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Health workforce: A global supply chain approach

New data on the employment effects of health economies in 185 countries

Xenia Scheil-Adlung

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The editor of the series is the Director of the Social Protection Department, ILO. For more information on the series, or to submit a paper, please contact:

Isabel Ortiz, Director Social Protection Department
International Labour Organization
4, route des Morillons
CH-1211 Geneva 22 (Switzerland)
Tel.: +41.22.799.62.26 Fax:+41.22.799.79.62
email: ortizi@ilo.org

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Foreword

Moving towards Universal Health Coverage (UHC) in the context of the Sustainable Development Goals (SDGs) requires a sufficient number of workers producing and delivering health care such as doctors and nurses but also workers in other occupations, e.g. those concerned with administration or maintaining health facilities. However, currently there is a significant workforce shortage which is expected to increase given the demographic aging of the population. As a result, in most countries large numbers of unpaid "care workers", often women, are indispensable to fill in for the shortages, and provide care, for example to older family members.

Filling the workforce gaps provides the opportunity to achieve better health outcomes and generate millions of jobs. The jobs required for activities within and across countries to produce goods and services needed are part of the national health economies and global health protection supply chains. Investing in related employment will create significant multiplier employment effects for skilled and unskilled workers within and beyond the health sector and contribute to inclusive and sustainable economic growth.

However, for the time being, these important economic impacts of investing in health protection are largely ignored and returns of investments in UHC in terms of employment have not been sufficiently assessed. Against this background, this paper provides for the first time global estimates on the total employment potential of workers in health and non-health occupations employed in the health economies of 185 countries.

Creating the needed jobs and combining them with decent salaries, social protection and rights at work, will generate important returns of investments specifically in countries with large health coverage deficits and informal labour markets. Further, huge gains of investments can be expected from revealing the economic potential of female workers which withdrew from the labour market to provide care to family members in the absence of skilled health workers. Thus, investments in health protection can be considered as a sustainable domestic source of employment that creates inclusive economic growth.

This paper expands on ILO's work for the United Nations High-Level Commission on Health Employment and Economic Growth announced by the UN Secretary General in March 2016, co-chaired by the President of France and the President of South Africa and vice-chaired by the Director General of the WHO and ILO as well as the Secretary General of the OECD.

Isabel Ortiz
Director
Social Protection Department
International Labour Office

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Abbreviations and acronyms

AAAQ	availability, accessibility, acceptability and quality (criteria)
ADB	Asian Development Bank
ADL	activities of daily living like bathing, eating etc.
BRIICS	Brazil, Russian Federation, India, Indonesia, China, South Africa
COMEEHG	High Level Commission on Health Employment and Economic Growth
DHS	Demographic and Health Surveys
EU	European Union
EHCP	essential health care package
FD	financial deficit
GDP	gross domestic product
HC	head count (of numbers of LTC workers)
HO	(workers in) health occupations
HIC	high-income country
FTE	hull-time equivalent (of numbers of LTC workers)
GFATM	Global Fund to Fight AIDS
GHWA	Global Health Workforce Alliance
GHO	The WHO Global Health Observatory database
HDI	Human Development Index
HPI	Human Poverty Index
HRH	Human Resource for Health
ILO	International labour Organization/ Office
IMF	International Monetary Fund
ISSA	International Social Security Association
ISSR	International Social Security Review
LC	legal coverage
LTC	long-term care
MDG	Millennium Development Goals
MMR	maternal mortality ratio
MOH	Ministry of Health
NGO	non-governmental organization
NHA	national health accounts
NHO	(workers in) non-health occupations
OECD	Organisation for Economic Co-operation and Development
OOP	out-of-pocket payments
PPP	purchasing power parity
R202	ILO Social Protection Floors Recommendation, 2012 (No. 202)
SAD	staff access deficit

SDGs	Sustainable Development Goals
SPFs	social protection floors
UHC	universal health coverage
UDHR	Universal Declaration of Human Rights, 1948
UN	United Nations
WB	World Bank
WHO	World Health Organization
WSPR	World Social Protection Report

Acknowledgements

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Further, the ILO is grateful for the very helpful comments received during intensive exchanges, discussions of the data development and assessment in the context of numerous meetings of the experts appointed to the ComHEEG. In particular, we would like to express thanks to Richard Horton, The Lancet; Philippe Aghion, Harvard University; Edson C. Araujo, The World Bank; Haroon Bhorat, University of Cape Town; Saskia Bruysten, Yunus Social Business; Alicia Ely Yamin, Harvard University; Claudia Jacinto, National Council of Scientific Research, Argentina; Barbara McPake, University of Melbourne; Ritva Reinikka, The World Bank; K. Srinath Reddy, Public Health Foundation, India; Jean-Olivier Schmidt, GIZ Competence Center for Health, Social Protection and Inclusion; Lina Song, University of Nottingham; Lawrence H. Summers, Harvard University; Sylvia Trent-Adams, US Public Health Service; Viroj Tangcharoensathien, International Health Policy Program Foundation, Thailand and David Weakliam, Health Service Executive, Ireland.

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Key messages

- This paper provides evidence that investments in health protection not only impact on the achievement of health objectives, but also create an important source of employment across numerous economic sectors by presenting for the first time data on:

  (i) current number of workers in the entire global health protection supply chains involving the health economies of 185 countries;

  (ii) employment potential created by addressing health workforce shortages and producing universal health coverage (UHC);

  (iii) ratio of jobs in health and non-health occupations needed to achieve health objectives;

  (iv) number of decent jobs required to allow family care workers filling in for workforce shortages to remain in the labour market.

  Against this background the paper calls for significantly increasing investments in decent jobs for the production of UHC, sustainable development and inclusive growth.

- Currently, many countries experience a lack of investments in health protection resulting in critical health workforce shortages of millions of jobs. The shortages are expected to increase in future given global demographic ageing and progress towards UHC by 2030 and jeopardize inclusive economic growth and full employment. They impact on health outcomes and global health security as observed in the case of Ebola: Currently due to the absence of health workers, 84 per cent of the population in low income countries is excluded from access to health care and more than half of the population in lower middle income countries. Particularly concerned are older persons and women: In the absence of skilled workers, more than 50 per cent of the global older populations remain without long-term care (LTC). As a result, large numbers of women give up employment to provide LTC to family members. This care involves high economic costs both for families and societies at large.

- Addressing the shortages necessitates a comprehensive assessment of national health economies and global health protection supply chains taking into account that health employment is not limited to jobs in health occupations, the public service or a single economic "health" sector. Thus, in this study we identify the number of all workers contributing to the production of health protection, regardless of their occupation and employment status in the public or private sector, including the unpaid health workforce providing informal care.

- Applying this approach we find that currently health employment in 185 countries amounts to jobs for 234 million workers. At regional level, the current size of health employment amounts to 14 million jobs in the health economies of Africa; 44 million in the Americas; 5 million in the Arab States; 109 million in Asia and the Pacific and 62 million in Europe and Central Asia.

- Health care is globally produced by large numbers of unpaid women and non-medical workers: Global health protection supply chains consist of a more important size of employment in non-health occupations than in health occupations: We find 106 million jobs for workers in non-health occupations, such as unskilled workers maintaining facilities, or cleaning bed linen, as compared to 71 million jobs for workers in health occupations, e.g. nurses. In addition, we observe 57 million unpaid workers in non-

health occupations – mostly female workers which gave up formal employment to provide care to older family members in the absence of health workers. Thus, the hidden workforce in non-health occupations needed to achieve health objectives constitutes of more than 60 per cent of all paid workers employed in health economies and amounts to 70 per cent of all paid and unpaid workers.

