these cancers 72.8%, 26.2%, 58.4%, 63.1% and 55.6% respectively in 2018 among recommended population.

There are a number of chronic disease management programmes in place. For example, starting from December 2018, the Ministry of Health and Welfare has teamed up with local communities and provided comprehensive NCD management services for patients with chronic conditions such as hypertension and diabetes. This is called the "Pilot primary care NCD control program" and it is mostly provided through local clinics. Participating local clinics develop personalised care plans for NCD patients and conduct education, patient management, monitoring, and interim evaluation according to the care plans. Doctors, nurses and nutritionists within the local clinics may provide education on diseases and better lifestyles. If necessary, local community public health institutions may be asked to offer education.

In the absence of a strong primary care system, proactive secondary prevention and disease management strategies ought to be a priority in Korea. For example, management of high blood pressure or cholesterol. However, there are currently clear signs that the Korean health system is focused on curative, rather than preventive, care. Community Health Centers have, traditionally, been the main locus of NCD management, and have sought to identify high-risk groups. However, in light of Korea's rapidly aging population, and not insignificant risk factors for chronic disease, the current provision may well be insufficient. For example, currently there is just one Community Health Center for every 300-500 000 population. The current government does appear to be focused on strengthening the primary care-equivalent sector, and strengthening Community Health Center capacity, but the policy prioritisation of this area should not be understated.

### *Korea has a strong collaborative approach to public health governance by data and information linkage should be improved*

There are some encouraging signs of a collaborative approach being taken to public health in Korea. First, it cross-government working in Korea is quite well-developed. Communication seems particularly strong in some areas, for example emergency preparedness. Coordination across horizontal levels of government – local to central – is quite strong, and a good balance between autonomy and oversight is generally achieved. The Deliberative Committee on National Health Promotion Policy is a strong positive approach to cross-government working for the development of public health promotion. The Committee, led by the Vice Minister of Health and Welfare, has participation at Director-General level from the Ministry of Strategy and Finance, Ministry of Education, Ministry of National Defence, Ministry of Culture, Sports and Tourism, Ministry of Employment and Labour, and Ministry of Environment, as well as professors in preventive health and experts from relevant research institutions.

Second, there are some positive signs of engagement with civil society actors, patient and consumer groups in Korea, although it is not clear how systematic this approach is. For example, Seoul Government engaged with civil society panels in designing smoking regulation for the city. The Deliberative Committee on National Health Promotion Policy should be a mechanism through which civil society groups can be effectively engaged in public health promotion policy development; the Ministry of Health and Welfare (MOHW) should be sure to engage civil society in this process, and not restrict engagement to government departments and academic experts.

However, despite some sources of data on population health – for instance the Korea National Health and Nutrition Examination Survey (KNHANES), and individual electronic medical records, data from the Korean Centers for Disease Control – weak data linkage limits potential for more detailed understanding of population health. For example, use of data for secondary purposes – such as linking of Korean Biobank data and health insurance (HIRA) – is not allowed. While data linkage must put patient privacy and data protection at the forefront, Korea could look for ways to draw more from its rich data infrastructure and use this as a public health governance resource.

### *High levels of health care consumption, but a very hospital-centric system not well aligned with changes needs of the population*

Levels of health care consumption in Korea are well above the OECD average; for example, the rate of clinic visits in Korea was 16.0 in 2015, compared to the OECD average of 6.9. However, the patterns of health care consumption do not necessarily engender opportunities for health promotion or prevention interventions. Indeed, Korea's health care system is highly orientated towards the specialist, and hospital, sectors.

Korea does not have a well-established primary care system, for example a General Practitioners or Family Doctors sector, as seen in many OECD countries. In fact, hospital beds in Korea increased between 2000 and 2017, at a time when other OECD countries decreased the number of hospital beds, shifting focus instead to outpatient settings. There are signs that the hospital-centric health system model has consequences for chronic disease management: the number of avoidable hospital admissions in Korea for chronic obstructive pulmonary disease (COPD), asthma, and uncontrolled diabetes – disorders which can be effectively controlled in the primary care sector – were all above the OECD average in 2017, although these admissions have been falling.

In the absence of a well-developed primary care sector, Korea has sought other ways of delivering key public health interventions. Public Health Centers provide some primary and preventive care, in particular in non-metropolitan areas. For example, Public Health Centers help to provide vaccinations, and Korea has very high rates of infant and elderly vaccinations. 83% of over-65s were vaccinated for influenza in

2017, the highest proportion in the OECD, and vaccination rate for 1 year olds (DTP, measles and hepatitis B) was 97% in 2018, again one of the highest rates in the OECD.

## Tackling harmful alcohol use

Harmful alcohol use is a key public health issue in Korea. Korean men drink considerably more than the OECD average, and while men still drink more than women, alcohol consumption among women has increased considerable in recent years. Moreover, heavy episodic and high-risk drinking are common. The average number of drinks consumed in one sitting has almost tripled in four years, from 2.2 cups in 2013 to 6.0 cups in 2016. This is partially driven by the important role that consumption of alcohol plays in social interactions, in particular in the workplace.

This high rate of harmful alcohol consumption has considerable consequences for the Korean society and economy. Healthcare expenditure associated with alcohol use disorders tripled between 2002 and 2013, from KRW 120 billion to KRW 375 billion. In addition, Korea faces KRW 1.0 trillion in medical expenses to treat conditions associated with alcohol use.

In addition to health care cost, alcohol use also leads to accidents and crime. Korea has one of the highest rates of road traffic crashes due to alcohol, and consumption is responsible for 10.8% of all road traffic crashes in Korea. When it comes to violent crime, more than 30% of incidents is committed under the influence of alcohol.

### *Korea has implemented a range of policies to try to reduce harmful alcohol consumption*

To reduce harmful alcohol consumption, Korea has implemented a range of interventions and policies. They focus primarily on two of the four Ps – price and promotion, though policies in these areas can be strengthened. Regulations on products and place are limited. Policies are primarily enforced through the Health Promotion Act, as well as topic specific acts, such as the Liquor Tax Act and the Road Traffic Act.

Korea Health Promotion Institute (KHPI) plays a central role in public awareness and education, as it runs national awareness campaigns and supports health promotion activities by Public Health Centers. In universities, student moderate drinking supporters – trained and supported by the Ministry of Health and Welfare - play a role in raising awareness around harmful alcohol use. In addition, a Moderate Drinking Code for college students was developed by the Ministry of Health and Welfare in 2018, and disseminated to 300 universities across the country. There are also examples of awareness programmes targeting drinking among employees and after work, but these are more ad-hoc.

Korea has an *ad valorem* tax on wine (30%) and distilled alcoholic beverages including soju (72%). The amount of liquor tax payable is itself taxed with an education tax, at 30% for liquors taxed more than 70% and 10% for all others. Beer, makkoli and spirits are taxed based on their volume. On the other hand, the Act on Promotion of Korean Traditional Liquor Industries provides tax cuts for producers of traditional liquors, and supports the promotion of these beverages.

### *Relatively low prices, limited marketing restrictions, and few restrictions on points of sale make alcoholic beverages widely accessible*

Overall, alcoholic beverage in Korea are relatively cheap. While prices for carbonated drinks and fruit juice increased by 208% and 61% respectively between 2005 and 2018, the prices of alcohol drinks increased between 4% and 36%– less than inflation. The popular Korean drink soju is particularly inexpensive, and can be bought for USD 0.15 per alcohol unit (8g/10ml of pure alcohol).

While there exist some regulations on the content of alcohol marketing, and on the time and place of such marketing, alcohol advertisements remain omnipresent. Broadcast advertising of alcohol products is only

allowed after 10pm and before 7am. However, there is no regulation on the depiction of alcohol in television series and programming. Many Korean television shows contain frequent depictions of drinking, which are displayed as social, fun and desirable. There is no national regulation of other forms of alcohol advertising such as billboards, public transport and at retailers and catering. Alcohol marketing can be seen on billboards, public transport and at retailers and catering.

In 2016, Korea revised the warning phrases that are required to be printed on the label of alcoholic products. Producers can choose between three versions, all of which describe the risks of drinking during pregnancy as well as excessive drinking. Two also refer to the carcinogenic nature of alcohol. There are specific requirements for the design and placement of the warning sentence, but while there is a penalty clause in the National Health Promotion Act for not including the warning sentence, there is not one for violating the design requirements. A review by the Korea Public Health Association showed that, in 2014, the warning sentences on 81 out of 100 products did not follow the design guidelines.

While restricting the sale and consumption of alcohol is on the radar of the Ministry of Health as well as local governments, so far there are very few regulations. Alcohol can be sold anywhere and at any time – the only exceptions are sales to underage people and online sales. Local initiatives have been explored to create alcohol-free zones in parks. However, these bans could not be enforced as there is no legal basis for this in the National Health Promotion Act.

There exist inpatient and outpatient treatment programmes for alcoholism in Korea – with inpatient treatment accounting for 94% of all expenditure. In the community, addiction management Centers provide addiction case management and counselling services for alcoholism. However, these services are hampered by limited integration between detection, inpatient and outpatient services, and a lack of funding.

Drink-driving is a major issue in Korea, and the government has recently implemented more restrictive measures to prevent driving under the influence of alcohol. The national maximum legal blood alcohol concentration was lowered from 0.05% (the level most frequently used in OECD countries) to 0.03%. In addition, penalties for driving under the influence of alcohol were made tougher.

### *To change Korea's harmful patterns of alcohol consumption, a comprehensive policy package is needed*

Korea recognises the issues that exist around harmful alcohol use, and has stepped up its public health response. However, there is more that can be done. Korea should consider implementing a comprehensive policy package that acts at different levels, comprehensively covering all four Ps (place, price, promotion and product) as well as education. In particular, advertising and sales restrictions can help reduce the normalisation of harmful patterns of alcohol consumption that occurs through constant exposure and availability; education can change behaviour and help people manage social pressures; and consistent price policies can act as a barrier to initiation or harmful consumption.

### *Restricting the ubiquitous presence of alcohol through more limits on advertising and point of sale*

One of the most important issues to address is the ubiquitous presence of alcohol in Korea – where advertisements can be seen on street corners and public transport, television programmes feature young people engaging in heavy drinking with friends, and K-Pop celebrities promote soju on billboards and TV. While a comprehensive ban on alcohol marketing would be most effective in reducing exposure to alcohol, the political climate and the complexity of such a ban would mean that this might not be feasible straight away.

Korea should consider addressing print, television and outdoor advertising first. This would considerably reduce the public's exposure to alcohol marketing, and the ban could be further expanded once the

acceptability of such regulation increases. In addition to this, Korea should also review which content is allowed in advertisements, and in regular media such as television shows. There restrictions should aim to prohibition the association of alcohol with popularity, beauty and success.

To further reduce the omnipresence of alcohol, Korea should consider decreasing the availability of alcohol by restricting sales and consumption. Alcohol availability restrictions have been proven to be effective in reducing consumption, and are one of the pillars of the Global strategy to reduce harmful use of alcohol. Korea should consider regulation to restrict the places at which alcohol can be bought, the times during which it can be bought, as well as the places it can be consumed.

In particular, Korea could consider banning alcohol sales at petrol stations and other highway establishments. In addition to reducing the consumption of alcohol, this would also help address the issues with drink-driving.

To enable the implementation of alcohol-free zones in public places, Korea could consider revising the National Health Promotion Act. Currently, the Act already allows local governments to designate and enforce smoke-free zones, setting a legal precedent to include similar provisions for alcohol. Once the appropriate laws are in place, municipalities should be encouraged to identify and implement alcohol-free zones in their local environment.

### *Addressing alcohol culture in schools, universities and workplaces*

One of the key issues for Korea is addressing the alcohol culture, where social pressures, customs and etiquettes can encourage harmful alcohol use. The Ministry has taken steps to educate university students, and similar approaches could be taken for school students and workplaces. Life skills education can provide students with a critical understanding of the health impact of their choices, and with negotiation or refusal skills to manage peer pressure.

Alcohol plays a central role in social interactions among co-workers. Employees can experience social pressure to participate due to the hierarchical nature of work teams, the etiquettes around drinking and dining, and the bonding aspect associated with social drinking, which can translate into job progression. To address this, employers could be encouraged to implement an alcohol code of conduct. Managers and more senior employees should be targets as they are often perceived as leaders even outside of the workplace. Employers should also be encouraged to set-up workplace-based alcohol prevention programmes.

### *Tweaking alcohol pricing policies to better align with public health objectives*

As a last, and critical, pillar of a stronger comprehensive alcohol package, Korea should review its taxation and pricing policies. While Korea levies excise taxes on alcohol products, they remain relatively affordable. The popular soju is particularly inexpensive: A 360 millilitre bottle of 20% ABV soju costs around KRW 1 340, or USD 1.15. This translates to an alcohol unit price of GBP 0.12 (USD 0.15), far below the GBP 0.50 (USD 0.64) minimum price that Scotland, Wales and England are considering.

In addition, Korea should review existing policies that aim to promote the traditional liquor industry, but inadvertently also promote alcohol consumption. While the Act on Promotion of Korean Traditional Liquor Industries states that it is committed to developing a wholesome drinking culture, other elects of the act contradict this, such as subsidies to people who establish and operate a centre for promotion and exhibition of traditional liquors, or government-operated alcohol fairs. Moreover, the reduced tax rate for traditional liquors – despite applying to only a limited number of producers and a limited volume – can lead to a lower price and increased consumption

## Public health genomics in Korea

In Korea, genomics is an exploding field: genomic research, large-scale genome genetic testing, genomic screening and diagnostic tests, personalised medicine, and direct-to-consumer genomic testing, are significant areas of policy attention. This expanding domain could bring significant gains in Korea, from a deeper understanding of the population's genomic profile and disease risk, to earlier disease detection, and more effective treatment. There are, however, risks associated with the field of genomics, for example around the effective regulation of sensitive genetic information, ensuring equal access and appropriate use to cutting edge therapies, or ensuring that the use of genomics in health care is driven by the evidence-base, rather than potentially costly consumer or provider demand.

There are some further areas where governance of public health genomics should be strengthened. A regulatory framework has been developed for genetic tests, but quality assurance of private testing laboratories and training for health professionals are less well-developed and health coverage does not appear to be keeping pace with demand from patients and clinicians. The cost-effectiveness of widespread use of genetic testing to personalise treatment has not been established. The area which generates the most concern when it comes to genomic medicine in Korea is the booming field of DTC genetic tests. At present the Korean Government is proceeding in a cautious and stepwise fashion, which is appropriate. Careful consideration should be given to the potential risks to DTC test consumers, and impacts on the health system, following increased availability of genetic testing for health risks.

While genomic medicine may hold great potential to improve peoples' lives and treatment pathways, at this point in time, 'traditional' approaches to preventing ill-health still have the strongest evidence-based. At present the impact of precision medicine for public health, prevention, or even diagnosis remains narrow, and interventions such as restricting alcohol sales, using educational approaches to change drinking patterns, or reviewing pricing and taxation policies, have been well-established as evidence-based and in many instances cost-effective, and should form the backbone of all robust public health policy packages.

### *Precision medicine and public health genomics*

Over the last two decades, and particularly with the sequencing of the human genome and advances in informatics and a range of technologies, new possibilities have opened-up in the field of medicine allowing an increasingly precise consideration of variability in genes, environment, and lifestyle factors to determine individual risk of disease, and design optimal prevention and treatment strategies.

Precision medicine can be used as a powerful diagnostic tool, to test for congenital abnormalities, inherited conditions, and diagnose other conditions, such as rare diseases. Genomics can also provide information on individual risk of diseases, which can in turn inform the design of targeted prevention strategies. For example, genomics can be used to identify people carrying genetic mutations that predispose them to a very high risk of developing colorectal or breast cancer, which would allow screening programs to offer more aggressive screening and surveillance regimen to these groups. However, many common diseases such as cancers and many cardiovascular diseases, have been found to be more genetically complex than was first anticipated. For example, for example for Ischemic Heart Disease (IHD), is less predictive than a range of traditional tests, including blood pressure, blood cholesterol or body mass index at determining IHD disease risk.

### *Korea's extensive genomic research field could be better leveraged for public health policy if data linkage were possible*

Korea has an extensive infrastructure when it comes to genomic research and mapping, with one of the biggest biobanks in the world, the National Biobank of Korea and biobank network. Regulated by a series of acts on bioethics and safety, the biobank includes a network linking research hubs and samples from

across Korea. As part of the National Biobank of Korea, a number of large-scale genomic projects have been undertaken, including the Korean Genome Analysis Project (KoGAP) and the Korean Reference Genome (KRG). The biobank is already generating significant research, some of which is clearly relevant to deepening understanding of public health risks in Korea. Since the establishment of the biobank research has looked at the relationships between genes and diseases, behaviour and environmental risks. For example, the Korea Association REsource (KARE)/KoGAP project aims to identify genetic and environmental risk factors leading to the development of five common life-style-related diseases (i.e. obesity, diabetes, hypertension, osteoporosis, and metabolic syndrome) in a large number of Korean populations.

However, for genomic research, preventive interventions, and clinical application, personalised medicine, linkage of genomic data with other health system data, and/or the inclusion of individual's genomic information in personal medical records as it becomes available, would contribute to a far richer information source and potentially greater relevance for public health genomics. At present, the Korean Biobank does not provide linkage of genomic data with other secondary data such as health or medical information. Despite Korea's extremely extensive health information system, and extensive legislative infrastructure for health data, it is not yet possible to link biobank data with unique patient IDs. At present, information from Korea's biobank cannot be linked to HIRA or NIH data systems, even in an anonymised way. If it were possible to accelerate these connections, there is potential for this data to be a valuable source of research and a first step in establishing a big data system that includes genetic information. Additionally, despite the fact that the Korean Government is strongly committed to Korea being a leader in genetic research, current data legislation strongly restricts sharing of (even de-identified) health data, which may limit Korea's capacity to participate in potentially fruitful international collaborative efforts.

### *Precision medicine for preventive interventions and public health in Korea*

Genetic testing is widespread and increasing in Korea, both for hereditary (mostly infant) diseases, and following cancer diagnoses to personalise treatment. A regulatory framework has been developed for these tests, under the Bioethics and Safety Act, which was last updated in 2015 to introduce further regulation on genetic treatment research.

There are certain restrictions in place with regards to genetic testing in the health system; for example, testing for BRCA 1/2 can only be undertaken if breast cancer is detected or the individual has a strong family history of breast cancer. In general, genetic testing is usually used for hereditary diseases, and cancer diagnoses, in order to refine the cancer treatment approach. Overall the volume of genetic tests has been increasing in Korea, but there has not been a comprehensive study assessing this expansion, and concrete, quantitative evidence is hard to find.

Most genetic tests are not covered by Korea's National Health Insurance Service, with many tests paid, at least partly, out-of-pocket. For example, the co-payment rate for solid cancer is 50% in the case of progress, metastatic and recurrent cancers, while the co-payment rate is 90% for other cancer patients eligible for reduced co-payment rates. Depending on the patient's condition, different co-payment rates apply to National Health Insurance rates. There are also some limits on the number of genetic tests that can be undertaken, so that the same individual cannot repeatedly request testing (either different or the same), for example one genetic test for hereditary diseases, and one genetic test for non-hereditary diseases.

Health coverage does not appear to be keeping pace with demand from patients and clinicians, and the cost-effectiveness of widespread use of genetic testing to personalise treatment (in particular cancer) has not been established. There are not any easily available guidelines in place – either for physicians or consumers – regarding the prescribing of genetic tests. This situation has the risk of creating incentives for hospitals to prescribe genetic tests in order to increase out-of-pocket payments, with little protection for patients who may not be in a position to assess the necessity of such a test. If genetic testing is to become

a core part of the Korean medical landscape the government may wish to look for ways to provide coverage for tests that are evidence-based and with demonstrated clinical utility.

The Korean Government has clearly been making public health genomics a priority, and has been investing in research to try to operationalise genetic insights for public health. However, the government's current focus is on the development of new treatments rather than preventive interventions. For example, in 2017 the Korean Government invested 63.1 billion Won (roughly USD 55.7 million) in developing precision medicine in a project led by Korea University to run until 2021 focused on developing personalised cancer treatments, starting with the analysis of the genetic information of 10 000 cancer patients.

### *Direct-to-consumer genetic testing is booming in Korea, and generates some concerns*

The area which generates the most concern when it comes to genomic medicine in Korea is the booming field of DTC genetic tests. DTC testing allows people to access information about their genetic makeup without passing through a medical professional. DTC can make available health-related and non-health-related genetic information, for example vulnerability to certain diseases, or information on ancestry. At present, Korea allows a relatively limited number of DTC genetic tests, which give information such as genetic traits linked to blood pressure, cholesterol, skin elasticity, or hair loss. Cosmetic information for example on skin health or type.

In early 2019 the Government agreed to explore the introduction of a further suite of DTC genetic tests for 13 diseases, such as coronary artery disease, hypertension, type-2 diabetes, stroke and a number of cancers. Easing of the DTC market restrictions was anticipated, by the Korean Labor Institute, to lead to an expansion in sales for the industry of 503%, a growth in investment of 458%, and a growth in jobs of 45% over ten years.

The suggested benefits of greater access to DTC genetic tests include changing consumer behaviour, for example seeking to improve diet if shown to have an elevated genetic risk of obesity or high cholesterol. Genetic testing showing elevated disease risk could also lead to more targeted preventive actions, for example more frequent cholesterol testing, or more frequent mammography. However, licensing requirements for DTC are less strict, and quality controls are weaker. In Korea DTC genetic tests are not regulated as medical technologies. Weak legislation means that the accuracy of DTC genetic tests cannot necessarily be assured. Some medical professionals, and research papers, have raised concerns about the accuracy of DTC genetic tests, in Korea and internationally. The potential privacy risks from DTC genetic test consumers should be considered, especially given that regulation of DTC providers at present is weak.

Additionally, the DTC industry is booming in Korea, but understanding test results is not always straightforward, and there are several ethical considerations that should be considered. Even if DTC genetic testing was consistently accurate, the risk of presenting individuals with information that they do not understand or that they cannot act upon, could result in considerable emotional distress. The potential additional burden to the health care system, generated by an expanded DTC genetic test market, should be considered. The health system and medical professionals specifically may come under increasing pressure to make secondary testing available to check DTC genetic test results, interpret results, or even provide care that may not be medically necessary.

The potential risks to consumers and the health system from DTC genetic testing, including privacy risks, ethical risks, potential exposure of individuals to distressing information which they may struggle to understand, and possible increased strain on the health system, should all be given serious consideration during this demonstration period, and in any further decisions to expand the DTC genetic test market. Additionally, robust processes ought to be put in place to ensure the quality of DTC genetic tests, protection of consumer data, the comprehensibility of information about the tests and about the results.

### *Korea should develop a national strategy on precision medicine*

Precision medicine is, clearly, an expanding field in Korea. The use of genetic testing in the medical field is growing, and appetite for genetic testing amongst Korean consumers is high. Korea also has an extensive infrastructure when it comes to genomic research and mapping, with one of the biggest biobanks in the world, the National Biobank of Korea and biobank network. The biobank is already generating significant research, some of which is clearly relevant to deepening understanding of public health risks in Korea.

In many respects Korea can be considered ahead of OECD peers when it comes to managing the growing field of precision medicine. The legislative framework for genetic testing is in place, and DTC genetic tests also fall under these regulations. Increases in DTC genetic tests are being approached in an appropriately cautious and stepwise way.

However, at present Korea does not have an overarching strategy in terms of harnessing the potential of precision medicine, increasing its positive impact on public health, or managing impacts on the health system. Korea should look to develop an overarching National Strategy for Precision Medicine, which would include consideration of issues. Such a strategy ought to cover issues such as the particular characteristics of the Korean health system, workforce implications such as the need for genetic medicine specialists and building genetic literacy amongst Korean medical professionals in general, guidelines identifying genetic tests that demonstrate both clinical validity and utility, cost-effectiveness analysis of tests, and ensuring that cost-sharing requirements currently in place for medically-prescribed genetic tests do not cause inequalities in health care access.

As part of this national strategy, building genetic literacy amongst medical professionals, and the Korean population, should be key. Improving genetic literacy amongst health care professionals would anticipate precision medicine playing a growing role in diagnosis in treatments in the decades, if not years, to come. Up-skilling professionals would also help them meet the increasing generic inquiries coming from patients, possibly prompted by DTC genetic tests that they had undertaken. When it comes to health professionals, inclusion of modules in formal education or continuing education, or distribution of informational materials in the work place, or checks as part of quality assurance should be considered.

Improving population health literacy can improve individuals' capacity to judge the pros and cons of different treatment options, reduce hospital use, adopt better preventive measures, and reduce health care costs. For the Korean population, a first step would be ensuring that easy to understand information about precision medicine, genetic tests prescribed by the health system, and the advantages and limitation of the existing range of precision medicine. Introducing genetic counselling for patients undergoing genetic testing would also be a positive step forward, and follow in the footsteps of other OECD countries such as Austria, Australia, France, Germany, Portugal and Switzerland.

At the same time, Korea should ensure that quality assurance and regulation around genetic testing is robust. Legislation around which actors can prescribe, undertake and finance (a limited number of) genetic tests is in-place in Korea, and existing data privacy legislation should cover the data generated by the tests. However, most of the tests prescribed by medical institutions are processed by a limited number of private laboratories, and a quality assurance system which ensures the safety and validity of these processes would be welcome. Additionally, specific clinical guidelines to ensure quality at the point of clinical testing may be warranted. Establishing a comprehensive regulatory framework would make Korea a relative leader in this field, and is a process that should be undertaken in tandem with the development of the National Strategy for Precision Medicine, and with input from all relevant national (and international) agencies.

## Public health emergency preparedness

Despite a moderate exposure and vulnerability to hazards and threats, recent shock events demonstrated that Korea was not prepared enough to deal with major crises and best use its resources to reduce their public health consequences. The 2014 Sewol Ferry accident and the 2015 Middle East Respiratory Syndrome Coronavirus (MERS-CoV) revealed important shortcomings in public health emergency preparedness and response, causing significant human losses and a large disarray within Korea society. The dramatic public health consequences of these crises also impacted trust in government and public institutions. In this context, improving public health emergency preparedness should be seen as a strategic investment for both better health outcomes and reinforcing public trust.

Since then, public health emergency preparedness has become a priority in Korea, and the government has engaged in important reforms to restructure and reinforce its public health emergency preparedness policies and capabilities. The legal and institutional frameworks have been revised, and important investments are made to reinforce emergency preparedness capabilities across the board, making the overall system at the right level of capabilities in light of the Korean risk landscape. Korea is also making the best use of innovation and technologies to foster timely detection, enable information-sharing from authorities to citizens, and facilitate decision-making.

Despite the usefulness of these necessary policy reforms and new capabilities, strengthening emergency preparedness in Korea remains an unfinished agenda. Overall, Korea appears to be over-reliant on planning at all the levels of its administration, which is important but not sufficient to be ready for more complex and unforeseen emergencies. Strengthening capacities for a more agile response based on multi-stakeholder partnerships, flexible arrangements, and engaged leadership should be the guiding objectives to further progress. Furthermore, strengthening preparedness at the local level is a major priority. More work also needs to be done on the primary care system to avoid rushes to large hospitals for any symptom, which can contribute to spreading infections. Finally, a challenge for the future will be to maintain the momentum to continue strengthening public health emergency preparedness overtime, and not fading off the effort, even in the absence of major crises.

## Coronavirus COVID-19

This review was carried out before the start of the outbreak of the coronavirus COVID-19. The COVID-19 outbreak started at the end of 2019 in China, and rapidly spread to neighbouring countries and across the globe. As of early March 2020, all OECD countries report active cases of coronavirus COVID-19.

Korea and other OECD countries are implementing policy actions to contain and mitigate the impact of this global health threat.

### *Despite a moderate exposure to disasters, recent crises and increasing vulnerabilities call for increased attention to public health emergency preparedness*

While known as the land of the morning calm, Korea regularly suffers contingencies that can have serious public health consequences. In addition to the yearly typhoon season, the last decade has seen a series of large-scale fires, marine and industrial accidents, natural hazards and infectious disease outbreaks affecting Korea. While floods and typhoons are the most significant in terms of their frequency and recorded death toll, other hazards, such as heatwaves and yellow dusts storms can have also important public health impacts. This is all the more important in the context of climate change, which is projected to affect hazards frequency, intensity and duration. In addition, industrial accidents, transport accidents, maritime accidents

human casualties represent half of the total casualties caused by disasters in Korea, demonstrating major shortcomings, which makes of better preparing for their human consequences a priority.

Regarding infectious diseases outbreaks and the risk of pandemics, Korea, as a global economic hub, is exposed to virus or pathogens in a similar manner to most OECD countries. Nevertheless, with 186 confirmed cases, 38 deaths and 16 693 quarantined or isolated individuals, Korea has been the most affected country in the world outside of the Middle East by MERS-CoV in 2015, demonstrating significant shortcomings in its public health emergency preparedness. Korea is also marked by a high prevalence of Tuberculosis and subject to the resurgence of more classic infectious diseases, such as measles, which sporadically continue to affect citizens and cause deaths.

Overall, Korea's risk profile shows a moderate risk exposure, in terms of number of disaster events affecting the country every year, pretty close to the OECD average over the last three decades. However, data on the socio-economic consequences caused by disasters originating from natural hazards, technological accidents, epidemics or acts of terrorism, shows that Korea ranks better at reducing their economic losses than at limiting the number of fatalities they can generate. There is in consequence a margin of progress in Korea to reduce public health consequences of disasters.

In terms of vulnerabilities, Korea presents some characteristics that are important to consider in order to prepare for future risks. The increased share of the elderly in the Korea population is of serious concern when it comes to individual resilience. Demographic projections indicate the Korea population over 65 years will rise to 71% of the population aged between 15 and 64 by mid-century, compared to only 17.3% in 2014. Korea's high population density, and the large and increasing numbers of inbound and outbound travellers to and from the country are factors that can favour the spread of infectious diseases.

Despite an effective vaccination programme, Korea's health profile and societal habits also contribute to its vulnerability to epidemics and infectious diseases. Overall, the vaccination rate in Korea slightly exceeds the OECD average, contributing to a good level of immunisation for many infectious diseases, but Korea's high consumption of antibiotics, with 31.7 defined daily doses per thousand inhabitants in 2016, compared to the OECD average of 23.7 raises concerns around anti-microbial resistance. Furthermore, Korean societal habits, such as doctor shopping, familial care-giving and vising in hospitals can contribute to reducing resilience to infectious diseases, as happened during the MERS-CoV outbreak.

### *Korea makes of preparedness for public health emergencies a priority, as reflected in recent reforms of its public policies*

Korea's legal framework for public health emergencies is based on an all-hazard approach, as recommended by the OECD Recommendation on the Governance of Critical Risks. The Framework Act on the Management of Disasters and Safety established in 2004 a comprehensive system for emergency management in Korea, for both natural and social disasters – which includes infectious diseases. As in most OECD countries, the complementary Infectious Disease Control and Prevention Act addresses those specific public health risks. Both Acts define roles and responsibilities of Ministries and local governments. All actors have to prepare countermeasure plans for their jurisdictions from national to local levels, following the principle of subsidiarity.

Following the 2014 Ferry Sewol accident and the 2015 MERS-CoV outbreak, both the Framework Act on the Management of Disasters and Safety and the Infectious Disease Control and Prevention Act were updated to incorporate lessons learned, which is good practice. Changes addressed some of the most pressing needs, such as the lack of coordination between emergency response agencies in the first case or the need to strengthen the infectious disease control system, reinforce hospital regulation and increase public health workforce in the second.

The institutional framework for public health emergency preparedness has significantly evolved with these reforms, although repetitive institutional change do not always favour implementation. Overall, the need to

strengthen inter-ministerial coordination for a more effective emergency preparedness and response was taken seriously in Korea in the last years. The MOIS now centrally coordinates the different emergency preparedness and response capacities, with a dedicated Vice Minister for Disaster and Safety Management, after those functions had been transferred in 2014 to the Prime Minister. As the first reform enabled to strengthen horizontal coordination, it is hoped that the new governance in place will help improve coordination with local governments, which remains a major challenge in Korea. Regarding the public health sector, the reforms led to a significant strengthening of the Korea Center for Disease Control (KCDC), under the MOHW, as the main operational agency and unique control tower for infectious disease prevention and control.

Strengthening multi-level coordination is a key area to improve preparedness in Korea, now that central level governance has been stabilised. Central authorities have powerful policy levers on local governments, as they control a large part of their budget allocations and human resources through the MOIS, set guidelines and evaluate emergency preparedness and related plans. Nevertheless, clarity of roles and responsibilities between the levels of governments could be improved and coordination mechanisms streamlined in order to make the best of existing local capacities and proximity when emergencies unfold.

### *A good knowledge of the critical risks and their public health consequences are essential to prepare for public health emergencies*

With an all-hazard approach, Korea has set up sophisticated systems for risk related data collection and analysis with comprehensive information-sharing platforms in the context of the government 3.0 initiative. The development of these tools reflects the advanced technologic development and the importance of government innovation of Korea. By making risk information largely available, such systems enable Korea emergency management system to identify and asses critical risks and to communicate them across government, from national to local levels, as well as to the citizens. The Disaster Management Portal of the Integrated Disaster and Safety Information System is a good practice in this respect, as are the Korea Safety Index and Public Safety Maps.

Nevertheless, Korea is less advanced in utilising this rich information-base to plan strategically its emergency response capabilities through a whole-of-government scenario-based National Risk Assessment. Unlike many OECD countries, Korea does not yet conduct such assessment, allowing to compare all its major risks in terms of likelihood and potential impacts, and to prioritise resources accordingly. With the revisions of the national governance, which makes of MOIS the central national institution for emergency preparedness, and the mandate it has received to develop risk analysis with all the emergency response stakeholders, Korea has all the technical ingredients in place for such comprehensive approach.

For infectious disease, KCDC has strengthened its risk assessment process and the approach taken is promising: KCDC monitors 11 categories of infectious diseases and assess them in terms of likelihood and probability. This risk assessment constitutes the basis for capabilities planning and could be further institutionalised as an element of a wider national risk assessment.

### *Capabilities for public health preparedness and response in Korea are fairly robust*

Based on its risk analysis and following recent disaster events, Korea has invested resources for the development of a robust infrastructure and dedicated capabilities to prepare for public health emergencies, from their detection and surveillance to the response and medical care.

A notable budget increase in risk management contributed to strengthening Korea emergency capabilities in the last 5 years, with the creation of new information systems, the enhancement of health care infrastructures, and the reinforcement of human resources, especially for infectious diseases preparedness

and control. These capacities are generally tailored in good accordance with the level of risk in Korea, national policies and international standards, particularly at the national level. Nevertheless, ensuring that local governments build also the commensurate capabilities to fulfil their responsibilities is a concern across health and emergency professionals.

Korea has significantly invested in its capacities to monitor, detect, and analyse threats to public health, as well as to warn emergency responders and citizens. With a large use of cutting-edge technologies, a series of monitoring and reporting mechanism, complemented with information systems now allow smart detection of hazardous events and infectious diseases. Significant improvements were put in place following the Sewol Ferry disaster and the MERS-CoV outbreak, in order to increase information sharing and to strengthen the infectious disease surveillance system, which demonstrated major weaknesses. The National Notifiable Infectious Disease Surveillance System follows now best international standards, but reporting requirements for health care facilities might risk being excessively burdensome.

Similarly, Korea is reinforcing its health infrastructure to cope more effectively with both infectious diseases and mass-casualties disasters. This includes the designation of new infectious disease and disaster base hospitals, equipment for disease control, as well as new regulation. As health emergencies in the last years demonstrated preoccupying gaps in infectious disease control in hospitals, rapid availability of health care in large accidents, as well as safety concerns in health institutions, increasing investments and strengthening regulations is relevant. Nevertheless, sustaining these improvements overtime would require for Korea to properly resource operation and maintenance for this infrastructure, and maintain the momentum on safety improvements in hospitals with an equilibrated partnership with the private sector.

Korea plans large stocks of medical countermeasures and emergency supplies for emergency response. As in most OECD countries, Korea stockpiling policy was significantly upgraded after the 2009 H1N1 outbreak. Antiviral drugs in the National Strategic Stockpile cover 26% of the population, and a more dynamic stockpiling approach was recently adopted. Appropriate mechanism are also in place to introduce new vaccines. Regarding other types of emergency supplies, as responsibilities lie within each sectors a centrally coordinated resource utilisation system is being deployed.

Workforce development for public health emergency preparedness is an on-going priority in Korea. The Disaster Medical Assistance Teams were reformed and reinforced, MOHW is establishing a system of psychological support practitioners for disasters, and most significantly infectious diseases specialists are being hired and trained to reinforce KCDC and Public Health Centers throughout Korea. The late response during MERS-CoV outbreak convinced Korean decision-makers of the need to reinforce skills and staff in KCDC and across national and local governments for infectious diseases preparedness and control. The challenge now is to make sure that these strategic investment in skills best contribute to strengthening the entire public health system where the most important needs are. At the local level, Public Health Centers and local governments are attentive to how these new resources will be distributed across the country as some fears it might not be risk-based.

### *An encouraging dynamic is shaping up to improve emergency response in Korea, but this remains an unfinished agenda*

Korea has developed a set of emergency plans to mobilise its capabilities and implement countermeasures when public health crises occur. Based on the overarching Master Plan for National Safety Management, this large development of emergency plans across Korea’s institutions and levels of governments has benefits, as it reinforces engagement, accountability and responsibility of stakeholders. The monitoring system in place for those plans, which provides incentives to improve their quality is good practice. However, with 33 types of crisis management manuals, 278 crisis response manuals, 1300 related organisations, and 2339 on-site action manuals, the multiplicity of plans makes it difficult to ensure coherence when a crisis strikes. More efforts would be required to simplify and ensure coherence between this large set of emergency plans, and favour a more flexible approach to deal with complex emergencies.

Evidence of coordination failures in crisis management have prompted a major reflection in Korea on inter agency coordination in public health emergency response and crisis leadership. The establishment of the National Disaster Safety Control Center (NDSCC) under MOIS in 2015 as a joint situation centre with representatives from all the relevant ministries and agencies is promising. A direct link to political leadership facilitates decision-making, with the involvement of the Minister of the Interior and Safety or the Prime Minister, depending on the crisis' scale. Similarly, KCDC has also strengthened its capacities to operate as an effective command and control centre with its Emergency Operations Center established in 2015. This new organisation clarifies leadership and facilitates inter-agency coordination. However, the establishment of two new structures requires specific arrangements to clarify their coordination mechanisms in case of a large-scale infectious disease outbreak.

Revisiting approaches to crisis communication in Korea is a priority, and on-going efforts are promising. The lack of transparency during the MERS-CoV epidemic outbreak contributed to aggravating the crisis, and also during the Ferry Sewol disaster. Since then, KCDC has fundamentally transformed its crisis communication approach, with the establishment of a dedicated Office of Communications in 2015.

Multi-stakeholders emergency simulation exercises based on complex scenarios should be done regularly, to develop agile response to crises and strengthen inter-agency coordination. In Korea, simple exercises are undertaken regularly to test emergency plans and procedures. All these exercises and drills are useful to ensure that procedures are well-known and tested. But most of them are based on testing the manuals and this approach may not be sufficient to prepare for complex emergencies.

# 1 The public health system in Korea

In Korea, where compared to the OECD average the population is relatively young and rate of behavioural risk factors comparatively low, the system has perhaps been understandably focused curative, rather than preventive care. However, shifting demographics including rapid aging, key risk factors especially amongst certain population groups notably males, and an increasing burden of chronic disease mean that prevention and public health should be a focus sooner, rather than later. This chapter outlines some of Korea's strengths when it comes to public health policy, notably a collaborative governing approach and rich data infrastructure, as well as areas for strengthening, including stronger primary prevention policies, and scope for more robust chronic disease management.

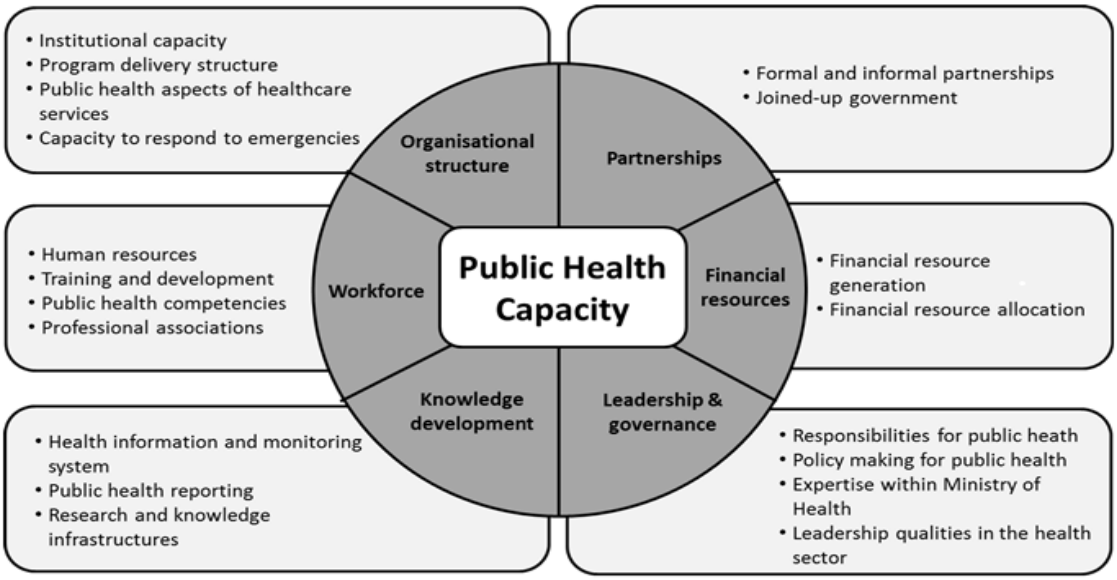
## Introduction

Public health issues have gained importance across OECD countries in recent years, as governments grapple with the best way to prevent disease and ill health, and help their populations live longer, healthier lives. Chapter 1 of the OECD Reviews of Public health examine the core public health architecture in place in countries to prevent disease, detect disease early, prevent secondary complications from diseases, and promote good population health and wellbeing. The public health architecture includes all the public, private, and voluntary entities dealing with the organisation of core public health functions such as public health programme delivery and institutional capacity to respond to public health emergencies, workforce such as public health specialists, knowledge development and epidemiological surveillance, formal and informal public health partnerships, financial resources for disease prevention and health promotion, and leadership and governance in the system.

This chapter gives an overview of the epidemiological context and national public health needs in Korea, sets out a summary of the strengths and weaknesses of Korea's public health system, and where weaknesses are identified makes recommendations for policy strengthening. The description of public health policies in this chapter is structured according to a framework for analysing the public health system detailed in Figure 1.1 below.

### Figure 1.1. Appraising Korea's public health capacity – analytical framework

Analytical Framework for the OECD Public Health Reviews




Source: Authors' elaboration.

## 1.1. The public health picture in Korea

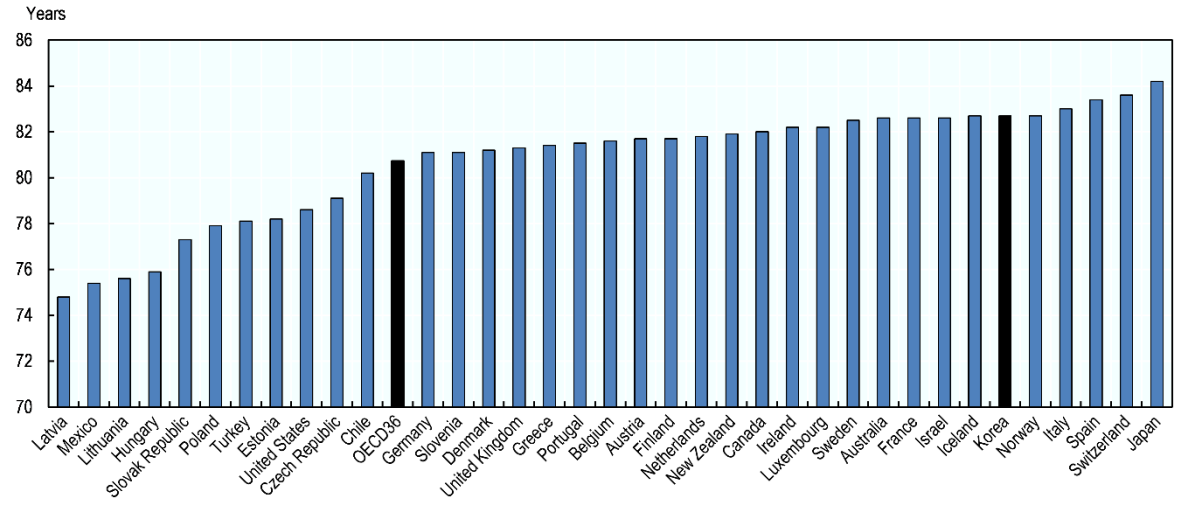
### *1.1.1. The health status of the Korean population*

In Korea, life expectancy at birth was 82.7 years in 2017, higher than the OECD average of 80.8 (see OECD (2019[1])). It was higher for both men and women: life expectancy for males was 79.7 years,

compared to an OECD average of 78.1 year, and life expectancy for females was 85.7 years compared to an average of 83.4 years (OECD, 2019[2]).

## Figure 1.2. Life expectancy at birth

Life expectancy at birth in OECD countries, 2017 or nearest year

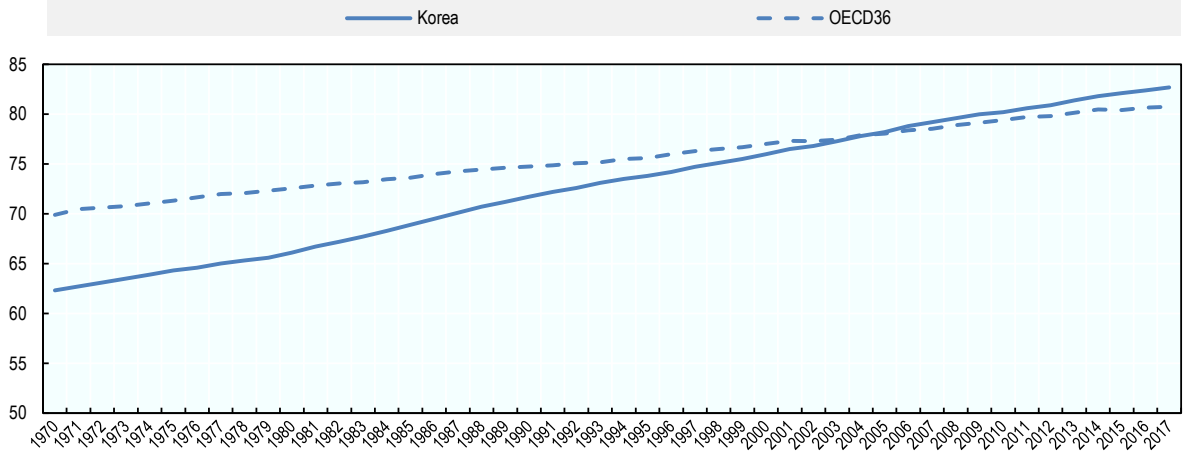



Source: OECD (2019[1]), *OECD Health Statistics 2019,* https://stats.oecd.org/.

The high life expectancy in Korea is the result of a rapid increase in the last four decades. While in 1970 Korea's life expectancy was nearly 8 years less than the OECD average, by 2005 it had caught up with other countries (see Figure 1.3). Since then Korea's life expectancy has continued to grow at a steeper pace than the OECD on average.

## Figure 1.3. Life expectancy at birth over time

Life expectancy at birth in Korea, and OECD average, 1970 - 2017

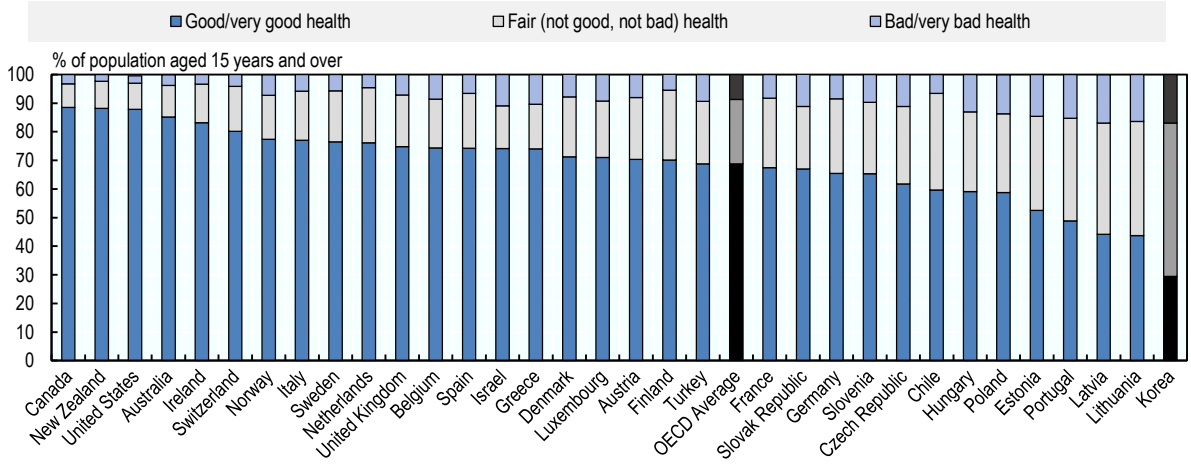



Source: OECD (2019[1]), *OECD Health Statistics 2019,* https://stats.oecd.org/.

