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HEALTH AND LONG-TERM CARE WORKFORCE

Demographic challenges and the potential contribution of migration and digital technology

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Joint Research Centre

Health and long-term care workforce: demographic challenges and the potential contribution of migration and digital technology

Contact information
Name: Sara Grubanov Boskovic
Email: sara.grubanov-boskovic@ec.europa.eu

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HEALTH AND LONG-TERM **CARE** WORKFORCE

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AUTHORS

Sara Grubanov Boskovic (ed.)[1,2]
Martina Belmonte[1,2]
Alessandra Conte[1,2]
Daniela Ghio[1,2]
Anne Goujon[1,2]
Marco Scipioni[1,2]
Sona Kalantaryan[1,2]
Emilio Gómez-González[3]
Emilia Gómez[1]
Songül Tolan[1]
Fernando Martínez-Plumed[1]
Annarosa Pesole[1]
Enrique Fernández-Macías[1]
José Hernández-Orallo[4,5]

[1] European Commission, Joint Research Centre
[2] European Commission's Knowledge Centre on Migration and Demography
[3] ETSI Universidad de Sevilla, Spain
[4] Universitat Politècnica de València
[5] Leverhulme Centre for the Future of Intelligence
[6] Universitat Pompeu Fabra

ABSTRACT

In the EU, the right to timely access the 'affordable, preventive and curative health care of good quality' and the right to 'affordable long-term services of good quality' are enshrined in the European Pillar of Social Rights (C(2017) 2600 final). The backbone of health and long-term care (LTC) systems' capacity to ensure that EU citizens can exercise these rights is its workforce.

The COVID-19 pandemic has put the resilience of national health and LTC systems to the test and has made it even more tangible that 'health is a precondition for our society and economy to function' (COM(2020)724 final). However, even prior to the COVID-19 outbreak, the national health and LTC systems were faced with an unprecedented challenge with regard to the progressive ageing population in the EU. The rise in the number of elderly people has been increasing the demand for health and LTC services which, in turn, has generated a rising demand for a qualified health and LTC workforce. In the period 2018-2030 alone, the EU-27 will need 11 million newly trained or imported health and LTC workers to satisfy the rising demand in the health and LTC sectors.

Planning a health and LTC workforce that has the size and skills suitable to satisfy the demand is a challenging task, given the numerous and often interrelated factors in play. These factors range from the demographic and health characteristics of a population, a country's economic growth, technology, the migration of health and LTC professionals, to education and retirement policies. This implies a need for a holistic approach in workforce planning, capable of incorporating and coordinating various policy domains at local, national and EU level.

Drawing on research activities carried out at the Joint Research Centre (JRC) – specifically within the framework of the Commission's Knowledge Centre on Migration and Demography (KCMD) and the Centre for Advanced Studies HUMAINT project – this report aims to contribute to workforce planning by enhancing the scientific knowledge in three specific domains: demography, migration and digital technology.

More specifically, **the aim of this report is to provide scientific insights into the role of demographic change, migration and intra-EU mobility, as well as digital technology, in determining the demand and the supply of health and LTC workers** in an effort to inform the EU's workforce planning policies.

EXECUTIVE SUMMARY

In the EU, the right to timely access the 'affordable, preventive and curative health care of good quality' and the right to 'affordable long-term services of good quality' are enshrined in the European Pillar of Social Rights (C(2017) 2600 final). The backbone of health and long-term care (LTC) systems' capacity to ensure that EU citizens can exercise these rights is its workforce.

The COVID-19 pandemic has put the resilience of national health and LTC systems to the test and has made it even more tangible that 'health is a precondition for our society and economy to function' (COM(2020)724 final). In response, the Commission has taken the first steps towards building the European Health Union. On that basis, the Commission, among others, will support the Member States in detecting shortages in healthcare staff and in taking targeted actions to guarantee the 'availability of sufficient and up-skilled healthcare staff who can be redeployed to new roles in case of emergency' (COM(2020) 724).

Even prior to the COVID-19 outbreak, the national health and LTC systems were faced with an unprecedented challenge with regard to the progressive ageing population in the EU. **The rise in the number of elderly people has been increasing the demand for health and LTC services which, in turn, has generated a rising demand for a qualified health and LTC workforce**. In the period 2018-2030 alone, the EU-27 will need 11 million newly trained or imported health and LTC workers to satisfy the rising demand in the health and LTC sectors (Cedefop, 2020).

Planning a health and LTC workforce that has the size and skills suitable to satisfy the rising demand is a challenging task, given the numerous and often interrelated factors in play. These factors range from the demographic and health characteristics of a population, a country's economic growth, technology, the migration of health and LTC professionals to education and retirement policies. This implies a need for a holistic approach in workforce planning, capable of incorporating and coordinating various policy domains at local, national and EU level.

Drawing on research activities carried out at the Joint Research Centre (JRC) – specifically within the framework of the Commission's Knowledge Centre on Migration and Demography (KCMD) and the Centre for Advanced Studies HUMAINT project – this report wants to contribute to workforce planning by enhancing the scientific knowledge in three specific domains: demography, migration and digital technology.

More specifically, **the aim of this report is to provide scientific insights into the role of demographic change, immigration and intra-EU mobility, as well as digital technology, in determining the demand and the supply of healthcare and LTC workers in an effort to inform the EU's workforce planning policies**.

The main policy-relevant findings can be summarised as follows.

DEMOGRAPHIC CHANGE, A DRIVER OF THE DEMAND FOR A HEALTH AND LTC WORKFORCE

Demographic change is the **key driver of the demand** for health and LTC services and the related workforce. The most important demographic indicators for workforce planning in health and LTC sectors are changes in the size, age structure and health conditions of the population, the patterns of health and LTC utilisation by population and its unmet medical needs.

In this domain, the report offers scientific insights into the main demographic elements that, within the context of the EU's ageing society, should be accounted for in order to have efficient workforce planning in health and LTC sectors.

Overall, **with rising life expectancies, the quality of life of elderly people remains a challenge** in the EU. One fifth of the EU population is above 65 years of age; on average, the elderly population has a remaining life expectancy of 20 years, but half of that time is spent in poor health.

One of the major challenges of the rising number of elderly people for the EU's health sector is the growing demand for chronic disease treatments. At the same time, the EU's LTC sector is facing an increasing number of elderly people suffering from serious functional limitations (or disabilities). Overall, the bulk of the demand for both health and LTC services is generated by elderly people in the 75-84 age group. Gender also plays a relevant role. For example, women above 75 years of age have higher likelihood of being affected by chronic diseases than men in the same age group; while men in the age group 65-84 have higher likelihood of suffering from serious mobility-related functional limitations in comparison to women in the same age group. However, the challenges of an ageing population on health and LTC sectors do not apply to all EU Member States equally, nor are they distributed equally within the same Member State.

On average, elderly people in the EU have 7 doctor visits during a one-year period, and 17% of elderly people are hospitalised for at least one night per year. Still, there are **remarkable differences between and within Member States** in the utilisation of specific health and care services, such as primary care, hospital-based care and home-based care. These differences not only reflect different demographic and health characteristics of populations, but also the variety of national (and local) health and LTC policies in place.

Although the largest part of the demand for health care is being satisfied through primary care and hospital-based services, there is still a small part of the demand for care by elderly people, which is not currently being met. In fact, around 3.6% of the EU's population above 65 years of age do not

receive the medical examination they would need, either because it is expensive, geographically inaccessible, the waiting lists are too long or because the person has a fear of doctors or could not find one that they could trust. It is in particular the elderly living in rural areas and elderly women with a higher risk of not receiving the healthcare attention needed. At the same time, with current data, it is difficult to estimate what part of the LTC demand is being satisfied through formal and informal care and what part of this demand qualifies as unmet care needs.

Continuous monitoring and better understanding of demographic changes allow societies to timely prepare and address associated challenges through the efficient and cost-effective planning of services and the workforce in both health and LTC sectors. The effectiveness of monitoring of demographic changes, however, relies on data. In this vein, the Council Conclusions on Demographic Challenges (8668/20) has invited the European Commission 'to further develop a common basis and interactive EU-wide resource for obtaining timely, consistent, comparable and accessible data, disaggregated by sex and age'.

This has repercussions for the organisation of the health and LTC systems, for which the continued yet diverse process of population ageing would require further **efforts to develop integrated approaches between hospital-based systems, primary care and long-term care not only in terms of the delivery of services, but also in terms of integrated workforce planning**.

MIGRATION AND INTRA-EU MOBILITY, DRIVERS OF THE SUPPLY OF A HEALTH AND LTC WORKFORCE

Migration and intra-EU mobility have been playing an increasingly important **role in shaping the overall supply** of a health and LTC workforce, therefore becoming a crucial dimension in workforce planning.

In recent years, the EU has been attracting an increasing number of foreign-born healthcare and long-term care workers. In 2018 there were almost 2 million health and LTC workers born in a country different than the one they were working in. The majority of these workers originated from a) other EU Member States; b) European countries not part of the EU; and c) the region of North Africa & Middle East.

Out of 27 EU MSs, 5 Member States absorb almost two thirds of health and LTC foreign-born workers: Germany, Italy, France, Spain and Sweden. However, each Member State has a different pattern in terms of types of occupations (health professionals, health associate professionals and personal care workers in health services) in which the foreign labour force is employed, therefore reflecting different national labour market needs.

Whereas the EU mobile citizens benefit from the free movement of workers in the EU, non-EU migrant health and LTC workers have to satisfy the requirements of

the national migration systems. The majority of these workers arrived in the EU via the family reunification channel and, to a somewhat smaller extent, via the employment channel.

In compliance with the principle of ethical recruitment, migration has the potential to contribute to alleviating the pressure of workforce shortages in healthcare and LTC sectors in the EU. The findings of this report, however, suggest that there are still several **open challenges** related to the recruitment of health and LTC workers outside the EU.

Firstly, the exhaustive analysis of policies in force shows that **there is no specific EU sectoral labour migration instrument or tool for attracting foreign healthcare and LTC workers**. This, coupled with the heterogeneity of skills and employment profiles of health and LTC workers, fragments the labour migration management system for this type of workers into a variety of instruments, both at EU and national level. Also, the absence of specific migration channels for LTC workers and the fact that they may not be eligible for skilled or general programmes makes it particularly challenging for EU families to recruit LTC support from abroad. Consequently, foreign-born LTC workers are often recruited domestically, informally and, at times, as undocumented migrants.

In addition, as several health professions are regulated in the EU, migration requirements often include the **recognition of qualifications** as a prerequisite for exercising regulated professions. The complex procedures associated with it may pose a challenge in a context in which the health-related education and training programmes considerably differ from those imparted in the EU. On the contrary, LTC workers, while often not in need of formal qualifications, perform tasks involving a set of informal skills that is difficult to assess. The absence of specific tools to do so may also discourage recruitment.

Lastly, examples of international partnerships for the recruitment of health and LTC personnel in line with the WHO Global Code of Practice remain limited in numbers and scope.

One way forward is to **integrate current labour migration channels with more specific considerations for the health and LTC sectors**, in compliance with ethical recruitment practices. Such mechanisms could foster circularity and therefore yield benefits for both countries of origin and destination. This approach would also imply the facilitation of the recognition of qualifications and the full activation of skills of the migrant workforce in the EU.

It is equally important to ensure labour market integration and provide conditions for the full activation of skills that migrants bring. In this context, our findings suggest that more effort should be made to reduce the scope of involuntary forms of temporary and part-time contracts, the latter among personal care workers in health services in particular. Improving job security for all workers, regardless of

origin, would help unlock their potential and increase productivity in health and LTC sectors. Moreover, considering the series of challenges related to the immigration of health and LTC workers, greater job security could incentivise participation in skills and knowledge sharing cooperation projects between countries of destination, transit and origin.

THE ROLE OF DIGITAL TECHNOLOGY IN HEALTH AND LONG-TERM CARE SECTOR

The role of digital technologies in health and LTC sectors has been manifold. Digital technologies have, amongst others, transformed the delivery of health and LTC services and generated new type of professional roles and skillsets, therefore affecting both the demand for and the supply of health and care workers. However, the full implementation of digital technologies, as well as its potential effect on health and LTC workforce, remain closely related to numerous ethical, social and labour market aspects.

ARTIFICIAL INTELLIGENCE (AI) IN MEDICINE AND HEALTHCARE: AVAILABILITY AND SOCIO-ETHICAL IMPACTS

In order to understand the potential **impact of AI on the provision** of healthcare services – which in turn impacts the demand for health workers -, it is necessary to start with a comprehensive review of the applications of AI in the healthcare sector, taking into account how close they are to market implementation.

Currently, **the spectrum of AI applications in healthcare is extremely broad**: it ranges from applications with high technology availability value, such as algorithms for computer-aided diagnosis or imaging tools, to applications that are still immature, such as mind reading or whole-brain simulation.

The technological availability of AI applications is associated with three groups of ethical and social aspects related to AI in the healthcare sector: 1) issues such as data privacy, fairness or human oversight which have been broadly discussed in the context of general AI; 2) issues of particular relevance in medicine and healthcare, but also common in other domains, e.g. transparency, the required updates in evaluation, benchmarking and legislation; 3) controversial aspects not yet considered in other fields, e.g. ethical guidelines related to self-experimentation in medicine.

COVID-19 has emphasised both the opportunities and ethical challenges of the use of AI in medicine, bringing an increased interest for the public. Given the strong implications of health data-related AI systems and the overlap with public health policies, an analysis of opportunities and risks has to be carried out before systems are fully deployed.

New policy challenges clearly arise. The EU has the extended, experienced and trustworthy resources to lead this debate based on an open, international environment, and to define any ethical and social guidelines with the required legislative and regulatory actions.

THE IMPACT OF ARTIFICIAL INTELLIGENCE (AI) ON HEALTH-RELATED OCCUPATIONS

Analysing the impact of AI on the supply of healthcare workers is an equally complex task. This task entails predicting if and when machines could substitute humans in an entire, or in parts of, occupation. One way of analysing the specific **occupational impact of AI progress** in the healthcare sector is to connect AI benchmarks with tasks via an intermediate layer of cognitive abilities. The AI impact in this report was analysed in relation to the following occupations: 1) medical doctors; 2) nursing and midwifery professionals; 3) paramedical practitioners; and 4) medical and pharmaceutical technicians.

Overall, the findings suggest **high activity in AI areas that contribute to abilities dealing with things and ideas and low activity for abilities dealing with people**.

More specifically, **medical doctors are the category most exposed to AI**. The majority of AI exposure is driven by its impact on tasks that require abilities dealing with ideas (e.g. comprehension, attention and search as well as conceptualisation). On the other hand, little AI exposure can be expected via basic processing abilities (e.g. visual processing or auditory processing) nor through abilities that deal with people (e.g. modelling and social interaction or communication).

AI could also play a novel role in the context of technology-driven labour market polarisation, depending on whether AI exposure is labour-replacing or labour-enhancing. In the **labour-replacing scenario**, it could lead to unpolarised effects and a reduction in income inequality; whereas in the **labour-enhancing scenario**, it could imply an expansion of productivity for high-skilled occupations, potentially leading to occupational upgrading effects and an expansion of income inequality.

AGE AND TERRITORIAL DIVIDE FOR TELEMEDICINE

Digital technologies have great potential to improve the population's access to health and LTC, especially in the remote and rural areas affected by severe shortages of health and LTC workers. Focusing in particular on the example of **telemedicine** which enables the remote treatment of patients, the findings show that the divide in terms of access to computer and the internet, as well as in terms of digital skills, across certain socio-demographic groups remains considerable in the EU to the point of becoming a barrier to its implementation.

This analysis shows in particular that **older age groups have significantly less access to the internet and have fewer digital skills** to use it productively than younger groups.

In the context of a progressive ageing population, strengthening the potential of telemedicine requires **additional efforts to promote digital inclusion, especially among the elderly living alone in their homes, the elderly with a low level of education and those living in rural and remote areas**. In fact, reducing the digital divide between rural and urban areas remains a central barrier to be addressed for an effective implementation of telemedicine. Particular attention should also be paid to bridging the digital divide between elderly men and women, the latter group having lower percentages of internet use and digital skills than men.

Internet access is also an **issue of economic affordability**, as it implies owning a computer or a phone. However, only one third of the EU's population aged 80+ who live in rural and remote areas own a computer. At the same time, almost all households in the EU own a telephone which opens up the possibility of strengthening the mobile healthcare practices among the EU's elderly.

IN CONCLUSION

The EU is facing an unprecedented challenge. As the EU society is ageing, its elderly population is generating an ever-increasing demand for health and care services, also putting pressure on the fiscal sustainability of the EU's health and LTC sectors. The magnitude of this additional demand is not only dependent on the increases in life expectancy, but also on the quality of life at older ages. In other words, ensuring **ageing in good health** for the population can potentially reduce the demand and the pressure on the EU's health and LTC sectors.

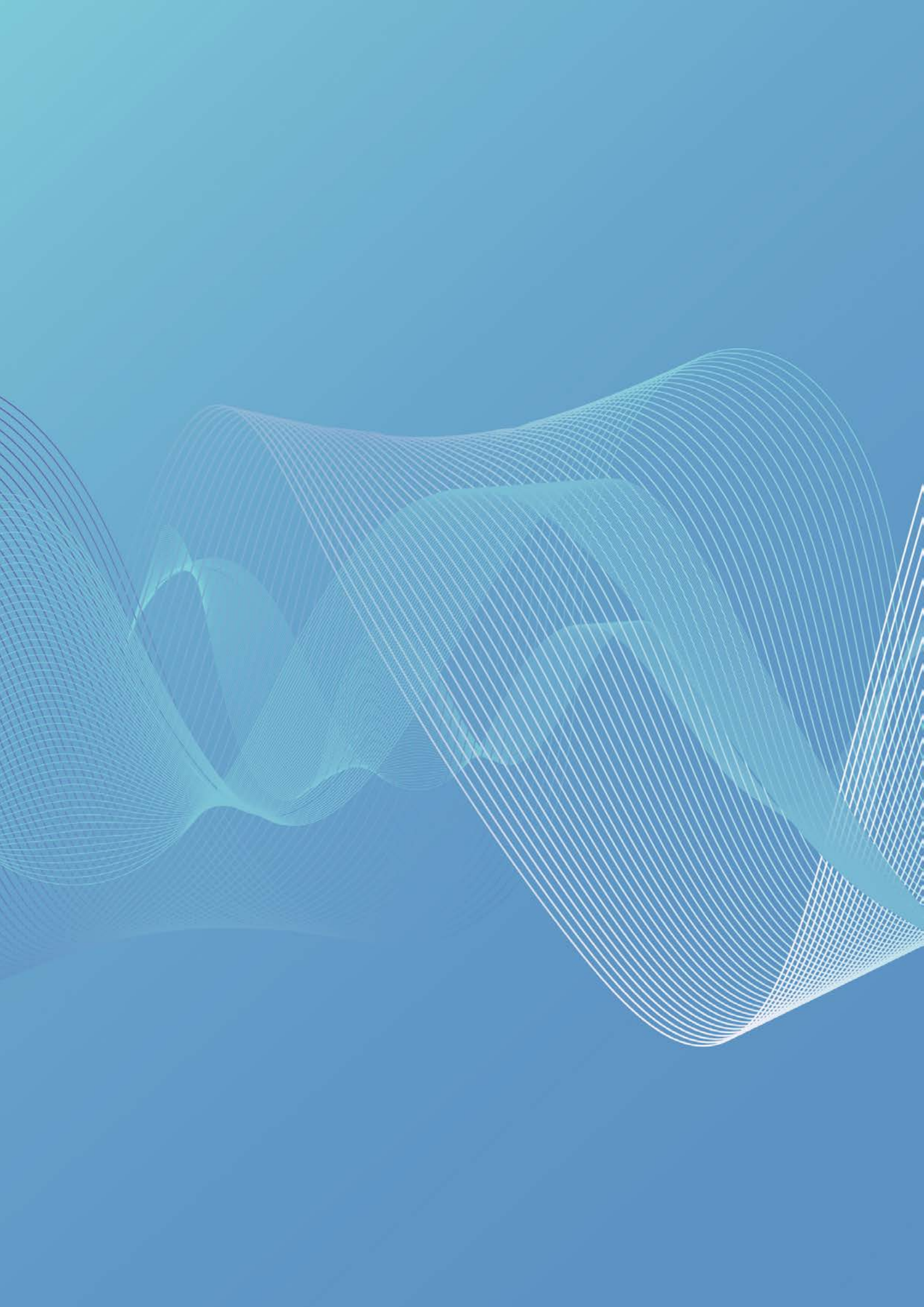
It is important to stress that the challenges of population ageing on health and LTC sectors are not equally distributed between the Member States, not within the same Member State. This diversity of implications reflects different demographic, health, socio-economic and health and LTC policies in place at local and national levels.

The majority of the demand for health and LTC services, and the related workforce, is being satisfied by domestic education systems which have the role of ensuring an adequate inflow of workers into the labour market. However, in a context of tight funding constraints, countries have been facing underinvestment in education and training programmes for health workers as well as mismatches between education strategies and actual population needs. At the same time, an increasing labour demand in the EU's health and LTC sectors is being satisfied by the migration and intra-EU mobility of health and LTC professionals. Nonetheless, the **potential of migration** to alleviate the pressure of workforce shortages in the EU's health and LTC sectors is still not fully harnessed. The reasons for this untapped potential

are manifold, ranging from the absence of a specific EU sectoral labour migration instrument or tool for attracting healthcare and LTC workers, complex qualification recognition procedures, to obstacles in the integration of migrants into the labour market.

An additional way of addressing the rising demand for health and LTC services is by harnessing the **potential of digital technologies**. Considering AI in particular, its role in shaping and addressing the demand for workers and skills is not only limited to AI's technological availability, but it is accompanied by crucial social, ethical and occupational implications, many of which are still an open debate. Ultimately, there is also a question of whether the elderly – as the growing category of recipients of health and care services – are in a condition to actually benefit from the adoption of digital technologies. Using the specific example of telemedicine, it is clear that elderly people in the EU are still facing significant barriers determined by the lack of access to the internet, to computers and fewer digital skills.

In a context of the progressive ageing of the EU's society and increasing challenges that the EU's health and LTC sectors have been facing, the Commission has taken a series of policy initiatives in support of its Member States. Some of the most relevant recent initiatives include the Commission's first steps towards building the European Health Union, which, together with the 'Pact for Skills' set out in the EU's Skills Agenda and the Green Paper on Ageing, are all directed towards supporting the Member States' efforts to build resilient health and LTC systems that rely on the availability of a qualified workforce, among others.



1. INTRODUCTION

Sara Grubanov Boskovic

Planning a health and long-term care (LTC) workforce that has the size and skills suitable to satisfy demand is a challenging task, given the numerous and often interrelated factors in play. These factors range from the demographic characteristics of a population, a country's economic growth, technology, the migration of health and LTC professionals to education and retirement policies. This implies a need for a holistic approach in workforce planning, capable of incorporating and coordinating various policy domains at local, national and EU level.

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The aim of this report is to provide scientific insights into the role of demographic change, migration and intra-EU mobility, as well as digital technology, in determining the demand and the supply of healthcare and long-term care (LTC) workers in an effort to inform the EU's workforce planning policies.

In the EU, the right to 'timely access to affordable, preventive and curative health care of good quality' and the right to 'affordable long-term services of good quality' are enshrined in the European Pillar of Social Rights (C(2017) 2600 final). The backbone of health and long-term care systems' capacity to ensure these rights is its workforce. It is only possible to deliver quality care to the people in need and at the moment they need it with the right number and right type of health and LTC human resources (Birch et al., 2009).

Today, national health and LTC systems are faced with an unprecedented challenge with regard to the progressive ageing population of European society: as the number of elderly Europeans has been rising, the need for both health and LTC services has increased. As a consequence, the EU countries have been facing difficulties in ensuring the right number and mix of skills of health and LTC workers that could satisfy the increasing demand for health and care support generated by the ageing population (OECD/EU, 2018). According to Cedefop (2020)[1] , **the EU-27 will need 11 million newly trained or imported health and care workers to satisfy the rising demand in the health and LTC sectors in the period 2018-2030**. The majority of these new job openings is to replace the departure of health workers due to retirement or other types of voluntary departure (around 87%), and a smaller element is the result of the occupational change in the health

FIGURE 1. Drivers of the demand for and the supply of a healthcare and long-term care workforce
Source: KCMD elaboration of relevant literature and national practices.

and LTC sectors (see Table I.1 in the Annex). More specifically, the EU-27 will need to fill around 3.9 million new vacancies for the profile of *health professionals*; 3.2 million for the profile of *health associate professionals*; and 3.8 million for the profile of *personal care workers* in the period 2018-2030 (see Figure I.1 in the Annex for data at MS level).

The issue of labour shortages in the health sector in particular has been on the EU's policy agenda for more than a decade now. Although competence in the area of public health mostly lies within Member States[2] – who are thus responsible for defining the health policy – the EU can act 'to support, coordinate or supplement the actions of the Member States' (supporting competences)[3] by pooling resources, coordinating and creating an exchange of best practices, promoting joint health activities and providing funding.

The first relevant policy initiative on workforce planning in the health sector was the Commission's 2012 Action Plan for the EU Health Workforce (SWD(2012) 93 final) which recognised the challenges of the healthcare sector and set out measures to 'improve health workforce planning and forecasting' through an EU joint action. More recently, with COVID-19 pandemics pushing national health systems to their limits, the Commission took its first steps towards building the European Health Union (COM(2020) 724 final). More specifically, the Commission put forward a set of proposals, among which also include actions to support Member States in detecting shortages in healthcare staff and to take targeted action to guarantee the 'availability of sufficient and up-skilled healthcare staff who can be redeployed to new roles in case of emergency' (For an overview of policies at EU level, see Box I.1 in the Annex).

However, planning and forecasting the future workforce is a complex task that requires taking into account a number of interrelated drivers determining both the **demand** for health and LTC services and the potential **supply** of workers that could satisfy it.[4] Figure 1 is an attempt to summarise the main drivers of the demand and supply of the workforce in health and LTC sectors, taking into account the relevant literature and national practices.

Starting from this conceptualisation, the following paragraphs provide more detail on how demographic change, healthcare expenditures and the delivery of services, digital health technologies, education systems and migration can affect the demand for and the supply of health and LTC workers.

DEMOGRAPHIC CHANGE

Demographic change is the key determinant of the demand for health and LTC services. The most commonly used indicator for determining the future need for health and LTC workers is the change in the *size of the population*, as recipients of health and care services. At the same time, the demand for workers is heavily affected by the changes in the population structure, given that people of different ages and sexes have different health and LTC needs. These health and care needs, however, are not constant over time and vary in relation to the changes in the *population's health status*. The latter implies the need to make assumptions about how the morbidities and disabilities by age and sex will evolve in future. The incidence of morbidities and disabilities in a population of a given size, age and sex affects its utilisation of health and LTC services. Therefore, the patterns of the current utilisation of health and LTC services, but also the lack of *utilisation of health and LTC services* due to financial or logistical obstacles – the so-called unmet health and care needs – are essential dimensions to be taken into account when determining the future need for a health and LTC workforce.
A detailed analysis of how different aspects of demographic change have been affecting the demand for health and LTC services, and the related workforce, in the EU is given in Chapter 2.

HEALTHCARE AND LONG-TERM CARE EXPENDITURE

The provision of health and LTC services is also determined by the amount of public and private resources available to fund these services which, among other things, depend on the country's economic growth. Health expenditure as a proportion of the GDP is the most commonly used indicator that describes the overall resource availability. Figure 2 shows that, overall, the ratio of health expenditures to GDP remained largely stable in EU Member States between 2013 and 2019. However, health expenditures to GDP ratios are quite different across EU MSs, reflecting both differences in the organisation and financing of health and LTC sectors (OECD, 2020a; EU, 2019a).

The Figure 2A shows that there was a relative stability in health spending (as a percentage of GDP) in EU MSs in the period 2013-2018. It also shows that there were important differences in health expenditure to GDP ratios between MSs, ranging from 5.3% in Luxembourg to 11.3% in France.

Within the overall healthcare expenditure (Figure 2A), the function of health-related LTC care services[5] (Figure 2B) represents only a small part. Similar to the

overall healthcare expenditure, the MSs' proportion of the expenditure directed towards LTC has remained stable over time. Additionally, the proportion of health expenditure directed towards health-related LTC care services differs significantly between MSs: ranging from MSs where the long-term care expenditure is below 1% (e.g. SK and BG) to MSs where the LTC absorbs between 20-27% of the overall healthcare expenditure (e.g. NL, SE, DK, BE and IE).[6]

In conclusion, it should be pointed out that, overall, all EU MSs have been facing fiscal pressures on their health systems (EU, 2019).[7] Nevertheless, their fiscal sustainability is fundamental to safeguarding the common values of universality, access to good quality care, equity and the solidarity of the EU's health and LTC systems.

HEALTH AND LONG-TERM SERVICE DELIVERY

The differences between MSs in terms of financing the health and LTC sectors follow MSs' differences in how these sectors are structured and, thus, how the related services are being delivered. In fact, any change in the structure and health service delivery models is also likely to impact the demand for health and LTC providers.

FIGURE 2A. Health and LTC expenditure in EU MSs, 2013 and 2018
Source: KCMD elaboration of Eurostat datasets [hlth_sha11_hf] and [tps00214].

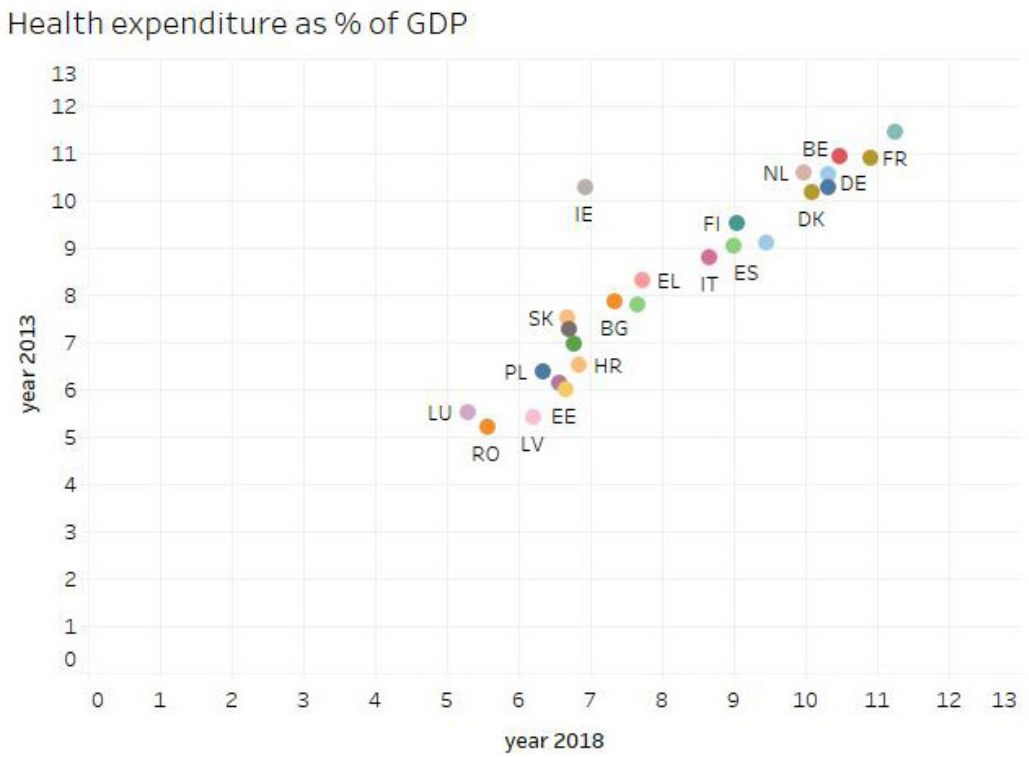

FIGURE 2B. Health and LTC expenditure in EU MSs, 2013 and 2018
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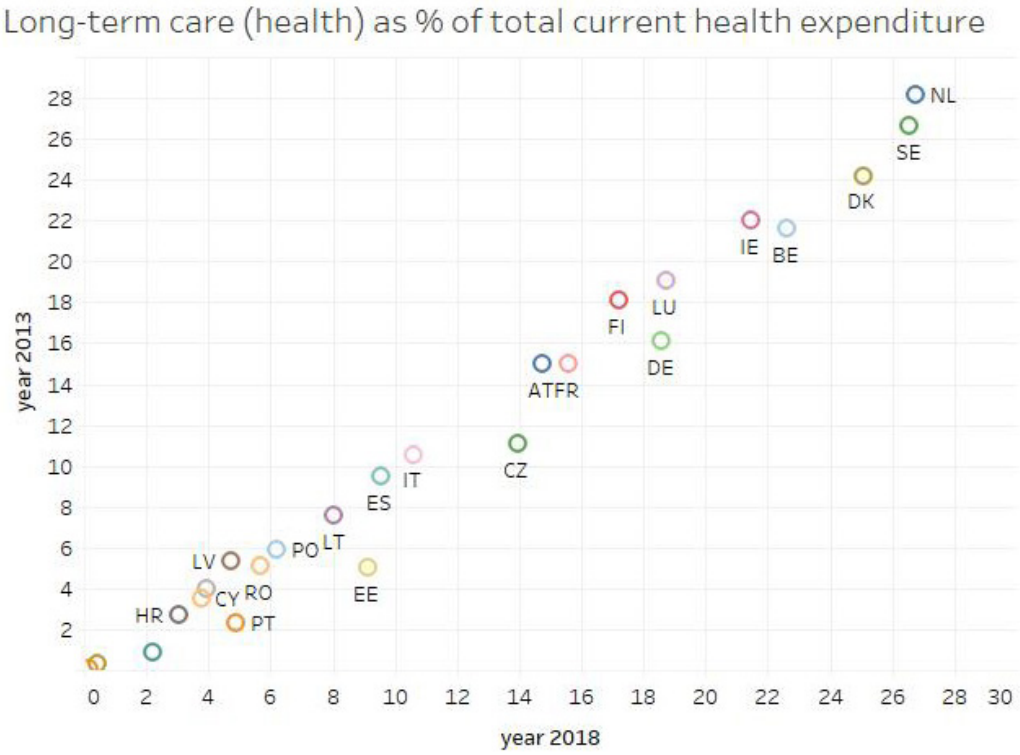


Today, the integrated health service delivery is the policy priority of EU MSs. It is based on the efficient re-orientation of activities from hospitals to primary care, home-based and community-based services (OECD, 2020b; EU, 2019a).
Hospitals are positioned at the top of the health system pyramid as an essential component of any functioning health system. Hospitals are also the most expensive part of the health system (OECD/EU, 2018). In order to implement a more cost-effective approach, both the WHO and EU MSs have put significant effort into strengthening the primary care, home-based care and community-based care.

Primary care is defined as the 'first level of contact for the population with the health care system, bringing health care as close as possible to where people live and work. It should address the main health problems in the community, providing preventive, curative and rehabilitative services' (WHO, 1978). Efficient primary care is a patient's first and main point of contact with the health system and thus the cornerstone to integration and continuity between and across levels of care (EU, 2017a).

The categories of health workers most active in providing primary care and, therefore, mainly affected by the changes in the service delivery models are: general practitioners/family physicians, midwives, nurses, dentists, dieticians, occupational therapists, optometrists, pharmacists, physiotherapists, psychologists and social workers, etc. (EU, 2014).[8]

At the same time, reforms in the area of LTC have been less numerous. The main focus of LTC reforms has been the deinstitutionalisation of care towards more community-based and home-based services (i.e. care provided in and around the elderly person's own home) by creating an extensive networks of community services and suppliers across the country (EU, 2019a).

The transformation from hospital to community-based health systems, however, is a complex process to implement and to measure (EU, 2018a).[9] The complexity mostly lies in the multidimensional nature of the primary care, which responds to both preventive and curative health needs throughout the entire life cycle, including the long-term care (EU, 2017).

DIGITAL HEALTH TECHNOLOGIES

The role of technology in health and LTC sectors is manifold. At the same time, technological advancements shape both the demand for health and LTC services and affect the supply of workers and skills.

Overall, progress in digital healthcare technologies (e.g. genomics, digital medicine, AI and robotics) has changed the nature of health services itself. Firstly, technologies have the potential to improve the delivery of health services (e.g. through the expansion of remote care models) and eventually support the transformation from hospital-based to home-based care (McKinsey & Company, 2020). Technologies also have the potential to improve the quality of care from prevention to diagnostics and treatment, e.g. through genomics and precision medicine and AI (NHS, 2019; WHO, 2016a).

One of the direct workforce effects of the penetration of digital technologies in the health sector is the creation of a new type of professional roles that can support the uptake of these technologies. For example, the adoption of AI has created the demand for profiles of data scientists, data engineers, AI engineers, data entry and data governance experts specialised in the healthcare field. The second direct effect is reflected in the demand for new skill sets for health and LTC workers. In fact, boosting the digital literacy of the health and LTC workforce has been considered a top priority over the past decade. The NHS Topol Review (2019), for example, identifies a series of skills that healthcare professionals will need to be trained in when using new digital technologies: e.g. health data provenance, curation, integration and governance, AI ethics. The upskilling in terms of digital literacy will also have to be accompanied by strong critical thinking skills allowing workers to not only use the technologies available but also critically assess their appropriateness for patients.

According to McKinsey & Company (2020), the penetration of digital technologies in the healthcare sector will occur in three phases: the first phase will address the automation of routine, repetitive and administrative tasks; the second phase will see the expansion of remote care models; whereas in the third phase we could expect more AI solutions in clinical practice. However, to be able to fully harness

the potential of technologies, certain conditions have to be satisfied: the digital divide will have to be closed and technologies will have to be regulated in line with country ethics, principles and values (WHO, 2016a).

Chapter 4 of this report offers three thematic contributions on the topic of the role of digital technology in determining the demand and the supply of a healthcare and LTC workforce.

DOMESTIC EDUCATION SYSTEM

The domestic education system has the role of ensuring the adequate inflow of a health and LTC workforce into the labour market. Education systems' programming ability to respond to the health and LTC needs of the population should be guided by robust workforce assessment considerations (ILO, 2019; OECD, 2016; OECD, 2013). Nevertheless, as WHO (2016b) pointed out, all countries have been facing underinvestment in education and training programmes for health workers as well as mismatches between education strategies and actual population needs.

With an aim of adjusting the supply to the needs of the health sector in a context of tight funding constraints, a large part of EU MSs has been regulating the number of students entering the medical and nursing education programmes using the 'closed number' policy lever. In addition to, or as an alternative to this, some EU MSs have been limiting the public budget subsidising the health-related education and training places (OECD, 2016). However, in light of rising concerns about labour shortages, the MSs have increased the number of students admitted to medical and nursing education over the past two decades (OECD, 2016).

While healthcare workers (especially nurses and physiotherapists) provide one part of LTC services, such as medication or rehabilitation, the carers provide the remaining part of LTC services. Publicly funded education and training programmes have been the main policy measures adopted by EU MSs for regulating the supply of formal carers (Spasova et al., 2018). However, the overall regulation of the supply of LTC workers proves to be more challenging given that the LTC sector heavily relies on the informal carers who are mainly spouses, children or other relatives of the care-dependent person. In case of informal carers, the regulation of the supply by EU MSs occurs through public policies in support of family carers that range from flexible working conditions, allowances replacing lost wages, cash benefits paid to the care recipients to training and education (EU, 2019a).

ATTRITION RATES: RETIREMENT AND OTHER DEPARTURES OF HEALTH AND LTC WORKERS

The analyses of the outflow of health and LTC workers are based on attrition rates. The notion of attrition comprises both departures from the workforce due

to retirement, illness and death as well as transitions to inactivity or to other sectors. High levels of attrition rates are considered as a worrisome trend as they are associated with a loss of public resources spent on training health and LTC workers, an increased workload and worsening of working conditions for the remaining labour force, which in turn contribute to a lower quality of care and worse health outcomes (Castro Lopes et al., 2017).