- The supply chain data suggest that economic returns of investments in UHC have an important potential to boost economic growth. Adequate investments will yield high impacts on job creation, including jobs in the broader economy for low paid and unskilled workers in non-health occupations:
  - Each investment in the creation of one job in health occupation such as a physician has the potential to result in the creation of 2.3 jobs for workers in non-health occupations in the broader health economy.
  - This ratio amounts to 3.42 in low income countries and 2.42 in high income countries. The more important employment effects in low income countries compared to high income countries are due to the higher shortage of workers in health occupations. If considering only paid workers in health and non-health occupations we find that globally each job requiring a health occupation is creating 1.5 paid jobs for workers in non-health occupations, 1.26 in low income countries and 1.67 in high income countries.
- The data reveal that jobs in national health economies play an important role in achieving full employment, particularly due to the significant multiplier employment effects of investments in health protection and the role of workers in non-health occupations supporting medical workers in achieving health objectives. The important contribution of multiplier employment effects and jobs in non-health occupations to employment and economic growth was largely overlooked in the past and led to foregone economic growth.
- Many global supply chain workers have jobs with low wages and lack decent working conditions in the public and the private sector, both within and beyond the health sector. Working conditions often do not respect human rights, including labour rights, social protection coverage, occupational safety and participatory processes through social dialogue.
- The current shortfall of the health workforce creates an employment potential and is estimated at globally 50 million paid workers in health and non-health occupations in the global health protection supply chain.
- The shortages are not equitably distributed around the world: Shortages of paid workers concern 96 countries out of the 185 assessed. In 89 countries 18.3 million workers in health occupations are missing and in 95 countries 31.8 million paid workers in non-health occupations are missing. When including shortages currently filled in by unpaid family workers this figure amounts to 38 million workers.
- Addressing the current shortages involves a high employment potential in the most affected lower-middle and low-income countries of Africa and Asia and the Pacific: 91 per cent of the missing employment is observed in in lower-middle and low-income countries and 58 per cent of jobs are needed in Asia and the Pacific, which reflects the fact that this region contains the most populous countries in the world. However, in relation to population size, the shortages in Africa are the most severe.
- The future workforce shortages will be driven by demographic growth. By 2030 the shortfall is estimated at an additional employment potential of about 82 million

workers. The number of needed jobs in low and middle income countries alone the amount to additional jobs for 75 million workers including 24 million workers in health occupations and 51 million paid and unpaid workers in non-health occupations. The majority of the employment potential by 2030 will be in Asia, where 43 million additional jobs will be required and in Africa, where 32 million jobs will need to be created.

- Addressing the shortages and creating inclusive and sustainable economic growth based on health economy employment will require:
  - Focusing on adequate investments in UHC to create demand and generate funding for needed jobs through enabling macroeconomic frameworks providing for fiscal space. This involves applying core principles of social protection in health ensuring equity in access to quality care and solidarity in financing.
  - Providing decent working conditions to all supply chain workers, including adequate salaries.
  - Transforming unpaid work linked to withdrawals from the labour market due to workforce shortages into paid jobs to accelerate inclusive and sustainable growth and reduce gender issues.
  - Considering that creating jobs in low and middle income countries and particularly in rural areas of Africa and Asia will maximise the returns of investments.
  - Acknowledging that migration of health workers will continue to increase given the mutual benefits for individuals, source and destination countries and should be regulated based on related ILO Conventions and Recommendations to compensate negative impacts.

I. The issue: Insufficient investments in health protection result in severe health workforce shortages undermining the SDGs, full employment and inclusive economic growth

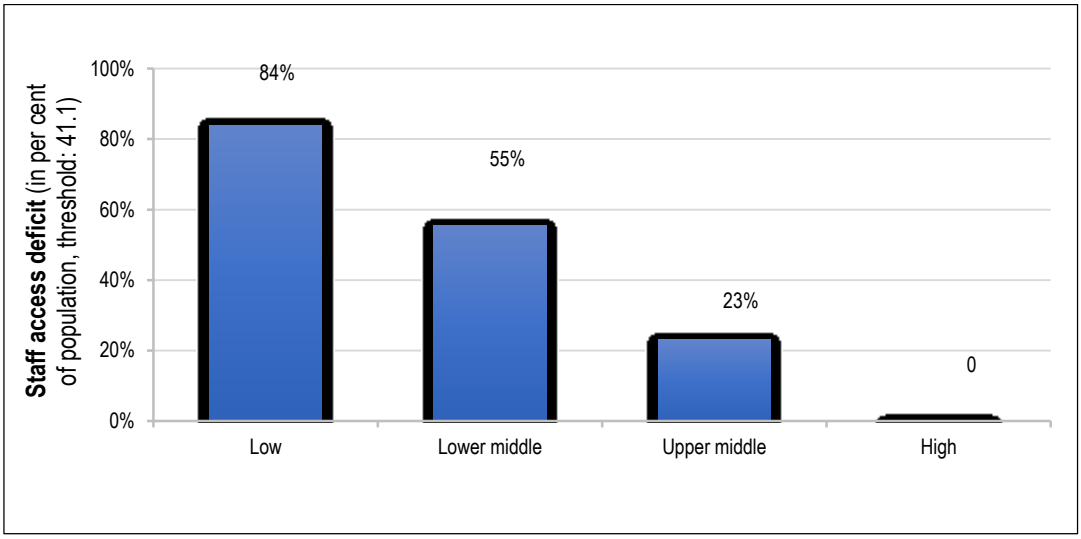
Globally, severe health workforce shortages undermine the objective of achieving universal health coverage (UHC) and thus progress towards the Sustainable Development Goals (SDG), particularly SDG 1, 3, and 8 focusing on social protection, good health, decent work and economic growth (ILO, 2014; WHO, 2016). The shortages observed result from insufficient investments in health protection. They impact negatively on both the health status of populations and the economy at large. This is due to the fact that:

– in the absence of an adequate number of health workers morbidity and mortality rates rise and thus the potential for a healthier and more productive workforce as well as increased labour supply is not realized;

– using the full employment potential of the jobs missing towards UHC will produce economic growth that is currently foregone.

Presently, as much as 84 per cent of the total population in low income countries is excluded from access to health care because of missing investments in jobs for health workers which are needed to deliver essential services. In lower-middle income countries related deficits result in access gaps for more than half of the total population (Figure 1).

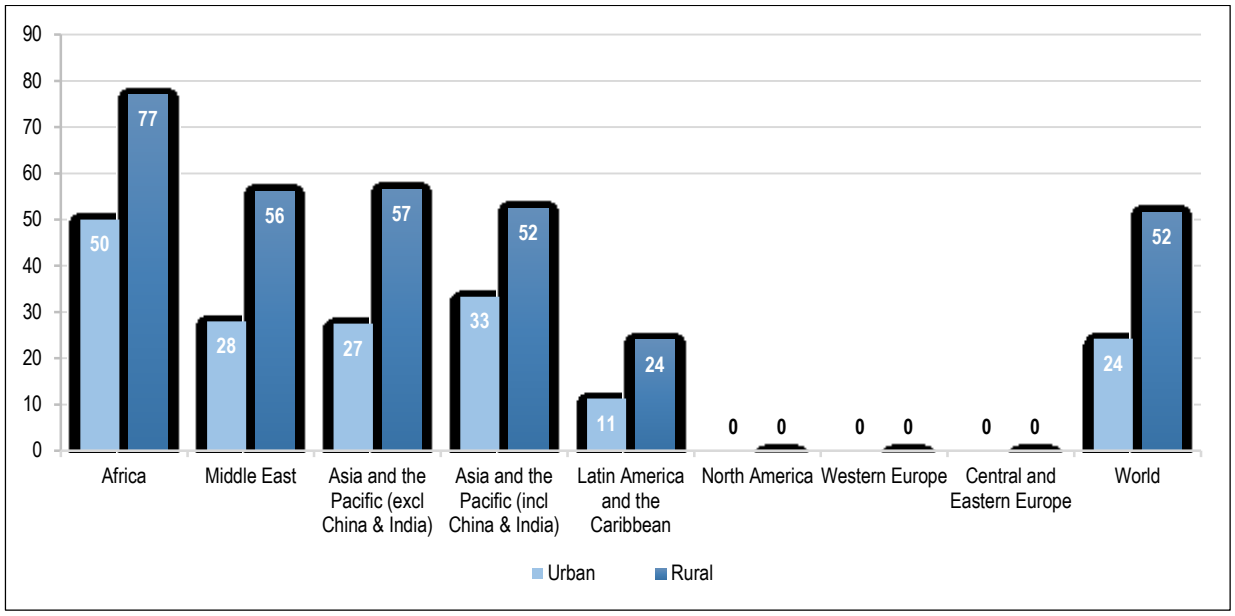
Figure 1. Exclusion from health care due to workforce shortages in the health sector
(ILO Staff Access Deficit Indicator by income-level of countries in per cent of population, 2014)