Nevertheless, while life expectancy is higher than average, these years are not all spent in good health. Korea has the lowest perceived health status of all OECD countries, with only a third of people reporting that they are in good or very good health (see Figure 1.4).

## Figure 1.4. Perceived health status

Percentage of population reporting that they are in good/very good, fair, or bad/very health, 2017 or nearest year



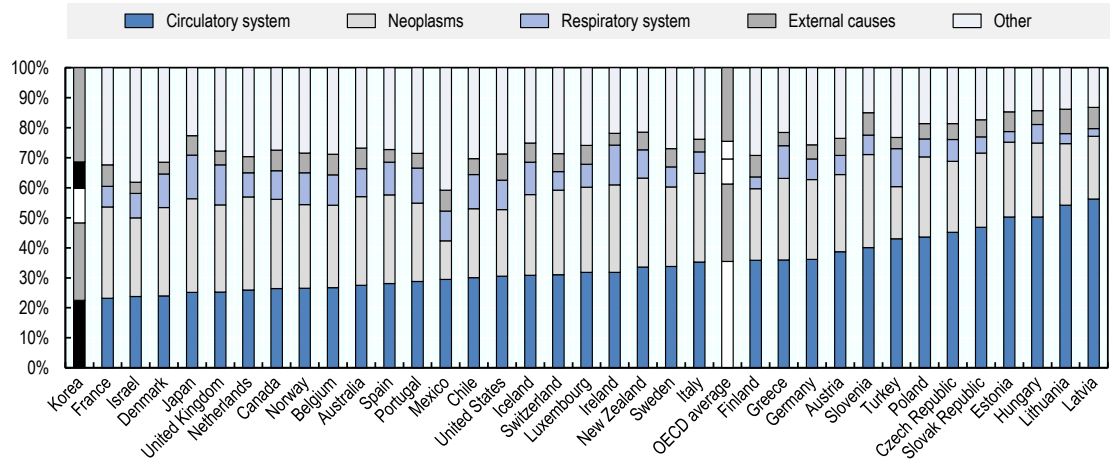

Source: OECD (2019[1]), *OECD Health Statistics 2019,* https://stats.oecd.org/.

### *1.1.2. Burden of disease*

Like in many other OECD countries, non-communicable diseases account for the majority of the disease burden in Korea. The top five causes of mortality in Korea are cerebrovascular disease, Alzheimer disease, ischaemic heart disease, lung and liver cancer (IHME, 2017[3]). While ischaemic heart disease is in the top five, diseases of the circulatory system only account for 23% of mortality in Korea – compared to an OECD average of 35% (see Figure 1.5). Cancers on the other hand account for 26% of mortality, which is the same as the OECD average.

## Figure 1.5. Causes of mortality

Percentage of deaths per 100 000 population (age-standardised rates), 2016 or nearest year

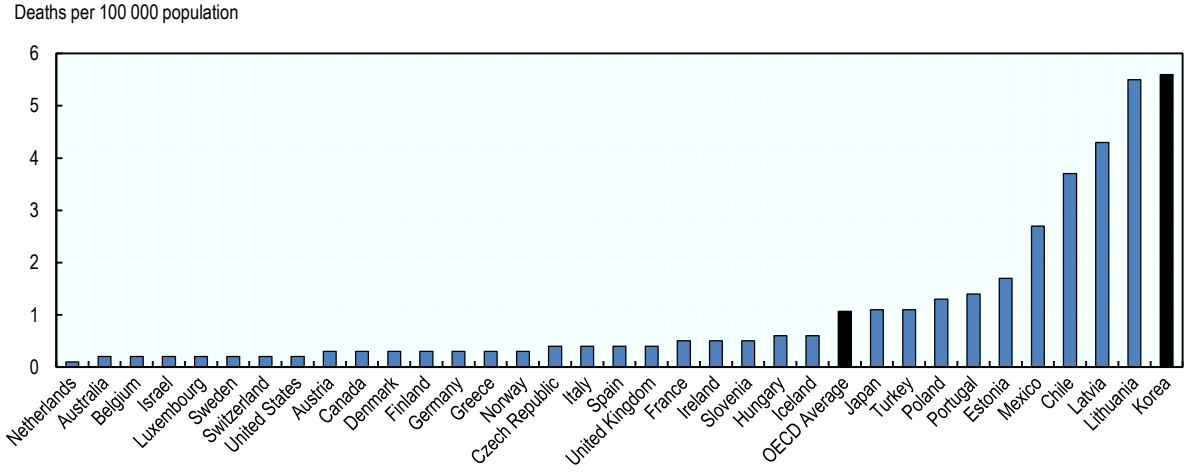



Source: OECD (2019[1]), *OECD Health Statistics 2019,* https://stats.oecd.org/.

While the majority of disease burden comes from non-communicable diseases, Korea has a high burden of tuberculosis (TB) as compared to other OECD countries (see Figure 1.6). Korea has 6.0 deaths per 100 000 population per year, compared to an OECD average of 1.0. This public health issue has been on the radar of the Korean Government, and disease management and control plans have reduced the incidence from 100 cases per 100 000 population in 2011 to 77 per 100 000 population in 2016 (Go et al., 2018[4]).

## Figure 1.6. Deaths from tuberculosis

Percentage of deaths per 100 000 population (age-standardised rates), 2017 or nearest year.




Source: OECD (2019[1]), *OECD Health Statistics 2019,* https://stats.oecd.org/.

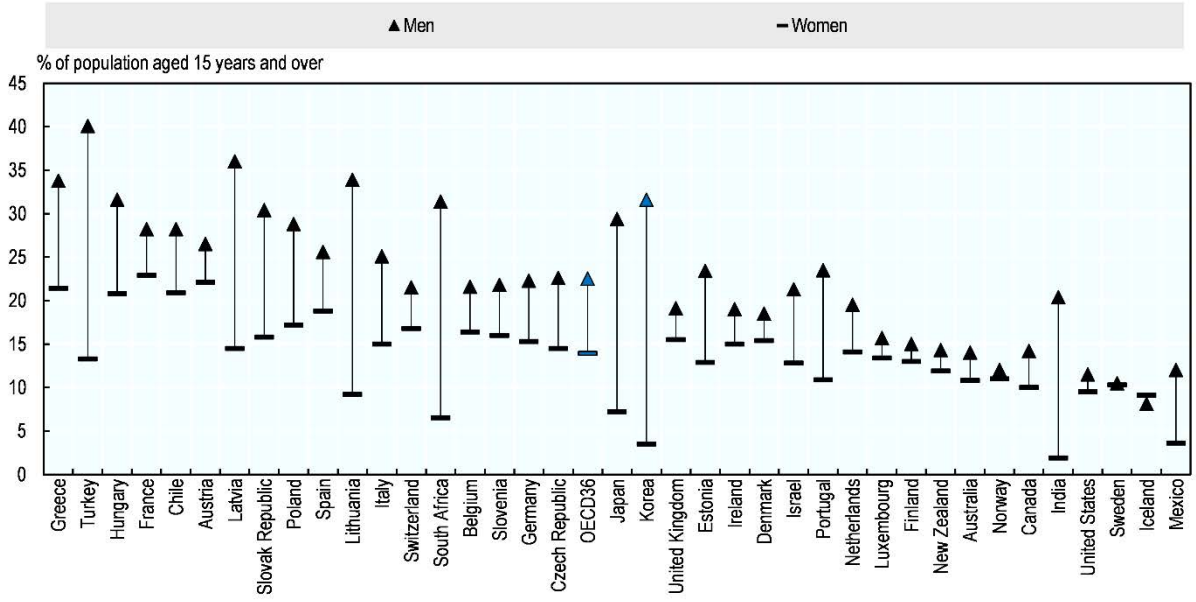
A second Comprehensive Plan on Tuberculosis was due to be released in 2019, and will focus on early detection (for example screening of elderly and high-risk groups), patient care and contact management, expanded development of research, and strengthening the TB response system. Strengthening the response system will include establishing a cross-government response system, strengthening local level response capacity, improving TB awareness, and strengthening international collaboration around TB.

### *1.1.3. Risk factors*

While tobacco consumption among females in Korea is very low compared to the OECD average, males smoke much more than in other OECD countries (see Figure 1.7). Nearly 31.6% of Korean men are daily smokers, compared to an OECD average of 22.5%. However, there has been a decrease – as the prevalence of daily smoking in men was nearly 60% two decades ago (OECD, 2019[2]).

## Figure 1.7. Daily smokers as a percentage of the total population

Percentage of population smoking daily, by sex, 2017 or nearest year



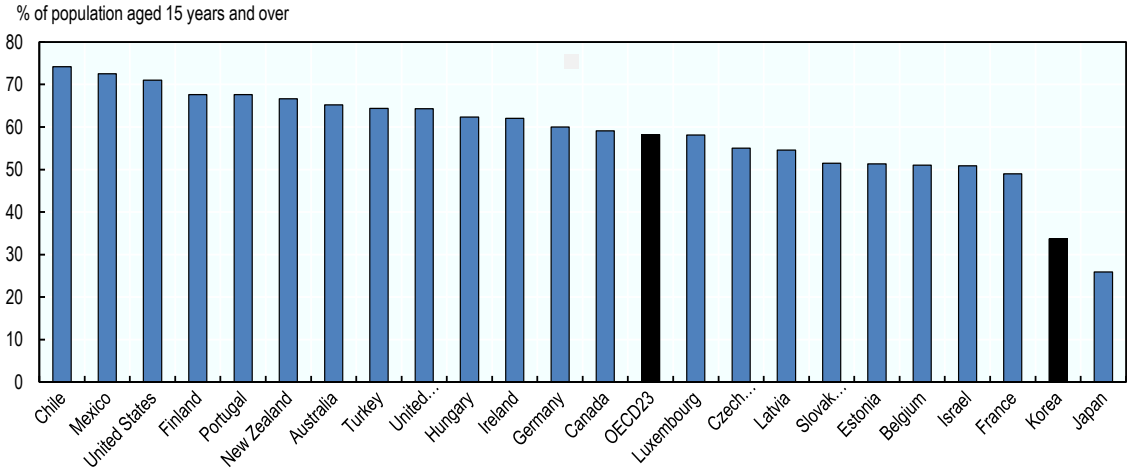

Source: OECD (2019[1]), *OECD Health Statistics 2019*, https://stats.oecd.org/.

Alcohol consumption in Korea, at 8.7 litres per person per year, is around the OECD average (OECD, 2019[2]). However, similar to tobacco, men drink considerably more than women. More patterns and trends on alcohol consumption are described in Chapter 2.

Korea has one of the lowest obesity rates of the OECD, at 5.5%, with 33.7% of the population overweight or obese (see Figure 1.8). Korea also does well when it comes to fruit and vegetable consumption (OECD, 2019[5]; OECD, 2019[1]).

## Figure 1.8. Adult overweight and obesity

Percentage of population who are overweight or obese (measured), 2017 or nearest year



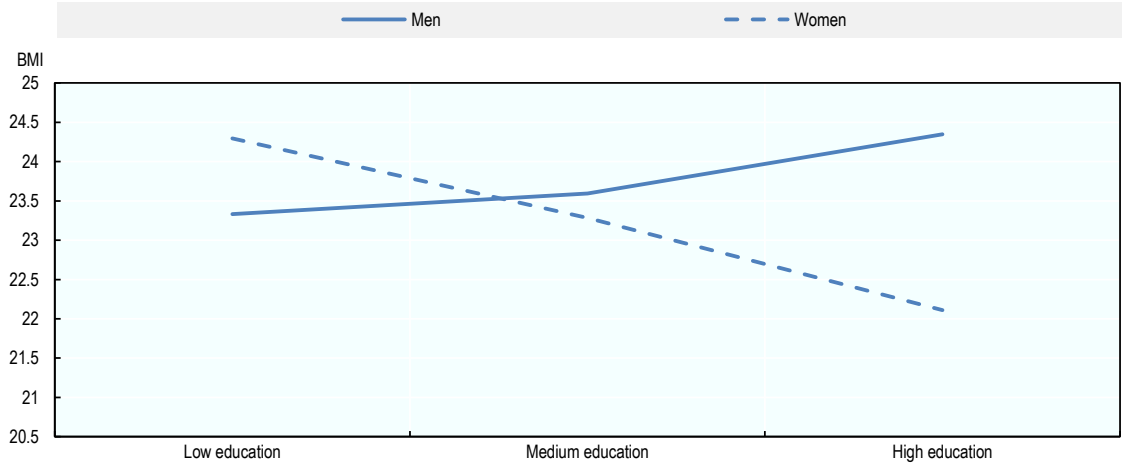

Source: OECD (2019[1]), *OECD Health Statistics 2019,* https://stats.oecd.org/.

However, it has been suggested that the international cut-off for obesity at a BMI (body mass index, a value derived from weight and height to determine whether a person carries excess weight) of 30 may not be appropriate for the Korean population. Studies have shown that at a lower BMI, Korean and other Asian ethnicities have relatively high percentages of body fat, as well as the associated higher risk of diabetes and heart disease (WHO Expert Consultation, 2004[6]). For these populations, a BMI of over 23 represents an increased risk. In 2017, 27.7% of the Korean population had a BMI of over 25 (OECD, 2019[1]).

In addition, levels of overweight including obesity amongst children aged 5-9 in Korea are above the OECD average. In 2016, the rate of overweight amongst 5-9 year olds in Korea was 31.8%, compared to the OECD average of 31.4%. Korean boys were particularly affected, with 38.0% overweight in 2016, compared to the OECD average of 34.0% (OECD, 2019[1]).

Looking at BMI and education, different trends can be observed between men and women (see Figure 1.9). For men, BMI increases in men who have a high education level. For women on the other hand, BMI decreases with increasing education level.

## Figure 1.9. BMI by educational level and sex, 2014

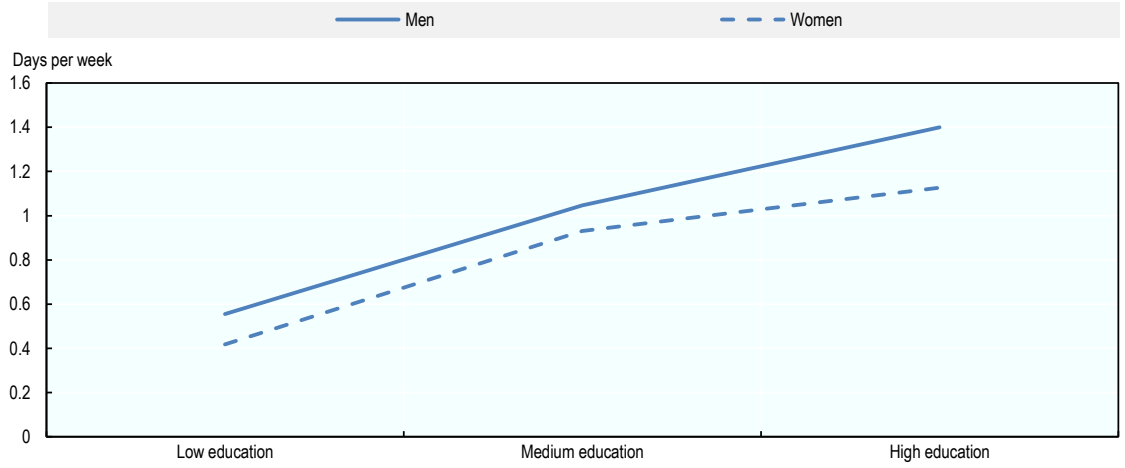



Source: KNHANES (2019[7]), *Korea National Health and Nutrition Examination Survey*, https://knhanes.cdc.go.kr/knhanes/sub01/sub01_02.do.

However, when it comes to physical activity, the same trend across educational level is observed for both men and women (see Figure 1.10). For both males and females, higher educational levels are associated with more physical activity.

## Figure 1.10. Physical activity by educational level and sex, 2014

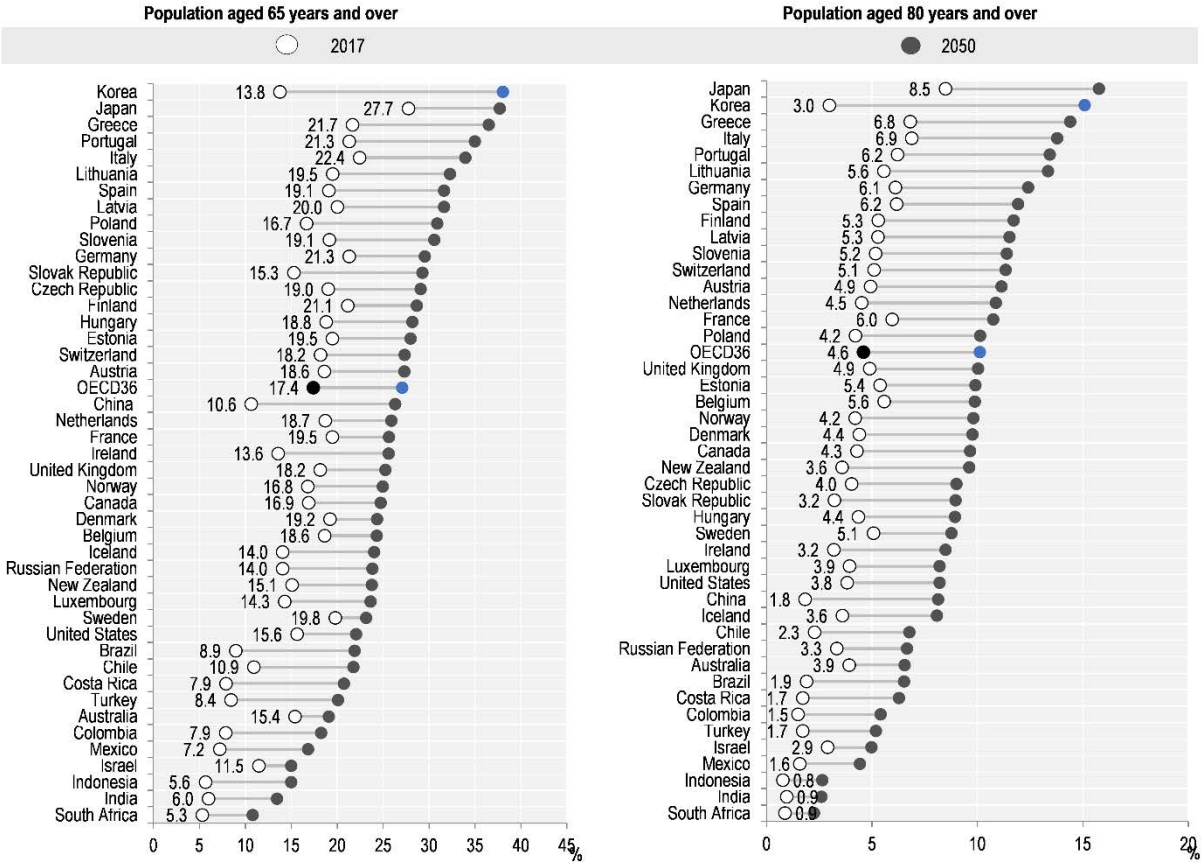
Days per week with at least 10 minutes of moderate intensity physical activity




Source: KNHANES (2019[7]), *Korea National Health and Nutrition Examination Survey*, https://knhanes.cdc.go.kr/knhanes/sub01/sub01_02.do.

In addition to behavioural risk factors, the health system in Korea faces a new challenge when its relatively young populations starts to age. While Korea currently has one of the youngest populations among OECD countries, with only 13.8% aged 65 or over, this is expected to increase considerably in the next decades (see Figure 1.11). By 2050, over 38.1% of the population is projected to be 65 or over, and 15.8% of the population are projected to be 80 or over, which would make Korea's population one of the oldest, and one of the fastest aging populations. This change in demographics creates a new public health challenge to support health aging, and diagnose and treat chronic conditions associated with advanced age.

## Figure 1.11. Percentage of population aged 65 and over and aged 80 and over, 2017 and projected 2020 population



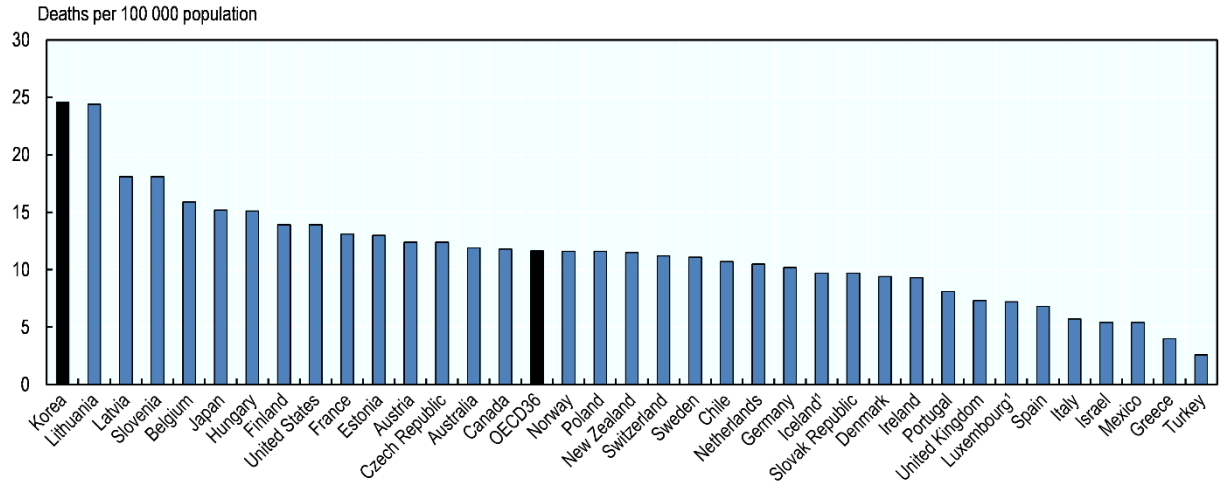

Source: OECD (2019[1]), *OECD Health Statistics 2019*, https://stats.oecd.org/.

### *1.1.4. Mental wellbeing*

Korea has by far the highest suicide rate among OECD countries (see Figure 1.12). Intentional self-harm was the number one cause of premature death in 2016 in Korea (IHME, 2017[3]). Moreover, while in other OECD countries suicide rates have been decreasing; in Korea the rate has increased over the past three decades (see Figure 1.13). However, in the last few years a drop can be observed.

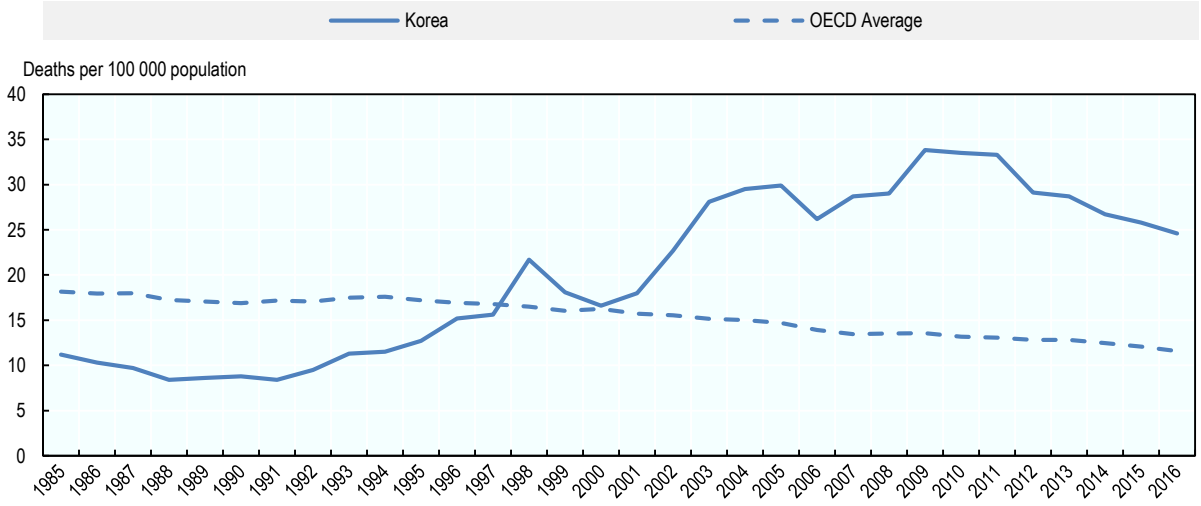
## Figure 1.12.Deaths by suicide

Death by 'intentional self harm' per 100 000 population, 2017 or nearest year




1. Three-year average.
Source: OECD (2019[1]), *OECD Health Statistics 2019,* https://stats.oecd.org/.

## Figure 1.13. Death by suicide 1985-2016, Korea and OECD Average



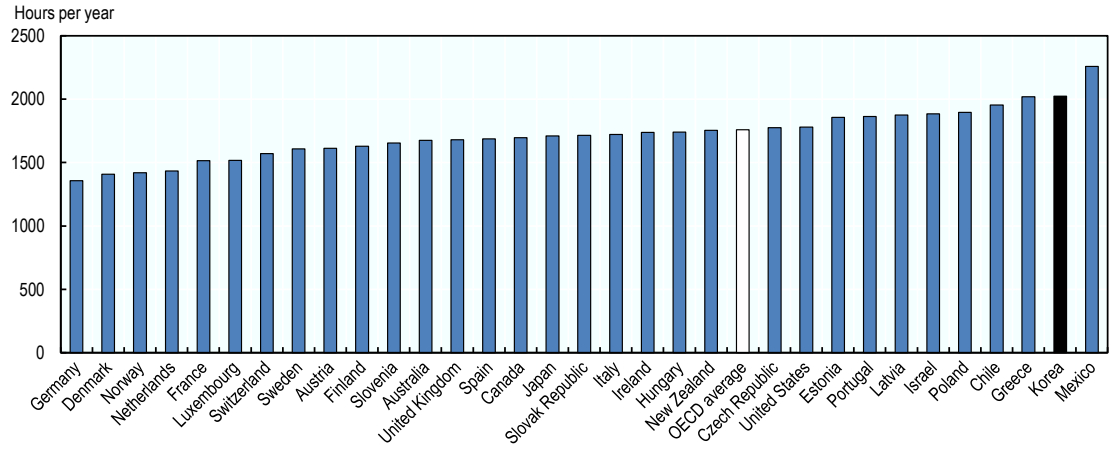

Source: OECD (2019[1]), *OECD Health Statistics 2019,* https://stats.oecd.org/.

Suicide can been, to an extent, seen as an indicator of the overall mental health status of a population (OECD, 2013[8]), making Korea's high rates a cause for concern. This is backed up by other studies, which found that more than one-quarter of Koreans had experienced at least one mental disorder in their lifetime (Je Cho et al., 2015[9]).

One of the contributing factors to the high rates of mental health issues may be long working hours, and work-related stress (Bannai and Tamakoshi, 2014[10]). Korea has one of the highest working hours per worker among OECD countries (see Figure 1.14). The long working hours, as well as precarious

employment status, have been shown to be associated with higher odds of depressive symptoms in Korean employees (Kim et al., 2016[11]).

### Figure 1.14. Average annual hours worked per worker, 2017




Source: OECD (2018[12]), *OECD Labour Force Statistics 2018*, https://stats.oecd.org/index.aspx?DataSetCode=ANHRS.

Some steps are being taken towards mental health promotion and suicide prevention. The Central Division of Mental Health Policy works closely with regional mental health centres and mental health hospitals; treatment of alcohol addiction is discussed in detail in Chapter 2. Currently, mental health care in Korea is extremely inpatient-based, and Korea has a far higher number of psychiatric inpatient beds than the OECD average (OECD, 2019[1]; 2014[13]).

The government set 2019 as the year of suicide prevention to reduce the number of suicide less than 10 000 per year by 2020 and to promote people's mental health in Korea by systematically monitoring those at high risk of suicide (Yonhap, 2018[14]). The 'Suicide Prevention and Spread of a Culture Promoting Respect for Life' plan makes suicide prevention one of the top policy priorities of the current government (see Box 1.1).

### Box 1.1. Suicide Prevention in Korea

The Korean Government, under the administration of President Moon Jae-in, choose to make 'Suicide Prevention and Spread of a Culture Promoting Respect for Life' one of their top policy priorities. This administration aims to reduce the suicide rate to 17.0 deaths per 100 000 population by 2022.

The Korean Government established a National Action Plan on Suicide Prevention on January 23rd 2018 (Government of Korea, 2018[15]). The key components of the National Action Plan are as follows:

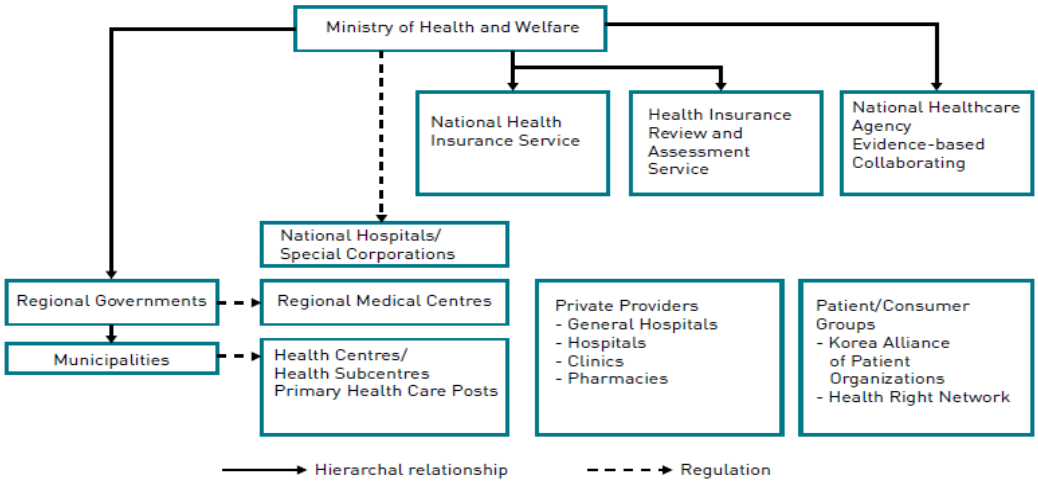
1. A strategic approach based on scientific evidence. Scientific evidence for policy making will be built through the investigation of all 70 000 suicide cases across 5 years (2013-2017). A national suicide surveillance system will be established to identify trends in suicide mortality across local governments and to provide monthly statistics.
2. Establish a whole-of-society network to identify high-risk groups for suicide. Gatekeeper programmes for suicide prevention will be diversified with more trained personnel. Depression screening will be expanded in terms of target age and frequency. Previously, the target ages were limited to 40 and 66. However, the screening cycle has been reduced to every 10 years in 2018, covering ages 40, 50, 60, and 70. In 2019, the coverage will be further expanded to include ages 20 and 30.
3. Eliminate suicide risk factors through active interventions and management. "Mental Health Welfare Centers" will reinforce professional personnel to expand access to community mental health services. Recommendations for press releases on suicide have been revised and disseminated to strengthen the follow-up management of suicide-inducing information and self-harming objects.
4. Suicide prevention through stronger follow-up management. The follow-up management of attempted suicide cases visiting emergency departments will be expanded. Various forms of support will be provided, including self-help group support, financial and administrative assistance, and the undertaking of a psychological autopsy for bereaved families.
5. Population-specific suicide prevention. Suicide prevention plans will be developed targeting respective population groups such as the unemployed, students, and the elderly, as well as high-risk occupations for suicide (e.g. police and firefighters)
6. Development of implementation mechanisms. The Division of Suicide Prevention was established within the Ministry of Health and Welfare in February 2018. The Suicide Prevention Policy Committee was formed in June 2019, chaired by the Prime Minister.

## 1.2. Organisational structure

### *1.2.1. The Korean Health System*

At the national level, the Ministry of Health and Welfare (MoHW) in Korea is in charge of health policy and planning (Kwon, Lee and Kim, 2015[16]). The MoHW also runs a number of speciality national hospitals where the private market fails to meet the needs of the population, such as the 17 psychiatric hospitals and three tuberculosis hospitals (see Figure 1.15). The National Health Insurance (NHI) Program is managed by the National Health Insurance Service (NHIS) and the care it covers is reviewed by the Health Insurance Review and Assessment Service (HIRA). While they are separate from the Ministry, the two organisations remain under some indirect control of the MoHW.

## Figure 1.15. Overview of the organisation of the Korean health system




Source: Kwon, Lee and Kim (2015[16]), "Republic of Korea Health System Review", *Health Systems in Transition*, Vol. 5 No. 4, World Health Organization, http://apps.who.int/iris/bitstream/handle/10665/208215/9789290617105_eng.pdf;jsessionid=202657338B0BE096D2E7FC62E0117DC3?sequence=1.

At the sub-national level, the regional governments manage the regional medical centres and other medical facilities according to local needs (Kwon, Lee and Kim, 2015[16]). Each municipality has one Public Health Centre, which offers basic public health services such as health check-ups, vaccination, antenatal care and basic medical care. In addition, Sub-Health Centres can be establish where additional services are required.

Private hospitals play an important role in health care delivery in Korea (Kwon, Lee and Kim, 2015[16]). Care provided in private clinics and hospitals is covered under the NHI, and its quality is monitored by HIRA.

### *Health Insurance*

Health insurance in Korea is provided by the National Health Insurance (NHI) programme. The health insurance system in Korea has had four major turning points: legislating the Medical Insurance Act in 1963; introducing the compulsory health care system for a corporation with over 500 employees in 1977; achieving universal health coverage in 1989; and integrating regional medical insurances and employed-based medical insurances into a single insurer in 2000. The health coverage in Korea has been gradually expanded from large to medium and small-size companies and from employee to self-employed individuals. Coverage takes the form of a statutory health insurance scheme to which beneficiaries contribute a premium, with no opt-out allowed.

Inpatient care is subject to a 20% co-payment, while in outpatient care the co-payment ranges from 30% to 60% depending on the provider (Kwon, Lee and Kim, 2015[16]). For people with a low income, the Medical Aid Programme covers both the insurance premium as well as co-payments (NHIS, 2018[17]). The coverage of NHI was 97.2% of the population in 2018, while 2.8% was covered by Medical Aid Program (NHIS, 2018[18]).

The NHI covers a set benefits package that focuses on curative care, including diagnosis, treatment, traditional medical care, emergency care, pharmaceuticals and dental care (Kwon, Lee and Kim, 2015[16]). However, it also includes some preventive care in the form of health check-ups and cancer screening.

Private health insurance plans play both supplementary and complementary roles to the NHI plan (Shin, 2012[19]). The NHI reported in their "2017 Survey of Public Perceptions Toward the Health Insurance System" that 86.9% of South Korean households had a private insurance such as cancer insurance or accident insurance. This is driven by the high co-payments associated with the NHI. In Korea, 34.3% of health care expenditure in 2017 was paid for out-of-pocket, compared to an OECD average of around 20% (OECD, 2019[2]). In 2017 the average premium for private health insurance was 287 000 won (USD 263) (Park Ki-yong, 2017[20]).

Two quasi-government organisations—the National Health Insurance Service (NHIS) and the Health Insurance Review and Assessment Service (HIRA)—run the National Health Insurance (NHI) system for the ministry (Kwon, Lee and Kim, 2015[16]). NHIS performs across-the-board tasks in health insurance such as managing the eligibilities of the insured, levying and collecting contribution, and managing insurance benefit payments. Additionally, NHIS is responsible for implementing prevention projects for maintaining and improving the health of the insured and their dependents, collecting the 5 major social contributions (health insurance, long-term care insurance, national pension, employment insurance, and industrial accident compensation) Every year, NHIS negotiates medical fees with medical provider associations.

HIRA was established in 2000 based on National Health Insurance Act (Health Insurance Review & Assessment Service, 2018[21]). HIRA manages reimbursement coverage, pharmaceutical reimbursement applications, coding and pricing of medical devices and diagnostics under the supervision of the health ministry, and is also in charge of medical claims reviews, quality assessment, drug management and Drug Utilisation Review, inspection and payment arrangement. HIRA has data on 46 million patients per year about patients' diagnosis, treatment, medical history and prescription drugs, which account for 90% of the total population in Korea. In addition, HIRA can access clinical data from the Hospital Quality Data Acquisition System and mortality data from the Ministry of the Interior and Safety. Researchers are allow to access to the data through HIRA website (Logyoung Kim, 2014[22]).

The National Evidence-based Healthcare Collaborating Agency (NECA) was founded in 2009 by the Korean Government as an independent agency collaborating with MoHW. The role of NECA is to lead the health technology assessment and generate evidence on clinical effectiveness and cost-effectiveness and cost-effectiveness of health service, health products and technologies, including medical devices, medicines. These assessments contribute to the efficient use of national medical resources.

### *Long-term care insurance*

Korea introduced mandatory long-term care insurance (LTCI) in 2008. LTCI aims to support old people with difficulties in physical activities and to ease the burden of their families. The contribution rate of LTCI is approximately 0.55% of nationally defined income. The contribution amount is decided depending on the contributor's income and asset status. Those over 65 are eligible for LTCI benefit application, while people under 65 years old living with an illness such as dementia or cerebrovascular disease are also eligible.

The beneficiaries of LTCI are decided by the LTC committee, considering the result of: i) the Korean need-assessment instrument which is composed of 52 items; and ii) the doctor's opinion. LTCI beneficiaries are categorised into six groups depending on their physical dependency and cognitive functional status: Grade 1 (most severe physical dependency) to grade 4 (low physical dependency), grade 5 (lower physical dependency with dementia) and the grade for cognitive performance support (lowest physical dependency with cognitive impairment).

LTCI beneficiaries can use home care or institutional care. Home care services includes: i) home based personal care; ii) home bathing; iii) home nursing; iv) day care service provided in day care centres; v) short-term respite care provided in respite care centres; and vi) the purchase or lease of assistive devices such as wheelchair. Institutional care is a 24 hour care service provided in long-term care facilities such as nursing home or group home.

The number of LTCI beneficiaries was 585 287 in 2017. Around 70% of LTCI-covered service users choose home care, while around 30% chose institutional care in 2017 (National Health Insurance Service, 2018[23]). There were 5 304 LTC institutions and 15 073 home care agencies in Korea in 2017 (National Health Insurance Service, 2018[24]). The number of LTC workforce increased from 224 278 in 2009 to 439 166 in 2017 (Ministry of Health and Welfare & National Health Insurance Service, 2018[25]).

There are three types of publicly funded long-term care services in Korea. The first one is the services covered by LTCI as explained in the above. The second one is LTC services covered by tax-financed Elderly Care program, which is run by local governments (MOHW, 2017). Around 50 000 elderly persons with a low level of care need, who are not eligible for LTCI benefit, receive long-term care service from the tax-financed elderly care program. The third type of care service is long-term care hospital services covered by national health insurance (Ministry of Health and Welfare, 2017[26]). Including the 350 thousand of elderly patients in long-term care hospital, the population coverage of the publicly funded long-term care system reaches to 13.8%.

### *1.2.2. Primary care system*

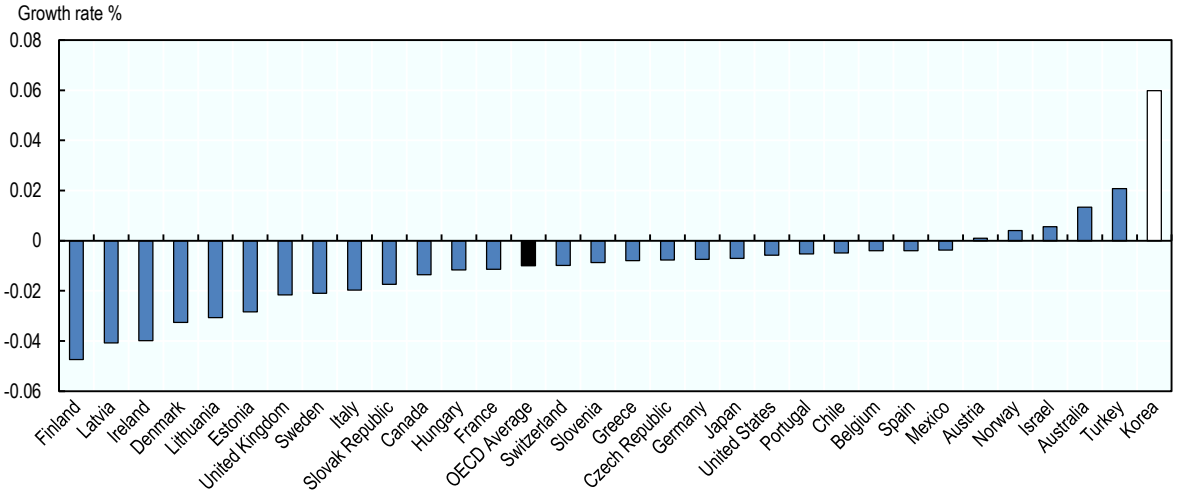
OECD defines primary care as care for non-emergency care, care for chronic condition and gate keeping for the secondary care, and most of OECD countries have a well-developed primary care sector (OECD, 2018[27]). A well-functioning primary care can effectively respond to a significant number of health care demands, prevent avoidable hospital admission, and contribute to reducing unnecessary health care expenditure and improving outcomes (Ock et al., 2014[28]).

In Korea, there is not a well-established primary care system, for example a General Practitioners or Family Doctors sector, as seen in many OECD countries (OECD, 2012[29]). However, patients have access to any specialty clinic in community and general hospital in Korea, and are able to receive the first consultation without a referral letter, except at tertiary hospitals managed by the Korean Government. This free access results in high frequency of medical consultation: in Korea the rate of doctor consultation was 16.6 times a year, compared to the OECD average of 6.8 in 2017; the number of consultations in Korea had increased from 10.6 in 2000 (OECD, 2019[1]). Patients can also receive primary-level care at public health care centres managed by the local government, staffed by family medicine doctors or other specialists. In terms of medical facilities 90% are private, while Health Centres are public, and studies suggest that elderly people and low-income groups tend to use public health centre more (Sung et al., 2010[30]).

The population in Korea is currently young, compared to other OECD countries, but is aging rapidly (OECD, 2017[31]), which will can be expected to increase the burden of chronic diseases. Regular preventive care, and ongoing disease management, are necessary to prevent worsening its conditions or the development of complications.

Such medical management can be provided at primary care, but traditionally Korea has focused on hospital care rather than primary care. At present, the primary care sector is relatively under-developed, and there are also relatively weak incentives to provide preventive services in primary care-equivalent settings, given the fee schedule. Indeed, hospital beds in Korea increased between 2000 and 2017, at a time when other OECD countries decreased the number of hospital beds, shifting focus instead to outpatient settings (see Figure 1.16). Furthermore, the number of avoidable hospital admissions in Korea for chronic obstructive pulmonary disease (COPD), asthma, and uncontrolled diabetes – disorders which can be effectively controlled in the primary care sector – were all above the OECD average in 2017, although these admissions have been falling (Lee et al., 2016[32]; OECD, 2019[1]).

## Figure 1.16. Average annual growth rate of hospital beds, 2000-17 (or nearest year)




Source: OECD (2019[1]), *OECD Health Statistics 2019,* https://stats.oecd.org/.

### *Public Health Centres*

There were 254 health care centers, 1 335 sub-health centers, 1 905 primary health care posts, and 46 community health promotion centers across Korea in 2018. Local health administration organisations centered on health care centers, are treated as part of the general comprehensive administration, and are under a dual administrative system. The Ministry of Interior and Safety is responsible for organisation and manpower, and the Ministry of Health and Welfare only provides technical guidance and oversight.

For example, there are 25 community health care centres in Seoul, the capital of Korea. Many of these centres appear to mix public health and primary care functions, and many of them accept phone calls from users even outside of regular working hours, such as at night and over the weekend (Seoul Metropolitan Government, 2014[33]). A typical public health centre in Seoul would have an outpatient clinic with medical doctors for primary care medicine and preventive care for communicable diseases. A public health centre typically is equipped with basic medical devices such as electrocardiograms, pathology room and radiation room, where patients can receive the primary medicine. Vaccination is also offered at the public health centres.

On average, in Korea, private clinics accounted for 70.5% of the total out-patients visit in 2015, while Public Health Centres accounted for 2.6% of out-patient visits (Lee et al., 2016[34]). However, in geographically remote areas, a public health centre also plays an important role for local residents. There are more private clinics in metropolitan areas, while there are fewer private clinics in in non-metropolitan area, and in the non-metropolitan area, public health center seems to play greater role in providing primary health care in metropolitan areas. For example, Goesan-gun County in Chungcheongbuk-do Province is surrounded by mountains in the center of Korea, where the access to a medical facility is limited compared to bigger cities in Korea. Goesan-gun County has 11 “sub-health centers” with resident a public health doctors and 28 “primary health care posts”. Besides a public health doctor who has received training for 24 weeks, there are nurses and midwives with qualification to treat patients with basic health problem such as cough, fever, stomachache or diarrhea. They can prescribe some pharmaceuticals subject to regulation. In the center of Goesan-gun, there is a country office, which manages all the sub-health centers and primary health care posts. The primary health care post offers primary health care and preventive care to the local residents. The residents can also enjoy the fitness center and sauna.

### *1.2.3. Delivery of essential public health operations in Korea*

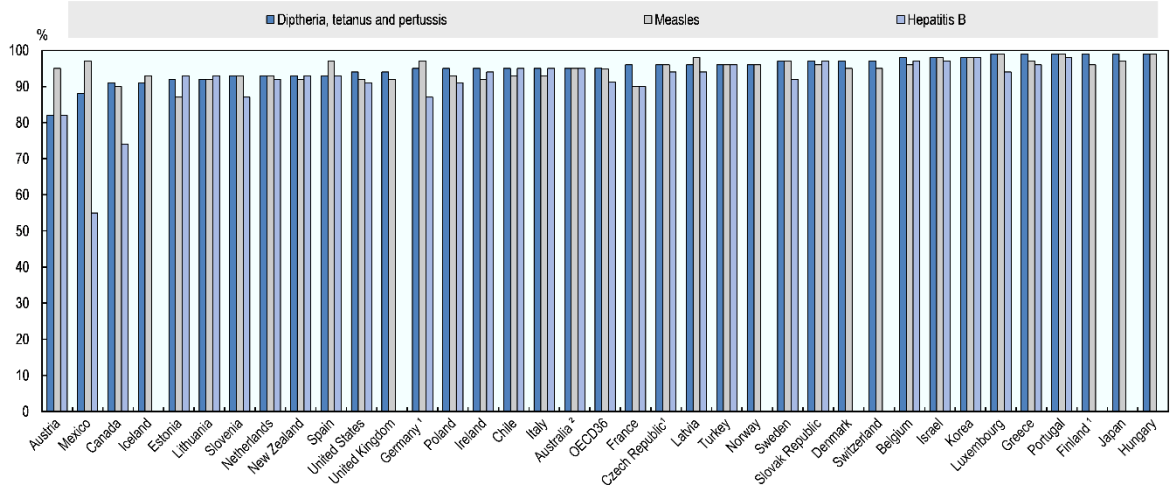
#### *Vaccination programmes in Korea*

Vaccination is a key priority for preventive medicine. The Korea Advisory Committee on Immunization Practices (KACIP) was established by law in the early 1990s to make recommendations on the National Immunization Program. KACIP consists of 15 members and always includes the two government officials who belong to the Korea Centres for Disease Control (KCDC) and Prevention and the Korea Food and Drug Administration (Choa et al., 2010[35]).

KCDC recommends 16 types of vaccination to children under 12 years old, including the National Immunization Program for children, including tuberculosis, human papilloma virus and hepatitis B (Kim et al., 2016[36]), which covers all the recommended vaccination by WHO (Lee et al., 2018[37]) (WHO, 2018[38]). The Korea government supports the total cost of these 16 vaccinations for the eligible children at clinics (KCDC, 2017[39]).

The vaccination rate at one year of age was 98% in 2015, which is higher than the OECD average of 95% (Figure 1.17). However the rate of full completion of hepatitis B (3 doses of the vaccine by the age of 3), could stand to be improved, as it was reported to be at 80.5% in 2013 (Kwon, 2015[40]).