More specifically, **retirement** from paid work is the most relevant driver of the outflow of the labour force supply in the health and LTC sectors. The impact of retirements on the outflow is even more pronounced in the context of the EU's ageing workforce: according to the EU LFS, in 2018 the average age of health professionals in the EU-27 was equal to 44.1 years of age; that of health associate professionals 41.6; and that of personal care workers in health services 44 years of age (see Table 2 in Chapter 3 for a detailed definition of health and LTC occupation categories). However, in terms of workforce planning, it should be taken into consideration that the standard age of retirement set at 65 years of age does not fully reflect the effective age of retirement, which in 2018 was equal to 64 years of age for men and 62.3 years of age for women (OECD, 2019a).

In addition to retirement, the outflow of workers is also determined by pre-retirement departures, which refer to cases in which health and LTC workers transition to other types of occupations or to inactivity. Taking into consideration pre-retirement departures is particularly relevant for analysing the supply of health and care worker categories affected by higher attrition rates, e.g. nurses (OECD, 2013). The literature has identified various factors determining the high rate of pre-retirement departures for certain categories of health and LTC workers that range from low salaries, a lack of professional development opportunities, large workload, poor working conditions and low job satisfaction (OECD, 2020c; Castro Lopes et. al, 2017; ILO, 2017).

MIGRATION

Lastly, the supply of a health and LTC workforce is also determined by the inflow of migrant workers (immigration) in a country and outflow of domestic workers (emigration) from a country.

Accounting for, and making assumptions about, the immigration and emigration of health and LTC workers is an extremely complex task and often neglected in workforce planning exercises (OECD, 2013). This task firstly involves selecting the criterion for defining the migrant health and LTC workers: based on the country where the worker was trained in, the country they were born in or the country of their citizenship. Each one of these criteria has different implications on domestic education planning and on the process of recognition of qualifications acquired abroad. The second challenge when accounting for migration in workforce planning exercises is related to the scarce availability and comparability of data on migration flows by a worker's occupational category.

In addition to traditional migration flows, when analysing the supply of a health and LTC workforce in the EU-27, it is necessary to also consider the dimension of intra-EU mobility. On the basis of the fundamental right of free movement of workers, EU (mobile) citizens can work as health and LTC workers within EU MSs and also benefit from a mutual recognition of qualifications in EU sectoral professions (medical doctors, nurses, midwives, dental practitioners and pharmacists).

A detailed analysis of the inward mobility of health and LTC workers born in the EU and the immigration of workers born outside the EU is given in Chapter 3.

STRUCTURE OF THE REPORT

This brief overview of the most relevant factors affecting the demand and the supply of health and LTC workers underlines the need for a holistic approach in workforce planning, capable of incorporating and coordinating various policy domains at local, national and EU level.

Bearing this in mind, the core analyses of this report aim to provide scientific insights into the specific role of demographic change, migration, intra-EU mobility and digital technology that could inform workforce planning in health and LTC sectors.

The report is structured in the following chapters:

Chapter 2 aims to provide scientific insights into some of the most important challenges posed by the EU's ageing society that are relevant to workforce planning in health and LTC sectors. The chapter opens with considerations on the age structure of the EU's ageing society and then describes the conditions of the elderly population in terms of mortality, morbidities, use of healthcare and LTC services and unmet medical needs. Lastly, attention is given to the additional burden on the demand for services caused by COVID-19 and the implications on workforce planning.[10]

Chapter 3 aims to provide scientific insight into the aspects of immigration and the inward mobility of health and LTC workers in the EU that can inform workforce planning in health and LTC sectors. The chapter first analyses the evolution of stocks and flows of migrant health and LTC workers into the EU using different data sources; secondly, the chapter offers an innovative review of the EU's immigration policies shaping the inflow of migrant health and LTC workers; lastly, the chapter concludes with considerations also on the employment conditions of immigrant health and LTC workers.[11]

Chapter 4 addresses the topic of the role of digital technology in determining the demand and supply of health and LTC workers. Given the broad scope of the topic, this chapter focuses on three specific thematic areas. The first contribution aims to provide an overview of the main applications brought to the healthcare sector by Artificial Intelligence (AI) together with their benefits and challenges. The

second contribution aims to provide an assessment of the impact of AI progress on health-related occupations. The last thematic contribution aims to analyse how the divide in internet access and digital skills among elderly Europeans poses a barrier to the implementation of telemedicine.[12]

Chapter 5 concludes.

2. DEMOGRAPHIC CHANGE, A DRIVER OF THE DEMAND FOR A HEALTH AND LONG-TERM CARE WORKFORCE

Daniela Ghio, Anne Goujon, Sara Grubanov Boskovic

Demographic change is the key driver of the demand for health and long-term care services (LTC) and the related workforce.
The most important demographic indicators for workforce planning in health and LTC sectors are changes in the size; age structure and health conditions of the population; the patterns of health and LTC utilisation by population; and its unmet medical needs.

The aim of this chapter is to provide scientific insights into the main demographic elements that, in the context of the EU's ageing society, are relevant to efficient workforce planning in health and LTC sectors.

KEY MESSAGES

With rising life expectancy, there is also a need to ensure a life in good health for elderly people. In the EU, one fifth of the population is older than 65 years of age; on average, the EU's elderly have a remaining life expectancy of 20 years, but half of that time is spent in poor health.

One of the major challenges of the rising number of elderly people for the EU's health sector is the growing demand for chronic disease treatments. At the same time, the LTC sector is facing an increasing number of elderly people suffering from serious functional limitations (or disabilities). Overall, the bulk of the demand for both health and LTC services is generated by elderly people in the 75-84 age group. Gender also plays a relevant role, especially in regards to the probability of elderly people suffering from serious functional limitations.

However, the challenges of population ageing on health and LTC sectors do not apply to all Member States equally nor are they distributed equally within Member

States, given the differences in age structures, health and socio-economic factors across EU populations.

On average, elderly people in the EU have 7 doctor visits during a one-year period, and 17% of elderly people are hospitalised for at least one night per year. Nevertheless, there are remarkable differences between and within Member States in the utilisation of specific health and LTC services, such as primary care, hospital-based care and home-based care.

Lastly, there is also a small part of the demand for health care by elderly people which is not currently being met. Around 3.6% of the EU's population above 65 years of age do not receive a medical examination due to various obstacles. It is in particular the elderly living in rural areas and elderly women with a higher risk of not receiving the healthcare attention needed. At the same time, with current data, it is difficult to estimate what part of the LTC demand is being satisfied through formal and informal care and what part of this demand qualifies as unmet care needs.

2.1 THE AGEING POPULATION STRUCTURE OF THE EU

Ageing is a normal and desirable part of individual life; however, the rise in life expectancy also bears societal consequences and new needs linked to high proportions of the population reaching and living in old age.[13]

According to the latest Eurostat data (Table 1), in the EU, the average life expectancy at for men at birth was *more than 78 years* in 2018 and is expected to increase, on average, by 7 years by 2060, while women's life expectancy that was *around 84 years* in 2018 is projected to add 5 more years by 2060. Relevant differences exist across EU Member States: e.g. male life expectancy in 2018 ranged from a minimum of 70 years in Latvia to a maximum of 81 years in Italy; likewise, female life expectancy in 2018 ranged from approximately 79 years in Bulgaria to 86 years in Spain. How to measure the ongoing COVID-19 pandemic effects and how it will affect life expectancy are still an open question (see section 2.4).

Rising life expectancies, combined with declining fertility rates and the limited magnitude of net migration[14] , are behind the ageing of the population structure in the EU that sees an increase in both the absolute number and the proportion of elderly people within the overall population.

1 in 5 people living in the EU in 2019 was above 65 years of age, and the proportion is projected to increase to 1 in 3 people in 2060. The situation across EU Member States is heterogeneous, ranging from MSs where the proportion of elderly people is relatively low, such as Luxembourg and Ireland, to others where the proportion is relatively high, such as Italy and Greece. Nevertheless, the proportion of the older population is projected to increase in all EU Member States.

The ageing phenomenon also generates a shift in the active and inactive population ratio. This aspect can be grasped by analysing the *old age dependency ratio (ODR)*[15] that gives an estimate of the proportion of the elderly population (aged 65+) in the working age population (aged 15-64). In 2019, there were 31 elderly people for every 100 people in the working age group. In 2060, this ratio would increase to 54 elderly people for every 100 persons of working age. Despite differences in the old age dependency ratio between EU MSs, the number of elderly people per 100 working age people is projected to rise everywhere.

TABLE 1. Population structure indicators in 2018/2019 and projected indicators in 2060
Note: n.a. – not available
Source: KCMD elaborations of Eurostat datasets [demo_mlexpec] and [demo_pjanind].

Area	Life expectancy at birth				Proportion of population aged 65+ (%)		Old age dependency ratio	
	2018	2018	2060	2060	2019	2060	2019	2060
	Male	Female	Male	Female	Total	Total	Total	Total
EU-27	**78.2**	**83.7**	**n.a.**	**n.a.**	**20.3**	**30.3**	**31.4**	**54.0**
Austria	79.4	84.1	85.2	89.2	18.8	28.8	28.2	50.2
Belgium	79.4	83.9	85.2	89.3	18.9	27.3	29.5	47.1
Bulgaria	71.5	78.6	81.0	86.2	21.3	32.6	33.2	60.5
Croatia	74.9	81.5	82.7	87.5	20.6	31.6	31.6	56.4
Cyprus	80.9	84.8	85.6	89.3	16.1	25.0	23.8	41.3
Czech Rep.	76.2	82.0	83.4	88.0	19.6	29.7	30.4	53.7
Denmark	79.1	82.9	84.9	88.7	19.6	26.7	30.6	46.2
Estonia	74.0	82.7	82.6	88.7	19.8	30.9	31.0	56.0
Finland	79.1	84.5	85.0	89.4	21.8	30.5	35.1	53.2
France	79.7	85.9	85.6	90.6	20.1	28.3	32.5	50.5
Germany	78.6	83.3	84.8	88.9	21.5	28.4	33.2	49.6
Greece	79.3	84.4	85.2	89.3	22.0	33.5	34.6	61.8
Hungary	72.7	79.6	81.8	87.0	19.3	29.5	29.3	52.0
Ireland	80.5	84.1	85.7	89.4	14.1	26.2	21.6	45.1
Italy	81.2	85.6	86.0	90.0	22.8	33.4	35.7	60.6
Latvia	70.1	79.7	80.6	87.1	20.3	33.4	31.7	63.2
Lithuania	70.9	80.7	80.9	87.4	19.8	33.5	30.4	62.5
Luxembourg	80.1	84.6	85.5	89.8	14.4	28.4	20.7	48.5
Malta	80.4	84.6	85.7	89.5	18.7	30.2	27.6	52.0
Netherlands	80.3	83.4	85.5	88.8	19.2	27.2	29.5	46.8
Poland	73.7	81.7	82.6	88.3	17.7	33.9	26.4	62.5
Portugal	78.3	84.5	84.5	89.4	21.8	33.5	33.9	62.2
Romania	71.7	79.2	81.6	87.0	18.5	32.2	28.1	58.8
Slovakia	73.9	80.8	82.4	87.6	16.0	32.6	23.5	60.4
Slovenia	78.5	84.4	84.6	89.4	19.8	31.3	30.5	56.4
Spain	80.7	86.3	86.0	90.6	19.4	32.6	29.5	58.9
Sweden	80.9	84.3	85.8	89.3	19.9	25.5	31.9	43.6

The rise in the number and proportion of elderly people will lead to a progressive expansion of the demand for healthcare and long-term care services. This represents an unprecedented challenge for both the healthcare and the LTC sector. For societies to effectively guarantee the healthy, active and ageing of their citizens with dignity, the monitoring of the specific challenges that population ageing poses to the healthcare and LTC sector is of utmost importance. Understanding the main challenges allows societies to be better prepared with the efficient and cost-effective planning of services and workforce in both healthcare and LTC sectors. The challenges for healthcare and LTC sectors will not be equally distributed between and within EU Member States given the different stages of demographic transition across EU populations. A dedicated JRC report 'Demographic Landscape of EU territories – Challenges and opportunities in diversely ageing regions' explores the territorial heterogeneities in population ageing.

Although Table 1 shows the traditional indicators of population ageing, different measures of ageing may change the perspective. In fact, there are numerous issues with how we measure population ageing, from the simple question of at what age is someone considered – or considers them – old. In addition, chronological age might not properly reflect ageing since it does not consider the experience of the entire

BOX 1 Other demographic measurements of ageing

Some researchers have suggested that ageing should not be measured using chronological age but should rather be based on the time left before the event of death occurs. Building on Ryder's (1975) work, Sanderson and Scherbov (2005) have developed the concept of prospective ageing based on the remaining life expectancy (15, 10 or 5 years of remaining life expectancy). Using the same country example as before, the age when the remaining life expectancy is below 15 years of age is 61 in Mali compared to 73 years in Finland in 2020 (Wittgenstein Centre, 2018). Therefore, while the proportion of elderly people measured by chronological age would be equivalent to the proportion of the population with a remaining life expectancy of less than 15 years in Mali (3%), the two figures would be dramatically different in Finland: 25% above the age of 65 years and 10% with a remaining life expectancy of less than 15 years. Thus, Finland is ageing less dramatically according to the indicator of prospective ageing in comparison to the indicators based on chronological age. The same applies to most EU MSs.

With appropriate data, the prospective ageing indicator can be calculated to include information about health, for instance remaining life expectancy without physical limitations or remaining life expectancy in good self-perceived health. Indeed, the health distribution of the population is often the missing ingredient of ageing measures. In this respect several indicators exist: the HALE, Health Adjusted Life Expectancy (and its counterpart, the Disability Adjusted Life Years (DALY)) has shown that not all gains in life expectancy happen free of chronic illnesses and that the increase in HALE is slower than in life expectancy. Among MS, the HALE at age 60 is on average 5 years lower than overall life expectancies. There are other existing measures of ageing, functional (cognitive or physical) or biomarkers (see Skirbekk et al., 2019 for a review).

population across a country and over time. For instance, in 2020 a 55-year-old woman might be considered old in a country where life expectancy at birth is 60 years, like Mali, or young in a country where life expectancy for women is 85 years like Finland.

In conclusion, identifying the challenges that population ageing might have on health and LTC sectors – and addressing them through adequate workforce planning – firstly requires considerations on how to define and how to measure the elderly population. In this chapter we will adopt a traditional approach and consider the elderly population based on chronological age (see Box 1 for other demographic measurements of ageing).

2.2 HEALTH CONDITIONS OF THE ELDERLY POPULATION IN THE EU: MORBIDITY AND FUNCTIONAL LIMITATIONS

The size of the elderly population alone is not a sufficient indicator of the challenges that population ageing might pose on health and LTC services. The magnitude and the type of demand for health and LTC services depend on the health condition of the elderly population. Therefore, in order to identify and adequately respond to the challenges of the rising number of elderly population it is necessary to analyse – and account for in workforce planning –the health status of the elderly population in terms of both morbidities and functional limitations.

The most widely used indicator for the health status of the elderly population is the remaining life expectancy. Today, a 65-year-old individual in the EU has an average remaining life expectancy of 20 years (Figure 3).[16] However, there are large disparities between sexes and Member States. On average, women live longer than men: a 65-year-old woman has a remaining life expectancy of 21.6 years, while a 65-year-old man has 18.1 years of remaining life expectancy. In terms of differences across Member States, the remaining life expectancy at the age of 65 years (for both sexes) ranges from 16.2 years in Bulgaria to 21.9 years in France.

Eurostat's *disability-free life expectancy at age 65*,[17] which describes the mean number of years a person could expect to live in healthy conditions at 65 years of age, provides additional information that can help identify the challenges for the EU care systems. Figure 3 compares[18] the overall remaining life expectancy at age 65 (dark blue bars for men and red bars for women) with the number of years remaining to live without disability at age 65 (light blue bars for men and grey bars for women). The difference between the two indicators designates the average number of years an elderly spends in poor health conditions. Combining information on the size of the elderly population with the average number of years an elderly person spends in poor health conditions allows the magnitude of the challenges depending on the care systems to be identified.

Today, one fifth of the EU population is over 65 years of age (Table 1); on average, the elderly population has a remaining life expectancy

of 20 years, but half of that time is spent in poor health (Figure 3). Despite rising life expectancies, the quality of life of elderly people remains a challenge.

Health conditions, however, are marked by gender and territorial differences. Women do live longer but in poorer health conditions: a 65-year-old man in the EU spends around 45% of his remaining life expectancy (18.1 years) in poor health

FIGURE 3. Life expectancy at 65 years of age by gender, health status and MS, 2018
Legend: Remaining life expectancy at age 65: dark blue bars for men and red bars for women
Disability-free life expectancy at age 65: light blue bars for men and brown bars for women
Source: Source: KCMD elaborations of Eurostat dataset [hlth_hlye].

conditions, whereas a 65-year-old woman spends around 54% of her remaining life expectancy (21.6) in poor health conditions.

Disparities in elderly health across the EU MSs are salient. The elderly living in Sweden and Malta live the least time in poor health conditions: a 65-year-old Swedish person spends around 23% of their remaining life expectancy in poor health, while a 65-year-old Maltese spends around 31%. At the same time, an elderly person in Slovakia, Latvia or Croatia spends most years of their remaining life expectancy in poor health conditions (75%, 74% and 72% of the remaining life expectancy at 65 years of age respectively).

The number of years a person lives in poor health conditions depends on underlying (co)morbidities and functional limitations. Therefore, the analyses of the incidence of morbidities and functional limitations within the ageing populations offers valuable insights into the different care sectors that will be affected by the growing demand for services.

Moreover, these analyses become important for determining not only the size of the workforce in each sector, but also the specific set of specialised skills needed to guarantee the continuity of care and quality of health services.

BOX 2 Data sources relevant for analysing the health conditions of the elderly

The Survey of Health, Ageing and Retirement in Europe (SHARE) is a longitudinal micro-dataset covering 25 EU MSs and Israel. The SHARE data collection has been funded by the European Commission through the 5th, 6th and 7th Framework Programme and through Horizon 2020. The survey focuses on the population aged 50+, including people living in nursing homes. It covers the multiple dimensions of ageing, such as the health conditions, labour market, income, family, social networking and generational interactions (Bergmann et al., 2019). Since 2004, seven waves of the survey have been conducted; in this chapter, we use the most recent 2017/2018 wave whose sample includes all EU MSs, with the exception of the Netherlands[19] and Ireland.[20] More specifically, the analysis considers the SHARE's population sample of 65+ (43,171) in 10-year age groups (65-74, 75-84, 85+). SHARE data allow for the analysis of elderly cohorts by areas of residence.[21] The selected sample is composed of the elderly distributed within areas of residence as follows: 14.7 % live in a big city, 7.4% in the suburbs or outskirts of a big city, 15.7% in a large town, 22.3% in a small town, 33.4% in a rural area or village and for 4.5%, the area type is unknown. For consistency with previous studies, the two areas, big cities and suburbs, have been merged into a single category.

Another relevant dataset is the European Health Interview Survey (EHIS), which is the official survey on health conditions in the EU. At the time of writing this report, the last available wave is EHIS 2 which allows analysing the population health conditions in 2013 and 2015. The future research will be integrated with wave EHIS 3, which was conducted in 2019 and is currently under finalisation.

The following section looks at chronic diseases and mobility-related functional limitations as examples of the challenges that health and LTC sectors face in the context of demographic ageing. The analyses are based on the 2017/2018 Survey of Health, Ageing and Retirement in Europe (Box 2).

CHRONIC DISEASES

According to Eurostat's latest available data for 2016,[22] chronic diseases are the main cause of death in the EU, and their incidence is higher among the elderly (84% of deaths due to chronic diseases) in comparison to the rest of the population (74% of deaths). Nevertheless, whether the incidence of chronic diseases within the elderly population remains stable, the increasing number of elderly people will inevitably raise the number of people requiring treatment for chronic diseases. Such a scenario would impose numerous challenges on the health sector. The first challenge is the financial burden on national health budgets as costs associated with treating chronic diseases are extremely high[23] (Hofmarcher et al., 2020; Luengo-Fernandez et al., 2013). The second challenge lies in ensuring adequate workforce planning as the complexity of health problems associated with chronic diseases requires changes in professional activities, qualifications and care settings (Maier et al., 2017).

WHO defines chronic diseases as diseases of long duration and generally slow progression. In the following analyses, we adopt the SHARE definition of chronic diseases which includes cancer, chronic lung disease, diabetes, Alzheimer's disease, benign tumours, rheumatoid arthritis and Parkinson's disease.

The computed probability in the EU of suffering from a chronic disease increases with age, reaching the peak within the population aged 75-84 years, after which it stabilises or slightly decreases, with a gender difference (65+ women are more likely to have a chronic disease than men are). Therefore, as the ageing progresses it is plausible to assume that the major demand for treatments related to chronic diseases will continue to be concentrated in the age group up to 75. However, as mentioned in Section 2.1, there are significant territorial differences in the pace of population ageing which are also associated with territorial differences in the chronic disease risk factors. As case studies, Figure 4 shows the territorial variations of chronic disease probability in Germany, Italy and Romania. In order to have comparability between the three MSs, the variation within countries is presented as the difference between big cities-suburbs, large towns, small towns and rural areas. The choice of these three EU MSs reflects three generic types of spatial settling of elderly population: rural-urban polarisation (Germany); widespread small-large town distribution (Italy); and rural-predominant distribution (Romania).[24] All three EU MSs show two common traits. **Firstly, the probability of suffering from a chronic disease increases with age, irrespective of the place of residence. Secondly, the gender gap increases with age**: men and women have a similar probability of suffering from a chronic disease between 65-74 years

FIGURE 4. Probability of chronic disease by gender, age and areas of residence in selected EU MSs
Legend: Red circles identify the female probability of suffering from a chronic disease; blue circles identify the male probability.
Note: the probability is computed using a logit model and as the function of age group, gender, area of residence and country.
Source: KCMD elaborations of SHARE microdata, wave 2017/2018.

(in Figure 4 red and blue circles overlap); however, when age increases, women are more likely to be affected by a chronic disease than men.

In Germany, men and women living in big cities-suburbs and small towns are less likely to suffer from a chronic disease than those living in rural and large town areas who register the highest probability, although as age increases the differences between areas of residence tend to diminish. In Italy, the probability of suffering from a chronic disease is the highest in rural areas and the smallest in big cities-suburbs areas. Unlike the German case, the difference in probability within Italian areas of residence persists across all age groups over 65 years. In contrast, in Romania, elderly people living in rural areas exhibit the lowest probability of being affected by chronic diseases and the advantage remains significant across all age groups.[25]

In conclusion, the three case studies highlight that ageing challenges in terms of the additional burden of chronic diseases not only differ between EU MSs, but also within a MS. A higher/smaller concentration of the elderly population of a specific age, specific gender and living in a specific area implies a different demand for and planning of health services (e.g. preventive and curative care) and the related workforce.

MOBILITY-RELATED FUNCTIONAL LIMITATIONS

In ageing societies, the major challenges in the LTC sector stem from an increasing number of elderly people suffering from *functional limitations*. It thus becomes crucial for national systems to also have adequate workforce planning in place in the LTC sector in order to ensure ageing in healthy conditions and with dignity and to improve the cost-effectiveness of the health sector by transferring avoidable healthcare services to LTC.[26]

Functional limitations are defined as 'the inability to perform specific physical or mental tasks used in daily life' (Cutler, 2001) and are measured in relation to specific tasks, such as whether the person can walk 100 metres, grasp an object, climb several flights of stairs, etc. Several indices have been developed with the aim of giving a comprehensive view of functional limitations such as the 'Activities of Daily Living (ADL)' and the 'Instrumental Activities of Daily Living (IADL)' measurements.

The SHARE data provide a *mobility index*,[27] which captures functional limitations related to physical mobility. Figure 5 illustrates the proportion of elderly people with serious mobility-related functional limitations by age, sex and area of residence in the EU. Overall, data show a declining gradient in functional mobility for both genders when comparing the 65-74 and the 75-84 age group. For the 85+ age group, selectivity may be responsible for the declining effects among men, whereas among women, who have a higher life expectancy, the proportion of elderly suffering from serious functional limitations in mobility reaches a peak in the age group 85+. However, these demographic patterns clearly vary between different areas of residence.

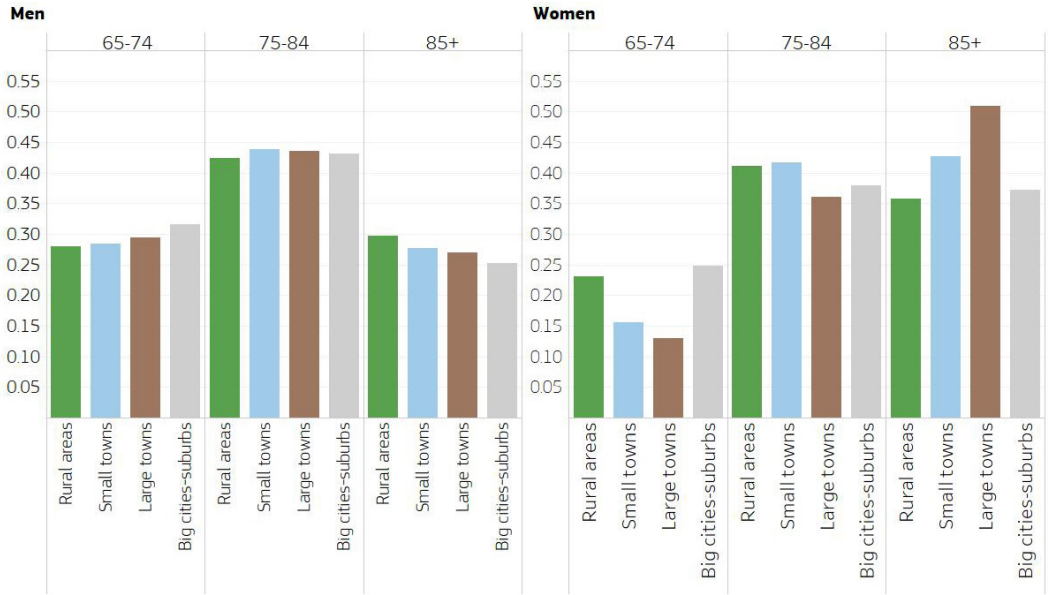
More specifically, the largest concentration of men reporting a serious mobility-related functional limitation is found to be in big cities-suburbs for the age group 65-74 (around 31%); in the small towns for the age group 75-84 (almost 45%); and in rural areas for men above 85 years of age (almost 30%). Likewise, the greatest proportion of women with a serious mobility-related functional limitation is registered in big cities-suburbs for the age group 65-74 (25%); in the small towns and rural areas for the age group 75-84 (around 41%); and in large towns for women aged 85+ (51%).

In conclusion, **the major challenges for the LTC sector due to ageing are concentrated in the age groups 75-84 and are associated with gender differences. Challenges are not uniformly distributed within countries, confirming the need for a territorial approach in any workforce planning exercises**.

COMBINING DEMOGRAPHIC AND SPATIAL PATTERNS WITH SELECTED SOCIO-DEMOGRAPHIC FACTORS AND HEALTH STATUS

The previous analyses have given examples of how health status varies according to the sex, age and area of residence of the population. However, there are also other

FIGURE 5. Proportion of elderly people suffering from a serious mobility-related functional limitation by gender (left panel men, right panel women), EU aggregate
Source: KCMD elaborations of SHARE microdata, wave 2017/2018.



socio-demographic and economic characteristics that affect an individual's health status and can provide important information on the future demand for health and care services and, ultimately, be integrated into the workforce planning models. As a matter of fact, population ageing is linked to socio-economic changes in a dynamic combination of individual and contextual socio-demographic characteristics and health behaviours.

The scientific literature has well established the existence of an education gradient: high educational attainment is associated with an important longevity premium. Educated people live healthier and longer lives than their less-educated peers (Zajacova & Lawrence, 2018; Pijoan-Mas & Rios-Rull, 2014; KC & Lentzner 2010; Meara et al., 2008). Figure 6 shows that the probability of suffering from a chronic disease is lower among elderly people reporting higher educational attainment, irrespective of their spatial and demographic characteristics. Similar trends are captured investigating mobility (Figure 7), to the exception of the eldest age group (85+). Women aged 85+ with lower levels of education are more likely to suffer from a serious mobility limitation than men are; however, the gender gap disappears among elderly people with higher educational attainment.

2.3 OVERVIEW OF THE UTILISATION OF HEALTH AND LTC SERVICES AMONG THE ELDERLY

The size of the elderly population and its health conditions – as described in the previous sections – provides an overview of the source and the magnitude of

FIGURE 6. Logit probability of suffering from a chronic disease by area of residence, education, age and sex in the EU
Legend: Red circles represent the female probability; blue circles represent the male probability.
Note: the probability of suffering from a serious mobility-related functional limitation was computed using a logit model and as the function of education, age group and area of residence. Red and blue circles overlap in most cases.
Source: KCMD elaborations of SHARE microdata, wave 2017-18..

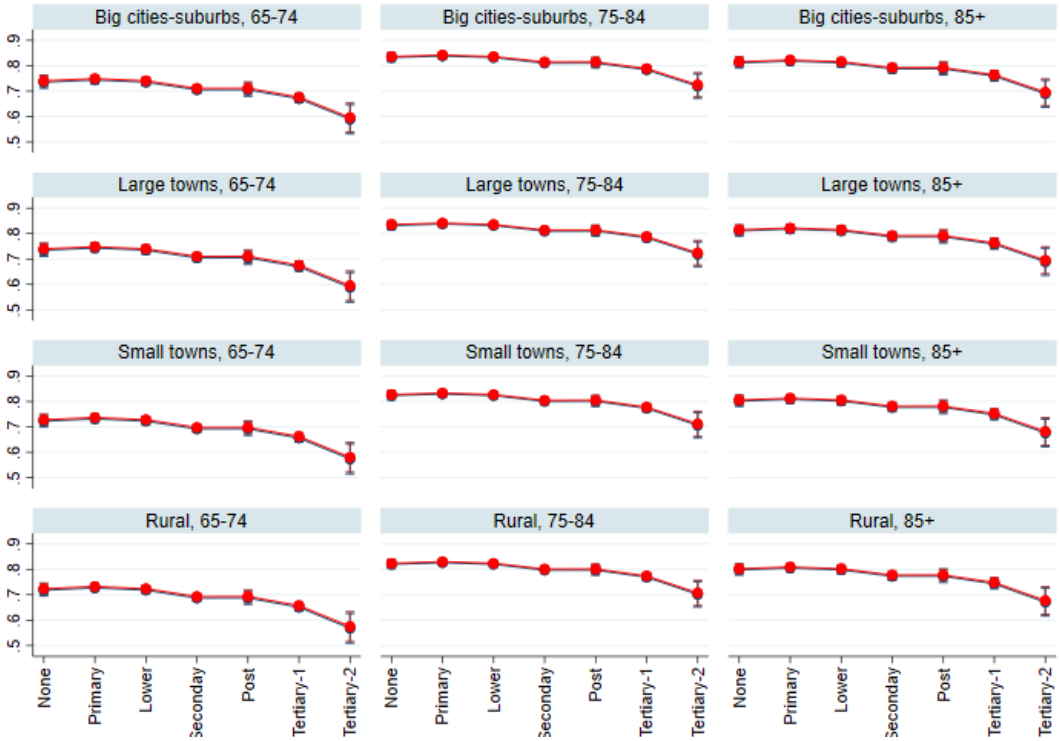
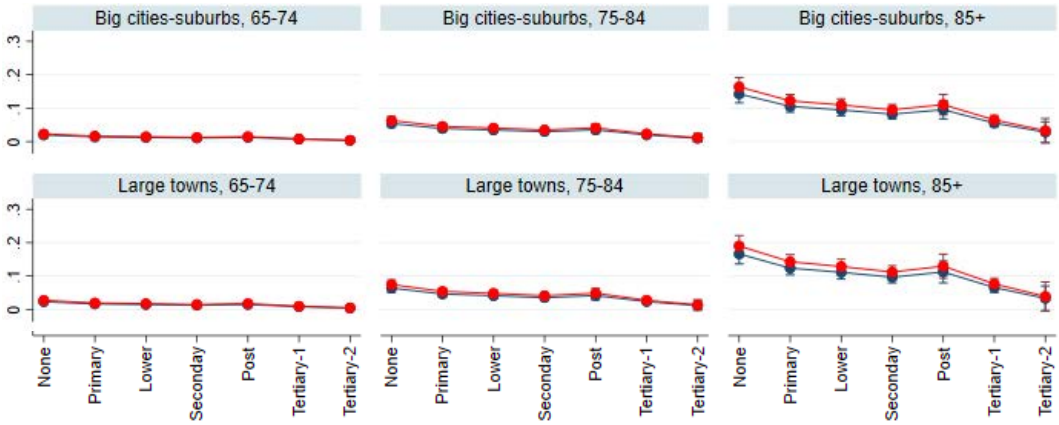
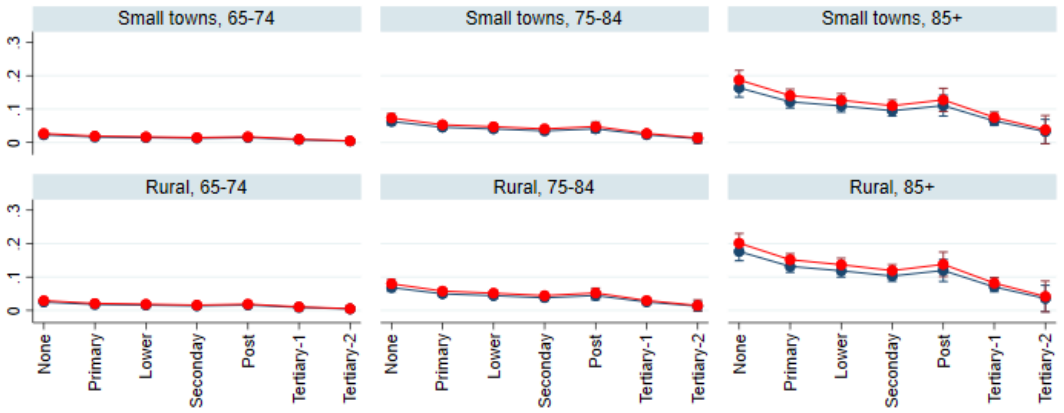


FIGURE 7. Logit probability of suffering from serious mobility limitations by area of residence, education, age and sex in the EU
Legend: Red circles represent the female probability; blue circles represent the male probability.
Note: the probability of suffering from a serious mobility-related functional limitation was computed using a logit model and as the function of education, age group and area of residence. Red and blue circles overlap in most cases.
Source: KCMD elaborations of SHARE microdata, wave 2017-18..





current challenges for health and LTC sectors to support future planning activities. In order to better qualify how these challenges affect specific areas of the healthcare and LTC sectors, it is necessary to add information on the current utilisation of specific care services, bearing in mind that utilisation patterns remain an indirect way of assessing healthcare needs, being biased by structural availability and individual constraints in using services. Therefore, accounting for and anticipating the demographic challenges in terms of human resources in health and LTC sectors requires combining information on structure and health status with the utilisation patterns of health and care services.

First of all, it should be pointed out that in order to improve the quality of care in a cost-effective manner, the EU's health systems have been undergoing a complex process of transformation which entails the reorientation of activities from hospitals to primary care, home-based and long-term care in institutions. Member States' health systems, however, differ in terms of organisational structure and the management of services; as a consequence, MSs have followed different approaches for the implementation of the transition from hospital-based systems to primary and LTC care. Moreover, in some EU MSs, the health systems are highly decentralised, for example in Italy and Spain, leading to a diversification of healthcare policies even within the same country. Therefore, any interpretation of healthcare and LTC utilisation patterns should take into account the national (and in some cases regional or local) specificities in the organisation of healthcare and LTC systems as well as differences in the state of reorientation of activities from hospitals to primary care, home-based and long-term care in institutions.

With the aim of providing some insights into healthcare and LTC utilisation patterns for the elderly population in the EU, we analyse the following indicators derived from the 2017/2018 SHARE data:

- **number of doctor visits within the past year**. The variable is derived from the question: *during the last 12 months, approximately how many times in total have you seen or talked to a medical doctor about your health?;*
- **hospital admission**. The variable is equal to 0 if the individual has not spent

any nights in the hospital over the past 12 months, and it is equal to 1 if the individual has spent at least one night in a hospital;[28]

- **personal care assistance from outside the household**. The variable identifies whether the respondent living in a single person household has received help from any family members, friends or neighbours. Help in this context incorporates personal care assistance (e.g. help with dressing, bathing, eating, getting out of bed, using the toilet), practical household help and help with paperwork (e.g. settling financial or legal matters).

Therefore, the aforementioned variables allow for the analysis of both formal assistance, provided by primary care and hospitals, and informal care, supported by individual social networks.

PRIMARY CARE AND HOSPITAL-BASED CARE UTILISATION BY THE ELDERLY

Primary care

Strong primary care is considered as the most cost-effective approach for improving the quality of services, ensuring better health outcomes and reducing inequalities (OECD, 2020b; EU, 2014). Data on the number of times that elderly individuals visited a doctor can be used as an approximation of the utilisation of primary care services. According to the 1978 Alma-Ata Declaration, primary care is the 'first level of contact for the population with the health care system. It should address the main health problems in the community, providing preventive, curative and rehabilitative services' (WHO, 1978). Today, primary care in the EU manages most of the chronic conditions without a specialist referral (OECD/EU, 2016).

In the EU, a person aged 65+ has, on average, 7 doctor visits during a one-year period, however there are large differences between EU MSs and within MSs (Figure 8).

In some EU MSs, elderly people visit the doctor more frequently than the EU average: for example, in Austria, elderly people living in big cities-suburbs and large town areas had, on average, 10 doctor visits per year, while those living in rural areas had 8 visits. On the other hand, there are EU MSs where elderly people visit the doctor relatively less often: in Finland, for example, elderly people from big cities-suburbs areas and large towns accessed doctor services on average 3 times per year, whereas those from small towns and rural areas 4 times. Moreover, within the same country, the number of doctor visits varies between areas with different degrees of urbanisation.