Source: Scheil-Adlung *et al.*, Health sector employment: a tracer indicator for universal health coverage in national Social Protection Floors, in: *Human Resources for Health 2015*, 13:66 available from: http://www.human-resources-health.com/content/13/1/66.

The global population living in rural areas suffers most significantly from access gaps: The absence of the health workers in rural areas results in the exclusion of 52 per cent of the global rural population as compared to 24 per cent of the global urban population (Figure 2).

Figure 2. Rural/urban populations excluded from health care due to workforce shortages in the health sector (ILO Staff Access Deficit Indicator in per cent of population, 2014)



Source: X. Scheil-Adlung (ed.): *Global evidence on inequities in rural health protection – new data on rural deficits in health coverage for 174 countries*, International Labour Organization, Geneva, 2015. Available from: http://www.social-protection.org/gimi/gess/RessourcePDF.action?ressource.ressourceId=51297.

Also older persons are importantly concerned by workforce shortages: ILO estimates that globally more than 50 per cent of older persons do not have access to needed long-term care (LTC) services given the absence of the required workforce (Scheil-Adlung, 2015a). Due to these shortages, the majority of older persons in the world in need of LTC receive services from family members filling the gaps in the health and social care workforce. Thus, a large part of the care work is provided by unpaid, often female workers who are fully or partly pulled out of the labour market to provide LTC to relatives. In the absence of their contribution to the economy, significant impacts on the economy – particularly foregone economic growth – can be assumed. Thus, family care cannot be considered as a "free service" without a cost to the economy as often assumed.

The negative externalities of excluding large parts of the populations from access to quality care have significant impacts on the economic development in the countries concerned. It is estimated that in the years 2000 to 2011 about 24 per cent of global economic growth resulted from years gained due to better health. [1] This percentage does not include effects related to increased wealth due to better health [2] and reductions in inequities and global disparities that also contribute to economic growth.

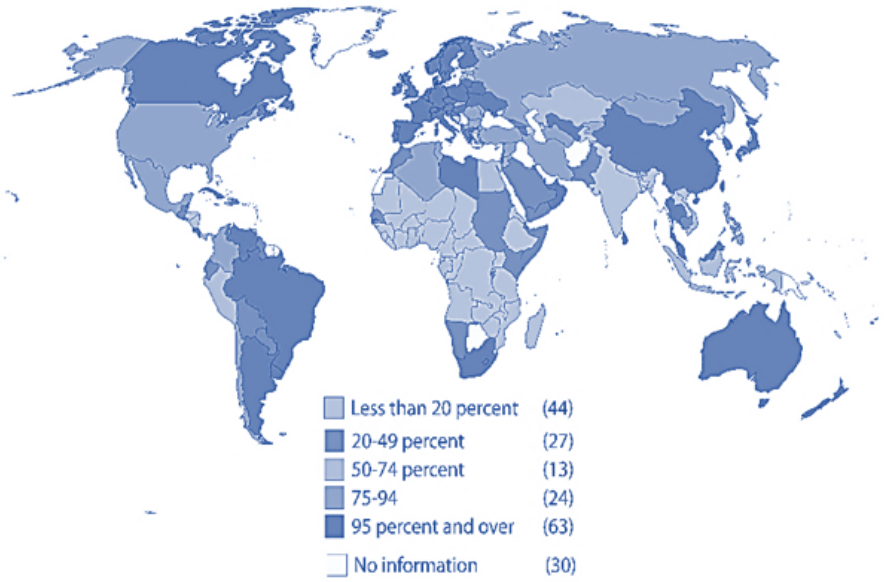
The highest employment potential and economic growth will derive from investments in UHC and related jobs in countries that currently have low health protection coverage rates, significant health workforce shortages and high unemployment rates. This is particularly the case in countries of Africa and Asia (Figures 3 and 4), where health workforce shortages and

[1] The Lancet Commission, Global health 2035: a world converging within a generation. The Lancet. 2013; 382(9908): 1898-1955. Available from: http://www.thelancet.com/commissions/global-health-2035.

[2] D. Blum, D. Cunning: Population Health and Economic Growth, Commission on Growth and Development, Working Paper No. 24, World Bank, Washington, D.C., 2008. Available from http://siteresources.worldbank.org/EXTPREMNET/Resources/489960-1338997241035/Growth_Commission_Working_Paper_24_Population_Health_Economic_Growth.pdf.

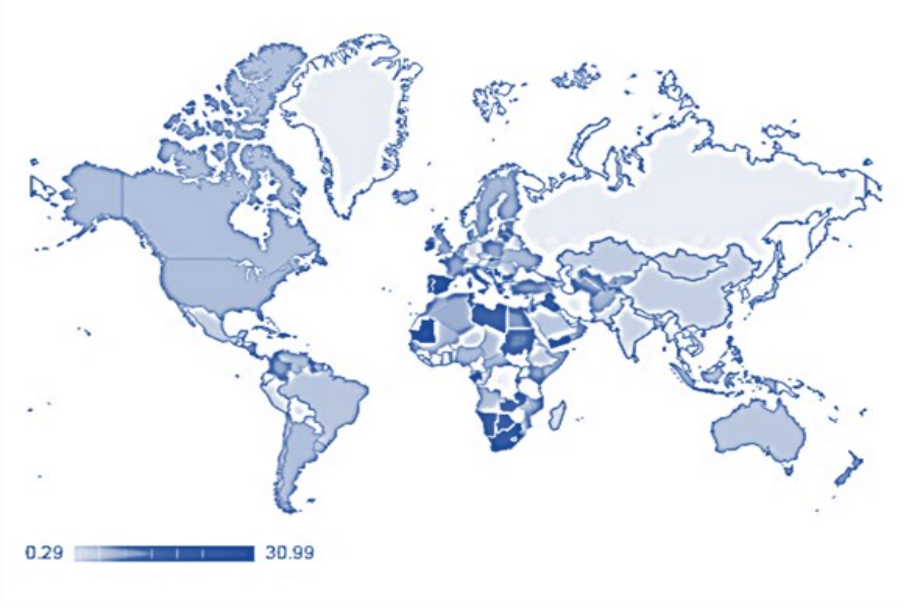
coverage rates are among the globally lowest - including countries where more than 80 per cent of the population are without health protection coverage and have no access to health workers and unemployment rates are above 30 percent such as in Mauritania.