**Figure 1.17. Percent of children aged 1 vaccinated for diphtheria, tetanus, and pertussis (DTP), measles and hepatitis, 2018 (or nearest year)**




1. DTP data are estimated. 2. Measles data are estimated.
Source: OECD (2019[1]), *OECD Health Statistics 2019,* https://stats.oecd.org/.

After implementing the national measles elimination program, Korea declared the measles had been eliminated in 2006. However, there were 41 cases diagnosed as measles in 2011, which resulted from inadequate rates of vaccination at the required vaccination ages (Park et al., 2013[41]).

#### **Food Safety Commission for Food and Drug Safety Assurance**

The food safety management system in Korea is run by the Ministry of Food and Drug Safety (MFDS) and implemented by local governments in Korea. Domestic foods are managed through three steps: manufacturing, distribution and consumption. At the first stop of manufacturing, MFDS oversees the manufacturing report made by a manager and self-quality inspection. To strengthen the safety level, MFDS

has applied the Hazard Analysis Critical Control Point (HACCP) System since 2002 based on Food Sanitation Act, which assesses harmful elements in raw materials in manufacturing, processing, cooking and distributing of foods. At the stage, foods for sales are tested, and traced in case of food poisoning, by the Food Traceability Information System. In 2015, the Hazardous Food Sales Prevention System was implemented and secure food safety at all the stores selling food products, including department stores, supermarkets and online stores.

People are at higher risk of food poisoning when they eat out, which accounts 72% of food poisoning cases. MFDS takes the lead in preventing food poisoning in cooperation with the other ministries. While MFDS provides education and promotion as prevention, and undertakes investigations into the causes in case of food poisoning, the Ministry of Education manages Meal Service Facilities in Schools. Underground water and pollutants are observed by the Ministry of Environment and the Ministry of Health and Welfare performs the epidemiological investigation of infectious disease with KCDC.

MFDS provides the potential risk of food poisoning outbreaks in Korea on the Food Poisoning Prediction Map By using social net services (MFDS, 2014[42]).

### *1.2.4. Environmental Protection*

The Environmental Health Bureau in the Ministry of Environment leads on prevention of environmental hazards, including air quality, noise pollution, and chemical hazards, taking a prevention-orientated approach. The Ministry is also seeking to focus on building a bottom-up approach, especially in the planning stages, by developing a network of stakeholders including hospitals and public health centres, working with local government. This model is currently under development, and should be shared more broadly in the years to come.

Currently, the Ministry publishes information on the quality of air, water and soil, and also develops 5-10 year plans for maintaining air, water and soil quality. The Ministry also manages chemical risks; companies are required to register all chemical use with the government, and in the case of a chemical accident or spill, they must report it.

Local governments play an important role in environmental protection, but the central role has recently been strengthened in order to effective response to chemical accidents. One change was to make information on chemical incidents available in real time, rather than based on bi-annual reporting as it had been in the past. The Chemical Substance Management Act was revised in 2018 to provide information on the safety management of chemicals, such as the current status of installation of hazardous chemical handling facilities, to the heads of local governments and their fire departments with using the current chemical comprehensive information system, with the revised Act in effect since June 2019.

Korea has improved chemical management systems after the leak of hydrofluoric acid in 2012, and has transferred the authority to control the facilities where handling hazardous substance from local governments to the central government in 2015 with a view to deal with chemical accidents intensively at a national level. Under the improved systems, the Ministry of Environment (MOE) in the central government is responsible for the management of hazardous substances nationwide, and each local environmental office as MOE's subsidiary body manage their own jurisdiction in the country.

The MOE looked for ways to strengthen the effective and efficient management of chemical substances. As a part of this effort, the National Institute of Chemical Safety (NICS) was established in 2014 as a research organisation covering the overall works of chemical accident such as preventive technologies, studies on dangers of chemical substances and so on.

Furthermore, the MOE has run seven Joint Emergency Centers for Chemical Accident nationwide in cooperation with the National Fire Agency (NFA), the Ministry of Employment and Labor (MOEL), and the Ministry of Trade, Industry and Energy (MOTIE), in order to deal with chemical accidents in major

chemical-based industrial complexes. When a chemical accident occurs, all of the divisions in the Center works together to ensure effective prevention and response to the chemical accident.

The MOE manages the overall response to chemical accidents, including a leak of hazardous substances, and local firefighting offices of each province take charge of emergency response and saving lives at the accident site. When a chemical accident occurs, the MOE should provide the relevant local firefighting office with information such as the type, dangers and control measures of the accident-causing substance, as well as the estimated scope of damage, which makes it possible to address the chemical accident effectively and minimise its damage. In addition, the MOE decides on the scope of the needed intervention by controlling for pollutants in the areas adjacent to the chemical accident site, and looks to protect against potential secondary damage. Such activities are conducted through a consultation onsite between a fire chief from relevant local firefighting office and a government official from the MOE. If a worker is injured, the MOEL participates in the emergency response and if high-pressure gas is leaked, the MOTIE also participates.

Local governments still play an important role at any chemical accident site even though, as mentioned above, they transfer the leadership authority over control of hazardous substance to the MOE. Local governments inform local residents of chemical accident, decide on any eventual evacuation of local residents, and seek to prevent further damage that could be caused by inflow of chemical substances into rivers and streams. Local government agencies also check for any injuries to local residents, and takes the lead on reconstruction after a chemical accident.

Currently, Korean local governments are tasked to work actively to avoid chemical accidents. For instance, local governments review risk management plans that are prepared by facilities of potentially hazardous substances in their own jurisdiction, and informs local residents of the details of any emergency response plan(s). Several local governments enact local ordinance on safety management of chemical substance, and organise governance together with residents and facilities of hazardous substances in the region. Furthermore, local government structures include a committee in which all stakeholders discuss safe management of chemical substances in the jurisdiction, and which develops the local emergency plan to prepare appropriate responses suitable for the specific conditions of each region.

### *1.2.5. Primary, secondary and tertiary prevention in Korea*

#### *Primary prevention*

The Health Promotion Division in the MoHW is in charge of promoting public health. The main focus of this Division includes tobacco control, health screening, and nutrition control. Korea Health Promotion Institute (KHPI) was established in 2011 to run health promotion projects through close cooperation with civil organisations and evidence-based policy implementation. The Institute is also in charge of four areas of national policy: smoking reduction, nutrition, alcohol consumption, and active lifestyles. This Institute decides on and manages concrete health promotion programmes and projects according to the policy direction set by MoHW. One of the health policies KHPI towards is supporting the National Health Plan 2020 (HP 2020), the third national health promotion plan, launched in 2020 based on the National Health Promotion Act. This health policy was established to promote national policies on health promotion and disease prevention. KHPI supports policy development and monitors the implementation process.

Physical activity is not currently included in the Health Promotion Act, though a bill to revise the Health Promotion Act has been proposed.

#### *Primary prevention – tobacco consumption*

The prevalence of daily cigarette smoking in Korea is higher amongst men than women in Korea (see ‘Risk factors’ in this chapter), and while Korean women smoke far less than the OECD average, there are more

male daily smokers in Korean than is typical amongst OECD countries. MoHW leads the response to smoking reduction, and part of the taxes on tobacco go towards the Health Promotion Levy, which funds smoking cessation programmes. A range of different policies are in place, most notably national legislation. Since the Health Promotion Act was introduced in Korea in 1995, non-smoking area have gradually expanded. The smoke-free laws exist in health care facilities, educational facilities except for universities, and restaurants (WHO, 2017[43]). However, indoor spaces with smoking zones are not considered (by the WHO) as completely smoke-free facilities (WHO, 2003[44]). Korea's *Health Promotion Act* allows the installation of smoking zones in indoor spaces, including in indoor workplaces, cafes and bars. Indoor spaces in public transportation such as bus, taxi, and train are completely smoke-free pursuant to *the Passenger Transport Service Act and Railroad Safety Act*.

In 2015 the Tobacco tax was increased, and is currently at 70% of the retail price (the WHO guideline on tobacco suggests a 76% tax), significantly increasing the price of tobacco products (Kwak et al., 2017[45]). A warning image on tobacco products was also introduced three years ago, with a warning statement, and the banning of misleading terms on tobacco products. Currently the image and text cover about half of the package, although the specific pack coverage has not been agreed.

Following the new smoking legislation in 2015, the smoking rate amongst men dropped, but then increased in 2016. The smoking rate amongst women is low and stable. In 2017, the smoking rate decreased again, with male smoking dropping from 40.7% to 38.1% of men between 2016 and 2017, below the 2015 rate of 39.4%. Female smoking rate was 6.0% in 2017, down from 6.4% in 2016.

Some programmes to reduce smoking do exist, along with a number of education programmes that promote smoking cessation. In 2015, NHIS started a smoking cessation support programme that covered consultation and medication costs. In 2016 more than 400 000 smokers had received medical support, with a cessation success rate of approximately 40% (Paek et al., 2018[46]).There are some provincial 'Quit Smoking Centres', which have been recently established, some including a residential smoking cessation programme. Smoking cessation support programmes are also provided through local public health centres across the country.

### *Primary prevention – healthy eating*

A school meal programme was started in Korea in 1953 under the support of UNICEF, following which the School Meal Act was enacted in 1981, and the educational role of school meals has been gradually increasing. In 2015, all 11 698 of Korea's schools served a free school meal every school day (Kwon, Kim and Lee, 2018[47]), and has mandatory nutrition standards for schools (OECD, 2019[5]). There have been nutrition teachers and nutrition staff assigned to schools in Korea since 2007 to improve students' health status and healthy eating habits. The free school meal in Korea should be seen as a significant opportunity to promote healthy eating habits, and restrict access to unhealthy foods. For example in Chile, where obesity and childhood obesity are major concerns, the *Contrapeso* programme increases the healthy food choices available for school meals and restricts the sale of unhealthy products in schools (OECD, 2019[48]).

Local education offices created range of educational materials for school children, such as a website, in cooperation with government agencies, the Ministry of Food and Drug Safety and the Ministry of Food, Agriculture, Forestry and Fisheries, the Ministry of Health and Welfare. (Woo, 2015[49]). The Ministry of Health and Welfare makes educational material, and education for schoolchildren, available through public health centres.

Given that Korean children age 5-9 have a higher rate of overweight than the OECD average for the age group (OECD, 2019[1]; OECD, 2019[5]), it would be appropriate to focus policy attention on supporting health eating and active lifestyles amongst this age group in particular. Some of Korea's existing policies already stand out as best practice. Korea is one of relatively few countries to have in place mandatory restrictions on food advertising to children: from 2010 Korea prohibited television advertising of energy-dense, nutrition-poor foods between 5:00pm and 7:00 pm, and during the commercial breaks of children's

programmes at other times – a practice that has also been expanded to non-broadcast media (e.g. social media and the internet in general) (OECD, 2019[5]). As a result, spending on television advertising of energy-dense, nutrition-poor foods (EDNP) fell by 31% for the two four-month periods studied, while spending for advertising on non-EDNP foods advertising increased by 17%, amounting to an overall increase in the total spend on food advertising of 13%.

In other areas, there may be space for stronger policies. For example, food labelling on pre-packaged food, in an easy-to-understand format for example with colour coded information or with a 'traffic light' code, has been found to attract consumer interest and increase consumers' likelihood of seeking healthier alternatives (OECD, 2019[5]). Front of package nutritional labels are voluntary in Korea at present (ibid), and Korea may wish to consider making front-of-pack labelling of some packaged foods a requirement. Requiring labelling on packaged foods marketed for children, for example sugary breakfast cereals, could be a good place to start, especially if labels were designed in a way that made them easy to spot and read.

### *1.2.6. Secondary prevention*

Secondary prevention aims at early detection of diseases which can be effectively treated, or more effectively treated or managed, if caught at an early stage. Such an approach can increase treatment success, avoid complications, and ultimately reduce morbidity, mortality, and health care costs. Many OECD countries focus on higher risk population for secondary prevention, for instance based on age, medical history and family history, through targeted screening (e.g. for cancer) or health check-ups (e.g. for cardiovascular diseases risk). In 2007, the government introduced a health check programmes, which were also expanded in subsequent years.

Korea has had the National Cancer Screening Program (NCSP) since 1999 for the cancers: gastric, liver, colorectal, breast and cervical cancer. Medical Aid Program recipients and NHI beneficiaries in the lower 50% income bracket are now eligible to free cancer screening (Lee et al., 2011[50]). In 2017, 68.8% of Korean females aged 50-69 had been screened for breast cancer, compared to the OECD average rate of 59.8% coverage (OECD, 2019[1]). In 2017 60.7% of females aged 20-69 in Korea had been screened for cervical cancer (based on survey data, based on programme data 57.1% of females had been screened (OECD, 2019[1]). Based on 2012 data, cancer screening rates for breast, cervical, gastric, colorectal, and liver cancers all exceeded target lifetime rates for men aged 40 or over, and women aged 30 or over specified in national guidelines, notably lifetime screening rates for all cancers except colorectal (65.8% lifetime screening coverage) were at or above 70% (Lee and Lee, 2018[51]).

In the absence of a strong primary care system, proactive secondary prevention strategies ought to be a priority. For example, management of high blood pressure or cholesterol. However, there are currently clear signs that the Korean health system is focused on curative, rather than preventive, care (see also 1.2.7). Community Health Centres have, traditionally, been the main locus of NCD management, and have sought to identify high-risk groups. However, in light of Korea's rapidly aging population, and not insignificant risk factors for chronic disease, the current provision may well be insufficient. For example, currently there is just one Community Health Centre for every 300-500 000 population. The current government does appear to be focused on strengthening the primary care-equivalent sector, and strengthening Community Health Centre capacity, but the policy prioritisation of this area should not be understated.

### *1.2.7. Tertiary prevention*

The purpose of tertiary prevention is to reduce the burden of disease by minimising suffering or reducing related impairments and disability. For example, disease management programmes can improve control of diabetes and prevent the development of secondary complications.

Compared to other OECD countries, there are some signs that chronic diseases are not well-managed in Korea. In particular, total rates of admission to hospital for asthma and COPD – conditions for which evidence for effective treatment is well-established and can be delivered by primary care – are higher in Korea than the OECD average. In 2017 there were 81.0 asthma admissions to hospital per 100 000 population in Korea, compared to the OECD average of 41.9 admissions, and there were 182.1 COPD admissions to hospital per 100 000 population in Korea, compared to the OECD average of 183.3 average (OECD, 2019[1]). Admissions to hospital for congestive heart failure, another condition considered amenable to effective management in primary care settings, were below the OECD average in Korea in 2017 (87.9 admissions per 100 000 population in Korea, compared to the OECD average of 233.0 admissions per 100 000 population) (ibid).

Given that there are already some signs that some chronic diseases could be more effectively managed in Korea, and given Korea's very rapidly aging population will likely bring a higher burden of chronic diseases in the years and decades to come, there is likely a need to put in place effective disease management support systems to avoid growing demand for hospital care. Korea does not have a well-developed primary care sector as seen in many OECD countries, and for example has a very low rate of General Practitioners (see Section 1.7). Therefore, there is a need to find alternative ways of delivering primary care-equivalent services, including chronic disease management, either through structures such as Public Health Centres or Community Health Centres, or through targeted tertiary prevention or disease management programmes.

Korea does have some examples of targeted tertiary prevention and disease management programmes. Starting from December 2018, the Ministry of Health and Welfare has teamed up with local communities and provided comprehensive NCD management services for patients with chronic conditions such as hypertension and diabetes. This is called the "Pilot primary care NCD control program" and it is mostly provided through local clinics. Participating local clinics develop personalised care plans for NCD patients and conduct education, patient management, monitoring, and interim evaluation according to the care plans. Doctors, nurses and nutritionists within the local clinics may provide education on diseases and better lifestyles. If necessary, local community public health institutions may be asked to offer education.

Patient management is undertaken not only through in-person consultation, but also through text messaging, email and smartphone apps. These digital devices are used to monitor patients' blood pressure and glucose levels and to give them recalls and reminders. Every 4 to 6 months, an interim evaluation is carried out to check and document the patients' conditions and health status.

The "pilot primary care NCD control program" is being implemented based on a service model which draws on the strengths of existing pilot NCD control programmes centred on primary care. The pilot programme will be assessed and an improved plan will be developed before moving on to a full implementation. The goal is to strengthen primary health care facilities' capacity to manage NCDs and empower NCD patients to manage their own conditions. By doing so, Korea expects to improve health care service delivery and prevent the deterioration and complications of NCDs.

The 'Registration Management Project for Hypertension and Diabetes' has been in place since 2007 under the KCDC (Kim, Yoo and Lee, 2018[52]). This Project aims to improve the sustained treatment rate of hypertension, diabetes, and to prevent the occurrence, death and disorders of severe cardiovascular diseases such as myocardial infarction and stroke. As of May 2018, 1 446 medical institutions and 2 004 pharmacies and 420 580 patients with hypertension and diabetes are participating in 25 public health centres in 19 regions.

The 'Medical Fee Demonstration Project for Chronic Diseases' was introduced in 2016 by the Ministry of Health and Welfare (Kim, Yoo and Lee, 2018[52]). This pilot project introduced a non-face-to-face management method for continuous observation and counselling to establish a continuous management system for hypertension and diabetes. The project focus is on strengthening the self-care of chronically ill.

## 1.3. Leadership and governance

### *1.3.1. Ministry of Health and Welfare, Regional and Municipal Governments*

Across the Korean system, the central government sets the direction for policy, some of which is delivered by regional governments. Regional governments (where there are 34 regional medical centres) and municipalities (where there are 254 health centres) also play a role implementing programmes. Public health policies are largely concentrated centrally, with the Ministry of Health and Welfare undertaking planning, technical support, capacity building, evaluation and financing. For example, national level campaigns, for instance advertising campaigns or tobacco legislation, are run by the central Department of Health Promotion, while Public Health Centers run programmes such as education, or smaller level health promotion advertising or warnings.

The MOHW develops a 5-year plan on health care – the last plan was developed in 2016 – for example addressing vulnerable areas, or medical education needs. Regional and municipal health centres develop a plan every year, which they report to the central government. In 2018, the MOHW established a specialised committee which evaluates regional public health plans, the first time that the government has taken such a step. Regional governments in turn evaluate the plans established by municipal government. While regional and municipal governments are frequently interested in maintaining autonomy, but concerns were raised that some local governments may be lacking capacity; the step towards a more formal evaluation committee seems a very positive development. A local-level contest is also run every year, with the central government awarding a prize to the most successful plan or programme, the 'Integrated Health Promotion Programme Award'. This mix of formal evaluation of plans and positive incentives for good performance appears to seek to balance local and central public health governance.

Korea is also active in using local benchmarking to track how well local governments are performing on public health and public health emergency preparations. For example, a set of indicators has been developed for local governments to assess capacity to respond to public health emergencies, which gives an overall score, which is used as a grant giving mechanism.

#### Box 1.2. Balancing local autonomy and central oversight in Korean public health policy

Korea has been taking some steps to encourage local government actors to design their own programmes, in order to address local challenges. The Integrated Health Promotion Program moves away from the previous top-down model, and helps communities design and operate their own programmes to address issues specific to them. City and provincial governments (regional local governments) take the lead in implementing these health promotion programmes in line with the central government's evaluation guidelines. The Program should better reflect the needs of local communities and residents.

Academics from major local universities form Integrated Health Program Support Teams and conduct evaluations, both of the process and outcome of the local programmes. Based on the evaluation results, awards are given annually, and best practice programmes are promoted and disseminated. This programme is also oriented towards linkage and integration between programmes.

### *1.3.2. Korea Centre for Disease Control*

While the Ministry of Health and Welfare leads on policy development and legislation, the Korean Centre for Disease Control (KCDC) is involved with some implementation and monitoring roles, research, and surveillance. For example, the KCDC has a key role in strengthening public health emergency response capacity (see Chapter 4), as well as disease surveillance, and biomedical response. The KCDC role includes focuses on infectious disease, chronic disease, and genomics (see Chapter 3). For example, the KCDC works to develop vaccines and develop the response to emerging infectious diseases, for instance MERS. The KDCD also undertakes some work on antimicrobial resistance (AMR, including patient surveillance related to AMR, on a ONE Health response (coordinating the human, animal and environmental use of antimicrobials), and on developing and screening new antibiotics.

### *1.3.3. Korea Health Promotion Institute*

The Korea Health Promotion Institute (KHPI) plays a key role in designing national policy and programmes around smoking reduction, nutrition, alcohol consumption and active lifestyles (see Section 1.3.3). The KHPI, which reports to the MOHW, also collects statistics on health risks and behaviour, undertakes a number of key surveys, designs programmes and supports public health policy in local governments.

In order to inform policy design, KHPI establishes ad hoc expert committees, which include civil society and academic experts. KHPI also has a permanent committee to advise on routine operations, the Deliberative Committee on National Health Promotion Policy (Kwon, Lee and Kim, 2015[16]).

### *1.3.4. Seoul City Government*

Roughly 50% of the Korean population lives in the Seoul metropolitan area, rendering the Seoul City Government a particularly important actor in public health policies in Korea. Seoul City has relatively well-developed public health policy, implements its own programmes, and in some areas, the city government has taken bolder public health policies than the central government. For example, Seoul has 22 metropolitan parks, in which drinking alcohol is banned, although this ban cannot be enforced as the national law does not support its implementation. Seoul also has campaigns, for example on promoting alcohol-free university campuses, promoting moderate drinking, and responsible after-work drinking by Seoul government employees.

With regards to tobacco policy, Seoul has also taken a bolder approach than national policy. Public smoking is banned in outside public spaces near schools, metro exits, and busy streets (national regulation only affects indoor spaces), and no-smoking parks have been introduced with some success. Seoul was able to expand national legislation as the design allowed for application of the ban in public spaces ‘as necessary’, which is not the case for alcohol regulation.

Seoul also has smoking cessation programmes which particularly target male smokers. Programmes also seek to target men in full time employment, who might be less able to or likely to visit Community Health Centres, for example through visiting workplaces to promote smoking cessation an environmental changes, such as removing outdoor smoking areas or making it more complicated or time consuming to reach a smoking area. All companies with more than 300 employees can request the intervention. The city is also targeting young people to try and reduce smoking, and prevent uptake of smoking, for example making streets around schools non-smoking areas.

Seoul’s smoking policy was introduced following a number of public debate forums with the public, including through civil society groups and Community Health Centres. This form of civic engagement that was understood to be critical, and is expected to be used in designing alcohol policy also.

## 1.4. Partnerships and collaboration

### *1.4.1. Engagement with civil society, patient and consumer groups*

There are some positive signs of engagement with civil society actors, patient and consumer groups in Korea, although it is not clear how systematic this approach is. For example, Seoul Government engaged with civil society panels in designing smoking regulation for the city. The Deliberative Committee on National Health Promotion Policy should be a mechanism through which civil society groups can be effectively engaged in public health promotion policy development; the MOHW should be sure to engage civil society in this process, and not restrict engagement to government departments and academic experts.

In general, as Kwon, Lee and Kim (2015[16]) point out, Korea is a health system where private providers play a particularly important role, which means that protecting the voice of patients and consumer is particularly critical. Since 2010 the Korea Alliance of Patient Organizations (KAPO) has existed as an umbrella patient group, and since 2003 the Health Right Network (HRN) has sought to ensure the right to health of citizens and patients as health consumers. In general though these groups appear engaged with efforts around health system entitlements, for example insurance coverage, rather than engagement with public health policy shaping.

### *1.4.2. Collaboration and cross-Ministry working*

In many respects, it appears that cross-government working in Korea is quite well developed. Communication seems particularly strong in some areas, for example emergency preparedness (see Chapter 4). Co-ordination across horizontal levels of government – local to central – also appears quite strong, and a good balance between autonomy and oversight seems to be struck.

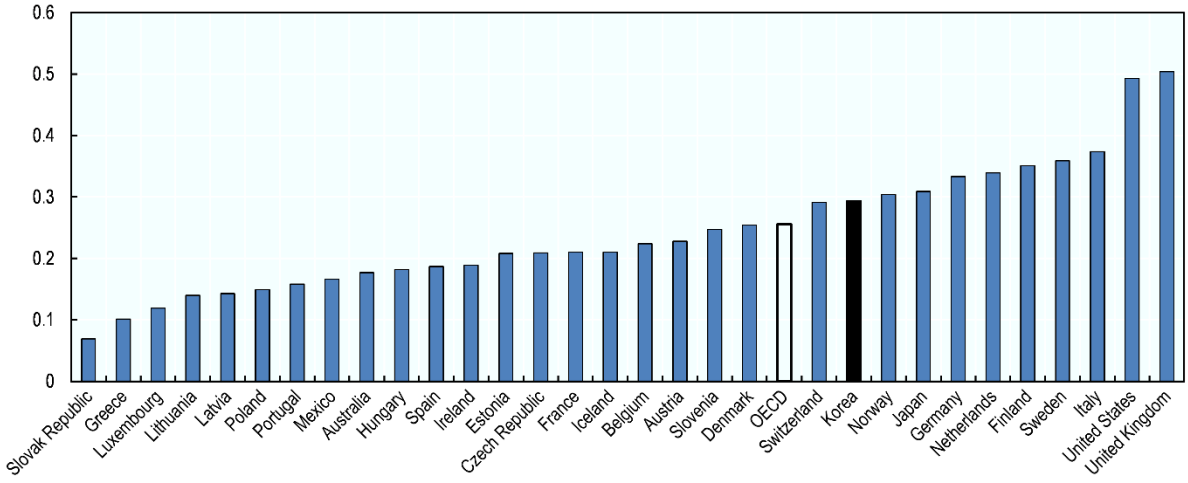
Specifically, the Deliberative Committee on National Health Promotion Policy could be seen as a strong positive approach to cross-government working for the development of public health promotion. The Committee, led by the Vice Minister of Health and Welfare, has participation at Director-General level from the Ministry of Strategy and Finance, Ministry of Education, Ministry of National Defence, Ministry of Culture, Sports and Tourism, Ministry of Employment and Labour, and Ministry of Environment, as well as professors in preventive health and experts from relevant research institutions.

## 1.5. Financial resources

### *1.5.1. Spending on health and public health*

In 2018, Korea spent 8.1% of GDP on health care – just under the OECD average of 8.8% (OECD, 2019[2]). Of this spend, 2.9% went to preventive care, just above the OECD average 2.6% spend (see Figure 1.18).

## Figure 1.18. Spending on preventive care as a percentage of total health spend, 2017 (or nearest year)




Source: OECD (2019[1]), *OECD Health Statistics 2019,* https://stats.oecd.org/.

Spending on preventive care has increased considerably in recent years, and a large part of this increase is due to additional spending on screening (Gmeinder, Morgan and Mueller, 2017[53]). Since Korea launched the National Cancer Screening Programme (NCSP) in 1999, its scope and target population have been increased while co-payments were reduced. Moreover, in 2007 the government introduced a health check programmes, which were also expanded in subsequent years.

### *1.5.2. Payment mechanisms to incentivise public health functions*

The National Health Promotion Fund was established in 1995 to fund health promotion and prevention programmes. In 2015, this fund was worth KRW 3.3 trillion, primarily financed by a dedicated tax on tobacco.

A number of health promotion programmes are financed through the National Health Promotion Fund. The National Health Promotion Fund is under operation to support and facilitate the implementation of national health promotion programmes. The main programmes focus on the promotion of healthy lifestyles, including smoking cessation, moderate alcohol use, obesity control, and better nutrition, as well as prevention and control of communicable and non-communicable diseases such as cancer. The National Health Promotion Fund also finances programmes aimed at strengthening public health programme implementation systems and expanding public health care infrastructure. The primary expenditure of the fund in 2017 was to support health insurance, with small percentages financing vaccination, research and development, and smoking cessation (Kim, Lee and Park, 2017[54]).

However, some programmes such as health care outreach programmes are financed through the general government budget. Funding for health check-up programmes is provided through different sources depending on the eligibility of the target recipients. Those eligible under the National Health Insurance Act are financed through the National Health Insurance System, whereas those eligible under the Medical Care Assistance Act are financed through the central and local governments' budgets. The Medical Care Assistance Act provides targeted health care to people living under national poverty line – around 3.2% of the total population (International Labour Organization, 2012[55]).

In most cases, there are no co-payment charges for health promotion programmes provided by public health care facilities such as Public Health Centres. However, it is common that clinics and other health care institutions charge 20-30% co-payment fees.

## 1.6. Knowledge development

### *1.6.1. Key data sources for understanding public health*

Data sources for public health include the Public Health Information System, the information system of the National Health Insurance Service, and various surveys.

The Public Health Information System (PHIS) was developed and launched between 2005 and 2009. It spread sequentially and the introduction had been completed to all centres by 2012 (Park, 2017[56]), and is currently being used by all 3 552 public health centres, public health sub-centres, and primary health care posts in Korea. The system integrates information from the different local public health facilities into a standardised national platform, with the aim to enhance the health management of citizens, reinforce the integration between organisations, advance new national health policies, and improve the efficiency of public health organisation (Ryu et al., 2013[57]).

The PHIS provides a standardised electronic medical record (EMR) for each patient and other services, including fee claims and test results. It also provides a standardised approach to 47 public health tasks, such as nutrition education, tuberculosis management, and vaccinations. For inter-organisational tasks that require the involvement of other organisation, the PHIS provides integration with external stakeholders such as the Korean Centers for Disease Control and Prevention (KCDC), the National Health Insurance Corporation, or the National Cancer Center – among others (Ryu et al., 2013[57]).

In addition to managing care delivery, the data from the PHIS is used by the Ministry of Health and Welfare and by local governments to monitor performance and formulate new policies.

The national health check-up programmes in Korea are linked to the National Health Insurance Service (NHIS). Target populations and the results of health check-ups are managed through the NHIS Information System.

To understand trends and behaviours related to public health, a number of surveys are run in Korea. The Korea National Health and Nutrition Examination Survey (KNHANES) is part of the National Health Promotion Act and samples 25 households in 192 regions, investigating about 10 000 individuals annually (KNHANES, 2019[7]) (Kweon et al., 2014[58]). The Youth Risk Behavior Survey is web-based, and questions around 70 000 middle- and high-school students about their health risk behaviours (KCDC, 2017[59]) (Kim et al., 2016[60]). Both surveys are managed by the KCDC.

However, despite the rich data sources that Korea has – from EMR and hospital data, to cancer data from the National Cancer Centre, KCDC data, data from HIRA, and National Institute of Health Data – data linkage sill appears to be a challenge. For example, use of data for secondary purposes – such as linking of Korean Biobank data and HIRA data (see Chapter 3) – is not allowed. A national data platform already exists, but the incentives for joining the network are weak. This network, which for example would show patient history to providers, is currently used by less than 10% of institutions (although a greater percentage of the population is covered).

### *1.6.2. Promoting health literacy around public health*

The Korea Health Promotion Institute runs a number of public health campaigns to promote healthy behaviours. These include campaigns on smoking cessation, nutrition, alcohol use and oral health. In

addition to running advertisements on mass and print media, the Institute provides materials for other stakeholders, including posters, leaflets and information on running educational events.

The Korea Health Promotion Institute also manages the examination and licensing of Health Educators. The content of the national examination for Health Educators is defined in the Enforcement Degree of the Health Promotion Act, and includes topics such smoking, alcohol use, disease prevention, diet, physical activity and other public health matters. To qualify for the one of the three examination levels, candidates need to have completed a certain number of relevant courses and/or be able to prove that they have experience working in public health. National and local governments are encouraged by the National Health Promotion Act to employ trained health education specialists in projects related to health promotion.

In addition to the Health Educator examinations, the Institute also runs topic-specific courses, such as a two-day course to become a certified “Specialist in Alcohol Prevention and Prevention”.

### *1.6.3. Generating Health-Related Data*

Besides the Public Health Information System (PHIS), other public data sources include the National Health Insurance Service (NHIS) fee claims and eligibility data, the National Cancer Center’s cancer registry, and KCDC’s Korea National Health and Nutrition Examination Survey and genomic epidemiology data. In addition, each health care institution holds electronic medical records (EMR) and patient data. The volume of data is rapidly increasing as the development of wearable devices enables the collection of personal health data from individuals.

## 1.7. Workforce

### *1.7.1. Human resources in public health care*

In terms of overall health workforce, Korea has one of the lower rates of practicing doctors in the OECD, with 2.3 doctors per 1 000 in 2017 (OECD, 2019[1]). Although this represents a considerable increase since 2000 (when there were just 1.3 doctors per 1 000 population), amongst OECD countries only Turkey has a lower rate of practicing doctors. Numbers of practicing nurses are not as low, but were still below the OECD average at 6.9 nurses per 1 000 in 2017 compared to the OECD average of 8.8, after a significant increase from 3.0 per 1 000 population in 2000 (ibid). The share of different categories of doctors in Korea is also unusual as compared to other OECD countries; 73% of Korean doctors were specialists in 2017, compared to 65% OECD-wide, and just 6% of doctors were ‘General Practitioners’, compared to the OECD average of 23% (ibid).

Indeed, public health services in Korea are primarily delivered in Public Health Centers, managed by the municipalities, and Sub-Health Centers. Nurses and nurse assistants account for over half of the medical staff in both types of centers. In addition, there are physicians (9% of medical personal in Public Health Centers, 21% in Sub-Health Centers) and medical technicians (32% and 10% respectively). The remainder is made up of dentists, pharmacists and doctors of traditional Korean medicine.

As of 2019, these local public health institutions had a total of 30 476 personnel, which includes doctors (7.4%), dentists (1.6%), traditional Korean medicine doctors (3.4%), pharmacists (5.1%), nurses (36.6%), nurse assistants (7%). The rest of the personnel included administrative staff, dental hygienists and other medical technicians (Table 1.1).

### Table 1.1. Public health workforce in Korea

Number of workforce in Public Health Centres and Sub-Health Centres, by category

| | Total | Physicians | Dentists | Doctors of traditional Korean medicine | Pharmacists | Nurses |
|---|---|---|---|---|---|---|
| Public Health Centres | 15 220 | 735 | 292 | 304 | 148 | 4 965 |
| Sub-Health Centres | 6 988 | 1 357 | 199 | 709 | 2 | 2 809 |
| | Nutritionist | Medical technicians | Nurse assistants | Administrative workers | Health service post | Technical post |
| Public Health Centres | 405 | 3 081 | 663 | 1 159 | 1 438 | 1 776 |
| Sub-Health Centres | 50 | 704 | 801 | 58 | 110 | 108 |

Source: Ministry of Health and Welfare (2018[61]), *Current Status of Health Care Center and Rural Sub-Health Care Centers*, http://kosis.kr/statHtml/statHtml.do?orgId=117&tblId=DT_11719N_001&conn_path=I3.

Korea's MOHW also wishes to develop a programme to encourage public health specialists, and specialists-in-training, towards particular areas. For example, students could be given incentives to serve in particular areas, for instance scholarship offers or fee waivers. Encouraging the right health care professionals to practice in particular areas, for example rural or remote areas, is a challenge many OECD countries have grappled with (OECD, 2016[62]). Countries such as Australia, Norway, Japan and Canada have used policies such as financial support for student medics in exchange for a commitment to practice in a rural area after their training, or targeted recruitment of students from rural backgrounds, who are more likely to return to practice in rural areas after their training (ibid).

## Conclusion

Korea's health system is in very large part focused on curative, rather than preventive care. In many ways this is understandable – mortality from chronic diseases, such as circulatory diseases, is still far lower than in many OECD-peers, while overall rates of risk factors – obesity, smoking, even overall alcohol consumption – appear comparatively low, though risky behaviour by males is higher and even above the OECD average for example for smoking. However, Korea's population is aging rapidly, and by 2050 the share of the population over 80 is projected to be nearly the same as in Japan. The average rates of risk factors, too, hide a more nuanced story, with some 40% of the male population smoking, rates of overweight amongst children are close to the OECD average, and binge drinking is common. These behavioural risks, combined with the demographic transformation that has already in Korea, are a clear sign that prevention policies and public health should become a top priority sooner, rather than later.

In some respects Korea is building a solid public health policy package. For instance, tobacco laws have been strengthened recently, and tobacco cessation programmes are available. There are signs that collaboration is good between local and central governments, and across Ministries, which is relatively rare, and central oversight over local public health policy making has recently been strengthened, which is surely a positive step. However, there is still scope to strengthen Korea's approach, notably around tobacco policy; regulations around tobacco point-of-sale, packaging, and public smoking could be tightened. In addition, there are likely missed opportunities to make the most of Korea's rich data infrastructure to inform public health policies and surveillance, with data bases not linked up or fully exploited. Finally, and critically, Korea should look to strengthen secondary and tertiary disease management programmes; in the absence of a developed primary care system, effective management of chronic diseases will be essential to ensure good population health and keep health costs down in the years and decades to come.

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# 2 Tackling harmful alcohol use

Harmful alcohol use is a considerable public health issue in Korea. Alcohol plays an important part in daily life and binge drinking is common. While some policies have been introduced to reduce harmful alcohol consumption – including taxation, labelling, drink-driving regulation and education in universities – there remains scope to improve. Implementing a comprehensive policy package, which includes stricter marketing regulation, regulation on the sale and consumption of alcohol, education and public awareness programmes among all levels of society as well as improved pricing policies, can help tackle harmful alcohol consumption in Korea.

## Introduction

The amount of alcohol consumed in Korea is similar to the OECD average – but this overall trend obscures the issues that exist around harmful alcohol use. Working men and young women are frequent drinkers; binge-drinking is common and socially accepted – if not encouraged; alcohol dependency rates are high; and there are more alcohol-related road traffic crashes per capita than in any other OECD country.

To address these issues, Korea has implemented a number of policies, including awareness and education campaigns, taxation, some regulation of advertising, warning labels on alcohol containers, and a national maximum legal blood alcohol concentration for drivers linked to monetary fines or imprisonment.

Despite these efforts, the social acceptability of excessive alcohol use remains high in Korea. This is turn hampers the implementation of more progressive alcohol legislation, which often lacks public and political support. For this reason, it is crucial to change the current social acceptability of harmful alcohol consumption, and pave the way for more comprehensive policies.

This chapter will first describe the levels and patterns of alcohol use in Korea, and the impact it has on society and the economy. Secondly, it will describe the current alcohol prevention strategy that is in place in Korea. Thirdly, it will outline additional policies that Korea should consider implementing to tackling the problem of harmful alcohol use.

## 2.1. Harmful alcohol use is a public health issue in Korea

### *2.1.1. Although the overall alcohol consumption rate in Korea is around OECD average, working men and young women are frequent drinkers*

Compared to recorded alcohol consumption in other OECD countries, Korea consumes a similar amount: 8.7 litres per capita compared to 8.9 on average in the OECD (see Figure 2.1). This level of consumption has remained largely stable over the past two decades. Unrecorded alcohol consumption in Korea is estimated at 1.2 litres per capita (World Health Organization, 2018[1]). This is below the OECD average of 1.4 litres. (Please refer to Box 2.1 for details on measuring alcohol consumption and the differences between OECD and WHO data).

### Box 2.1. Data on alcohol consumption

There are different ways of measuring alcohol consumption in a country. The WHO Global Information System on Alcohol and Health (GISAH) database contains both recorded and total consumption. Recorded alcohol consumption only takes into account the consumption that is recorded from production, import, export, and sales data, often via taxation. Total alcohol consumption also looks at unrecorded (and untaxed) alcohol and subtracts the amount of alcohol consumed by tourists (World Health Organization, n.d.[2]). Unrecorded alcohol is not included in official statistics because it is produced, distributed and sold outside the formal channels under government control.

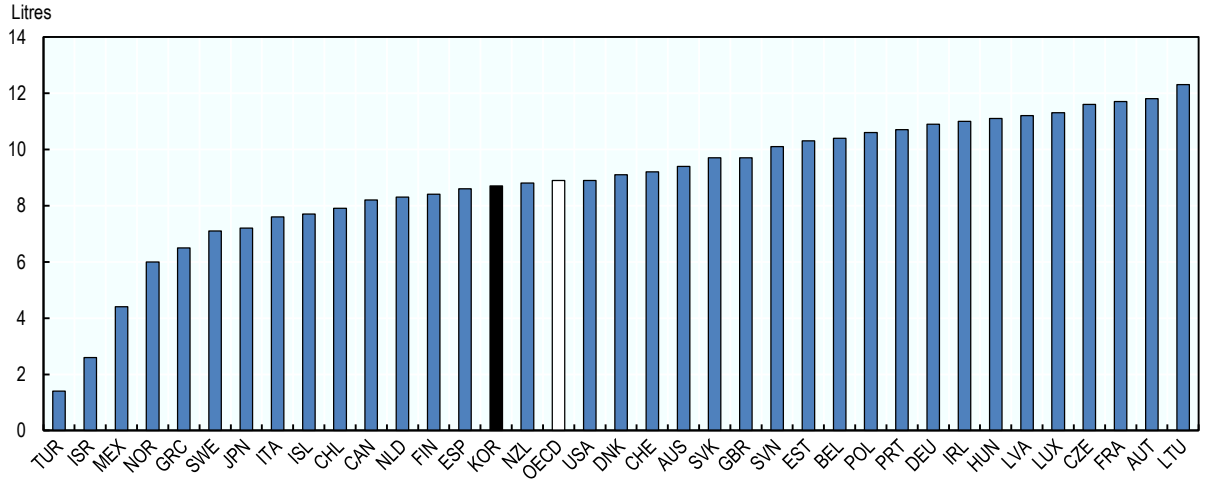
The OECD also reports data on recorded alcohol consumption in its Health Statistics. For some countries GISAH data is used, while for others data is supplied to the OECD by the country government. When considering just recorded alcohol consumption, estimated from OECD Health Statistics data and WHO GISHA data are very close. Exceptions are Estonia, Lithuania, Czech Republic, Russia, and Mexico. Generally, these differences are due to adjustments or differences in methodology. In Estonia, the OECD uses the government figure, which includes a correction for tourist consumption and illegal alcohol. In the Czech Republic, the government methodology also differs from the WHO, notably on the degree of alcohol in beer.

The Health Statistics data presented in this publication is different from the data in the OECD's forthcoming (2020) report on harmful alcohol consumption because that report primarily uses total alcohol consumption instead of recorded alcohol consumption, as in this publication.

Sources: World Health Organization (n.d.[2]), Alcohol, total per capita (15+ years) consumption (in litres of pure alcohol), https://www.who.int/data/gho/indicator-metadata-registry/imr-details/465; World Health Organization (2018[3]), WHO Global Information System on Alcohol and Health, http://apps.who.int/gho/data/node.main.GISAH?lang=en.

### Figure 2.1. Alcohol consumption in Korea compared to OECD countries

Recorded alcohol consumption in litres per capita (aged 15 and over), 2018 or latest available



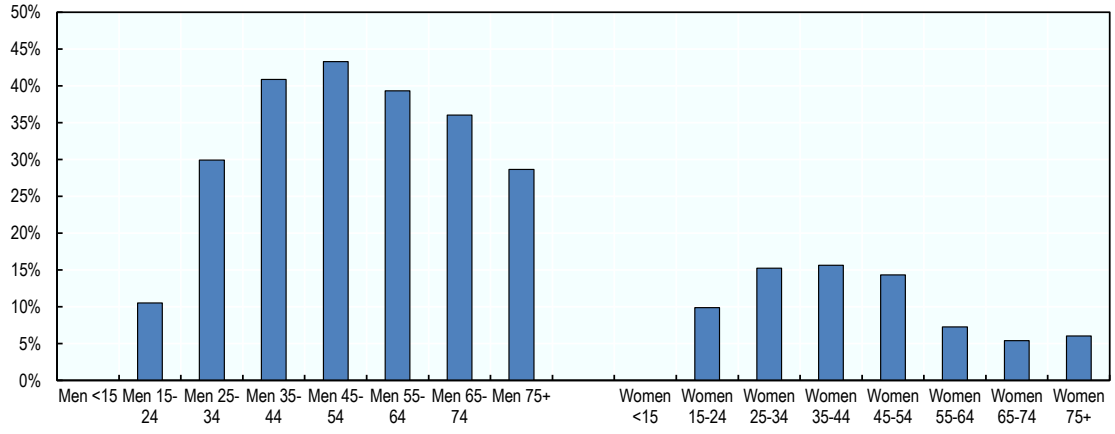

Note: Please refer to Box 2.1 for details on alcohol consumption data and the differences between OECD and WHO data.
Source: OECD (2019[4]), *OECD Health Statistics 2019*, http://stats.oecd.org/.

Alcohol consumption is not evenly distributed across the Korean population, as men consume more alcohol than women. Among those who drink, total alcohol consumption is 21.7 litres per year for men compared to 7.6 litres for women (World Health Organization, 2018[1]). However, alcohol consumption among women has increased considerable in recent years: while in 1992 33% of women over 20 drank alcohol (compared to 84.7% of men), this had increased to 59.5% in 2001 (Kim and Kim, 2008[5]). More recent data indicates that in 2014, 60% of women drank, compared to 75% of men (KNHANES, 2019[6]). Like in other cultures, traditionally women were expected to refrain from drinking. However, with changing social norms and the increased participation of women in the workforce this has started to change (Kim and Kim, 2008[5]).

For both men and women, regular alcohol consumption is most common in middle age (see Figure 2.2). However, for men the frequency of drinking remains relatively high in older age, with 29% of men over the age of 75 consuming alcohol at least twice a week.

## Figure 2.2. Frequent alcohol consumption by age

Percentage of people drinking alcohol 2 times per week or more by gender and age group, 2014

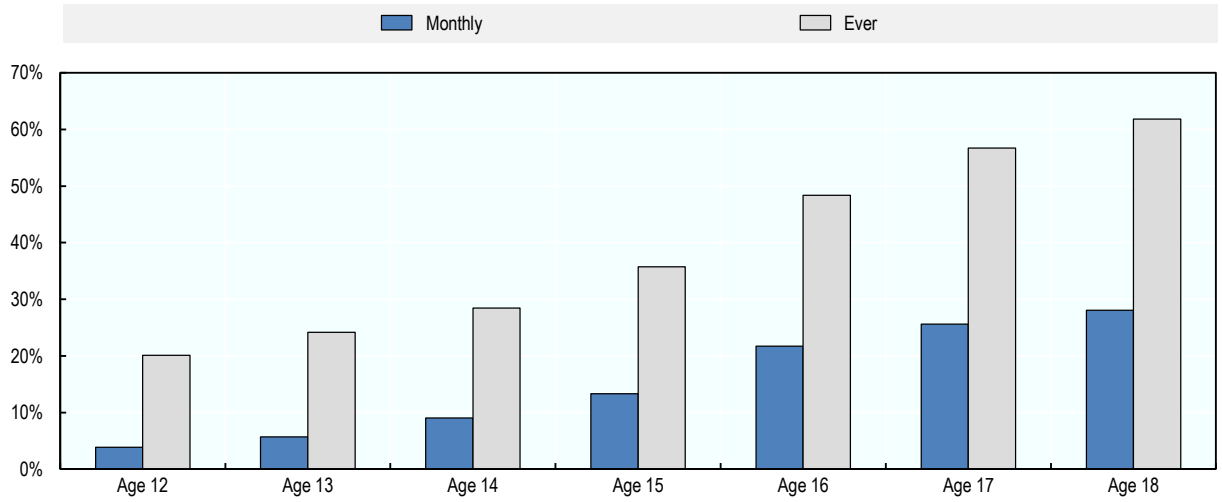



Source: KNHANES (2019[6]), *Korea National Health and Nutrition Examination Survey*, https://knhanes.cdc.go.kr/knhanes/sub01/sub01_02.do.

The legal drinking age in Korea is 19 years old. Nevertheless, nearly half of all 16 year olds have drunk alcohol at least once (see Figure 2.3). Moreover, by the age of 16 over 20% of children drink alcohol at least once a month, rising to nearly 30% at age 18 (KCDC, 2017[7]).