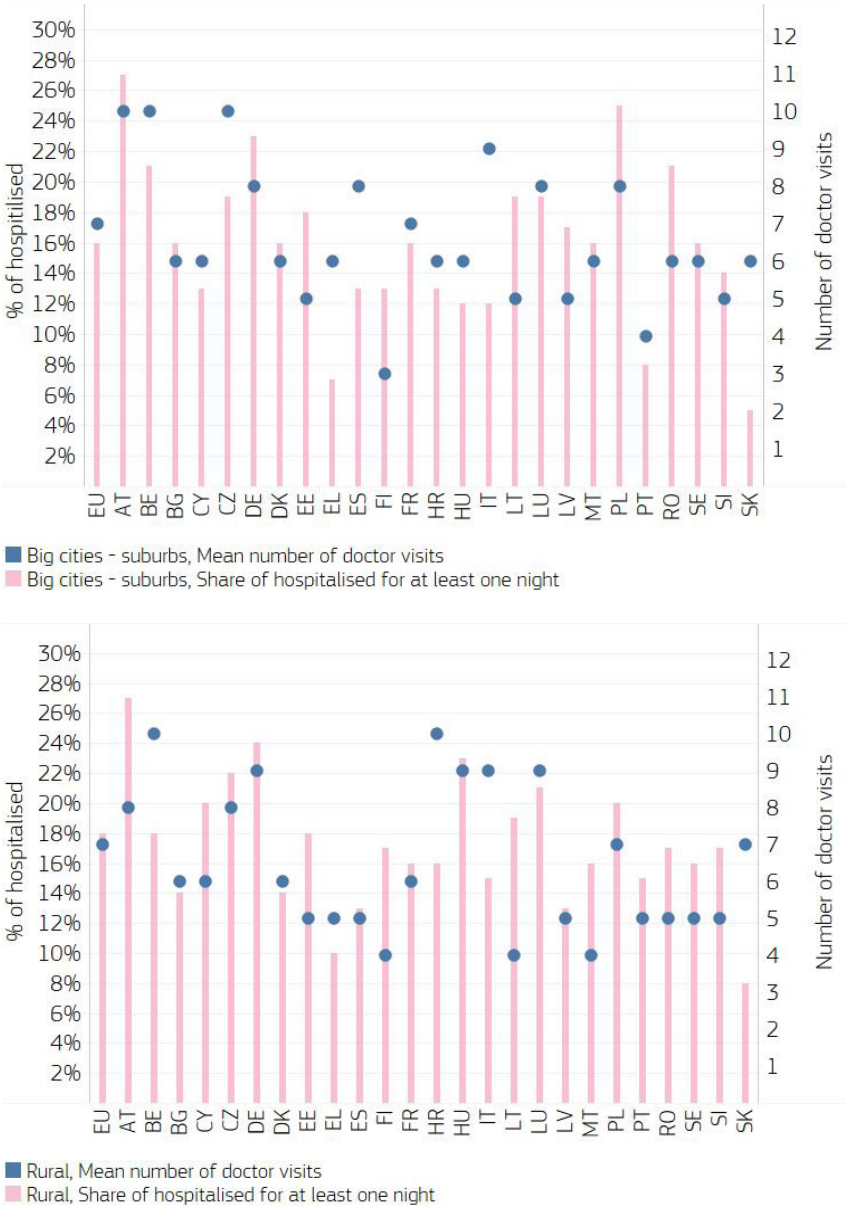
Lastly, no clear EU pattern emerges regarding the differences in access to primary care services across areas with different degrees of urbanisation. Comparing, for example, rural and big cities-suburbs areas, we find: 1) MSs where elderly people register the higher number of doctor visits in big cities-suburbs in comparison to

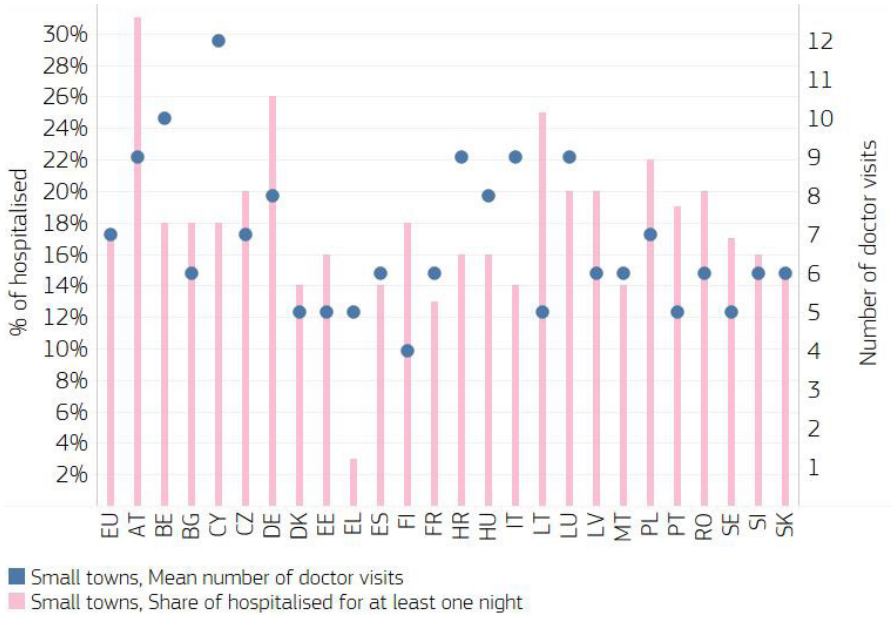
rural areas (AT, CZ, DK, EL, ES, FR, LT, MT, PL, RO, SE); 2) MSs with the same number of doctor visits in big cities-suburbs and in rural areas (BE, BG, CY, EE, IT, LV, SI); and 3) MSs where elderly people in rural areas consult the doctor more than those living in big cities-suburbs areas (DE, FI, HU, HR, LU, PT, and SK).

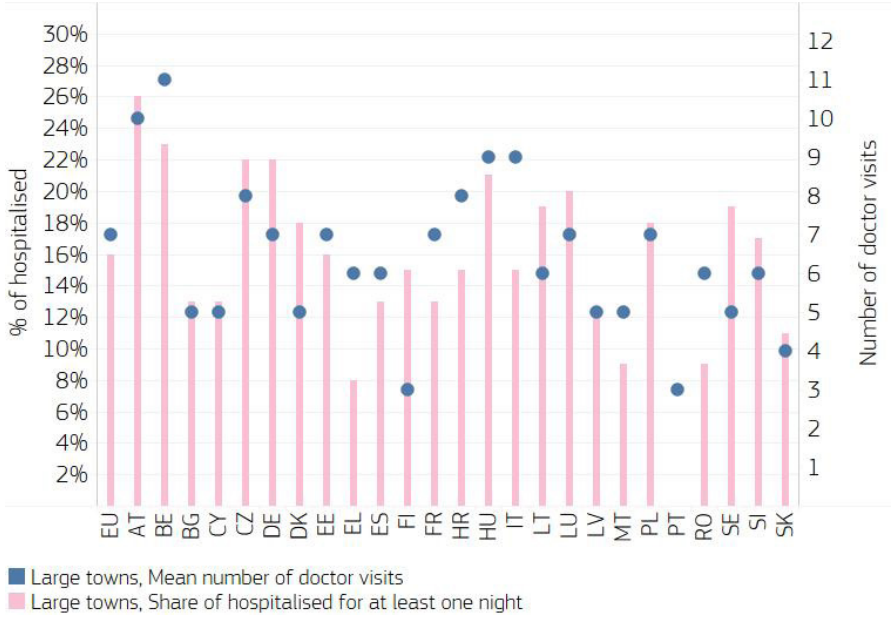
Hospital-based care

In terms of hospitalisations, data allow for an estimation of how many elderly people aged 65+ spent at least one night in the hospital over the 2017/2018 period. **Over the 2017/2018 period, 17% of the European population over the age of 65+ were hospitalised for at least one night, however there are great differences between and within EU Member States** (Figure 8).

FIGURE 8. Healthcare utilisation (doctor visits and hospitalisations) by MSs and place of residence
Source: KCMD elaborations of SHARE microdata, wave 2017/2018.







On the one hand, there are Member States (such as Austria and Germany) where more than 20% of the elderly population is being hospitalised yearly, and on other hand there are Member States where this proportion is less than 8% (e.g. Greece).

Taking the comparison between big cities-suburbs area and the rural areas as an example of heterogeneity within countries, we can observe that most MSs registered a higher number of hospitalisations occurring in rural areas in comparison to big cities-suburbs areas (CY, DE, EL, FI, HR, HU, IT, LU, PT, SI, SK). On the contrary, in several MSs the number of hospitalisations is highest among elderly people residing in big cities-suburbs areas than in the rural areas (BE, BG, CZ, DK, LV, PL and RO).

Lastly, several MSs do not register any difference in terms of hospitalisations between big cities-suburbs and rural areas (AT, DE, FR, EE, ES, LT, MT, SE).

Overall, it can be expected that the reorientation of health services from hospital-based to primary care and the strengthening of the integrated health services delivery could help health systems become more responsive to changing health needs (OECD, 2020; EU, 2014). Therefore, the capacity of national/regional/local health systems to design and implement a more integrated care delivery will be the first major determinant of the resonance of demographic challenges. As shown in the previous sections, the design of these strategies has to be built upon the territorial specificities of the ageing populations; otherwise 'one size fits all' solutions risk being ineffective in dealing with the specific challenges of the ageing populations at local levels.

INFORMAL HOME CARE PROVISION AMONG ELDERLY PEOPLE LIVING ALONE

As the increasing number of people is reaching an advanced age and becoming frailer, the need for strong and efficient LTC that could alleviate the impact of demographic challenges on health systems, mainly by reducing the avoidable hospital services, is essential (OECD, 2020c; Costa-Font et al., 2015).

In general, EU long-term care systems can be clustered into three macro-regions (Verbeek-Oudijk et al., 2014): 1) Northern Europe (Denmark, the Netherlands and Sweden), where the welfare state is the main provider of long-term care; 2) Central Europe (Austria, Belgium, France and Germany), where responsibility is shared between public institutions and families; and 3) Southern and Eastern Europe (Spain, Estonia, Italy and Slovenia), where families are the main providers of long-term assistance. As a matter of fact, there is extensive evidence that LTC relies heavily on informal care provision, which is the continuous care provided by informal carers such as relatives, spouses, friends and others, typically on an unpaid basis and in the home of the care recipient (Spasova et al., 2018).

In light of these conditions, the following section will focus on the provision of informal home care in particular. The SHARE data allows for the analysis of the informal home care provision of long-care services in the 2017/2018 period limited to the elderly living alone, as one of the most vulnerable population groups.[29] In the survey, the elderly respondents living in single person households are asked whether they received any assistance from external household providers in daily activities, be it relatives, friends or neighbours who are not their cohabitants.

Women account for 3 out of 4 single person households. In terms of residential patterns, single person households are more prevalent in rural and big cities-suburbs areas and to a lesser extent in large and small towns. Figure 9 plots

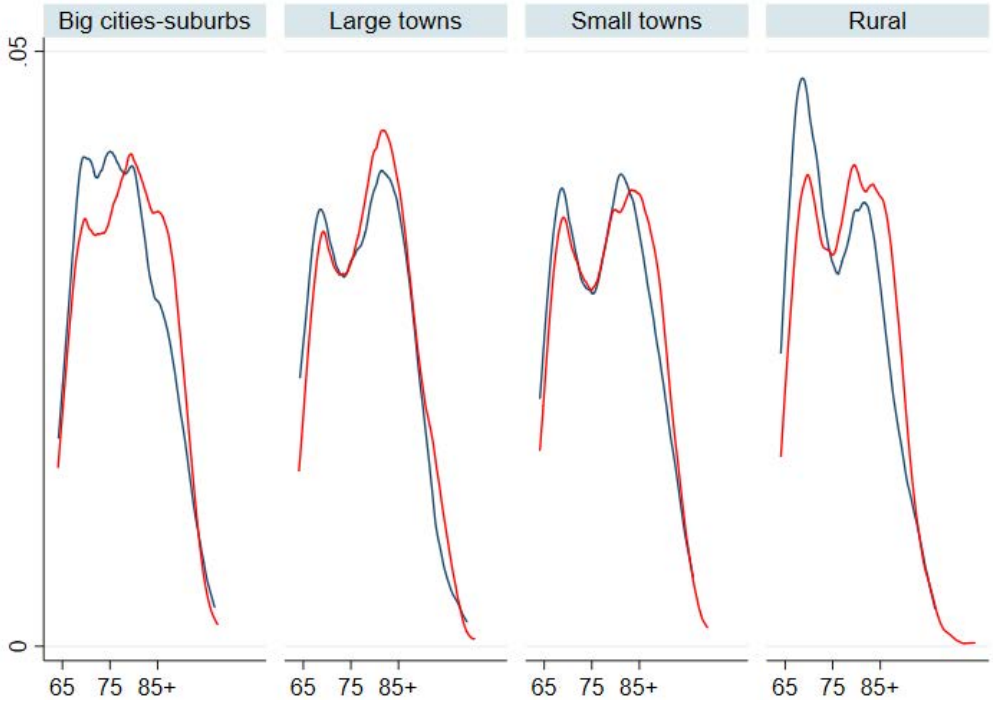
the age distribution of elderly people who live alone and have received external household care support, by gender and area of residence in the EU.

Informal home care received by elderly people living alone varies significantly by age, sex and area of residence. Informal home care is greater among men aged 65-74 years than among women in all areas, and especially in big cities-suburbs and rural areas. Over 75 years of age, women are the main receivers of informal care, irrespective of the place of residence, with the exception of small town areas where 80-84-year-old men receive more informal assistance from their social networks than women.

The analysis at national level shows cluster effects (Verbeek-Oudijk et al., 2014) across the EU: in central European countries, where the responsibility of LTC is shared within families, elderly people living alone are more likely to receive informal care than elderly people living in northern countries, where formal assistance is prevalent. However, when compared with southern countries where care needs are mainly addressed by social networks, the probability of receiving informal care decreases among elderly people living alone (from 19% to 10%).[30]

In conclusion, the high incidence of informal home care in the LTC sector means that families will bear a large proportion of the demographic challenges that lead to a rising demand of continuous care. Estimating the supply of informal home

FIGURE 9. Kernel distribution of the elderly population living alone who receive informal care assistance, by age, sex and area of residence, EU
Legend: Blue line – men; red line – women
Source: Source: KCMD elaborations of SHARE microdata, wave 2017-18.



care workers and ensuring their adequate training, counselling and respite services is an additional challenge faced by the LTC sector.

2.4 FOCUS ON THE IMPACT OF THE COVID-19 OUTBREAK

The projections proposed in this chapter (Table 1) were elaborated prior to the COVID-19 outbreak. How COVID-19 will impact the mortality dynamics of each country is an open question. Since January 2020, the spread of COVID-19 has translated into a substantial growth in the number of deaths compared to previous years – the so-called excess mortality. According to Eurostat (2021), there were around 297,500 more deaths in the EU between March and October 2020 in comparison to the same period in 2016-2019.[31]

A method for assessing the additional incidence of COVID-19 on the normal risk of dying consists in imputing the COVID-19-related fatality ratio as a proportion of the normal mortality rates. This, in turn, allows the deficit in years of life expectancy across age groups to be approximated (Spiegelhalter, 2020). Following a similar approach, Guillot & Khlat (2020) argue that, in France, the consequences of COVID-19 would be a decrease in life expectancy at birth of around 0.2 years for men (from 79.7 years in 2019 to 79.5 in 2020) and 0.1 years for women (from 85.6 years in 2019 to 85.5 in 2020). Similarly, life expectancy at the age of 65 years would be relatively shorter (0.3 years for men and 0.2 for women). While these effects are modest at national level, the impact could be more noticeable for specific population groups at local level, especially for the places most affected by COVID-19. For instance, Trias-Llimòs & Bilal (2020) estimate a decrease in life expectancy of 1.9 years among men and 1.6 years among women in Madrid, pointing out the disruption in the healthcare system caused by an excess in morbidity and mortality. COVID-19 effects on healthcare systems are discussed in the dedicated section.

Moreover, understanding the demographic characteristics of COVID-19 patients requiring hospitalisation or home-based treatment has the potential to provide key insights for a swift (re)allocation of healthcare resources. The limitations of this type of analysis are given by the lack of harmonisation in the collection of data across time and EU MSs.

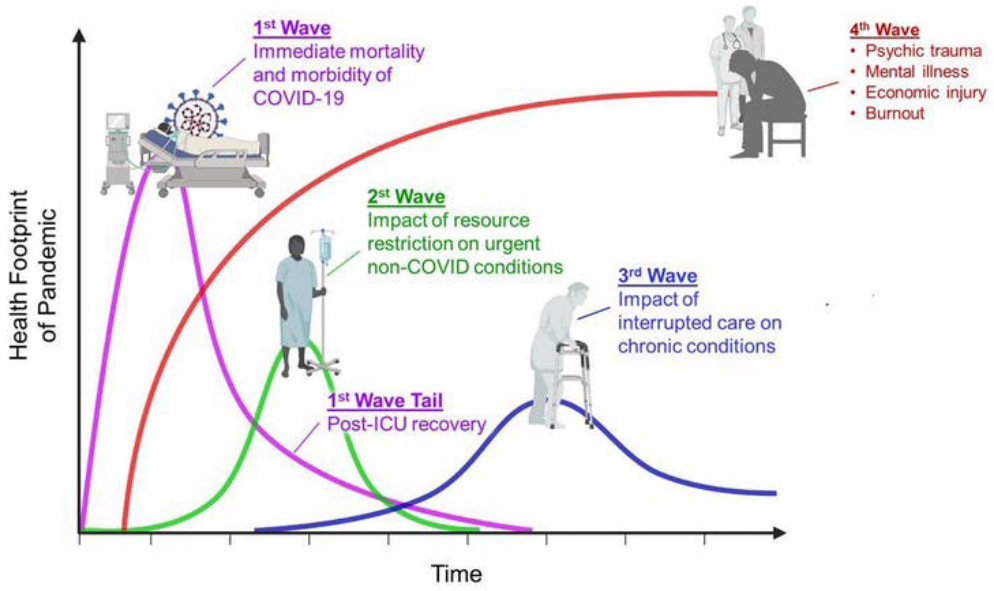
Using ECDC Tessy datasets,[32] we analyse the age and gender distribution of the cumulative number of confirmed COVID-19-associated hospitalisations relative to population size, covering the period of the first COVID-19 wave until 18 May 2020, for selected European Member States (see Figures D1-D2 in Annex D). We find higher ratios of hospitalisation in Sweden (102 hospitalisations per 100,000 men, 79 per 100,000 women), followed by the Netherlands (81 for men, 51 for women), Ireland (67 for men, 50 for women), Portugal (39 for men, 34 for women) and Italy (40 for men, 27 for women).

Overall, differentials are substantial by gender and age. In all selected EU MSs, male COVID-19 hospitalisation ratios are higher than female ones across all age groups. Hospitalisation ratios increase with age. The highest COVID-19 hospitalisation-associated rates are registered among the population of 70+ years of age. The only exceptions are Ireland and Sweden which recorded a peak in hospitalisation rates for the population over 90 years of age. According to the studies conducted in the United States and China (Chow et al., 2020; Guan et al., 2020), the majority of COVID-19 hospitalised patients have had underlying clinical conditions.

The relative number of COVID-19 positive tested cases who were not admitted to hospital and were treated at home is available for a few EU MSs. As a general trend observed until 18 May 2020, the ratio of confirmed cases treated at home is higher than the ratio of hospitalised cases (see Figures D1-D2 in Annex D). For example, in Ireland 459 per 100,000 women were treated at home compared to 50 women who were hospitalised (for men, 333 per 100,000 men and 67 respectively). Women are more frequently treated at home than men, except in Luxembourg. Overall, COVID-19 patients who receive treatment at home are younger than those admitted to the hospitals. COVID-19-associated home treatment ratios commonly decrease up to the age of 70 when there is again a rise in home treatments.

Additional studies are needed to better understand the conditions under which clinical and other[33] treatments at home have been considered more suitable. Completeness of data collected on confirmed patients treated at home could help identify best practices and guidelines on how hospital-based care and primary care could be more efficiently integrated. These preliminary findings suggest the need to further strengthen the capacity of the primary healthcare sector, relocating, when possible, medical assistance and treatments to at home. A strong primary

FIGURE 10. Expected phases in the need for healthcare services linked to COVID-19
Source: Four waves of the COVID-19 pandemic by Victor Tseng – Twitter provided on 30 March 2020



healthcare sector can alleviate the pressure put on the hospital systems during a pandemic.

Scholars have been trying to identify the whole range of implications that COVID-19 has on healthcare and LTC services and they have pointed out four different waves (Figure 10).

The excess of morbidity and mortality are the first consequences of COVID-19, which are followed by more waves producing an enduring health footprint. This is corroborated by numerous scientific findings: for example, a recent study on Italy (Carfì & Lardi, 2020) has shown persistent symptoms, such as fatigue, dyspnoea and chest pain, in patients discharged from the hospital after COVID-19 recovery (1st Wave Tail in Figure 12). Indications on the second wave were visible from Propper's early analyses, reporting that around 90% of individuals with planned treatments or a need for non-COVID-19 cures could not or did not access healthcare services in the UK. These effects are classified as indirect consequences of the pandemic due to resource restriction and the interruption of therapies for patients with chronic diseases. Lockdown and mobility restrictions imposed in several countries could have led to suboptimal healthcare and delays (Marijon et al., 2020). Patients with chronic diseases and other vulnerabilities are more likely to experience the hardest hit (third wave). Lastly, similar to previous epidemics, COVID-19's long-term knock-on effects will range from population health to economic inequalities at national and local levels (Autor et al., 2016). Since the pandemic has aggravated the economic crisis in the vast majority of countries, unemployment rates have risen substantially and will likely weaken the welfare safety nets, further endangering the health status and social security of some populations (Ahmed et al., 2020). On the basis of a nationally representative survey in Canada, 38% of adults reported a deterioration in mental health since the onset of the pandemic; effects were more pronounced among those with a pre-existing mental health condition, disability and those living in poverty (4th wave). There is a clear consensus on the link between population health and changes in macroeconomic conditions (Colombo et al., 2018; Antonova et al., 2017).

In the absence of consistent data, it is difficult to account for the indirect effects of the COVID-19 crisis linked to the disruption of care services for non-COVID-19 patients. As a consequence, the preparation of a timely intervention to counter the indirect effects of COVID-19 becomes a challenging task.

2.5 CONCLUSIONS

This chapter outlines the following main demographic elements that should be considered when assessing the demand for health and LTC provisions in ageing societies, such as the EU.

Population ageing is posing an unprecedented challenge on Europe's healthcare and long-term care sectors. The rise in the number and proportion of elderly people has

been increasing the demand for healthcare and long-term care services which, in turn, also translates into a rising demand for a qualified health and LTC workforce. In this context, in order to effectively guarantee the healthy, active ageing with dignity of people, it is essential to identify and monitor the specific challenges that population ageing is posing on both the healthcare and LTC sector.

As highlighted in this chapter, the growing number of elderly people in the EU is driving the expansion of health and care services, specifically those that respond to health conditions associated with advanced age. The largest part of this demand for care is being satisfied through hospital-based services, primary care and LTC. However, there is a small part of the demand for care by elderly people, which is not currently being met. According to 2019 EU-SILC survey data,[34] around 3.6% of the EU's population over 65 years of age do not receive the medical examination they would need, either because it is expensive, geographically inaccessible, the waiting lists are too long or because the person has a fear of doctors or could not find one that they could trust. It is in particular the elderly living in rural areas and elderly women with a higher risk of not receiving the healthcare attention needed. At the same time, with current data, it is difficult to estimate what part of the LTC demand is being satisfied through formal and informal care and what part of this demand qualifies as unmet care needs.

Continuous monitoring and better understanding of demographic changes allows societies to be timely prepare and address associated challenges through the efficient and cost-effective planning of services and workforce in both healthcare and LTC sectors. The effectiveness of monitoring demographic changes, however, relies on data. In this vein, the Council Conclusions on Demographic Challenges (8668/20) has invited the European Commission 'to further develop a common basis and interactive EU-wide resource for obtaining timely, consistent, comparable and accessible data, disaggregated by sex and age'.

As shown in this chapter, the challenges of population ageing would require an integrated approach between primary care, hospital-based systems and long-term care not only in terms of delivery of services, but also in terms of integrated workforce planning. Ultimately, as all the analyses on the demand for health and LTC services have shown, the design of workforce planning and policies should be built upon the territorial specificities of the ageing populations and health policies; otherwise, 'one size fits all' solutions might risk amplifying the challenges of the ageing populations.

3. MIGRATION AND INTRA-EU MOBILITY, DRIVERS OF THE SUPPLY OF A HEALTH AND LONG-TERM CARE WORKFORCE

Sona Kalantaryan, Martina Belmonte, Marco Scipioni, Alessandra Conte, Sara Grubanov Boskovic

The supply of a health and long-term care (LTC) workforce is also determined by the inflow of migrant workers (immigration) in a given country and the outflow of domestic workers (emigration) from a country.
The aim of this chapter is to provide scientific insight into the aspects of the immigration and intra-EU mobility of health and LTC workers in the EU that are most significant to efficient workforce planning.

KEY MESSAGES

The EU has been attracting an increasing number of foreign-born healthcare and LTC workers. In 2018 there were almost 2 million health and LTC workers born in a country different to the one they were working in.

The majority of these workers originated from other EU Member States, European countries not part of the EU, and the region of North Africa & Middle East. Out of 27 EU MSs, 5 EU Member States absorb almost two thirds of health and LTC foreign-born workers: Germany, Italy, France, Spain and Sweden.

There is no specific EU sectoral labour migration instrument or tool for attracting health and LTC workers. The labour migration management system is fragmented into a variety of instruments, both at EU and national level.

For regulated health professions, migration requirements often include the recognition of qualifications as a prerequisite for exercising regulated professions. The complex procedures associated with it may pose a challenge in a context in which the health-related education and training programmes considerably differ to those imparted in the EU.

One way forward is to integrate current labour migration channels with more specific considerations for the health and LTC sectors, in compliance with ethical recruitment practices. Such mechanisms could foster circularity and therefore yield benefits for both countries of origin and destination. This approach would also imply the facilitation of the recognition of qualifications and the full activation of skills of the migrant workforce in the EU.

Improving the labour market integration of foreign health and LTC workers would help to unlock their potential and increase the productivity of the two sectors. In terms of job security, the findings suggest that more effort should be made to reduce the extent of involuntary forms of temporary and part-time contracts, the latter among personal care workers in health services in particular.

3.1 FLOWS AND STOCKS OF THE FOREIGN HEALTH AND LONG-TERM CARE WORKFORCE IN THE EU

The two main sources of information that allow for the analysis of the migration component in the workforce employed in the health and long-term care (LTC) sectors in the EU Member States are the statistics on 'Health workforce migration' and the 'European Labour Force Survey', both provided by Eurostat (Box 3). In this section, we use both sources to present the flows of foreign-born and foreign-trained health and LTC workers towards and within the EU, their distribution across large geographic areas of origin and destination Member States.

THE STOCK OF MIGRANT WORKERS ACCORDING TO EU LFS

According to information provided by the EU LFS for EU-27, in 2018, almost 2 million of 14.2 million individual health and LTC workers were foreign-born, either in another EU Member State (693,700) or outside the EU (1.3 million).

The evolution of the foreign-born workforce in the health and LTC sectors in the EU indicates that from 2011 to 2018 for all the health and LTC occupations the number of foreign-born increased, although to a various extent (Figure 11).[35] The number of foreign-born health professionals and health associate professionals increased by 67,100 and 6,300 respectively. The largest absolute increase is detected for personal care workers in health services: there were 142,500 more foreign-born employees in this category in 2018 compared to 2011, which is equivalent to about one fifth of the foreign workforce employed in this category in 2011. The increase in the number of foreign-born workers did not necessarily translate into an increase in their proportion among the total employed in the three categories. The percentage of foreign-born workers has remained constant for both health professionals and health associate professionals, oscillating around 10% and 7% respectively. The percentage of foreign-born workers among personal care workers instead increased from 19% in 2011 to 23% in 2018.

BOX 3 Data sources relevant for analysing foreign health and LTC workforce in the EU

The statistics on 'health workforce migration' provide information on the total number of healthcare professionals (limited to doctors and nurses) by place of training, distinguishing between domestically-trained, foreign-trained (of which native-born but foreign-trained) and unknown place of training. The dataset provides both absolute and relative (% of foreign-trained medical doctors and nurses) figures. In addition, the dataset contains information on the annual inflow of foreign-trained doctors and nurses.

Eurostat provides some warning regarding the limitation in the comparability of the information across Member States. The first source of limited comparability is due to the underlying concept of a 'practicing' professional for which information is not always available or up-to-date. Moreover, the national data sources in some countries include interns and residents (in which foreign-trained professionals are often over-represented) but not in others (e.g. France, Hungary, Poland). This discrepancy in the included categories may result in an underestimation in the number of foreign-trained medical doctors and nurses in countries where these categories (interns and residents) are excluded. The second limitation is related to the fact that for some countries the provided information is based on nationality (Germany) or place of birth (Spain) and not on the place of training. Hence, to compare the availability of healthcare resources across countries, it is suggested to use the concept of 'practicing'. Table M1 in Annex M provides information on medical doctors and nurses by place of training in each Member State based on the most recent data available.

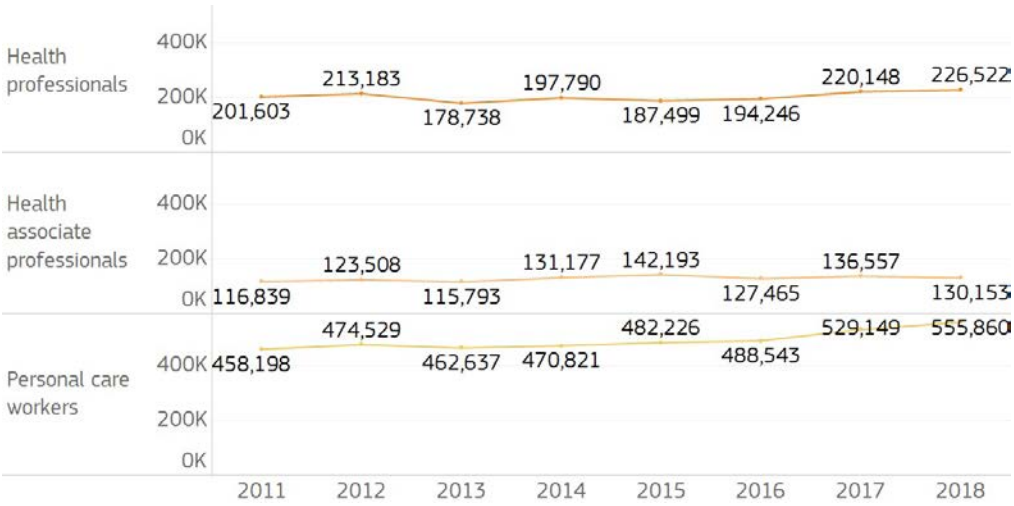
The second source of information is the 'European Labour Force Survey – EU LFS' widely used to produce labour market-related comparable statistics for the EU and its Member States. The EU LFS allows for the identification of all relevant occupational categories for the health and LTC sectors, namely health professionals, health associate professionals and personal care workers in health services according to the ISCO-08 classification (Table 2).

The use of these two sources of information allows for the advantages of each to be benefitted from and hence providing as complete a picture as possible. Firstly, the statistics on 'health workforce migration' allows the evolution of foreign-trained medical doctors and nurses to be monitored, distinguishing between native and foreign-born; however, the information on geographic areas of origin is not available. This gap is filled by the EU LFS as the dataset allows migrants to be identified by large geographic areas of origin (birth), which, for comparability across the EU Member States, are here aggregated into the following seven regions of birth: 1) EU-27 + UK; 2) non-EU Europe; 3) North Africa & Middle East; 4) Sub-Saharan Africa; 5) East & Southeast Asia; 6) North America, Australia & Oceania; and 7) Latin America. Secondly, while the health workforce migration dataset provides information on medical doctors and nurses based on the 4-digit ISCO-08 disaggregation level, the EU LFS dataset provides information at the 3-digit ISCO-08 level only. Lastly, the dataset on health workforce migration contains numerous gaps which are more relevant for some EU Member States than for others. In this respect, the EU LFS derived statistics are more complete, allowing EU level aggregate figures to be obtained and the evolution of stock of migrant workers to be analysed over time.

TABLE 2. Definition of a health and long-term care workforce using EU LFS
Note: any deviations from these base definitions of health workers are reported in the notes of the corresponding analyses.

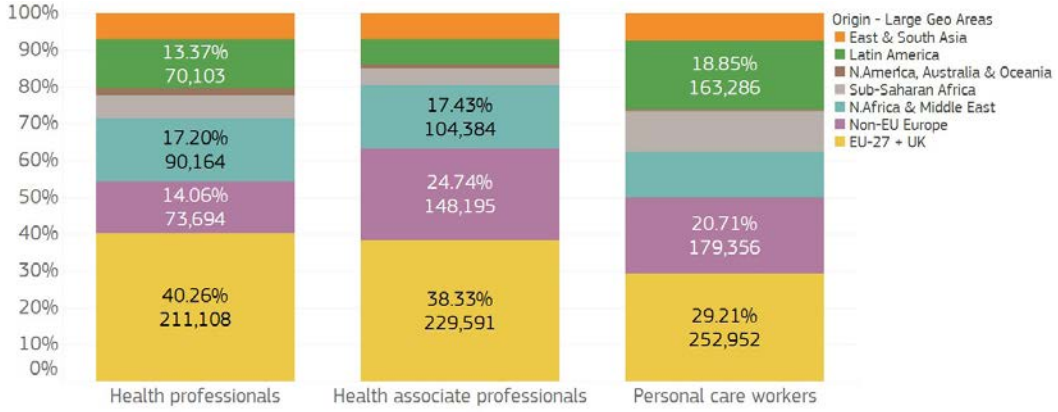
HEALTH PROFESSIONALS (HPS) **ISCO-08 group 22**	221 Medical doctors 222 Nursing and midwifery professionals 223 Traditional and complementary medicine professionals 224 Paramedical practitioners 226 Other health professionals *Excluding 225 veterinarians*
HEALTH ASSOCIATE PROFESSIONALS (HAPS) **ISCO-08 group 32**	321 Medical and pharmaceutical technicians 322 Nursing and midwifery associate professionals 323 Traditional and complementary medicine associate professionals 325 Health associate professionals *Excluding 324 veterinarian associate professionals*
PERSONAL CARE WORKERS (PCWS) **ISCO-08 group 53**	532 Personal care workers in health services *Excluding 531 child care workers and teachers' aides*

FIGURE 11. Numbers of the foreign-born health and long-term care workforce by occupational category over time, 2011-2018 (EU-27 aggregate excluding DE)
Note: the figure does not contain data for DE due to missing country of birth information before 2017. According to data available for 2018, DE registered 153,484 foreign-born health professionals, 394,411 health associate professionals and 99,077 personal care workers. Only analysis referring to the 2011-2018 trend, does not include DE.
Source: KCMD elaboration of EU LFS microdata, 2011-2018.



The **origin composition of foreign-born employees** in the health and long-term care sectors varies significantly across the three occupation groups (Figure 12). In all three occupational categories, EU mobile citizens (& UK citizens) constitute the largest part of the foreign health and LTC workforce. More than one third of the foreign-born workforce in the three categories are born within the EU-27 & UK area. The proportion of EU mobile citizens (& UK citizens) is higher among health professionals (40.3%) and health

FIGURE 12. Health and LTC workers by occupational category and region of birth in EU-27, 2018
Source: KCMD elaboration of EU LFS microdata, 2018.



associate professionals (38.3%) than among personal care workers in health services (29.2%). The second-largest origin group of health and LTC workers is composed of European countries outside the EU-27 & UK area (20.2%), followed by North Africa & Middle East area (15.2%) and Latin America (13.8%). Around 8% of foreign-born workers are from the Sub-Saharan Africa group and 7% from East & South Asia. The proportion of those coming from North America, Australia & Oceania is negligible – below 1%.

The **occupational composition reveals that there are significant differences between native and foreign-born workers as well as across large geographic origin areas** (Figure 13). Among the native-born 33.8% are those employed as health professionals (HPs) and 42.1% as health associate professionals (HAPs). With the exception of those born in North Africa & Middle East, North America & Oceania, for all other groups the proportion of employees in these two occupations (HPs and HAPs) is significantly lower. The proportion of health professionals is the lowest among those born in non-EU European countries (18.4%) and highest among those coming from North America, Australia & Oceania (50%). Among foreign-born workers, the proportion of health associate professionals is the lowest (15%) among those coming from Latin America and Sub-Saharan Africa. Instead, these origin groups have the highest proportion of personal care workers: 60% and 62% for Latin America and Sub-Saharan Africa respectively.

More than two thirds of foreign-born health and LTC workers are employed in just 5 EU Member States: Germany, Italy, Sweden, France and Spain. More specifically, the top five destination countries hosting more than 70% of all foreign-born health professionals are Germany (33%), Italy (20%), France (10%), Spain (10%) and Sweden (8%). Two thirds of all foreign-born health associate professionals are in Germany, slightly more than 10% in Italy. With regard to personal care workers in health services, Italy is the country hosting 38% of the total stock of foreign-born workers in this category in the EU, while Sweden, Germany, France and Spain host from 10% to 16% of the total EU stock each (Figure 14).

FIGURE 13. Health and long-term care workers by region of birth and occupation category EU-27, 2018
Source: KCMD elaboration of EU LFS microdata, 2018.

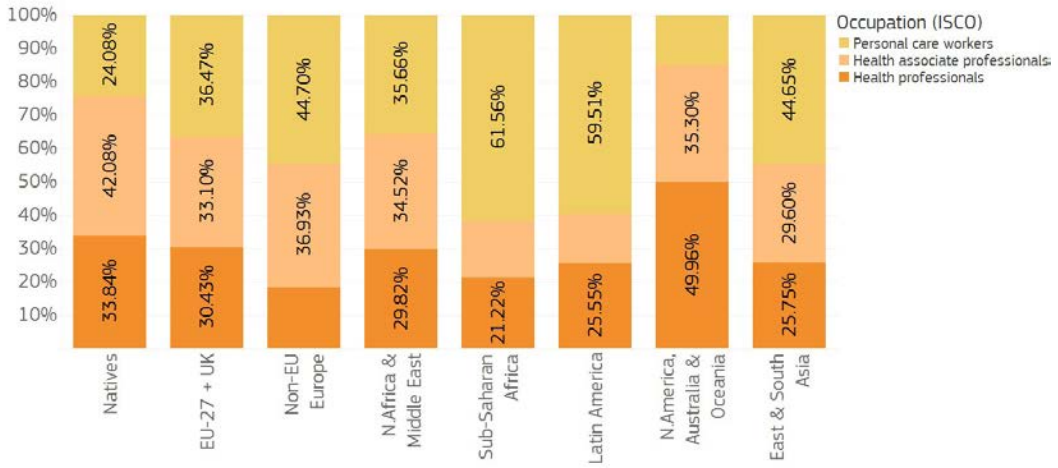
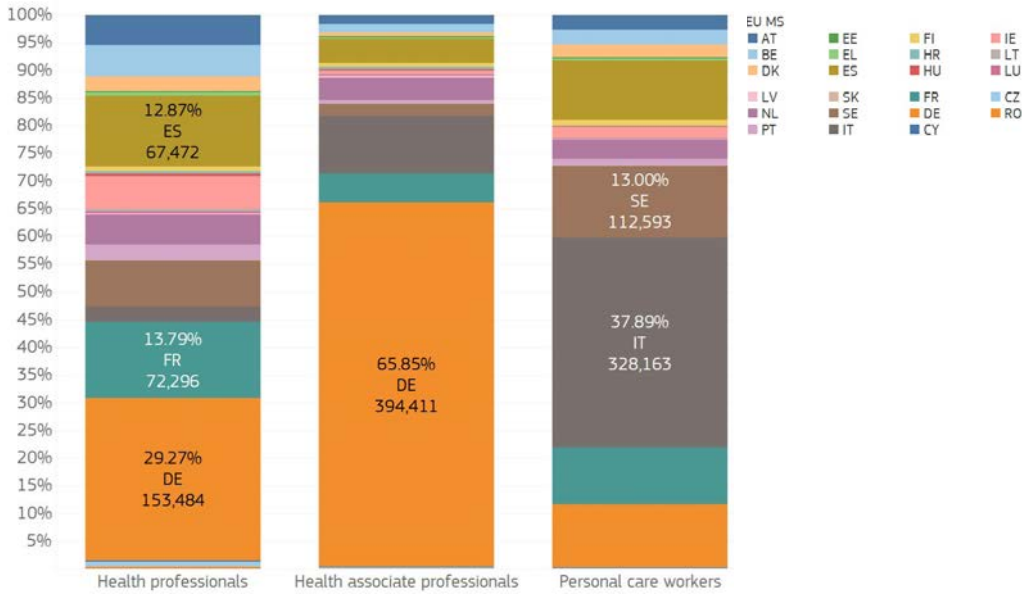


FIGURE 14. Distribution of health and long-term care workers by occupation and destination EU-27, 2018
Source: KCMD elaboration of EU LFS microdata, 2018.



The **origin-destination matrix** suggests that the following 'corridors' dominate the inflow of foreign-born health workers. The most important destinations for EU mobile health and long-term care workers are Germany (38%) and Italy (24%). This pattern is observed and is even stronger for those born in European countries outside the EU-27 & UK area: three quarters of them are employed in Germany (43%) and Italy (30%). Germany also employs the highest proportion of health and long-term care workers from North Africa & Middle East (43%), followed by France (22%) and Sweden (13%).

The health and long-term care workforce coming from the Sub-Saharan Africa group is mostly employed in France (32%), Sweden (17%), Germany (12%) and Belgium (10%). For those from Latin America, the main destinations are Spain (50%) and Italy (23%). These two EU Member States together host almost two thirds of all health and long-term care workers coming from the region, which is perhaps explained by linguistic and cultural proximity, historic ties (and bilateral agreements facilitating the migrants' entry. Germany (27%), Sweden (17%), Italy (15%) and Ireland (12%) are the main destinations for workers originating from East & South Asia. Lastly, the least numerous group, the workers coming from North America, Australia & Oceania are mainly employed in Germany (40%), Ireland and Italy, 10% each.