Figure 3. **Global health protection coverage rates** (proportion of population affiliated to national health services, social, private or micro-insurance schemes in per cent of population, population weighted, latest available year)



Source: ILO, 2014-15.

Figure 4. **Global unemployment rates** (2013 or latest available year, in per cent employment, latest available year)



Source: ILO, 2014.

Against this background, the UN Secretary General has appointed the *High Level Commission on Health Employment and Economic Growth* (United Nations, 2016) to address related inequities in access to health care and stimulate the creation of health and

social sector jobs for inclusive economic growth. This study [3] expands on background studies and policy briefs developed for the Commission's work. It aims to assess the employment potential of investing in health protection.

The paper provides a comprehensive evaluation of the total employment contributing to the achievement of health objectives taking into account that:

- Employment in the production process of health protection spans apart from the health sector to numerous economic sectors and occurs within and across countries. Thus, related employment should be estimated in broader national health economies and global health protection supply chains rather than in the single health sector.

- The production of health protection requires jobs in a broad range of occupations that reach far beyond health occupations.

- The supply of health protection is currently largely based on a care provider model that assumes the delivery of "free services" from an unpaid workforce consisting mostly of female family workers, e.g. providing informal long-term care to older relatives. However, these workers are often fully or partly pulled out of the labour market and thus left their jobs to "fill" missing jobs of the health workforce. This produces significant economic costs and results in foregone growth.

Currently, such a broader viewpoint is hardly taken in the existing literature, research and policy debates and related data at global, regional and national level are not available. Rather than covering the health economy including its public and private sectors, most analyses focus on the narrow health sector or limited public service coverage only. As a result, multiplier employment effects and related returns of investments in UHC created in other economic sectors are overlooked. Further, often reference is made to fragmented data limited to "expenditures" and civil service employment**.** In such approaches the employment potential and economic growth as well as decent working conditions of supply chain workers remain in the dark and social upgrading of jobs, e.g. by providing rights at work and social protection, can hardly be addressed. Further, the lack of data negatively impacts on countries' ability to distribute investments efficiently and devise evidence-based employment policies.

This paper focuses particularly on estimating:

– the current number of jobs for workers in health and non-health occupations that are contributing to attaining health objectives in the health economies of 185 countries;

– the employment potential for workers in global health protection supply chains producing UHC by 2030 in the context of the SDGs 1, 3 and 8.

Further, the paper provides policy options for investments in UHC addressing workforce shortages including challenges of the care production by unpaid family workers.

[3] The author expands particularly on research (X. Scheil-Adlung and A. Nove, 2016, and X. Scheil-Adlung, 2016) carried out in the context of the *High level UN Commission on Health Employment and Economic Growth* (United Nations, 2016).

II. Health employment and the economy: Which jobs and economic sectors contribute to producing health care in national health economies?

Health care goods and services are produced by a workforce that is employed in numerous economic sectors, be they public, private or voluntary: the health economy. It consists of the health sector itself and other service sectors and industries, such as:

- administration;
- information technology;
- cleaning;
- agriculture;
- food;
- transportation;
- retail;
- wholesale;
- research.

Employment in the health economy can best be assessed by focusing on the production and trade of health care in health protection supply chains as they allow an analysis of the impact of interactions of suppliers of health care and related funding. Health protection supply chains refer to various activities within or across countries that are required to produce and provide goods and services for health objectives such as UHC within the health sector and beyond. These activities range from services to supplying and transforming raw materials such as those used for medicines into final products through various phases of development, production, distribution and delivery. [4] Public and private institutions as well as enterprises involved in the various stages are linked to each other through the supply chain.

Health protection supply chains are affected by labour issues, workforce development and gender issues. Thus, investing in UHC and related health protection supply chains adds to both economic development and to broader socioeconomic values.

[4] This refers to the ILO definition (ILO, 2016a).

The activities performed in health protection supply chains require workers with different educational [5] backgrounds and a broad range of skills in:

(1) health occupations (HO), such as physicians, nurses and laboratory assistants; and

(2) non-health occupations (NHO), such as administrators, IT specialists and workers in cleaning jobs or truck drivers delivering pharmaceuticals.

Both groups together form the workforce of the health economy which is as critical as the workforce in other economic sectors for the production of quality care. Achieving health objectives will not be possible for HOs without the support of NHO workers: An adequate number of both HO and NHO workers working towards attaining health objectives and thus funded by health expenditure is essential, for example to register patients, provide social and long-term care (LTC) services, ensuring clean and sanitized lab coats, producing and packaging medicines, operating computers, delivering financial and legal advice, moving goods such as food in the production line and producing finished products.

Employment in health protection supply chains involves standard and non-standard forms, formal and informal, paid and unpaid work. Non-standard forms of employment, often informal employment, are characterised by high disparities in terms of working conditions, such as rights, working times, and wages e.g. for the large group of workers that are providing unpaid work and informal care such as daughters delivering LTC to their parents, or migrant workers. Their work is unpaid, physically and mentally demanding and carried out irrespective of national regulations on working time, vacation, occupational safety and health. Even if compensated by in kind or cash benefits, family workers risk poverty and ill health at later stages of their life and thereby increase the economic costs of family care.

Based on ILO estimates the group of family members delivering LTC services to their older relatives is estimated to provide as much as 90 per cent of all care work, in low and middle-income countries estimates are even higher due to the nearly complete absence of LTC workers in these countries. Frequently, they step in for the extreme shortages of skilled LTC workers that are estimated at 13.6 million globally (Scheil-Adlung, 2015a).

Often, the LTC work of family members is perceived as “free” without a cost to the economy serving as an argument not to create adequate numbers of jobs for skilled LTC workers in the public sector. Further, these workers are generally not considered when assessing labour market effects of UHC and health sector employment. However, many family workers are pulled out of the formal labour market to provide informally LTC for older persons as they give up or reduce formal employment or retire early. As a result, they are not available to contribute to the economy. Accepting the lack of formal LTC workers as normal fails to recognize the potential for physical and mental improvements possible by providing quality services of skilled workers. Further, this viewpoint ignores the potential of economic growth possible by creating a sufficient number of LTC jobs. In addition, informal care giving has negative consequences for economic growth as the workers are not paying taxes and contributions to social protection systems and schemes.

Table 1 provides a rough typology of the workforce employed in the health protection supply chains covering skilled and unskilled as well as public, private and voluntary workers employed in numerous economic sectors.

[5] The International Standard Classification of Education (ISCED), International Standard Classification of Occupations (ISCO) and the International Standard Industrial Classifications (ISIC) define the categorization based on fields of education and training, the occupations, and the industries in which they work.

Table 1. Typology of the workforce employed in health protection supply chains

National health economies (including public, private and voluntary sectors)	**Global health protection supply chains producing health care and UHC**				
	Formal workers		**Informal workers**		
	Paid		**Paid**		**Unpaid**
	In health occupations	**In non-health occupations**	**In health occupations**	**In non-health occupations**	
	Examples				
1. Health and social care sector	*Nurses* *Medical doctors* *Laboratory assistants*	*Directly employed or contracted workers providing services in occupations related to e.g.:* – *cleaning* – *insurance* – *finance* – *IT* – *transport*	*Irregular migrants working as nurses*	*Informal workers providing cleaning services*	*Family members providing long-term care services to relatives*
2. Other economic sectors and industries, e.g.: – Agriculture – Food – Cleaning – Administration – Transportation – Retail – Wholesale – Research					

Source: Author.

III. What is the current size of employment in global and regional health protection supply chains?

Today's production and distribution of health care is characterised by large gaps in the size of the health workforce in health and non-health occupations as observed in access deficits for large parts of the global population. These shortages are not equally distributed across the world. This often results in negative implications for the population, particularly in low and middle income countries: exclusion from and inequities in access to health care contributing to loss of health and social gains including social cohesion. (ILO, 2014-15).