## Figure 2.3. Underage drinking rate by age

Percentage of children drinking a cup of alcohol at least once in the preceding 30 days, or ever

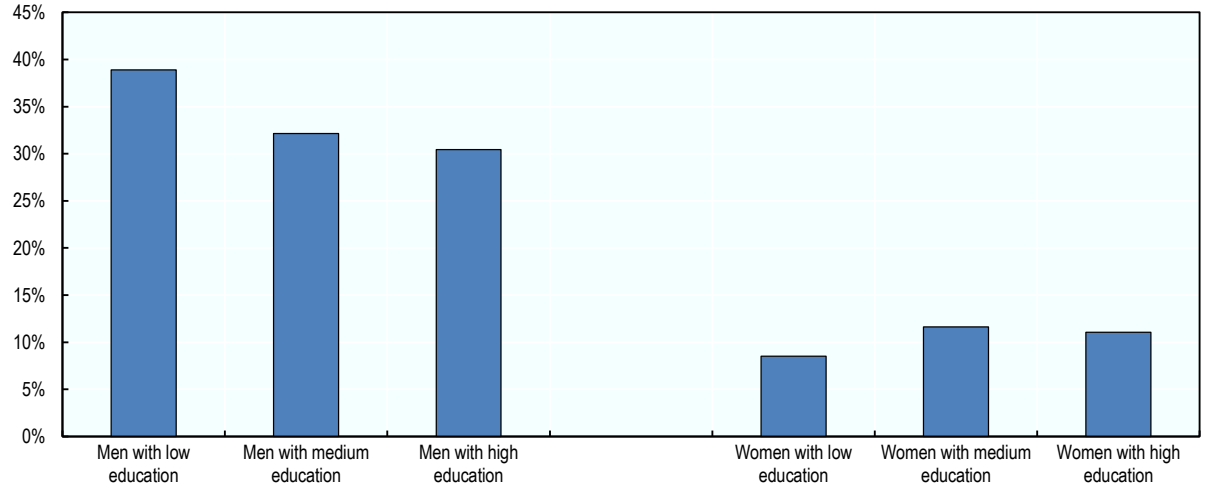



Source: KCDC (2017[7]), *Youth Health Behavior Survey*, http://www.cdc.go.kr/CDC/contents/CdcKrContentView.jsp?cid=77749&menuIds=HOME001-MNU1130-MNU2393-MNU2749.

The frequency of drinking in men is lower in population groups with higher education (see Figure 2.4). Nearly 40% of men with a low educational level drink at least twice a week, compared to less than one third of men with a high educational level. On the other hand, women with a low education are less likely to drink frequently compared to those with a medium or high educational level.

## Figure 2.4. Frequent alcohol consumption by education level

Percentage of people drinking alcohol 2 times per week or more, for men and women with low, medium and high education, 2014

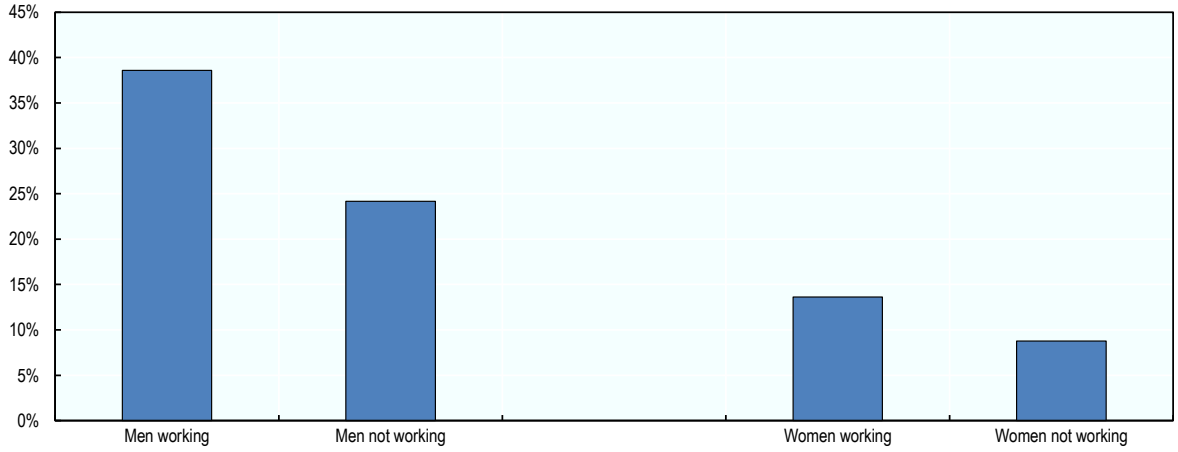



Source: KNHANES (2019[6]), *Korea National Health and Nutrition Examination Survey*, https://knhanes.cdc.go.kr/knhanes/sub01/sub01_02.do.

Occupational status is another important determinant of drinking status in Korea (see Figure 2.5). Men who work are much more likely to drink at least twice a week compared to men who do not work. For women the same effect can be observed though at a lower overall level.

### Figure 2.5. Frequent alcohol consumption by occupational status

Percentage of people drinking alcohol 2 times per week or more, for men and women with and without work, 2014




Source: KNHANES (2019[6]), *Korea National Health and Nutrition Examination Survey*, https://knhanes.cdc.go.kr/knhanes/sub01/sub01_02.do.

Beer and soju are the most popular drinks in Korea, accounting for approximately 60% and 25% of overall litres consumed respectively (USDA Foreign Agricultural Service, 2018[8]). Soju is a traditional distilled spirit with typically about 20-24% alcohol by volume (ABV). Its popularity in Korea means that it is one of the most consumed liquors worldwide (Drinks International, 2016[9]).

In recent years there has been an increase in the production, marketing and consumption of fruit-flavoured drinks and drinks with a lower alcohol percentage. The preference for liquors low in alcohol content has increased from 53.7% in 2013 to 57.0% in 2016 (Ministry of Drug and Food Safety, 2016[10]). This trend is driven in particular by young women.

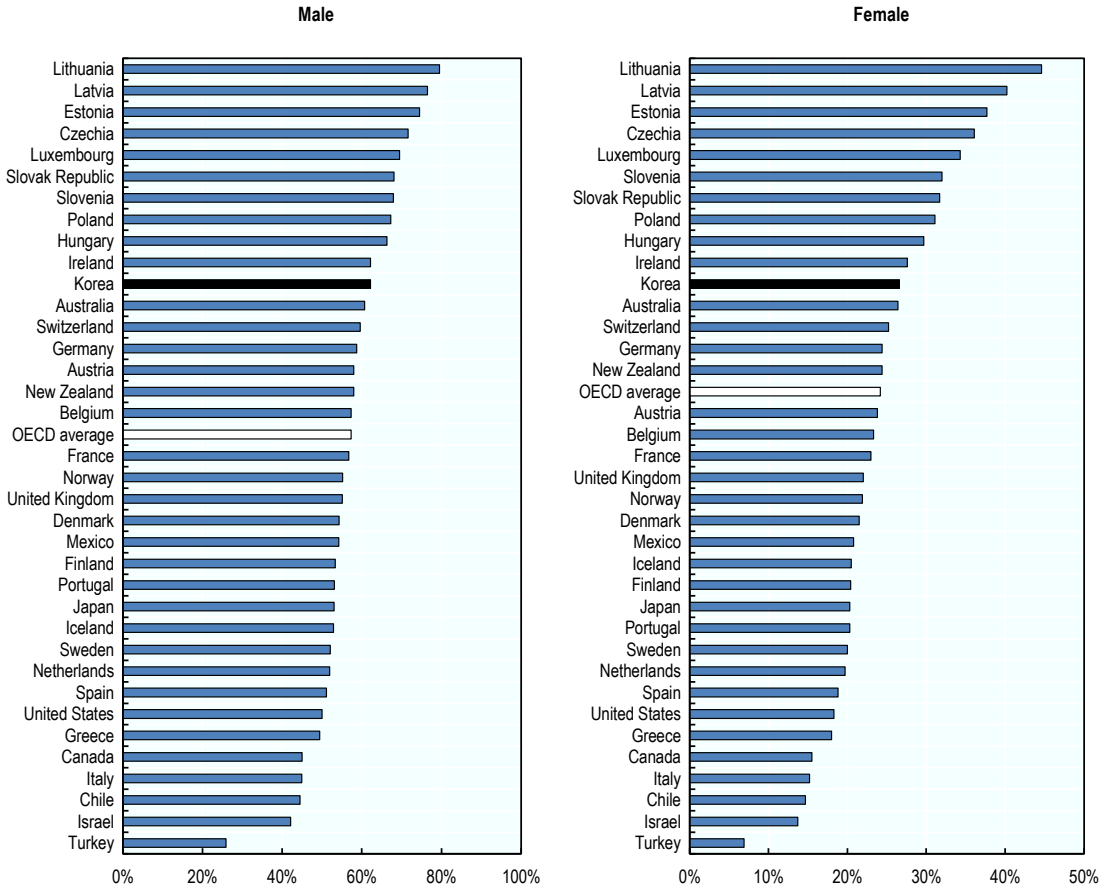
Craft and international beers are also gaining popularity, driven by an increased consumer demand for quality and diversity. The total volume of beer imports increased by 50% between 2016 and 2017. Nevertheless, the market for beer remains highly consolidated: two national brewers account for 86% of beer sales in 2017 (USDA Foreign Agricultural Service, 2018[8]).

### *2.1.2. Heavy episodic and high-risk drinking is common in Korea*

While the overall rates of alcohol use in Korea are around the OECD average, the rate of heavy episodic drinking, or binge drinking, is high (see Figure 2.6). The average number of drinks consumed in one sitting has almost tripled from 2.2 cups in 2013 to 6.0 cups in 2016 (Ministry of Drug and Food Safety, 2016[10]). This is important since heavy episodic drinking is harmful to a person's health even if the overall level of alcohol consumption is low. Moreover, in the presence of heavy episodic drinking, the cardioprotective properties of low-risk alcohol consumption disappear completely (World Health Organization, 2014[11]).

## Figure 2.6. Heavy episodic drinking prevalence among drinkers

Percentage of drinkers (15+ years) who have had at least 60 grams or more of pure alcohol on at least one occasion in the past 30 days, 2016

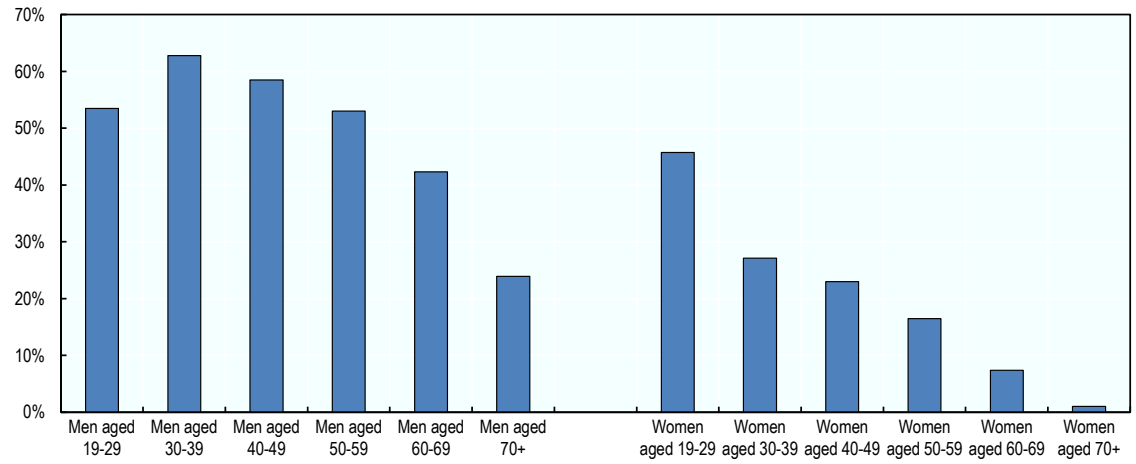



Source: World Health Organization (2018[3]), *Global Information System on Alcohol and Health*, http://apps.who.int/gho/data/node.main.GISAH?lang=en.

The prevalence of heavy episodic drinking, measured as the percentage of the men who consume 7 cups of alcohol or more in one drinking event at least once a month, or 5 cups or more for women, is a particularly high among younger people and adult men (see Figure 2.7). More than half of all men below the age of 59 binge drink at least once a month. While the overall prevalence of heavy episodic drinking in women is lower, nearly half of women aged 19-29 engages in monthly binge drinking.

## Figure 2.7. Monthly prevalence of heavy episodic drinking

Percentage of men and women consuming, respectively, 7 and 5 cups of alcohol per drinking event, at least once a month

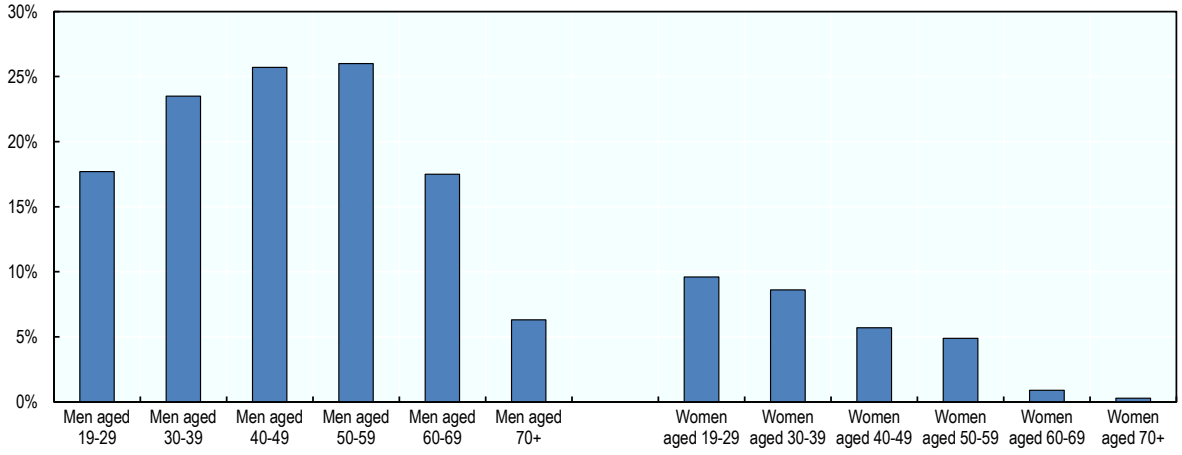



Source: Korean National Health Statistics (data supplied to the OECD by the Ministry of Health and Welfare).

When it comes to high-risk drinking, defined as engaging in heavy episodic drinking at least twice a week, men between the ages of 30 and 59 have the highest rates of around 25% (see Figure 2.8). The prevalence of high-risk drinking is lower in women, with the highest rate in women between 19 and 29 years old.

## Figure 2.8. Prevalence of high-risk drinking

Percentage of men and women consuming, respectively, 7 and 5 cups of alcohol per drinking event, at least once a month




Source: Korean National Health Statistics (data supplied to the OECD by the Ministry of Health and Welfare).

An important contributor to the high rate of harmful alcohol consumption in Korea is the drinking culture, which is conducive to heavy episodic drinking (see Box 2.2).

### Box 2.2. The role of alcohol in Korean culture

In Korea, the consumption of alcohol is an important part of social interactions, in particular in the workplace (Jun and Chung, 2008[12]). Employees go out regularly for team dinners, which often involve large quantities of alcohol and drinking games. Alcohol is thought to help overcome the barriers of work hierarchy and contribute to the creation of closer interpersonal relationships. Others see it as a way to cope with the high workload and long working hours that are typical of Korean office jobs.

The same social expectations around alcohol also affect other population groups, for example college students. Between 40% to 80% of college students is estimated to be a problem drinker (Kim and Park, 2015[13]), and studies have shown that social bonding and peer pressure are major drivers of alcohol misuse in this group – more so than in other cultures (Kim, Ahn and Lim, 2015[14]).

Traditional customs further contribute to the high intake of alcohol during social gatherings. It is considered impolite to refuse a drink, especially if offered by a superior, and to leave someone else's glass empty. Soju is usually sold in 375 millilitre bottles, which are shared among groups in small shot glasses that are regularly topped up.

The social acceptance of alcohol is also partially reflected in the regulation of consumption and in the social acceptability of drunkenness. Regulations of sales and consumption of alcohol product is much weaker in Korea than in many other OECD countries. Korean society and law enforcement are generally tolerant to public drunkenness. In fact, drunkenness is considered a mitigating circumstance for acts of violence, and can be cause for leniency in sentencing. There have however been calls to change this approach (Korea Times, 2017[15]).

Sources: Korea Times (2017[15]), *Anger growing against alcohol-influenced crimes*, http://www.koreatimes.co.kr/www/nation/2017/12/356_240362.html; Jun and Chung (2008[12]) "Effects of Workplace Alcohol-related Environment on Drinking Behaviors among Female Employees", *Korean Journal of Health Education and Promotion*, Vol. 25/3, pp. 21-43, http://linkinghub.elsevier.com/retrieve/pii/S0306460304000747; Kim, J. and S. Park (2015[13]), "Association between protective behavioral strategies and problem drinking among college students in the Republic of Korea", *Addictive Behaviors*, Vol. 51, pp. 171-176, http://dx.doi.org/10.1016/J.ADDBEH.2015.07.017; Kim, S., S. Ahn and T. Lim (2015[14]), "Predicting Alcohol Misuse Among College Students in the US and South Korea", *Journal of Ethnicity in Substance Abuse*, Vol. 14/3, pp. 308-322, http://dx.doi.org/10.1080/15332640.2014.996313.

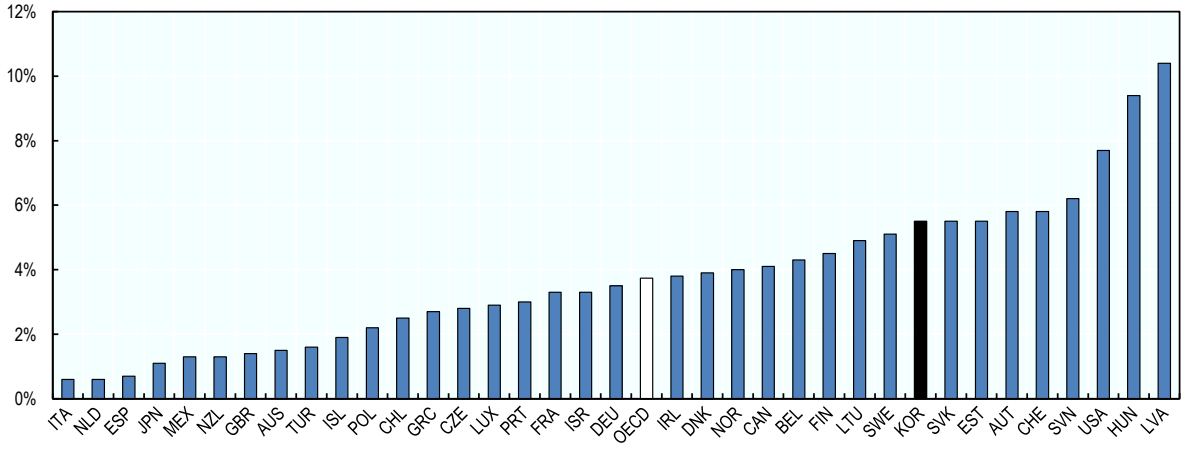
### *2.1.3. Alcohol use has a considerable impact on Korean health and society*

Harmful alcohol use negatively affects population health in Korea. For men, 6.7% of all deaths can be attributed to alcohol use in 2016 (GBD 2016 Alcohol Collaborators, 2018[16]). For women this is 2.2% of deaths. As such, alcohol is the third major behavioural risk factor, after tobacco use and dietary risk (Institute for Health Metrics and Evaluation, 2017[17]). It is responsible for 33% of all deaths from oesophageal cancer, 15% of deaths from liver cancer, 17% of deaths from breast cancer, 41% of deaths from chronic liver diseases (including cirrhosis), and 20% of deaths from self-harm.

The prevalence of alcohol dependency in Korea is relatively high compared to other OECD countries (see Figure 2.9), and this figure has grown in recent years. The number of persons seeking medical care for alcohol use disorders has also increased, growing over 50% between 2002 and 2013, from 73 000 to 114 000 (though it is unclear whether this is only due to an increase in prevalence, or whether this is also driven by an increase in access to treatment). The associated medical cost more than tripled from KRW 120 billion to KRW 375 billion over the same period (Korea Institute of Health and Social Affairs, 2017[18]).

## Figure 2.9. Prevalence of alcohol dependency amongst adults

Alcohol dependence (15+), 12-month prevalence (%), 2016



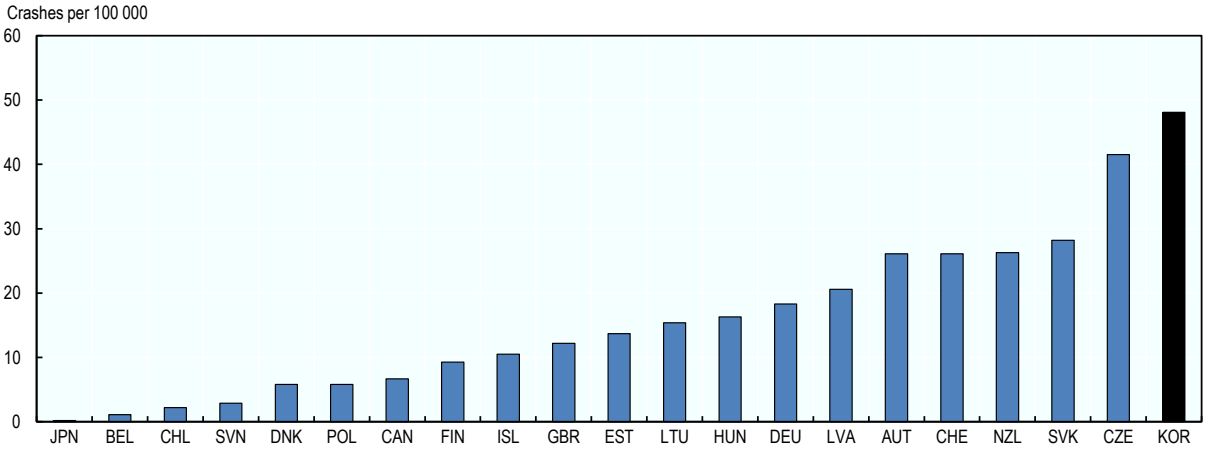

Source: World Health Organization (2018[3]), *Global Information System on Alcohol and Health*, http://apps.who.int/gho/data/node.main.GISAH?lang=en.

In addition to alcohol use disorders, alcohol consumption also causes other health issues, including cancers, cardiovascular diseases and liver disease, and contributes to the rate of injuries and suicides. The Korea Institute for Health and Social Affairs estimates the total cost of illnesses attributable to at-risk (drinking three to four times a week) and high-risk (drinking almost every day) alcohol use at KRW 4.6 trillion, of which KRW 1.0 trillion in medical expenses and KRW 2.9 trillion in lost income due to premature death (Korea Institute of Health and Social Affairs, 2017[18]). The cost of alcohol-attributable injuries and suicides contributes another KRW 1.5 trillion in lost income.

Furthermore, alcohol use contributes to crime and road traffic accidents. Korea has one of the highest rates of road traffic crashes due to alcohol (see Figure 2.10). Overall, alcohol consumption is responsible for 10.8% of all road traffic crashes in Korea (World Health Organization, 2017[19]). When it comes to violent crime, more than 30% of incidents is committed under the influence of alcohol (KIHASA, 2016[20]).

### Figure 2.10. Road traffic crashes due to alcohol in Korea compared to selected OECD countries

Alcohol-related road traffic crashes, per 100 000




Note: Based on countries with available data and showing 2016, or the most recent year for which data is available.
Source: World Health Organization (2018[3]), *Global Information System on Alcohol and Health*, http://apps.who.int/gho/data/node.main.GISAH?lang=en.

## 2.2. Korea has in place a multifaceted alcohol prevention strategy

### *2.2.1. Organisation of alcohol prevention*

In the Ministry of Health, the majority of work on alcohol prevention falls under the Mental Health Policy division, and the Department of Health Promotion. They are in charge of national regulation on packaging and advertising. The Ministry also works with the Korea Health Promotion Institute to run promotional campaigns and develop local health promotion plans. In addition, the Ministry of Food and Drug Safety is in charge of regulating the production and content of alcohol products; and the Ministry of Strategy and Finance manages alcohol taxation, distribution and sales.

Locally, Public Health Centers deliver health promotion and preventive care to their communities. Addiction Management Centers provide treatment for alcoholism and other addictions in a community center, but also play an important role in educating the community through outreach programmes and local campaigns.

The alcohol prevention strategy is set by the Ministry of Health. The first strategy was launched in 2006. The Bluebird Plan 2010 set out the Korean strategy on alcohol prevention until 2010, focusing on improving awareness, reducing harmful alcohol consumption and improving treatment. However, it has been suggested that the impact of the Bluebird Plan was limited, as it did not receive adequate budgets and failed to set up longer term action plans (Kim et al., 2013[21]). Since then, the strategy on alcohol prevention has been included in the five-year National Health Promotion Plan.

Most of the regulation on alcohol use is anchored in the Health Promotion Act, as well as topic specific acts, such as the Liquor Tax Act and the Road Traffic Act.

### *2.2.2. Awareness and education*

The Korea Health Promotion Institute (KHPI) plays a central role in public awareness and education, as it runs national awareness campaigns and supports health promotion activities by Public Health Centers. In

November, it coordinates the alcohol awareness month, providing materials for local interventions, web-tools and a national campaign to “re-start”.

There is no national alcohol-specific educational campaign for schools. Students receive health education, and while education on alcohol use is part of this curriculum, the primary focus is on tobacco. The Ministry of Health is looking to strengthen its alcohol education in schools and secure dedicated funding. Public Health Centers or Addiction Centers do provide materials and education in schools but only on an ad-hoc basis. Similarly, the KHPI has materials and trains instructors, but these are only provided at the schools’ request. A 2017 survey of youth showed that 58% of students did not receive alcohol education in the preceding 12 months (KCDC, 2017[7]).

In universities, student supporters play a role in raising awareness around harmful alcohol use. Since 2005, the Ministry of Health and Welfare has run a national programme to train and support students to act as moderate drinking supporters. In 2018, teams of students from 44 universities came together for an opening ceremony, where they received training, materials and mentoring in order to deliver prevention and education activities on their campuses (Korea Health Promotion Institute, 2018[22]). At the end of the year, a competition awards nine teams with scholarships.

In addition, a Moderate Drinking Code for college students was developed by the Ministry of Health and Welfare in 2018, and disseminated to 300 universities across the country. The Moderate Drinking Code advises students not to consume “bomb” drinks that combine soju and beer, not to force others to drink and not to drink shots or shout “bottoms up”, amongst others. It also recommends abstinence for people who experience an alcohol flush reaction (turning red in the face) – as well as people under the age of 19, pregnant women or women trying to get pregnant, and people on medication.

Workplace-based interventions exist that target drinking among employees and after work. The Ministry of Health is implementing a programme to promote cultural activities (such as a movie night) as company outings rather than drinking. The KHPI has created materials for companies to educate their staff on harmful drinking, but this is provided on request rather than systematically.

Local initiatives also try to address the workplace drinking culture. Some organisations, including Seoul City Hall and one of the major chaebol (business conglomerate) in the country, have adopted the “119 plan”. This slogan advises employees to have only one type of drink, at only one venue, and to go home before 9pm. Variations on this campaign are the “829 plan” which recommends finishing a work drinking outing between 8 and 9 pm, and the “222 plan”, which advised not to mix two kinds of alcohol, not to offer more than two shots to others and not to go to a second venue.

Both the KHPI and local Alcohol Addiction Centers produce leaflets that specifically focus on how to deal with social pressures to consume alcohol. Young people are advised to clearly state that they do not drink, to change the topic of conservation or to keep away from situations in which alcohol is consumed. Adults are also advised to avoid drinking, not to consume shots and “bomb drinks” (mixing soju and beer), and not to force others to drink.

### *2.2.3. Pricing*

Korea levies excise taxes on alcoholic beverages, as decreed by the Liquor Tax Act. Until recently, alcoholic beverages were taxed based on the price set by the manufacturer (*ad valorem*), with the exception of spirits, which are taxed based on their volume (see Table 2.1).

## Table 2.1. Excise tax on alcohol in Korea

| | Tax rate – before 1 January 2020 | Tax rate – since 1 January 2020 |
|---|---|---|
| Spirits (alcohol content 85% or more) | KRW 57 000 per kilolitre + KRW 600 per percentage point over 95% alcohol content | KRW 57 000 per kilolitre + KRW 600 per percentage point over 95% alcohol content |
| Makkoli (a low-proof fermented rice wine) | 5% of value | KRW 41.7 per litre |
| Rice wine and fruit wine | 30% of value | 30% of value |
| Refined rice wine | 30% of value | 30% of value |
| Beer | 72% of value | KRW 830.3 per litre |
| Distilled alcoholic beverages (including soju) | 72% of value | 72% of value |
| Other non-fermented alcoholic beverages | 72% of value | 72% of value |
| Other fermented alcoholic beverages | 30% of value | 30% of value |

Note: Tax rates are reduced by 50% for traditional liquors produced by designated manufacturers and within their shipment quota.
Source: Statutes of the Republic of Korea (2009[23]), *Liquor Tax Act*, https://elaw.klri.re.kr/kor_service/lawView.do?lang=ENG&hseq=38385.

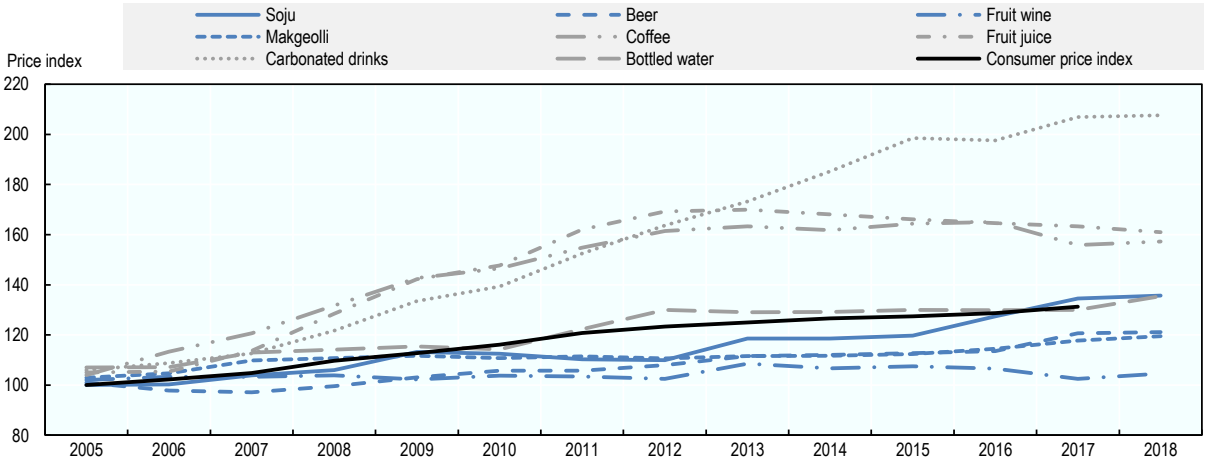
However, the government has recently revised the tax structure and introduced a tax based on volume rather than value (The Korea Herald, 2019[24]). At first, the change only applies to beer and rice wine. The aim of this change is to address inequalities in tax rates between domestic and international brands. While for domestic beer brands the 72% tax rate was based on manufacturing costs, profit as well as selling, general and administrative expenses, the tax for foreign beer brands was only applied to import price and tariffs (Korea Times, 2019[25]). Under the new system, both domestic and foreign beer brands are taxed 830.3 won per litre. As a result, the retail price of domestic beer is expected to decrease (The Korea Herald, 2019[24]).

In addition to liquor tax, the amount of liquor tax payable is itself taxed with an education tax, at 30% for liquors taxed more than 70% and 10% for all others (Statutes of the Republic of Korea, n.d.[26]). The aim of this education tax, which is also applied to revenue earned by financial or insurance business entities, consumption tax, traffic, energy, and environment tax, is to secure funding for education and to improve the quality of the schooling system.

Korea has implemented measures to promote traditional liquor industries and enhance the competitiveness of Korean traditional liquors abroad (Statutes of the Republic of Korea, n.d.[27]). In addition to assistance, education, training and certification schemes to maintain the traditions, tax rates are reduced by 50% for up to 200 kilolitre[1] of "traditional liquor", when manufactured by holders of a national intangible culture heritage or food grand master appellation (Statutes of the Republic of Korea, 2009[23]).

Despite the liquor and education tax, alcoholic beverages in Korea remain relatively cheap. While prices for carbonated drinks, fruit juice and coffee increased by 208%, 61% and 57% respectively between 2005 and 2018, the prices of alcohol drinks increased between 4% and 36%, depending on the type of alcohol product (see Figure 2.11) (Korea Health Promotion Institute, 2019[28]). This is below inflation, as measured by the consumer price index.

## Figure 2.11. Price index of popular alcohol and non-alcoholic drinks




Note: Indexed at 2005 = 100; alcoholic drinks in black, non-alcoholic drinks in blue.
Source: Price data from Korea Health Promotion Institute (2019[28]), *Price Index of Mainstream Liquor*, http://khealth.or.kr/acs/acsStat/result?menuId=MENU00688&tableGubun=DATA040401; consumer price index from OECD Inflation (CPI).

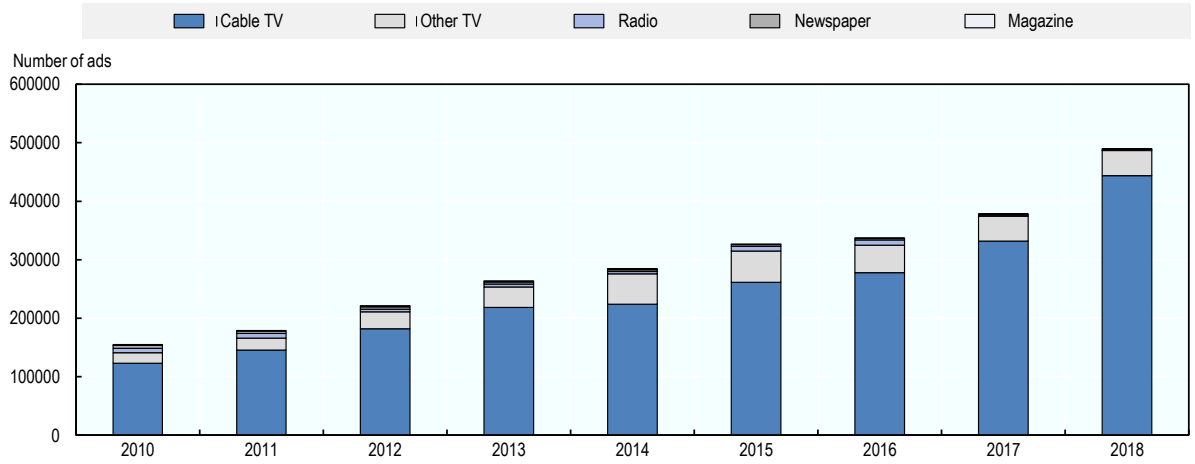
The popular soju is particularly inexpensive. A 360 millilitre bottle costs around KRW 1 340, or USD 1.15 (Korea Consumer Agency, 2019[29]). At 20% ABV, a bottle of soju provides 7.2 units[2] of alcohol. Per comparison, this translates to an alcohol unit price of GBP 0.12 (USD 0.15), far below the GBP 0.50 (USD 0.64) minimum price that Scotland, Wales and England are considering (Financial Times, 2018[30]; Scottish Government, 2017[31]; Angus et al., 2017[32]). One of the reasons for this is its low production cost, around KRW 400 per bottle (Korea Herald, 2012[33]; Korea Expose, 2018[34]). These low prices mean that the *ad valorem* excise tax has less impact on the final sales price.

Overall, the low prices in Korea make alcohol easy accessible and affordable for a large part of population, contributing to an environment which is conducive to the consumption of alcohol.

### *2.2.4. Advertising and media*

Advertising on traditional mass media primarily uses cable TV (see Figure 2.12). Between 2010 and 2018, the annual number of advertisements shown on cable TV increased by 17% per year, from 123 304 advertisements to 443 585 in 2018 (Korea Health Promotion Institute, 2019[35]).

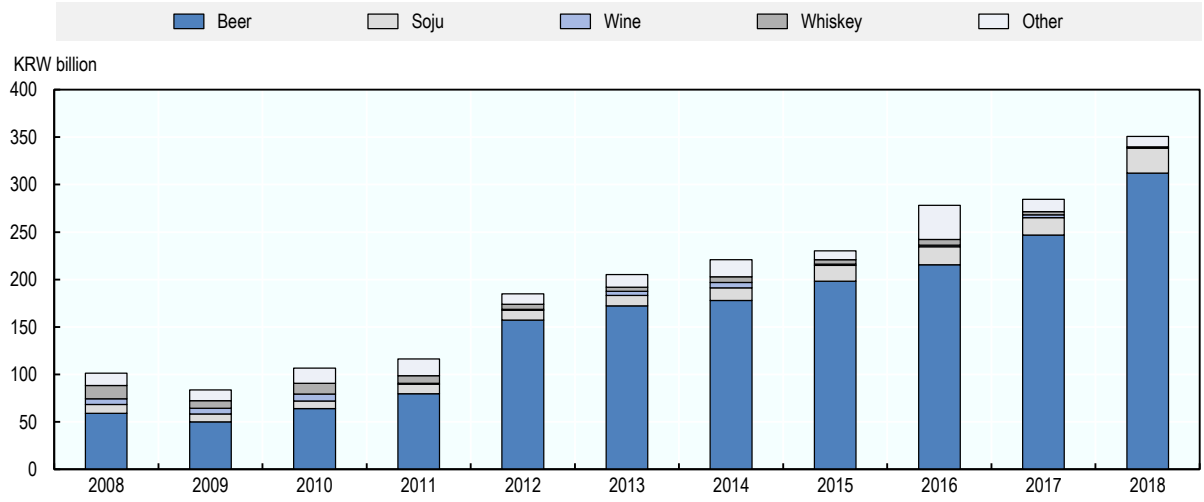
## Figure 2.12. Annual frequency of alcohol advertisements by traditional media channel




Source: Korea Health Promotion Institute (2019[35]), *Annual Frequency of Alcohol Advertising*, http://khealth.or.kr/acs/acsStat/result?menuId=MENU00690&tableGubun=DATA070101.

Spending on alcohol advertisement in traditional mass media has grown by 13% per year over the same period (Korea Health Promotion Institute, 2019[36]). The majority of advertising spend is for beer, with soju in a distant second place (see Figure 2.13). Beer advertising grew by 18% per year, from KRW 59 billion in 2008 to KRW 312 billion in 2018.

## Figure 2.13. Annual spend on advertising by alcohol product




Source: Korea Health Promotion Institute (2019[36]), *Annual Expenditure on Alcohol Advertising*, http://khealth.or.kr/acs/acsStat/result?menuId=MENU00691&tableGubun=DATA070201.

In Korea, there exist some regulation on the content of alcohol marketing, and on the time and place of such marketing. Alcohol advertisements are not allowed to depict pregnant women, or adolescents, and alcohol containers must have a warning text. There have been attempts to extend the latter to ban the use of celebrities and models to promote drinks, but no law has been passed yet (European Centre for Monitoring Alcohol Marketing, 2019[37]).

Broadcast advertising of alcohol products with more than 17% alcohol is prohibited. Marketing and advertising of alcohol products with less than 17% ABV on television is restricted to after 10pm and before 7am. Similar restrictions apply to radio advertisements. However, this regulation only concerns targeted advertisements during commercial breaks. There is no regulation on the depiction of alcohol in television series and programming. Indeed, many Korean television shows contain frequent depictions of drinking, which are displayed as social, fun and desirable (The Korea Herald, 2017[38]). While programmes rated appropriate for audiences aged 19 and over can only be broadcast between 9am and 1pm on weekdays, and 10pm to 7am, programming rated 15+ can be aired anytime as long as a warning label is shown at the beginning. Voluntary guidelines are being developed to regulate television programming content.

There is no national regulation of other forms of alcohol advertising. Alcohol marketing can be seen on billboards, public transport and at retailers and catering. In addition, alcohol producers use social media to promote their products. The Ministry is looking to reform this, and has banned alcohol marketing through video clips shown on trains.

Together, the limited regulations on alcohol marketing and the positive depictions of drinking can normalise and encourage drinking (Institute of Alcohol Studies, 2019[39]), reinforcing the social acceptability towards harmful alcohol drinking that exists in Korea.

Monitoring is done by the KHPI. The KHPI checks the contents of advertisements on TV, radio, internet, newspapers, magazines, outdoor, subway and in theatres against the regulation set out in the Enforcement Decree of the National Health Promotion Act. It also flags the depiction of excessive drinking in TV programmes, and monitors the use of warning phrases (Korea Health Promotion Institute, 2017[40]). They identify about 10-15 violations per week, and after flagging the findings with the offending company they monitor any follow-up actions taken. If no actions are taken, the Ministry of Health can fine the offender for up to KRW 1 000 000 (Korea Health Promotion Institute, 2019[41]).

### *2.2.5. Labelling*

In 2016, Korea revised the warning phrases that are required to be printed on the label of alcoholic products with more than 1% ABV. Producers can choose between three versions, all of which describe the risks of drinking during pregnancy as well as excessive drinking:

- “Drinking during pregnancy increases the risk for congenital anomaly. Alcohol is [a] carcinogen, so excessive drinking causes liver cancer, gastric adenocarcinoma and so on.”
- “Drinking during pregnancy, underage drinking, and excessive drinking cause congenital anomaly, brain development disruptions and cancer, respectively.”
- “Drinking during pregnancy increases the risk for congenital anomaly, Excessive drinking causes stroke, memory loss and dementia.

The previous warning labels, stemming for 1995, did not all refer to the dangers of drinking while pregnant, and focused on liver conditions only.

There are specific requirements for the design and placement of the warning sentence. The text is supposed to be printed in at least one-tenth of the size of the brand label, and in at least 7-point font size for containers with less than 300 ml, or at least 9-point font size on containers with more than 300 ml. In addition, there are colour and placement requirements to ensure the label is easily seen.

However, a review by the Korea Public Health Association showed that, in 2014, the warning sentences on 81 out of 100 products did not follow the design guidelines (Hani.co.kr, 2016[42]). For example, 55 products used colours that were not distinctive enough from the rest of the label, 56 placed the warning at the bottom of the label, and 34 breeched the minimum font size regulation. Nevertheless, there is little the Ministry can do to enforce the design requirements. While there is a penalty clause in the National

Health Promotion Act for not including the warning sentence, there is not one for violating the design requirements.

The rise in ready-to-drink and flavoured alcohol products has lead the Ministry of Food and Drug Safety to introduce mandatory labelling of non-alcoholic sparkling and mixed drinks to indicate that they do not contain alcohol. This policy is aimed at young consumers to educate them and prevent the formation of bad habits (Ministry of Food and Drug Safety, 2017[43]).

### *2.2.6. Sales and consumption regulations*

While restricting the sale and use of alcohol in public places is being considered by the Ministry of Health as well as local governments, so far there are very few regulations on alcohol sales and use. Alcohol can be sold anywhere and at any time – the only exceptions are sales to underage people and online sales. For the latter, an exception is made for designated traditional liquors, to promote their sale and export.

To sell alcohol in Korea, vendors need to apply for an alcohol license (Statutes of the Republic of Korea, 2009[23]). However, contrary to some other OECD countries, this licensing system is not used to limit the density of alcohol vendors or their location (World Health Organization, 2014[44]; OECD, 2015[45]). Supermarkets are the most common place to buy alcohol during the daytime, but late at night and in the early morning, people use liquor shops and small grocery stores more often. (Amista, Chun and Yun, 2017[46]).

Local initiatives have been explored to create alcohol-free zones. In 2017, Seoul City passed an ordinance which designated 22 parks as alcohol free, effective from the 1st January 2018, setting a fine of KWN 100 000 for violations of the ban. However, enforcement of this regulation is not possible as there is no legal basis to support it in National Health Promotion Act. Instead, fines can be written for excessive drinking as a form of disorderly behaviour, but this is difficult to define and enact. The Ministry of Health is working on changing the National Health Promotion Act to allow local governments to implement and enforce alcohol bans (Korea Times, 2018[47]).

In Korea, there are high rates of harmful alcohol use in college students (Kim and Park, 2015[13]). To address this issue, the Ministries of Health and of Education are working with universities to reduce the availability and consumption of alcohol on campuses.

Initiation and orientation activities for new students at universities at the beginning of the school year have repeatedly resulted in deaths from alcohol use (Ministry of Health and Welfare, 2011[48]). In 2011, the Ministry of Education, Science and Technology, the Ministry of Health and Welfare, the Korea University Education Council and the Korea College of Education worked together to develop practice guidelines to reduce harmful drinking in new students. The guidelines focus on education, limiting alcohol advertising on campus, and creating alcohol-free zones in dormitories, classrooms, student assembly halls and student lounges (Korea Times, 2017[49]; Ministry of Health and Welfare, 2011[48]).

In 2018, the Ministry of Education and National Tax Service announced that student bodies were not licensed to sell alcohol in student-run pop-up bars during the popular end-of-year festivals that take place in the spring. This move was met with strong criticism. The notice was issued days before some festivals were about to start, giving organisers little time to adjust, and without adequate consultation. Moreover, the festivals and the pop-up bars were considered a tradition. In practice the ban appeared to have had little impact on alcohol consumption and binge drinking, as students still could buy alcohol from nearby retailers (The Korea Times, 2018[50]).

### *2.2.7. Treatment of alcoholism and prevention of relapse*

There are seven designated, specialist hospitals in Korea that offer inpatient treatment for alcoholism and alcohol-associated disease treatment, all of which are public. They generally offer 8 to 12 week intensive

programmes. In 2017, 46 thousand patients received inpatient care, and 77 thousand received outpatient care. Nevertheless, inpatient treatment accounts for almost all of the expenditure on alcohol use disorders, with only 5.8% of the KRW 352 billion going to outpatient care in 2017.

In the community, Addiction Management Centers provide addiction case management and counselling services for alcoholism. Brief interventions, consisting of 3 to 4 counselling sessions combined with physiological test, are offered, after which patients can be registered for long-term care according to an Individualised Service Plan (ISP). The ISP can last as long as needed, and is tailored to the patient's level of motivation.

Treatment of alcoholism is hampered by limited integration between detection, inpatient and outpatient services (Kim et al., 2013[21]). There are examples of local Addiction Management Centers attempting to solve these issues. Through outreach programmes in the community they aim to identify patients at risk and provide them with timely interventions. To increase the number of patients receiving outpatient counselling after their discharge, counsellors from the Addiction Centers visit inpatient wards to establish contact. However, these practices are not regulated or funded.

Another issue is the lack of funding for treatment and counselling. Addiction Management Centers are dependent on the central, prefectural and municipal government for their budget, and the budget therefore varies depending on the interest and commitment of these bodies. Most Centers cover a large catchment area (e.g. 4 treatment Centers, with 4 to 8 staff members each, cover the entire Seoul population of nearly 10 million), and also deal with other addiction problems such as drugs, internet and gambling (see Box 2.3). As a result, many of the alcohol outreach programmes are restricted to the district in which the clinic is located.

### Box 2.3. Treating multiple additions

Outpatient treatment for alcohol addiction in Korea takes place in Addiction Management Centers, which also treat a range of other addictions, including drugs, internet and gambling. While this means that the Centers face an increased workload, it also provides benefits, as many patients have more than one addiction.

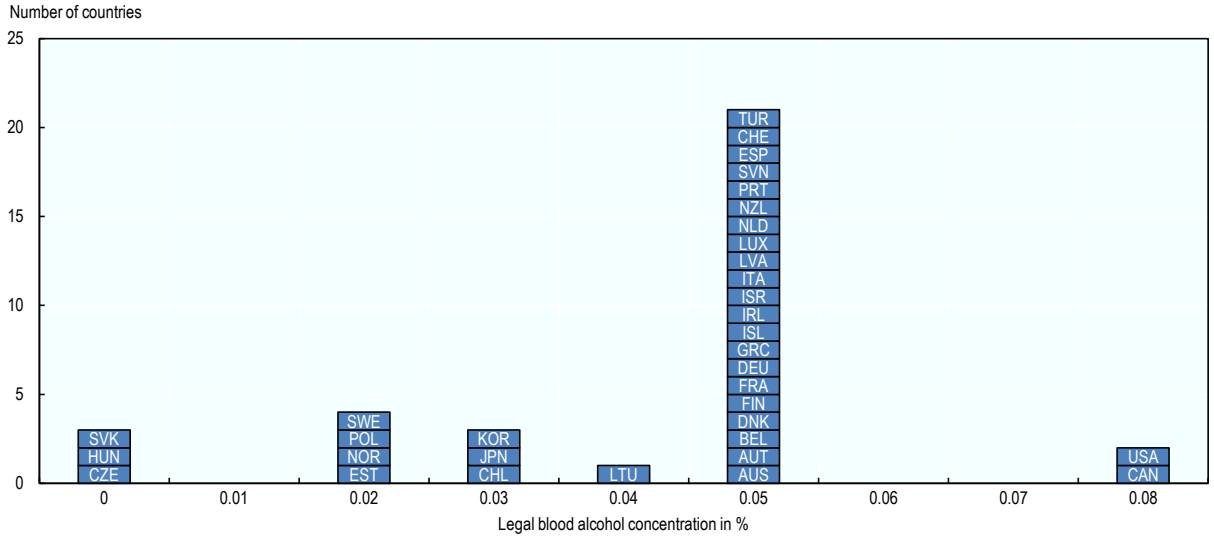
While the link between gambling or drug addiction and alcohol addiction is widely acknowledged, internet addiction is a relatively new concept. Nevertheless, a relation between this addiction and alcohol use has been observed. Especially in adolescents and young adults, internet addiction often presents alongside alcohol addiction in Korea (Park et al., 2017[51]; Lee et al., 2013[52]). The symptoms observed for both conditions are comparable: changes in cerebral function, lying, difficulty with stopping the addictive behaviour, irritation and anger, difficulty in maintaining study or other everyday functions, and the occurrence of health problems (Kim et al., 2006[53]). Research has found that people with alcohol addiction and with internet addiction are similar terms of emotion, temperament, and personality traits (Hwang et al., 2014[54]). This close relation between the two addictions suggests that treatment responses could also be related.