FLOWS AND STOCKS OF MIGRANT WORKERS ACCORDING TO HEALTH WORKFORCE STATISTICS

The information on 'health workforce migration' provided by Eurostat allow both the stock, flows of foreign (trained) workers as well their percentage among the total employed to be observed in corresponding occupations. It is important to remember that here we switch from country of birth to place of training as the criterion. We distinguish between domestically-trained, foreign-trained (of which native-born but foreign-trained) and unknown place of training. The dataset contains numerous missing observations. The information gap is particularly prominent for some EU Member States (e.g. Finland, Spain, and Portugal). Fortunately, for the majority of EU Member States or years, the information is complete which allows the evolution of flows of foreign medical doctors and nurses over time to be analysed.

The annual inflow of medical doctors to the EU from 2011 to 2017 was relatively constant: 7,000 to 8,000.[36] For the same period, **the annual inflow of nurses doubled** going from 4,400 to 8,500. Figure 15 depicts the dynamics of the annual inflow for selected EU Member States from 2008 to 2018.

Figure 15 shows that the largest increase is observed for the inflow of nurses to Germany; from less than 700 in 2012 to almost 4,700 in 2018. Nevertheless, in Germany the inflow of medical doctors peaked in 2013 reaching 2,225 thereafter; while remaining among the highest in the EU, it gradually decreased to 1,330 in 2017. A similar pattern is observed for Ireland, where the annual inflow of nurses increased from around 800 in 2008 to 3,300 in 2018. The increase in the annual inflow of medical doctors, despite more modes, was still tangible – from almost 800 in 2010 to 1,400 in 2018 with a peak in 2016 (1,800). The largest decrease – about 10 times – in the annual inflow of nurses is observed in Italy: from 3,600 in 2008, it steadily decreased to 300 in 2018. Instead, the flow of medical doctors to Italy increased from around 150 in 2008 to 200 in 2018 with some decline in between. In France, the annual inflow of medical doctors and nurses during the same period was, on average, 1,500 and 520 respectively.

FIGURE 15. Flows of medical doctors & nurses in selected EU Member States (2008-2018)
Source: KCMD elaboration of health workforce migration [hlth_rs_wkmg], Eurostat.

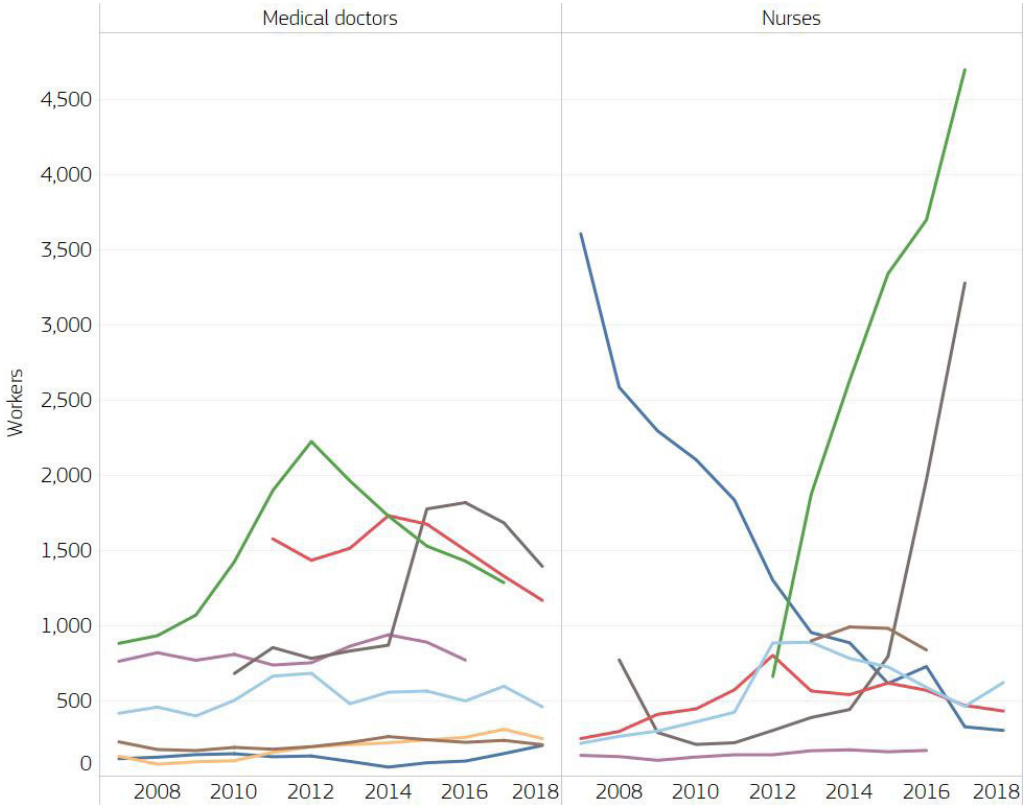


Figure 16 presents the distribution of cumulative inflow (2009 to 2018) of medical doctors and nurses across the EU Member States. Both pie charts suggest that the vast majority of inflow was directed towards a few EU Members States, namely Germany, Ireland, France, Italy, Belgium, Sweden, Denmark and Austria.

Figure 17 specifically shows the inflow of foreign-trained medical doctors and nurses between 2000 and 2018. With the exception of Italy, for the EU Member States for which a time series is available, the proportion of foreign-trained doctors is higher than the proportion of foreign-trained nurses. The opposite is observed in Italy. Moreover, the increase in the proportion of foreign-trained doctors was sharper than that of foreign-trained nurses. For instance, in Sweden during the period from 2000 to 2015, the proportion of foreign-trained doctors increased by 20 percentage points: from 14.0% to 34.8%, while the proportion of foreign-trained nurses remained constant, oscillating around 2.8%. The highest percentage of foreign-trained medical doctors is observed in Ireland (42.3% in 2017) and the lowest percentage in Estonia (3.9% in 2017). Overall, the proportion of foreign-trained nurses is very low within the eastern Member States. The highest figures are observed for Germany (7.9%), Belgium (7.4%) and Italy (5.0%) in 2017. Two EU Member States, namely Portugal and Latvia, do not follow the general trend. In both countries, the proportion of foreign-trained medical professionals decreased.

FIGURE 16. Cumulative flows of medical doctors and nurses, 2009-2018
Note: the dataset contains gaps and the figure provided can be only considered as an approximation of the true flow over the period from 2009 to 2018 (Table M1 in Annex M).
Source: KCMD elaboration of health workforce migration [hlth_rs_wkmg], Eurostat.

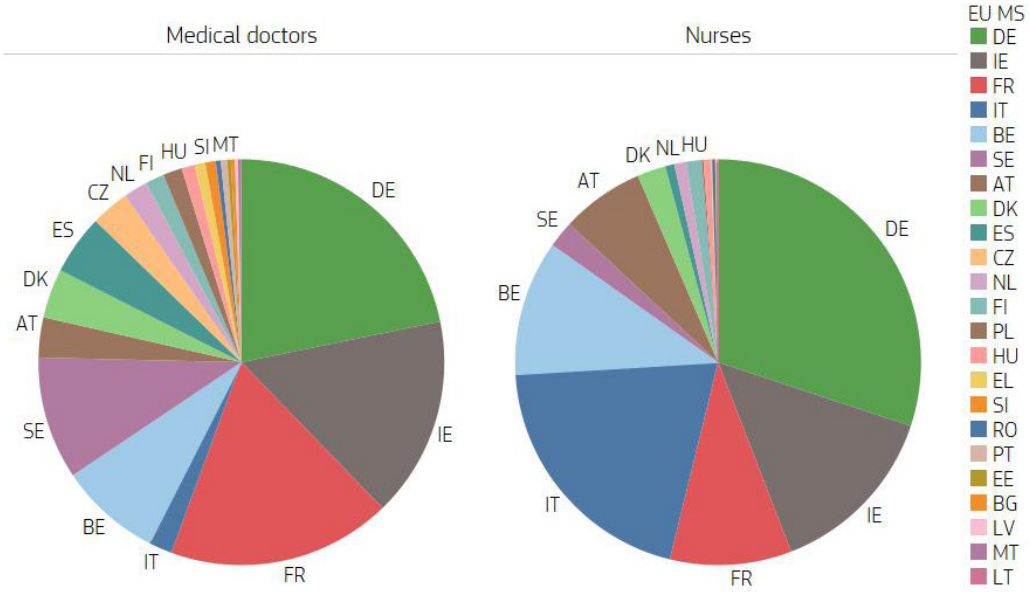


FIGURE 17. Proportion of foreign-trained medical doctors and nurses across the EU MSs (2000-2018)
Note: EE, EL, HR, LT, MT and SK are excluded due to the absence of a sufficient amount of information. No data on the share of foreign-trained nurses in AT, CZ and IE.
Source: KCMD elaboration of health workforce migration [hlth_rs_wkmg], Eurostat.

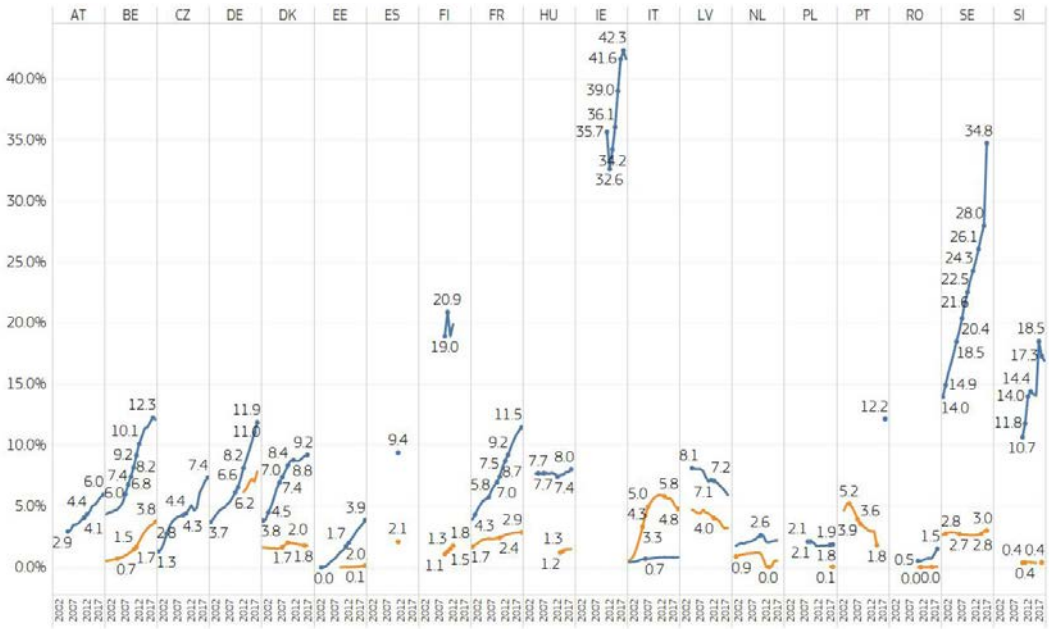
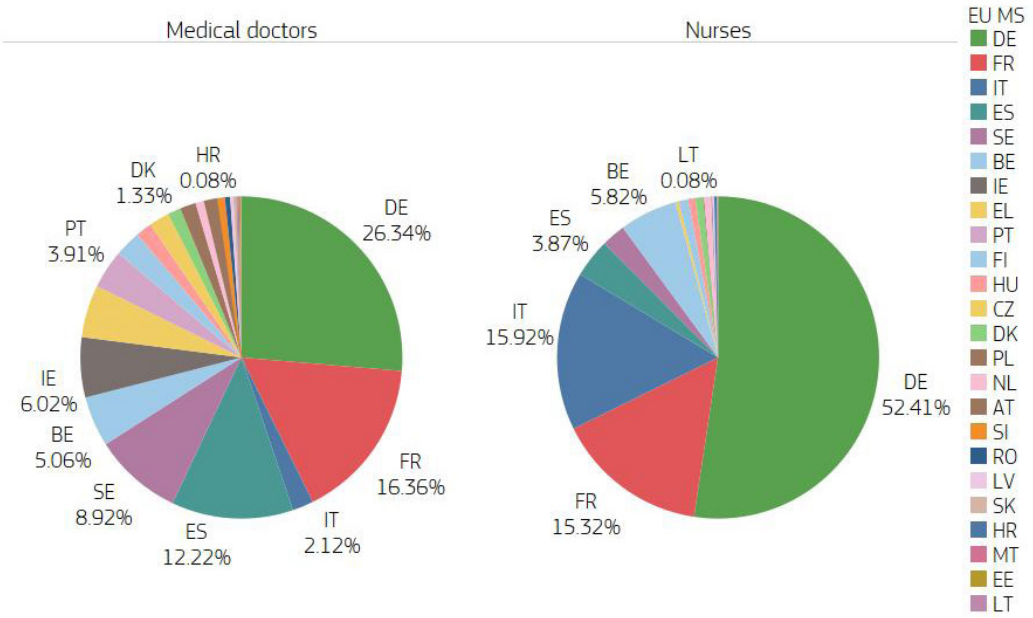


Figure 18 (and Table M1 in Annex M) provides the distribution of the total foreign-trained medical doctors and nurses across the EU Member States using the last year of available figures in each country of destination. **National administrative data confirms the results obtained based on EU LFS information using the county of birth criterion** (Figure 14). Germany, France, Italy, Spain and Sweden host the largest part (more than half) of all foreign-trained medical doctors practicing in the EU. Interestingly, Portugal and Greece host a significantly larger proportion of foreign-trained (medical doctors) rather than foreign-born (health professionals). This is perhaps explained by the fact that many Greeks and Portuguese study medicine abroad. Indeed, both countries have a high number of foreign-trained but native-born doctors; 7,832 in Greece and 2,865 in Portugal. More than half of all foreign-trained nurses are practicing in Germany, followed by Italy and France which employ slightly more than 15% each.

The analysis presented above indicates that over the last decade the EU has been attracting an increasing number of foreign-born healthcare and LTC workers. In 2018 there were almost 2 million health and LTC workers born in a country different to the one they were working in, which is around 220,000 more compared to 2011. However, this absolute increase did not lead to a significant increase in their proportion of the total workforce. Moreover, the percentage of foreign-born health workers currently observed (13.2%) is significantly lower than in other popular destinations for health professionals such as the UK or USA. The majority of these workers originate from other EU Member States & UK area, from the European countries not part of the EU and from the region of North Africa & Middle East. The

FIGURE 18. The stock of foreign trained medical doctors and nurses by country of practising
Note: the figures are based on the latest available figures for each EU Member State (Table M1 in Annex M).
Source: KCMD elaboration of health workforce migration [hlth_rs_wkmg], Eurostat.



foreign workers are not evenly distributed across the EU Member States with more than two thirds of them working in just 5 EU Member States: Germany, Italy, Sweden, France and Spain. Moreover, there is significant heterogeneity across Member States in terms of the types of occupations which reflects different national labour market needs and origins due to various historic and cultural ties.

3.2 IMMIGRATION POLICIES ON HEALTH AND LONG-TERM CARE WORKERS

While the previous section has described the stock and flows of migrants and EU mobile citizens in the health and LTC professions, this section looks at the regulatory framework under which mobility and migration takes place. In particular, while EU health and long-term care (LTC) workers can freely move across the EU to seek and take up employment, non-EU citizens migrating for work purposes are subject to the labour migration system. The following sections mainly focus on the immigration of non-EU health and long-term care workers.

The management of migration flows of health and long-term care workers lies at the intersection between health and migration policies. These domains have a different distribution of competences between the EU and Member States, different stakeholders and instruments.[37]

THE INTERNATIONAL AND EU TOOLS AVAILABLE TO REGULATE THE MIGRATION OF HEALTH AND LONG-TERM CARE WORKERS

In immigration policy, the EU shares competence with the Member States. With the aim of establishing a common migration policy, as mandated by the Treaty on the Functioning of the European Union (TFEU), the EU has the competence to take measures on the conditions on entry and residence of third-country nationals, while Member States have the right to determine the volume of admission (TFEU, Article 9).

The EU legal framework on entry channels for economic purposes include several directives (Students and Researchers Directive, Blue Card Directive, Seasonal Workers Directive, Intra-Corporate Transferee Directive, Single Permit Directive – Box M1 in Annex M), **but there is no specific sectoral labour migration instrument or tool that deals with the health and long-term care sector in particular.** The directives do not impose restrictions on the sectors of application and are, rather, framed in terms of qualifications/skills (e.g. the Blue Card reserved for highly qualified individuals) and characteristics of the employment (i.e. seasonality, research or intra-corporate transfers).

At international level, the WHO laid down a Global Code of Practice on the International Recruitment of Health Personnel, whose principles should

be used to respond to skills needs and shortages (WHO, 2010a). The Code was negotiated and formally unanimously adopted in 2016 at the 63rd World Health Assembly. Although it is not binding, WHO Member States have 'a general good faith obligation to consider its recommendations' (from user's guide). Moreover, it is associated with a reporting mechanism, whereby countries are encouraged to report every three years on measures they have adopted to implement the Code.

As per the Code, 'Member States should strive, to the extent possible, to create a sustainable health workforce and work towards establishing effective health workforce planning, education and training, and retention strategies that will reduce their need to recruit migrant health personnel' (Code, Article 3.6). However, the Code also recognises that migration 'can make a sound contribution to the development and strengthening of health systems, if recruitment is properly managed' (Code, Article 3.2).

To do so, the **Code provides ethical principles for international recruitment**, and in particular 'discourages the active recruitment of health personnel from developing countries facing critical shortages of health personnel' and 'encourages collaboration between destination and source countries' (from user's guide), as well as encourages MS to facilitate circular migration so that skills and knowledge can be achieved to the benefit of both countries of origin and destination.

The EU endorses the WHO Global Code of Practice. The 2012 Action Plan stressed Member States' commitment to the Code 'to help reduce the negative impact of migrants' flow on fragile healthcare systems'. Moreover, the Blue Card Directive included general provisions on ethical recruitment. In particular, it foresees the possibility for Member States or the EU to conclude agreements with third countries which would list professions excluded from the scope of the Blue Card due to ethical recruitment concerns (Article 3(3)). It also includes, among the possible grounds for refusal, the fact that certain sectors in the countries of origin lack qualified personnel (Article 8(4)). However, from the latest available evaluation of the implementation of the Directive contained in the 2016 Blue Card impact assessment,[38] there has been limited uptake at national level of ethical recruitment provisions in implementing the EU Blue Card. In particular, no Member State concluded any agreements with third countries. Although six Member States (BE, CY, DE, EL, LU and MT) considered ethical recruitment a ground for refusal, this ground has not yet been used in practice.

DIVERSITY OF LABOUR MIGRATION PATHWAYS FOR THE MIGRANT HEALTH AND LONG-TERM CARE WORKFORCE

Skills and employment profiles of health and long-term care workers

As the labour migration directives framed labour migration in terms of skills and qualifications, and EU Member States' migration systems tend to have different

migration channels depending on the skill level (Fernandez-Reino et al., 2020), it is important to describe the profiles of health and LTC workers to identify the relevant migration pathways.

The health and long-term care workforce is heterogeneous in terms of skills/qualifications profiles and in terms of the types of employment taken up. The description of different categories of health and LTC workers – namely health professionals, health associate professionals and personal care workers in health services, as defined by the ISCO-08 classification – can be found in Table 2, Section 3.1.

The **level of skill or qualification required (legally or practically) to practice these professions varies, covering the entire skill spectrum**.[39] Skills requirements vary by country (or by region) and by individuals, as qualifications may be compensated by the previous professional experience. In terms of occupations, health professionals are mostly highly skilled (although in some countries, like Germany, nursing is a vocational training profession), health associate professionals are a mix of high- and medium-skilled workers, while personal care workers in health services are a mix of middle- and low-skilled workers (Table 3, Section 3.3.).

In some cases, **there are specific regulatory qualification requirements to perform the relevant professions and the relevant qualification becomes compulsory.** These requirements are normally set at Member State level. For some healthcare professions, however, these are set at EU level and concern the duration of the theoretical as well as practical training. These professions are those covered by Directive 2005/36/EC on automatic recognition of qualifications in the EU, and include nurses and midwives (at least 3 years of training), generalist medical doctors, dental practitioners and pharmacists (basic medical training lasting at least 5 years), specialist medical doctors (specialised training, lasting from 3 to 5 years, on top of basic medical training) and specialised dental practitioners (additional 3 years on top of the training for dental practitioners). For health-associated professions and personal care workers in health services, no specific requirement is defined at EU level.

Health and long-term care professions also differ by type of employment. They can work as employees of public or private healthcare establishments; as self-employed; or in the informal economy, as can be the case for domestic personal care workers in particular.

Schemes for health and long-term care workers

The heterogeneity of the skills and employment profiles of health and long-term care workers and the absence of instruments covering an entire sector implies that **the labour migration management of health and LTC workers is fragmented into different instruments**.

At Member State level, as employees, health and long-term care professions can be covered by the schemes that, to a different extent, take the specific professions into account:

- general schemes that do not distinguish between skills or professions;
- skill-based schemes that target migrants of a specific skill level (generally for highly skilled migrants);
- general or skill-based schemes that present some facilitations for certain professions, due, for instance, to shortages in relevant professions or sector;
- specific schemes reserved for migrants wishing to practice a health or long-term care profession.

Member States differ in the entry requirements for each channel (in terms of salary, qualifications and fulfilment of the labour market test in particular) and in the presence of skill-based channels (Table M1 in Annex M for an exhaustive overview across all EU MSs).

For most Member States, **general schemes** do not have specific qualification[40] or salary requirements in addition to what is foreseen by the minimum salary legislation or sectoral labour agreements. However, often applicants (employers or prospective migrants) need approval from labour authorities certifying that there is no suitable candidate for the relevant position in the existing workforce (i.e. labour market test). They may be exempted if the position features in specific lists of shortage occupations.

Schemes for highly skilled workers – be they the EU Blue Card or the national scheme – are more likely to have qualification entry barriers and salary requirements, but are less likely to request a labour market test.

No EU MSs have specific provisions for the health and long-term care sector in the general or in the highly skilled schemes. However, healthcare workers are mentioned in **shortage lists** in some cases (BE, DE, IE, ES, HU, MT, AT), thus benefitting from an expedited process (e.g. no labour market test, lower salary threshold). This is less often the case for long-term care workers, although some MSs, like MT, list long-term care workers among the professions in shortage. The way Member States draft this list, their level of detail and the very definition of a shortage vary to a significant extent (EMN, 2015; EMN, 2019a).

Table M2 in Annex M reports the characteristics of the most important labour migration channels in each EU MS, divided into general programme; without skill differentiation; and skill-based programme.

In Ireland, for example, there are two lists of shortage occupations and its labour migration system foresees facilitations or impediments depending on the presence of the professions on such lists. One list is for critical skills.[41] Applicants for these professions have two benefits: for the general scheme (general employment permit),

they are exempt from the labour market test which is otherwise compulsory; for the highly skilled permit, they become eligible for the critical skills employment permit. Another list contains the occupations that are ineligible for the general employment permits.[42] Both lists are based on the Standard Occupational Classification and are highly detailed (four-digit level). The categories of health managers and health associate and therapy professionals feature on both lists with different professions in each, while the categories of health professionals and long-term care workers (with the exception of carers in a private home) feature on the essential skill and ineligible list respectively.

The only EU MS with a **scheme specifically for the category of healthcare workers** is Italy. In this MS, there are predominantly two possible labour migration channels: *1) the general migration scheme based on annual quotas, for which the call for applications opens once a year; and 2) the extra quota schemes, covering the subcategory of a) highly skilled workers subject to specific requirements and covered by EU directives,*[43] *and b) a heterogeneous category primarily including temporary workers,*[44] *as well as nurses.*[45] This latter channel pre-exists any EU labour migration instrument.

There is limited information on the actual use of each entry channel by each specific profession. EU Blue Cards, potentially covering health professionals, seem to have been used to a very limited extent for this category of workers,[46] although many countries do not report this information. National data provide more information. In Germany, which issued 83% of all Blue Cards in 2018, 20% are issued to migrants working as medical doctors (BAMF, 2016), while nurses are not eligible. Information on other work permits at EU level is limited and not fully reliable due to several missing pieces of data.[47]

MIGRATION PATHWAYS USED BY HEALTH AND LONG-TERM CARE WORKERS

Little information is available on the migration entry pathways that migrant workers initially use. Healthcare and LTC workers may migrate to a Member State for the first time to take up an employment (thus using labour migration entry channels as described in the section above); or may access the health or long-term care profession having first migrated for other reasons (thus also using non-labour migration entry channels).

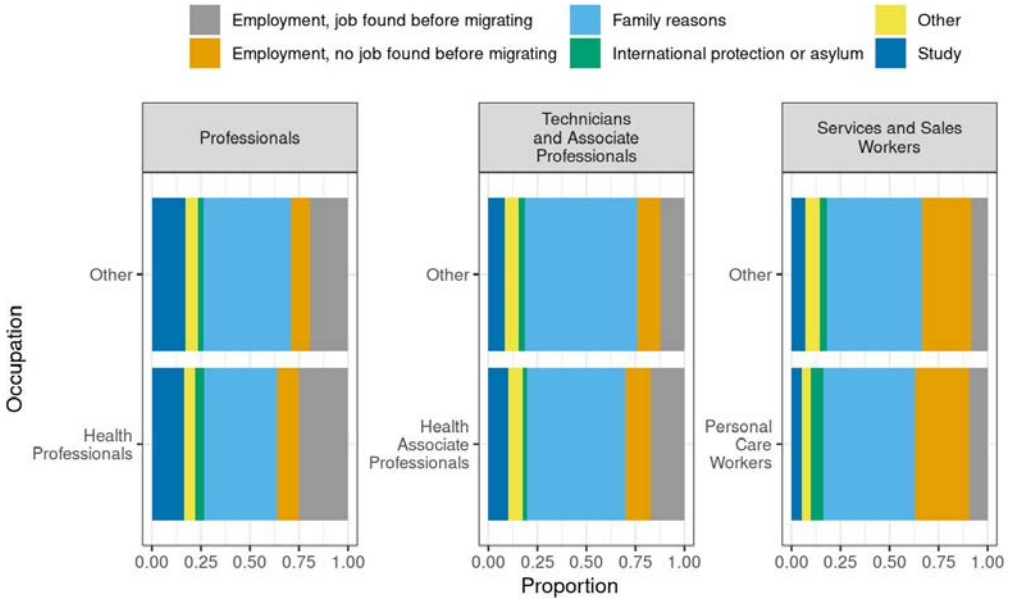
This knowledge gap is particularly important in relation to an attractive policy and international recruitment. In particular, highly skilled workers in general, and health professionals among those, are the main target of EU and Member States' efforts to design attractive labour migration policies. However, little is known of how many of the sought-after highly skilled workers initially migrate via highly skilled labour migration channels. In 2016, the BAMF survey showed that half of EU Blue Card holders in Germany were already in the country when

they applied for a highly skilled residence permit (BAMF, 2016). This suggests that they found the job that would entitle them to a highly qualified permit when already settled in the country.

In absence of administrative data on the previous residence permits, **it is possible to look at the workers' reasons for migrating to provide an indication of the entry channel used**. The 2014 ad hoc module of the EU LFS provides the most recent evidence available on the reasons for migrating to the EU. Respondents were asked about their reasons for migrating and whether they had a job offer before migrating. The declared reasons do not necessarily correspond to the legal and administrative category of the residence permit, so they can only represent an indication of which channels the person might have used. Nevertheless, the answers could help understand the proportion of each channel of admission within all health occupations considered in this study. Immigrants' self-reported reasons for migrating are shown in Figure 19, broken down by occupation according to the ISCO-08 classification.

Overall, migration for employment-related purposes represents the reason for migrating in between 27% and 43% cases for foreign-born health and LTC workers, depending on the professional category. Those who migrated for employment reasons, but did not have a job offer prior to migrating, represent between 11% and 32% of all healthcare migrant workers (11% for professionals, 13% for health associate professionals and 32% for personal care workers in

FIGURE 19. Proportion of self-reported reasons for migrating among health workers and other workers (aggregated) according to the ISCO-08 classification
Note: DE not included in the ad hoc module. MT not included due to missing disaggregation beyond ISCO1; population 15+. Definition of worker categories can be found in Table 2, Section 3.1
Source: Ad hoc module EU LFS microdata, 2014.



particular). At the same time, migration with pre-arranged employment – i.e. with a job offer – is more common for high- and medium-skilled workers in the healthcare sectors, while low-skilled workers (personal care workers) migrating for employment purposes are more likely to migrate without a job offer (11% among health professionals, 13% among health associate professionals, 28% among personal care workers). Considering that much of labour migration in the EU is demand-driven, it is reasonable to expect that people migrating for employment reasons but without a job offer moved via non-employment-based channels, or irregularly. If true, this would leave the proportion of those who migrated through labour migration channels at approximately one fourth of all health workers. There may be various reasons for this. Limited availability of labour migration channels, regulatory barriers, difficulties in the recognition of qualifications, difficulties in international job matching may be some of them.

For the three groups of healthcare professions, **the largest proportion of migrant healthcare and LTC workers is represented by people migrating for family reasons.** These in particular represent half of all the reasons for health-related and personal care workers (54% and 40% respectively) and more than one third for health professionals (38%). This is in line with the more general migration trend whereby family migration is the main channel of migration to a large number of countries (OECD, 2017).

The proportion of health workers who migrated for study reasons is larger among health professionals (16%) than among the health associate professionals (10%) and the personal care workers (5%). This is in line with the fact that study mobility is higher among people in tertiary education, and health professions are the most qualified among the three groups.

MIGRATION FOR EDUCATIONAL PURPOSES AS AN ENTRY CHANNEL

Migration for educational purposes can be a strategy that prospective labour migrants adopt to overcome the obstacles linked to international recruitment, such as the recognition of qualifications or job matching. It can also be **a strategy used by countries to attract prospective highly qualified workers**, who initially migrate for education purposes and then stay **and take up employment** over **in the destination** country. Study is thus an important category to consider when analysing the entry pathways of highly skilled workers.

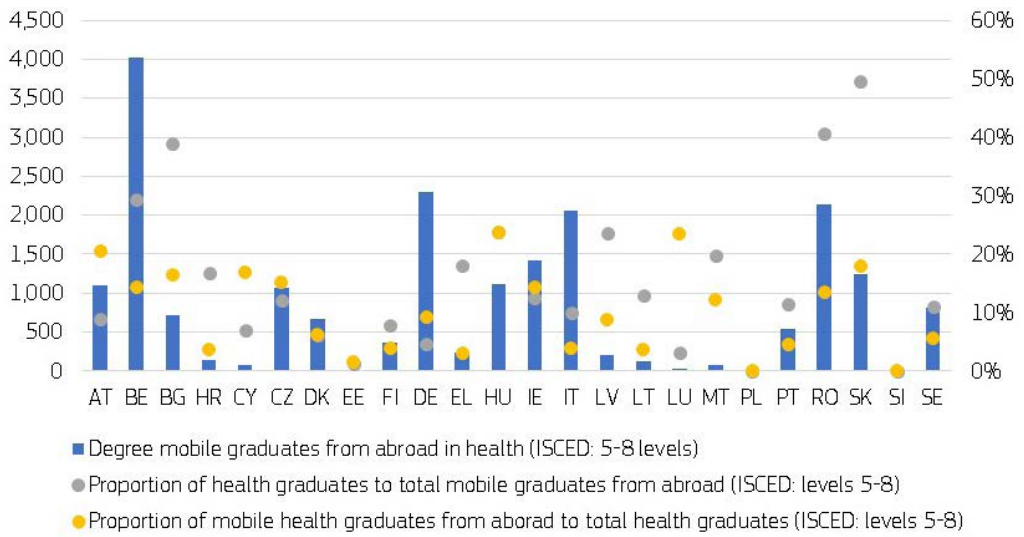
Research shows that although students might leave the country once graduated, 'the experience of being an international student increases the likelihood of becoming a skilled migrant after graduation' (Weinar & von Koppenfels, 2020). As shown above, a significant minority of health professionals (16%) migrate for study reasons. The BAMF survey on EU Blue Card holders found that almost a third of the EU Blue Card holders studied in the country, and in most cases the degree obtained in the country complemented a degree that migrants had already obtained

abroad (BAMF, 2016). In a context of workforce shortages and limited migration through labour migration channels, migrant students can therefore represent an important resource.

Currently, it is not possible to quantify the pool of non-EU graduates in health-related fields, as Eurostat does not distinguish between EU and non-EU students. However, looking at data covering both EU and non-EU graduates, it is possible to gain some important insights into the differences between Member States in terms of the presence of foreign graduates. Eurostat defines as 'degree mobile graduates' those graduates whose country of origin (preference to prior education, vs residence, vs citizenship) is different from the country where the graduation is obtained (i.e. the country of destination).

From these data, some Member States seem to be more attractive than others to the so-called degree mobile graduates. This can be assessed by using three indicators: the absolute numbers of degree mobile graduates in the area of health[48] (blue bars in Figure 20); the ratio of degree mobile graduates in health fields over total degree mobile graduates (grey dot in Figure 20); and the ratio of degree mobile health graduates over total health graduates (yellow dot in Figure 20). In some Member States, the number of degree mobile EU and non-EU graduates in the health field is particularly high in absolute numbers, such as BE, DE, IT, RO (> 2,000 graduates in 2018). In other Member States, foreign graduates are over-represented in the health field compared to other fields, such as BG, SK and SI (> 30% of foreign graduates are in health fields). Lastly, in some Member States the proportion of foreign graduates to the total number of graduates in the health field is particularly large, such as HU, LU, AT (> 20% of all health graduates).

FIGURE 20. 'Degree mobile graduates' from abroad (EU and non-EU) in the health sector, in absolute numbers (left axis) and as a proportion (right axis), in 2018
Note: data for NL and ES not available.
Source: KCMD elaborations of Eurostat datasets [educ_uoe_mobg01] and [educ_uoe_grad02].



Migrant university graduates develop part of their human capital in the host country and, following a qualification-based definition, can be considered **highly skilled individuals**. Some of them stay to take up employment, changing the reason for their permit from study to work. While the work that they take up is not always at their skill or qualification level, they still represent a pool of highly qualified workers.

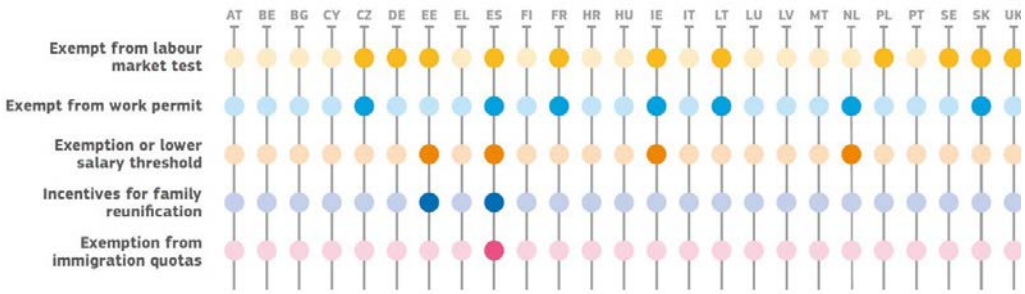
The capacity to transform this pool of migrant graduates in health fields into workers in the health sector depends on economic and migration policy factors in addition to migrants' personal attitudes. Attractive labour market conditions and generous legal possibilities for students to stay in the country after graduation to look for employment, as well as facilitations in fulfilling labour migration requirements, are expected to increase student retention.

As per the Students and Researchers Directive (Article 25(1)), students are entitled to stay in the Member State to seek employment or set up a business for at least 9 months. This period is in general conceived as temporary (up to 18 months at most), and the permits issued during this period are generally non-renewable and need to be converted into another permit as soon as the person finds a job (EMN, 2019b). In addition to the duration of the post-graduate period, there are other incentives to retain students, although none of them are specific to the healthcare sector. These are the exemptions from the labour market test or from obtaining a work permit; the exemption from a lower salary threshold; incentives for family reunifications; and the exemption from immigration quotas. Less than a half of Member States have put in place at least one of those incentives (Figure 21).

Regularisation as an indirect channel for health and long-term care workers

Regularisation is another indirect migration channel for some health and LTC workers. Migrant health and LTC workers can have an irregular migration status in the country, either because they entered irregularly or because they overstayed. Under this status, they may find employment in the informal sector, thus coupling

FIGURE 21. Incentives for retaining international students
Note: darker dots indicate that the MS has put in place a measure in the relevant category.
Source: EMN Study: Attracting and retaining international students in the EU, 2019.



their irregular migration status with the illegal employment (EMN, 2017; OECD, 2017). This can more often be the case in sectors where illegal employment is already significant, such as the domestic sector.[49] Regularisations generally tackle both employment and the migration position of such workers.

Regularisations are different in nature. They may be used as 'a corrective policy instrument, which often follows a human right based and protection-oriented rationale or broader considerations of legal principles and due process of the law' (REGINE, 2009). These generally target individuals, hence taking into account the individual situation on a case-by-case basis. This form of regularisation is often called 'regularisation mechanism' and is driven by humanitarian rather than economic concerns. On the contrary, regularisation programmes are mass regularisation that tend to be driven by employment and labour market policy considerations. They normally target groups of persons working in specific sectors (REGINE, 2009). Regularisation as a secondary status relevant to this study is this second type.

Mass regularisations occurred rather often in EU MSs[50] from the mid-1990s up until the mid-2000s (REGINE, 2009), but have decreased in frequency since then. The countries with the largest regularisation programmes were IT, ES and EL, with more than 1 million people regularised during that decade (REGINE, 2009; MPI, 2011). Regularisation programmes have become much less frequent since the mid-1990s.

LTC workers often feature among the beneficiaries of regularisation programmes. When these target the irregular migrant population in general, without sectoral limitations, long-term personal care workers in the domestic sector have often represented a significant proportion of people regularised (OECD, 2000). For instance, in 2000, Spain granted residence permits to more than 150,000 applicants for regularisation, with the majority working 'in agriculture, domestic services or construction' (Levinson, 2005). Another regularisation in Spain, running between June and July 2001, granted more than 221,000 permits, with the majority again going to workers 'in domestic service and construction' (Levinson, 2005). In other cases, regularisations have specific sectoral limitations, and the health and LTC sectors (especially family-based) is often mentioned. Between 1998 and 1999, the UK conducted the Domestic Worker Regularisation Programme, reportedly aiming at terminating abuse and exploitation in the sectors (Levinson, 2005). In 2009, the Italian regularisation programme targeted home nurses and caregivers; and the 2002 regularisation programme targeted caretakers and domestic workers (Box 4).

Although they can be used as an indirect migration route, regularisations are a controversial policy instrument. On one hand, they legitimise a breach of immigration law, possibly creating incentives for non-compliance; on the other hand, by offering an implicit post-departure legal channel, they compensate for the difficult pre-departure job matching which is a prerequisite of many legal channels

BOX 4 Italian regularisation programmes

In the past, Italy has run several mass regularisation programmes (EMN Italia, 2012). It seems that, since 2002, domestic care workers (aids called 'colf' and long-term healthcare workers called 'badanti') were singled out as either the only category included in the scope of the programme or one of the main targets. Article 33 of Italian Law No. 189/2002 (known as the Bossi-Fini) first listed domestic workers as the only category to be regularised, but the scope was then extended in a subsequent decree (195/2002) to include other forms of employment. To date, that was the largest Italian regularisation, with 693,937 applications, more than 641,000 of which were accepted. In particular, more than 315,000 reportedly accepted applications were for domestic care workers (Briguglio, 2020).

In 2009, another regularisation included domestic care workers as the only eligible category. Around 294,000 applications were filed, approximately 180,000 of which for the 'colf' category ('collaborazione familiare') and 114,000 for the domestic long-term workers 'badanti' ('assistenza a persone non autosufficienti'). These numbers should however be taken with caution as, while the sectoral limitation formally precluded accessing this procedure for other categories of workers, it was still possible to hire someone as a domestic care worker, and subsequently fire and re-hire them under a different contract.

Another regularisation programme was put in place in 2012, and although it did not have an exclusive focus on domestic care workers, the large majority of applications came for domestic care workers. The Ministry of Interior received a total of more than 134,000 applications, approximately 116,000 of which for domestic care workers.[51] However, again doubts were raised concerning the genuine classification for workers being regularised, as the lower administrative costs for being regularised as domestic workers could have represented an incentive to use that channel instead of others (Piccirillo, 2012).