Filling the current workforce gaps has the potential to stimulate additional – so far forgone – economic growth as it can be assumed that:

(1) each additionally employed worker supporting the attainment of health objectives will contribute to GDP growth and economic development. However, a precondition for inclusive growth relates to quality products and services that require jobs with decent working conditions, such as adequate wages as highlighted in SDG 8 on the promotion of economic growth and decent work;

(2) multiplier employment effects in numerous economic sectors beyond the health sector will occur as employment is generated in the health protection supply chain to produce goods and services to the health sector. When the incomes generated from these jobs are spent and re-spent on a variety of items in the broader economy (e.g. food and clothing), further employment effects will occur. Also taxes and contributions paid from these incomes will increase the countries' tax bases and social protection schemes and systems.

Given the extreme workforce shortages in rural areas that frequently consist of informal economies, additional employment will reveal opportunities for rural development, growing formal labour markets and increased formal employment.

Against this background, we aim at estimating the current size of employment in health protection supply chains. Unfortunately, global and regional estimates of the total size of the workforce producing health protection are constrained by incomplete data. Further, the existing data is hardly internationally comparable given divers definitions, categories of workers and limitations to paid and public employment. In addition, data on the number of NHO workers working in the broader health economy are largely absent.

Given these constraints, we are using a specific methodology that takes into account all workers in the health sector as well as in other sectors that contribute to the health sector in public and private employment and on a voluntary basis, particularly unpaid family members providing long-term care to relatives. We also consider workers in both health occupations and non-health occupations working in the health economy.

Thus, we define workers in occupations that require higher or vocational education in a health field (HO) based on the International Standard Classification of Occupations (ILO, ISCO). This framework includes particularly "health professionals" such as doctors, nurses, midwives, dentists, pharmacists, "health associate professionals", such as medical and pharmaceutical technicians, traditional practitioners without formal training and "personal care workers in health services" such as health care assistants and home-based personal care workers (ISCO codes beginning with 22, 32 and 532).

Workers who are not employed in heath occupations and contributing through the delivery of goods and services to HO workers within the health sector or in other sectors – paid or unpaid, providing formal or informal care – are defined as non-health occupational workers (NHO). They include employees providing administrative support, laundry and food services, financial and insurance services, real estate activities, research, education and also LTC workers such as family members, friends or neighbours delivering unpaid informal services.

The size of this workforce is estimated for 185 countries based on most recent data from the ILOSTAT database, [6] WHO Global Health Observatory database [7] and where available and comparable national databases. To overcome the limitations of these databases on formal employment and the underestimation of informal workers as well as the workers in other economic sectors than the health sector, we include further data and assumptions as detailed in the annexes that allow the quantification of related employment.

Based on these data we estimate numbers of workers in all service industries and estimate the proportion of these who are paid NHO workers based on a proxy indicator of total health expenditure as a percentage of GDP. Numbers of unpaid NHO workers are estimated with a view to the needs of the population aged 65 and over and based on recent ILO estimates (Scheil-Adlung 2015a). We assume that the majority of such work is carried out by family members and consider that these workers are required to provide their services "for free" given the shortage of the paid formal LTC workforce if the following conditions are given:

– formerly paid employment has been given up;

– working hours of paid work have been reduced; or

– early retirement from paid work has been taken.

We assume that unpaid care work meeting these criteria should be converted into formal paid jobs. More details on the methodology and related data are provided in the annex.

This approach allows the estimation of the total number of workers employed in national health economies contributing to global health protection supply chains. For estimates of additional employment required to deliver services to all in need and achieve particularly SDG 3 on UHC and SDG 8 on economic growth and decent work we follow established ILO methodologies which set a threshold based on workforce-to-population ratios and compare each country's situation against this threshold. (Scheil-Adlung, 2013).

Given limited data availability, it was necessary to apply proxy variables, e.g. to estimate the number of HO workers in non-health sectors and assumptions, such as that the ratio of workers' wages to material costs is similar for all service industry sectors. Further, the estimates are based on a limited number of countries that is used to apply workforce weighted average ratios to others. This is likely to introduce inaccuracies at individual country level for countries without data, but should not greatly affect the global total.

[6] ILO's database of labour statistics: www.ilo.org/global/statistics-and-databases.

[7] WHO Global Health Observatory Database http://apps.who.int/gho/data/node.main?showonly=HWF.

As a result, in comparison with most frequently used standard counts of health workers, this method extends the range of workers counted to the health economy and the broader health protection supply chain, by:

– identifying the number of all workers within the health sector, regardless of their occupation and employment status in the public or private sector;

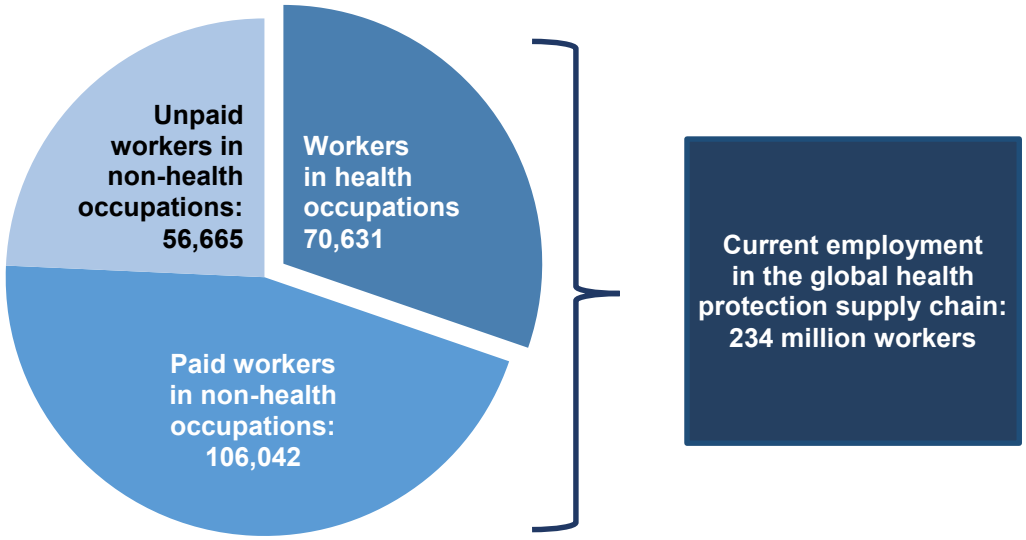
– counting in all health professionals and associate professionals, even if they do not work within the health sector;

– using a proxy variable to estimate the number of workers in non-health occupations which contribute to the health sector but are employed beyond the health sector;

– estimating the size of the unpaid informal health workforce.

Based on the above methodology, the global estimates of the size of the workforce in the health economy of 185 countries indicate an availability of currently 234 million workers in the global health protection supply chain (Figure 5).