Source: Park, S. et al. (2017[51]) "Prevalence and Psychiatric Comorbidities of Internet Addiction in a Nationwide Sample of Korean Adults.", *Psychiatry investigation*, Vol. 14/6, pp. 879-882, http://dx.doi.org/10.4306/pi.2017.14.6.879; Lee, Y. et al. (2013[52]), "Substance abuse precedes Internet addiction.", *Addictive behaviors*, Vol. 38/4, pp. 2022-5, http://dx.doi.org/10.1016/j.addbeh.2012.12.024; Kim, K. et al. (2006[53]), "Internet addiction in Korean adolescents and its relation to depression and suicidal ideation: A questionnaire survey", *International Journal of Nursing Studies*, Vol. 43/2, pp. 185-192, http://dx.doi.org/10.1016/J.IJNURSTU.2005.02.005; Hwang, J. et al. (2014[54]), "Shared psychological characteristics that are linked to aggression between patients with Internet addiction and those with alcohol dependence", *Annals of General Psychiatry*, Vol. 13/1, p. 6, http://dx.doi.org/10.1186/1744-859X-13-6.

### *2.2.8. Drink-driving*

As described earlier, drink-driving is a major issue in Korea, where the rate of alcohol-related road traffic crashes is one of the highest among OECD countries. While up until recently the national maximum legal blood alcohol concentration for drivers was 0.05% (in line with many other OECD countries, see Figure 2.14), from June 2019 it was lowered to 0.03%. These reforms follow the changes made in Japan (see Box 2.4).

## Figure 2.14. National maximum legal blood alcohol concentration for the general population in OECD countries




Source: World Health Organization (2018[3]), *Global Information System on Alcohol and Health*, http://apps.who.int/gho/data/node.main.GISAH?lang=en.

### Box 2.4. The impact of changes in drink-driving law in Japan

In 2002, Japan lowered the legal blood alcohol concentration limit from 0.05% to 0.03% (OECD, 2015[45]). In addition, the penalties for drink-driving were increased: the fine for driving while intoxicated was increased from JPY 50 000 to 500 000, amongst other measures.

The measures appear to have been successful. One study, comparing motor vehicle crash rate due to alcohol per 100 000 licensed drivers before (1998-2001) and after (2002-2005) the introduction of the new regulation, found that the number of crashes among 16-19 year olds, adult males and adult females decreased by 64%, 50% and 52%, respectively (Desapriya et al., 2007[55]). Another study found that alcohol-related traffic fatalities per billion kilometres driven decreased by 38% in the post-law period, and alcohol-related traffic injuries by 33% (Nagata et al., 2008[56]). However, others have suggested that these decreases were also due to the news coverage of a high-profile fatal crash in November 1999 (Nakahara, Katanoda and Ichikawa, 2013[57]).

Source: OECD (2015[45]), *Tackling Harmful Alcohol Use: Economics and Public Health Policy*, OECD Publishing; Desapriya, E. et al. (2007[55]), "Impact of lowering the legal blood alcohol concentration limit to 0.03 on male, female and teenage drivers involved alcohol-related crashes in Japan", *International Journal of Injury Control and Safety Promotion*, Vol. 14/3, pp. 181-187, http://dx.doi.org/10.1080/17457300701440634; Nagata, T. et al. (2008[56]), "Effectiveness of a law to reduce alcohol-impaired driving in Japan.", *Injury prevention : journal of the International Society for Child and Adolescent Injury Prevention*, Vol. 14/1, pp. 19-23, http://dx.doi.org/10.1136/ip.2007.015719; Nakahara, S., K. Katanoda and M. Ichikawa (2013[57]), "Onset of a declining trend in fatal motor vehicle crashes involving drunk-driving in Japan.", *Journal of epidemiology*, Vol. 23/3, pp. 195-204, http://dx.doi.org/10.2188/JEA.JE20120134.

In 2011, the fines for drink-driving were revised, differentiating them based on the blood alcohol level at the time of the offense (Jeju Weekly, 2011[58]; Statutes of the Republic of Korea, 2012[59]) (see Table 2.2). With the new drink-driving limit introduced in 2019, the penalties were adjusted again – becoming much tougher.

### Table 2.2. Penalties for drink-driving

| Before 2011 | Between 2011 and June 2019 | From June 2019 |
|---|---|---|
| Blood alcohol level in excess of 0.05%: Up to 3 years imprisonment of up to KWN 10 million fine | Blood alcohol level between 0.05% and 0.1%: Up to 6 months imprisonment or up to KWN 3 million fine | Blood alcohol level between 0.03% and 0.08%: Up to 1 year imprisonment or up to KWN 5 million fine |
| | Blood alcohol level between 0.1% and 0.2%: 6 months to 1 year of imprisonment or KWN 3 million to 5 million fine | Blood alcohol level between 0.08% and 0.2%: Up to 2 years of imprisonment or up to KWN 10 million fine |
| | Blood alcohol level in excess of 0.2%: 1 to 3 year of imprisonment or KWN 5 million to 10 million fine | Blood alcohol level in excess of 0.2%: Up to 5 year of imprisonment or up to KWN 20 million fine |

Source: Jeju Weekly (2011[58]). "Korea cracking down on DWIs", *Jeju Weekly*, http://www.jejuweekly.com/news/articleView.html?idxno=1793; Statutes of the Republic of Korea (2012[59]), *Road Traffic Act*, http://elaw.klri.re.kr/eng_mobile/viewer.do?hseq=22353&type=part&key=11.

In addition, a new provision prohibiting riding bicycles while intoxicated took effect in September 2018. Anyone who rides a bicycle while over the legal alcohol limit is subject to a fine of up to KRW 200 000, or detention.

## 2.3. To reduce harmful alcohol use, Korea should implement a range of alcohol policies

The Korean government recognises the issues that exist around harmful alcohol use, and has stepped up its public health response. A number of new policies have been implemented, and while the design may be optimised in some cases (for example the warning labels on containers), these new policies bring Korea closer to OECD best practice (for example the drink-driving limits). In other cases, there is the motivation to make changes – to regulate advertising or public drinking– but it remains a struggle to get these policies implemented.

One of the main factors preventing the implementation of more comprehensive prevention policies is the social acceptability of alcohol in Korea (Seo et al., 2015[60]). Alcohol plays a central and important part in Korean daily life, and public and professionals alike are opposed to restrictive policies. It is therefore crucial to design new policies by taking into account this cultural factor. Implementing a wide range of policies, part of the WHO global strategy to reduce the harmful use of alcohol (World Health Organization, 2010[61]), can help to de-normalise harmful drinking and change the public acceptability and desirability of harmful drinking. Global action to tackle tobacco smoking suggests that comprehensive policy packages may be successful in decreasing the social acceptability of unhealthy lifestyles (see Box 2.5).

### Box 2.5. Tobacco policy and the social acceptability of smoking

Ever since the negative health impacts of tobacco became apparent, public health agencies and governments have worked to reduce smoking. In the last decade, significant process has been made in OECD countries, reducing the proportion of daily smokers from 24% in 2005 to 18% in 2015 (OECD, 2017[62]). These reductions are the result of several different policies, including taxation, bans on smoking in public places, mass media campaigns, support for people who want to quit, advertising restriction and warning labels on packages.

While each of these policies has had a direct influence on tobacco use, together they have also brought about a shift in public opinion regarding smoking. Research has shown that the interventions with the greatest impact on tobacco use are those that alter the social contexts and incentives (Cummings and Proctor, 2014[63]). Smoking bans in public places have been shown to reduce the perceived social acceptability of smoking (Albers et al., 2004[64]; Thrasher et al., 2009[65]), and are associated with an increase in homes that are kept smoke-free (Nyborg and Rege, 2003[66]). Awareness of anti-tobacco information and smoking restrictions has been found to be associated with feeling uncomfortable about smoking and societal disproval of smoking (Rennen et al., 2014[67]).

Existing policies can also contribute to the acceptability of additional regulations. Exposure to anti-tobacco campaigns has been shown to be correlated with a favourable attitude towards new potential tobacco regulations (Schmidt et al., 2018[68]). Other studies have found that support for smoking bans increased after they were implemented in Scotland (Brown, Moodie and Hastings, 2009[69]), Mexico (Thrasher et al., 2010[70]), the United Kingdom, France, Germany and the Netherlands (Mons et al., 2012[71]), because of their impact on social norms.

Finally, the sequenced implementation of a wide range of policies focused at smoking can support the psychological perception of a major change, and further contribute to a change in the social norm (Nyborg et al., 2016[72]).

Sources: OECD (2017[62]), *Health at a Glance 2017: OECD Indicators*, OECD Publishing, Paris, http://dx.doi.org/10.1787/health_glance-2017-en; Cummings, K. and R. Proctor (2014[63]), "The changing public image of smoking in the United States: 1964-2014.", *Cancer Epidemiol Biomarkers Prev*, Vol. 23/1, pp. 32-6, http://dx.doi.org/10.1158/1055-9965.EPI-13-0798; Albers, A. et al. (2004[64]) , "Relation between local restaurant smoking regulations and attitudes towards the prevalence and social acceptability of smoking: a study of youths and adults who eat out predominantly at restaurants in their town", *Tobacco Control*, Vol. 13, pp. 347-355, http://dx.doi.org/10.1136/tc.2003.007336; Thrasher, J. et al. (2009[65]), "Smoke-free policies and the social acceptability of smoking in Uruguay and Mexico: findings from the International Tobacco Control Policy Evaluation Project.", *Nicotine & tobacco research : official journal of the Society for Research on Nicotine and Tobacco*, Vol. 11/6, pp. 591-9, http://dx.doi.org/10.1093/ntr/ntp039; Nyborg, K. and M. Rege (2003[66]), "On social norms: the evolution of considerate smoking behavior", *Journal of Economic Behavior & Organization*, Vol. 52/3, pp. 323-340, http://dx.doi.org/10.1016/S0167-2681(03)00031-3; Rennen, E. et al. (2014[67]), "Associations between tobacco control policy awareness, social acceptability of smoking and smoking cessation. Findings from the International Tobacco Control (ITC) Europe Surveys", *Health Education Research*, Vol. 29/1, pp. 72-82, http://dx.doi.org/10.1093/her/cyt073; Schmidt, A. et al. (2018[68]), "Attitudes towards Potential New Tobacco Control Regulations among U.S. Adults", *Int. J. Environ. Res. Public Health*, Vol. 15/72, http://dx.doi.org/doi:10.3390/ijerph15010072; Brown, A., C. Moodie and G. Hastings (2009[69]), "A longitudinal study of policy effect (smoke-free legislation) on smoking norms: ITC Scotland/United Kingdom", *Nicotine & Tobacco Research*, Vol. 11/8, pp. 924-932, http://dx.doi.org/10.1093/ntr/ntp087; Thrasher, J. et al. (2010[70]), "Differential impact of local and federal smoke-free legislation in Mexico: a longitudinal study among adult smokers", *Salud Pública de México*, Vol. 52, pp. S244-S253, http://dx.doi.org/10.1590/S0036-36342010000800020; Mons, U. et al. (2012[71]), "Comprehensive smoke-free policies attract more support from smokers in Europe than partial policies", *The European Journal of Public Health*, Vol. 22/suppl 1, pp. 10-16, http://dx.doi.org/10.1093/eurpub/ckr202; Nyborg, K. et al. (2016[72]), "Social norms as solutions", *Science*, Vol. 354/6308, pp. 42-43, http://science.sciencemag.org/content/354/6308/42.

Korea should consider implementing a comprehensive policy package to tackle harmful alcohol consumption that acts at different levels (Lee, 2019[73]). Actions to reduce the impact of advertising and to regulate the availability of alcohol can help reduce constant exposure to marketing and prevent easy access to alcohol, particularly for vulnerable and high-risk groups. Education interventions can increase awareness, help people manage social pressure and, if well designed, can help mobilise public opinion and support for effective alcohol policies. Finally, price policies can act as a barrier to underage drinking or reduce harmful consumption.

### *2.3.1. Reduce the constant exposure to marketing by regulating advertising and media portrayal*

In Korea, regulation of alcohol advertising is more limited than in many other OECD countries. Advertisements can be seen on street corners and public transport, television programmes feature young people engaging in heavy drinking with friends (The Korea Herald, 2017[38]), and K-Pop celebrities promote soju on billboards and TV (European Centre for Monitoring Alcohol Marketing, 2019[37]). This leads to a constant exposure to alcohol advertisement.

One strategy to reduce the exposure to alcohol publicity is to regulate advertising and other marketing. Currently Korea has some restrictions on television advertising, but other media remain available to alcohol marketing. Many OECD countries have considerably restricted the advertisement of alcohol (OECD, 2015[45]). In France, the Loi Évin prohibits the advertising of all alcoholic beverages containing over 1.2% ABV on television and in cinemas, as well as sponsorship of sports or cultural events, and restricts marketing on the internet (an exception to these restrictions is advertisement of oenological information and promotion of a certain region or terroir). In Norway, any form of mass communication on alcohol is prohibited, including advertisements in printed newspapers, films, radio, television, telephone networks, data networks, illuminated advertisement hoardings, signboards and similar devices, depictions and exhibitions.

Comprehensive bans are the most effective in reducing exposure to alcohol use, as partial bans can lead to a displacement rather than a reduction in marketing (World Health Organization, 2011[74]; OECD, 2015[45]). Korea should therefore aim to implement comprehensive regulations on alcohol advertisement and other marketing. However, implementing a complete ban may not be feasible right away, both due to the political climate in Korea and the complexity of designing and enforcing such regulation, in particular regarding internet and social media advertising (OECD, 2015[45]). As a first step towards comprehensive regulations, Korea could consider addressing print, television and outdoor advertising. This would considerably reduce the public's exposure to alcohol marketing, and the restrictions could be further expanded once the acceptability of such regulation increases. Regulations in other countries can provide a blueprint to expand marketing restrictions to platforms such as social media and the internet (see Box 2.6).

### Box 2.6. Regulation of alcohol marketing through social media in Finland

In 2015, Finland was the first country in the world to introduce regulation on the use of social media for the purpose of marketing alcohol products. The Finnish Alcohol Act prohibits the use of user-generated or user-shared content. The National Supervisory Authority for Welfare and Health (Valvira) is responsible for the implementation and enforcement of marketing regulations in Finland. Valvira has set out guidelines that interpret the social media restrictions for alcohol producers, stating that they cannot:

- Use or distribute content generated by consumers, such as comments or pictures of alcoholic products, for advertising.
- Provide a sharing function when advertising alcoholic beverages, or encourage consumers to share content.

However, execution and enforcement of social media marketing regulations is complicated. In some cases, it might not be possible to disable a sharing function on a third-party social media platform. When it comes to enforcement, it can be difficult to identify marketing by alcohol companies when this is done through influencer marketing and other advanced product placement techniques. While the Finish regulations have been formulated to apply even in the case of advertising distributed through another country, the global nature of social media and the internet make national laws hard to enforce.

Source: Kauppila, E. et al. (2019[75]), *Alcohol Marketing on Social Media Sites in Finland and Sweden*, Faculty of Social Sciences, University of Helsinki, https://blogs.helsinki.fi/hu-ceacg/files/2019/04/Alcohol-marketing-on-social-media-sites-in-Finland-and-Sweden-2019.pdf (accessed on 20 January 2020).

In addition to regulating the media channels used for advertising, Korea should also review which content is allowed. The depiction of adolescents and pregnant women is not permitted, but otherwise the messaging is unrestricted. The use of widely popular K-Pop artists in advertisements, or the depiction of drinking in television shows with attractive actors and in social situations, can make drinking seem desirable. Moreover, it appeals to younger audiences in particular, who are particularly susceptible to advertising (OECD, 2015[45]).

To address this powerful exposure, it is important that Korea redouble its efforts to implement regulation that controls these types of marketing. The recent proposal to ban the use of models and celebrities is a positive first step, but – if implemented – this would not limit the messaging of advertisements. Instead, more wide-ranging regulations should be considered, to ban the association of alcohol with popularity, beauty and success.

An example of such regulation is the Loi Évin in France, which limits the content of alcohol advertisements to 'objective' characteristics of the product (e.g. alcohol content, origin, means of production) (OECD, 2015[45]). In New Zealand, the Code for Advertising and Promotion of Alcohol states that alcohol advertisements cannot promote drinking alcohol as a better or more attractive lifestyle choice; imply that the success of a social occasion depends of alcohol; suggest that alcohol can lead to sexual, social, sporting or business success or popularity; or is necessary to achieve social status with peers (Advertising Standards Authority, 2017[76]).

In addition to regulating the marketing of alcohol products, Korea should also consider regulating the portrayal of alcohol use in regular media. While content for audiences over the age of 19 can only be show at certain times, many television dramas that depict alcohol are rated appropriate for audiences 15 years and older, and can therefore be shown at any time. Other countries have implemented graded restrictions: in Finland, content for audiences over 16 cannot be shown before 9pm, and for audiences over 18 before 11pm; in Germany content for over 16 year olds can be shown at 10pm, and for over 18 year olds at 11pm.

Korea could consider implementing a similar regulation on content for audiences over 15 years old, to reduce their exposure to glamorised and socialised drinking in television shows.

### *2.3.2. Control the availability of alcohol by regulating sales and consumption*

Currently, there are limited regulations on where alcohol can be bought and consumed. The wide availability of alcohol can increase consumption, and create a perception of social acceptance of drinking, particularly in adolescents (Paschall, Lipperman-Kreda and Grube, 2014[77]). Alcohol availability restrictions have been proven to be effective in reducing the general level of harmful use of alcohol. (OECD, 2015[45]). Korea could consider regulation to restrict the places at which alcohol can be bought, the times during which it can be bought, as well as the places it can be consumed.

The existing licensing system in Korea could be used to regulate the density of alcohol vendors, to decrease alcohol use. Two systematic reviews have found that the density of alcohol outlets was associated with an increase in alcohol consumption (Popova et al., 2009[78]; Bryden et al., 2012[79]). In Scotland for example, the licensing board must refuse an application for a new license if this would result in the overprovision of licensed premises in the locality (Scottish Government, 2005[80]).

In addition to controlling the density of alcohol vendors, Korea could also consider regulating alcohol sales at petrol stations and other highway establishments. In 2010, Italy expanded its regulation of the sales of alcohol at petrol stations and motorway service stations: no spirits can be sold there between 10pm and 6pm, and no alcohol at all between 2am and 6am (OECD, 2015[45]). In the two subsequent years, highway accidents involving an injury or death decreased by 15.3% and 14% respectively. Considering the high rate of alcohol-related accidents in Korea, this could make a considerable impact.

Korea could also implement regulations on the time at which alcohol is available for sale and consumption. There is evidence that controlling alcohol sales hours can reduce alcohol-related injuries, homicides and other crime (Sanchez-Ramirez and Voaklander, 2017[81]), in particular when restricting evening opening hours for on-premise trade, including bars and clubs (Hahn et al., 2010[82]; Wilkinson, Livingston and Room, 2016[83]). However, the sale of alcohol can also be limited at other times. For example, New York prohibits bars and restaurants from selling alcohol before 10am on Sundays.

Finally, Korea could consider legislation to support local governments in their attempt to restrict alcohol consumption in certain public spaces. Local governments in Korea are already implementing alcohol-free zones in parks, but they currently lack the legal basis to enforce these laws. The National Health Promotion Act does not give local governments the right to enforce public drinking bans. In the case of tobacco, the National Health Promotion Act does includes a clause that allows local governments to designate and enforce smoke-free zones, which sets a legal precedent to include similar provisions for alcohol.

Once the appropriate laws are in place, municipalities should be encouraged to review their local environment for places where alcohol consumption should be restricted and implement such measures (see Box 2.7).

### Box 2.7. Local governance of alcohol-free zones

Several OECD countries have given local governments the power to introduce alcohol-free zones, which function in addition to nation-wide regulation of drinking in public institutions such as hospitals and schools. This approach empowers municipalities to introduce bans where they are most needed or most effective.

In the Australian state of New South Wales, local governments have the legislative power to establish alcohol-free zones or alcohol-prohibited areas. Within these zones, police officers are allowed to confiscate open alcohol containers and impose fines of up to AUD 2 200 (KRW 1 750 000). Over 80% of the 152 local government authorities have implemented such zones (Fisher, Wadds and Clancey, 2018[84]), which include car parks, streets, beaches, playgrounds, reserves, sporting fields and parks.

In the Netherlands, mayors hold the power to introduce "Algemene Plaatselijke Verordeningen" (General local ordinances, or APVs). These APVs can restrict alcohol consumption in certain areas or streets, or at certain times (for example on match days around sport stadiums). Decentralising this decision making to the local governments allows policies to be tailored to local circumstances. For example, in the municipality of The Hague, the local government reviews the area's crime statistics every year to identify where the alcohol-bans should apply (Gemeente Den Haag, 2017[85]). Perpetrators can be given monetary fines.

In Sweden, the municipalities are responsible for a large number of alcohol policies, including licensing, public education and rehabilitation (Karlsson, 2012[86]). In addition to these obligatory duties, the municipalities have the freedom to implement other alcohol regulations, including local restrictions on the consumption of alcohol in public places.

Sources: Fisher, D., P. Wadds and G. Clancey (2018[84]), "The patchwork of alcohol-free zones and alcohol-prohibited areas in New South Wales (Australia)", *Safer Communities*, Vol. 17/2, pp. 94-102, http://dx.doi.org/10.1108/SC-06-2017-0025; Gemeente Den Haag (2017[85]), *Alcohol-gebiedsverbod*, https://www.denhaag.nl/nl/in-de-stad/veiligheid/alcohol-gebiedsverbod.htm (accessed on 19 November 2018); Karlsson, D. (2012[86]), "Alcohol policy and local democracy in Sweden", *Nordic Studies on Alcohol and Drugs*, Vol. 29/3, pp. 233-252, http://dx.doi.org/10.2478/v10199-012-0016-9.

### *2.3.3. Invest in education to increase awareness, reduce social pressures and to mobilise public opinion*

Existing information campaigns have focused on providing tools to resist social pressures and reduce consumption, by giving explicit instructions on how to consume alcohol safely and how to say no. For university students, the Ministry has developed and disseminated a Moderate Drinking Code and set up a programme to train and assist moderate drinking supporters.

Korea should consider setting up similar dedicated educational programmes for other high-risk groups: school students and employees.

Early education in a school-based setting should aim to delay the initiation of drinking and prevent the establishment of harmful drinking habits. The Ministry of Health has indicated that it is looking to expand alcohol education in schools. While evidence of the effectiveness of school-based alcohol education programmes is relatively weak, programmes centred on enhancing basic skills such as critical thinking and resistance to social influences show promise (OECD, 2015[45]). Research has shown that effective school-based interventions need to address social norms around alcohol use and build personal and social skills to help resist pressure to use alcohol (Stigler, Neusel and Perry, 2011[87]) (see Box 2.8).

### Box 2.8. Life skills education to reduce harmful alcohol use

The past two decades have seen a rapid spread of life skills education programmes, encouraged by international organisations such as the WHO and UNICEF, and implemented in national policies by many countries (UNICEF, 2012[88]). Life skills education aims to provide people with knowledge and skills to protect them from harm or abuse (Nasheeda et al., 2018[89]). Such skills include communication, assertiveness, self-awareness, decision-making, and critical thinking.

Many school-based life skill education programmes focus on specific life skills, such as dealing with smoking, alcohol and drug use, and sexual activities (Nasheeda et al., 2018[89]). In this case, life skills education aims to provide students with a critical understanding of the health impact of their choices, and with negotiation or refusal skills to manage peer pressure.

There is some evidence that life skill education programmes reduce the frequency of alcohol consumption and episodes of drunkenness among school-aged children, though studies are often subject to methodological limitations (Martin, Nelson and Lynch, 2013[90]). A study looking at the long-term impact of a life skills programme on substance use in Germany found that the students who received the intervention showed less increase in alcohol consumption over the first three years – during which they received booster sessions after the initial programme – but caught up to the control group after this (Weichold and Blumenthal, 2016[91]). The researchers suggest that further booster sessions may be needed once alcohol use becomes highly normative among peers.

Sources: UNICEF (2012[88]), *Global evaluation of life skills education programmes*, UNICEF, New York, https://www.unicef.org/evaldatabase/files/UNICEF_GLS_Web.pdf (accessed on 13 August 2018); Nasheeda, A. et al. (2018[89]), "A narrative systematic review of life skills education: effectiveness, research gaps and priorities", *International Journal of Adolescence and Youth*, pp. 1-18, http://dx.doi.org/10.1080/02673843.2018.1479278; Martin, K., J. Nelson and S. Lynch (2013[90]), *Effectiveness of school-based life-skills and alcohol education programmes: a review of the literature*, NFER, Slough, http://www.nfer.ac.uk (accessed on 13 August 2018); Weichold, K. and A. Blumenthal (2016[91]), "Long-Term Effects of the Life Skills Program IPSY on Substance Use: Results of a 4.5-Year Longitudinal Study", *Prevention Science*, Vol. 17/1, pp. 13-23, http://dx.doi.org/10.1007/s11121-015-0576-5.

Similar skills are needed in the workplace, where drinking is an important part of the social environment. After-hour company dinners, also known as *hoesnik* or *hweshik*, frequently involve large amounts of alcohol (Çakar and Kim, 2016[92]). Employees can experience social pressure to participate due to the hierarchical nature of work teams, the etiquettes around drinking and dining, and the bonding aspect associated with social drinking, which can translate into job progression.

Employers can consider implementing an alcohol code of conduct (Work Safe Victoria, 2017[93]). While such codes are more difficult to enforce outside of the workplace, employers can promote recommendations such as the "119" plan. These types of guidelines, which recommend reducing the alcohol intake and ending the night earlier, can be particularly helpful for *hweshik,* which often involve bar hopping until late in the evening on a weekday. These guidelines should be targeted in particular at managers or other high-ranking supervisors, as they are often the decision makers at these events. As companies and local governments are starting to experiment with these guidelines, it would be interesting to evaluate their impact and effectiveness.

In addition to codes of conduction, companies should be encouraged to set-up workplace-based alcohol prevention programmes. These programmes can include education (using written communication, face-to-face conversations or presentations, or web-based counselling), peer-based interventions or employee assistance programmes for those with dependency (see Box 2.9).

### Box 2.9. Workplace-based alcohol interventions

**Web-based interventions**: A Cochrane review of programmes that provide personalised alcohol consumption advice via computer or mobile devices found that it could help people reduce heavy drinking – reducing alcohol consumption by of up to three (UK) standard drinks per week on average (Kaner et al., 2017[94]). Such interventions have the benefit that they can be conducted in private by the employee, avoiding any stigma (Khadjesari et al., 2014[95]). An interactive online intervention can also be personalised and may be delivered at a low cost and a convenient time.

**Peer-based interventions:** Some employers have implemented peer-based interventions to reduce alcohol-related harm, which a focus on changing workplace culture, attitudes, and perceptions around alcohol (OECD, 2015[45]). One example is the Team Awareness programme, which aimed to change the culture by reviewing group risks, promoting responsiveness to problems, and encouraging alternatives to the social bonding provided by drinking. In one experiment, this programme was able to reduce the prevalence of problem drinking from 20% to 11% (Bennett et al., 2004[96]).

**Employee Assistance Programmes (EAP)**: EAPs are common in larger enterprises and can be required by company policy (OECD, 2015[45]). While the core component of EAPs is psychological counselling, programmes can also provide other services such as identification and assessment; mediation; assistance in finding other treatment; and return to work support. A systematic review found that EAPs enhance employee outcomes, in terms of presenteeism and functioning (Joseph, Walker and Fuller-Tyszkiewicz, 2018[97]).

Sources: Kaner, E. et al. (2017[94]), "Does personalised advice via computer or mobile devices reduce heavy drinking?", *Cochrane Database of Systematic Reviews*, http://dx.doi.org/10.1002/14651858.CD011479.pub2; Khadjesari, Z. et al. (2014[95]), "Health on the Web: Randomised Controlled Trial of Online Screening and Brief Alcohol Intervention Delivered in a Workplace Setting", *PLoS ONE*, Vol. 9/11, p. e112553, http://dx.doi.org/10.1371/journal.pone.0112553; OECD (2015[45]), *Tackling Harmful Alcohol Use: Economics and Public Health Policy*, OECD Publishing, https://doi.org/10.1787/9789264181069-en; Bennett, J. et al. (2004[96]), "Team awareness, problem drinking, and drinking climate: workplace social health promotion in a policy context.", *American journal of health promotion : AJHP*, Vol. 19/2, pp. 103-13, http://dx.doi.org/10.4278/0890-1171-19.2.103; J oseph, B., A. Walker and M. Fuller-Tyszkiewicz (2018[97]), "Evaluating the effectiveness of employee assistance programmes: a systematic review", European Journal of Work and Organizational Psychology, Vol. 27/1, pp. 1-15, http://dx.doi.org/10.1080/1359432X.2017.1374245.

### *2.3.4. Review the taxation and pricing policies*

Policies to increase the retail price of alcoholic beverages have the potential to generate large health gains (OECD, 2015[45]). While Korea levies excise taxes on alcohol products, they remain relatively cheap. Proposed changes to the tax structure for beer and rice wine are aimed at improving the competitive position of domestic brands but are expected to decrease the tax on domestic beers (The Korea Herald, 2019[24]). Soju in particular is relatively affordable, and as one of the most popular drinks in Korea, this can contribute to the high consumption.

Increasing the price of alcohol is one of the most effective strategies to reduce harmful alcohol use (World Health Organization, 2018[1]). The WHO Global strategy recommends that countries review alcohol prices regularly, looking at inflation and income levels. It also suggests implementing minimum prices where applicable (Box 2.10).

### Box 2.10. Minimum unit pricing

While alcohol taxing has been in use for decennia, minimum pricing is a relatively new policy approach that is gathering interest. The general idea is to charge a minimum price for alcohol products, thus reducing the consumption of low-cost products specifically. In practice, this can be achieved by banning below-cost sales, establishing minimum mark-ups or profit margins, or setting minimum unit prices based on the alcohol content of the beverage (OECD, 2015[45])

Minimum pricing strategies can have certain benefits over taxation. Firstly, because they specifically target very cheap alcohol products, which may be more often purchased by heavy users, they are expected to have more impact on high-risk drinking. Secondly, contrary to taxes, which may not be passed on to the consumer, minimum prices are certain to reach the consumer. On the other hand, while taxes bring in revenue for the government, increased income from minimum prices stays with the producers.

Scotland has become one of the first countries to vote in comprehensive legislation on minimum alcohol prices. With alcohol becoming increasingly affordable, it had become possible to exceed the weekly low risk drinking guidelines of 14 units of alcohol on less than GBP 3 (3.35 EUR) (Scottish Government, 2017[31]). The Alcohol (Minimum Pricing) (Scotland) Act 2012 increased this cost to GBP 7 (7.82 EUR), by setting a minimum price of GBP 0.50 (0.56 EUR) per unit of alcohol, effective 1 May 2018.

An initial evaluation of the minimum price regulation in Scotland, using household shopping panel data, showed an overall GBP 0.064 increase in the price of a gram of alcohol and a reduction of 9.5 grams of alcohol in the weekly per adult per household alcohol purchases. Importantly, this reduction in volume of alcohol purchased only occurred in households that were in the top fifth in terms of alcohol purchasing. For those households, alcohol purchases reduced by 15 g of alcohol per week per adult after the introduction of minimum unit prices (O'Donnell et al., 2019[98]).

Several other countries have implemented, or are considering implementing, similar regulations. Wales has also introduced a GBP 0.50 minimum unit price on alcohol, which will come into force in March 2020 (Wales Statutory Instruments, 2019[99]). Three Canadian provinces have implemented minimum prices in different forms. Quebec's minimum price regulation applies only to beer and is adjusted based on cost of living (i.e. inflation) (Canadian Association of Liquor Jurisdications, 2013[100]). In British Columbia, minimum prices for alcohol products were introduced in 1989. These do not take into account inflation; however, periodic increases in the floor price are applied (Canadian Association of Liquor Jurisdications, 2013[100]). Saskatchewan requires businesses that serve alcohol to charge a minimum price per ounce of spirits, beer and wine (Stockwell et al., 2012[101]).

Sources: OECD (2015[45]), *Tackling Harmful Alcohol Use: Economics and Public Health Policy*, OECD Publishing, https://doi.org/10.1787/9789264181069-en; Scottish Government (2017[31]), Minimum Unit Pricing, http://www.gov.scot/Topics/Health/Services/Alcohol/minimum-pricing; O'Donnell, A. et al. (2019[98]), "Immediate impact of minimum unit pricing on alcohol purchases in Scotland: Controlled interrupted time series analysis for 2015-18", The BMJ, Vol. 366, http://dx.doi.org/10.1136/bmj.l5274; Wales Statutory Instruments (2019[99]), "The Public Health (Minimum Price for Alcohol) (Minimum Unit Price) (Wales) Regulations 2019".; Canadian Association of Liquor Jurisdications (2013[100]), Minimum Pricing in Canadian Alcohol Jurisdictions; Stockwell et al. (2012[101]), "The raising of minimum alcohol prices in Saskatchewan, Canada: Impacts on consumption and implications for public health", American Journal of Public Health, http://10.2105/AJPH.2012.301094.

In addition, from a public health perspective, Korea should consider reviewing existing policies that aim to promote the traditional liquor industry. The Act on Promotion of Korean Traditional Liquor Industries notes that while its aim is to promote the competitiveness of tradition liquor industry, it is committed to developing a wholesome drinking culture (Statutes of the Republic of Korea, n.d.[27]). However, aspects of the act could have a negative impact on public health, such as subsidies to people who establish and operate a

Center for promotion and exhibition of traditional liquors, or government-operated alcohol fairs. Moreover, the reduced tax rate for traditional liquors – despite applying to only a limited number of producers and a limited volume – can lead to a lower price (Statutes of the Republic of Korea, 2009[23]).

## Conclusion

Heavy episodic and high-risk drinking are highly prevalent in the Korean population with a considerable impact on population health and the economy. A number of policies have been implemented to reduce harmful alcohol use, including taxation, drink-driving regulation, and educational programmes in universities. At present, it appears that opposition currently prevents the introduction of a more comprehensive policy package.

There is scope though, to introduce a more comprehensive policy package, and which could well lead to positive outcomes for both population health, and the Korean economy. Korea should focus on changing the culture around harmful drinking, which is currently widely available and a key part of many social events. This would include making it harder to access alcohol, through some regulations on the sale and consumption of alcohol for example not allowing alcohol to be sold in roadside service stations, and examining alcohol pricing policy to better align with public health priorities. Efforts should also be made to reduce the visibility and prevalence of alcohol and imagery related to alcohol in Korean daily life, for example through stricter marketing regulation. Finally, this should be reinforced through education and awareness programmes among all levels of society.

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## Notes

[1] Fermented liquors - up to 200 kℓ when producing the liquors less than 500 kℓ per year; Distilled liquors - up to 100 kℓ when producing the liquors less than 250 kℓ per year.

[2] Using the UK standard of 8g or 10ml of pure alcohol (Holmes et al., 2014[102]).

# 3 Public health genomics in Korea

In Korea, genomic medicine is a fast-growing and popular field: genomic research, genetic testing and precision medicine, and direct-to-consumer genetic testing, are significant areas of policy attention, while in terms of genomic research, Korea has one of the biggest biobanks in the world. Genetic testing is widespread and increasing, both for hereditary (mostly infant) diseases, and following cancer diagnoses to personalise treatment. A regulatory framework has been developed for these tests, but quality assurance of private testing laboratories and training for health professionals are less well-developed and, most importantly, health coverage does not appear to be keeping pace with demand from patients and clinicians, and the cost-effectiveness of widespread use of genetic testing to personalise treatment (in particular cancer) does not appear to have been established. The area which generates the most concern when it comes to genomic medicine in Korea is the booming field of direct-to-consumer tests genetic tests.

## Introduction

In Korea, genomics is an exploding field: genomic research, large-scale genome genetic testing, genomic screening and diagnostic tests, precision medicine, and direct-to-consumer genomic testing, are significant areas of policy attention. This expanding domain could bring significant gains in Korea, from a deeper understanding of the population's genomic profile and disease risk, to earlier disease detection, and more effective treatment. There are, however, risks associated with the field of genomics, for example around the effective regulation of sensitive genetic information, ensuring equal access to cutting edge therapies, or ensuring that the use of genomics in health care is driven by the evidence-base, rather than potentially costly consumer or provider demand. This chapter will explore some of these issues, but this chapter will primarily take a public health focus, and address the extent to which genomics can be leveraged to improve population health and preventive care. The chapter will follow the definitions set out in Box 3.1; in this chapter the term 'precision medicine' is used to refer to the different applications of genomics (e.g. genetic testing or genome sequencing, precision or stratified medicine, or genomic research) in the health care and research field.

This chapter describes and assesses, in turn, the state of genomic research in Korea, the use of clinical genomics in Korea including genomic screening and precision medicine, and the field of direct-to-consumer genetic and genomic testing. Each section explores some of the strengths and shortcomings of the particular area of genomic use in Korea, with a focus on the implications for public health policy. A final section makes a series of recommendations for ways in which Korea could strengthen the use of genomics, with the objective of maximising the positive impact on population health.

## 3.1. Precision medicine and public health genomics

This chapter discusses the potential of public health genomics to improve public health and preventive health care in Korea. Other important applications of genomics such as therapeutics are considered where appropriate and relevant.

### *3.1.1. Precision medicine and public health genomics*

Over the last two decades, and particularly with the sequencing of the human genome and advances in informatics and a range of technologies, new possibilities have opened-up in the field of medicine allowing an increasingly precise consideration of variability in genes, environment, and lifestyle factors to determine individual risk of disease, and design optimal prevention and treatment strategies.

The field of genomics can be understood as the study of all of an organisms' genes and relationships between the genes; genetics addresses the functioning and composition of a single gene (WHO, 2016[1]). In health, genomics is being used in different ways, including around screening, testing, therapeutic development and treatment, policies and research, related to the human genome. The National Human Genome Research Institute in the United States defines genomic medicine as follows: "Genomic medicine is an emerging medical discipline that involves using genomic information about an individual as part of their clinical care (e.g. for diagnostic or therapeutic decision-making) and the health outcomes and policy implications of that clinical use." (National Human Genome Research Institute, 2016[2]). Public Health Genomics has been understood as the integration of genomic-based knowledge into public health policy and population health (Boccia et al., 2009[3]; Bellagio Statement, 2005[4]; Burke et al., 2006[5]). For example, public health genomics could include the integration of population-based information on genetic variation and gene-environment interactions to develop stronger health improvement and disease prevention. There are a number of common terms in the field of genomics, including precision medicine, stratified medicine, and genetic counselling (see Box 3.1).

Along with the term public health genomics, this chapter primarily uses the terms 'precision' medicine, in particular following the definition established by the United Kingdom's Programme Coordination Group, and repeated in the OECD's 2017 publication on New Health Technologies (OECD, 2017[6]): "[refining] our understanding of disease prediction and risk, onset and progression in patients, informing better selection and development of evidence-based targeted therapies and associated diagnostics. Disease treatment and other interventions are better targeted to take into account the patient's genomic and other biological characteristics, as well as health status, medications patients are already prescribed and environmental and lifestyle factors" (OECD, 2017[6]; Innovate UK, 2016[7]).

### Box 3.1. Genomics and public health genomics – key terminology

There are a number of commonly used terms in the field of genomics, including precision medicine, stratified medicine, genomic medicine, or personalised medicines, some of which are equivalent.

**Precision medicine** is relates to the tailoring of therapies and interventions based on a patient's genomic and other biological characteristics (which can include health status, existing medications, environmental and lifestyle factors) (Phillips et al., 2014[8]; OECD, 2017[6]; Innovate UK, 2016[7]). Precision medicine can be used as an all-encompassing term that includes more specific terms, including personalised, stratified, and genomic medicine. Personalised medicine is a widely used term, but has been criticised for the suggestion that it entails the development of unique therapies designed for each individual, and amongst experts a preference for more specific terminology has emerged (Doble et al., 2017[9]). **Genomic medicine** is the use of genetic information (for instance gleaned from genomic sequencing) to a determine individuals' disease risk, diagnosis, and treatment. Genomics addresses all genes and their inter relationships, while genetics scrutinises the individual gene, its composition and functioning. **Genetic testing** looks at an individual's genetic code to identify changes – variants or mutations – which could indicate health conditions. Until recently genetic testing has been performed on a small number of known genes, for example analysis of genes known for determining certain cancer risks (for example BRCA1 and BRCA2), but recent developments have made it possible to rapidly sequence far larger amounts of DNA (Phillips et al., 2014[8]).

'**Sequencing'**, which is also referred to as **next-generation sequencing (NGS), parallel or high-speed sequencing** refers to a number of different modern technologies to sequence DNA and RNA much more quickly and cheaply than before. Sequencing includes targeted sequencing which targets one or two genes, including as a panel of multiple genes, whole exome sequencing which involves the DNA sequencing of the exome (about 1% of the genome), and whole genome sequencing (WGS) which entails the sequencing of the entire genome (about 22 000 genes) (Phillips et al., 2014[8]; Doble et al., 2017[9]; OECD, 2017[6]).

**Stratified medicines** refers to the grouping of patients based on their disease risk or likely responsiveness to treatment, based on the use of a biomarker diagnostic test to determine the target population (a biomarker is a biological molecule found in blood, other body fluids, or tissues that is a sign of a normal or abnormal process, or of a condition or disease) (Doble et al., 2017[9]; OECD, 2017[6]). Such a test is used to identify before or during treatment patients who are most likely to benefit from the corresponding medical product or patients likely to be at increased risk of serious adverse reactions. Biomarker diagnostics include single tests to establish risk or disposition to treatment, or as increasingly the case, multiplex tests testing several biomarkers simultaneously.

**Genetic counselling** can be used to understand an individual's disease risk, based on their family history, and an understanding of different hereditary risks, and patterns of genetic transmission. Genetic counselling does not need to involve genetic testing.

Sources: Phillips, K. et al. (2014[8]), "Genomic sequencing: assessing the health care system, policy, and big-data implications.", *Health affairs (Project Hope)*, Vol. 33/7, pp. 1246-53, http://dx.doi.org/10.1377/hlthaff.2014.0020; OECD (2017[6]), *New Health Technologies: Managing Access, Value and Sustainability*, OECD Publishing, Paris, https://dx.doi.org/10.1787/9789264266438-en; Innovate UK (2016[7]), *Mapping the UK Precision Medicine Landscape*, assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/853560/Precision_Medicines_Booklet_Final_Web_002_.pdf; Doble, B. et al. (2017[9]), *Prioritising the application of genomic medicine*, http://dx.doi.org/10.1038/s41525-017-0037-0.

Precision medicine is also an exploding field. Since 2003 and the mapping of the human genome the availability of genetic testing has grown rapidly; recent estimates suggest that there are currently 75 000 genetic tests on the market, and a further 10 are appearing on a near-daily basis (Phillips et al., 2018[10]). While developments in the field of genomics are potentially game-changing for patients – a recent study found that between 2013 and 2017, 48% of FDA-approved precision medicines could be considered 'breakthrough therapies' (Pregelj et al., 2018[11]) – these new and rapid developments nonetheless pose new challenge for health policy makers, many of which this chapter seeks to explore.

### *3.1.2. Precision medicine may advance preventive health care and public health more broadly*

Precision medicine can be used as a powerful diagnostic tool, to test for congenital abnormalities, inherited conditions, and diagnose other conditions.

For children born with a major congenital abnormality, around one third will have a genetic component such as Trisomy 21 (Down's Syndrome), and identification of the underlying genetic cause is important to understand prognosis, guide treatment decisions, and support parents when considering having additional children. Improving the detection rate of other genetic components for major congenital abnormalities – which again can guide treatment decisions and help parents when considering having additional children – requires more sophisticated tests, such as molecular karyotyping (where DNA probes are labelled with fluorescent tags, for example).

The development of genomic medicine, and in particular NGS, can also bring new perspectives on rare diseases, both at an individual level and at a population level (Wordsworth et al., 2018[12]). For example, Wilson's disease, which is caused by a gene mutation (of the ATP7B gene) results in copper accumulation in the liver, and can lead to hepatic, neurological or psychiatric symptoms (Jang et al., 2017[13]). A DNA-based screening approach is not only an effective diagnostic tool for Wilson's disease, but can also glean population-level insights, for example the finding that the carrier frequency of Wilson's disease in the Korean population is higher than previously thought (Jang et al., 2017[13]).

In terms of public health, the value of genomics is evident when tests can provide reliable information on individual risk of disease, which in turns can inform the design of targeted prevention strategies at the population level. For instance, using genomics to identify people carrying genetic mutations that predispose them to a very high risk of developing colorectal or breast cancer could allow screening programs to offer more aggressive screening and surveillance regimen to these groups (Pashayan et al., 2013). Or, genetic information could be combined with other forms of health information – for example traditional medical testing – as well as information about environmental and behavioural risks and context.

For some time there has been a general expectation that increased precision could offset other unnecessary tests and yield cost savings, and some evidence is beginning to emerge for cost-effective genetic screening interventions. For example, there is some evidence of the cost-effectiveness of using NGS panels for screening for Lynch syndrome, or screening for women at risk of hereditary breast cancer (Doble et al., 2017[9]). In general though there is still limited evidence for the cost-effective whole exome sequencing (WES) and whole genome sequencing (WGS) (Schwarze et al., 2018[14]).

However, at this point, common diseases including, but not limited to, cancers and many cardiovascular diseases, have been found to be more genetically complex than was first anticipated. To take an example, Ischaemic Heart Disease (IHD) has a hereditary component, but this information is less predictive than a range of traditional tests, including blood pressure, blood cholesterol or body mass index at determining IHD disease risk (Howson et al., 2017[15]; Khoury, Iademarco and Riley, 2016[16]). A 2018 systematic literature review found that evidence of the cost-effectiveness widespread use of WES and WGS is very limited (Schwarze et al., 2018[14]). To take another example, screening for some cancers can be informed by genetic screening, for example screening for hereditary mutations on the BRCA 1 and BRCA 2 genes, which are known to significantly increase cancer risks, especially for breast and ovarian cancer. Such screening can lead to increased screening (for example more frequent self-checks or mammography), preventive medication or even surgical intervention, which can be effective at significantly reducing risks from cancers arising from this specific mutation (see Box 3.3).

## 3.2. Genomic research and gene mapping in Korea

### *3.2.1. The National Biobank of Korea and gene mapping project*

Korea has one of the biggest biobanks in the world, the National Biobank of Korea and biobank network (Lee et al., 2012[17]; Cho et al., 2012[18]). Established in 2008, the biobank at the National Institute of Health, depends on a sophisticated network of 17 biobanks spread across Korea. Each regional biobank can secure and store the biospecimens, and inputs standardised samples and clinical information into the Human Biobank Information Systems (HuBIS) which is run by the National Biobank of Korea. Including specimens held in regional biobanks, the Korea Biobank Network (KBN) holds human biospecimens from more than 820 000 participants, from the general population and from diseased populations (around 50% of specimens are held at the National Biobank of Korea in Osong).

The information held includes human biospecimens – blood, body fluids, tissues, serum, plasma, and DNA – but also personal information related to health records, life style, family history and genetic information. The information and biospecimens have been collected through the Korean Genome Epidemiology Study (KoGES), Korea National Health and Nutritional Examination Survey, and other research project under the Korean National Institute of Health (Cho et al., 2012[18]). Resource information of human biospecimens and their related data have been shared through the web-based Korea Biobank Network (KBN) system. The biospecimens and related data stored in the biobanks can be used by researchers whose applications are approved by the Distribution Review Board. As of end-2017 an estimated 894 papers had been published using data and specimens from the biobank (KNIH, 2018[19]).