The Italian government more recently started another regularisation programme. This measure is part of a broader package of primarily economic measures aiming at driving the economic recovery of the country after the COVID-19 pandemic (dubbed 'decreto rilancio' in Italian). The Italian government specifically framed the 2020 regularisation in terms of securing individual and public health and safety in the context of an 'exceptional' health emergency.[52]

The regularisation targeted three specific sectors: agriculture and again domestic workers and personal care workers (mirroring the 2009 formula which included the 'colf' and 'badanti'). This regularisation aims to regularise both the employment contract – for migrants and Italians alike – and the irregular migration status, and covers both actual contracts and prospective employment (i.e. migrants who would like to work in agriculture). The number of irregular migrants who are estimated to be covered by this decree is approximately 200,000 of a total 560,000 estimated persons (Misculin, 2020). The report released by the Italian Ministry of Interior indicated that, of all the approximately 207,542 requests filed up to 15/08/2020, 85% were for 'domestic workers'.[53]

While regularisations are no longer common, it is not clear to what extent international recruitment has become easier for LTC workers. The recent Italian 2020 regularisation saw 85% of the requests (170,000) coming from personal healthcare and domestic workers, suggesting that informal channels are still widely used in the country (Boeri & Fasani, 2020). Comprehensive data for the EU is not available, but in view of the continually pressing demand for these professions, it will be increasingly important to build an evidence base on recruitment practices for this category of workers.

RECOGNITION OF QUALIFICATIONS

Having certain qualifications recognised is often an important requirement for workers in health and LTC sectors to be able to practice their profession. This is particularly important for health professionals, but also associate and technical professions in some MSs, and personal care workers in health services need some qualifications.[54] For migrants and EU mobile citizens who did not acquire the qualification in the EU MSs where they intend to practice, this means undergoing recognition procedures.

In the context of promoting the free movement of professionals, the EU has adopted measures to foster the **recognition of professional qualifications obtained in other EU MSs**, with provisions also extending to EEA countries and Switzerland. These apply to third-country nationals who are acquiring qualifications in EU MSs and are covered by equal treatment clauses in relevant migration directives (OECD, 2016).

Directive 2005/36/EC, amended by Directive 2013/55/EU, establishes the automatic recognition of qualifications for seven professions for which training conditions are harmonised. The healthcare sector is particularly important, as 6 out of 7 professions within the scope of the Directive are in the healthcare sector. These are general care nurses, dental practitioners, veterinary surgeons, midwives, pharmacists and doctors; while architects are the only non-health profession. The European Professional Card (EPC) introduced the possibility of applying online for the recognition of qualifications for selected professions, the majority of which are in the healthcare sector (general care nurses, physiotherapists, pharmacists, and real estate agents and mountain guides), thus making the process more efficient.

When it comes to qualifications obtained in third countries, there are some EU instruments to facilitate the recognition of qualifications obtained in third countries; however, their recognition is the competence of Member States and practices vary to a great extent (OECD, 2019b; Ecorys, 2016; IOM, 2013). The EU Skills Profile Tool for Third Country Nationals, is aimed at facilitating the early skill profiling of third-country nationals; the European Qualifications Passport for Refugees provides an assessment of higher qualifications, work experience and language skills on the basis of available documentation and a

structured interview, specifically targeting refugees. Other instruments may be devised in the future, as following the revision of the European Qualifications Framework (EQF) in 2017 as part of the 2016 Skills Agenda, the Commission was invited to develop the external dimension of the EQF.

No instrument, however, targets health professions specifically. For health professions, practices are extremely varied and depend on the qualifications; the availability of bridging courses; the personal experience of the applicant; the country where this experience was obtained; and often the region where the applicant intends to practice (Box M2 in Annex M).

LTC professions are often not regulated and do not require specific qualifications or training. However, their tasks tend not to be limited to the provision of daily living (OECD, 2020c) and require a set of informal skills, such as communication, social and interpersonal skills and resilience, as well as at least basic knowledge of care. These skills and knowledge are difficult to assess, even more so for migrants who come from educational backgrounds and social contexts with which recruiters are not necessarily familiar. **The absence of tools to assess these informal skills and targeted training courses may become an obstacle to recruitment** from abroad or from the country, and for families and LTC establishments.

INTERNATIONAL RECRUITMENT

As shown above, the proportion of health and LTC worker migration through the employment channel is limited. There are several challenges for the international recruitment of this type of workers that may explain this. These challenges include the recognition of qualifications; difficult access to the global supply of workers, especially for SMEs and families looking for domestic care workers; legal limitation to participating in public competition for migrants or for people residing abroad; ethical recruitment bans that protect the workforce in developing countries facing shortages.

Bilateral or multilateral agreements are aimed at addressing these challenges. They are 'understandings formalised in written instruments, whether intended to give rise to international legal obligations or simply to serve a normative or political purpose' (Dhillon et al., 2010). They take a variety of forms and often have a broad scope, covering several aspects of migration management, with the inclusion of specific provisions for health and long-term professionals. Limited information is available on such agreements, but some examples include the UK-South Africa agreement, first signed in 2003 and renewed in 2008, aiming to 'facilitate the exchange of health care workers and expertise'; the Germany-Ukraine agreement in 2005, for the recruitment of nursing aids; and the France-Senegal agreement, which 'comprehensively addresses migration flows with a particular focus on health professionals and support for human resources for health development'.

More recently, **new forms of agreements have been put in place, with a stronger focus on the migration consequences for third countries and trying to achieve a triple win:** for countries of destination, of origin and migrants themselves (Dhillon et al., 2010). An example in the healthcare sector is represented by the Triple Win initiative (Box 5) and by the Ireland-Sudan collaboration agreement signed in 2017, with the aim of maximising the benefits of the mobility of the health workforce for both countries and the involvement of the diaspora.[55] Skills partnerships, or Talent Partnerships, as they are called in the New Pact on Migration and Asylum (COM(2020) 609 final), belong to this form of agreement and typically see the involvement of the country of destination in training a wide pool of potential migrants in professions needed in both the countries of origin and destination (OECD, 2018, Clemens 2015). These are generally considered particularly suitable for the health and long-term care sector, where shortages are global and where the incentive for partnerships and the potential benefits are higher.

To facilitate international recruitment, in 2019 Germany established the **German Agency for International Healthcare Professionals** (DeFa).[56] This is part of a more comprehensive programme on workforce development and retention in the nursing sector, called Concerted Action on Nursing (KAP),[57] which includes specific actions for recruiting nurses from abroad. The tasks of the agency consist of supporting employers that have found a candidate abroad (being hospitals, clinics, nursing homes and personnel service agencies) in smoothly recruiting the candidate by pre-checking applications, qualifications, and ensuring international recruitment standards are met. In some cases, in addition to fast-track recruitment, the agency can also connect applicants with employers.[58] The pilot project countries are the Philippines, Mexico and Brazil, although support is also possible for other countries.

COVID-19 OUTBREAK AND THE MIGRATION OF THE HEALTH AND LONG-TERM CARE WORKFORCE

The recent Covid-19 pandemic has shown the importance of having a sufficiently large healthcare workforce. This entails fully activating and utilising the healthcare workforce, including migrants who faced administrative obstacles, in terms of admission and the recognition of qualifications.

In a context of a pandemic-induced substantial reduction of international mobility, a number of OECD and EU countries have enacted measures to maintain labour migration in essential sectors (EMN-OECD, 2020). The health and LTC sectors, being considered essential, have been covered by these measures.

In March 2020, the Commission adopted a Communication on Temporary Restriction on Non-Essential Travel to the EU (COM(2020) 115 final), where it recommends establishing temporary travel restrictions for non-essential travel from third ountries. These exclude, among others, 'healthcare professionals, health researchers, and elderly care professionals'.

BOX 5 Germany's Triple Win initiative

In the context of the 'Triple Win' initiative – Sustainable recruitment of nurses (Kovacheva & Grewe, 2015) – the German Federal Employment Agency (ZAV), along with the German federal enterprise for international cooperation (GIZ) and the labour administration of the respective partner country (Serbia, Bosnia-Herzegovina, Philippines and Tunisia) come to an agreement regarding nurses' placements. The matching of qualifications is also streamlined bilaterally (on average, this occurs within the first 10 months of placement – mandatory by the end of the first year). The recognition of qualifications may occur in several ways, either through a 'knowledge exam' or through an 'adaptation period', i.e. 'an internship with a final examination'.[59] The administrative costs of the German government are borne by the employer, not the nurses, and the employer also bears the travel arrangement costs and has to organise the first apartment. Only countries with surplus medical personnel are selected by the German authorities. Since 2013, 515 nurses have come from Bosnia-Herzegovina; 622 from Serbia; 1,122 from the Philippines; and 18 from Tunisia. Reportedly, 81.5% of the nurses are still with their employer after 2 years.[60] Due to the perceived success of the project, Germany is actively seeking to expand the number of partner countries.

National authorities took measures regarding the 'international mobility and recruitment of foreign health workers'; 'work authorisations' (Chile, Australia, France, Spain); the recognition of foreign qualifications (Belgium, Canada, Germany, Ireland, Italy, Luxembourg, United States); and to a large extent facilitated access to the labour market in the healthcare industry for third-country nationals already in the country (EMN-OECD, 2020).

More specifically, Spain has prioritised the entry of third-country nationals in the health sector and accelerated 'the recruitment in the national health services' (approximately 400 people by the end of April 2020). Italy facilitated 'the temporary licensing of doctors with foreign medical degrees'; Spain, Belgium, Germany, Ireland, Luxembourg, Spain have expedited 'current applications for the recognition of foreign qualifications of health professionals'; France extended the probation period for seasonal workers in the medical sectors and relaxed the conditions of practice for foreign doctors, by allowing those who were not entitled to practice to carry out non-medical duties and by making access to the status of associated contract workers easier for refugee foreign doctors (EMN-OECD, 2020).

While authorities need to preserve the health of citizens by certifying the competence of health and long-term care professionals, the COVID-19 pandemic might have shown the need to find more expedite and agile ways of doing so. The current initiatives taken to respond to the emergency may lay the groundwork for future long-term practices in some Member States.

3.3 EMPLOYMENT CHARACTERISTICS OF THE FOREIGN HEALTH AND LONG-TERM CARE WORKFORCE

Monitoring the indicators of the employment conditions for health and LTC workers is a crucial step for enabling the full activation of skills and for anticipating and addressing retention[61] concerns. Both the insufficient activation of skills and low retention of workers in health and LTC sectors are a particularly worrisome trend because they generate high costs for both the employer and the public sector (OECD, 2020c; WHO, 2016a; EU, 2015).

Demographically, the profile of native, EU mobile and non-EU born health and LTC workers is largely similar (Table 3).

Gender-wise, there is a very high concentration of women in health and even more so in LTC occupations. Almost three quarters of health professionals (HPs) and health associate professionals (HAPs) are women, whereas among personal care workers (PCWs), women constitute almost 90% of the workforce. In respect to this general trend, non-EU born HPs make an exception as being relatively more gender-balanced (63.2% are women). Likewise, EU mobile PCWs stand out as being almost entirely represented by women (95.2%). Despite the high participation of women in these occupations, their professional career is still marked by inequalities in terms of wages, contractual arrangements and professional development (ILO, 2019; ILO, 2017).

In terms of **educational attainment**, HPs are almost exclusively tertiary educated, with the highest proportion within non-EU born workers. Among HAPs, tertiary

TABLE 3. Demographic characteristics of the health and LTC workforce, 2018
Note: the sample includes the population aged 15+.
Source: KCMD elaborations of EU LFS microdata, 2018.

ISCO-08 - employed 15+	Migrant Origin	Share of women	Average age	% Tertiary Education	% Secondary Education	% Primary education	% in cities	% in towns and suburbs	% in rural & remote areas
Health Professionals (HPs)	Native	70.1%	44	90.2%	9.4%	0.0%	52.1%	29.9%	18.1%
	EU mobile	72.3%	44	92.7%	6.8%	0.0%	45.6%	31.1%	19.4%
	non-EU born	63.2%	45	94.6%	5.2%	0.0%	65.8%	25.2%	8.8%
Health associate professionals (HAPs)	Native	75.3%	42	56.9%	39.6%	0.0%	40.6%	34.3%	25.5%
	EU mobile	74.4%	44	63.3%	33.0%	3.8%	50.0%	34.0%	13.6%
	non-EU born	75.0%	43	57.0%	36.3%	6.7%	60.6%	28.4%	10.3%
Personal care workers in health services (PCWs)	Native	86.7%	44	10.9%	68.2%	20.9%	31.5%	35.2%	32.7%
	EU mobile	95.2%	47	15.0%	54.5%	30.5%	35.7%	37.2%	25.1%
	non-EU born	86.3%	45	19.3%	48.8%	31.9%	57.7%	30.3%	12.4%

education is also the most prevalent level of educational attainment, although there is also a relevant proportion (one third) of HAPs with secondary education. In terms of origin, EU mobile HAPs stand out as having the highest proportion of tertiary education. Lastly, the majority of PCWs possess secondary-level of education, with a significant proportion of workers with a primary-level of education. Moreover, there is also a trend of PCWs with a tertiary degree that is more present among EU mobile and non-EU born PCWs (15.0% and 19.3% respectively) in comparison to natives (10.9%). The proportion of tertiary educated workers in LTC occupations points to potential over-education and, therefore, an inefficient use of human resources; at the same time, the large proportion of primary educated workers in LTC potentially indicates under-education and a need for training and upskilling to ensure quality care delivery (OECD, 2020c; Spasova et al., 2018).

The **place of residence** reveals significant differences between occupations and across different migrant origins.[62] HPs and HAPs are mainly concentrated in cities and least concentrated in rural and remote areas. On the other hand, PCWs are more equally distributed between cities, towns and rural areas, with the exception of non-EU born PCWs. Indeed, the strong preference of non-EU born workers for cities can be seen for all three occupations (with cities absorbing around 60% of non-EU workers) as well as their lowest preference for rural areas where the proportion is around 10%.

The specific employment characteristics of the health and LTC workforce in 2018 show some relevant differences between native, EU mobile and non-EU born workers (Table 4 and Figures 22-23).

For all three occupations and origins, dependent employment is the prevalent form of professional status in the EU's health services. The **self-employment**[63] status is more present among HPs and its proportion ranges from 21% for non-EU born HPs to 28% for EU mobile HPs. It should be stressed that the proportion of self-employment among HPs is well above the average, 14.3% in 2018, for all ISCO-08 occupations. At the same time, self-employment is a negligible form of professional status among all PCWs.

In terms of the **size of the firm**, data show that more than half of HPs and HAPs are employed in big local units with more than 50 workers, regardless of the workers' origin. On the contrary, the largest proportion of EU mobile and non-EU born PCWs (60.3% and 45.4% respectively) are employed in small local units with 10 or fewer employees, unlike native PCWs who are largely employed in big local units. The EU LFS data does not allow disaggregating PCWs at 4-digit ISCO-08 level and thus distinguish between sub-category 5321 'Health care assistants' in institutional settings[64] and 5322 'Home-based personal care workers'.[65] Nevertheless, the nature of these two sub-categories and insights into the size of the local units could suggest that native PCWs mainly work as healthcare assistants in institutional settings (hospitals, nursing homes), whereas non-native PCWs are more specialised in home-based care.

TABLE 4. Main employment characteristics of the health and LTC workforce, 2018
Note: the sample includes the population aged 15+.
Source: KCMD elaborations of EU LFS microdata, 2018.

ISCO-08 - employed 15+	Migrant origin	Self employed	Dependent employee	Size of the firm: small 1-10 workers	Size of the firm: medium 11-49 workers	Size of the firm: big 50+ workers	Average years of work for the current employer
Health professionals (HPs)	Native	22.6%	77.1%	22.5%	20.9%	56.6%	13
	EU mobile	28.0%	71.0%	20.6%	24.7%	54.7%	10
	non-EU born	21.0%	78.9%	23.1%	23.0%	53.9%	10
Health associate professionals (HAPa)	Native	11.7%	88.2%	22.2%	25.8%	52.0%	13
	EU mobile	13.4%	86.2%	18.9%	23.2%	57.9%	10
	non-EU born	13.8%	85.9%	22.6%	26.7%	50.8%	10
Personal care workers in health services (PCWs)	Native	3.5%	96.4%	17.7%	33.7%	48.6%	10
	EU mobile	2.6%	97.3%	60.3%	19.8%	19.9%	6
	non-EU born	0.8%	99.2%	45.4%	25.9%	28.7%	6

One of the indicators most frequently used to analyse the retention of workers is **job turnover rate**. The EU LFS offers the possibility to compute the indicator solely as the proportion of employed people that started to work in a certain occupation during the last 12 months, and not as a proportion of people that left the work. However, when computed in reference to the number of new hires, the frequency of job changes in an occupation offers mixed insights into the turnover that reflects available job opportunities and turnover that reflects departures due to job instability (e.g. due to involuntary temporary and part-time contracts).

Bearing in mind the above-mentioned caveats, Figure 22 shows that the job turnover rate grew for the HPs and HAPs category between 2014 and 2018, yet it remained lower in comparison to the overall turnover rate computed for all ISCO-08 occupations.[66] At the same time, the turnover rate for the PCWs category declined. Nonetheless, PCWs continue to be the category mostly affected by the high job turnover rate with significant differences between workers' origin: non-EU born workers registered the highest job turnover rate, followed by EU mobile workers; whereas native workers registered the lowest turnover.[67]

The high job turnover has generally been associated with the expansion of **non-standard forms of employment** (temporary contracts, part-time work, agency work, etc.), the latter adopted as a response to cost and efficiency concerns (ILO, 2019; ILO, 2017). The downside of non-standard forms of employment is job insecurity, lower pay and social protection gaps for workers and problems of recruiting and retaining quality staff and difficulties in maintaining service quality and continuity of care (OECD, 2020c; ILO, 2019).

FIGURE 22. Job turnover within the health workforce, 2014 and 2018
Note: HPs – health professionals; HAPs – health associate professionals; PCWs – personal care workers in health services. The sample includes the population aged 15+.
Source: KCMD elaborations of EU LFS microdata, 2014 and 2018.

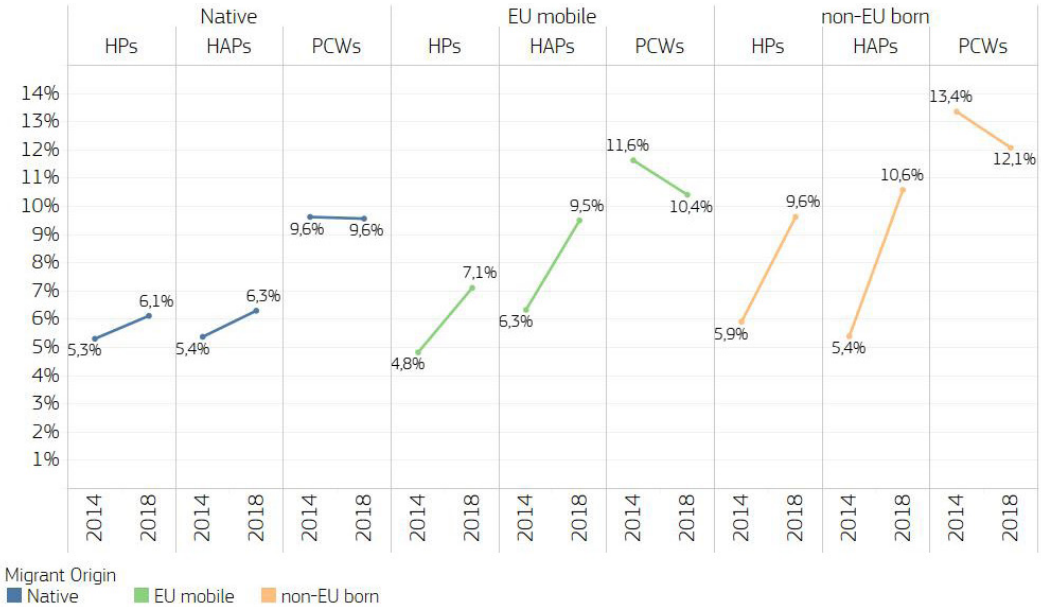


FIGURE 23. Proportion of temporary and part-time contracts, 2014 and 2018
Note: Note: HPs – health professionals; HAPs – health associate professionals; PCWs – personal care workers in health services. The sample includes the population aged 15+.
Source: KCMD elaborations of EU LFS data, 2014 and 2018.

Figure 23 offers some insights into the trend in **non-standard forms of employment** in the EU's health and LTC sectors by comparing proportions of temporary and part-time contracts between 2014 and 2018 for each occupation and origin. The Figure also contains data on the involuntary working arrangements,

which describe whether the person is having a temporary contract or part-time contract because they could not find permanent or full-time employment.

Figure 23 shows that there was an increase in the proportion of temporary contracts for all occupations and origins between 2014 and 2018, with the exception of EU mobile PCWs and non-EU born HPs.

In regard to *health professionals (HPs)*, in 2018, the proportion of dependent employees with temporary contracts varied according to the origin of the HP: it was lowest for native HPs (15.56%); followed by EU mobile HPs (17.2%); and highest for non-EU born HPs (22.9%). For more than half of the HPs, the contract duration was one year or less. Between 60-68% of HPs have declared that they have temporary contracts because they could not find a permanent job – the so-called 'involuntary' contracts. Although the proportion of involuntary temporary contracts has somewhat decreased for native and non-EU born HPs, the proportion of involuntary contracts among EU mobile HPs has seen a sharp rise (from 39.5% in 2014 to 65.7% in 2018).

With regard to *health associate professionals (HAPs)*, all origins of HAPs saw an increase in the proportion of temporary contracts between 2014 and 2018, although the overall proportion in 2018 remains relatively lower (11.1% for native HAPs, 15.4% for EU mobile HAPs and 17.8% for non-EU born HAPs) in comparison to that of HPs. Around half of the contracts had a duration of 1 year or less, regardless of the worker's origin. Native and EU mobile HAPs also saw an increase in involuntary temporary contracts, whereas non-EU born HAPs saw a slight decline from 2014 to 2018. The highest proportion of involuntary temporary contracts in 2018 was registered for EU mobile HAPs (76.0%), followed by native HAPs (68.8%) and non-EU born HAPs (61.5%).

Lastly, with regard to *personal care workers (PCWs)*, it can be observed that both native and non-EU born PCWs saw a rise in the proportion of temporary contracts between 2014 and 2018, whereas EU mobile workers registered a slight decline. In 2018, among native PCWs, 21.9% were employed on a temporary contract followed by 20.0% of EU mobile PCWs and 13.4% of non-EU born PCWs. More than 70% of these contracts had a duration of 1 year or less. At the same time, the proportion of involuntary temporary contracts rose for all origins reaching 85.7% among EU mobile PCWs, 77.1% among non-EU born PCWs and 72.6% among native PCWs in 2018. It can thus be concluded that PCWs are the category most affected by the involuntary temporary contracts, in comparison to HPs and HAPs, and more so if of non-native origin.

A less clear-cut trend can be observed for part-time contracts.

Overall, less than a quarter of HPs have part-time jobs and a relatively low proportion is involuntary. More specifically, the proportion of native and non-EU born HPs with part-time jobs increased between 2014 and 2018, however the proportion of those with involuntary part-time jobs decreased. The opposite trend can be seen

for EU mobile HPs, whose proportion of part-time employment decreased with a concurrent increase in involuntary part-time arrangements. In 2018, on average, less than one quarter of HPs held part-time jobs, of which 15.0% was involuntary, and this is largely similar for all three origin groups.

Among HAPs, non-EU born register the highest proportions of part-time and involuntary part-time contracts, while EU mobile workers register the lowest. The proportion of native HAPs holding part-time job has remained stable, around 22%. In the same period, EU mobile and non-EU born HAPs registered a slight decrease in the proportion of part-time contracts, reaching 20.0% and 25.6% respectively in 2018. At the same time, natives and non-EU born HAPs saw an increase in involuntary part-time (20.1% and 28.2% in 2018 respectively), whereas EU mobile HAPs a decrease (17.3% in 2018).

Among all occupations considered, PCWs registered the highest proportion of part-time contracts (37.0% for natives and around 32% for non-native PCWs), although mainly decreasing since 2014. The PCWs also have highest proportions of those declaring that they work part-time because they could not find full-time employment, albeit the proportion has reduced since 2014. Of particular relevance is the difference between origins of birth for PCWs: while one third of natives have involuntary part-time contracts, the proportion increases to 57.9% in the case of EU mobile PCWs and to 54.1% in the case of non-EU born PCWs.

Our findings suggest that more effort should be made to reduce the extent of involuntary forms of temporary and part-time contracts, the latter among PCWs in particular. Improving job security for all workers, regardless of origin, would harness their potential and, overall, increase productivity in health and LTC sectors. Moreover, considering the series of challenges related to the immigration of health and LTC workers (see Section 3.2), greater job security could incentivise the workers' participation in skills and knowledge sharing cooperation projects between countries of destination, transit and origin.

In conclusion, it should be taken into account that trends in non-standard forms of employment, such as (involuntary) temporary and part-time contracts, are only one of the factors affecting worker retention and skills activation. Other important factors comprise prospects of professional advancement, job satisfaction, wages and other financial incentives (OECD, 2020c; OECD, 2019c), all of which necessitate tailored regulatory, professional and personal support interventions (WHO, 2016a, 2016b; EU, 2015).

3.4 CONCLUSIONS

Migration and intra-EU mobility play an important role in shaping the overall supply of the health and LTC workforce.
In recent years, the EU has been attracting an increasing number of foreign-born

healthcare and long-term care workers. In 2018 there were almost 2 million health and LTC workers born in a country different to the one they were working in. The majority of these workers originated from a) other EU Member States & the UK area; b) European countries not part of the EU & the UK area; and c) the region of North Africa & Middle East.

Out of 27 EU MSs, 5 EU Member States absorb almost two thirds of health and LTC foreign-born workers: Germany, Italy, France, Spain and Sweden. However, each Member State has a different pattern in terms of types of occupations (health professionals, health associate professionals and personal care workers) in which the foreign labour force is employed, therefore reflecting different national labour market needs.

Whereas the EU mobile citizens benefit from the free movement of workers in the EU, non-EU migrant health and LTC workers have to satisfy the requirements of the national migration systems. The majority of them arrived in the EU through the family reunification channel and, to a somewhat smaller extent, via the employment channel.

Migration has the potential to contribute to alleviating the pressure of workforce shortages in healthcare and LTC sectors in the EU. The findings of this report, however, suggest that there are several challenges still open related to the recruitment of health and LTC workers outside the EU.

Firstly, the exhaustive analysis of policies in force shows that there is no specific EU sectoral labour migration instrument or tool for attracting healthcare and LTC workers. This, coupled with the heterogeneity of skills and employment profiles of health and LTC workers, makes the labour migration management system for this type of workers fragmented into a variety of instruments, both at EU and national level. For LTC workers in particular, the absence of specific migration channels for LTC workers and the fact that they may not be eligible for skilled or general programmes makes it particularly challenging for EU families to recruit the LTC support from abroad. Consequently, foreign-born LTC workers are often recruited domestically, informally and, at times, as undocumented migrants.

In addition, as several health professions are regulated in MSs, migration requirements often include the recognition of qualifications as a prerequisite for exercising regulated professions. The complex procedures associated with it may pose a challenge in a context in which the health-related education and training programmes considerably differ from those imparted in the EU. On the contrary, LTC workers, while often not in need of formal qualifications, perform tasks involving a set of informal skills that is difficult to assess. The absence of specific tools to do so may also discourage recruitment.

At the same time, examples of international partnerships for the recruitment of health and LTC personnel, in line with the WHO Global Code of Practice, remain limited in numbers and scope.
One way forward is to integrate current labour migration channels with more

specific considerations for the health and LTC sectors, in compliance with ethical recruitment practices. Such mechanisms, when temporary, could foster circularity and therefore yield benefits for both countries of origin and destination. This approach would also imply the facilitation of the recognition of qualifications and the full activation of skills of the migrant workforce in the EU.

It is equally important to ensure labour market integration and provide conditions for the full activation of skills that migrants bring. In this context, our findings suggest that more effort should be made to reduce the extent of involuntary forms of temporary and part-time contracts, the latter among PCWs in particular. Improving job security for all workers, regardless of origin, would help unlock their potential and increase productivity in health and LTC sectors. Moreover, considering the series of challenges related to the immigration of health and LTC workers, greater job security could incentivise participation in skills and knowledge sharing cooperation projects between countries of destination, transit and origin.

4. THE ROLE OF DIGITAL TECHNOLOGY IN HEALTH AND LONG-TERM CARE SECTORS

Emilio Gómez-González, Emilia Gómez, Songül Tolan, Fernando Martínez-Plumed, Annarosa Pesole, Enrique Fernández-Macías, José Hernández-Orallo, Emilia Gómez, Alessandra Conte, Sara Grubanov Boskovic

The role of digital technologies in health and long-term care sectors has been manifold. Digital technologies have, amongst others, transformed the delivery of health and care services and generated new type of professional roles and skillsets, therefore affecting both the demand for and the supply of healthcare workers. However, the full implementation of digital technologies – and its potential effect on health and care workforce – remain closely related to numerous ethical, social and labour market aspects.

Given the broad scope of the topic, this chapter focuses on **three specific thematic areas.**

The **first contribution** aims to provide an overview of the main applications brought to the healthcare sector by Artificial Intelligence (AI), together with their benefits and challenges.

KEY MESSAGES

Currently, the spectrum of AI applications in healthcare is extremely broad: it ranges from applications with high technology availability value, such as algorithms for computer-aided diagnosis or imaging tools, to applications that are still immature, such as mind reading or whole-brain simulation.

Three groups of ethical and social aspects related to AI in the healthcare sector can be distinguished: 1) issues such as data privacy, fairness or human oversight which have been broadly discussed in the context of general AI; 2) issues of particular relevance in medicine and healthcare, but also common in other domains, e.g. transparency, the required updates in evaluation, benchmarking and legislation; 3) controversial aspects not yet considered in other fields, e.g. ethical guidelines related to self-experimentation medicine.

COVID-19 has emphasised both the opportunities and ethical challenges of the use of AI in medicine, bringing an increased interest for the public. Given the strong implications of health data-related AI systems and the overlap with public health policies, an analysis of opportunities and risks has to be carried out before systems are fully deployed.

The **second contribution** aims to assess the impact of AI progress on four specific health-related occupations: medical doctors; nursing and midwifery professionals; paramedical practitioners; and medical and pharmaceutical technicians.

KEY MESSAGES

Overall, the findings on AI research intensity suggest high activity in AI areas that contribute to abilities *dealing with things* and ideas and low activity for abilities *dealing with people.*

In particular, medical doctors are the category most exposed to AI. The majority of AI exposure is driven by its impact on tasks that require abilities dealing with ideas (e.g. comprehension, attention and search as well as conceptualisation). On other hand, little AI exposure can be expected through basic processing abilities (e.g. visual processing or auditory processing) or through abilities that deal with people (e.g. modelling and social interaction or communication).

AI could also play a novel role in the context of technology-driven labour market polarisation, depending on whether AI exposure is labour-replacing or labour-enhancing. In the labour-replacement scenario, it could lead to unpolarising effects and a reduction in income inequality; whereas in the labour-enhancing scenario, it could imply an expansion of productivity for high-skilled occupations, potentially leading to occupational upgrading effects and an expansion of income inequality.

The **third thematic contribution** aims to analyse how the divide in internet access and digital skills within elderly Europeans poses a barrier to the implementation of telemedicine.

KEY MESSAGES

Digital technologies, such as telemedicine, have great potential to improve the population's access to health and LTC. However, the digital divide within certain socio-demographic groups remains considerable in the EU to the point of becoming a barrier to the implementation of telemedicine.
The findings show that strengthening the potential of telemedicine among elderly people requires additional efforts in promoting digital inclusion, especially for elderly people living alone in their homes, the elderly with a low level of education and those living in rural and remote areas. Moreover, particular attention should

also be paid to bridging the digital divide between elderly men and women, the latter group having lower percentages of internet use and digital skills than men.

Internet access is also a social and economic affordability issue. For example, only one third of the EU's population aged 80+ who lives in rural and remote areas owns a computer. At the same time, almost all households in the EU own a telephone, which opens up the possibility of strengthening the mobile healthcare practices among the EU's elderly.

4.1 ARTIFICIAL INTELLIGENCE IN MEDICINE AND HEALTHCARE: SOCIAL IMPACTS AND CHALLENGES

Artificial intelligence (AI) has become a technological domain of strategic importance and a key driver of economic development in all sectors. In the domain of medicine and healthcare, AI is giving rise to new applications, paradigms – even defying the traditional roles of doctors and patients – and risks. Here we present a brief overview of the main applications brought to medicine and healthcare by AI, together with their benefits and challenges. We then introduce these issues in the context of the COVID-19 health emergency. Lastly, we illustrate some specific, very recent examples of AI systems in medicine and healthcare related to demography and migration, and, from the questions that arise: the risk of data bias and the dual potential of communication and conversational platforms and of systems for border control.

AI IN MEDICINE AND HEALTHCARE: BENEFITS AND CHALLENGES

Gómez-González & Gómez (2020) provide an updated review of the current and future applications of AI in the area of medicine and healthcare based on an analysis of state-of-the-art research and technology, including software, personal monitoring devices, genetic tests and editing tools, personalised digital models, online platforms, augmented reality devices and surgical and companion robotics.

Figure 24 presents a 'visual overview' of the Gómez-González & Gómez (2020) review, including well-established applications such as the use of algorithms to support medical diagnosis, robots in surgery or conversational platforms ('chatbots') for patient assistance. In Figure 24, the different applications are assigned a Technology Availability Level (TAL) scale, presented in Table 5. The TAL provides a qualitative description of the degree of availability of a technology in a numerical scale in 10 steps (levels), ranging from 0 (unknown status, not considered feasible) to 9 (available for the general public).

We observe in Figure 24 that applications such as algorithms for computer-aided diagnosis or imaging tools have a high TAL value, while others such as mind reading

or whole-brain simulation are still immature according to this scale. The TAL scale is similar in format (and related) to the standard 'Technology Readiness Level' (TRL) scale commonly used to assess research and development figures, but it is based on published references (in scientific and academic literature, industrial or corporate reports, and in general media citing sources considered to be reliable according to standards). These kinds of scales are useful for conveying practical information about the proximity to the market of any given technology.

The technological realm expands to the social and ethical aspects associated with the use of medical AI systems. Beyond their technology availability level, AI systems offer extraordinary opportunities – e.g. derived from greater efficiency – in medical and clinical areas of deep social interest such as oncology, genetics and neurosciences, but also present possible risks and ethical questions raised by their implementation. This balance between benefits and risk is represented by the 'controversy level' in Figure 24. This level ranges from (commonly assumed) 'positive' or beneficial applications of AI (e.g. software for decision support to improve diagnostic efficiency) to (commonly considered) 'negative' or harmful areas (e.g. new tools for bioterrorism or the possibility of engineering biologic weapons targeted against certain populations), crossing through many intermediate domains where a balance between the potential benefits and associated risks needs to be carefully sought.

There are different types of controversial issues. Some of them show a clear potential duality, such as the possibility of preventing diseases through genetic editing and the use of neural interfaces and neurostimulation for controlling advanced prosthesis, or for unwanted registration of brain signals ('thought reading') and interference with neural signals to impose limits on human free will. Other questionable topics refer to autonomous systems which may make vital decisions for people, and the use of AI-mediated genetic research to challenge fundamental boundaries and the very basic definitions of life (e.g. 'engineered, enhanced humans', human-animal hybrids) (Gómez-González & Gómez, 2020).

TABLE 5. The Technology Availability Level (TAL) scale defined in Gómez-González and Gómez (2020)

TAL Score	Status of viability of the technology
TAL 0	Unknown status. Not considered feasible according to references.
TAL 1	Unknown status. Considered feasible according to related, indirect references.
TAL 2	General/basic idea publicly proposed.
TAL 3	Calls for public funding of research and development (R&D) open.
TAL 4	Results of academic/partial projects disclosed.
TAL 5	Early design of product disclosed.
TAL 6	Operational prototype/'first case' disclosed.
TAL 7	Products disclosed but not available.
TAL 8	Available products for restricted (e.g. professional) users.
TAL 9	Available for the public.

FIGURE 24. - A visual overview of the classification of AI and AI-mediated technologies in medicine and healthcare according to their ethical and social impact. SW: software, AR: augmented reality, VR: virtual reality, IoT: internet of things, TAL: Technology Availability Level
Note: reproduced with permission from Gómez-González & Gómez (2020)

AI and AI-mediated technologies	Specific implementations.	TAL	Social Impact
Algorithms for computer-aided diagnosis.	SW for decision support in (most) clinical areas.	8, 9	Positive
Structured reports, eHealth.	SW for improved workflow, efficiency.	8, 9	
AR/VR, advanced imaging tools.	Tools for information visualization and navigation.	6, 7, 9	
	Image-guided surgery. Teleoperation.	4, 6, 9	
Digital pathology, 'virtopsy'.	SW for automated, extensive analysis.	4-9	
Personalized, precision medicine.	Tailored treatments. Prediction of response.	4-9	
	'In-silico' modeling and testing. The 'digital twin'.	4-8	
	Drug design.	4, 8	
Apps, chatbots, dashboards, online platforms.	The 'digital doctor' (assistance for professionals and for patients).	8, 9	
Companion and social robots.	For hospitalized persons, children & the elderly.	4-9	
Big Data collection and analysis.	Epidemiology, prevention and monitoring of disease outbreaks.	2-9	
	Fraud detection. Quality control, monitoring of physicians and treatments.	4-9	
IoT, wearables, mHealth.	Automated clinical/health surveillance in any environment/institution.	7, 8	
	Monitoring, automated drug delivery.	7-9	
Gene editing.	Disease treatment, prevention.	7, 8	
Merging of medical and social data. 'Social' engineering.	Prevention of episodes with clinical relevance (e.g. suicide attempts).	6, 8	Controversial
	Tailored marketing (e.g. related to female cycles).	6, 8	
Reading and decoding brain signals. Interaction with neural processes.	Treatment of diseases. Restoring damaged functions.	3-8	
	Brain-machine inferfaces.	5-8	
	Control of prostheses, exoskeletons. 'Cyborgs'.	2-7	
	Neurostimulation. Neuromodulation.	4-8	
	Neuroprostheses (for the central nervous system).	2-5	
	Mind 'reading' and 'manipulation'.	1-3	
Genetic tests. Population screening.	Disease tests. Direct-to-consumer tests.	4-9	
Personalized, precision medicine.	Individual profiling. Personalized molecules (for treatment) at 'impossible' prices.	3-8	
Gene editing.	'Engineered' humans.	2, 6	
	Gene-enhanced 'superhumans'.	2	
	Self-experimentation medicine. Biohacking.	2, 6	
Fully autonomous AI systems.	The 'digital doctor'.	2-5	
	'Robotic surgeon'.	2, 4	
Human-animal embryos.	Organs for transplants.	2, 4, 5	
	Hybrid beings ('chimera').	2, 4	
The quest for immortality.	Whole-brain emulation / 'transplant'.	1, 2	
The search for artificial life forms.	'Living machines' ('biological robots', 'biobots')	4, 6	
	Military.	2, 3	
Evil biohacking.	Targeting specific individuals or groups.	1, 2	
Weaponization.	From 'small labs' to military labs.	1, 2	
Bioterrorism.	From 'small labs'.	1, 2	Negative

These controversial aspects are being dealt with at different levels. We can distinguish three groups of ethical and social aspects related to AI in medicine, according to how they are considered in comparison to other application domains (Gómez-González & Gómez, 2020). The first group includes issues which are common to other areas of the application of AI systems, namely social networks, electronic commerce, automation of manufacturing processes and autonomous vehicles. These are topics such as data privacy, fairness or human oversight, and have been broadly discussed in the context of general AI ethical frameworks (EU, 2019b). The second group comprises topics also common in other application domains but of particular relevance in medicine and healthcare such as transparency, the trust in the relationship between doctors and patients or the required updates in evaluation, benchmarking and legislation. Lastly, a third group refers to controversial aspects not yet considered in other fields. Among them, ethical guidelines related to self-experimentation medicine (including gene editing) or the generation of artificial life forms.