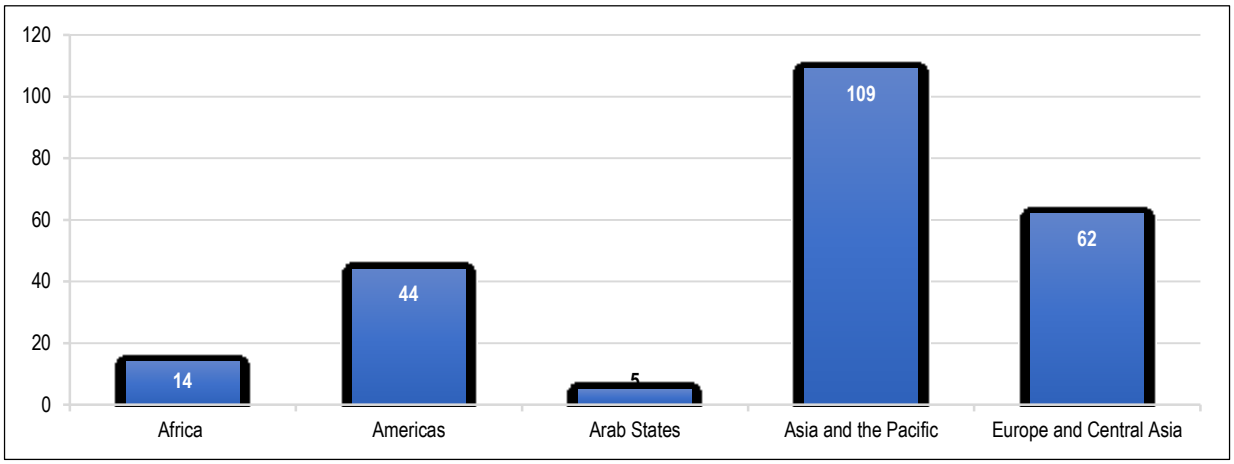
Figure 5. Current employment in the global health protection supply chain: Size and composition of workers (in thousands, 2016 or latest available year)



Source: ILO calculations 2016

The global employment is composed of employment in the health economies of Africa amounting to 14 million jobs, in the Americas to 44 million, in the Arab States to 5 million, in Asia and the Pacific to 109 million and in Europe and Central Asia to 62 million (Figure 6).

Figure 6. Current employment in the global health protection supply chain by region



Source: ILO calculations.

When breaking down the total number of workers into HO and NHO workers, we find globally:

– 71 million workers in health occupations;

– 106 million paid workers in non-health occupations, mostly formal workers; and

– 57 million unpaid ("voluntary") workers in non-health occupations, mostly female LTC workers providing care to older relatives, who were pulled out of the formal labour market to provide "free" services.

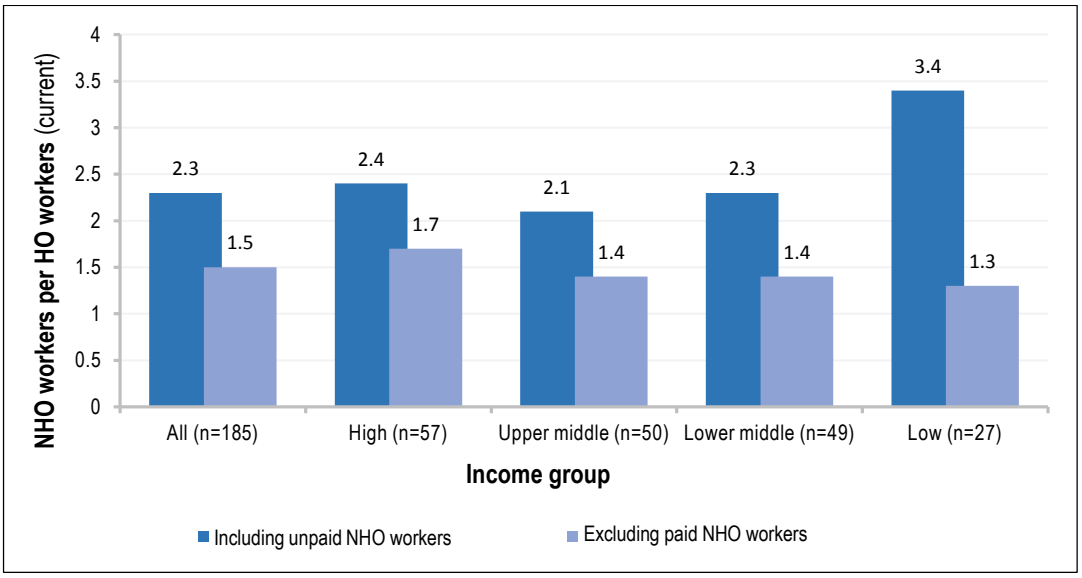
NHO workers account for 70 per cent of all paid and unpaid workers, including informal LTC workers in the health economy and 60 per cent of the paid workforce in global health economies.

Based on the total size and composition of the workforce, the global ratio of NHO workers to HO workers is 2.3. Thus, globally each HO worker is supported by 2.3 paid or unpaid, formal or informal NHO workers to achieve health objectives.

Excluding unpaid NHO workers – and their work that would need to be transformed into paid LTC jobs – brings the ratio to 1.5, meaning that each HO worker is supported by 1.5 paid NHO workers.

The ratio of NHO workers to HO workers varies by income group. If we consider just paid NHO workers, high-income countries have a ratio of 1.7 NHOs for every HO, compared with 1.4 for middle-income countries and 1.3 for low-income countries (Figure 7).

Figure 7. Ratio of workers in non-health occupations to workers in health occupations, by income group, 2016 or latest available year

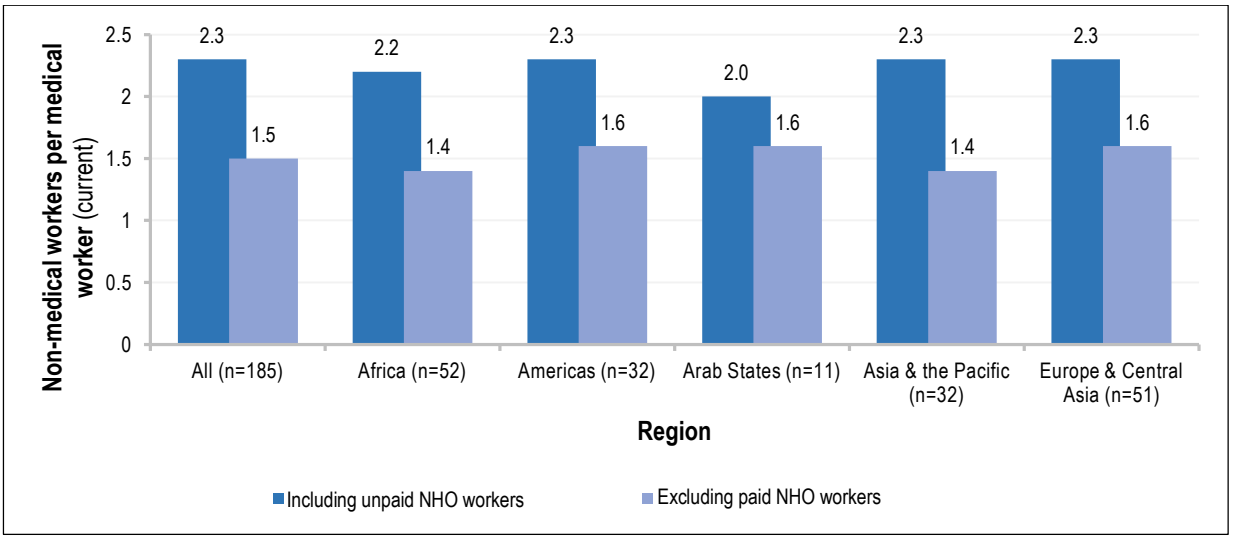


Source: ILO calculations 2016.

Taking paid and unpaid, formal and informal workers into account, however, we see a much higher ratio in low-income countries, because these countries tend to have small numbers of HO workers relative to the size of their populations. The relatively high ratio in high-income countries, on the other hand, is likely a reflection of the higher proportion of older persons among the populations and therefore greater numbers of LTC workers.