The National Biobank of Korea complies with the *Korean Bioethics and Safety Act* and the *Act on the Acquisition, Management, and Utilization of Bio-Resources for Research*; clear guidelines for sample integrity, including DNA, are established, and quality tests are encouraged for the regional biobanks (see (Lee et al., 2012[17]). All data is anonymised and shared securely, but in the case of disease-related biospecimens, the limited information from the individual's Electronic Medical Record (EMR) is periodically transferred to the Human Biobank Information Systems.

The first Korean individual genome sequence (SJK) and analysis results was published in 2009 (Ahn et al., 2009[20]). As part of the National Biobank of Korea, a number of large-scale genomic projects have been undertaken, including the Korean Genome Analysis Project (KoGAP) and the Korean Reference Genome (KRG). This effort, undertaken by the Center for Genome Science of the National Institute of Health (NIH) and the Centers for Disease Control and prevention (CDC), published whole genome sequencing for 622 Koreans by 2012, and had identified many newly detected Korean genetic variants. Another large scale genomic study, Korea Association Resource (KARE) and many researches utilised the biospecimens

secured through Korea Genome Epidemiology Study (KoGES) and Korea Biobank Project (KBP) (Cho et al., 2012[18]).

### *3.2.2. Using the Korean Biobank, Korean Genome Project and other genomic initiatives to strengthen population health knowledge*

The biobank is already generating significant research, some of which is clearly relevant to deepening understanding of public health risks in Korea. Since the establishment of the biobank research has looked at the relationships between genes and diseases, behaviour and environmental risks. KARE/KoGAP aims to identify genetic and environmental risk factors leading to the development of five common life-style-related diseases (i.e. obesity, diabetes, hypertension, osteoporosis, and metabolic syndrome) in a large number of Korean populations. (Lee et al., 2012[17]). KARE used 8 842 Korean DNA samples to identify genomes related to hypertension, the waist/hip ratio, and bone mineral density (Cho et al., 2012[18]; Kim et al., 2011[21]); another study highlighted previously unknown biological pathways for nine metabolic traits by combining the Korean genome information from the KARE project with data in BioBank Japan (Kim et al., 2011[21]). The biobank is also informing research around personalised medicine.

The Korean genome and epidemiology study (KoGES) is an example of the commitment of the Korean Government to harnessing the potential of precision medicine for public health. KoGES is funded by the Korean Government, delivered through the National Institute of Health (NIH), Centers for Disease Control and Prevention and the Ministry of Health and Welfare. It integrates six prospective cohort studies categorised into population-based and gene-environment model studies. The study aims to address the genetic and environmental aetiology of a number of common (chronic) diseases, such as type 2 diabetes, cardiovascular disease and cancer, as well as risk factors including hypertension, obesity and metabolic syndrome (Kim, Han and KoGES group, 2017[22]).

KoGES has already established a range of findings with potential relevance to public health, and public health policy, some of them drawing on information on genetic variants (Kim, Han and KoGES group, 2017[22]):

- Identification in genetic variants in Asian Korean populations associated with type 2 diabetes, blood pressure, waist-hip-ratio, bone mineral density and serum lipid level;
- Identification of protective factors for metabolic syndrome, including an increased baseline serum adiponectin level, and for diabetes (high plasma concentration of isoflavones in women, suggesting a beneficial effect of soy-based food intake);
- Demonstration that haemoglobin A1c (HbA1c) cut-off values of 5.9% and ≥ 5.6% can be effectively used to identify undiagnosed type 2 diabetesT2DM and an increased risk for disease incidence, respectively.

However, the translation of these findings into policy making and effective public health strategies seems under-developed, and it is not clear whether the Ministry of Health and Welfare are well-briefed on relevant research from the biobank.

### *3.2.3. Linkage of genetic information and other health system data is critical*

For genomic research, preventive interventions, and clinical application, precision medicine, linkage of genomic data with other health system data, and/or the inclusion of individual's genomic information in personal medical records as it becomes available, would contribute to a far richer information source and potentially greater relevance for public health genomics. At present, the Korean Biobank does not provide linkage of genomic data with other secondary data such as health or medical information.

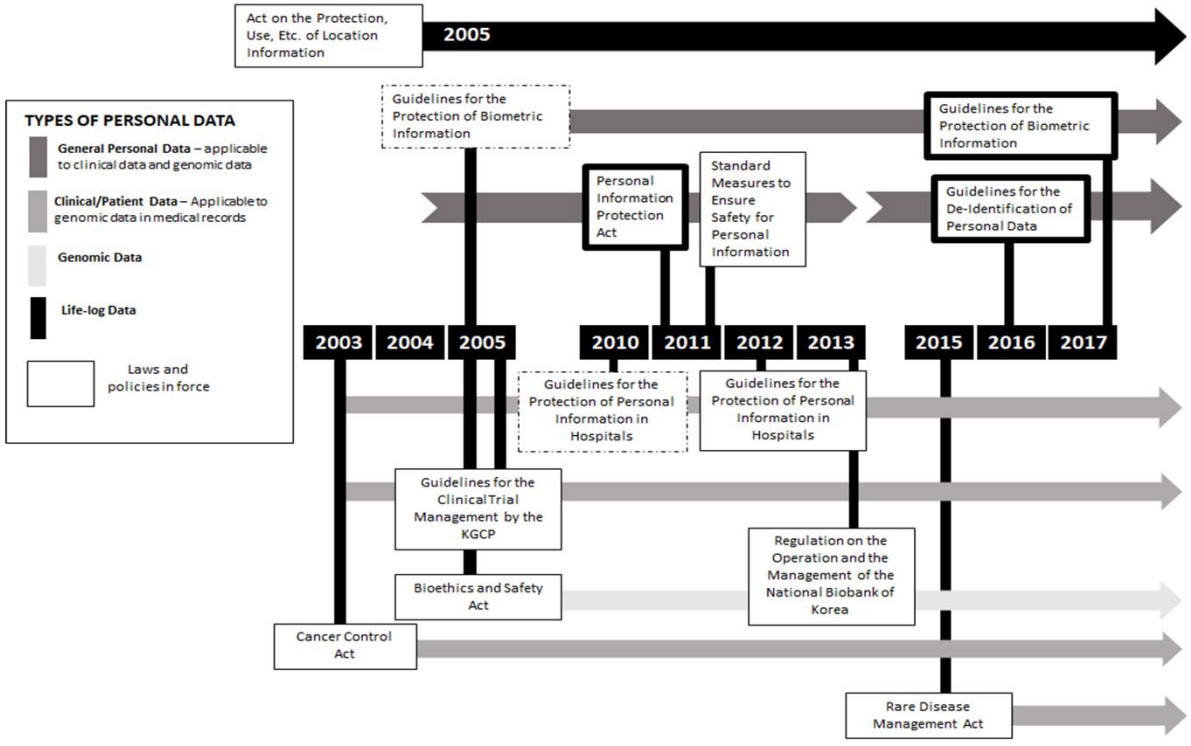
Korea has been identified as having one of the strongest health information systems in the OECD. In Korea around 80% of data sets covering at least 80% of the population, more than 90% of datasets sharing the same unique patient ID, and more than 70% of datasets regularly linked for research, statistics and/or

monitoring (OECD, 2015[23]). Korea's health data governance legislation allows relatively open sharing of (identifiable) personal health data amongst public authorities, but personal health data from the Health Information Regulation Agency (HIRA) cannot be shared outside of the public sector, including with academic institutions. De-identified data can be lawfully shared with researchers working in the public, academic and non-profit sectors.

Korea has an extensive legislative infrastructure for health data, although different sources of data are collected under different legislation, including for example a Cancer Management Act and a Genetic Management Act. Many of these individual Acts have clauses related to data sharing, while the Statistics Act covers data holdings (OECD, 2015[23]). Significant debates on information security and linkage are also ongoing, both in terms of data use for research and for clinical practice. The Korean government has made utility of its health data infrastructure a priority, including introduction of new guidelines on the protection of bio-information as recently as 2017 (see Figure 3.1) (Kim, Kim and Joly, 2018[24]).

## Figure 3.1. Data Protection and Regulation in Korea

Timeline of key Legislation around health data protection in Korea




Source: Author's elaboration based on Kim, Kim and Joly (2018[24]), "South Korea: in the midst of a privacy reform centered on data sharing", *Human genetics,* Vol. 137/8, pp. 627-635, http://dx.doi.org/10.1007/s00439-018-1920-1.

At present, information from Korea's biobank cannot be linked to HIRA or NIH data systems, even in an anonymised way. If it were possible to accelerate these connections, there is potential for this data to be a valuable source of research and a first step in establishing a big data system that includes genetic information.

## 3.3. The use of precision medicine for preventive interventions and public health

Genetic testing is widespread and increasing in Korea, both for hereditary (mostly infant) diseases, and following cancer diagnoses to personalise treatment. A regulatory framework has been developed for these tests, but quality assurance of private testing laboratories and training for health professionals are less well-developed. Most importantly, health coverage does not appear to be keeping pace with demand from patients and clinicians, and the cost-effectiveness of widespread use of genetic testing to personalise treatment (in particular cancer) does not appear to have been established.

### *3.3.1. Use of genomics in Korea*

The Korean Government's genomics policy is overseen by the Division of Bioethics Policy, in the Bureau of Public Health Policy, in the Office for Healthcare Policy in the Ministry of Health and Welfare (see Box 3.2). The primary legislation for the use of genomics in health care is the Bioethics and Safety Act (Republic of Korea, 2014[25]), which was amended extensively in 2012, and then further amended in 2015 to introduce further regulation on genetic treatment research. A National Bioethics Committee informed the revision of the law (Box 3.2).

### Box 3.2. Korea's Law on Bioethics and Safety

The National Bioethics Committee in Korea informs the Law on genetics, which appears to be relatively comprehensive. For example, the Law bans tests with low scientific evidence, and places restrictions on embryonic/in vitro testing (60 embryonic tests are currently allowed).

### Table 3.1. Ammendments to Korea's Bioethics and Safety Act

| Bioethics and Safety Act – original | Bioethics and Safety Act – amendment 29 December 2015 |
|---|---|
| Article 50<br><br>No genetic testing institution, other than a medical institution, shall conduct a genetic test in connection with the prevention, diagnosis, or treatment of a disease: Provided, That the foregoing shall not apply to a genetic test conducted at the request of a medical institution. | Article 50<br><br>No genetic testing institution, other than a medical institution, shall conduct a genetic test in connection with the prevention, diagnosis, or treatment of a disease unless it falls under the following cases:<br>1. Where it is requested by a medical institution;<br>2. Where it conducts a genetic test related to the prevention of a disease, the necessity* of which is recognized by the Minister of Health and Welfare.<br>If genetic testing is conducted by a genetic testing institution, other than a medical institution, the limitations and scientific basis of the test results should be specified in the result sheet and fully explained to the test subjects.<br><br>*Regulation on genetic test items that can be conducted directly by a genetic testing institution, other than a medical institution [Enactment Date June 20, 2016] [Ministry of Health and Welfare Notice No.2016-97]. |
| | Bioethics and Safety Act – further amendment SPRING 2019<br><br>Complete with further info, e.g. coverage of dementia testing |

Source: Republic of Korea (2014[25]), *Statutes of the Republic of Korea: Bioethics and Safety Act,* https://elaw.klri.re.kr/eng_mobile/viewer.do?hseq=33442&type=part&key=36.

With regards to genetic testing in the health system, with the use of certain clinical tests restricted. For example, testing for BRCA 1/2 can only be undertaken if breast cancer is detected or the individual has a strong family history of breast cancer. In general, genetic testing is usually used for hereditary diseases, and cancer diagnoses, in order to refine the cancer treatment approach. Overall the volume of genetic tests has been increasing in Korea, but there has not been a comprehensive study assessing this expansion, and concrete, quantitative evidence is hard to find. Current permitted tests are listed in Table 3.2.

### Table 3.2. Current permitted NGS Genetic Panel Testing in Korea

Disease area and gene permitted for testing in Korea

| Disease | Mandatory gene |
|---|---|
| Hereditary retinitis pigmentosa | PRPF31, RHO, RP1, RP2, USH2A, PRPH2, RPGR |
| Hereditary hearing loss | GJB2, POU3F4, SLC26A4, TECTA |
| Charcoal maritus disease | GJB1, MFN2, MPZ, PMP22 |
| Other hereditary diseases excluding the three mentioned above | None |
| Solid Cancer | HER2,EGFR,ALK,KRAS,NRAS,BRAF, BRCA1,BRCA2, KIT,PDGFRA,IDH1IDH2, MYC(C-myc),N-myc(MYCN) |
| Plasma cell tumour | NRAS, KRAS, TP53 |
| Acute myeloid leukaemia | CEBPA, FLT3, JAK2, KIT, NPM1, RUNX1, TP53, IDH1, IDH2 |
| Acute lymphocytic leukaemia | TP53, RB1, JAK2, NRAS, IKZF1 |
| Myelodysplastic syndrome, myeloproliferative tumours | ASXL1, CALR, CSF3R, DNMT3A, JAK2, MPL, RUNX1, SETBP1, SF3B1, SRSF2, TET2 |
| Malignant lymphoma | MYD88, BRAF, TP53 |

Source: Information supplied to the authors by the Korean Government, based on Ministry of Health and Welfare Notice No.2017-15.

Most genetic tests are not covered by Korea's National Health Insurance Service. Some genetic tests, for example for cancer, are covered by private insurance; around 68% of the population in Korea are covered by supplementary/complementary health insurance (OECD, 2017[26]). However, many tests are paid (at least partly) out-of-pocket. Next Generation Sequencing panel testing is sorted into two types, Level I and Level II, with different costs; Level I and Level II tests incur a 50% co-payment for the patient, with Level II tests having a higher price (see Table 3.3). For example, the co-payment rate for solid cancer is 50% in the case of progress, metastatic and recurrent cancers, but the co-payment rate rises 90% for some other cancer patients. Depending on the patient's condition, different co-payment rates apply to National Health Insurance rates. There are also some limits on the number of genetic tests that can be undertaken, so that the same individual cannot repeatedly request testing (either different or the same), for example one genetic test for hereditary diseases, and one genetic test for non-hereditary diseases. One additional genetic test is authorised in the case of recurrence and treatment failure (information reported to the OECD by the Korean Authorities).

### Table 3.3. NGS Testing levels and frequency permitted

Genetic tests included in different reimbursement categories

| | Hereditary | Non-hereditary |
|---|---|---|
| **Level I** | The number of genes is 2 to 30, or the gene length is 150 kb or less | The number of genes is 5 to 50 or the gene length is 150 kb or less |
| **Level II** | If the gene length exceeds 150kb or more than 31 genes, it is recognized only for hereditary retinitis pigmentosa, hereditary hearing loss, and Charcot maritus disease. | The number of genes is over 51 or the gene length is over 150 kb |
| **Frequency** | 1 time per disease | 1 time at diagnosis<br>However, in case of recurrence and treatment failure only one additional authorisation |

Source: Information supplied to the OECD based on Korea's National Health Insurance Service coverage.

There do not appear to be any guidelines in place – either for physicians or consumers – regarding the prescribing of genetic tests. This situation has the risk of creating incentives for hospitals to prescribe genetic tests in order to increase out-of-pocket payments, with little protection for patients who may not be in a position to assess the necessity of such a test. If genetic testing is to become a core part of the Korean medical landscape the government may wish to look for ways to provide coverage for tests that are evidence-based and with demonstrated clinical utility.

South Korea's Bioethics and Biosafety Act specifies that only medical institutions are permitted to undertake genetic testing connected with prevention, diagnosis or treatment, but an important exception exists if medical testing is requested by a medical institution, which allows for private companies to undertake processing of genetic test (Fukuda and Takada, 2018[27]). Indeed, in reality, much of the processing of genetic tests is undertaken by private laboratories, of which there are around 3-4 in Korea. Testing is prescribed by a doctor, and then run by private companies, who return the results to the doctors.

At present, there are no explicit or specialised quality checks in Korea around genetic tests. Genetic laboratories receive annual quality control management and accreditation from the Korea Institute of Genetic Test Evaluation (KIFTE). Currently, genetic tests are regulated as pharmaceuticals (manufactured reagents), and one NGS genetic testing panel is approved as a medical device.

The development of further regulations and/or quality check systems could be desirable. The development of further regulation around the use of genetic tests appears to be under consideration; Korea may wish to look to other OECD countries who have introduced certification and/or regulation systems for precision medicine. However, it is worth stressing that across OECD countries (and beyond) genetic testing is a relatively emergent area; in some instances technology has out-paced regulatory frameworks, or will soon out-pace newly established provisions (Table 3.4).

### Table 3.4. Regulation around the provision of genetic testing in select OECD countries, 2018

Requirements for the provision of genetic testing in OECD countries

| Country | Provision of genetic testing | | |
|---|---|---|---|
| | Involvement of health professionals | Genetic counselling | Informed consent |
| Austria | ✓ | ✓ | ✓ |
| Belgium | | | |
| Canada | | | |
| France | ✓ | ✓ | ✓ |
| Germany | ✓ | ✓ | ✓ |
| Japan | | | |
| Portugal | ✓ | ✓ | ✓ |
| South Korea | ✓ | | ✓ |
| Switzerland | ✓ | ✓ | ✓ |
| United Kingdom | | | ✓ |
| United States* | No federal legislation but covered in state law | | No federal legislation but covered in state law |

Source: Adapted from Fukuda, R. and F. Takada (2018[27]), "Legal regulations on health-related direct-to-consumer genetic testing in 11 countries", Kitasato Med J, Vol. 48, pp. 52-59, http://mlib.kitasato-u.ac.jp/homepage/ktms/kaishi/pdf/KMJ48-1/KMJ48-1p52-59.pdf.

### *3.3.2. The clinical genetics workforce in Korea genetic literacy amongst physicians*

Overall, Korea has lower numbers of health professionals than the OECD average, and shortages of health professionals are a preoccupation for the Ministry of Health and Welfare. For example, in 2017 Korea had 2.2 physicians per 1 000 population compared to the OECD average of 3.4, and 5.9 nurses per 1 000 population compared to the OECD average of 9.0 (OECD, 2017[26]). Numbers of health professionals are

rising faster than average OECD-wide, but numbers of medical graduates remain well below the OECD average.

There is no clinical geneticist specialisation in Korea. Some specialisations have components of genetic training. Some graduate schools have genetics programmes, but they are not licenced by the government. There are 10-20 nurses who work on genetic medicine across the country. There are 36 genetic counsellors in practice in Korea, and 27 in training.

At present it is not possible to identify the number of graduate schools which have genetics programmes, the extent of 'genetic graining' in basic medical training or the options for genetics or precision medicine training in continuing professional development.

### *3.3.3. Using precision medicine for public health interventions*

The Korean Government has clearly been making public health genomics a priority, and has been investing in research to try to operationalise genetic insights for public health. However, the government's focus appears to be the development of new treatments rather than preventive interventions.

For example, in 2017 the Korean Government invested KRW 63.1 billion (roughly USD 55.7 million) in developing precision medicine in a project led by Korea University to run until 2021 (Korea Biomedical Review, 2017[28]). The focus of this work is on developing personalised cancer treatments, starting with the analysis of the genetic information of 10 000 cancer patients. Related trials will also try to improve access to new forms of therapies, expanding indications of already-approved drugs.

However, despite investment in elaboration of some regulatory provisions, and investment in research activities, there seem to be clear translation strategy to integrate the findings of the existing research into effective precision medicine or public health policies.

## 3.4. The use of direct-to-consumer (DTC) testing

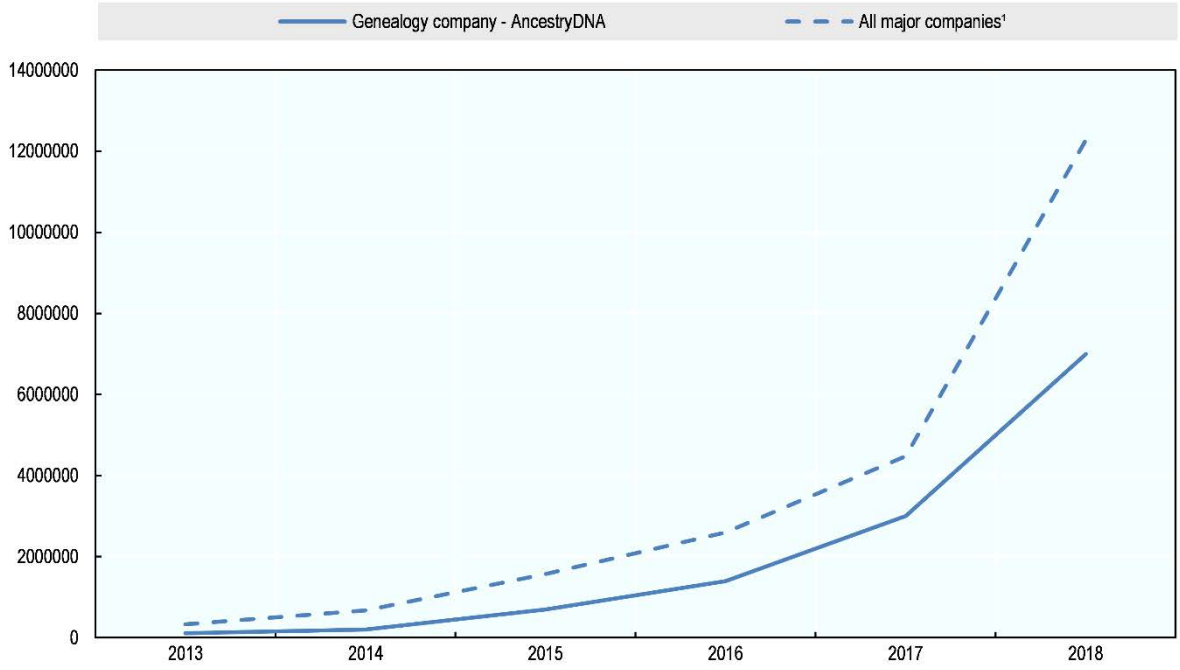
The area which generates the most concern when it comes to genomic medicine in Korea is the booming field of direct-to-consumer (DTC) genetic tests. At present, Korea allows a relatively limited number of DTC genetic tests, which give information such as genetic traits linked to blood pressure, cholesterol, skin elasticity, or hair loss. Cosmetic information for example on skin health or type. In early 2019 the Government agreed to explore the introduction of a further suite of DTC genetic tests for 13 diseases, such as coronary artery disease, hypertension, type-2 diabetes, stroke and a number of cancers. This section explores the current evidence base for the impact of DTC genetic tests on consumers' health behaviour, their effectiveness as tools to promote good health and prevent disease, and the potential risks to the population and to the health system associated with expanding the DTC genetic test market.

### *3.4.1. DTC genetic testing availability and regulation*

Direct-to-consumer (DTC) testing allows people to access information about their genetic makeup without passing through a medical professional. DTC can make available health-related and non-health-related genetic information, for example vulnerability to certain diseases, or information on ancestry. In the past several years DTC genetic tests have more and more available in many OECD countries, oftentimes with regulation struggling to keep up with shifting supply, and indeed consumer interest and demand (see Figure 3.2). While the rate of testing by consumer genetic companies appears to have increased in Korea in recent years, official data tracking this trend is not available.

## Figure 3.2. Rate of testing by consumer genetics companies in the United States 2013-2018

Total number of people tested, in millions




[1] Genealogy services operating in the United States

Source: Data based on MIT Technology Review (2018[29]), 2017 was the year consumer DNA testing blew up - MIT Technology Review, https://www.technologyreview.com/s/610233/2017-was-the-year-consumer-dna-testing-blew-up/ (accessed on 18 April 2019).

DTC tests are advertised as able to offer benefits ranging from satisfying curiosity in ancestry or heritage, to improving individual's understanding of their health, and improving health-promoting behaviours. The suggested benefits of greater access to DTC genetic tests include changing consumer behaviour, for example seeking to improve diet if shown to have an elevated genetic risk of obesity or high cholesterol. Genetic testing showing elevated disease risk could also lead to more targeted preventive actions, for example more frequent cholesterol testing, or more frequent mammography. A recent systematic review and meta-analysis of health behaviour change following a DTC genetic test showed that on average 23% of the included studies participants reported a positive lifestyle change after undertaking the test – including 12% reporting improved dietary and exercise practices and 19% quitting smoking (Stewart et al., 2018[30]).

Some genetic tests, including those which in some countries are now available as DTC tests, have led to preventive operations, for example preventive mastectomies for individuals with BRCA1/2 gene (see Box 3.3).

### Box 3.3. Genetic testing for BRCA 1/2

Breast cancers due to mutations in the BRCA 1 and 2 genes represent one of the best illustration of the health benefits that genomic medicine could bring through targeted screening and prevention. BRCA 1 and BRCA 2 are two genes producing tumour suppressing proteins; mutations in these genes can lead to an elevated life-time risk and early onset of breast and ovarian cancers. It is estimated that 69-72% of women with a harmful BRCA 1 or 2 mutation will develop breast cancer before the age of 80, compared to 12% of women in the general population; an estimated 17-44% of women with a harmful mutation will develop ovarian cancer by the age of 80, compared to 1.3% of women in the general population (Kuchenbaecker et al., 2017[31]; Howlader et al., 2017[32]).

Many OECD countries, including Korea, offer BRCA gene testing under certain circumstances, for example following a diagnosis of breast cancer especially at a young age, family history of breast or ovarian cancer, or ethnic risk factors (notably the Ashkenazi Jewish ethnicity has a known vulnerability) (Walsh et al., 2017[33]). Testing can help tailor treatment if cancer has already developed, and can help women take certain steps to manage their risk of developing cancer in the event of a positive diagnosis, for example increased screening, preventative medication, or even risk-reducing surgery.

Some countries, and some DTC genetic testing companies, allow testing for BRCA mutations outside of medical establishments. This is not currently the case in Korea. BRCA is perhaps one of the best known genetic tests, in part due to the good understanding of the related risks, but also since American actress Angelina Jolie publicly discussed her own experience as a BRCA carrier, and the preventive surgery she underwent as a consequence (Liede et al., 2018[34]; Evans et al., 2014[35]). Consumer interest in the test is understandable, and appears to have had an impact in Korea also, with a rise in BRCA testing rate (Lee et al., 2017[36]).

However, DTC genetic testing for BRCA mutations come with some risks. DTC genetic tests can be inaccurate. Schleit et al. (2019[37]) detail the experience of one woman with a family history of breast cancer, for whom a DTC tested negative for BRCA markers, but for whom a clinical molecular genetic test showed she was a mutation carrier. DTCs often cover a narrow range of the known BRCA1/2 mutation, and can be based on a narrow ethnic sample of genetic data (Breast Cancer Action, 2018[38]; Schleit, Naylor and Hisama, 2019[37]; The New York Times, 2019[39]). The test results can also cause emotional distress – in the case of a positive result – or even patient harm – should a negative result appear which in fact is later found to be inaccurate (The New York Times, 2019[39]).

Finally, BRCA 1/2 testing does not lead to a straightforward treatment or preventive solution. For example, preventive mastectomy may not be warranted in all circumstances, and the advantage of such an approach would need to be carefully weighed against other factors such as previous cancer diagnoses or family history (McGee et al., 2017[40]; Yang et al., 2016[41]; Boccardo and Gentilini, 2016[42]). Assessing the appropriate preventive or treatment strategy should happen with appropriate input and guidance from medical professionals (Singer et al., 2019[43]; Rutgers et al., 2019[44]); the risk of DTG genetic tests is that this support is not readily available.

Sources: Kuchenbaecker, K. et al. (2017[31]) , "Risks of Breast, Ovarian, and Contralateral Breast Cancer for BRCA1 and BRCA2 Mutation Carriers", *JAMA*, Vol. 317/23, p. 2402, http://dx.doi.org/10.1001/jama.2017.7112; Howlader, N. et al. (2017[32]), *SEER Cancer Statistics Review, 1975-2014, National Cancer Institute*, SEER, Bethesda, MD., http://seer.cancer.gov; Walsh, T. et al. (2017[33]), "Genetic Predisposition to Breast Cancer Due to Mutations Other Than BRCA1 and BRCA2 Founder Alleles Among Ashkenazi Jewish Women", *JAMA oncology*, Vol. 3/12, pp. 1647-1653, http://dx.doi.org/10.1001/jamaoncol.2017.1996; Liede, A. et al. (2018[34]), "Risk-reducing mastectomy rates in the US: a closer examination of the Angelina Jolie effect", *Breast Cancer Research and Treatment*, Vol. 171/2, pp. 435-442, http://dx.doi.org/10.1007/s10549-018-4824-9; Evans, D. et al. (2014[35]), "The Angelina Jolie effect: how high celebrity profile can have a major impact on provision of cancer related services", *Breast Cancer Research*, Vol. 16/5, p. 442, http://dx.doi.org/10.1186/s13058-014-0442-6; Lee, J. et al. (2017[36]), "Influence of the Angelina Jolie announcement and insurance reimbursement on practice patterns for hereditary breast cancer", *Journal of Breast Cancer*, Vol. 20/2, pp. 203-207, http://dx.doi.org/10.4048/jbc.2017.20.2.203; Schleit, J., L. Naylor and F. Hisama (2019[37]), "First, do no harm: direct-to-consumer genetic testing", *Genetics in Medicine*, Vol. 21/2, pp. 510-511, http://dx.doi.org/10.1038/s41436-018-0071-z; Breast Cancer Action (2018[38]), *FDA-Approved Breast Cancer DNA Test by 23andMe May do More Harm than Good | Breast Cancer Action*, https://bcaction.org/, https://bcaction.org/2018/03/07/fda-approved-breast-cancer-dna-test-by-23andme-may-do-more-harm-than-good; Schleit, J., L. Naylor and F. Hisama (2019[37]), "First, do no harm: direct-to-consumer genetic testing", *Genetics in Medicine*, Vol. 21/2, pp. 510-511, http://dx.doi.org/10.1038/s41436-018-0071-z; The New York Times (2019[39]), *Don't Count on 23andMe to Detect Most Breast Cancer Risks, Study Warns*, https://www.nytimes.com/2019/04/16/health/23andme-brca-gene-testing.html (accessed on 18 April 2019); McGee, J. et al. (2017[40]), "Risk of breast cancer after a diagnosis of ovarian cancer in BRCA mutation carriers: Is preventive mastectomy warranted?", *Gynecologic Oncology*, Vol. 145/2, pp. 346-351, http://dx.doi.org/10.1016/J.YGYNO.2017.02.032; Yang, Y. et al. (2016[41]), "The rise in bilateral mastectomies: Evidence, ethics, and physician's role", *The Breast*, Vol. 29, pp. 160-162, http://dx.doi.org/10.1016/J.BREAST.2016.07.024; Boccardo, C. and O. Gentilini (2016[42]), "Contralateral risk reducing mastectomy in patients with sporadic breast cancer. Benefits and hazards", *European Journal of Surgical Oncology (EJSO)*, Vol. 42/7, pp. 913-918, http://dx.doi.org/10.1016/J.EJSO.2016.04.054; Singer, C. et al. (2019[43]), "Genetic counselling and testing of susceptibility genes for therapeutic decision-making in breast cancer—an European consensus statement and expert recommendations", *European Journal of Cancer*, Vol. 106, pp. 54-60, http://dx.doi.org/10.1016/J.EJCA.2018.10.007; Rutgers, E. et al. (2019[44]), "European Breast Cancer Council manifesto 2018: Genetic risk prediction testing in breast cancer", *European Journal of Cancer*, Vol. 106, pp. 45-53, http://dx.doi.org/10.1016/J.EJCA.2018.09.019.

In the United States, '23andMe' is perhaps the best-known DTC genetic test, which provides information about ancestry, as well as about health predispositions to a variety of condition such as type 2 diabetes, BRACA1/2, celiac disease, late-onset Alzheimer's, and Parkinson's disease (23andme, 2019[45]). 23andme tests can also give information about 'how genes play a role in well-being and lifestyle choices', for example sleep or weight, as well as carrier status for cystic fibrosis, sickle cell anaemia, or hereditary hearing loss. Background information on carrier status testing and genetic health risk testing is provided, including encouragement to speak to a genetic counsellor before and after testing, but this is not required and 23andMe does not provide this service. 23andMe is regulated as a medical device by the United State's FDA, setting requirements for analytical performance, clinical validity, and access to genetic counselling services (Fukuda and Takada, 2018[27]), although in a number of other countries where 23andMe is operating it is not regulated as a medical device.

Given the diversity of regulation across countries for this single company, it is unsurprising that there is significant diversity between OECD countries when it comes to legal regulations for DTC genetic testing services. In Austria, France, Germany and Switzerland DTC genetic testing was, in 2018, prohibited, although at the time of writing some international DTC genetic testing companies were shipping to all these states. Regulation in Belgium, Canada, Japan, and the United Kingdom does not cover these tests, while in South Korea and the United States limitations are in place (Table 3.5).

### Table 3.5. Laws and policies on regulating health-related DTC genetic testing without health professionals' involvement, 2018

| Country | Legal regulations for DTC Genetic testing services |
|---|---|
| Austria | Prohibited |
| Belgium | No direct application |
| Canada | No direct application |
| France | Prohibited |
| Germany | Prohibited |
| Japan | No direct application |
| Portugal | Prohibited |
| South Korea | Limitations on certain genetic tests |
| Switzerland | Prohibited |
| United Kingdom | No direct application |
| United States* | Limits certain genetic testing including requiring a premarket review |

Source: Adapted from Fukuda, R. and F. Takada (2018[27]), "Legal regulations on health-related direct-to-consumer genetic testing in 11 countries", Kitasato Med J, Vol. 48, pp. 52-59, http://mlib.kitasato-u.ac.jp/homepage/ktms/kaishi/pdf/KMJ48-1/KMJ48-1p52-59.pdf.

The potential risks of weak regulation of DTC genetic tests should not be underestimated, both in terms of the range of tests which are permitted, and the accuracy of the results. To take the example of BRCA1/2 testing, which is not currently permitted in Korea (see 3.4.2), criticisms have included that testing may encourage medically unnecessary preventive surgeries, and that existing tests cover only a narrow range of known mutations potentially leading to an under-estimation of risk, or that tests are not accurate (Breast Cancer Action, 2018[38]; Schleit, Naylor and Hisama, 2019[37]). Schleit et al. (2019[37]) detail the experience of one woman with a family history of breast cancer, for whom a DTC test did not show up positively for BRCA markers, but for whom a clinical molecular genetic test showed a genetic risk. Some studies have suggested that discrepancy in DTC and clinical genetic testing is relatively commonplace (Tandy-Connor et al., 2018[46]).

### *3.4.2. DTC genetic testing availability and regulation in Korea*

In June 2016, Korea allowed direct-to-consumer (DTC) genetic testing on 42 genes (Jeong, 2017[47]), see also Table 3.6. Direct-to-consumer testing in Korea is regulated under the Bioethics and Safety Act, under provisions for testing undertaken other than in a medical institution (see Box 3.2, Korea's Bioethics and Safety Act). Regulation of DTC functions under a 'positive list' for genetic tests that covers genetic test items that can be conducted directly by a genetic testing institution, other than a medical institution. Limitations are placed on certain genetic tests, for example tests predicting physical characteristics or personality traits, tests lacking in scientific evidence, or tests which are forbidden by Presidential Decree following review by the National Committee (Fukuda and Takada, 2018[27]).

Currently, the DTC genetic tests allowed in Korea focus on many cosmetic dimensions (for instance hair loss, skin elasticity, hair thickness). However, other tests such as those showing an odds-ratio for BMI level, for cholesterol or blood pressure, could give consumers some information about their health status or "risks". However, it is not clear how useful this information is. At best, this information could encourage healthier behaviours, but at worst, could constitute a serious public health risk if it leads people to under- or over-estimate their susceptibility to particular health conditions, which might in turn them to engage in risky behaviours or undertake unwarranted medical procedures.

### Table 3.6. Genetic test items that can be conducted directly by a genetic testing institution (outside of medical institutions), 2018

Direct to consumer tests allowed in Korea showing what the DTC tests for, the number of genes included in the test, and the individual genes

| Test Item (Number of Genes) | Gene |
|---|---|
| BMI(3) | FTO, MC4R, BDNF |
| Concentration of triglycerides(8) | GCKR, DOCK7, ANGPTL3, BAZ1B, TBL2, MLXIPL, LOC105375745, TRIB1 |
| Cholesterol(8) | CELSR2, SORT1, HMGCR, ABO, ABCA1, MYL2, LIPG, CETP |
| Blood sugar(8) | CDKN2A/B, G6PC2, GCK, GCKR, GLIS3, MTNR1B, DGKB-TMEM195, SLC30A8 |
| Blood pressure(8) | NPR3, ATP2B1, NT5C2, CSK, HECTD4, GUCY1A3, CYP17A1, FGF5 |
| Pigmentation(2) | OCA2, MC1R |
| Hair loss(3) | chr20p11(rs1160312, rs2180439), IL2RA, HLA-DQB1 |
| Hair thickness(1) | EDAR |
| Skin aging(1) | AGER |
| Skin elasticity(1) | MMP1 |
| Vitamin C concentration(1) | SLC23A1(SVCT1) |
| Caffeine metabolism(2) | AHR, CYP1A1-CYP1A2 |

Source: Information supplied to the OECD by the Korean Authorities.

Even following the 2016 decision by Korea to allow DTC genetic testing on a limited number of genes, a survey the same year indicated that enthusiasm for genetic information amongst Korean consumers was significant (Jeong, 2017[47]). This survey suggested that Korea consumers were also interested in having access to a wider range of genetic information than the existing 42 gene DTC genetic tests permitted.

In early 2019, the Korean Government announced a significant expansions of allowed DTC genetic tests. From the initially allowed DTC tests (Table 3.6), the expansion will cover 13 diseases, including coronary artery disease, atrial fibrillation, hypertension, type-2 diabetes, stroke and osteoarthritis, prostate, colorectal, stomach, lung and liver cancer, Parkinson's disease and macular degeneration (Korea Biomedical Review, 2019[48]). This move followed a request by the biotech firm Macrogen for expansion in permitted DTC genetic testing; the government declined the request to include breast cancer and dementia testing, and suggested that further review was needed on testing for late-onset Alzheimer's. Initially the expansion will be to a 'demonstration project' for 2 000 adults, across two years, after which the project will be reviewed. Easing of the DTC market was anticipated, by the Korean Labor institute, to lead to an expansion in sales for the industry of 503%, a growth in investment of 458%, and a growth in jobs of 45% over ten years (Business Korea, 2019[49]).

While legislation in Korea limits the genes that can be tested, quality control of DCT genetic tests appears to be weak. While genetic tests within the health system are relatively tightly regulated, licensing requirements for DTC are less strict, and quality controls are weaker. In Korea DTC genetic tests are not regulated as medical technologies.

Weak legislation means that the accuracy of DTC genetic tests cannot necessarily be assured. Some medical professionals, and research papers, have raised concerns about the accuracy of DTC genetic tests (Kim et al., 2014[50]; Jeong, 2017[47]; The New York Times, 2019[39]; Moscarello et al., 2019[51]), and anecdotal reports have suggested that private DTC genome testing generated results inconsistent with those of medical laboratories in Korea. With the broadening of permitted genetic testing to include a significant number of health conditions consequences of inaccurate testing could be considered to increase. Some inherent risks based on methodology should also be considered, for example the ethnic representativeness of comparator populations in the Korean context (Kim et al., 2014[50]; The New York Times, 2019[39]).

### 3.4.3. Weak regulation of DTC genetic testing could constitute a privacy risk

The potential privacy risks from DTC genetic test consumers should be considered, especially given that regulation of providers at present appears to be weak (Hendricks-Sturrup, Prince and Lu, 2019[52]).

Firstly, consumers are potentially sharing significant amounts of sensitive personal medical data with a private company, for which monitoring and quality assurance is currently weaker than for traditional medical providers. This data should be protected under the Personal Information Protection Act and the Bioethics and Safety Act. However, without sufficient steps to secure personal data, leaks and hacks become more likely. While the legal framework in Korea should protect consumer's data, it is not clear that DTC genetic testing companies are checked for their data protection standards, or would be held to the same standards as medical institutions when it comes to data handling.

Secondly, consumers' data may be used in a way that they were not fully aware of. Jeong (2017[47]) points to a potential regulatory loophole, wherein a company could analyse genes or store genes not currently allowed to be tested or stored, and/or share or sell analysis results with third parties. Although the current legislative framework prohibits such activity, the current regulatory and monitoring architecture may not be sufficient to dissuade or catch any such activities.

Even without such actions, consumers may consent to the use of their data in a way that they did not fully understand, perhaps given lengthy terms and conditions or disclaimers which were difficult to fully grasp. DTC genetic testing can generate huge genetic databases, which have potential to be extremely valuable for research, including for private companies. Databases might include not just the genetic testing results, but also the (linked or otherwise) results of any background information that the consumer has filled out. For example, 23andMe has established significant partnerships with major pharmaceutical companies (Check Hayden, 2017[53]; Time Magazine, 2018[54]; GSK, 2018[55]; Forbes, 2018[56]).

### 3.4.4. Potential risk to consumers and the health system from DTC genetic testing

Direct-to-consumer testing is a growing industry, and it appears that the situation in Korea is no exception. Consumer enthusiasm is high, and companies are growing and multiplying to meet that demand. Proponents of DTC genetic testing defend both a normal curiosity about heritage, ancestry, and health status, and even point to the potentially positive impact on health behaviours. However, understanding of the test results is not straightforward, and there are several ethical considerations that should be considered. Even if DTC genetic testing was consistently accurate, the risk of presenting individuals with information that they do not understand or that they cannot act upon, could result in considerable emotional distress.

First, there is good reason to question the ethics of making widespread testing available for diseases for which there is not (yet) an effective cure, especially if support to interpret and understand the consequences of the results is not systematically in place (Roberts and Uhlmann, 2013[57]). Second, presenting individuals with information that they do not understand, that is difficult to interpret, or which needs further contextual information to improve understanding, risks causing emotional distress (Rutgers et al., 2019[44]; Singer et al., 2019[43]; Wang et al., 2018[58]); a 2018 study in the Netherlands found that individuals with lower knowledge of genetic principles were more likely to consider and/or intend to undergo DTC genetic testing (Stewart et al., 2018[59]). In Korea, some DTC genetic tests show odd-ratios between the risk of developing a disease based on genetic variants, and population risks, to present a relative risk ratio. For even an educated and relatively well-informed consumer, such information can be extremely hard to understand.

In addition, the potential additional burden to the health care system, generated by an expanded DTC genetic test market, should also not be under-estimated. The health system and medical professionals specifically may come under increasing pressure to make secondary testing available to check DTC genetic test results (Moscarello et al., 2019[51]), interpret results, or even provide care that may not be medically necessary. Recent evaluations of the DTC genetic testing market in the United States have suggested that 20-30% of consumers share their genetic test data with health care providers (Wang et al., 2018[58]; Stewart et al., 2018[30]); if DTC

genetic tests in Korea grew to similar levels of popularity as in the United States, and consultation with health care providers followed a similar pattern, this would constitute a significant extra burden on the health system. A 2016-17 survey in Korea suggested that Korean physicians expressed concerns about the impact of DTC genetic tests, and appeared sceptical about potential expansion (Eum et al., 2018[60]).

Taken to its most extreme, a test suggesting a protective trait for certain diseases could even lead individuals to engage in high-risk behaviours, for example in terms of tobacco consumption or sedentarism. The public health benefits of a genetic test which suggests a 'low risk of becoming obese', in a context where obesity rates are rising, seems negligible.

## 3.5. Strengthening the use of genomics for public health in Korea

### *3.5.1. Develop a national strategy on precision medicine*

Precision medicine is, clearly, an expanding field in Korea. The use of genetic testing in the medical field seems to be growing, and appetite for genetic testing amongst Korean consumers appears high. In many respects Korea appears to be ahead of OECD peers when it comes to managing the growing field of precision medicine. The legislative framework for genetic testing appears robust, and DTC genetic tests also fall under these regulations. Increases in DTC genetic tests are being approached in an appropriately cautious and stepwise way.

However, at present it does not appear that Korea has an overarching strategy in terms of harnessing the potential of precision medicine, increasing its positive impact on public health, or managing impacts on the health system. Korea should look to develop an overarching National Strategy for Precision Medicine, which would include consideration of issues such as:

- The particular characteristics of the Korean health system should be taken into consideration. Notably the relatively low rate of medical professionals, high rate of consultations, and absence of a primary care gatekeeper function; the potential impact of increased demand for care, for examine following DTC tests, from the Korean population should be considered;
- The need for a greater number of medical specialists in genetic medicine, and building genetic literacy amongst Korean medical professionals in general, for instance by including precision medicine as part of basic medical education or continuing education;
- Developing guidelines to clearly identify genetic tests that demonstrated both clinical validity and utility, and help clinicians to make informed decisions for their usage;
- Systematically evaluating the cost-effective of genetic tests and their use for prevention;
- Ensuring that cost-sharing requirements currently in place for medically-prescribed genetic tests do not cause inequalities in health care access.

Numerous other OECD countries have developed national strategies for precision medicine (or, for "genetic medicine" or "genomic medicine"), and could offer models for Korea to follow (see Box 3.4). In both Denmark and France the development of a national strategy was preceded by a stock-taking effort to understand the existing provision of, need for, and implications of expanding precision medicine. It would be important, as was the case in Denmark and France, for Korea to develop such a strategy through a multi-stakeholder consultation process. The objectives of different stakeholders may differ significantly: for example, the Korean population may see genetic testing as far more beneficial than Korean physicians, or Korean oncologists could be worried about exploding demand for unnecessary preventive interventions such as mastectomies, while patient groups for rare cancers might see genetic testing as a key weapon in better diagnosis and care. The stakeholder group developing Korea's National Strategy on Precision Medicine should have high level endorsement from the Korean government, and should also include stakeholders such as physicians and nurses, genetic counsellors, patient and/or consumer groups, researchers in the field, and representatives of industry.

### Box 3.4. National strategies for precision medicine – Australia, Denmark, France and the United Kingdom

The Australian Government announced the Genomics Health Futures Mission (GHFM) in May 2018, backed by a budget of AUD 500 million over 10 years, the GHFM is intended to help Australians live longer and better by funding health and medical research into improved testing, diagnosis, and treatment (Australian Government Department of Health, 2019[61]). The GHFM is also intended by Australia to be an opportunity to promote and build on the country's reputation as a leader in the field, both in terms of research and the implementation of genomic medicine. Initial investments under the GHFM have included AUD 20 million in a pilot research study of reproductive carrier screening for genetic conditions affecting children, AUD 20.4 million to produce the largest ever cancer proteome dataset, AUD 33.7 million a research projects grant round to answer complex genomics research questions in cancers including ethical, legal and social issues related to the use of genomics in health care, and AUD 32 million large scale flagship projects in pathogen genomics. In each area, there is also a focus on translating findings into health care usage, for example the pilot study of reproductive carrier screening is designed to inform how such screening can best be equitably and usefully offered to Australians, while the investment in pathogen genomics specifically focuses on demonstrating the clinical and/or public health utility, cost effectiveness, and capacity for research translation of pathogen genomics in mainstream healthcare. An independent Expert Advisory Committee is overseeing the GHFM and providing specialist knowledge and implementation advice to best support the objectives of the GHFM.

In France, the 'France Genomic Medicine Plan 2025' (*France Médecine Génomique Plan 2025)* was established by the French government in 2016 and will run until 2025, and is being coordinated by AVIESAN (*Alliance national pour les sciences de la vie et de la santé*, National alliance for human sciences and health) under the supervision of the Prime Minister. The Plan was developed with an ambition of assessing the current availability of, and prospect for evolution over ten years, access to diagnostic genetics in France. The plan was developed with input from representatives of genetic research, the health system and health insurance system, industry, research agencies, French central ministries, and a number of major universities. The plan identifies four major challenges (a potential revolution in public health care; the need for scientific and clinical research; technological pressures in particular around storing, sharing, and using data; and the economic impact) and three major objectives. The objectives are, firstly, to position France as an international leader in personalised and precision medicine, secondly to integrate genetic medicine into health care delivery and care, and thirdly the development of a genomic medicine sector capable of driving innovation and economic growth, including industry as well as academic and public partners (AVIESAN, 2016[62]). So far, the France Genomic Medicine Plan 2025 has led to the establishment of two high volume genetic sequencing platforms: SEQOiA supported by a coalition of hospitals (Public Assistance - Paris Hospitals, APHP), and research institutions Institut Curie and Institut Gustave Roussy; and AURAGEN supported by the Civils Hospices of Lyon, Grenoble University Hospital, Saint-Etienne University Hospital, Clermont-Ferrand University Hospital, the Léon Bérard Center, Jean Perrin Center and the Loire Cancer Institute (French Government, 2017[63]).