From the previous analysis, we can emphasise three novel emerging paradigms. Firstly, we observe a division of medicine into three main streams, all of them having AI as a supporting tool: (1) 'fake-based medicine', based on (unfounded, unconfirmed) rumours and presenting 'ancient, natural knowledge' as opposed to scientific, evidence-based medicine, supposedly under malicious control by academia, institutions and governments; (2) 'patient-generated medicine', derived from the growing online availability of the many (correct and unsupervised, unreliable) sources of medical information; and (3) 'scientifically tailored medicine', evolved from the most advanced scientific research into extended personalised and precision medicine (Gómez-González & Gómez, 2020). The second emerging effect is the increase in social differences and inequalities in the access to AI systems in medicine and healthcare, due to the technical complexities and high costs associated with these systems, e.g. personalised drug design or (genetically) tailored treatments (Gómez-González & Gómez, 2020). Lastly, this analysis also warns about new forms of 'digital health scammers', bio-hacking and bioterrorism, arguing how a disorderly development of technology – without analysis and debate about ethical and societal impact – may bring strong conflicts with fundamental rights and principles of our free, democratic, particularly European, societies.

A SOCIAL DEBATE

A public debate has already started around some of the issues presented above. Most of them relate to the human perception of AI-based diagnostics, the (un) trust generated by increasingly autonomous systems and the well-known concerns about the privacy and security of personal data.
In addition, there is a growing number of voices (including highly qualified scientists, physicians and entrepreneurs) who demand for open and truthful information on the actual results of AI-based medicine, particularly in areas of high social interest (e.g. cancer and neuroscience). They also ask for preventive regulations, especially on

the most dangerous and controversial topics – before it's 'too late' – and advocate a clear focus on human-centred AI development in medicine and healthcare. Most of these concerns are also explicitly included in the 'urgent priorities for the next decade' defined by the World Health Organization in early 2020 (WHO, 2020).

However, to date, there are still no European or international references to a coordinated overview and analysis of the ethical aspects and social impact of AI in the medical field and related areas. Nor are there any specific regulations on many of the most conflictive issues mentioned below.

THE COVID-19 PANDEMIC: CONSEQUENCES AND AN ENHANCED ROLE FOR AI

Since early 2020, the unexpected Severe Acute Respiratory Syndrome Coronavirus (SARS-CoV-2) outbreak and the corresponding COVID-19 disease have had strong consequences for individuals and societies all over the world. In many areas, including the most industrialised, the effectiveness of the mechanisms of transmission and contagion of the virus has caused an overflow of patients and the immediate scarcity of health resources – from supplies to professionals and hospital facilities – leading to severe societal effects and very high death tolls.

The many unknowns about the disease and the lack of vaccine or effective treatment have prompted many harsh measurements of compulsory population confinement, prohibition of travel and economic lockdown at a very fast pace and with many uncertainties about their duration and future evolution. In this extraordinarily difficult context, there has been an explosion of research in all related scientific fields in which AI-mediated technologies have proven to be essential tools for the common goals of controlling the spread, preventing the contagion and curing the many sick people. Machine learning techniques are being exploited to support COVID-19 diagnosis, to develop potential vaccines and drugs and to build epidemiological models of transmission and spread. AI is also exploited in online information platforms – including the fight against fake information – robotics and telemedicine, and data-driven models are exploited for individual contact tracing and social distancing, as well as quarantine and population confinement control (Nigris et al., 2020).
In these extraordinary circumstances, some of the ethical questions mentioned in the previous section become more relevant, bringing a sudden interest for the public. They include conceptual reflections on how to prioritise health attention (Ahuja, 2020) and assign reduced resources (e.g. who should be attended to? How should an automated system assist the triage of incoming patients? (Walsh, 2020)); concerns of massive (including genetic) data collection (Wee, 2020) and population monitoring (Schechner et al., 2020); the opposition of the industry to additional regulations about data control and the training of systems which – in their view – would slow down the ability to respond to crises such as COVID-19 (Chee, 2020); and the possibility of deleting personal information after the pandemic can be considered as 'controlled' – as in Norway (Klesty & Macfie, 2020).

In addition, AI-mediated technologies are being used for different levels of social monitoring, from aerial drones to enforce the confinement of the population (Linder, 2020a) to the control of interpersonal distancing in public spaces (Linder, 2020b). However, devices with an original 'healthcare orientation' (e.g. hand washing (Kelly et al., 2020)) can be easily employed to monitor the individual behaviour – even in private environments – and send the information to third parties.

DEMOGRAPHY AND DATA BIAS IN AI SYSTEMS

One important factor influencing the performance of AI systems in general (and machine learning models in particular) is the 'quantity' and 'quality' of the data used to train them. This has been a subject of extensive analysis since the early days of AI that becomes a particularly complex question for health-related data since they are commonly fragmented and potentially biased with respect to the many demographic features (e.g. age, gender, ethnicity, body mass and others) accounting for the variability of the population in which they will be exploited (Panch et al., 2019).

Systems trained with non-representative, biased datasets will not only produce 'operational' (strictly technical) errors if applied to individuals for which they have not been suited, but the resulting outputs may be completely wrong, with very serious consequences and the corresponding – yet unsolved – questions about liability and responsibility. In another area – security monitoring – an initial example of this new type of errors was recently brought into the headlines as the incorrect identification by a facial – possibly racially biased – recognition system led to the arrest of an innocent person (Hill, 2020).

AI algorithms require representative numbers of cases to 'learn' and it may not be easy to provide them with enough, well-balanced sets to achieve an appropriate representation of the different human groups for generalised medical applications. This is a particularly high risk for under-represented populations.

PERSONAL CROSS-LANGUAGE COMMUNICATION AND 'PSYCHOLOGICAL HACKING'

Of particular interest is the development of AI-mediated devices to enhance interpersonal communication. In the context of the COVID-19 pandemic, they are potentially useful for overcoming the limitations in physical contact required to fight the disease.

New technological designs include conversational assistants (e.g. 'chatbots') that can also work in a cross-language setting, incorporating, for instance, devices or 'connected' face masks capable of performing real-time translations (Kelly & Tomoshige, 2020). These types of systems evolve from an extensive research literature on natural language processing and automatic translation. With an obvious

potential 'for good', they are exploited to facilitate medical assistance, interactive translations, cross-language communication (e.g. the integration of migrants), cross-language telemedicine and to fight loneliness in quarantine periods or in certain remote, isolated environments.

Nevertheless, automated (autonomous) conversational platforms may also result in the development of psychological, emotional links between people and machines. This has been a topic of extensive analysis since the early days of AI which has come to the interest of the general public in the context of the current COVID-19 pandemic. During prolonged periods of social isolation – with available online platforms – some users declare that they 'feel very connected' to the AI systems they use (Metz, 2020). Questions arise as to whether such platforms are used by vulnerable populations – children, the elderly and people with mental ailments – which may develop trust in and affection for them. There may be beneficial applications of affective computing, for example to support certain therapies linked to neurological or psychiatric disorders (e.g. dementia), but the risk of manipulation is high.

A recent report[68] shows that malicious interference ('hacking') of a wearable can (relatively easily) generate fake signals for the user to take medicines or other actions, with the obvious risks of inducing severely damaging consequences (e.g. overdose). As pointed out in Gómez-González & Gómez (2020), health data present a worrying vulnerability to illicit 'manipulation', since alterations of data would be extremely difficult to track and identify. It seems that the (evil design of) conversational chatbots may open a window to new forms of interference in people (particularly for those more vulnerable). This can be considered as 'psychological hacking' ('psycho-hacking'), and calls for its further analysis.

HEALTH AND AI SYSTEMS FOR BORDER CONTROL

One of the areas in which AI systems are beginning to be exploited is that of border control. This is a very sensitive application with many different aspects to consider, from the strictly logistic ones (many hundreds of millions of people enter the European Union each year) to governmental requirements to fight crime and terrorism, the need for user-friendly procedures and the requirement for the robust protection of the human rights of citizens, migrants and asylum-seekers. Automated systems for screening at borders, with conversational capabilities in particular, are of great interest (Accenture, 2017), even the subject of EU-funded projects,[69] and some countries are in different stages of testing (Kendrick, 2019). In 2018, a detailed analysis of the use of automated systems at the Canadian border warned how they may have a strong, negative impact from the point of view of human rights and exacerbate disparities with the more vulnerable, under-resourced communities (Molnar & Gill, 2018).

In the current international situation established by the COVID-19 pandemic, health information related to the disease is an additional requirement for entering Europe

and virtually any country in the world. Many of the issues commented come to the front line. What would happen if health data were merged with other types of individual information at a border? (Beduschi, 2020; Molnar & Gill, 2018) Will access to Europe, or to a particular country, be granted if a person has 'proper' (COVID-19) antibodies? We should develop automated systems, as in other context, in a trustworthy way (EU, 2019b).

CONCLUSIONS: ADDRESSING NEW CHALLENGES

Given the strong implications of health data-related AI systems and the overlap with public health policies required to address the exceptional circumstances of the COVID-19 pandemic, an analysis of opportunities and risks should be carried out before systems are fully deployed.

AI advances in medicine and healthcare result from research, development and innovation with considerable public funding. However, society and citizens are not fully aware of the extent to which the use of these technologies has expanded in the medical and healthcare field, or of the ethical and social implications that they may have. There is a need for a multidisciplinary analysis covering not only the clinical and scientific perspectives on AI systems in the medical and healthcare sectors, but their humanistic, ethical – even philosophical – views as well. Moreover, new policy challenges clearly arise.

The European Union has the extended, experienced and trustworthy resources to lead this debate based on an open, international environment, and to define any ethical and social guidelines – even setting limits if necessary – with the required legislative and regulatory actions.

4.2 THE IMPACT OF AI ON HEALTH-RELATED OCCUPATIONS: TASKS, COGNITIVE ABILITIES AND AI BENCHMARKS

'We should stop training radiologists now. It's just completely obvious that within five years, deep learning is going to do better than radiologists.'[70] This is what Geoffrey Hinton, one of the pioneers and global leading researchers in artificial intelligence (AI) said in November 2016. Many other top AI researchers share this opinion. So, Andrew Ng, too wondered whether 'radiologists should be worried about their job'.[71] It is the opinions of AI experts, who have led Frey & Osborne (2017) to conclude that 47% of all US jobs are at high risk of being automated. This alarmist study triggered waves of concern about the future of work: if half of all existing jobs will disappear as a result of automation, will there be sufficient replacement jobs and where will they come from? However, as of July 2020 (four years after Hinton's 5-year-prediction), there is no radiologist who has been replaced by AI.

Clearly, predicting future developments of work is not a trivial task. There are many aspects to consider when determining if and when machines could substitute humans in an entire occupation. One reason for why radiologists have not been replaced is that the stakes of decisions in radiology are extremely high (human lives depend on them) and we still need humans accountable in high-stakes decision-making (Reardon, 2019). Another reason is that radiologists have to perform in their occupation many other relevant tasks in addition to interpreting medical images. In fact, most jobs involve many tasks and not all of them may be visible when researchers determine their potential for automation. In most cases, AI may only have the capabilities to perform parts of an occupation, in such a way that the introduction of AI only leads to a reorganisation of a job. Nevertheless, in order to predict which occupations will be affected by AI, we need to have adequate measures for the contents of occupations and the capabilities of AI.

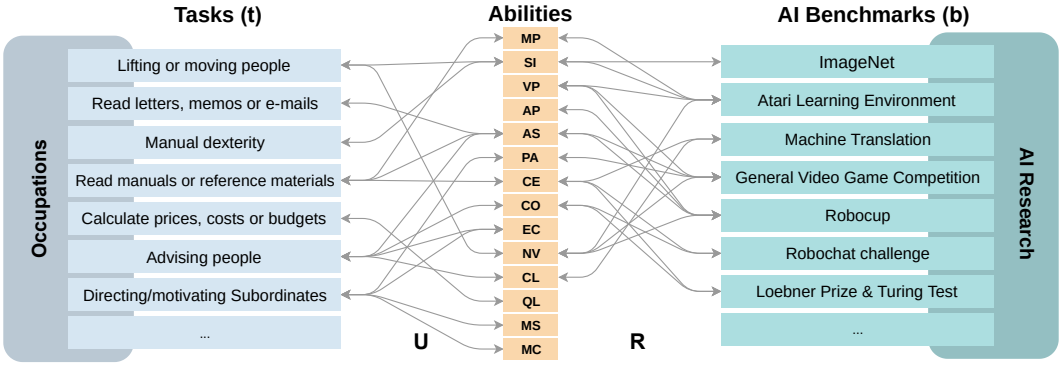
In this thematic contribution, we present a framework, developed in Tolan et al. (2020), that allows for the analysis of the occupational impact of AI progress. The section focuses on medical occupations. In this framework, we measure occupations as bundles of tasks and we measure AI progress as the result of research activity that is made observable through performance metrics or benchmarks. In order to connect AI benchmarks with tasks, we introduce an intermediate layer of cognitive abilities. Thus, the framework links tasks to cognitive abilities, and these to indicators that measure performance in different AI fields (Figure 25).

The intermediate layer of cognitive abilities allows us to distinguish machines that, through AI, are empowered with the abilities to perform a range of several tasks using machines that are explicitly constructed or programmed to perform specific tasks. For instance, the ability to understand the human language (Manning & Schütze, 1999) can be applied to a variety of tasks (such as reading or writing emails or advising patients). We derive the following 14 cognitive abilities from the cognitive science literature (Hernandez-Orallo, 2017):

- Memory processing (MP)
- Sensorimotor interaction (SI)
- Visual processing (VP)
- Auditory processing (AP)
- Attention and search (AS)
- Planning, sequential decision-making and acting (PA)
- Comprehension and expression (CE)
- Communication (CO)
- Emotion and self-control (EC)
- Navigation (NV)
- Conceptualisation, learning and abstraction (CL)
- Quantitative and logical reasoning (QL)
- Mind modelling and social interaction (MS)
- Metacognition and confidence assessment (MC)

We combine multiple data sources to develop the framework. The task information is based on a combination of the European Working Conditions Survey (EWCS) worker surveys and the Survey of Adult Skills (PIAAC) as well as the occupational database O*Net. The list of 328 AI computational tasks is obtained from

FIGURE 25. Bidirectional and indirect mapping between occupations and AI
Source: Tolan et al. (2020)



benchmarking initiatives, challenges, competitions and scientific literature as metrics indicating progress in AI techniques. Furthermore, we obtain information on wage percentiles of occupations from the Structure of Earnings Survey 2014.[72]

For a comprehensive measure of work contents, we use the task-based approach from Fernández-Macías & Bisello (2020). An occupational task can be understood as a specific act of transformation on an object. On the basis of the type of object being transformed and the type of transformation, we can create a taxonomy of different types of tasks. At the highest level, this classification differentiates between tasks that operate on material things (physical tasks), tasks that operate on ideas or information (intellectual tasks) and tasks that operate on social relations (social tasks). From those, a nested taxonomy with increasing levels of detail unfolds. The parts of that taxonomy relevant to this chapter are listed in Table 6.

The framework allows us to present the work content of occupations in terms of task requirements. When applying the framework to the data, we obtain information on the relevance of each task for each occupation, where the relevance of a task is composed of time spent on that task and the workers' subjective evaluation of the importance of that task to the occupation.

We present in Figure 26 the task requirements for the following selected medical occupations:[73]

- **medical doctors**: medical doctors (physicians) study, diagnose, treat and prevent illness, disease, injury and other physical and mental impairments in humans through the application of the principles and procedures of modern medicine. They plan, supervise and evaluate the implementation of care and treatment plans by other healthcare providers, and conduct medical education and research activities;
- **nursing and midwifery professionals**: nursing and midwifery professionals provide treatment and care services for people who are physically or mentally

TABLE 6. Tasks: nested structure of work content
Source: Fernández-Macías & Bisello (2020).

Physical tasks	Intellectual tasks	Social tasks
a) Strength b) Dexterity	a) Information processing: i. Literacy: a. Business b. Technical c. Humanities ii. Numeracy: a. Accounting b. Analytic b) Problem solving: i. Information gathering and evaluation ii .Creativity and resolution	a) Serving/attending b) Teaching/training/coaching c) Selling/influencing d) Managing/coordinating

ill, disabled or infirm, and others in need of care due to potential risks to health including before, during and after childbirth. They assume responsibility for the planning, management and evaluation of the care of patients, including the supervision of other healthcare workers, working autonomously or in teams with medical doctors and others in the practical application of preventive and curative measures;

- **paramedical practitioners**: paramedical practitioners provide advisory, diagnostic, curative and preventive medical services more limited in scope and complexity than those carried out by medical doctors. They work autonomously or with the limited supervision of medical doctors, and apply advanced clinical procedures for treating and preventing diseases, injuries and other physical or mental impairments common to specific communities;
- **medical and pharmaceutical technicians**: medical and pharmaceutical technicians perform technical tasks to assist in the diagnosis and treatment of illness, disease, injuries and impairments.

Figure 26 shows that, for nurses and paramedicals, physical tasks (strength and dexterity) are more relevant than for medical doctors or medical technicians, while social tasks (serving, teaching, selling and managing) are equally relevant for nurses and medical doctors. The greatest differences are prevalent among the intellectual tasks. Here, medical doctors exhibit the highest relevance, in literacy and problem-solving tasks specifically, where creativity and resolution tasks have the highest relevance for medical doctors. In contrast, accounting tasks are most relevant for medical technicians. All in all the task-based approach provides an appropriate measure of work contents.

When mapping tasks to cognitive abilities, we maintain the threefold division. We thereby need to consider that cognitive abilities do not exhibit physical properties

per se but that they are active when performing tasks on physical objects. Therefore, we translate the high level categorisation of work tasks to cognitive abilities by sorting each ability according to the objects that they operate on into one of the following three categories: (1) dealing with **people**; (2) dealing with **ideas** or information; and 3) dealing with (physical or virtual) objects or **things**.

For a detailed view of the relevance of different cognitive abilities within occupations, we present in Figure 27 the required abilities for each occupation relative to the total required cognitive abilities in each occupation. All four medical occupations clearly show very similar relevance profiles. For all selected occupations, abilities related to things are on average less relevant than abilities related to people or ideas. For all four occupations, human language comprehension (CE), communication (CO), attention and search (AS) and conceptualisation (CL) are the most relevant cognitive abilities. Not surprisingly, for nurses and paramedicals, people-related abilities and sensorimotor interaction (SI) are more relevant than for medical doctors and medical and pharmaceutical technicians. Equivalently, memory processing (MP) and quantitative reasoning (QL) are more relevant for doctors and medical technicians than for nurses or paramedical practitioners. Overall, considering the nature of these occupations, we can say that task requirements are adequately mapped to cognitive ability requirements.

Figure 28 shows the computed AI research intensity for each cognitive ability for benchmarking initiatives taking place in every two-year period from 2008 to 2018.

FIGURE 26. Relevance of tasks for selected medical occupations
Source: JRC CAS – HUMAINT.

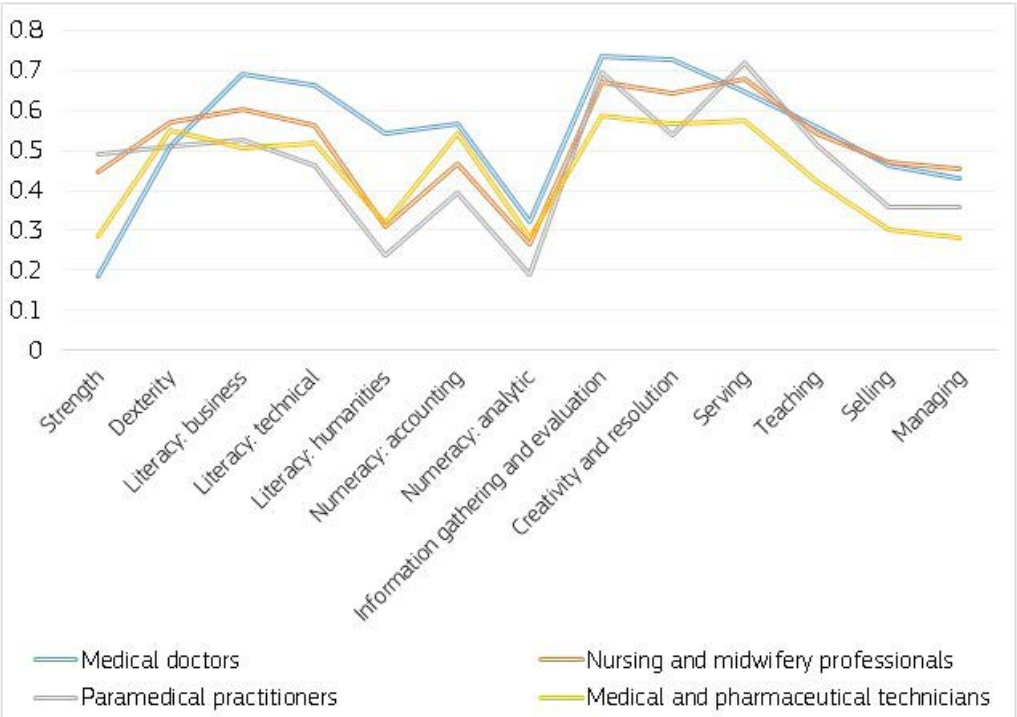
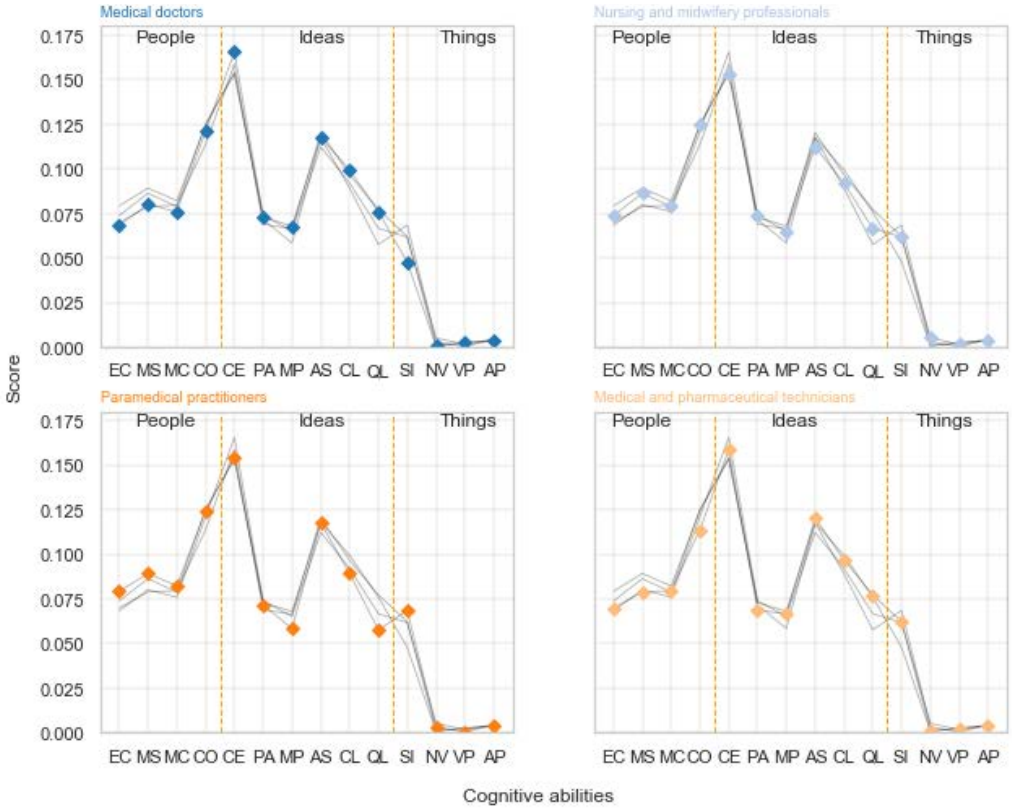


FIGURE 27. Relevance of cognitive abilities for selected medical occupations
Source: JRC CAS – HUMAINT.



AI research intensity measures activity in terms of documents created in research and development related to the list of AI benchmarks. We relate AI benchmarks to the cognitive abilities that they address, e.g. we link the benchmark 'imageNet initiative' to visual processing (VP). We see that most AI research activity can be attributed to visual processing (VP), attention and search (AS), comprehension, compositional expression (CE), conceptualisation, learning and abstraction (CL) and quantitative and logical reasoning (QL). We see almost no research intensity on people-related social interaction (MS) and metacognition (MC). This may be due to the lack of suitable benchmarks to evaluate the interactions of agents (human and virtual) in social contexts, as well as the challenge (today) of developing agents able to properly perform in social contexts with other agents having beliefs, desires and intentions, coordination, leadership, etc. as well as being aware of their own capacities and limits. Note that Figure 28 also shows trends over the years for each cognitive ability. There is a clear 'increasing' trend in visual processing (VP) and attention and search (AS), while other abilities remain more or less constant (MP, SI, AP, CO, CL and MS) or have a small progressive decline (PA, CE, EC and QL). Note that these values are relative. For instance, PA, CE or QL have decreased in proportion to the rest. In absolute numbers, with an investment in AI research that is doubling every 1-2 years (Shoham et al., 2018), all of them are actually growing. Thus, the figure shows that imbalances in AI research activity are increasing.

FIGURE 28. AI research activity per cognitive ability weighted by average intensity per period
Source: JRC CAS – HUMAINT.

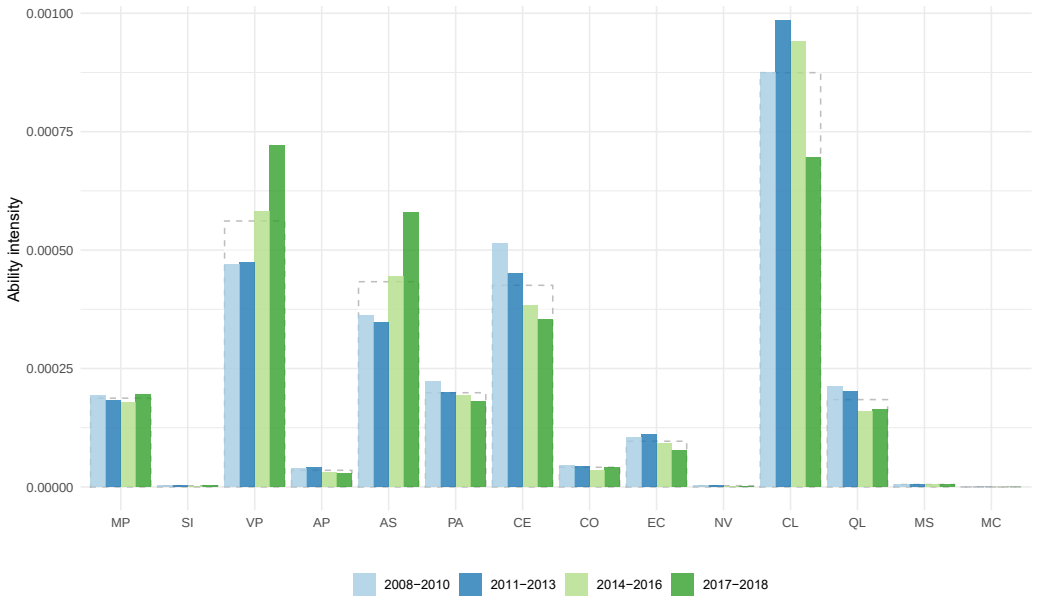


Figure 29 depicts the computed AI exposure score differentiated by cognitive abilities. We obtain the AI exposure score by mapping AI progress to work contents through the layer of cognitive abilities for the four medical occupations selected. Firstly, the figure shows that out of this group of occupations, medical doctors are most exposed to AI. Secondly, Figure 29 clearly shows that most AI exposure is driven by its impact on tasks that require abilities that deal with ideas, such as comprehension (CE), attention and search (AS) as well as conceptualisation (CL). This is not because we assign more cognitive abilities (six) to the ideas category than to the other categories (four each), since the smallest exposure score from the ideas abilities (in most cases quantitative reasoning (QL)) is still always greater than the highest exposure score from the people category. Compared to this, the exposure scores in the things category are negligibly small. That is, little

AI exposure can be expected through basic processing abilities, such as visual processing (VP) or auditory processing (AP), nor through abilities that deal with people, such as mind modelling and social interaction (MS) or communication (CO). However, our findings based on the tasks and occupation data indicate a relatively high need for people abilities in most occupations and a relatively low need for abilities dealing with things. Equivalently, the findings on AI research intensity suggest high activity in AI areas that contribute to abilities dealing with things and ideas and low activity for abilities dealing with people.

Lastly, we compute a single AI exposure and plot the score against average wage percentiles for all occupations in our dataset, illustrated in Figure 30.We clearly observe a positive relationship between wages and AI exposure. That is, high-income occupations seem to be more likely to be affected by AI progress than low-income occupations.

FIGURE 29. Ability-specific AI exposure scores for selected occupations
Note: patterns reflect ability categories, where stripes represent people abilities, checked patterns represent ideas abilities and no pattern represents things abilities.
Source: JRC CAS – HUMAINT.

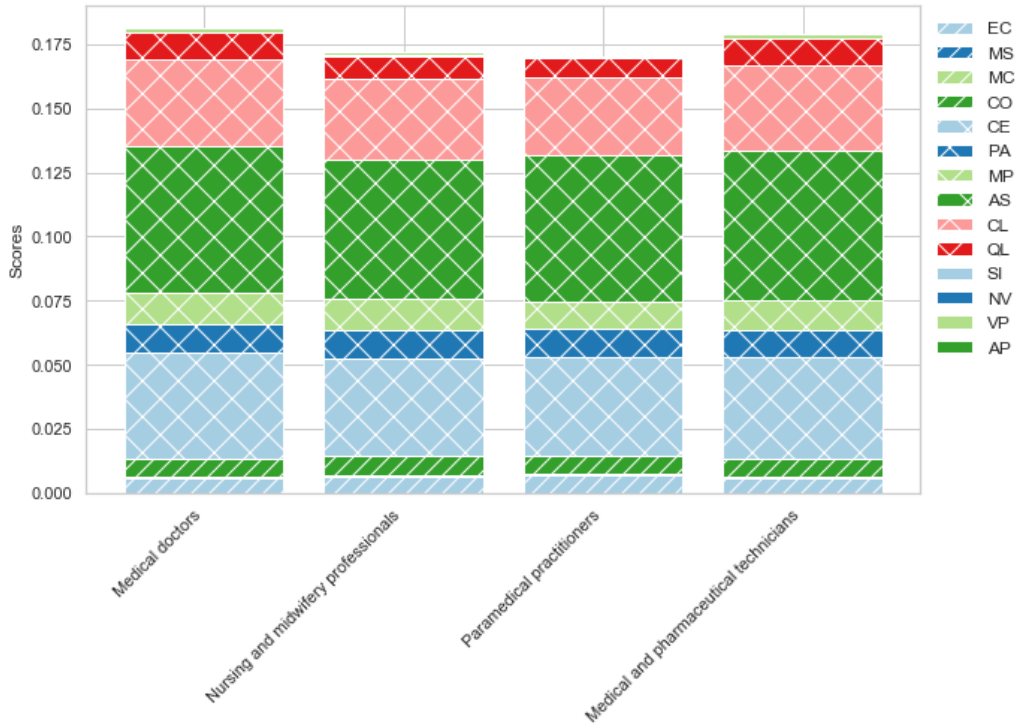
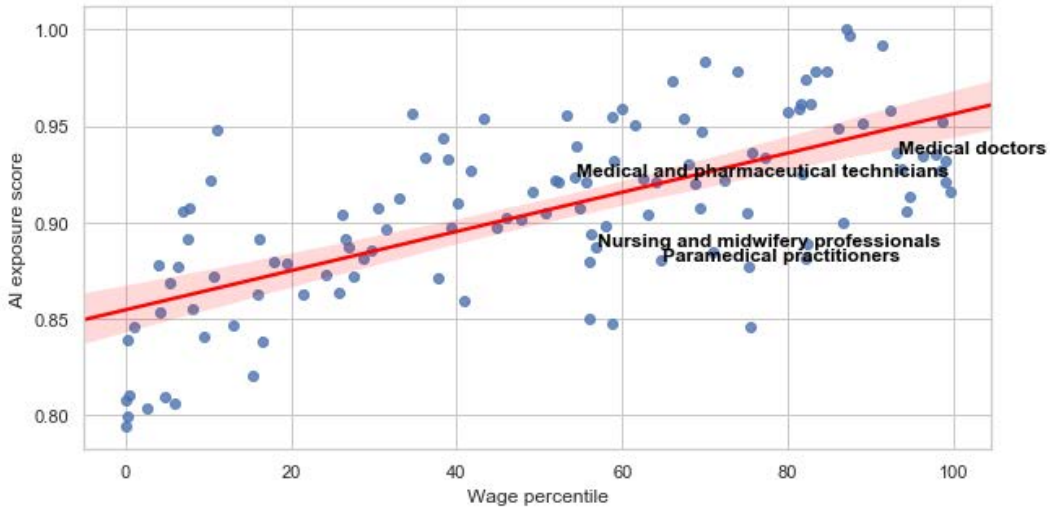


FIGURE 30. Scatterplot and best fit line, AI exposure score against wage percentiles
Source: JRC CAS – HUMAINT elaborations of Structure of Earnings Survey, 2014.



CONCLUSIONS: THE IMPACT OF AI ON LABOUR MARKETS

It is clear that there are many effects to consider when analysing the impact of AI on work (Brynjolfsson & Mitchell, 2017). This analysis is limited to the technical potential of AI (i.e. the things that AI could potentially do at work). We can use this approach to highlight occupations and abilities involved where AI could play a role. However, this framework remains silent about the complementary conditions necessary to enable the integration of AI in the workplace and the processes that occur after the integration of AI. Consequently, our results have to be interpreted in light of this limitation. Nevertheless, this study sheds light on some aspects of the relationship between AI progress and labour markets.

Firstly, these findings show that AI – as an emerging technology – could potentially play a novel role in the context of technology-driven labour market polarisation. According to some studies (Autor et al., 2003; Goos et al., 2014), previous waves of technological progress led to polarisation on the labour market where the automation of medium-skilled occupations pushed medium-skilled workers to either low- or high-skilled occupations. In contrast, our findings (according to Figure 30) suggest relatively high AI exposure for high-skilled medical doctors but lower AI exposure for medium-skilled occupations such as nursing and paramedicals. However, AI exposure can also be relatively high for medium-skilled occupations such as medical technicians. In the end, it depends on the cognitive abilities required. Overall, this can have different implications for labour market polarisation (and consequently inequality) depending on whether AI exposure is labour-replacing or labour-enhancing. If this effect is in fact a labour-replacing one, it could potentially lead to unpolarising effects and a reduction in income inequality (Webb, 2019). If this effect is a labour-enhancing, it could imply a significant expansion in productivity for high-skilled occupations, potentially leading to occupational upgrading effects and an expansion of income inequality (very much like the traditional hypothesis of skills-biased technological change; see Acemoglu (2002)).

Furthermore, our findings show that AI progress could affect how specific skills are rewarded (e.g. in terms of wages and working conditions) on the labour market. The finding of low exposure through people abilities versus high exposure through ideas abilities is parallel to Deming (2017) who explores the relationship in the labour market returns to social skills and, what he calls, cognitive skills which we refer to here as analytical skills. More specifically, we use social skills to interact with people and we use abilities that deal with ideas in areas that require analytic skills. Deming (2017) finds that social and analytical skills are complements rather than substitutes. That is, an increased labour demand for analytical skills, which increases wages for people with analytical skills, leads to an increased labour demand for people that, in addition to analytical skills, also have strong social skills. In addition, we find that many labour market tasks require high levels of people as well as ideas abilities, but AI exposure occurs mostly through ideas abilities only. Consequently, we can expect an increase in the wages for workers that combine their strong ideas abilities with strong people abilities.

4.3 AGE AND TERRITORIAL DIGITAL DIVIDE FOR TELEMEDICINE

The adoption of digital technology in the healthcare industry is generating major changes in the way healthcare services are delivered and in patients' interactions with medical workers. Many EU Member States are removing some of the regulatory and financial barriers to remote healthcare in order to strengthen their capacities and reduce the increasing cost pressures arising from healthcare expenditure related to the ageing population (EU, 2019a, 2018b; Alotaibi & Federico, 2017; Stroetmann et al., 2015; Nouhi et al., 2012).

Additionally, the acceptance of digital products for healthcare is increasingly widespread among consumers (Safi et al., 2019), and people are generally supportive of using their data to create new knowledge and improve care (OECD, 2020d). The ongoing COVID-19 pandemic is further changing users' perspectives in favour of remote healthcare even in the new normality, thus acting as an additional driver for the implementation and use of remote consultation.[74]

The main technological solutions in healthcare include mhealth, ehealth, telehealth and telemedicine, and primarily target issues related to mobility, communication, interactivity, remote monitoring and the timely provision of patient-specific information. In short, the terms '*eHealth*' and '*mHealth*' are used to describe the provision of health services using the internet and wearable devices respectively.

The term 'telehealth' is used to describe various electronic procedures related to health, while '*telemedicine*' specifically refers to the remote treatment of patients (see Box 6 for definitions). Telemedicine is categorised into three types of services using different ICT solutions, which are real-time communication, store-and-forward approach, and patient tele monitoring. Real-time communication makes use of standard communication technologies for patient contact and data exchange, including video visits, live chat, and email. Video/audio quality is therefore essential for physician and patient appointments. Official communication methods and platforms are typically used to ensure data privacy and security. Telemedicine also uses the store-and-forward approach through which clinical data - typically demographic data or lab reports - are filled in and transmitted. The healthcare provider can either use a mobile device or desktop computer to collect and send the information via email or upload it to a secure platform. Finally, with the remote patient monitoring, it is possible to track patients' vital statistics remotely through the use of electronic devices that transmit patient statistics to a healthcare provider's analytic interface. In particular, wearable devices (e.g. cardiac and activity sensors) are becoming increasingly common in people's daily lives, especially in areas with better internet coverage. Overall, these technologies and applications demand users to have adequate training on how to use them. While systems for healthcare providers may consist of a variety of analytical interfaces, ICT applications for older users are getting more user-friendly, although they require them to acquire the knowledge and skills to use electronic devices.

The adoption of telemedicine has so far been rather fragmented and limited in the EU. Challenges related to the diffusion of telemedicine are manifold and include regulatory, cultural and commercial barriers; substantial investment in infrastructure or human resources; territorial differences in broadband internet services;[75] and a significant digital and e-skills divide among the elderly patients that prevents their full involvement via mhealth. The age-based digital divide in Europe in particular is very deep, both between and within countries, and internet access is still a luxury for the inhabitants of some remote and rural areas. All these factors challenge the potential of the new digital health systems that can be used by a large part of the population.

BOX 6 Definition of key concepts: eHealth, mHealth, Telemedicine and Telehealth

The WHO defines **eHealth** as the 'cost-effective and secure use of information and communications technologies in support of health and health-related fields, including health-care services, health surveillance, health literature, and health education, knowledge and research'[76]. eHealth therefore includes a wide range of solutions including electronic health record systems, patient and laboratory administration systems, telemedicine and mhealth.

mHealth (or mobile health) is defined by the WHO Global Observatory for eHealth as 'medical and public health practice supported by mobile devices, such as mobile phones, patient monitoring devices, personal digital assistants (PDAs), and other wireless devices'. Patients can store and monitor their health data, consult electronic medical records on their mobile devices, communicate directly with doctors and therapists through text messages or video visits, and use reminders and medical applications to follow appointments or pursue a healthy lifestyle.

Telemedicine refers exclusively to the provision of remote clinical services to patients. It is defined as 'The delivery of health care services, where distance is a critical factor, by all health care professionals using information and communication technologies for the exchange of valid information for diagnosis, treatment and prevention of disease and injuries, research and evaluation, and for the continuing education of health care providers, all in the interests of advancing the health of individuals and their communities' (WHO, 2010b).

Telehealth refers to both remote clinical and non-clinical services. It is associated with telemedicine but includes a wider application of technologies, such as distance medical training, consumer awareness, nursing call centres and other digital applications designed to support health services. The terms telehealth and telemedicine are often used interchangeably as there are no universal definitions of these concepts.