This analysis also suggests that countries in the Americas, Arab States and Europe/Central Asia regions tend to have more formal NHOs per HO (1.6 in these three regions, compared with 1.4 in Africa and Asia & the Pacific). Americas and Europe/Central Asia also have the highest ratios when unpaid NHOs are taken into account, along with Asia and the Pacific (2.3 NHOs per HO), whereas the Arab States region has only 2.0, suggesting a lower reliance on unpaid LTC workers in this region (Figure 8).

Figure 8. Ratio of workers in non-health occupations to workers in health occupations, by region, 2016 or latest available year



Source: ILO calculations 2016.

This is the first time that there has been an attempt to estimate employment in the entire health economy and thus the important impact on economic growth from the workforce contributing to the achievement of health objectives. The estimates exceed by far related assessments from other sources given the broader approach applied and differing definitions and data sources. [8] They reveal the important role of workers that are supporting physicians, nurses and others in achieving health objectives through services related to e.g. cleaning and administration. Whether or not unpaid workers in non-health occupations are included, the number of jobs for this group is estimated to be much higher than the number of workers in health occupations.

[8] The estimates of HO workers are thus different from and larger than estimates e.g. from WHO. The differences show how much the size of the total health workforce is dependent on choices about which groups to include.

IV. What is the additional employment potential in health economies producing UHC?

The above evidence is based on the current situation and does not take into account the fact that many countries currently do not have sufficient numbers of workers in HOs and NHOs to produce UHC and provide adequate services to all: Thus, it is necessary to identify the employment potential to meet current and future needs. This requires to estimate the number of:

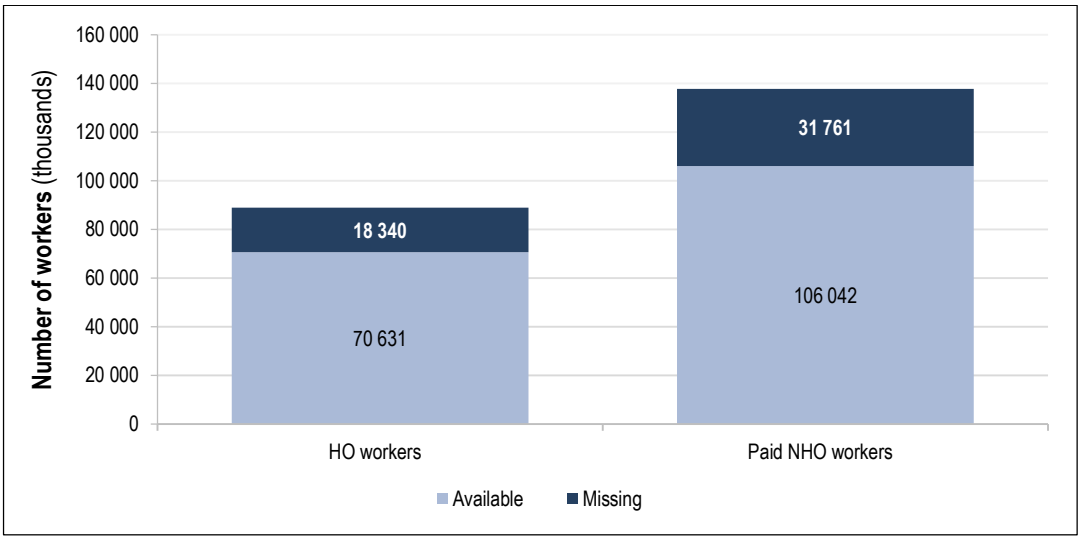
(1) currently needed workers required to attain the health objective of UHC;

(2) number of workers needed by 2030 to produce UHC in the context of the SDGs given the demographic developments.

Our estimates are based on a threshold of a minimum number of workers in health and non-health occupations in the global health protection supply chain and related national health economies to provide over the life cycle access to goods and services. [9]

The estimates suggest currently a global employment potential of about 50 million missing paid workers in health and non-health occupations in the global health protection supply chain (Figure 9).

Figure 9. Current numbers of paid workers in health and non-health occupations and employment potential in the public and private sector to produce UHC in global health protection supply chains (public and private employment, 2016 or latest available year)



Source: ILO calculations 2016.

Globally, shortages concern currently 96 countries out of the 185 assessed. While some countries have a surplus of jobs for HO workers and NHO workers – particularly high-income countries – others show gaps:

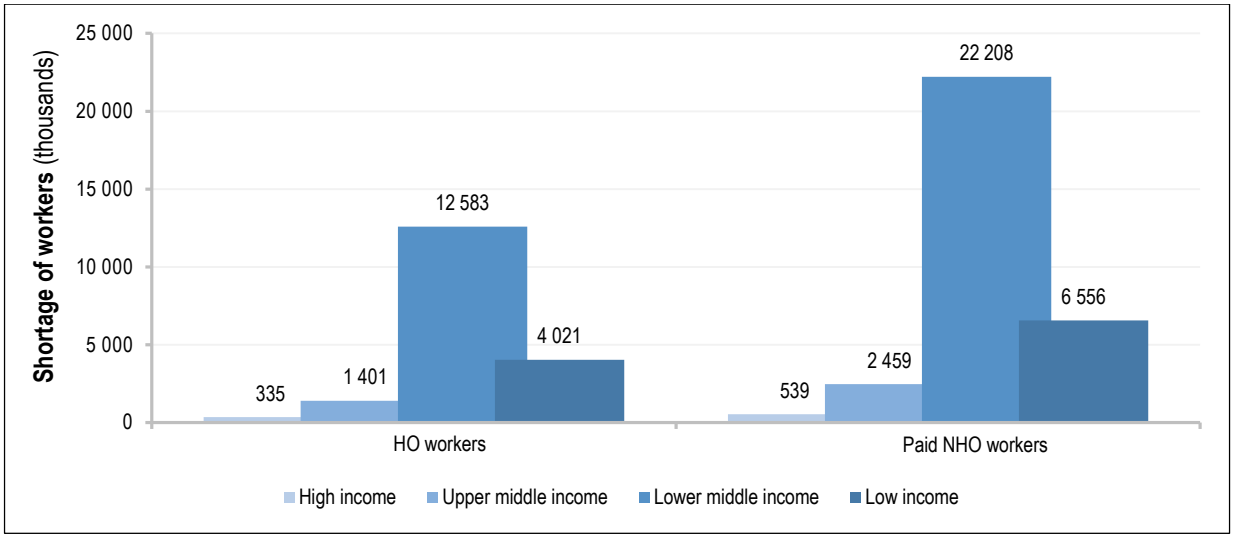
– shortages of workers in health occupations exist in 89 countries and add up to 18.3 million HO workers;

[9] See methodological annex for more details.

– shortages of workers in non-health occupations exist in 95 countries amounting to 31.8 million NHO workers.