In Denmark, the National Strategy for Personalised Medicine 2017-2020 was established by the Danish National Government and the Danish Regions in 2017. The strategy focuses on establishing better and more targeted care for patients, stronger ethical, legal and safety regulations regarding the use of genetics in health care, the establishment of joint governance structures and stronger collaboration between health care and research in this field, building safe, collaborative and coherent technological infrastructure, and initiating relevant research and development projects. The Strategy was backed by an initial allocation of 100 million DKK (~16.1 million USD), with the expectation that developments

would be co-financed by public research resources, regional resources, and private actors (Danish Ministry of Health, 2017[64]).

The development of the plan was informed by a preliminary analysis project, in 2016, which assessed the professional, technical, ethical and financial implications of development of a Danish programme for personalised medicine. This analysis was undertaken by a steering committee of the Danish Ministry of Health (Chair), Danish Regions (Vice-chair), Ministry of Higher Education and Science, Ministry of Business and Growth and Ministry of Finance, and had a reference group which included representatives from health care, research, patient groups, academia and industry. The analysis considered the ethical and legal aspects related to using biological material and personal information, considered international experiences, and gathered Danish citizen's views towards personalised medicine and genetic tests (Danish Ministry of Health, 2017[65]).

The United Kingdom announced a new 'National Genomic Health Care Strategy' in February 2019, which aims to deliver a 'predictive, preventative and personalised health and care service for people with rare diseases'. Targeted to rare conditions, this strategy builds on the United Kingdom's existing projects in the area of genetic medicine, which includes offering whole genome sequencing to every adult and child with certain cancers and rare genetic conditions, and large-scale projects such as the 100 000 Genomes Project, and the NHS National Genomic Medicine Service. The strategy includes care delivery dimensions, such as a dedicated person to co-ordinate care, and detailed information on the condition, treatment regime and key expert contacts (Department of Health and Social Care (United Kingdom), 2019[66]).

Other OECD countries, including Canada, China, Germany, the United Kingdom, the United States have also national personalised medicine plans (see (OECD, 2017[6]; Garrido et al., 2018[67]; OECD, 2019[68]).

Sources: Australian Government Department of Health (2019), *Genomics Health Futures Mission*, https://www.health.gov.au/initiatives-and-programs/genomics-health-futures-mission (accessed on 29 January 2020); AVIESAN (2016), *France Médicine Génomique 2025*, Alliance nationale pour les sciences de la vie et de la santé, Paris, http://www.gouvernement.fr/sites/default/files/document/document/2016/06/22.06.2016_remise_du_rapport_dyves_levy_-_france_medecine_genomique_2025.pdf (accessed on 22 April 2019); French Government (2017), "Plan & France médecine génomique 2025; : lancement des 2 premières plateformes | Gouvernement.fr", https://www.gouvernement.fr/partage/9344-plan-france-medecine-genomique-2025-lancement-des-2-premieres-plateformes (accessed on 22 April 2019); Danish Ministry of Health (2017), *Preliminary Personalised Medicine Analysis 2016*, https://www.sum.dk/English/Healthcare-in-Denmark-An-Overview/Personalised-Medicine/Preliminary-Personalised-Medicine-Analysis-2016.aspx (accessed on 22 April 2019); Department of Health and Social Care (United Kingdom) (2019), "NHS must lead the world in genomic healthcare - GOV.UK", *gov.uk*, https://www.gov.uk/government/news/health-minister-nhs-must-lead-the-world-in-genomic-healthcare (accessed on 22 April 2019); OECD (2017), *New Health Technologies: Managing Access, Value and Sustainability*, OECD Publishing, Paris, https://dx.doi.org/10.1787/9789264266438-en; Garrido, P. et al. (2018), "Proposal for the creation of a national strategy for precision medicine in cancer: a position statement of SEOM, SEAP, and SEFH", *Clinical & Translational Oncology*, Vol. 20/4, p. 443, http://dx.doi.org/10.1007/S12094-017-1740-0; OECD (2019), *OECD Reviews of Public Health: Chile: A Healthier Tomorrow*, OECD Publishing, Paris, https://dx.doi.org/10.1787/9789264309593-en.

### *3.5.2. Ensure that quality assurance and regulation are robust*

Legislation around which actors can prescribe, undertake and finance (a limited number of) genetic tests appears to be well in-place in Korea. Equally, data privacy legislation should cover the data generated by the tests. However, most of the tests prescribed by medical institutions are processed by a limited number of private laboratories. At present Korea does not have a quality assurance system which ensures the safety and validity of these processes. Additionally, specific clinical guidelines to ensure quality at the point of clinical testing may be warranted. Establishing a comprehensive regulatory framework would make Korea a relative leader in this field, and is a process that could be undertaken in tandem with the

development of the National Strategy for Personalised Medicine, and with input from all relevant national (and international) agencies.

The WHO and the OECD give general guidance regarding the quality assessment of genetic tests, which would need to be adapted and specified to the Korean context and the evolving field (OECD, 2007[69]; WHO, 2016[70]):

- Quality should be assured throughout the process, from the pre-clinical phased including establishing whether a test is necessary, obtaining consent, and providing counselling, to sample retrieval, analysis in the laboratory, and interpretation of the results and sharing with the patients;
- Steps should be taken to ensure analytic validity (competency of the laboratory and assessment against standardised samples); clinical validity (predictiveness) of the test; and clinical utility;
- The regulatory structure for genetic tests should include 'what it ultimately means to interpret test results accurately and fairly, and who determines the standards to which the professionals, from lab technicians to counsellors, should be held… how, and by whom, these standards are maintained or enforced';
- Steps to measure the performance of laboratories, such as quality assurance accreditation, should be considered, and quality checks should extend to reporting practices;
- Education and training practices for laboratory personnel are key.

### *3.5.3. Strengthen data linkages*

To build on its already-strong health data information system, in the further development of precision medicine Korea should look to develop an integrated system of genome information with medical and patient information.

Going forward, data linkage should be a priority pillar of the Korean Government's approach to precision medicine. While the ethical questions around the management and use of genetic data must remain at the forefront, the field of precision medicine is an area where big data could be game-changing (Wordsworth et al., 2018[71]). For example, genomic information can be stored for research only, but cannot be linked to the HIRA and National Health Insurance databases, and is difficult to use in routine clinical care.

Additionally, despite the fact that the Korean Government appears to be strongly committed to Korea being a leader in genetic research, current data legislation strongly restricts sharing of (even de-identified) health data, which may limit Korea's capacity to participate in potentially fruitful international collaborative efforts (Wordsworth et al., 2018[71]).

### *3.5.4. Focus on building on genetic literacy amongst medical professionals and the Korean population*

As the importance of precision medicine in Korean health care grows, Korea should look to improve 'genetic literacy' amongst Korean health care professionals and the Korean population. Already there are signs that despite enthusiasm for DTC genetic tests in Korea (Jeong, 2017[47]), a small survey of the Korean population revealed low awareness of genetic risk factors for disease (Lee et al., 2018[72]). Another survey suggested that Korean cancer patients over-estimated the potential benefits of genetic testing, but that greater access to genetic testing was viewed in a strong positive light by general respondents (Eum et al., 2018[60]).

Improving genetic literacy amongst health care professionals would anticipate precision medicine playing a growing role in diagnosis in treatments in the decades, if not years, to come. Up-skilling professionals would also help them meet the increasing generic inquiries coming from patients, possibly prompted by DTC genetic tests that they had undertaken. Finally, improving professionals' genetic literacy could

harness understandings of genetic and hereditary disease risks to improve preventive care without necessitating and expansion in testing coverage (see Box 3.5).

Improving population health literacy can improve individuals' capacity to judge the pros and cons of different treatment options, reduce hospital use, adopt better preventive measures, and reduce health care costs (Moreira, 2018[73]). Low health literacy can also be expected to reduce consumers' ability to interpret DTC genetic tests, and understand how this information relates to their health behaviours, status, and care needs.

Korea ought to look for different ways to improve the 'genetic literacy' of health care professionals, and the Korean population. When it comes to health professionals, inclusion of modules in formal education or continuing education, or distribution of informational materials in the work place, or checks as part of quality assurance could be considered.

For the Korean population, a first step would be ensuring that easy to understand information about precision medicine, genetic tests prescribed by the health system, and the advantages and limitation of the existing range of precision medicine. Tools and information should be easy to read and understand (Wang et al., 2011[74]). Additionally, DTC genetic test companies, especially those included in the new suite of DTC genetic tests, should be required to provide similar information about the advantages, limitations and risks of the tests, clear information to help with the interpretation of test results, and details of genetic counselling services.

### Box 3.5. Tools to build literacy around disease risk for health providers and the general population

There are ways to leverage understanding of genetic and inherited disease risks without relying primarily on genetic testing. Family health history-based risk assessment can be used in primary care-equivalent settings, or even as a population education approach, to improve understanding of risk (Wu et al., 2019[75]).

A number of tools that can be embedded in primary practice, or for general access, can help understanding of family health history and disease risk. One example is MeTree, developed by the Duke Center for Applied Genomics and Precision Medicine, which gathers data entered by patients, for example on diet, exercise and smoking, but also on personal and family health history on cancer, cardiovascular syndromes, and other conditions (Wu et al., 2014[76]; Orlando et al., 2014[77]; Wu et al., 2013[78]; Wu et al., 2019[75]). The information collected can be accessed by the provider, but the tool also providers action-orientated information to the patient, including potentially relevant follow-up genetic test and pharmacogenomic tests.

Other tools are freely accessible online, and targeted at the general population to help building family health history for discussion with primary health providers. The Centres for Disease Control and Prevention have the "My Family Health Portrait" tool, endorsed by the United States Surgeon General, which gathers basic family history in 15 to 20 minutes, that is then collated in a format that is easily shared and discussed with health care providers and is compatible with integration into electronic health records (Centers for Disease Control and Prevention, 2018[79]). Other tools, including some recommended by the United States' National Human Genome Research Institute such as Family Health*Link*, give individuals an estimation of disease risk by reviewing patterns of disease such as cancer and heart disease in the family.

Sources: Wu, R. et al. (2014), "Quality of family history collection with use of a patient facing family history assessment tool", *BMC Family Practice*, Vol. 15/1, p. 31, http://dx.doi.org/10.1186/1471-2296-15-31; Orlando, L. et al. (2014), "Implementing family health history risk stratification in primary care: Impact of guideline criteria on populations and resource demand", *American Journal of Medical Genetics Part C: Seminars in Medical Genetics*, Vol. 166/1, pp. 24-33, http://dx.doi.org/10.1002/ajmg.c.31388; Wu, R. et al. (2019), "Implementation, adoption, and utility of family health history risk assessment in diverse care settings: evaluating implementation processes and impact with an implementation framework", *Genetics in Medicine*, Vol. 21/2, pp. 331-338, http://dx.doi.org/10.1038/s41436-018-0049-x; Wu, R. et al. (2013), "Patient and primary care provider experience using a family health history collection, risk stratification, and clinical decision support tool: a type 2 hybrid controlled implementation-effectiveness trial", *BMC Family Practice*, Vol. 14/1, p. 111, http://dx.doi.org/10.1186/1471-2296-14-111; Centers for Disease Control and Prevention (2018), *My Family Health Portrait|Public Health Genomics Knowledge Base*, https://phgkb.cdc.gov/FHH/html/index.html (accessed on 19 April 2019).

In terms of genetic counselling, this is considered by many countries as a critical part of clinical care, both before and after genetic countries, and is mandatory in countries such as Austria, Australia, France, Germany, Portugal and Switzerland (see Table 3.5). In Korea, genetic counselling is not required for patients undergoing genetic testing, and this may be an area where further examination and/or inclusion in clinical guidelines is warranted. Genetic counselling is not yet institutionalised in Korea.

### *3.5.5. Take a cautious approach to DTC genetic testing*

As set out earlier in this chapter, in early 2019 the Korean Government elected to expand the DTC genetic tests allowed in the country, subject to a two year demonstration period. This expansion includes allowing tests covering 13 diseases, including diabetes, several cancers, Parkinson's disease, and macular degeneration.

Following this decision, and in the context of a Korean population who appear enthusiastic about the expansion in the range of DTC genetic tests available (Jeong, 2017[47]; Eum et al., 2018[60]), the Korean Government should nonetheless proceed with caution. The potential risks to consumers and the health system from DTC genetic testing, including privacy risks, ethical risks, potential exposure of individuals to distressing information which they may struggle to understand, and possible increased strain on the health system, should all be given serious consideration during this demonstration period, and in any further decisions to expand the DTC genetic test market. Additionally, robust processes ought to be put in place to ensure the quality of DTC genetic tests, protection of consumer data, the comprehensibility of information about the tests and about the results.

### *3.5.6. From a public health perspective, 'traditional' approaches to preventing ill-health still have the strongest evidence-based*

In a relatively small number of cases, precision medicine can have a transformative impact. For example, WGS can be a powerful tool for diagnosing rare infant diseases, and understanding of how some gene mutations can cause breast cancer can strengthen the potential of preventive interventions and the effectiveness of treatments. However, the impact of precision medicine for public health, prevention, or even diagnosis remains narrow. Precision medicine approaches cannot, at this stage, form the basis of a country's public health or preventive strategy.

The evidence base for 'traditional' approaches to public health and disease prevention, meanwhile, is far more robust. Interventions such as those detailed in Chapters 1 and 2, for instance restricting alcohol sales, using educational approaches to change drinking patterns, or reviewing pricing and taxation policies, have been well-established as evidence-based and in many instances cost-effective.

## Conclusion

In Korea, genomic medicine is an exploding and popular field: genomic research, genetic testing and precision medicine, and direct-to-consumer genetic testing, are significant areas of policy attention, while in terms of genomic research, Korea has the biggest biobank in Asia and one of the biggest in the world. Genetic testing is widespread and increasing, both for hereditary (mostly infant) diseases, for some cancers where there is a strong family history, and following cancer diagnoses to personalise treatment. A regulatory framework has been developed for these tests, but quality assurance of private testing laboratories and training for health professionals are less well-developed and health coverage does not appear to be keeping pace with demand from patients and clinicians. The cost-effectiveness of widespread use of genetic testing to personalise treatment (in particular cancer) does not appear to have been established. The area which generates the most concern when it comes to genomic medicine in Korea is the booming field of direct-to-consumer tests (DTC) genetic tests. At present the Korean Government is proceeding in a cautious and stepwise fashion, which seems appropriate. Careful consideration should be given to the potential risks to DTC test consumers, and impacts on the health system, following increased availability of genetic testing for health risks.

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# 4 Korea's preparedness for public health emergencies

Recent disasters and infectious diseases outbreaks have led Korea to reconsider the importance of its preparedness for public health emergencies. This chapter looks at how Korea sets-up and implements public health emergency policies and at how it builds the resilience of its health system, in accordance with the OECD Recommendation on the Governance of Critical Risks and other international guidelines. The chapter suggests that despite the usefulness of policy reforms and new capabilities, strengthening emergency preparedness in Korea remains an unfinished agenda, and more work is needed to address some key areas of weakness.

## Introduction

Given the fundamental responsibilities of governments to provide security and safety, citizens and businesses expect them to be prepared for a wide range of possible crises and global shocks, and to handle them effectively should they arise. The first demand on government is to protect citizens' physical integrity when shock events disrupt the normal functioning of a society. Public health systems play here an essential role in reducing human casualties and other negative health impacts of emergencies, through well-planned and resourced emergency preparedness, and by building resilience to shock events.

While known as the land of the morning calm, Korea regularly suffers contingencies that can have serious public health consequences. In addition to the yearly typhoon season, the last decade has seen a series of large-scale fires, marine and industrial accidents, natural hazards and infectious disease outbreaks affecting Korea. The diversity of these events demonstrates that one cannot adopt a single risk approach when it comes to developing public health emergency preparedness and response capacities or building resilience.

An all-hazards and threats approach to risk management is what the OECD calls for, with its Recommendation on the Governance of Critical Risks, adopted at its Ministerial Council Meeting in 2014. This approach requires working across sectors, though a whole-of-government strategic approach to manage critical risks, which should encompass the different stages of the risk management cycle, from risk assessment, to risk prevention, emergency preparedness and response, and recovery. Engaging the whole-of-society in developing its own resilience is also a critical aspect of modern risk management policies, from local governments to civil society and the private sector.

These principles are well aligned with the International Health Regulations of the World Health Organisation (WHO) regarding preparedness for pandemic and infectious diseases outbreaks, and their three-pronged approach: prevent-detect-respond. They are also consistent with the Sendai Framework for Disaster Risk Reduction adopted in 2015 by the United Nations, which includes preparedness for public health emergencies and health systems resilience amongst its priorities.

With a focus on risk governance, this chapter will assess Korea's policies and their implementation to prepare for public health emergencies, including but not limited to epidemic and infectious disease outbreaks, floods, earthquakes and other natural hazards, major accidents, as well as security risks. The chapter will focus on how public health emergency stakeholders work jointly across siloes to assess, prepare, detect, respond, recover and learn from public health emergencies. It will also analyse how Korea is building the resilience of its health systems to the diversity of shock events that can occur in our increasingly complex and interconnected societies.

## Coronavirus COVID-19

This review was carried out before the start of the outbreak of the coronavirus COVID-19. The COVID-19 outbreak started at the end of the 2019 in China, and rapidly spread to neighbouring countries and across the globe. As of early March 2020, almost all OECD countries report active cases of coronavirus COVID-19.

Korea and other OECD countries are implementing policy actions to contain and mitigate the impact of this global health threat.

## 4.1. Korea's risk profile and potential public health consequences

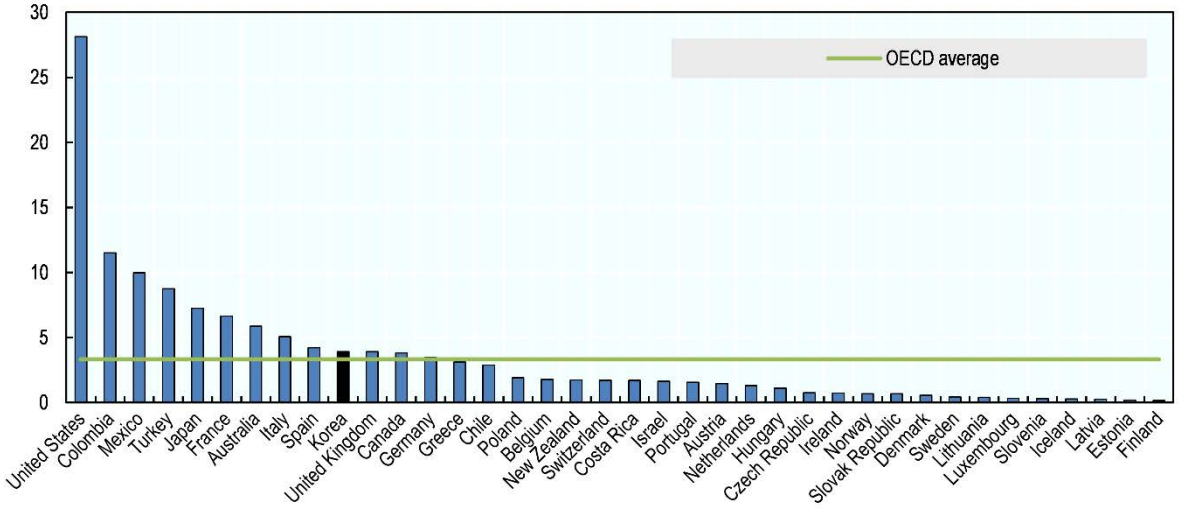
Prior to diving into policies, this section aims at scanning the risk profile of Korea, to evaluate its risk level with respect to public health emergencies and gain insights on why emergency preparedness should be placed at the top of the public health policy agenda in. With a classic risk assessment approach, this section includes information on past emergencies, exposure to hazards and factors of present and future vulnerabilities in Korea.

### *4.1.1. Preparedness for public health emergencies should be at the top of the policy agenda in Korea*

When compared to other OECD countries, Korea's risk profile shows a moderate risk exposure, in terms of number of disaster events affecting the country every year, pretty close to the OECD average over the last 3 decades (Figure 4.1). However, data on the socio-economic consequences caused by disasters originating from natural hazards, technological accidents, epidemics or acts of terrorism, shows that Korea ranks better at reducing their economic losses than at limiting the number of fatalities they can generate. Out of 38 countries, Korea ranks 22$^{nd}$ in terms of the average economic damages caused by disasters on its GDP (Figure 4.2), but it is the eighth OECD country in terms of number of fatalities caused by disasters on its population (Figure 4.3). There is scope for further progress in Korea to reduce public health consequences of disasters, implying a need to make public health emergency preparedness a priority in the country.

## Figure 4.1. Average number of disaster events per year, 1980-2016

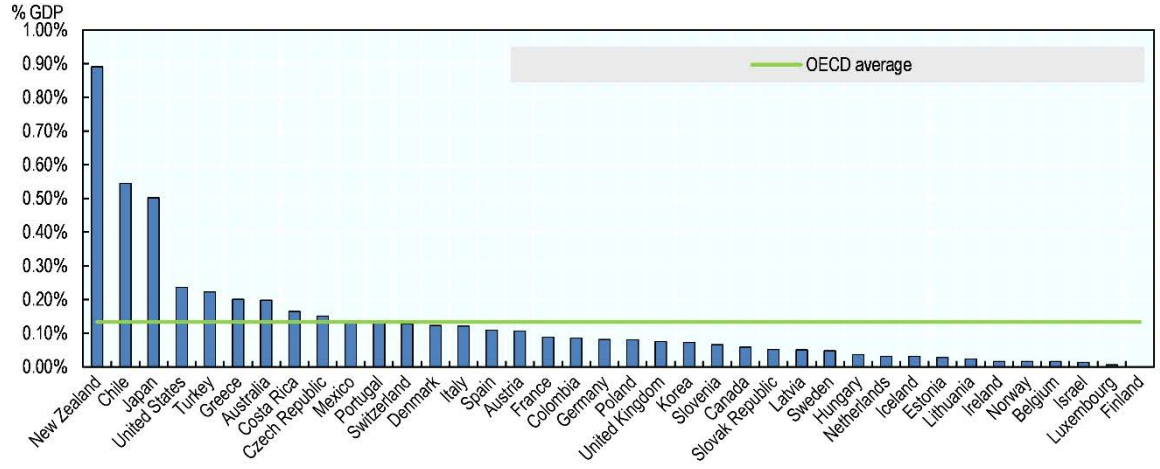
The average number of annual disaster events between 1980 and 2016, by country and showing OECD average




Source: OECD (2018[1]), Assessing global progress in the governance of critical risks, calculation made using data from EM-DAT (2017), International Disaster Database, www.emdat.be and Global Terrorism Database, https://www/start.umd.edu/gtd.

## Figure 4.2. Average economic damage as % of GDP caused by disasters, 1995-2015

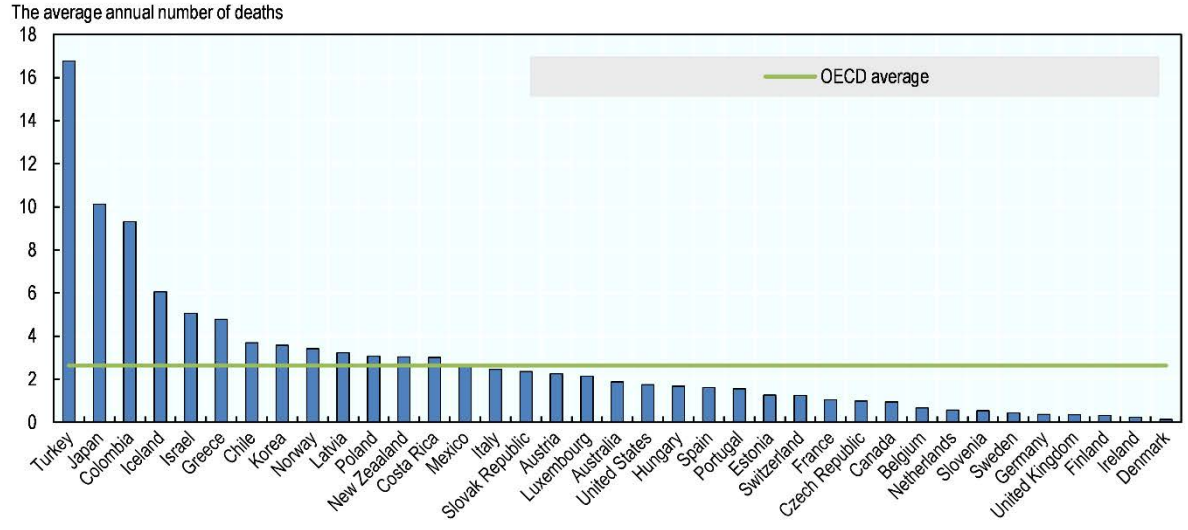
The average annual cost of disaster events between 1995 and 2016, by country and showing OECD average




Source: OECD (2018[1]) Assessing global progress in the governance of critical risks, calculation made using data from EM-DAT (2017), International Disaster Database, www.emdat.be, Global Terrorism Database, https://www/start.umd.edu/gtd, and OECD (2017), "Gross Domestic Product" (indicator), http://dx.doi.org/10.1787/dc2f7aec-en.

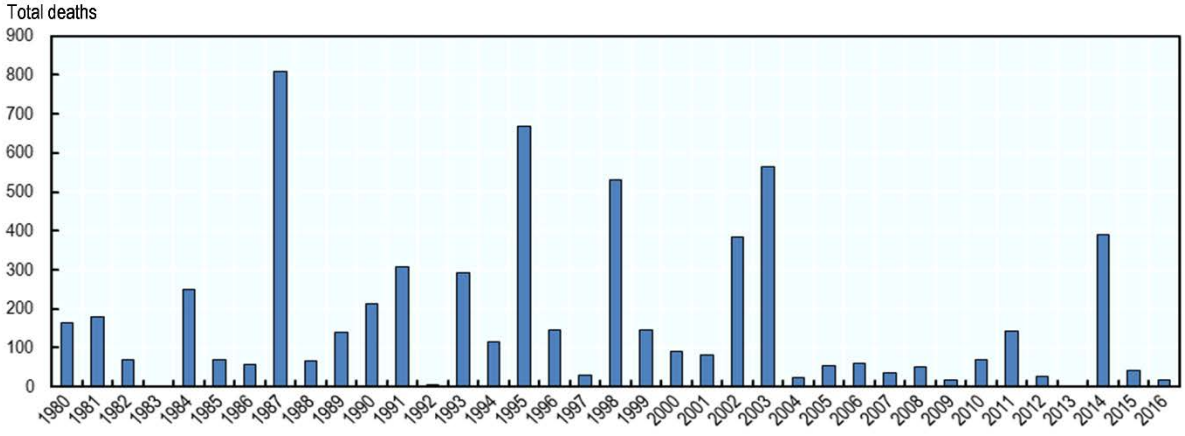
## Figure 4.3 Average death per million inhabitants caused by disasters, 1980-2016

The average annual number of deaths from disaster events between 1980 and 2016, by country and showing OECD average




Note: this dataset excludes deaths caused by heatwaves, due to inconsistent reporting of related fatalities across OECD countries.
Source: OECD (2018[1]), Assessing global progress in the governance of critical risks, calculation made using data from EM-DAT (2017), the International Disaster Database, www.emdat.be, Global Terrorism Database, https://www/start.umd.edu/gtd.

## Figure 4.4. Annual deaths caused by disasters in Korea – 1980-2016




Source: EM-DAT (2017), The International Disasters Database, available at: https://www.emdat.be/.

Recent major crises, such as the Sewol ferry disaster in 2014 or the Middle-East Respiratory Syndrome Coronavirus (MERS-CoV) epidemic outbreak in 2015 revealed major shortcomings in applying safety regulations and managing complex crises, causing significant human losses and large disarray within Korea society (Box 4.1). Recent OECD work on the drivers of trust in public institutions in Korea highlights how the failures in managing these disaster events contributed to lowering the level of trust in the government (OECD, 2018[1]). This has implication well beyond public health, and can affect the overall capacity of the government to function properly and deliver services to citizens. Given persistent low levels

of trust in public institution in the country, improving public health emergency preparedness should be seen as a strategic investment for both better health outcomes and reinforcing public trust.

### Box 4.1. Recent major public health emergencies in Korea caused by organisational shortcomings

**2014 sinking of Sewol ferry**: The South Korean ship MV Sewol sinking in April 2014 led to the death of ferry 304 passengers, mostly high school students. It eventually became clear that the accident was caused by over-loading, crating failure and poor initial emergency responses by the crew, coast guard, and Control Center. There was also criticism of the government's handling of the incident's aftermath; when government is perceived as failing to handle critical crisis effectively, citizens can come to lose faith in government institutions (OECD/KDI, 2018[2]).

**2015 outbreak of Middle East Respiratory Syndrome (MERS)**: Between May and July 2015 an outbreak of the Middle East Respiratory Syndrome affected 186 people in South Korea, and caused 38 deaths and 16 693 quarantined or isolated individuals. The government, in particular the Ministry of Health (MoH), was heavily criticised for not disclosing relevant information to hospitals and citizens (Reuters, 2015[3]; OECD/KDI, 2018[2]). The MoH did not initially reveal the names of the medical institutions hospitalising the MERS patients, which, according to the MoH's statement at the time, was intended to avoid unnecessary anxiety to health care users. A number of medical institutions were also criticised; for example in Seoul, 35 infected patients were discharged without knowing that they were infected and allowed to move freely through the city.

Source: OECD/KDI (2018[2]), *Understanding the Drivers of Trust in Government Institutions in Korea,* OECD Publishing, Paris, https://dx.doi.org/10.1787/9789264308992-en; Reuters (2015[3]), "South Korea replaces health minister criticized over MERS outbreak - Reuters", https://www.reuters.com/article/us-health-mers-southkorea-idUSKCN0Q90JJ20150804

### *4.1.2. Korea is exposed to natural hazards and climate change calls for elevating public health emergency preparedness for these risks*

Natural hazards occur frequently in Korea, which is exposed to floods, typhoons, winter storms, landslides, earthquakes, extreme temperatures and dust storms. While floods and typhoons are the most significant in terms of their frequency and recorded death toll, other hazards such as heatwaves and yellow dust can have also important public health consequences.

Floods and typhoons occur every year in Korea, especially during the summer months, and the associated torrential rains can cause significant socio-economic damage. These hydro-meteorological hazards represented 50% of the disaster events collected in the EM-DAT database over the 1980-2016 period, 50% of the human fatalities and 90 % of both the affected or injured people by disasters and their economic costs (EM-DAT, 2017[4]). Flash floods can be particularly damaging, especially also when they trigger landslides, such as in July 2011, when Seoul metropolitan area was slashed with heavy downpours, resulting in 69 losses of lives and tens of thousands of citizens affected and in need (Reuters, 2011[5]; Asia Sentinel, 2012[6]).

During the typhoon season between June and October, tropical cyclones originating usually east of the Philippines frequently travel towards the Korean peninsula. Typhoons Rusa in 2002 and Typhoon Maemi in 2003 hit the records, being the most powerful cyclones affecting Korea in decades, with strong wind gusts and heavy rains, causing more than 100 deaths each. The most powerful recent typhoon named Bolaven in 2012 also hit the country, with important electricity cuts, large citizen's evacuations, and 20 human casualties (Table 4.1).

## Table 4.1. Selection of major disasters in Korea over the 1980-2016 period

Disaster event, year, type, loss of lives and affected or injured persons, and total economic damage, of select disaster events in Korea

| Disaster event | Year | Disaster type | Loss of lives | Total affected or injured | Total damage in (thousands USD) |
|---|---|---|---|---|---|
| MERS-CoV epidemic outbreak | 2015 | Epidemic | 36 | 185* | - |
| Honam and Yeongnam flash floods | 2014 | Flood | 17 | - | - |
| Hyosarang Hospital fire | 2014 | Fire | 21 | 10 | - |
| Tropical storm Nakri | 2014 | Storm | 14 | - | - |
| Winter storm | 2014 | Storm | 10 | 101 | 11 000 |
| Sewol Ferry Disaster | 2014 | Transport accident | 304 | - | - |
| Gumi hydrofluoric gas leakage | 2012 | Industrial accident | 5 | 3178 | 30 000 |
| Typhoon Bolaven | 2012 | Storm | 20 | - | 450 000 |
| Seoul flood and landslide | 2011 | Flood | 67 | 29000 | 52 000 |
| Daegu Subway Fire | 2003 | Fire | 430 | 146 | - |
| Typhon Maemi | 2003 | Storm | 130 | 80000 | 4 500 000 |
| SARS epidemic outbreak | 2002 | Epidemic | | 3 | - |
| Typhoon Rusa | 2002 | Storm | 184 | 88625 | 4 200 000 |
| Flash floods | 1998 | Flood | 403 | 121000 | 1 500 000 |
| Sampoong department store collapse | 1995 | Accident | 458 | 922 | - |
| Typhoon Thelma | 1987 | Storm | 483 | 56000 | 325 000 |

Note: * This figure excludes one (1) Korean National who was laboratory-confirmed in China
Source: EM-DAT (2017[4]), The International Disasters Database, available at: https://www.emdat.be/.

Geological hazards should not be overlooked. While not being as exposed to earthquakes or tsunamis as neighbouring Japan, in 2016 Korea experienced the most powerful earthquakes since the country started recording seismic data in 1978 (Lee et al., 2018[7]), with a second powerful earthquake hitting Pohang city in 2017. North Gygeongsang province was hit these two times, which resulted in 23 injuries, and 9 000 incidents of property damages in the 5.8 magnitude earthquake of 2016 (Korea Meteorological Administration, 2017[8]), and 135 injuries and 1 797 people left homeless in the city of Pohang in the 2017 5.4 magnitude earthquake (Korea Meteorological Administration, 2018[9]).

Both direct and indirect public health consequences of disasters have to be considered: disaster risks, especially large-scale ones, can lead to a significant number of injured people, for whom specific emergency interventions often on-site have to be planned for traumas or burns directly caused by the disaster. From a public health perspective, it is equally important to consider indirect health effects, occurring after the disaster, which can be caused by affected health care provision, post-trauma stress and related psychological impact, or population evacuation and displacement. Large-scale disasters consistently show how damaging these indirect health effects can be. The example of the Great East Japan Earthquakes illustrates the range of consequences (OECD, 2019[10]).

Korea is also exposed to other hydro-meteorological hazards, such as heatwaves and dust storms. While these hazards may appear less destructive, their public health consequences can on the contrary be particularly significant. Recent summers in Korea, for instance, were marked by heatwaves throughout the country, causing excess mortality and significant rises in hospitalisations. The type of health impact caused by heat waves vary greatly, ranging from death, exacerbation of cardiovascular diseases, respiratory diseases, neurological diseases, and psychiatric diseases to the development of heat-related illnesses (Na et al., 2013[11]).

2016 was the hottest year on record since 1972, with 22 heatwaves recorded (Korea Meteorological Administration, 2017[8]). In August 2018, extreme temperatures again broke the records with severe health impacts. According to media sources quoting officials from the Korea Center for Disease Control, the

heatwave episode caused at least 42 deaths, and, 3400 people were treated for health-related illnesses, such as heat stroke. This is the highest number of deaths and affected people since South Korea began officially counting casualties due to heat in 2011.

Similarly, yellow dust storm occur regularly in Korea, and can lead to severe public health consequences, such as respiratory diseases (Box 4.2).

### Box 4.2. Yellow dust storms in Korea and their public health impacts

Korea is periodically exposed to "yellow dust storms", which originate in the dry desert regions of China and Mongolia. The storms are driven by low-pressure systems combining with strong winds and cold air fronts, pushing dust into the atmosphere and carrying it across the continent. The impact of this trans-border environmental risk ranges from visibility reduction, to a variety of human health problems, including a negative impact on respiratory function, and a risk of aggravating respiratory diseases such as asthma. Over the past decade, the yellow dust phenomenon has become a more serious problem, because of industrial pollutants and intensified desertification in originating regions. The below table shows yellow dust phenomena that have impacted Korea in the 2003-2012 period; in 2010, there were 15 incidents and a total of 25 days where yellow dust storms were affecting the country The socio-economic impact of yellow dust, stemming from increased medical treatment, decreased industrial and agricultural production, complications in aviation transport and product purchase for preventing the damage, were estimated at 0.8% of Korean GDP in 2002 (Jeong, 2008[12]). Yellow dust storms also have negative effects on water, air, soil and animals.

### Table 4.2. Frequency of annual yellow sand in Korea

| Year | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 |
|---|---|---|---|---|---|---|---|---|---|---|
| Frequency | 2 | 6 | 11 | 9 | 13 | 10 | 10 | 15 | 7 | 5 |
| Duration (day) | 3 | 14 | 17 | 21 | 22 | 20 | 18 | 25 | 15 | 6 |

Source: OECD (2018[13]), National Risk Assessments: A Cross Country Perspective, OECD Publishing, Paris, https://dx.doi.org/10.1787/9789264287532-en; Jeong (2008[12]), "Socio-Economic Costs from Yellow Dust Damages in South Korea", *Korean Social Science Journal*, Vol. XXXV/N° 2, pp. 1-29, http://www.kossrec.org/wp-content/uploads/2015/04/Socio-Economic_Costs_from.pdf.

Climate change and other trends from urbanisation to ageing will affect Korea's exposure to natural hazards and its vulnerability. According to the Intergovernmental Panel on Climate Change (IPCC) floods and typhoons frequency and strength will be affected, heatwaves are projected to be longer and more intense, and desertification in East Asia might increase the risk of yellow dust storms (Kim, 2017[14]); (Hijioka, Lin and Jacqueline Pereira, 2014[15]).

### *4.1.3. Korea is at risk of infectious diseases outbreaks and has a high tuberculosis prevalence rate*

Regarding infectious diseases outbreaks and the risk of pandemics, Korea, as a global economic hub, is exposed to virus or pathogens in a similar manner to most OECD countries. Korea is also marked by a high prevalence of tuberculosis (TB) and subject to the resurgence of more classic infectious diseases, such as measles, which sporadically continue to affect citizens and cause deaths.

The recent most noticeable examples of outbreaks, such as the MERS-CoV outbreak in 2015, the H1N1 pandemic influenza in 2009 or SARS in 2003 are all revealing of how similar forms of public health

emergencies can affect Korea. These outbreaks have shown that Korea is not always best prepared for these emergencies: the SARS epidemic was well handled compared to neighbouring countries, the H1N1 response did show few shortcomings, and many of the MERS-CoV consequences could have been limited with a better response.

As highlighted earlier, the recent Middle East respiratory syndrome coronavirus (MERS-CoV) outbreak in 2015 demonstrated significant shortcomings in Korea's preparedness for public health emergencies. With 186 confirmed cases, 38 deaths and 16 693 quarantined or isolated individuals, Korea has been the most affected country in the world outside of the Middle East from where this virus originated (Ki, 2015[16]). Almost all the infected cases originated the original patient returning from a business trip in the Middle East in May and few other "super-spreaders" that this individual infected. Several studies point out that these nosocomial infections could have been much more limited as the outbreak was not attributable to biomedical factors but rather due to late diagnosis, quarantine failure for super-spreaders, familial care-giving and visiting, poor crisis communication, inadequate hospital infection management, as well as the doctor-shopping habit within Korean society (Kim et al., 2017[17]; Cho et al., 2016[18]). This outbreak brought significant concerns about public health emergency preparedness in Korea.

Like most OECD countries, Korea was affected by the H1N1 pandemic influenza in 2009. From its emergence in March 2009 in Mexico, the first case in Korea was confirmed early May 2009 and another break out in an English Institute happened in late May that same year (Kim et al., 2010[19]). Influenza activity peaked in October reaching 45 cases per 1 000 inhabitants, spreading across local communities, in particular in schools. The epidemic declined rapidly after the vaccination programme started in early November and reached baseline levels in February 2010 (Yun et al., 2017[20]). Between May 2009 and August 2010, there were 750 000 cases of pandemic influenza H1N1 that were confirmed by laboratory tests and the number of H1N1-related deaths was estimated at 252 (Kim, 2016[21]). Data from National Health Insurance Claims database, meanwhile, suggests an overall infection of 3 million Korea residents, and a total cost of the pandemic reaching USD 1.09 billion or 0.14% of the national GDP (Kim, Yoon and Oh, 2013[22]). Korea had a mortality rate of 5.1 deaths per million individuals compared to other OECD countries such as the United Kingdom (2.2), Canada (2.8), Mexico (2.89), United States (3.3), New Zealand (4.4), Chile (8.1), or Australia (8.6), and significantly higher than neighbouring Japan (0.2) (Takahashi et al., 2017[23]).

Other infectious disease outbreaks with global or regional impacts, such as SARS in 2003, which affected many neighbouring Asian countries, or Ebola haemorrhagic fever in 2014, did not affect Korea or only had a limited impact. Korea was the model of disease containment during SARS: only three confirmed cases and no deaths, despite many Koreans living in or travelled to the SARS major epicentres in neighbouring countries (Hong and Collins, 2006[24]). As a comparison, China was significantly affected, with 349 deaths out of more than 5 327 cases (ibid.).

The prevalence or resurgence of other infectious diseases should also be considered. TB in Korea remains a serious health problem with an estimated 77 per 100 000 incidence rate for 2016. This makes Korea the only OECD country with high incidence of TB: for instance, the rate is 3.1 in the United States, 5.5 in Canada, 6.8 in Australia, 8 in France, 8.9 in the United Kingdom or 15 in Japan (World Health Organisation, 2018[25]). According to data from the Korean Center for Disease Control, in recent years there has been a decreasing rate of new cases of TB infection, which had peaked in 2011 to 78.9 per 100 000 inhabitants (Table 4.3), just before the government released its new five-year tuberculosis control plan for 2013–2017 (Go et al., 2018[26]).

### Table 4.3. Number of new Tuberculosis cases and rate in Korea

Number of new TB cases, the TB rate by population, and annual change in TB rate from 2001 to 2016

| Year | 2001 | 2005 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
|---|---|---|---|---|---|---|---|---|---|
| No. of new cases (thousands) | 34.1 | 35.3 | 36.3 | 39.6 | 39.5 | 36.1 | 34.9 | 32.2 | 30.9 |
| New TB rate (per 100 000 population) | 71.3 | 72.4 | 72.8 | 78.9 | 78.5 | 71.4 | 68.7 | 63.2 | 60.4 |
| Annual change (%) | - | - | 0.8 | 8.4 | -0.5 | -9.0 | -3.8 | -8.1 | -4.3 |

Source: KCDC (2018[27]), *National TB Elimination Project,* http://www.cdc.go.kr/contents.es?mid=a30301120000.

### *4.1.4. Accidents have caused significant public health damages in Korea*

Korea also experienced in the last few decades a series of major accidents in different sectors, which led to important public health emergencies. The Sampoong department store collapse in 1995, the Daegu subway fire in 2003, the Gumi chemical leak in 2012, and the Ferry Sewol disaster in 2014, all have had a tragic death toll, with many injured and affected people. Overall industrial accidents, transport accidents, maritime accidents human casualties represent half of the total casualties caused by disasters in Korea, which makes of better preparing for their human consequences a priority.

These disasters require that public health emergency managers better prepare their capacities and plans to respond to mass casualties' events, toxic chemical leaks or oil spills, maritime disasters, and industrial fires. This is all the more important given the significant shortcomings that these accidents highlighted, such as the delay in deciding to evacuate affected zones by the hydrogen fluoride gas leakage in Gumi in 2012, which affected 12 000 residents with various health symptoms (Bae, Joo and Won, 2015[28]). Coordination failures among the emergency responders were also particularly tragic in the case of the Ferry Sewol sinking, during which 304 passengers, including 250 high-school students, could not be evacuated despite the presence of the emergency responders, and died of drowning (Dostal, Kim and Ringstad, 2015[29]).

These different disaster events tend to show that the implementation of safety regulations in Korea could be improved. Furthermore, with regards to the resilience of the health sector in Korea, it is important to flag that several accidents occurred in recent years in health facilities, such as fires in hospitals or nursing homes, which not only has had significant casualties but can also further affect health service provision.

### *4.1.5. Rising vulnerabilities call for strengthening public health emergency preparedness in the years to come*

In terms of its vulnerabilities to natural hazards, accidents, and infectious diseases, Korea presents some characteristics that are important to consider in order to prepare for future risks as called for by the OECD Recommendation on the Governance of Critical Risks. Korea's risk profile depends upon a series of factors, such as the ageing population, population density, international exchanges and travels, ageing infrastructure, as well as hygienic precautionary measures taken by the population, population health conditions, vaccination coverage rate (Chapter 1), and levels of anti-microbial resistance. Korea presents a mixed situation when we look at the different indicators related to such vulnerabilities.

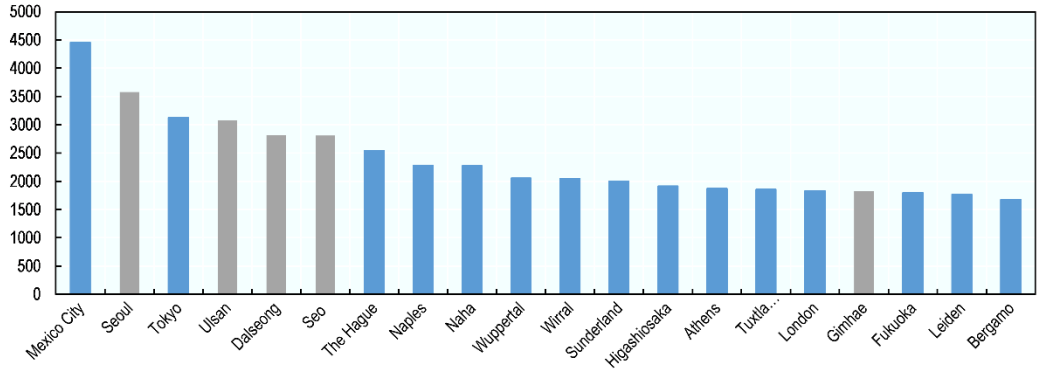
Korea's rapidly ageing population raises concerns for public health emergency preparedness, given the specific vulnerabilities of elderly people. According to the OECD Demography and population Database, population ageing in Korea is projected to be the fastest in the OECD. In 2050, the Korea population over 65 years will represent over 70% of the population aged between 15 and 64, compared to only 20% in 2015 (OECD, 2018[30]). Elderly persons are particularly vulnerable to airborne and respiratory diseases that can be caused by sand and dust storm (UNEP, WMO and UNCCD, 2016[31]), as well as to risks of

heatwaves. When flood, typhoons or earthquakes happen, the elderly are also more susceptible to be injured, have more difficulties evacuating and protecting themselves, and can be affected disproportionally by their indirect effects (Aldrich and Benson, 2008[32]; Yoo, Lee and Tullmann, 2016[33]). This holds also true for infectious diseases outbreaks, where poorer health conditions of elderly people can contribute to aggravating health consequences of infections.

Korea's high population density, and the large and increasing numbers of inbound and outbound travellers to and from the country are factors that can favour the spread of infectious diseases. Indeed, Korea concentrates five of the densest metropolitan areas in the OECD (Figure 4.5). With 14 million visitor arrivals and 26 million Koreans travelling abroad in 2018, Korea more than doubled the number of inbound and outbound travellers in a decade (Korea Tourism Organisation, 2019[34]).

## Figure 4.5. Population density in the 20 densest OECD metropolitan areas, 2015

Number of inhabitants per kilometre²




Note: Light grey bars represent metropolitan areas in Korea
Source: OECD (2019[35]), "Metropolitan areas", *OECD Regional Statistics* (database), https://dx.doi.org/10.1787/data-00531-en.

As explained in Chapter 1, Korea's vaccination programmes follows WHO recommendations; vaccinations are highly recommended for 16 selected diseases as routine vaccination and are administered for free through the National Immunization Program (NIP), including TB, polio, and measles. Overall the vaccination rate in Korea slightly exceeds the OECD average contributing to a good level of immunisation for many infectious diseases.

The growing challenge of anti-microbial resistance (AMR) around the world is also a concern for Korea's preparedness for public health emergencies. Despite the decreasing consumption trends, antibiotic consumption in Korea is relatively high, with 31.7 defined daily doses (DDD) per thousand inhabitants in 2016, compared to the OECD average of 23.7 DDD (OECD, 2018[36]). In addition, the prevalence of the most resistant organisms is increasing significantly as per the results of a Korea nationwide surveillance study reporting high rates of several resistant organisms (Ryu, 2017[37]). Beyond nosocomial infections, this raises concerns on the risk of outbreaks of anti-microbial resistant infections at community levels, for which Korea started to collaborate horizontally with its 5-year National Action Plan, which follows the One Health approach promoted by WHO.