ACCESS TO THE INTERNET

The presence of a significant age-based digital divide in the access to the internet[77] and the lack of ICT skills for productive purposes by a large part of the population most in need of healthcare are key obstacles to the effective implementation of telemedicine. A high percentage of the older European population, particularly those with a low level of formal education and residing in rural and remote areas, indeed do not use the internet and are not familiar with ICT.

According to the EU-SILC 2018 microdata, elderly citizens have less access to the internet in their homes than the total European population. On average, 54% of the adult population aged 65 and over had an internet connection for personal use in 2018, compared to an average of 81% of the total population. The EU-SILC survey identifies the internet access that can take place via smartphones and other devices such as tablets, laptops, desktop computers, TVs, etc. Internet activities for personal use include creating social networks, sending/receiving emails, creating web pages, internet banking, reading or downloading videos or news, searching for information, making phone/video calls, participating in online consultations or voting on civic or political issues.

There are considerable disparities between EU Member States in the proportion of adult individuals who habitually use the internet and an uneven distribution of such an access among different age groups in the population. In 2018, the percentage of individuals in the EU-27 aged 65 and over with internet access for private use was 54%. The percentages of regular users are much higher among younger individuals, with these percentages above 94% for individuals aged 16-29, between 90% and 93% for users aged 30-54 and around 55% for those aged 55-59.

At national level, the percentage of the adult population aged 65 years and over with internet access varies considerably from a minimum of 20% in Romania to a maximum of 89% in Denmark. In general, northern and western Member States demonstrate the highest levels of internet use compared to Eastern and Southern European countries. The Member States with the highest percentages of adults with internet access are indeed Denmark (89%), the Netherlands (88%) and Sweden (87%), while those with the lowest percentages – beyond Romania – are Bulgaria (22%), Croatia (24%) and Greece (23%) (Figure 31).
In order to understand the size and heterogeneity of the population that could be more involved in digital applications for telemedicine, it is necessary to determine the extent to which these people are connected to the internet and some of their specific needs.

We look at a series of questions from the 2018 EU-SILC survey on household material deprivation related to internet access – i.e. the possession of a PC, telephone, the internet – for more than 270,000 people over the age of 50 years. In particular, we highlight both the age and the geographical aspects of the internet access divide,

presenting figures for four age groups (50-59, 60-69, 70-79, 80+) in the population and for the degree of urbanisation of the place of residence.[78]

Table 7 shows the presence of a divide in overall internet access across the different age groups of the adult population and by the degree of urbanisation. Overall, internet access is greater among the adult population living in large cities (87%), while the lowest percentages are observed among those living in less densely populated areas (80%). Among the adult population, the youngest group (50-59 years old) uses the internet the most, with percentages above 90% in the three geographical areas by the degree of urbanisation. In contrast, the older group (80+) has the lowest percentage of internet users, with the lowest scores observed in remote areas (41%) and the highest scores reported among the residents of densely populated areas (57%).

These data also show differences by age groups in the availability of a computer at home; the 50-59 age group has higher rates of availability of a computer at home than older groups, reporting a percentage of over 90% in the three areas of residence. Among the over-80s, only 34% of those living in remote areas have a PC, compared to 41% of older people living in intermediate areas and 46% of the group living in large cities. Most EU households have a telephone, regardless of age or place of residence.

We now turn our attention to demography and some aspects of material deprivation of the adult off-line population. The EU-SILC microdata contain information on the

FIGURE 31. Proportion of population using the internet, 2018
Note: Malta excluded due to missing values on the age of internet users
Source: KCMD elaboration based on EU-SILC microdata, 2018.

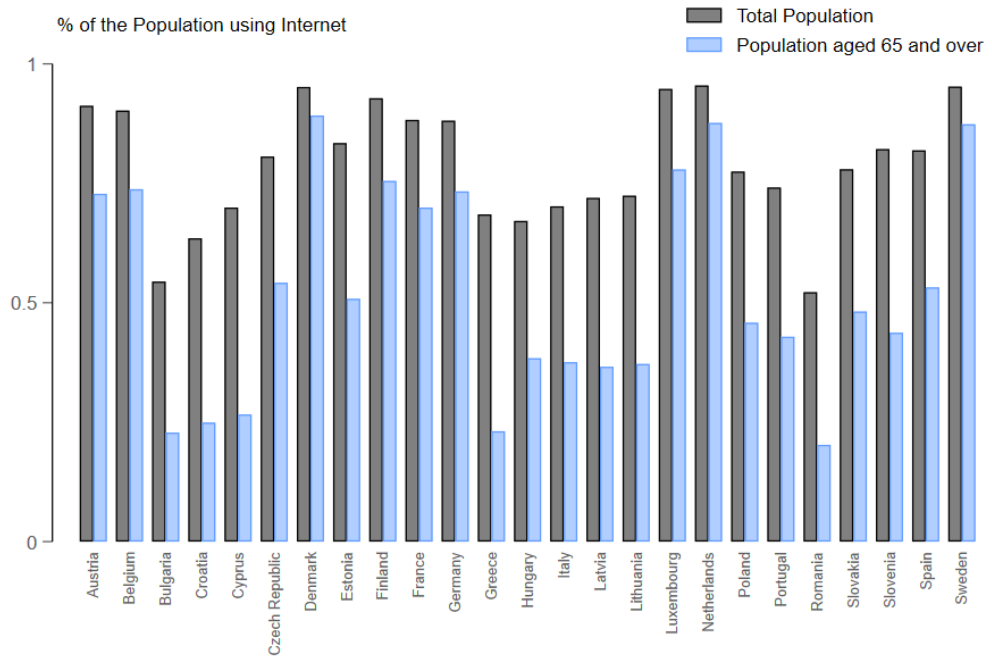


TABLE 7. Internet access and material deprivation items by age groups and degree of urbanisation
Source: KCMD elaboration based on EU-SILC microdata, 2018.

Age groups	Degree of urbanisation	Internet access	Computer	Telephone (including mobile phone)
50-59	Thinly populated area	93%	90%	100%
60-69		86%	85%	99%
70-79		68%	65%	99%
80+		41%	34%	100%
Total (50+)		80%	78%	100%
50-59	Intermediate area	94%	92%	100%
60-69		92%	90%	100%
70-79		80%	75%	100%
80+		51%	41%	100%
Total (50+)		85%	82%	100%
50-59	Densely populated area	93%	90%	100%
60-69		92%	87%	99%
70-79		83%	74%	100%
80+		57%	46%	100%
Total (50+)		87%	82%	100%

population, sufficiently detailed in their economic and socio-demographic breakdown to identify where the main challenges of internet access may operate.

In Table 8, we use a range of information on health conditions, socio-economic status, social and family networks and the area of residence, as follows. The general health status assessment is expressed with a categorical variable ranging from 1 to 5, with the lowest values indicating the lowest health condition; the presence of chronic illness or condition is a dummy variable equal to 1 (and equal to 0 in the absence of disease); activity restriction indicates the percentage of individuals who are limited in their usual activities due to a health problem; female indicates the sex of the respondent; the variable single person household indicates whether the household is composed of one person, while the household members variable indicates the total number of household components; higher education corresponds to post-secondary non-tertiary education and tertiary education (ISCED levels 4 and above). The material deprivation is measured by the indicator of poverty and social exclusion risk, expressed on a scale from 0 to 7, with 7 indicating the highest material deprivation; the variable financial ability indicates the ability to cope with unexpected expenses; financial satisfaction indicates a positive perception of one's finances measured on a scale from 0 to 10, with 10 corresponding to the highest levels of satisfaction; lastly, being together is a binary indicator indicating whether meetings with friends and relatives take place regularly.

Access to the internet is a social and economic issue and it remains particularly limited for the population that would need it the most (Table

TABLE 8. Demographics and socio-economic breakdown of the adult offline population
Source: KCMD elaboration based on EU-SILC microdata, 2018.

	Thinly populated area					Intermediate area					Densely populated area				
Age groups	50-59	60-69	70-79	80+	Total (50+)	50-59	60-69	70-79	80+	Total (50+)	50-59	60-69	70-79	80+	Total (50+)
Health status (1 Very bad –5 Very good)	3.311	3.403	3.306	3.055	3.254	3.136	3.166	3.12	3.099	3.123	2.796	3.09	3.204	3.038	3.044
Chronic illness	54%	54%	58%	71%	60%	59%	61%	59%	62%	60%	71%	59%	55%	71%	64%
Activity restriction	51%	52%	54%	73%	59%	55%	54%	64%	70%	63%	65%	53%	57%	64%	60%
Female	52%	53%	54%	66%	57%	55%	54%	60%	71%	62%	56%	66%	60%	65%	62%
Single person household	27%	16%	34%	53%	35%	46%	47%	42%	65%	52%	42%	46%	44%	73%	53%
Household members	2.123	2.416	1.779	1.673	1.935	1.732	1.725	1.686	1.403	1.596	1.86	1.83	1.63	1.272	1.603
High education	9%	5%	8%	9%	8%	11%	8%	10%	9%	9%	21%	13%	14%	16%	16%
Risk of poverty and social exclusion	1.135	0.808	1.023	1.293	1.069	2.059	1.088	0.905	0.904	1.106	3.455	1.808	0.69	0.584	1.447
Financial ability	81%	79%	85%	81%	82%	51%	66%	80%	87%	76%	27%	48%	71%	78%	60%
Financial satisfaction (0 Low – 10 High)	6.631	6.867	7.299	7.595	7.206	5.79	6.437	7.013	7.2	6.8	4.258	5.922	7.078	7.482	6.398
Get-together	75%	81%	78%	74%	77%	59%	63%	70%	68%	66%	59%	62%	70%	76%	68%

8). Around half of the respondents without an internet connection stated that they are in a medium state of health, presenting a 'health' index of approximately three points in each age group and level of urbanisation. However, more than half of the adult offline population report having a chronic illness. The older group of people over 80 certainly require more attention and healthcare, presenting the highest rate of chronic diseases, equal to 71% in remote areas, 62% in intermediate areas and 71% in densely populated areas. 71% of the population in the age group 50-59 years old, and resident in large cities, also report suffering from chronic diseases. These health conditions represent a limit in the performance of daily activities for around 60% of the total adult population (50 years and over) and for the different levels of urbanisation.

Among those lacking access to the internet, women have the highest percentage across all age groups and levels of urbanisation (Table 8). We therefore highlight an internet gender divide with differences in the access and effective use of ICT within and between countries. The highest percentages of women without access to the internet are observed among residents of intermediate areas and among the older groups of the adult population.

Approximately 52% of the adult offline population lives alone in intermediate and densely populated areas, while this percentage is around 35% of the sample interviewed in remote areas. It is in large cities where older people aged over 80 have the highest percentage of single person households (73%), followed by 65% in intermediate areas and 53% in remote areas. Families are indeed more numerous among the residents of small cities or remote areas where, on average,

the family unit is made up of two components. It is therefore essential to improve the accessibility to digital services, as digital activity increasingly contributes to social and cultural inclusion and may help in preventing social isolation.

Overall, individuals with a high level of education (post-secondary and tertiary) are almost all regular internet users (Table 8). The percentage of the adult population without internet access but with a high level of education is indeed below 10% in rural and intermediate areas and for the different population age groups. Among those with a high level of secondary education, the highest percentage of offline users is in the population between 50 and 59 years old living in large cities (21%). On average, adults aged 50 years and over are exposed to a similar risk of poverty and social exclusion through the different levels of urbanisation (Table 8). However, respondents aged between 50 and 59 have slightly higher rates of material deprivation than older groups in large cities and intermediate areas, and economic affordability remains an important barrier for ICT use within the offline population. Similarly, the younger group living in large cities and intermediate areas report lower financial satisfaction, less financial capacity to sustain unexpected expenses and reduced social encounters than older groups living in the same areas.

DIGITAL SKILLS OF ELDERLY PEOPLE

In addition to having a device that can be connected to the internet (phone, computer, etc.) and an access to the internet, the implementation of telemedicine also requires a sufficient level of digital skills in the patient.
Basic digital skills or above basic digital skills represent the two highest levels of the general e-skills indicator, which is a composite Eurostat indicator based on the activities undertaken by individuals aged between 16 and 74 on the internet predominantly in the areas of information, communication, problem solving and content creation.

Table 9 summarises Eurostat's information for the year 2019 on the proportion of the total population, adult population aged 65 to 74, adult population aged 55 to 74 (by educational level and gender) and the population living in rural, medium and large cities with basic or higher digital skills. The highest percentages of individuals self-reporting to have basic or higher digital skills are in Denmark and Germany (70%), the Netherlands (79%) and Sweden (72%), while the lowest are in Bulgaria (29%) and Romania (31%). With regard to e-skills within the population aged 65-74, Finland, Sweden, Denmark and the Netherlands have the highest percentages for the adult population with basic or higher digital skills (over 40%); on the other hand, in Bulgaria, Romania, Latvia, Poland, Greece, less than 10% of the population aged 65-74 reports to have good e-skills. Lastly, in Bulgaria, Cyprus, Latvia, Lithuania, Slovakia and Poland we find the lowest percentages of women between 55 and 74 years old and the population in the same age group with a low level of formal education claiming to have good digital skills.

TABLE 9. Proportion of individuals who have basic or above basic overall digital skills, 2019
Source: KCMD elaborations of Eurostat dataset [isoc_sk_dskl_i].

EU MS	All individuals	65 to 74 years old	55 to 74 with low formal education	Females 55 to 74 years old	Individuals living in cities	Individuals living in towns and suburbs	Individuals living in rural areas
EU-27	56%	24%	12%	28%	62%	55%	48%
Belgium	61%	34%	20%	32%	57%	63%	61%
Bulgaria	29%	4%	0%	11%	40%	23%	17%
Czechia	62%	21%	3%	31%	72%	61%	56%
Denmark	70%	44%	35%	47%	77%	70%	62%
Germany	70%	36%	22%	41%	74%	69%	66%
Estonia	62%	18%	7%	29%	68%	56%	57%
Ireland	53%	19%	11%	28%	63%	50%	43%
Greece	51%	9%	2%	15%	58%	54%	35%
Spain	57%	19%	11%	26%	63%	52%	48%
France	57%	31%	15%	34%	63%	51%	54%
Croatia	53%	12%	3%	19%	67%	54%	44%
Italy	42%	14%	7%	17%	47%	40%	36%
Cyprus	45%	10%	1%	16%	50%	43%	36%
Latvia	43%	9%	1%	21%	50%	42%	35%
Lithuania	56%	12%	1%	25%	67%	55%	46%
Luxembourg	65%	37%	24%	38%	75%	57%	65%
Hungary	49%	14%	2%	19%	60%	46%	38%
Malta	56%	17%	11%	14%	53%	59%	52%
Netherlands	79%	58%	38%	56%	81%	77%	77%
Austria	66%	27%	13%	32%	71%	66%	61%
Poland	44%	9%	1%	13%	55%	43%	36%
Portugal	52%	13%	7%	17%	60%	50%	37%
Romania	31%	7%	2%	13%	39%	32%	23%
Slovenia	55%	16%	5%	23%	63%	57%	51%
Slovakia	54%	11%	1%	22%	61%	55%	48%
Finland	76%	40%	31%	57%	85%	73%	68%
Sweden	72%	42%	26%	48%	78%	73%	65%

An overview of the degree of urbanisation shows that the level of digital skills in the EU-27 was the lowest among individuals living in rural areas. In 2019, 48% of the rural dwellers had basic or higher skills compared to 55% of city and suburban residents and 62% of people living in cities. According to Eurostat data, the only exception to this general trend is seen in Belgium, where the highest percentage of e-skills is recorded among city and suburban inhabitants (63%). The digital skills gap between urban and rural residents – the difference in proportions of adults possessing basic or above basic digital skills – was, on average, 14 percentage points in 2019, with the highest skill gaps recorded in Bulgaria, Greece, Croatia and Portugal (23 percentage points), and the lowest observed in Belgium (-4), Malta (1), the Netherlands (4) and Germany (8).

CONCLUSIONS

Through an analysis of the EU-SILC 2018 microdata, this section showed that the digital divide between some demographic groups remains considerable in Europe. Reducing the existing gaps relating to access and the use of this resource is increasingly important for the implementation of telemedicine in the future.

This analysis shows in particular that older groups have less access to the internet and have fewer skills to use it productively than younger groups. The analysed group of over-50s is an extremely heterogeneous population group in terms of health situation, medical care needs or socio-economic living conditions. The demand for health services based on ICT therefore varies substantially throughout the older adult and elderly population. However, the results show that special attention needs to be paid to older people living alone in their homes, those with a low level of education and people living in rural and remote areas. Moreover, women demonstrate lower percentages of using or possessing digital skills than men.

Internet access is still a social and economic issue and affordability is an obstacle to the adoption of ICT by users. The urban/rural divide is also a central issue to be addressed for the effective implementation of telemedicine. The urban/rural divide reflects inequalities in access and barriers to productive use, with many areas that remain largely disconnected.

Training the elderly could play a key role in improving digital skills and the use of the internet for telemedicine. Educational activities and computer training courses for older people, such as free computer and internet use courses, information and educational meetings and universities of the third age could be particularly significant.

5. CONCLUSIONS

The EU is facing an unprecedented challenge. As the EU society is ageing, its elderly population is generating an ever-increasing demand for health and care services, also pressuring the fiscal sustainability of the EU's health and LTC sectors. The magnitude of this additional demand is dependent not only on the increase in life expectancy, but also on the quality of life at older ages. In other words, **ensuring ageing in good health** of the population can potentially reduce the demand and the pressure on the EU's health and LTC sectors.

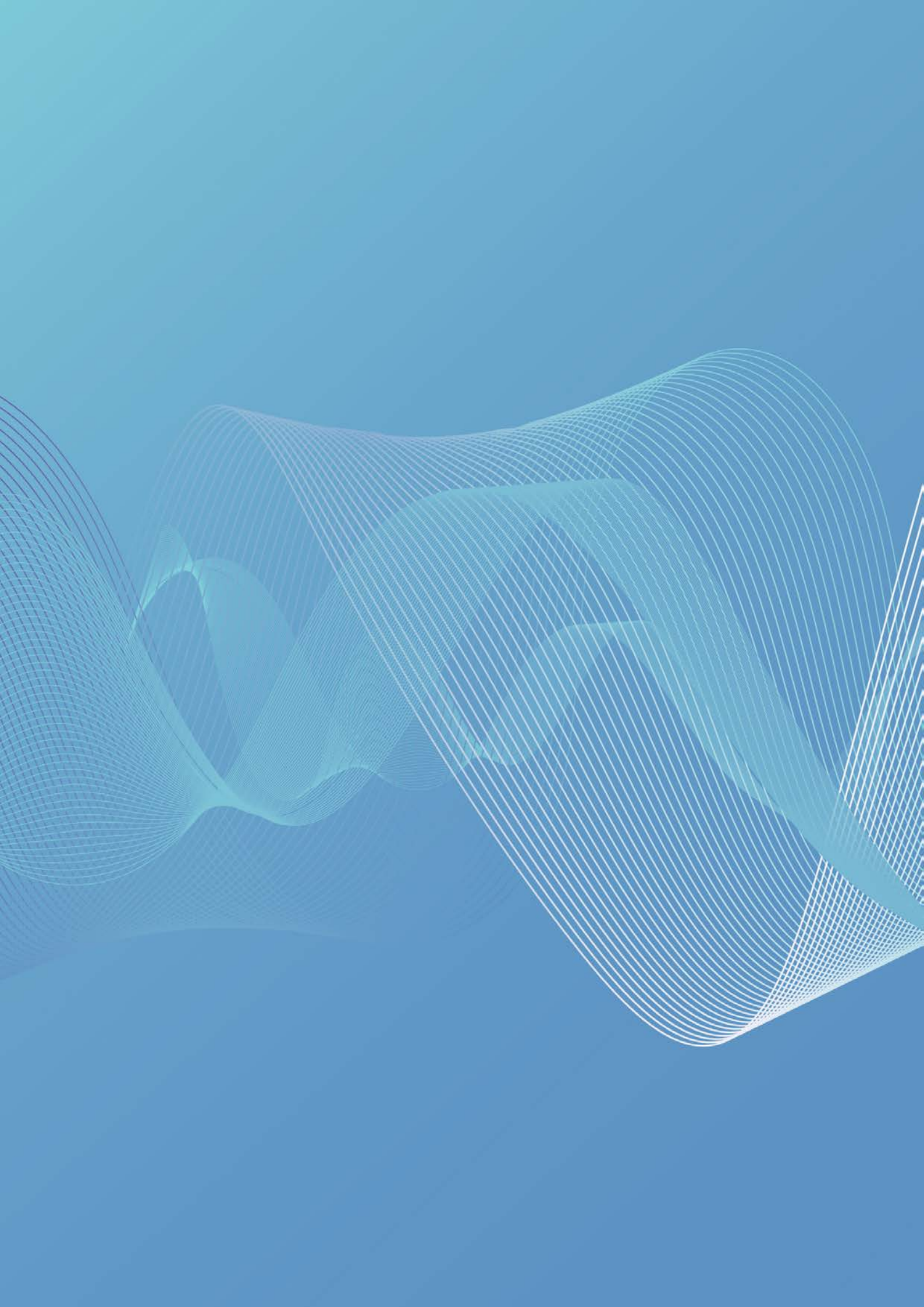
It is important to stress that the challenges of population ageing on health and LTC sectors are not equally distributed between the Member States, or within the same Member State. This diversity of implications reflects not only different demographic, health socio-economic characteristics of populations, but also diversity of health and long-term care policies in place at local and national levels.

The majority of the demand for health and LTC workforce is being satisfied by domestic education systems which have the role of ensuring an adequate inflow of workers into the labour market. However, in a context of tight funding constraints, countries have been facing under-investments in education and training programmes for health workers as well as mismatches between education strategies and actual population needs. At the same time, the increasing labour demand in the EU's health and LTC sectors is being satisfied with the migration and intra-EU mobility of health and LTC professionals. Nonetheless, **the potential of migration** to alleviate the pressure of workforce shortages in the EU's health and LTC sectors has still not been fully harnessed. The reasons for this untapped potential are manifold, ranging from the absence of specific EU sectoral labour migration instruments or tools for attracting healthcare and LTC workers, complex qualification recognition procedures, to obstacles in the labour market integration of migrants.

An additional way of addressing the rising demand for health and LTC services is by harnessing **the potential of digital technologies**. Considering AI, in particular, its role in shaping and addressing the demand for workers and skills is not only limited to AI's technological availability, but is accompanied by crucial social, ethical and occupational implications, many of which are still an open debate. Ultimately, there is also a question of whether the elderly – as the growing category of recipients of health and care services – are in a condition to actually benefit from the adoption of digital technologies. Using the specific example of telemedicine, it is clear that elderly people in the EU are still facing important barriers determined by the lack of access to the internet, to computers and fewer digital skills.

In a context of the progressive ageing of the EU's society and increasing challenges that the EU's health and LTC sectors have been facing, the Commission has taken a series of policy initiatives in support of its Member States. Some of the most

relevant recent initiatives include the Commission's first steps towards building the European Health Union, which, together with the 'Pact for Skills' set out in the EU's Skills Agenda and the Green Paper on Ageing, are all directed towards supporting the Member States' efforts to build resilient health and LTC systems that rely on the availability of a qualified workforce, among others. Finally, for health and LTC sectors an important forthcoming initiative is the adoption of the Action Plan to implement the European Pillar of Social Rights in 2021, as set out in the Commission Communication on the Strong Social Europe for Just Transitions (COM(2020) 14 final).



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COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS European Skills Agenda for sustainable competitiveness, social fairness and resilience COM(2020) 274 final

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DIRECTIVE 2014/36/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 26 February 2014 on the conditions of entry and stay of third-country nationals for the purpose of employment as seasonal workers

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COUNCIL DIRECTIVE 2009/50/EC of 25 May 2009 on the conditions of entry and residence of third-country nationals for the purposes of highly qualified employment
COMMISSION RECOMMENDATION of 26.4.2017 on the European Pillar of Social Rights, C(2017) 2600 final

LIST OF ABBREVIATIONS

AI	Artificial intelligence
AR	Augmented reality
EU	European Union
EU LFS	European Union Labour Force Survey
EU-SILC	European Union Statistics on Income and Living Conditions
EWCS	European Working Conditions Survey
GDP	Gross domestic product
HAPs	Health associate professionals
HPs	Health professionals
ILO	International Labour Organization
IoT	Internet of things
JRC	Joint Research Center
KCMD	Knowledge Centre on Migration and Demography
LTC	Long-term care
MS	Member State
OECD	Organisation for Economic Co-operation and Development
PCWs	Personal care workers in health services
PIAAC	Survey of Adult Skills
SW	Software
TAL	Technology availability level
WHO	World Health Organization

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ANNEX I
INTRODUCTION

FIGURE I.1. Occupation change 2018-2030 (job creation versus job losses)
Note: *Health professionals* include medical doctors, nurses and midwife professionals, traditional and complementary medicine professionals, paramedical practitioners, veterinarians and other health professionals.
Health associate professionals include medical and pharmaceutical technicians, nursing and midwifery associate professionals, traditional and complementary medicine-associate professionals, veterinarian associate professionals and other health associate professionals.
Personal care workers include personal care workers in health services (that is health care assistants in institutional settings and home-based personal care workers) and child care workers and teachers' aides. Note that Cedefop (2020) data do not allow disaggregating the estimates solely for personal care workers in health services. According to the 2018 EU LFS data, the personal care workers in health services represented 68% of all workers in the category of personal care workers.
Source: KCMD elaboration of Cedefop data, 2020.

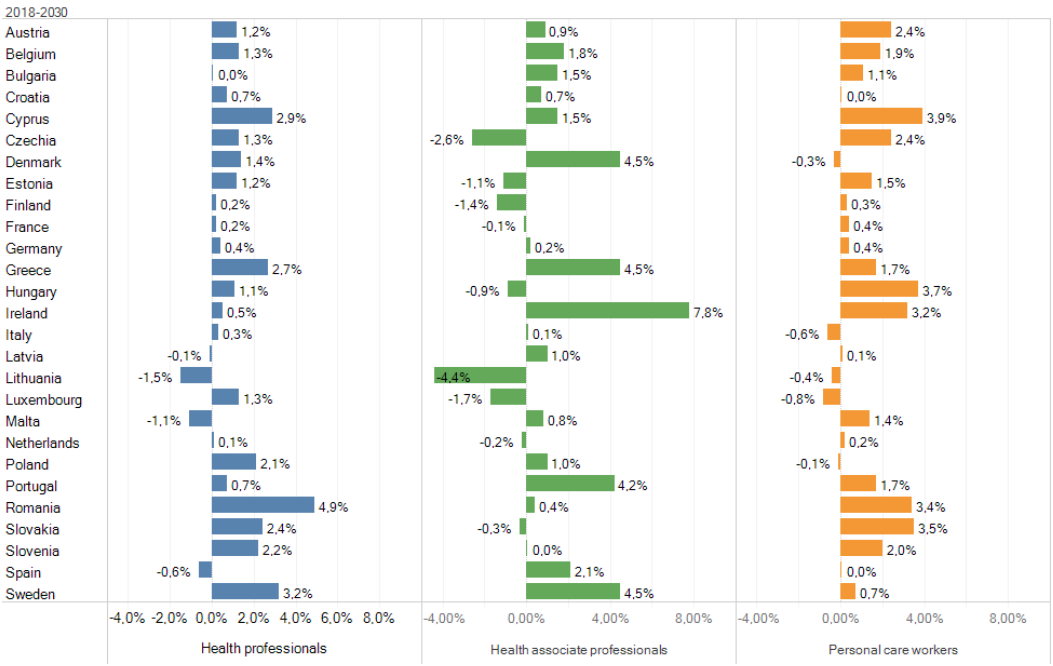


TABLE I.1. New job openings and replacement needs in EU MSs, 2018-2030
Note: see Table I.1.
Source: KCMD elaboration of Cedefop data, 2020.

2018-2030	Health professionals - Replacement needs	Health professionals - Total job openings	Health associate professionals - Replacement needs	Health associate professionals - Total job openings	Personal care workers - Replacement needs	Personal care workers - Total job openings
Austria	52,061	65,800	65,291	83,470	68,253	112,360
Belgium	113,244	148,030	56,835	80,327	85,969	127,349
Bulgaria	69,556	69,147	16,774	20,419	53,034	62,266
Croatia	20,037	23,092	27,243	30,557	9,953	10,039
Cyprus	5,592	10,344	2,230	2,824	3,096	5,489
Czech Rep.	57,442	74,381	43,779	13,319	71,502	110,855
Denmark	77,129	100,993	25,022	49,873	122,542	115,457
Estonia	8,223	9,713	6,754	5,320	11,934	14,631
Finland	27,009	28,017	53,397	36,359	120,854	128,232
France	427,757	441,019	355,803	350,323	642,841	715,763
Germany	639,816	691,649	1,276,638	1,344,997	357,351	389,857
Greece	82,493	124,897	31,595	79,397	22,507	29,577
Hungary	23,891	30,865	41,775	28,909	30,481	67,690
Ireland	43,826	49,970	13,767	44,481	67,166	118,732
Italy	387,730	404,653	424,766	438,448	504,619	448,982
Latvia	13,338	13,212	4,888	5,866	17,449	17,765
Lithuania	30,012	22,535	5,315	11	15,490	14,469
Luxembourg	5,050	6,502	1,644	628	9,653	8,599
Malta	490	185	492	761	1,443	2,908
Netherlands	181,764	186,586	122,843	118,030	218,569	228,955
Poland	292,918	439,641	81,803	102,445	60,027	59,163
Portugal	77,292	91,183	21,006	49,850	93,997	128,796
Romania	76,474	214,909	27,442	32,932	59,829	112,872
Slovakia	19,520	29,454	27,504	25,313	50,605	86,530
Slovenia	11,339	18,281	8,277	8,359	4,916	7,174
Spain	434,947	387,923	122,290	187,057	373,982	377,363
Sweden	169,226	280,523	55,387	101,409	284,252	325,770
EU-27	3,348,176	3,963,504	2,920,560	3,241,684	3,362,314	3,827,643

BOX I.1 Overview of the relevant EU policy initiates related to the health care workforce

Already in 2008 the Commission's Green Paper on the European Workforce for Health raised the issue of increasing health workforce shortages and proposed several ways forward: improving the collection of comparable information about health workers to support better decision-making on workforce planning; exchanging among MSs' good practice on mobility of health workers; and enhancing digital skills of health workers in order to harness the potential of new technologies.

The green paper was followed by the Commission's 2012 Action Plan for the EU health workforce with an aim to respond to the challenges of the health sector such as the ageing workforce, the low replacement rate and the need to increase retention, and the potential impact of new technology on the organisation of work and on the workforce skill profile. In order to address these challenges the Action plan set out measures to "improve health workforce planning and forecasting" and announced the EU joint action on health workforce planning and forecasting.

In the context of promoting free movement of professionals, Directive 2013/55/EU, amended the Directive 2005/36/EC, established the automatic recognition of qualifications for five professions in the health care sector (i.e. care nurses, dental practitioners, midwifes, pharmacists and doctors), for which training conditions are harmonised. The EPRS (2019), recognised a clear EU added value in increasing the mobility of healthcare professionals across EU MSs, and incentivising the circulation of medical knowledge beyond national borders.
In 2014 Commission adopted the Communication on effective, accessible and resilient health systems calling national medical training systems to develop strategies to attract students to the specialties that are needed the most. The Communication also strengthens the EU's support national workforce planning systems by developing, together with MSs, recommendations, common tools, indicators and guidelines.

Today, the COVID-19 outbreak has put EU's health systems under stress by posing, in a short time, new challenges and by exacerbating the old ones. The Commission has quickly responded in support of Member States with a range of policies that, among others, aim at removing the barriers for internal mobility of health workers and at efficient investments in their skills.

The following are some of the policy actions[79] related to supporting the Member States in strengthening the national health workforce capacity, taken by the Commission since the outbreak of COVID-19:

8th May 2020 Communication on the Guidance on free movement of health professionals and minimum harmonisation of training in relation to COVID-19 emergency measures was adopted providing guidance to EU MSs on how to facilitate the mutual recognition of qualifications of health professionals in line with the flexibilities provided by the Directive 2013/55/EU.

27th May 2020 Commission presents a Recovery plan for Europe, which foresees, among others, a reinforced EU health programme, called EU4Health for the period 2021-2027. The EU4Health will aim at "Tackling cross-border health threats", "Making medicines available and affordable" and "Strengthening health systems". In terms of workforce, the EU4Health will aim at establishing a pool of EU healthcare staff and experts that can be mobilised across EU MSs. On 21st July 2020, the Council agreed on a Recovery plan and the MFF for 2021-2027. On 15th December 2020, the European Parliament and Council reached a provisional political agreement on the EU4Health programme.

1st July 2020 EU Skills Agenda for Sustainable Competitiveness, Social Fairness and Resilience launched the flagship action "Pact for Skills" as a new governance model for quality investments in skills based on large-scale partnerships. Health sector is identified as one of the priority areas. The quality investments in the skills will be based on defining and mapping occupational needs and profiles and developing health training programmes. The Agenda, among others, stresses out the need to enhance health workforce digital skills and harness the potential of artificial intelligence in improving the efficiency of health systems.

15th July 2020 Communication on Short-term EU health preparedness for COVID-19 outbreaks recognised that in managing the COVID-19 outbreaks the availability of healthcare staff with right skills is one of the most pressing needs. In order to help increase the availability of health workforce the Commission has set out specific actions to "finance and organise the transport of medical personnel and teams into the EU and between Member States"; to foster "online European network of clinicians and development of training modules on COVID-19 for health professionals"; and to provide "trainings to frontline staff working with vulnerable groups".

11th November 2020 the Commission took the first steps towards building the European Health Union. In the area of human resources, the COM(2020)724 sets out the Commission's support to Member States in detecting shortages in healthcare staff and in taking targeted actions to guarantee "availability of sufficient and up-skilled healthcare staff who can be redeployed to new roles in case of emergency"

ANNEX D
DEMOGRAPHIC CHANGE

FIGURE D1. Confirmed COVID-19-associated hospitalisation ratios per 100,000 people, by sex and age

Source: Source: KCMD elaboration of ECDC TESSy data, May 18th 2020.[80]

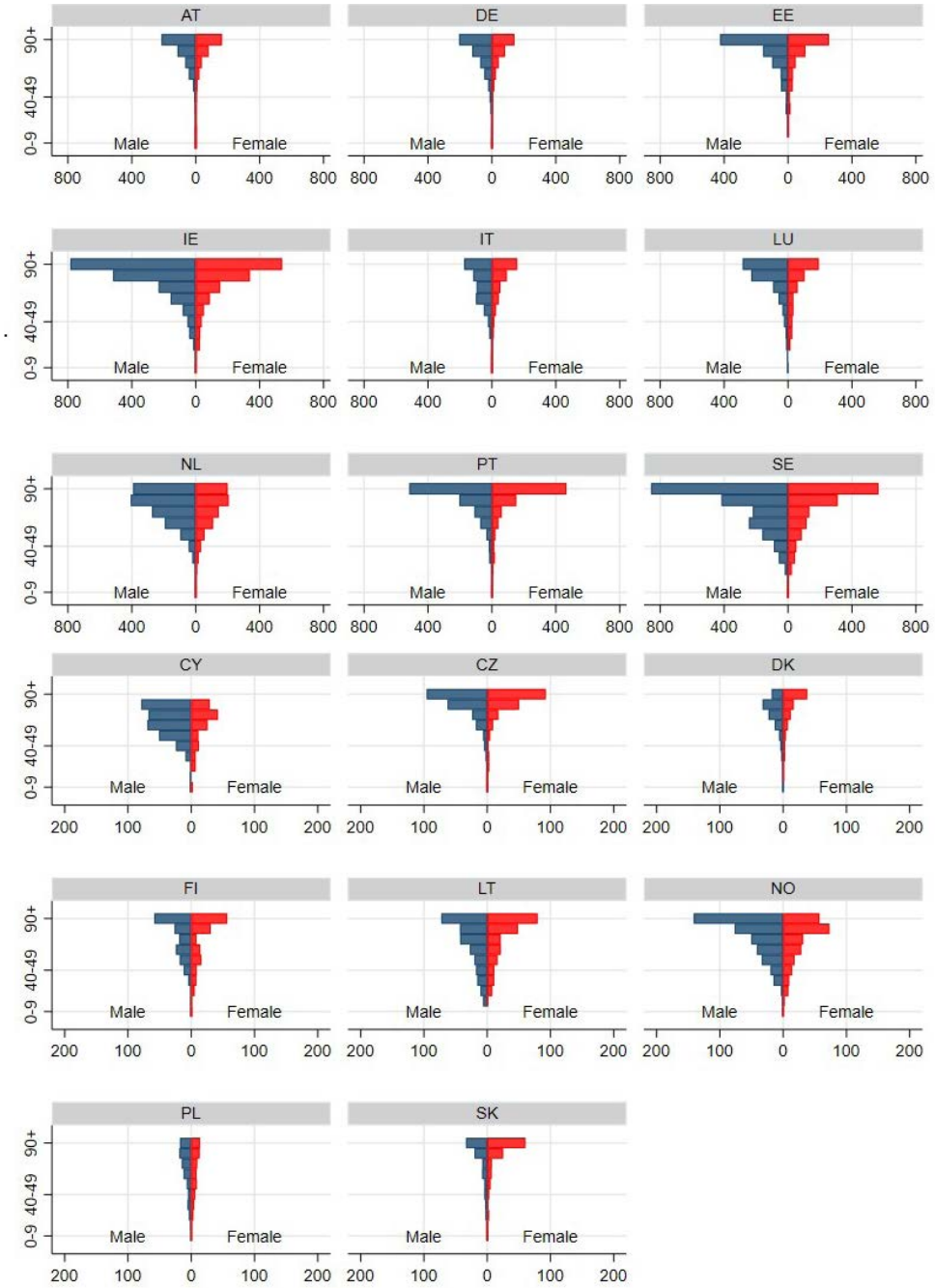
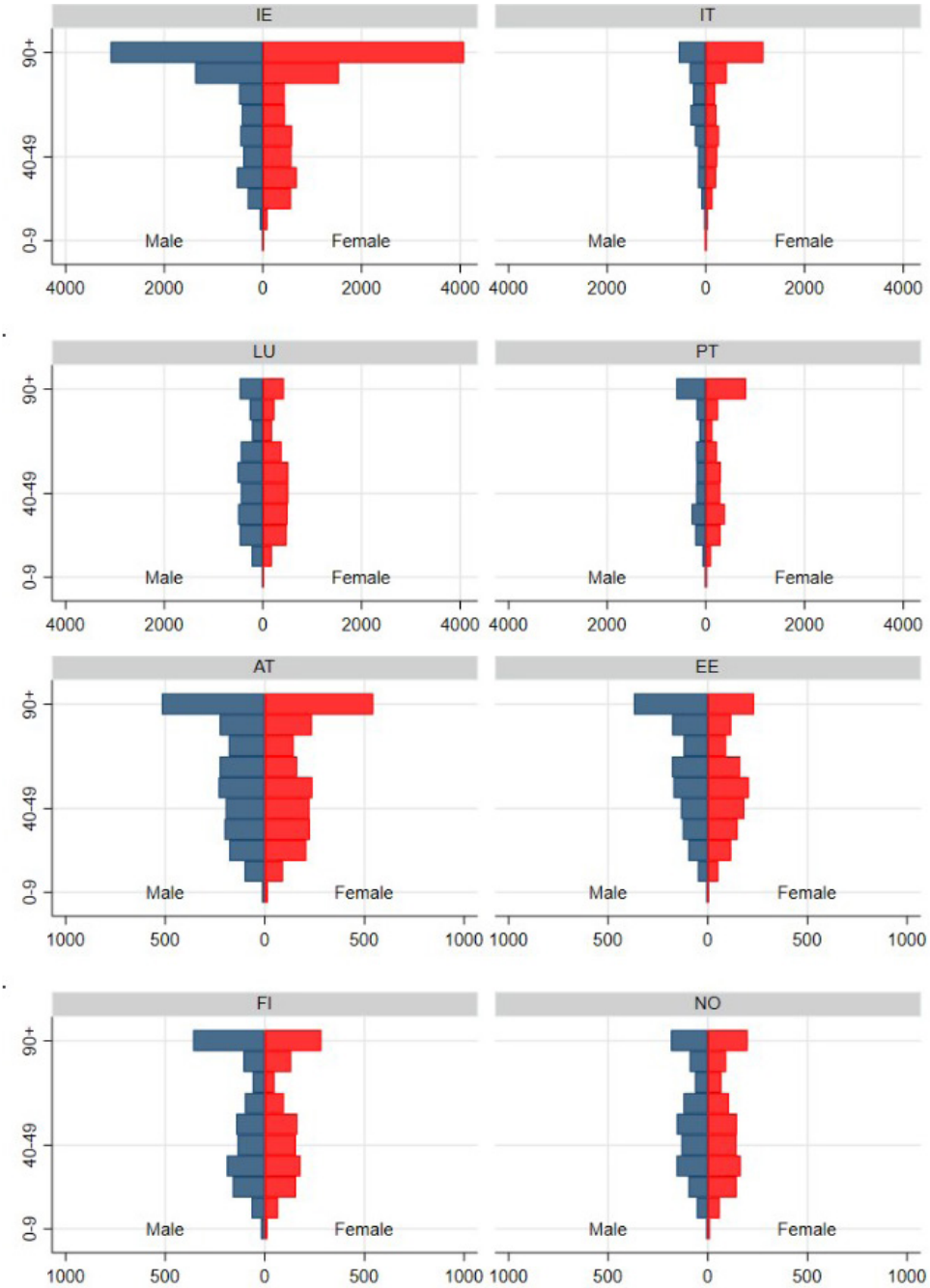
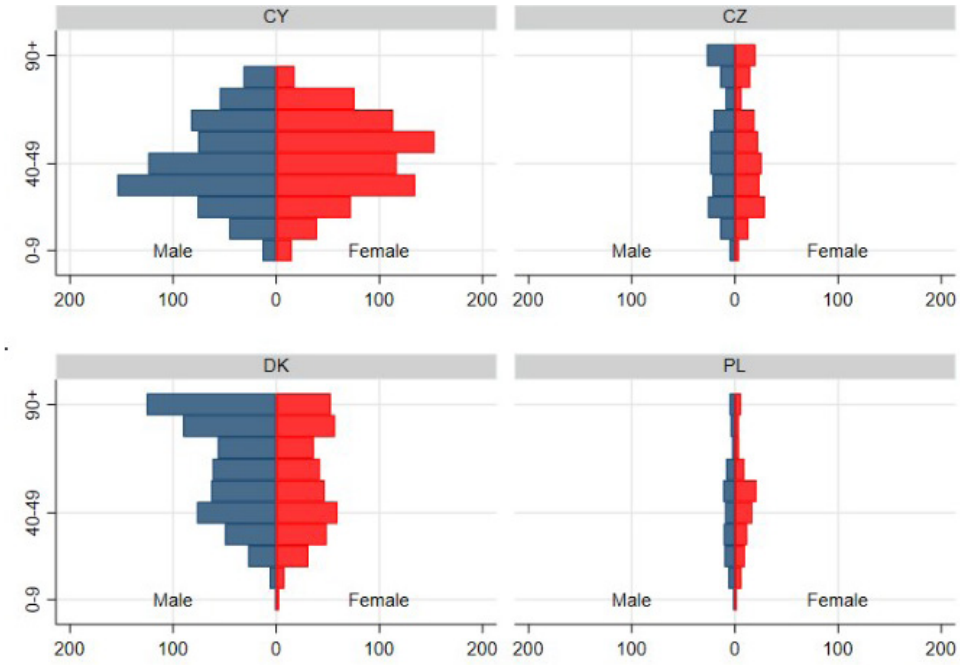


FIGURE D2. Confirmed COVID-19-associated home-treatment ratios per 100,000 people by sex and age

Source: KCMD elaboration of ECDC TESSy data, May 18th 2020.




