

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, its 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. These restrictions should aim to prohibit 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 elements 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 visiting 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 assess 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.

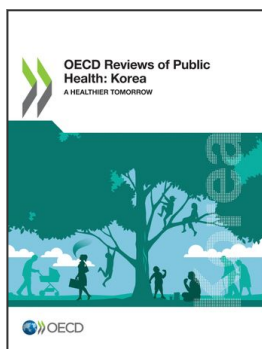
An encouraging dynamic is shaping up to improve emergency response in Korea, but this remains an unfinished agenda

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.



From:
OECD Reviews of Public Health: Korea
A Healthier Tomorrow

Access the complete publication at:
<https://doi.org/10.1787/be2b7063-en>

Please cite this chapter as:

OECD (2020), "Assessment and recommendations", in *OECD Reviews of Public Health: Korea: A Healthier Tomorrow*, OECD Publishing, Paris.

DOI: <https://doi.org/10.1787/dfd9c6a4-en>

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