Finally, while difficult to measure, the significant use of precautionary and hygienic measures within the Korean population is largely recognised as a factor that limits the risk of infectious diseases propagation in the country. These measures include regular handwashing and the widespread use of face masks, which

has significantly increased amongst the population in recent years, especially following the H1N1 outbreak (Park et al., 2010[38]).

## 4.2. Korea makes of preparedness for public health emergencies a priority, as reflected in its public policies

In light of major risks for public health, Korea makes of preparedness for public health emergencies a key policy priority. This is first reflected in its legal and institutional framework related to the important risks of pandemic outbreaks and disasters.

### *4.2.1. Korea's legal framework for public health emergencies is based on an all-hazard approach*

As in many countries, following major crises Korea readjusted its legal and institutional framework to better prepare for public health emergencies.

In 2004 the Framework Act on the Management of Disasters and Safety established a comprehensive system for emergency management in Korea. By addressing both natural and social disasters – which includes infectious diseases – this legislation was the first taking an all-hazard and threat approach to emergency management in Korea, as recommended by the OECD Recommendation on the Governance of Critical Risks. Prior to this act, there were more than 70 disaster-related laws and executive orders under the jurisdiction of 13 different agencies, which created significant governance gaps and coordination challenges (Bae, Joo and Won, 2016[39]). Drawing lessons from the series of disasters which affected Korea in the early 2000 - Typhoon Rusa in 2002, Daegu subway fire in 2003, SARS epidemic in 2003 – the administration designed the Framework Act to streamline government efforts in emergency preparedness and foster whole-of-government coordination.

With the overall aim of protecting citizen's lives, safety and property, the Framework Act on the Management of Disasters and Safety clarifies the responsibilities of national to local governments all across the risk management cycle, from prevention, to preparedness, response and recovery (Government of Korea, 2015[40]; Heo, Park and Heo, 2018[41]). The Act instructs all levels of government to establish both a Safety Management Committee for policy planning and implementation and a Disaster and Safety Countermeasures Headquarter for operational response, as well as the development of Safety Management Plans in all local governments, aligned with the national Master Plan for Safety Management developed every 5 years.

While the Act states that local governments bear the primary responsibility for emergency response, it also includes a series of provisions for direct interventions from the national level, when local capacities are overwhelmed, when several local governments are affected or in case of declaration of State of Disaster by the Ministry of Interior and Safety. The principles of mutual cooperation should then apply, which can at times create confusion in the response.

The Act promotes a series of emergency preparedness measures, including the development of alert systems, response manuals, and emergency drills, as well as reporting systems on a local safety index, post event reviews, safety inspections and related financing and incentive mechanisms. The Prime Minister, who chairs the Central Safety Management Committee, together with the Ministry of the Interior and Safety, bear the primary responsibility for overseeing policy implementation and ensuring multi-stakeholder coordination.

Regarding infectious disease, the Framework Act was complemented in 2010 by the Infectious Disease Control and Prevention Act in order to reflect the 2005 International Health Regulation adopted at the WHO, as well as the lessons from the H1N1 influenza pandemic. The Infectious Disease Control and

Prevention Act first defines categories of infectious diseases depending on their infectiousness and the severity of the symptoms. The Act requests that the Ministry of Health and Welfare prepare the Master Plan for preventing and controlling infectious disease every 5 years and to establish the Infectious Disease Control Committee. It specifies also the responsibilities of the various levels of governments and health institutions for the national infectious disease surveillance and detection system, the vaccination programme, the various infection control countermeasures, the stockpiling policy for medical countermeasures as well as a set of financing and compensation regulations. However, the Act does not specify the coordination mechanism between the various levels of government in great details, which can create governance loopholes during outbreaks, as was the case during the MERS epidemic.

Both the Framework Act on the Management of Disasters and Safety and the Infectious Disease Control and Prevention Act have been updated in recent years to incorporate lessons learned following the 2014 Ferry Sewol accident and the 2015 MERS-CoV outbreak and adjust the institutional framework. These changes addressed some of the most pressing needs identified after these disasters, such as the lack of coordination between emergency response agencies in the first case or the need to strengthen the infectious disease control system, reinforce hospital regulation and increase public health workforce in the second. It remains to be seen whether the fundamental governance challenges of properly articulating local and national responsibilities and resources in public health emergency preparedness (Bae, Joo and Won, 2016[39]) have been effectively addressed.

### *4.2.2. Korea reformed its institutional setting for public health emergency preparedness in recent years*

After a series of institutional changes, the Ministry of the Interior and Safety (MOIS), created in 2017 by the new administration, now regroups the different emergency response capacities under its responsibility. MOIS' Vice-Minister for Disaster and Safety Management oversees the National Disaster and Safety Control Center for the operational response as well as the different policy design and implementation offices related to public safety, risk prevention, emergency preparedness, response and recovery. This follows the 2014 total reform of the disaster management system, which had initially brought these capacities under the direct responsibility of the Prime Minister, in order to regroup the former National Emergency Management Agency, the Korean Coast Guards, and the National Fire Agency under the same umbrella (Park, 2017[42]). While the 2014 reform helped to strengthen horizontal coordination in emergency preparedness and response, this also weakened the link with local governments traditionally governed from the Ministry of the Interior. With the new governance in place, it is now expected that improvements in vertical coordination between the national and local governments will facilitate the construction of a more effective emergency preparedness and response system in Korea.

Regarding the public health sector, the Ministry of Health and Welfare (MOHW) oversees policy development and implementation both for infectious disease control and for disaster emergency healthcare, in accordance with the two aforementioned legislations. The Korea Center for Disease Control (KCDC) is the main operational agency for infectious disease prevention and control, in charge of risk assessment, disease surveillance, risk communication, field investigation, among others. As for the above, this central government agency has seen its role as the control tower for infectious disease emergency preparedness and response significantly reinforced after the MERS-CoV outbreak, with the creation of new divisions to strengthen event-based surveillance, information collection, risk assessment and emergency operations through the establishment of its public health Emergency Operations Center (EOC) (World Health Organisation, 2017[43]). Regarding other types of disaster, MOHW's Division for Emergency Healthcare coordinates medical emergency support with MOIS in accordance with the Framework Act on the Management of Disasters and Safety.

In addition to MOIS and MOHW, other line Ministries and national agencies contribute to public health emergency preparedness and response in Korea in their respective areas of responsibilities in line with

the whole-of-government approach to emergency preparedness adopted in Korea. This includes for instance the Ministry of the Environment for environmental pollution accidents or yellow dust storm, the Ministry of Agriculture, Food and Rural Affairs for zoonotic diseases or the Ministry of Education for disasters in schools, as well as the various emergency response agencies, technical agencies.

### *4.2.3. Horizontal and vertical policy coordination for public health emergency preparedness*

Korea's horizontal coordination is facilitated at the strategic level through the Central Safety Management Committee, chaired by the Prime Minister and to which the Government Office for Policy coordination and the National Security Council participate as well. Furthermore, MOIS has established dedicated policy bureaus for specific types of disaster events, which allow the Ministry to coordinate more easily with other Ministries involved. For instance, MOIS's Public Health Disaster Response Division coordinates closely with the MOHW including through staff exchange, which is good practice. As explained above, it appears that the need to strengthen inter-ministerial coordination for a more effective emergency preparedness and response was taken seriously in Korea in recent years, in accordance with OECD recommendations related to strategic crisis management (OECD, 2015[44]).

At the local level, Korea builds on its three tiered decentralised governance system, with its 17 provinces and metropolitan cities and its 226 municipalities, which all have preparedness responsibilities within their jurisdiction. As decentralisation in Korea was initiated in the mid-1990s, local level responsibilities have progressively been devolved to this level. Since the adoption of the Framework Act on the Management of Disasters and Safety in 2004, local governments have seen these responsibilities increasing, as the Act puts emphasis both on strengthening the central command and control system and on decentralising the first response (Bae, Joo and Won, 2016[39]). Local governments have established disaster management divisions and are required to develop their Safety Management Plan in line with national guidelines and manuals. They can count on local Fire Services, 119 Rescue teams and medical institutions. A bottom up approach with scaling up procedures lets higher levels of government provide complementary emergency support in case of need.

In addition to the multi-hazard and threat Safety Management Plan, regional and local governments are required to prepare a specific plan for infectious disease prevention and control. Such plans outline the roles of local government in the infectious surveillance and detection system in Korea, their prevention responsibilities and the various types of countermeasures to be taken at their level when an infectious disease is detected. The central government along with provincial and local governments implement the infectious disease prevention and control policy, together with the network of the 256 Public Health Centers located across Korea, and medical institutions.

Several public health and emergency management officials expressed that strengthening multi-level coordination is a key area to improve preparedness in Korea now that central level governance has been stabilised. Central authorities have powerful policy levers on local governments, as they control a large part of their budget allocations and human resources through the MOIS, set guidelines and evaluate emergency preparedness and related plans. Nevertheless, clarity of roles and responsibilities between the central and local governments could be improved and coordination mechanisms streamlined in order to make the best of existing local capacities and proximity when emergencies unfold (Bae, Joo and Won, 2016[39]).

## 4.3. Identifying and assessing public health emergencies risk in Korea

Preparing for public health emergencies requires, first, a good knowledge of the critical risks and their potential public health consequences. With an all-hazard approach, Korea has set up sophisticated systems for risk related data collection and analysis with comprehensive information-sharing platforms in the context of the government 3.0 initiative. The development of these tools reflects the advanced technological development and the importance of government innovation in Korea.

By making risk information widely available, such systems let Korea emergency management system identify and asses critical risks and to communicate them across government, from national to local levels, as well as to citizens. Nevertheless, Korea is less advanced when it comes to utilising this rich information-base to strategically plan its emergency response capabilities through a whole-of-government scenario-based National Risk Assessment. Unlike many OECD countries, Korea does not yet undertake such an assessment (OECD, 2018[13]), which would allow the comparison of all major risks in terms of likelihood and potential impacts, and prioritisation of resources accordingly.

### *4.3.1. Korea has developed advanced risk analysis tools with a multi-hazard approach*

As per the Framework Act on the Management of Disasters and Safety, MOIS collects risk-related data and information for all the disaster risks that can affect Korea. This includes information on both natural hazards and social disasters as defined in the Act (Table 4.4).

**Table 4.4. Typology of disasters in Korea**

| | |
|---|---|
| Natural disasters | Disasters caused by a typhoon, flood, downpour, strong wind, wind and waves, tidal wave, heavy snowfall, lightning, drought, earthquake, sandy dust, hypertrophied of algae, ebb and flow, volcanic activity, crash or collision of a natural space object, such as an asteroid and meteoroid, and other natural phenomena equivalent thereto |
| Social accidents | Damage caused by a fire, collapse, explosion, traffic accidents (including aviation accidents and marine accidents), chemical, biological, and radioactive accidents, environmental pollution incidents, etc.; damage caused by the paralysation of the national backbone systems, such as energy, communications, transportation, finance, medical treatment, and water supply; and damage caused by the spread, etc. of infectious diseases or contagious animal diseases. |

Source: Government of Korea (2015[40]), Framework Act on the Management of Disasters and Safety.

All sectoral ministries and agencies are required to report disaster's data and statistics, which has enabled MOIS to develop a comprehensive database of disaster characteristics over the years for all these disaster types, including on their public health consequences (see Box 4.3). Geospatial data has also been collected on hazards, exposure and vulnerability to support risk analysis, through the network of technical agencies and their information systems. This includes for instance meteorological and geological information from the Korean Meteorological Administration, hydrological information from the Flood Control Offices of the Ministry of Land Infrastructure and Transport, geospatial information on human settlements, population density and so on (Kang, 2016[45]). Furthermore, MOIS monitors information on the available emergency response capabilities from the national to the local levels, which is good practice to assess preparedness levels.

### Box 4.3. Korean Integrated Disaster and Safety Information System

Amidst the increasingly more complex nature of disasters, Korea MOIS has established an integrated Disaster and Safety Information System to support cross-government risk information sharing. This information system has integrated 11 previously existing disaster management systems and information from 16 various ministries. Based on a 3-D geospatial information system (GIS) the system makes available all the data and information necessary to conduct risk assessment at the national and local levels. The System's web based Disaster Management Portal is accessible to central and local governments to access this information as well as to upload their own information. In addition to risk assessment, the system can also be used during the emergency and recovery phases as a risk communication and collaboration tool, facilitating inter-agency response.

Source: Ministry of the Interior and Safety (2019[46]), *Integrated Disaster and Safety Information System,* https://www.mois.go.kr/eng/sub/a03/bestPractices1/screen.do; Kang (2016[45]), *Disaster Early Warning Services in the Republic of Korea*, http://www.safekorea.go.kr/ids

This rich information is made available to the various agencies of Korea emergency response system, from the national to the local levels, through the Disaster Management Portal of the Integrated Disaster and Safety Information System set-up after the 2014 revision of the Act (see Box 4.3). Furthermore, MOIS, with the support of its National Disaster Management Institute (NDMI) has developed a project aimed at calculating Safety Index for all the local governments across the country, with information directly available to citizens through Public Safety Maps (Box 4.4). This open platform helps to strengthen citizen's risk awareness and contributes to making local government more accountable in risk management decision-making.

### Box 4.4. Korea Safety Index and Public Safety Maps

The Public Safety Map Service (http://www.safemap.go.kr) is designed to provide various, previously scattered information on maps via the Internet and mobile app in eight categories (crime, traffic, natural disasters, safety for the vulnerable, facilities, industries, public health, and man-made disasters). It also provides an alarm service with real-time information, in the areas near the user's current location using GPS from mobile devices, as well as the location and contact of public facilities including police stations, fire stations, and emergency facilities such as shelters and hospitals. According to MOIS, 2.7 million Korean citizens have accessed these public safety maps.

In addition, MOIS has compiled various safety statistics to compute local safety indices in seven key areas, i.e. traffic accidents, fires, crimes, safety accidents, suicides, and infectious diseases. These are further classified into one of five levels for each local government and disclosed to the public annually. Local governments can use the Local Safety Diagnosis System and local safety indices to identify local risk factors in their areas for improvement, and the central government offers consulting. Such efforts have resulted in the mitigation of negligent accidents in each area.

Source: Ministry of the Interior and Safety (2019[46]), *Integrated Disaster and Safety Information System,* https://www.mois.go.kr/eng/sub/a03/bestPractices1/screen.do.

### *4.3.2. For infectious diseases, KCDC has strengthened its risk assessment process following the MERS-CoV outbreak*

Under the Infectious Disease Prevention and Control Act, Korea has established a list of notifiable infectious diseases and defined 11 categories of infectious diseases according to their infectiousness and the severity of the symptoms (Table 4.5). In addition to contributing to the whole-of-government risk assessment process presented in the section above, KCDC monitors and assess these risks using a classic risk assessment methodology combining their likelihood and potential impact. This new risk assessment approach is promising and could be further institutionalised as an element of a wider National Risk Assessment.

The development of this methodology follows a major strengthening of KCDC's capacities in the aftermath of the MERS-CoV outbreak. In light of the failure to identify key vulnerabilities of the Korean medical system as an important risk factor (Park, 2017[42]), KCDC has reinforced its risk assessment process, notably with the creation of its Risk Assessment & International Cooperation Division. Concretely, criteria have been defined to characterise four different levels of likelihood, and five levels of potential impacts for the different infectious diseases. A matrix analysis then defines five levels of risks (very low, low, moderate, high and very high), the highest level being the most likely with the highest potential impact. Data used in this risk assessment includes yearly domestic cases (by months, cities or province), domestic response capacities (response system, laboratory diagnostics, and supply of vaccines), as well as public perception.

Eleven priority infectious diseases have been identified by KCDC, forming the basis for planning and resource stockpiling (World Health Organisation, 2017[43]). This includes diseases that are candidate for eradication, those identified by WHO as threats to global public health security (smallpox, wild-type Poliomyelitis, new types of Influenza, Pneumonic plague, viral haemorrhagic fevers), MERS and any other infectious diseases with a risk assessment level of moderate to higher.

The development of this risk assessment enables Korea to prioritise the different risks for which it should develop public health response capacities. This aligns well with the purpose of risk assessment as expressed in the OECD Recommendation on the Governance of Critical Risks. It remains nevertheless unclear how this risk assessment corresponds to the categories of infectious diseases enshrined in the Infectious Disease Prevention and Control Act, and whether the results of this risk assessment are shared within the wider whole-of-government risk assessment stakeholders as well as with local governments. For instance, KCDC pandemic influenza scenario is not shared with local governments in details, which is a missed opportunity for them to prepare their planning accordingly.

**Table 4.5. Notifiable infectious diseases under the Korea Infectious Diseases Prevention and Control Act**

| Category | Description | Infectious disease |
|---|---|---|
| Group 1 | Infectious diseases spread via drinking water or food, with a high risk of mass outbreak, requiring the formulation of immediate control measures upon the outbreak or prevalence | Cholera; Typhoid; Paratyphoid; Shigellosis, Bacillary dysentery; Colon bacillus infection with enterorrhagia; Viral hepatitis A; |
| Group 2 | Infectious diseases which can be prevented and controlled by vaccinations, subject to national vaccination programmes | Diphtheria; Pertussis; Tetanus; Measles; Mumps; Rubella; Poliomyelitis; Viral hepatitis B; Japanese encephalitis; Varicella; Haemophilus influenza type B; Pneumococcus; |
| Group 3 | Infectious diseases which require continuous surveillance and the formulation of control measures against the outbreak thereof as they may prevail intermittently. | Malaria; Tuberculosis; Hansen's disease, Scarlet fever, Meningococcal meningitis, Legionellosis, Vibrio vulnificus sepsis, Epidemic typhus, Murine typhus, Scrub typhus, Leptospirosis, Brucellosis, Anthrax, Rabies, Hemorrhagic fever with renal syndrome, Influenza, AIDS, Syphilis, Creutzfeldt-Jakob disease, Viral hepatitis C, Vancomycin Resistant Staphylococcus Aureus, Carbapenen-resistant |

| | | |
|---|---|---|
| | | Enterobacteroceae, |
| Group 4 | Infectious diseases which have newly broken out or are likely to break out in Korea, or which prevail abroad with a risk to be transmitted into Korea. Provided, that Group 4 include infectious diseases designated by MOHW, as they are feared to be suddenly transmitted into or prevalent in Korea and are necessary for urgent prevention and control | Pest, Yellow fever, Dengue fever, Viral hemorrhagic fever (VHF), Smallpox, Botulism, Severe acute respiratory syndrome (SARS), Animal influenza infection in humans, Novel influenza (H1N1), Tularaemia, Q fever, West Nile fever, Emerging infectious disease syndrome, Lyme disease, Tick-borne encephalitis, Melioidosis, Chikungunya fever, Severe fever with thrombocytopenia syndrome, Middle East respiratory syndrome (MERS) |
| Group 5 | Infectious diseases spread by parasite infection, which are designated by MOHW Ordinance, as requiring surveillance through regular investigations: Provided, That Group 5 include infectious diseases designated by the MOHW, as they are feared to be suddenly transmitted into or prevalent in Korea and are necessary for urgent prevention and control; | |
| Designated infectious diseases | Infectious diseases designated by MOHW, as they requires surveillance to investigate as to whether they are epidemic, other than Groups 1 through 5 infectious diseases; | |
| Infectious diseases under WHO surveillance | Infectious diseases designated to be subject to surveillance by the World Health Organization to prepare for international public health emergencies, as publicly announced by MOHW | |
| Infectious diseases spread through bioterrorism | Infectious diseases publicly announced by the MOHW, among those spread by pathogens either deliberately used or for terrorism, etc.; | |
| Sexually transmitted infectious diseases | Infectious diseases publicly announced by the MOHW, among those transmitted by sexual contact | |
| Zoonoses | Infectious diseases publicly announced by the MOHW, among those spread by pathogens transmittable from animals to humans and vice-versa; | |
| Nosocomial infectious diseases | Infectious diseases occurred to patients, expecting mothers, etc. in the course of undergoing medical activities, which are publicly announced by the MOHW, as they requires surveillance | |

Source: Government of Korea (2015[47]), Korea Infectious Diseases Prevention and Control Act.

### *4.3.3. Korea could further benefit from its advanced risk assessment capacities by developing a National Risk Assessment*

As shown in previous sections, Korea has effectively developed databases, information systems and analytical tools that enables national and local governments to conduct risk analysis and base their emergency preparedness and planning on this evidence. The revision of the national governance, which makes MOIS the central national institution for emergency preparedness, and the mandate it has received to develop risk analysis with all the emergency response stakeholders provides a robust base for developing a more ambitious approach with a national risk assessment. In addition, the new risk assessment approach developed by KCDC demonstrates the value of using such analytical tool, which makes it possible to compare the different risk the country faces depending on their likelihood and potential impacts. As expressed in OECD cross country analysis on National Risk Assessments (OECD, 2018[13]), Korea has all the technical ingredients in place for such comprehensive approach, which is in place in a large number of OECD countries such as the Netherlands (Box 4.5).

The benefits of a whole of government approach are numerous and can create an even greater level of protection for citizens. These benefits include optimisation in the allocation of resources in dealing with the most serious risks that have been identified as affecting the country. Additionally this should lead to a reduction in the unpredictability of risks and the identification of the highest risks which may require special treatment by government and experts in this particular subject matter. The adoption of a strategic approach specifically focused on a better strategy for managing risk would provide an objective and systematic evidence base for government-level emergency planners and foster cooperation across government.

A comprehensive national risk assessment could provide crucial support to an effective strategy for the governance of critical risks in Korea. It would draw from existing technical capacities in risk assessment, and provide an overarching framework across different fields of expertise to conduct analyses according to common criteria. This would help to prioritise investments in the mitigation of risks and their consequences and improve overall preparedness and consequence management.

### Box 4.5. National Risk Assessment in the Netherlands

The Netherlands has regularly conducted a National Risk Assessment (NRA) since 2008. The NRA supports development of a cross-government National Safety and Security Strategy, providing an evidence base for determining priorities for risk reduction and prevention, and through investment in capabilities for response to and recovery from civil contingencies. Expertise from the private and academic sectors is strongly integrated into the analytical process supporting the NRA, through the use of a Network of Analysts for National Security. The National Steering Committee for National Safety and Security is the sponsor of the entire exercise. The NRA method is scenario-based.

Risk scenarios are assigned scores for their likelihood and impact on the different national security interests. The results give high and low estimates of a risk occurring. The impact assessment allows the Netherlands to determine which capabilities are needed for each type of risk. Each NRA is reported to parliament accompanied by an account of the capabilities that the government has decided need be reinforced, based on the NRA. For each of the main risks assessed, a capability analysis is carried out under the responsibility of the government department that is most involved, with support from the Ministry of Security and Justice.

Source: OECD (2018[48]), OECD Toolkit on Risk Governance, https://www.oecd.org/governance/toolkit-on-risk-governance/home/.

## 4.4. Capabilities for public health emergency preparedness and response in Korea

Based on its risk analysis and following recent disaster events, Korea has invested resources for the development of a robust infrastructure and dedicated capabilities to prepare for public health emergencies, from their detection and surveillance to emergency response and medical care. A notable budget increase in risk management contributed to strengthening Korea's emergency capabilities significantly in the last 5 years, with the creation of new information systems, the enhancement of health care infrastructures, and the reinforcement of human resources, especially for infectious diseases preparedness and control. While progress can be continuously undertaken in this domain, these capacities appear to be generally tailored in good accordance with the level of risk in Korea, national policies and international standards, particularly at the national level. Nevertheless, ensuring that local government also build the commensurate capabilities to properly fulfil their requirements is a concern across health and emergency professionals.

### *4.4.1. Surveillance, monitoring and information systems make good use of innovation to detect public health emergencies.*

Korea has invested significantly in its capacities to monitor, detect, and analyse threats to public health, as well as to warn emergency responders and citizens in case of disaster events. Making the best of the widespread use of cutting-edge technologies in the government and within the society, a series of monitoring and reporting mechanisms, complemented with information systems are in place which allow smart detection of hazardous events and infectious diseases. Significant improvements to these systems were put in place in recent years, following the Sewol Ferry disaster and the MERS-CoV outbreak, in order to increase information sharing between diverse platforms and to strengthen the infectious disease surveillance system.

As prescribed in the Act on the Management of Disasters and Safety, a whole-of-government system has been designed to monitor hazards, detect threats and define emergency levels. Linked to the Disaster

Situation Information System (DSIS) managed by the MOIS National Disaster and Safety Control Center (NDSCC), the system gathers information from 15 ministries and agencies, ranging from the Korea Meteorological Agency for natural hazards, to the Korea Center for Disease Control for infectious diseases, which all have invested in robust monitoring and surveillance networks for the risks that they are in charge of (MOIS, 2018). Regarding healthcare information, the Emergency Medical Information Center (NEMC) also connects to the DSIS through its Disaster Emergency medical Service situation room established in 2014 (Cha et al., 2017[49]).

This state-of-the-art multi-hazard early warning systems enables timely detection for all the different types of emergencies which can endanger public health in Korea. The four-level categorisation of emergencies from attention (Blue), to caution (Yellow), alert (Orange) and serious (Red) with pre-defined thresholds, on which the system is based, (Table 4.6) is common for all hazards and threats. This approach facilitates a good understanding of risk levels across the large emergency response network and the society at large.

### Table 4.6. Warning level criteria for different hazards and threats

| Warning levels | Infectious disease | Typhoon | Heavy snowfall |
|---|---|---|---|
| Attention (Blue) | Infectious disease overseas | Summer season | Winter season |
| Caution (Yellow) | Infectious diseases cases reported | Typhoon advisory issued | Heavy snowfall advisory issued |
| Alert (Orange) | High probability of spread of an infectious disease | Typhoon warning issued | Heavy snowfall warning issued |
| Serious (Serious) | On-going spread of an infectious disease | Typhoon warning issued and major disaster expected | Heavy snowfall warning issued and major disaster expected |

Source: Responses of the Korea Authorities to the OECD questionnaire to inform the OECD Reviews of Public Health: Korea.

Redundant dissemination and two-ways communication make of the Korea warning system an advanced risk communication tool. Partnerships with telecommunication companies and broadcast media enables timely dissemination of warnings through a variety of channels. The Safemap application previously described is also used to provide direct warning to citizens, with a Cell Broadcasting System enabling warnings to reach citizens located in areas where safety is at threat and providing them with all the necessary information. Citizens can also report on disaster situations through the app back to the emergency responders, enabling crowdsourcing of risk information to get a clearer situation picture.

Regarding infectious diseases surveillance and detection, KCDC acts as the control tower of the National Notifiable Infectious Disease Surveillance System (NNIDSS), which is a robust country-wide system, to which all the medical institutions and personnel contribute. As per the Infectious Disease Control and Prevention Act, reporting is mandatory for 80 types of infectious diseases by all public and private healthcare facilities and laboratories, as well as for local governments. Medical personnel are to report 56 types of infectious diseases from Category 1 to Category 4 immediately through the dedicated information system. Category 3 influenza and Category 4 infectious diseases, and nationally identified infectious diseases, are reported through the sentinel surveillance system within seven days. NNIDSS builds on a solid network of 298 hospitals, 256 Public Health Centers, 13 quarantine stations and 17 Research Institute on Health and Environment with complementary national BSL-3 ad BSL-4 lab capacities (World Health Organisation, 2017[43]). In addition, for bio threats, a syndromic surveillance system is in place in all 132 emergency medical facilities of Korea to monitor and report suspected patients with acute rashes, haemorrhage, nervous, and respiratory symptoms.

While NNIDSS was designed according to best international standards (Park and Cho, 2014[50]), the 2015 MERS-CoV outbreak demonstrated weaknesses in the detection of the outbreak and communication to the population (Jung et al., 2019[51]). This led the government to strengthen the event-based surveillance system, to create a new Emergency Operation Center at KCDC, and to increase the reporting requirements for healthcare facilities. These improvements will certainly contribute to an improved capability to detect

infectious diseases in Korea, but attention should be paid to the risk of reporting fatigue in health institutions over the years, in a system which might appear excessively burdensome.

### *4.4.2. Korea is currently investing in strengthening health infrastructures dedicated to emergencies to increase preparedness and safety following a series of failures*

Similarly, Korea is investing significantly in strengthening its health infrastructure to cope more effectively with both infectious diseases and multi-casualty disasters. As health emergencies in the last years demonstrated preoccupying gaps in infectious disease control in hospitals, rapid availability of healthcare in large accidents, as well as safety concerns in health institutions (Cha et al., 2017[49]), these on-going investments and the strengthening of the regulatory framework appear particularly relevant to bridge these gaps. Nevertheless, sustaining these improvements overtime would require for Korea to properly resource operation and maintenance for these infrastructure, and maintain the momentum on safety improvements in hospitals with an equilibrated partnership with the private sector.

Following the MERS outbreak, MOHW conducted a detailed assessment of the infectious diseases control capacities over Korea in 2015, with the aim of responding to the identified weaknesses during the epidemic and investing in new capabilities across the healthcare system. This risk-based capability assessment was based on a series of criteria, including the distribution of health and medical resources, the living environment and the population, the frequency of infectious diseases and the proximity to airports and sea ports. As a result, MOHW set up an ambitious plan to raise the level of preparedness of health infrastructure throughout the country with a series of new capabilities (Box 4.6). While these investments are largely financed by KCDC, there is a need to ensure sufficient budget for the maintenance of these capabilities overtime (World Health Organisation, 2017[43]).

### Box 4.6. Investments in new infectious diseases control capabilities in Korea in the aftermath of the MERS outbreak

The large spread of the MERS-CoV in 2015 was mostly nosocomial and required to upgrade the capabilities of infectious disease hospitals in Korea. Following the MOHW risk-based capability assessment, 10 new hospitals were designated as infectious diseases hospitals, and are progressively equipped with an additional 198 negative pressure beds and isolated outpatients room. With these new capabilities, Korea has now 29 infectious diseases hospitals across its 16 main cities and provinces. In addition, 100 negative pressure beds will be installed per regulation across the central hospitals of Korea (i.e. in hospitals with more than 500 beds). Finally, MOHW plans to establish a central hospital to deal with infectious diseases in 2022, which would act as a control tower overseeing infectious diseases hospitals.

Source: Compiled by the Authors based on interviews conducted with health professionals in Korea and Ministry of Health and Welfare response to the questionnaire to inform the OECD Reviews of Public Health: Korea.

Regarding other public health risks, Korea has also designated disaster-base hospitals across its territory and expanded its number from 20 to 40 in 2015 with the revision of the Framework Act on the Management of Disaster and Safety (Cha et al., 2017[49]). These disaster-base hospitals constitute the backbone of the National Emergency Medical Center (NEMC) disaster response system: they host the local disaster Medical Assistance Teams (DMAT) which can be deployed on disaster scenes to provide healthcare. The increase of disaster base hospitals enables a better coverage of the national territory and population and improves medical response preparedness for disasters.

Finally, hospital safety is a major concern in Korea. Beyond the MERS nosocomial infections, hospital accidents frequently occur, as shown in the recent fire of the Sejong hospital of Miryang during which 41 people died. As the OECD country with the highest number of hospital beds per inhabitants, ensuring safety levels of these healthcare providers is a key issue for public safety. Korea's hospital evaluation programme was revised in 2015, to increase its focus on safety. However, this programme is mandatory only for general, public and specialised hospitals, and the participation rate is particularly low (World Health Organisation, 2015[52]).

### *4.4.3. Korea plans large stocks of medical countermeasures and emergency supplies for emergency response*

Emergency capabilities also include stockpiling of medical countermeasures for disease outbreaks, as well stocking emergency relief supplies for disasters. Korea's stockpiling policy for medical countermeasures follows international standards. Based on its risk assessment, this policy is supported by a robust legal base with the Infectious Disease Control and Prevention Act and the Pharmaceutical Affairs Act, and is updated regularly, every 3 years.

As in most OECD countries, the stockpiling policy in Korea was significantly upgraded after the 2009 H1N1 outbreak. A National Stockpile Plan was designed and guidelines developed for stockpiling and its management and distribution. Five national stockpile centres are strategically positioned throughout the country and local governments also contribute on the distribution plan. In 2012, Korea was storing 13 million doses of antiviral drugs (Tamiflu: 73% and Relenza: 27%), covering 26% of its population (Lee et al., 2013[53]). Personal protection equipment's and other medical countermeasures for the 11 priority diseases identified by KCDC are also stored in the National Stockpile. Following the MERS outbreak, changes were introduced to adopt a more dynamic stockpiling approach with a system for real time stockpiling management currently under implementation as well as a 5 year National Strategic Stockpile.

Regarding vaccines, in addition to pre pandemic stockpile, Korea has the appropriate mechanisms to introduce new vaccines in vase of need through the Vaccine Management Council and Committee for the Safe Supply of National Essential Medicine (World Health Organisation, 2017[43]). Korea has also a national stockpile of smallpox vaccine covering 80% of the population.

Beyond the health sector, each sector is also responsible for maintaining stockpiles for responses to emergencies under the Framework Act on the Management of Disasters and Safety. A joint resource utilisation system was initiated in 2014 to coordinate inventory management and material deployment across sectors and is currently in the process of implementation (World Health Organisation, 2017[43]).

### *4.4.4. Workforce development for public health emergency preparedness is an on-going priority in Korea*

As for the other capabilities described in this chapter section, workforce development is amongst Korea's priorities to strengthen its public health emergency preparedness. The Disaster Medical Assistance Teams were reformed and reinforced, MOHW is establishing a system of psychological support practitioners for disasters, and most significantly infectious diseases specialists are being hired and trained to reinforce KCDC and Public Health Centers throughout Korea. The challenge now is to make sure that these strategic investments in skills best contribute to strengthening the entire public health system where the most important needs are.

The slow response during the MERS outbreak convinced Korean decision-makers of the need to reinforce skills and staff in KCDC and across national and local governments for infectious diseases preparedness and control. After a recruitment campaign, KCDC now counts approximately 1 400 staff for prevention, investigation, quarantine, testing, and research of infectious diseases. The 10 KCDC's Rapid Response Teams (RRT) can be deployed rapidly for epidemic investigations. For surge capacities during large-scale epidemics, complementary Emergency Investigation Officers are trained through the Field Epidemiology Training Program and private sector healthcare professionals can also be mobilised. In addition, MOIS is currently recruiting a total of 366 people in charge of infectious diseases at the subnational in the Public Health Centers (World Health Organisation, 2017[43]). At the local level, Public Health Centers and local governments are attentive to how these new resources will be distributed across the country as some fears it might not be risk-based.

For other public health emergencies, Korea also has adjusted its workforce. Disaster Medical Assistance Teams (DMAT) are now better able to rapidly deploy on disaster scenes and maintain a longer presence. Based on foreign experience, such as the Japan DMAT, these emergency healthcare providers' teams have been reduced in size, dispatched in a larger number of disaster base hospitals throughout the country, reorganised and trained (Cha et al., 2017[49]). Furthermore, Korea MOHW aims also to develop dedicated process for the mobilisation of Disaster Psychological Assistance Teams (DPAT) to provide psychological support during and after disasters to affected populations. The National Center for Mental Health has initiated these reflexions in the aftermath of the Ferry Sewol Accident, which largely traumatised the Korean society (Jo et al., 2018[54]).

## 4.5. Emergency countermeasures and their implementation during crisis

Korea has developed a set of emergency plans to mobilise its capabilities and implement countermeasures when public health crises occur. A large planning effort across levels of government and sectors based on the development of standard operating procedures contributes to improve preparedness, but this tends to favour silo-ed and rigid approaches. However, as shown in recent crises, inter-agency coordination grounded on regular multi-stakeholder exercises would need to be strengthened for a more flexible and adaptable crisis response in Korea, with improved crisis leadership and crisis communication.

As proposed by the OECD Recommendation on the Governance of Critical Risks, preparing better for the more complex and unforeseeable crises of today's risk landscape requires going beyond standard operating procedures based on the history of past events to embrace agile multi-stakeholder partnerships. An encouraging dynamic is shaping up in this direction in Korea, which demonstrated a change of mind-set, but this remains an unfinished agenda.

### *4.5.1. Public health emergency plans are developed at all levels in Korea but this approach does not favour agile emergency response*

In Korea, based on the overarching Master Plan for National Safety Management developed by MOIS, all ministries and agencies have to prepare a Standard Manual for Crisis Management for the emergencies they are responsible for. These 33 manuals cover all the national emergencies identified in the risk assessment and include 13 crisis management functions such as management, communication, financing, medical services, search and rescue, etc. (Jang and Yun, 2017[55]). Similarly, local plans are developed based on national guidelines by local governments.

Regarding public health specifically, MOHW is responsible for developing and maintaining the Standard Manual for Infectious Diseases Emergency Management as well as for supporting the function of supporting medical and disinfection services for other types of crises. KCDC, as the main operating agency for infectious diseases response has also developed a dedicated Operational Manual, detailing the standard operating procedures for engaging disease control countermeasures. Based on lessons learned during the MERS-CoV outbreak, these manuals are currently being updated.

This extensive development of emergency plans across Korea's institutions and levels of governments has benefits, as it reinforces engagement, accountability and responsibility of stakeholders. Through yearly inspections of the plans from sectoral ministries to local governments, MOIS ensures that guidelines are followed. Furthermore, MOIS has set up incentives for local governments to develop qualitative plans: based on a series of indicators, rewards for high-quality preparedness and special grants to support strengthening for the ones showing weaknesses are allocated. A similar model exists in MOHW for the public health plans of local government, which also addresses public health emergency preparedness.

More efforts would nevertheless be required to ensure coherence between this large set of emergency plans. Based on the 33 types of crisis management manuals in Korea, departments created 278 crisis response manuals, 1 300 related organisations, and 2 339 on-site action manuals (Bang and Kim, 2016[56]). The multiplicity of plans makes it difficult to ensure coherence when a crisis strikes. As these manuals tend to favour a command and control system with pre-determined standard operating procedures (SOP), they have often generated silo-ed approaches and did not demonstrate sufficient flexibility when facing complex emergencies. While SOP are necessary for classic emergencies, more and more, OECD countries are adopting a multi-hazard approach based on flexible partnerships, robust leadership and regular exercises across a multi-stakeholder response network to prepare better for complex and unprecedented types of crises (OECD, 2018[1]).

### *4.5.2. Korea is making efforts to foster inter-agency coordination in public health emergency response*

Evidence of coordination failures in crisis management have prompted a major reflection in Korea on inter agency coordination and crisis leadership. Both during the Ferry Sewol disaster and the MERS outbreak (Box 4.7), applying crisis manuals by individual organisations proved largely insufficient to reduce the public health consequences of these crises: crisis sense-making was affected by the absence of pan-governmental communication and information exchange, ineffective coordination between organisations led to delayed responses, lack of leadership made decision-making unclear.

### Box 4.7. Crisis leadership and interagency coordination during the MERS outbreak

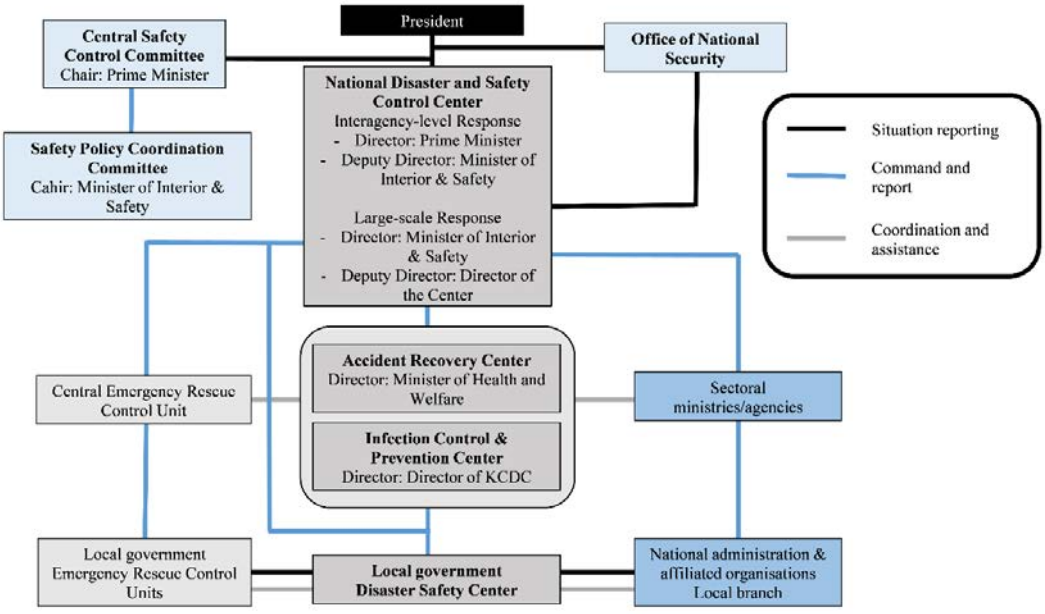
The MERS epidemic outbreak demonstrated the importance of clarifying governance for crisis management in Korea. Both crisis coordination mechanisms and crisis leadership changed not less than four times during the outbreak, which led to major confusions in the response, and contributed to creating panic and deteriorating trust in government.

While KCDC established its Countermeasure Headquarter after the first patient was confirmed to be infected by MERS on May 20, 2015, MOHW took over the crisis control through its Central MERS management headquarters a few days after, as the infection was mostly nosocomial. Then, the Ministry of Public Safety and Security – now MOIS – set-up the Pan Government MERS Countermeasure Support Centre to ensure coordination across ministries and with local governments.

Source: Park, M. (2017[42]), "Infectious disease-related laws: prevention and control measures", *Epidemiology and Health*, Vol. 39, p. e2017033, http://dx.doi.org/10.4178/epih.e2017033.

Since then, revisions to the governance of crisis management represent substantive changes towards improved interagency coordination. The establishment of the National Disaster Safety Control Center (NDSCC) under MOIS in 2015 as a joint situation center with representatives from all the relevant ministries and agencies is promising. The Centre is equipped with appropriate situation awareness and information sharing tools. A problem-solving doctrine has been core to its design, based on comprehensive situation judgement meetings. A direct link to political leadership facilitates decision-making, with the involvement of the Minister of the Interior and Safety or the Prime Minister, depending on the crisis' scale (Figure 4.6).

### Figure 4.6. Inter-agency coordination for emergency response in Korea




Source: Compiled by the author based on responses of the Korea Authorities to the OECD questionnaire to inform the OECD Reviews of Public Health: Korea.

In the case of infectious diseases, KCDC has also strengthened its capacities to operate as an effective command and control center with its Emergency Operations Centre established in 2015. The Centre which operates on a 24/7 basis can operate as the Central Epidemic Control Countermeasure Headquarters if an infectious disease crisis is detected, under the leadership of the KCDC director or the Ministry of Health in case of severe crisis.

This new organisation clarifies leadership and facilitates inter-agency coordination. However the establishment of two new structures, NDSCC and KCDC EOC, requires specific arrangements to clarify their coordination mechanisms in case of a large-scale infectious disease outbreak. MOIS and the Prime Minister remain overarching coordinators during large scale events, and are also essential for ensuring a good coordination with local governments.

### *4.5.3. Revisiting approaches to crisis communication in Korea is a priority*

Crisis communication is an essential part of emergency response. It is fundamental to convey critical messages for the safety and security of the population as well as to reduce citizens' uncertainty during crises (OECD, 2015[44]). Good or poor crisis communication can significantly change the course of a crisis, both in terms of public health consequences (e.g. if citizens are not well informed of the countermeasures taken or that they should follow) and/or in terms of trust in government and public institutions (e.g. if the perception that the crisis is not well managed prevails).

During the MERS outbreak, public risk communication was delayed and resulted in a widespread panic. The government's non-disclosure decision on the names of the hospitals where the infection had spread, significantly affected trust in government and in the health system (Kim et al., 2017[17]). One can understand the difficulty of crisis communication in light of the important uncertainties on the crisis' status, future developments, and on the ways to handle it. Nevertheless, attention to citizens' expectations and disarray is also fundamental to consider in crisis communication. Otherwise, there are risks that inadequate communication contributes to aggravating the crisis, as was the case during the MERS outbreak, and also during the Ferry Sewol disaster.

Korea invested in recent years to improve its crisis communication approach towards more transparency. KCDC for instance has established a dedicated Office of Communications in 2015, and mobilised the right skills by hiring communication professionals and media specialists, including to work on public perceptions. This resulted in the diffusion of crisis communication guidelines and SOPs for officials (KCDC, 2017[57]). In addition to using a variety of communication channels from media briefing, to web based platforms, social media, and call centres, there is a mechanism in place to promptly identify and manage rumours and misinformation through social networks (World Health Organisation, 2017[43]).

### *4.5.4. Multi-stakeholder emergency simulation exercises based on complex scenarios could be undertaken regularly*

In Korea, simple exercises are undertaken regularly to test emergency plans and procedures, but simulation exercises based on more complex scenario including multiple stakeholders are necessary to improve its preparedness.

Every year, MOIS organises a national exercise with all the departments at the occasion of the Disaster Safe Korea day in May. Monthly exercises are also conducted for 22 types of crises, with scenarios, such as traffic accident, earthquakes, large fires, chemical accidents, bioterrorism or explosion of a nuclear reactor. On public health emergencies specifically, MOHW and KCDC also organise regular national exercises and simulation drills and has increased the number of these from 20 to 30, including a yearly large-scale drill. For instance in 2018, they organised a table-top exercise with 100 Public Health Centers. Smaller-scale drills at the local level are conducted every two years in each Public Health Centre.

All these exercises and drills are useful to ensure that procedures are well-known and tested, but most of them are based on testing the manuals and this approach may not be sufficient to prepare for complex emergencies. Indeed, these exercises often lack elements of surprise and complexity which would force crisis managers and officials to go out of their comfort zone as real emergencies require, and to detect areas of improvement. Beyond the yearly multi-stakeholder exercise on the Disaster Safe Korea day, such complex exercises should involve the entire network of emergency responders from the different sectoral ministries as well as the levels of government, the private sector and civil society. As more and more OECD countries are now utilising exercises to go beyond the testing of emergency procedures to learn lessons, identify deficiencies and improve policies and procedures, Korea could learn from these advanced approaches (OECD, 2018[1]).

## Conclusion

Korea has invested significantly in the last few years in restructuring and reinforcing its public health emergency preparedness policies and capabilities, notably following the Sewol Ferry Disaster in 2014, and the MERS-CoV epidemic outbreak in 2015. Both crises revealed major shortcomings in applying safety regulations, their control, and crisis management. This led to revisiting the legal framework, including the Framework Act on the Management and Disasters and Safety, and the Infectious Diseases Control and Prevention Act. There is now an all-hazards and threats approach to risk management although not yet a National Risk Assessment process in place that would allow to prioritise efforts across the different risks to public health in the country.

The institutional framework has been revised under the new Ministry of Interior and Safety, following a series of reforms. Regarding infectious diseases, the aftermath of the MERS epidemic led to a major strengthening of the Korea Center for Diseases Control, which revised its risk assessment and risk communication processes significantly. Investments in public health emergency capabilities across the board, from detection and information systems, to stockpiling of countermeasures and public health emergency workforce leave the overall system at the right level of capabilities in light of the Korean risk landscape. Korea is also making the best of innovation and technologies to foster timely detection, enable information-sharing from authorities to citizens, and facilitate decision-making.

Despite the usefulness of these necessary policy reforms and new capabilities, strengthening emergency preparedness in Korea remains an unfinished agenda. Overall, Korea appears to be over-reliant on planning at all the levels of its administration, which is important but not sufficient for preparedness for more complex and unforeseen emergencies. Strengthening capacities for a more agile response based on multi-stakeholder partnerships, flexible arrangements, and engaged leadership should be the guiding objectives for Korea to further progress in emergency preparedness. Furthermore, strengthening preparedness at the local level is a major priority. More work also needs to be done to address the main weakness of Korea's public health system when it comes to infectious diseases prevention: because of the weak primary care system in Korea, Koreans rush to large hospitals for any symptom, which can contribute to spreading infections. Finally, it is also important to maintain the momentum to continue strengthening public health emergency preparedness capacities overtime, and prevent a fading-off of efforts, even in the absence of major crises. There is no place for complacency in emergency preparedness.

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# OECD Reviews of Public Health: Korea

## A HEALTHIER TOMORROW

This review assesses Korea's public health system, highlights areas of strength and weakness, and makes a number of recommendations for improvement. The review examines Korea's public health system architecture, and how well policies are responding to population health challenges, including the growing burden of chronic disease, and resulting pressures on the health system. In particular, the review assesses Korea's policies to prevent harmful alcohol use, and the risks and opportunities around public health genomics in Korea, which is both a growing field in the health sector, and a booming commercial industry. The review also examines Korea's exposure to public health emergencies, and capacity to respond to emergencies as and when they occur.

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