CY
CZ
DK
PL
90+
40-49
0-9
Male
Female
200
100
0
100
200

ANNEX M
MIGRATION AND MOBILITY

TABLE M.1. Medical doctors and nurses by place of training. Latest available data.
Note: *E=A+B+D, C and C is a subset of B, F=100xB/E. For Medical doctors in Portugal, this formula does not work.*
Source: KCMD elaboration of Health workforce migration dataset [hlth_rs_wkmg], Eurostat.

	Medical doctors						
	Domestically trained	Foreign trained	Native born / foreign trained	Unknown place of training	Total	Foreign trained (%)	Reference Year
EU MS	(A)	(B)	(C)	(D)	(E)	F	
AT	35,970	2,282	399		38,252	5.97	2018
BE	58,499	8,062			66,561	12.11	2018
CZ	40,719	3,232			43,951	7.35	2018
DE		41,934			352,869	11.88	2017
DK	20,764	2,111		27	22,902	9.22	2016
EE	6,525	262			6,787	3.87	2018
EL	33,626	8,367	7,832	432	65,240		2017
ES	187,580	19,462			207,042	9.40	2011
FI	16,712	4,154			20,866	19.91	2012
FR	200,811	26,048	715		226,859	11.48	2018
HR	13,295	134	56	1	13,430	1.00	2016
HU	29,929	2,614	400		32,543	8.03	2017
IE	13,429	9,583			23,012	41.64	2018
IT	398,574	3,378	1,443	859	402,811	0.84	2018
LT	14,760	72		4	14,836	0.49	2018
LV	7,545	477			8,022	5.95	2017
MT	1,559	296			1,855	15.96	2017
NL	58,897	1,336	483		60,233	2.22	2016
PL	132,919	2,549			135,468	1.88	2017
PT	45,708	6,229	2,865		51,241	12.16	2017
RO	54,757	846	620		55,603	1.52	2017
SE	26,656	14,195			40,851	34.75	2016
SI	5,324	1,085	147		6,409	16.93	2018
SK	12,125	506		4,268	16,899	2.99	2011

Nurses							
	Domestically trained	Foreign trained	Native born / foreign trained	Unknown place of training	Total	Foreign-trained (%)	Reference Year
EU MS	(A)	(B)	(C)	(D)	(E)	(F)	
AT							
BE	202,617	7,889			210,506	3.8	2018
CZ							
DE	837,000	71,000			908,000	7.9	2017
DK	55,956	1,034		1	56,991	1.8	2016
EE	13,766	20			13,786	0.1	2018
EL	17,319	451	416		17,770	2.5	2015
ES	245,030	5,247			250,277	2.1	2011
FI	71,178	1,293			72,471	1.8	2012
FR	700,743	20,757		1,072	722,572	2.9	2018
HR	38,563	364			38,927	0.9	2017
HU	62,786	953	17		63,739	1.5	2017
IE					70,953		2017
IT	267,201	21,561	458	161,019	449,781	4.8	2018
LT	25,965	113			26,078	0.4	2018
LV	8,186	274			8,460	3.2	2017
MT							
NL	180,737	978	249	-	181,715	0.5	2016
PL	291,628	162			291,790	0.1	2017
PT					68,976	1.8	2017
RO	161,926	83	71		162,009	0.1	2017
SE	104,916	3,269			108,185	3.0	2016
SI	6,576	27		128	6,731	0.4	2017
SK							

BOX M.1 List of relevant EU labour migration directives

The EU has equipped itself with a number of legislative measures dealing either directly or indirectly with labour migration. This box summarises the labour migration directives as main instrument at the EU level that apply also to the health sector.

While formerly two separate instruments,[81] in 2016 the EU adopted the Students and Researchers Directive on the conditions of entry and residence of third-country nationals for the purposes of research, studies, training, voluntary service, pupil exchange schemes or educational

projects and au pairing. Research, in particular, is defined as "creative work undertaken on a systematic basis in order to increase the stock of knowledge, including knowledge of man, culture and society, and the use of this stock of knowledge to devise new applications". The Directive stipulates that "students and researchers have the right to stay for at least 9 months after finishing their research or studies, to look for work or set up a business". Within the scope of the Directive, students have the right to work at least 15 hours per week, and no labour market test should be conducted. Attracting students and researchers to EU countries and the promotion of circularity between sending and destination countries have long been objectives of the European Commission, also in the previous version of the Directives on Students and Researchers. Overall, the Students and Researchers Directive was regarded as an essential component in the Union's toolkit in the global competition for highly skilled migrants.

The EU Blue Card Directive represent another facet of EU's policy towards attracting highly-skilled immigrants. The Directive coexists side-by-side national measures, and does not substitute them. According to Article 2(g), "higher professional qualifications means qualifications attested by evidence of higher education qualifications or, by way of derogation, when provided for by national law, attested by at least five years of professional experience of a level comparable to higher education qualifications and which is relevant in the profession or sector specified in the work contract or binding job offer". Eligible candidates for Blue Card permits must meet several criteria (e.g. salary threshold, valid work contract or binding job offer) and be offered an employment as manager or professional. If their applications is accepted Blue Card holders are granted a set or rights ranging from family reunification, to social security and labour rights (even if Member States enjoy some discretion in these regards). A revision of the Directive is currently ongoing.

In 2014, the EU adopted the Intra-corporate Transferees Directive. Art. 3(b) stipulates that "'intra-corporate transfer' means the temporary secondment for occupational or training purposes of a third-country national who, at the time of application for an intra-corporate transferee permit, resides outside the territory of the Member States, from an undertaking established outside the territory of a Member State, and to which the third- country national is bound by a work contract prior to and during the transfer, to an entity belonging to the undertaking or to the same group of undertakings which is established in that Member State, and, where applicable, the mobility between host entities established in one or several second Member States". The Directive includes in its scope "intra-corporate transfer as managers, specialists or trainee employees" (Art. 2).

Lastly, the EU also adopted the so-called Seasonal Workers Directive. Article 3(c) defines an "'activity dependent on the passing of the seasons' [as] an activity that is tied to a certain time of the year by a recurring event or pattern of events linked to seasonal conditions during which required labour levels are significantly above those necessary for usually ongoing operations". The economic sectors that marked by such "passing of the seasons" are to be spelled out by each Member State (Art. 2).

Finally, the Single Permit Directive is a general directive covering third country nationals (TCNs) entitled to work. It offers to TCNs a single procedure and permit for work and residence. It covers TCNs who are both abroad or already residing and working in the MS at the time of application (with some exceptions, such as, long-term residents). Importantly, the Directive contains specific clauses relative to rights to equal treatments for TCNs who are granted Single Permits, specifically regarding "recognition of diplomas" (Art. 12(1)(d)). The latter should be interpreted in the framework of existing legislative measures, and specifically regarding recognition of diplomas acquired in another EU member state by virtue of Directive 2005/36/EC (as also specified in the Preamble, Recital 23).

Table M2 reports the characteristics of the most important labour migration channels in each MS, divided by general programme, without skill differentiation, and skill-based programme. This latter can be a national scheme or the EU Blue Card.

The relevant characteristics are the presence of a qualification requirement, of the labour market test (LMT) and of the presence of a salary requirement, which differs from what is the normal salary requirement in compliance with labour agreement and labour law.

Moreover, the table reports specific exceptions to the general or skilled programme based on the presence of a list of professions in shortage used for migration purposes; it specifies which advantages are associated with the list; and whether any health or long-term care profession is included.

The table has been compiled by using official information wherever available. However, it has not been possible to verify whether the information provided is still up-to-date.

Box M2 provides some examples of recognition of foreign qualifications for doctors and nurses, selected on the basis of the share of foreigners in health professions (IE, SE) and the absolute number of foreign workers among this category (DE).

TABLE M.2. Overview of labour migration general and skill-based programme.
Note: *Note: N.I.. –no information; N.A. – not applicable.*
Source: The table was compiled using a combination of different sources: 2016 Blue Card Impact Assessment SWD(2016) 193 final, part 5/6; 2016 EMN Study on Determining labour shortages and the need for labour migration from third countries in the EU; 2019 EMN AD HOC QUERY 2019.86 Labour market tests in the migratory context; 2019 EMN AD HOC QUERY 2019.55 Immigration for employment; EU Immigration Portal; official national websites. It was not possible to verify information with official and up-to-date sources.

MS	General programme (no skill differentiation)		
	Qualification	Labour market test	Salary
Belgium	No	Yes	No
Bulgaria	N.I.	Yes	N.I.
Czech Republic	No	Yes (but if graduated in CZ)	No (minimum wage)
Germany	N.A.	N.A.	N.A.
Estonia	No	Yes	Yes, at least the average annual wage
Ireland	No	Yes, with exceptions	EUR 30,000 per year, or €27,000 in exceptional cases
Greece	No	Yes	Yes, at least the monthly salary of an unskilled worker
Spain	No	No	No
France	No	Yes	No
Croatia	N.A.	N.A.	N.A.
Italy	No	Yes	No
Cyprus	No	Yes	No
Latvia	No	Yes, with some exceptions	No
Lithuania	No	Yes, unless shortage profession	No
Luxembourg	No	Yes	No
Hungary	No	Yes	No (minimum wage)
Malta	No	Yes	No
Netherlands	No	Yes	Yes (sufficient income, i.e. gross salary of EUR 1,680 per month)
Austria	N.A.	N.A.	N.A.
Poland	No	Yes	No (minimum salary)
Portugal	No	Yes	No
Romania	No	Yes	Yes, national average wage
Slovenia	No	Yes	No
Slovakia	No	Yes	No
Finland	No	Yes	No (minimum salary)
Sweden	No	Yes (but very loose)	No, minimum and according to agreements

MS	Skill-based programme			
	National highly skilled scheme			
	Name	Qualification	Labour market test	Salary
Belgium	Type B Permit	At least BA	No	At least approx. EUR 42,000 gross per year (2019).
Bulgaria	N.A.	N.A.	N.A.	N.A.
Czech Republic	N.A.	N.A.	N.A.	N.A.
Germany	Work visa for qualified professionals	Advanced vocational training or university education	Yes	No
Estonia	Permit for top specialists	No	Yes	Yes, twice the average annual salary
Ireland	Critical Skills Employment Permit	Yes , a relevant degree or professional experience	No	EUR 32,000 or 64,000
Greece	N.A.	N.A.	N.A.	N.A.
Spain	Residence visas Law 14-2013	No - case-by-case assessment	No	No - case-by-case assessment
France	Salarié qualifié	Master level	No	Twice the minimum salary (SMIC)
Croatia	N.A.	N.A.	N.A.	N.A.
Italy	N.A.	N.A.	N.A.	N.A.
Cyprus	TCNs employed in companies of foreign interest	N.I.	No	Yes, based on category
Latvia	N.A.	N.A.	N.A.	N.A.
Lithuania	N.A.	N.A.	N.A.	N.A.
Luxembourg	N.A.	N.A.	N.A.	N.A.
Hungary	N.A.	N.A.	N.A.	N.A.
Malta	N.A.	N.A.	N.A.	N.A.
Netherlands	Highly skilled scheme	No	No	Yes (at least EUR 4,600 gross/month with exception for students and <30)
Austria	Red-White-Red card for a) highly skilled workers; b) Skilled Workers in Shortage Occupations; c) other key workers	No - a combination of requirements including qualifications accruing points	c) Yes	b) minimum pay stipulated by law, regulation or collective agreement; c) statutory minimum salary (EUR 2,685 (2020) gross monthly pay for <30; otherwise; EUR 3,222
Poland	N.A.	N.A.	N.A.	N.A.
Portugal	N.I.	N.I.	N.I.	N.I.
Romania	N.A.	N.A.	N.A.	N.A.
Slovenia	N.A.	N.A.	N.A.	N.A.
Slovakia	N.A.	N.A.	N.A.	N.A.
Finland	Permit for specialists	Higher education	No	Yes (at least EUR 3,000 gross pay per month, higher than the average)
Sweden	N.A.	N.A.	N.A.	N.A.

MS	Skill-based programme		
	Blue Card		
	Qualification	LMT	Salary
Belgium	At least 3-years long post-secondary education	Allowed, but not applied	Between EUR 50,000 and 53,000 depending on region
Bulgaria	At least 3-year post-secondary education	No	Approx. EUR 10,000 in 2016
Czech Republic	Tertiary education	Yes	1.5 times the average gross annual salary
Germany	Academic degree	Yes	Minimum salary of EUR 55,200, or 43,056 for STEM professions
Estonia	Three years of tertiary education or five years of professional experience	Yes	Yes, at least the average annual wage times 1.5
Ireland	N.A.	N.A.	N.A.
Greece	Three year of tertiary education or five years of professional experience	Yes	1.5 times the average annual gross salary, EUR 30,675 in 2015
Spain	Three year of tertiary education or five years of professional experience profession	Yes	EUR 33,908 (in 2015)
France	Three year of tertiary education or five years of professional experience	No	1.5 times the average gross annual salary, i.e. 53,836 in 2020
Croatia	University degree, bachelor's and master's degree, or integrated bachelor's/master's degree or specialised master's degree	No	1.5 times the average gross annual salary
Italy	3-year tertiary education	Yes (except for pre-approved employers)	At least 3 times the salary that would entitle the person to be exempted from health fees
Cyprus	Higher education	Yes	1.5 times the average gross annual salary (EUR 23,964 in 2014)
Latvia	University or college diploma from an at least 3-year long educational programme	No	1.5 annual average salary
Lithuania	University degree or at least five years of professional experience	No LMT, unless salary is <3x average	EUR 23,160
Luxembourg	University degree or at least five years of professional experience	No	1.5 times the average gross salary; 1.2 for shortage
Hungary	Higher education or professional qualifications	Yes	EUR 16,700
Malta	University degree or at least five years of professional experience	Yes	EUR 16,036 (in 2014)
Netherlands	Yes, higher education programme of at least 3 years	No	Yes, EUR 5,403 gross per month
Austria	University or other tertiary educational institution with a minimum duration of three years	Yes	At least EUR 63,672 as annual salary
Poland	Graduate university or having at least 5 years of professional experience	Yes	EUR 15,446 in 2015
Portugal	Higher education or professional qualifications	No	Annual salary of, at least, 1.5 times the gross national medium salary, and in shortage professions at least 1.2 times.
Romania	Higher education or professional qualifications	No	EUR 25,828 in 2015
Slovenia	Higher education	Yes	EUR 28,006 in 2015
Slovakia	University education	Yes	1.5 times the wage in Slovak national economy in the relevant field
Finland	Higher education degree	No	Gross minimum salary is EUR 4,852 per month
Sweden	Tertiary education or 5 years professional experience	Yes (but very loose)	1.5 average salary (in 2019: SEK 51,900 per month)

MS	Specific exceptions to general or skill-based channel		
	Presence of shortage list	Advantages	Health and long-term care professions
Belgium	Only in Flanders as of Dec 2018, shortage occupation list for medium skilled TCN	For Flanders: no LMT, lower salary threshold (EUR 33,500)	Nurses
Bulgaria	N.I.	N.I.	N.I.
Czech Republic	No	N.A.	N.A.
Germany	Yes - positive list.	No LMT	Health (doctors and nurses), health associate, care workers - very detailed definitions
Estonia	Not a list, but limited categories of exception	No LMT, lower salary threshold for BC (124%)	Top specialists in health service
Ireland	a) Critical Skills Occupation List for the high skill permit and for general permit b) List of ineligible occupations for the general programme	a) No LMT for the general programme; eligibility to the Critical Skills employment Permit;[82] b) eligibility for the general scheme	a) Specific health professions for a)[83] and for b)[84]
Greece	A quota system whereby every two years a catalogue containing the number and specialties of foreign workers needed is drafted	Eligibility to the quota system	N.I.
Spain	a) Yes - the Catalogue of Difficult Occupation Vacancies; b) list of 1 and 2 ISCO professions for which the BC admits lower salary thresholds	a) Eligibility to the general programme; b) 1.2 gross annual average income salary threshold for BC	a) N.I.. - regional and quarterly updated, b) doctors and nurses included
France	Yes (list de métiers en tension + other lists within bilateral agreements)	No LMT	List by region, but no health professions apparently
Croatia	A quota system whereby the number and professions available for work permits is defined	Some professions are excluded from the quota system	A third-country national who is doing specialization in Croatia in healthcare activities
Italy	No	N.A.	N.A.
Cyprus	A specific entry channel for domestic workers (including domestic long-term carers for people with diseases or >75)	N.I.	Long-term carers
Latvia	Yes	Shortened LMT	N.I.
Lithuania	Yes	No LMT	None
Luxembourg	Category of highly skilled professions in shortage	Lower salary threshold	N.I.
Hungary	Yes	Lower salary threshold at EUR 13,350	Selected health-related professions[85]
Malta	Vacancy exemption list	No LMT	Personal care workers, doctors (generalists and specialists), nurses, veterinarian
Netherlands	No	N.A.	N.A.
Austria	Yes, lists for a) highly skilled shortages and b) skilled shortage occupation	a) Fewer points needed to be eligible to the highly skilled stream; b) Eligibility to the skilled workers in shortage stream of the red white red card	a) Doctors; b) Qualified healthcare assistant; Healthcare assistant; Special medical-technical specialists; Graduate nurses; Ophthalmic opticians
Poland	Yes	No LMT	N.I..
Portugal	N.I.	N.I.	N.I.
Romania	No	N.A.	N.A.
Slovenia	No	N.A.	N.A.
Slovakia	Yes	No LMT if foreign employees<30% workforce	N.I. regional lists
Finland	No	N.A.	N.A.
Sweden	No	N.A.	N.A.

BOX M.2 Examples of recognition practices for doctors and nurses

In Germany the authorities responsible for issuing a licence to practice medicine as a generalist or specialist doctor are the health authorities of the federal states (Approbationsbehörden). They assess the equivalence of the training received in the non-EU/EEA or Switzerland countries, to the German one. The duration of the assessment is up to 4 months after notification of receipt of the application, which happens within one month after the complete application is submitted.

If the assessment finds out that there is equivalence, full recognition is issued. On the contrary, if it finds out that there are too great differences, no recognition is provided. The intermediate case is when the assessment finds out that there are substantial differences between the two trainings (e.g. in terms of duration of training, knowledge and competences delivered and skills acquired), and when there is no relevant professional experience that could compensate for these differences. In this case, a partial recognition is issued and the applicant must sit a proficiency test. This is an oral practical examination that covers a wide range of subjects. Upon successful completion, an equivalence certificate is issued. The path is simplified if the person has already obtained a recognition of qualification from another EU MS and has professional experience in the EU. The person has to sit also a German medical language proficiency examination (at C1 level), generally administered by the state chambers of physicians. State chambers of physicians (Landesärztekammer) further recognise speciality training and specialty medical qualifications. The regulations for these vary for each state. While waiting for the recognition of equivalence, migrants can apply for an authorisation to practice a profession, which would allow them to practice for a limited period under the supervision of a person with a licence.

The recognition process for nurses is very similar to the one for generalist doctors. Relevant regional authorities are different and they do not have to sit the medical language proficiency examination.

To facilitate the recognition process, the German authorities have set up the Anerkennung-in-deutschland.de portal, targeting employers, skilled workers and professionals working in the area of recognition. Doctors and nurses are professions that appear in the website as sought-after onces.

Moreover, Germany offers a specific visa for the recognition of foreign qualifications. Migrants who have received partial qualifications and want to attend a qualification programme in Germany to compensate their skills and knowledge gaps, may apply for a specific visa, provided that they have applied for the recognition of qualification, enrolled in a programme a, have basic German language skills (A2), and can cover their living costs during their stay.

In Ireland, doctors need to be registered with the Medical Council of Ireland before being authorise to practice. The authorisation to practise is condition on passing the PRES examination. Ireland has developed visa options to facilitate international recruitment. As of 2014, Ireland allows doctors a special visa only to sit the PRES, but must leave immediately thereafter. In addition, when an interview for a job offer is scheduled, doctors may enter the country through the "Highly Skilled Job Interview Authorisation".

As of first of January 2020, in the case of a nurse or midwife, a third level degree or diploma accepted by the Nursing and Midwifery Board of Ireland (NMBI) as a sufficient qualification for registration to practice as a nurse or midwife. To be eligible to apply for registration with NMBI, non-EU applicants must hold a current registration or licence without restriction with the competent authority in the country in which they qualified or have been practising. For applicants who obtained their education more than five years prior to the date of application, they must have practiced for at least 12 months during that five-year period. Finally, they must meet the English language requirements.

In **Sweden**, doctors who want to see their qualifications recognised have two different options.

The first options is to apply for a licence through Swedish National Board of Health and Welfare.

The process takes between 2 and 4 years. First, the education is assessed, after which the migrant has to pass a proficiency test (this is a theoretical and practical tests, in Swedish), take a course on Swedish laws, undergo clinical training, and finally pay and send the application for the licence.

Alternatively, an individual can turn to a university which will assess the qualification and propose additional training, then carry out an internship (however, there are limited places available), and finally again pay and send the application for a licence. This second avenue takes between 1 and 3 years.

ENDNOTES

1 Source: https://www.cedefop.europa.eu/en/publications-and-resources/data-visualisations/skills-forecast. Note that the estimates were elaborated prior to the Covid-19 outbreak.

2 For an overview of EU MSs' health systems see https://ec.europa.eu/health/state/country_profiles_en. For an overview of EU MSs' long-term care systems see https://ec.europa.eu/social/BlobServlet?docId=20225&langId=en

3 Moreover, on the basis of the TFEU, the EU has shared competence with the MSs provided for in Articles 4 and 168 (common safety concerns in public health matters) and Articles 4, 26 and 114 (the internal market). Lastly, the Council and the European Parliament can enact legislation in the health field (Article 294 TFEU) and the Council of the EU can also adopt recommendations on public health.

4 The reviews of national health workforce planning carried out by Malgieri et al. (2015) and OECD (2013) identified that only 7 EU MSs (BE, DE, FI, FR, IE, IT, NL) have developed and implemented health workforce planning that is based on forecasting models that account for both the demand- and the supply-side factors.

5 According to Eurostat, the health-related function of LTC 'consists of a range of medical and personal care services that are consumed with the primary goal of alleviating pain and suffering and reducing or managing the deterioration in health status in patients with a degree of long-term dependency'.

6 These MSs differences are also linked to a different interpretation of what LTC activities comprise in each MS (OECD, 2020a).

7 For an overview of the fiscal sustainability of EU MSs' healthcare and LTC systems see: https://ec.europa.eu/info/publications/joint-report-health-care-and-long-term-care-systems-and-fiscal-sustainability-country-documents-2019-update_en

8 It should be stressed that categories employed in primary care vary depending on the national structure of the primary care itself.

9 For tools and assessment methodologies see: https://op.europa.eu/en/publication-detail/-/publication/82541e0b-3c6e-11e8-b5fe-01aa75ed71a1

10 The chapter draws on research activities of the Commission's Knowledge Centre on Migration and Demography

11 The chapter draws on research activities of the Commission's Knowledge Centre on Migration and Demography

12 The first two thematic contributions on AI in this chapter draw on research activities carried out in the framework of the Centre for Advanced Studies HUMAINT; the last thematic contribution of the chapter is linked to the Commission's Knowledge Centre on Migration and Demography.

13 The European Commission Report on the Impact of Demographic Change provides further insights on demographic challenges across the EU (https://ec.europa.eu/info/sites/info/files/demography_report_2020_n.pdf)

14 While in some European regions, migration can mitigate the deficit in working age population (JRC, Demographic Landscape of EU territories: Challenges and opportunities in diversely ageing regions, Chapter 3, https://publications.jrc.ec.europa.eu/repository/handle/JRC123046), the migration inflow is not sufficient to offset the phenomenon of population ageing in the EU as whole.

15 An alternative indicator to the old age dependency ratio (ODR) is the economic dependency ratio (EDR). EDR is the ratio of the number of the economically inactive population to those employed. In general, the EDR is much higher than the ODR due to low labour force participation.

16 Values estimated before the COVID-19 outbreak.

17 'Disability-free life expectancy' or also what is known as a 'healthy life expectancy' indicator combines both the mortality and morbidity of population behaviours into a single composite indicator. According to Nusselder and Looman (2004), the indicator provides information on the length and healthfulness of life, adding years to life and adding life to years.

18 The comparison is justified by the independence of the life expectancy indicators from the age structure of the population and their measurement in terms of expected years of life.

19 The Netherlands did not participate in the regular SHARE waves 6 and 7.

20 The Irish SHARE dataset has been merged with TILDA, the Irish Longitudinal Study on Ageing.

21 The question is formulated as follows: in which type of area is your home (building) located? Possible answer: a big city, the suburbs or outskirts of a big city, a large town, a small town, a rural area or village. It should be noted that EUROSTAT makes use of different criteria to classify rural and urban areas.

22 Eurostat dataset [hlth_cd_asdr2].

23 For example, 'the total cost of cancer was €199 billion in Europe (EU-27 plus Iceland, Norway, Switzerland, and the United Kingdom) in 2018. Total costs ranged from €160 per capita in Romania to €578 in Switzerland [...] Health expenditure on cancer care were €103 billion, of which €32 billion were spent on cancer drugs. Informal care costs were €26 billion. The total productivity loss was €70 billion, composed of €50 billion from premature mortality and €20 billion from morbidity' (Hofmarcher, et al., 2020, p. 41).

24 Based on SHARE data, in Germany, the largest proportion of the older population lives in rural or big cities-suburbs areas (40% and 25% respectively) against a smaller proportion (35%) residing in small and large towns. In Italy, the sample population is shared more equally by area: 46% live in small and large towns and 54% in big cities-suburbs and rural areas. Lastly, in Romania, the elderly population mostly resides in rural areas (72%).

25 As visible by a large confidence interval for the large towns, the related probability should be interpreted considering the higher variability and limited representativeness in the sample of people living in this area.

26 https://www.who.int/ageing/long-term-care/en/

27 The index is based on the following questions in the survey: the respondent has difficulties walking 100 metres, walking across a room, climbing several flights of stairs and climbing one flight of stairs. The index ranges from 0 to 3, where the value 0 corresponds to 'no problem' or 'good functional abilities' and the value 3 attest that the respondent 'has serious functional limitations in moving'.

28 The variable includes hospital admissions due to surgery, medical tests, non-surgical treatments and mental health problems. Hospital admissions do not therefore include stays in long-term care facilities or in nursing homes.

29 Due to the declining fertility and more individualistic models of society, elderly people are less likely to live with close family members, or to have children to rely on (McGarry & Schoeni, 2000). This may result in a relatively larger proportion of the elderly population living alone, especially in Western European countries (Reher & Requena, 2018). Elderly people living alone are likely to experience loneliness and social isolation, especially when living in rural areas where they risk being more geographically isolated and have greater difficulties accessing healthcare and LTC services.

30 Although additional work is required to untangle differences between the EU MSs, a possible interpretation may derive from the larger household structure in southern European countries, where adults – more often children than in the northern countries – cohabit with their elderly kinsperson (Silverstein & Giarrusso, 2010).

31 Eurostat [demo_mexrt]

32 The information and views set out in this report are those of the authors and do not necessary state or reflect the official opinion of the European Centre for Disease Prevention and Control (ECDC). Neither the European Union institutions and bodies nor any person acting on their behalf may be held responsible for their use, which may consist of the information contained therein. The accuracy of the authors' statistical analysis and the findings they report are not the responsibility of ECDC. ECDC is not responsible for conclusions or opinions drawn from the data provided. ECDC is not responsible for the correctness of the data and for data management, data merging and data collation after provision of the data. ECDC shall not be held liable for improper or incorrect use of the data.

33 Other conditions may refer to reducing the patient's exposure to the risk of infections in the hospital by being assisted at home.

34 Eurostat Dataset [hlth_silc_21].

35 Only data referring to the evolution of the stock of foreign-born workers in the period 2011-2018, does not include Germany for which there is no information on the country of birth of the workers prior to 2017.

36 These figures do not include Spain (3,192 in 2011), Latvia (5 to 15 from 2014 to 2018), Malta (20 to 46 from 2014 to 2017) Portugal (328 in 2017), Greece (77 to 167 from 2012 to 2017) and Finland (272 to 381 from 2010 to 2012).

37 For an overview of health policies, see Chapter 1 and Box I.1 in the Annex.

38 European Commission, Annexes to the Impact Assessment Report accompanying the document Proposal for a Directive of the European Parliament and the Council on the conditions of entry and residence of third-country nationals for the purposes of highly skilled employment, Part 5/6, SWD(2016) 193 final.

39 Conventionally, we use the definition of highly skilled persons as individuals holding at least a university degree at BA level; medium-skilled persons as those holding an upper secondary VET qualification; and low- skilled as those having a lower secondary qualification or less, according to the ISCED 2011 classification.

40 In Germany there are no labour migration channels for those with a qualification below the vocational training level.

41 Available here: https://dbei.gov.ie/en/What-We-Do/Workplace-and-Skills/Employment-Permits/Employment-Permit-Eligibility/Highly-Skilled-Eligible-Occupations-List/, list effective as of 1 January 2020, visited on 28 August 2020.

42 Available here: https://dbei.gov.ie/en/What-We-Do/Workplace-and-Skills/Employment-Permits/Employment-Permit-Eligibility/Ineligible-Categories-of-Employment/, list effective as of 1 January 2020, visited on 28 August 2020.

43 Volunteers, researchers, EU Blue Card holders, intra-corporate transferees.

44 Intra-corporate transfers (different from EU ones), university lecturers and professors, translators and interpreters, domestic aides with pre-existing working relationships abroad, trainees, maritime workers, artists and athletes, foreign correspondents, au pairs, Article 27 of Testo Unico (Immigration Act 286/98).

45 The sub-category of nurses was introduced in the early 2000s to face the shortages and establish a more flexible admission.

46 According to Eurostat data, only 38 EU Blue Cards were issued for health professionals in the EU in 2018. Many MSs, including Germany, do not report data to this level of disaggregation, even if Eurostat reports '0'.

47 On intra-corporate transfers: there are currently 0 permits for the category 'human health', but overall, numbers for the implementation of the Directive are rather low and many Member States did not report the relevant economic activity for which permits are issued. On seasonal worker permits: Spain is the only reporting country to issue seasonal workers for 'human health and social work activities' (144 in 2018).

48 Health is defined as category 72 of ISCED 1997, including: health broad programmes, medicine, nursing and caring, dental studies, medical diagnostic and treatment technology, therapy and rehabilitation, pharmacy.

49 Other relevant sectors where illegal employment is relevant are agriculture, construction, manufacturing, hospitality and food and services (EMN, 2017).

50 For instance, the REGINE report informs that the only countries which did not run any regularisation programmes are: AT, BG, CY, CZ, EE, FI, MT, RO, SI, SK.

51 https://www1.interno.gov.it/mininterno/export/sites/default/it/sezioni/sala_stampa/speciali/emersione_irregolare_2012/dati_domade_ricevute.html

52 Ministry of Interior (2020), Emersione dei rapport di lavoro, https://www.interno.gov.it/sites/default/files/2020-08/dlci_-_analisi_dati_emersione_15082020_ore_24.pdf

53 Ministry of Interior (2020), Emersione dei rapport di lavoro, https://www.interno.gov.it/sites/default/files/2020-08/dlci_-_analisi_dati_emersione_15082020_ore_24.pdf

54 See for instance information collected in the Regulated profession database, available at https://ec.europa.eu/growth/tools-databases/regprof/index.cfm

55 https://www.hse.ie/eng/services/news/media/pressrel/hse-signs-collaboration-agreement-with-federal-ministry-for-health-sudan.html

56 https://www.bundesgesundheitsministerium.de/konzertierte-aktion-pflege.html

57 https://philippinen.ahk.de/en/initiatives/defa-german-agency-for-health-care-professionals

58 https://philippinen.ahk.de/en/initiatives/defa-german-agency-for-health-care-professionals

59 http://www.poea.gov.ph/twp/files/Triple%20Win%20Philipinen.pdf

60 https://www.giz.de/en/worldwide/41533.html; https://www.who.int/hrh/migration/B-Triple-Win.pdf?ua=1

61 Defined as 'the capacity to maintain health workers in the health care system, limiting unjustified losses to other organisations, sectors or geographical areas, within and out of the country' (EU, 2015).

62 Note that the variable indicates the place of residence and, therefore, it is not possible to derive information on the place of work.

63 Data do not allow a distinction between dependent and independent self-employment with or without employees.

64 According to the ISCO-08 classification, 'Health care assistants provide assistance, support and direct personal care to patients and residents in a variety of institutional settings such as hospitals, clinics, nursing homes and aged care facilities. They generally work in support of health professionals or associate professionals'.

65 According to ISCO-08, 'Home-based personal care workers provide routine personal care, such as bathing, dressing, or grooming, to elderly, convalescent, or disabled persons in their own homes or in an independent residential care facility' (ILO, 2012).

66 The overall turnover rate for all ISCO-08 occupations was 10.5% in 2018.

67 This finding for the EU-27 is largely in line with a higher turnover trend within the migrant health workforce found also in the US health sector (Frogner, 2018).

68 This finding for the EU-27 is largely in line with a higher turnover trend within the migrant health workforce found also in the US health sector (Frogner, 2018).

69 CORDIS, 'AI-controlled checks to boost security and speed up traffic at EU borders', Phys.org,2019. https://phys.org/news/2019-01-ai-controlled-boost-traffic-eu-borders.html (accessed 26 June 2020).

70 https://www.youtube.com/watch?v=2HMPRXstSvQ&t=29s

71 https://www.economist.com/leaders/2018/06/07/ai-radiology-and-the-future-of-work

72 For details on the framework, see Tolan et al. (2020).

73 Occupational group definitions from: https://www.ilo.org/public/english/bureau/stat/isco/docs/groupdefn08.pdf

74 Some analyses report a growing awareness of telemedicine and increased patient satisfaction with video visits during the Covid pandemic (Ramaswamy et al., 2020; Zahoor et al., 2020).

75 https://ec.europa.eu/eurostat/web/products-eurostat-news/-/DDN-20200414-2

76 See resolution WHA58.28 (2005) on eHealth.

77 The 'digital divide' is defined by Eurostat as the distinction between those who have access to the internet and are able to use it and those who are excluded from these services. The term specifically includes access to ICT and the skills needed to participate in the information society. The digital divide is classified according to gender, age, education, income, social groups or geographical location.

78 We follow the DEGURBA classification used by EU-SILC which divides the areas into three categories (densely populated, intermediate and thinly populated). More precisely, a densely populated area is defined as contiguous grid cells of 1 km2 with a density of at least 1,500 inhabitants per km2 and a minimum population of 50,000 inhabitants; an intermediate area refers to contiguous grid cells groups of 1 km2 with a density of at least 300 inhabitants per km2 and a minimum population of 5,000 inhabitants; thinly populated areas are grid cells outside urban agglomerations.

79 For a comprehensive overview of Commission's actions in all domains of health system, see: https://ec.europa.eu/info/live-work-travel-eu/health/coronavirus-response/public-health_en

80 The information and views set out in this report are those of the authors and do not necessary state or reflect the official opinion of the European Centre for Disease Prevention and Control (ECDC). Neither the European Union institutions and bodies nor any person acting on their behalf may be held responsible for the use, which may be made of the information contained therein. The accuracy of the authors' statistical analysis and the findings they report are not the responsibility of ECDC. ECDC is not responsible for conclusions or opinions drawn from the data provided. ECDC is not responsible for the correctness of the data and for data management, data merging and data collation after provision of the data. ECDC shall not be held liable for improper or incorrect use of the data.

81 Directive 2005/71/EC of 12 October 2005 on a specific procedure for admitting third-country nationals for the purposes of scientific research; and Directive 2004/114 of 13 December 2004 on the conditions of admission of third-country nationals for the purposes of studies, pupil exchange, unremunerated training or voluntary service.

82 Moreover, for selected professions in the Critical Skill Employment Permit, lower salary threshold; immediate family reunification for Critical Skill Employment Permit holders.

83 Specific professions in the category of: Health Professionals; Health and Social Services Managers and Directors; Nursing and Midwifery Professionals; Therapy Professionals; Health Associate Professionals; Natural and Social Science Professionals (including, inter alia, Medical laboratory scientists).

84 Specific professions in the category of: Managers in Health and Care Services, Therapy Professional, Health Associate Professionals, Caring Personal Services.

85 Specialist Pharmacist; Optometrist; Dietician and Nutritionist; Physiotherapist; Heath Visitor; Ambulance Officer; Nurse (relating to persons with tertiary education); Obstetrician (relating to persons with tertiary education.

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