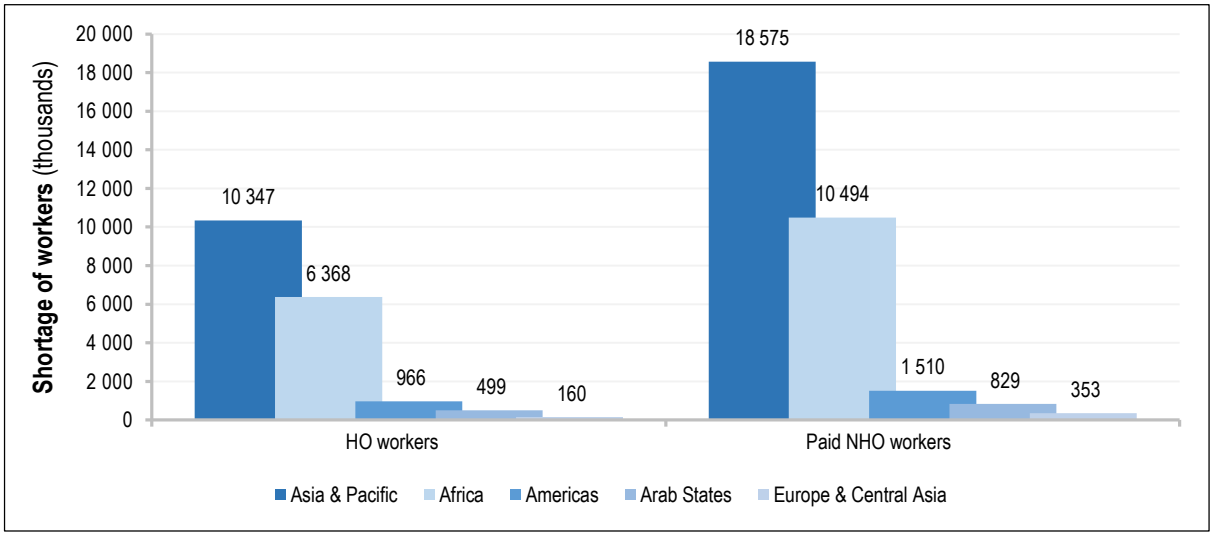
Thus, the missing workers and their jobs are not equitably distributed around the world. The shortages of HOs and NHOs predominantly affect lower-middle and low-income countries (Figure 10) in Africa and in Asia and the Pacific (Figure 11).

Figure 10. Current employment potential to fill gaps of missing workers by income group
(public and private employment, 2016 or latest available year)



Source: ILO calculations 2016.

Figure 11. Current employment potential to fill gaps of missing workers by region
(public and private employment, 2016 or latest available year)



Source: ILO calculations 2016.

The vast majority (91 per cent) of the missing HOs and NHOs are needed in lower-middle and low-income countries, and over half (56 per cent of missing HOs and 58 per cent of missing NHOs) are needed in Asia and the Pacific, which reflects the fact that this region contains the most populous countries in the world. However, in relation to population size, the shortages in Africa are the most severe.

In addition to addressing current shortages in the workforce required to provide quality services, it is important to acknowledge that based on the current trajectory, this situation

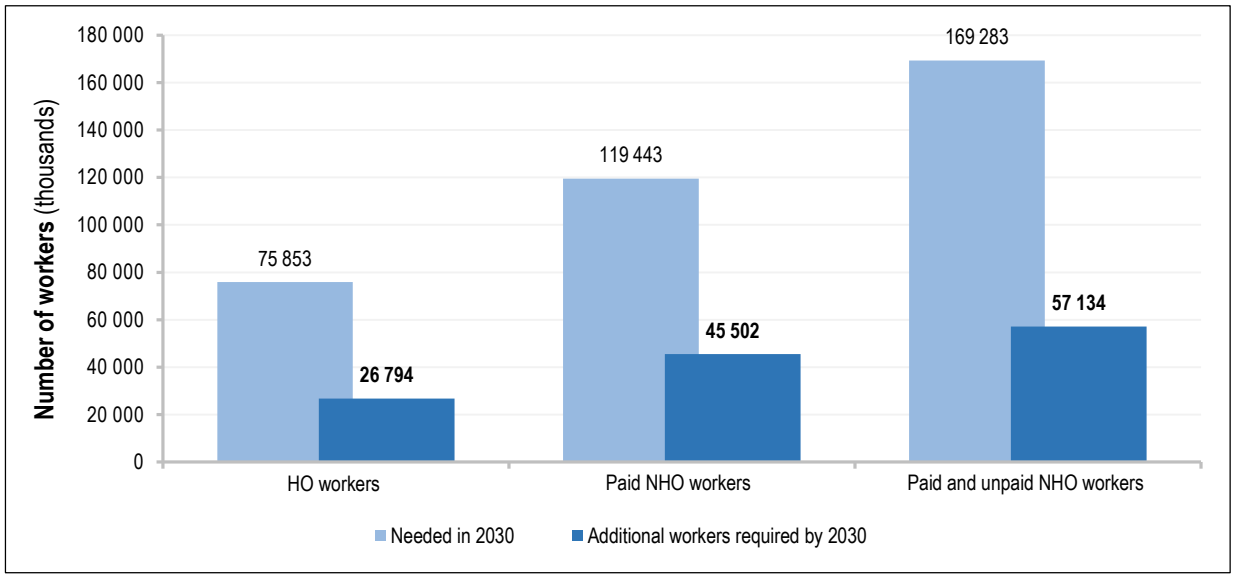
will be even worse in the future: By 2030, population growth means that the world will have to create even more additional jobs to produce UHC (Figure 12). This implies the need to create over the next 15 years jobs in the global health protection supply chain for:

– 27 million HO workers;

– 45.5 million paid NHO workers; and

– 57 million paid and unpaid NHO workers.

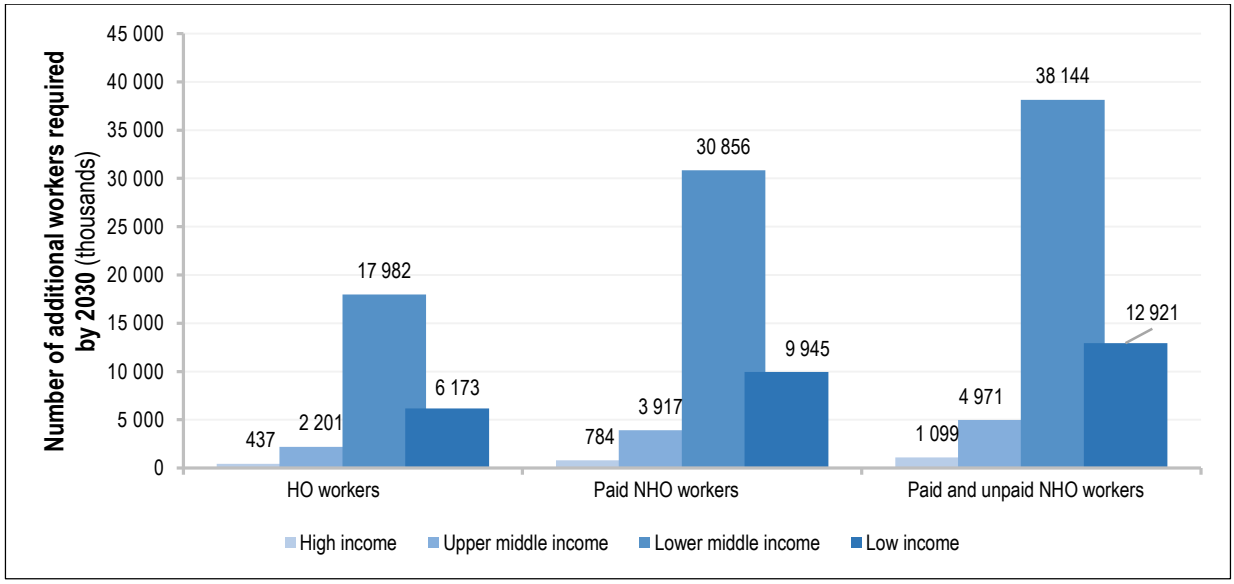
Figure 12. Additional jobs to be created in health and non-health occupations in the global health protection supply chain by 2030



Source: ILO calculations 2016.

As with current need, the vast majority of the additional need for HOs and paid NHOs will be in lower-middle income and low-income countries (Figure 13).

Figure 13. Employment potential for additional workers needed by 2030, by income group



Source: ILO calculations 2016.

In low and middle income countries, the employment potential of the global health protection supply chain producing UHC by 2030 amounts to additional jobs for 82 million workers, comprising:

– 26 million HO workers;

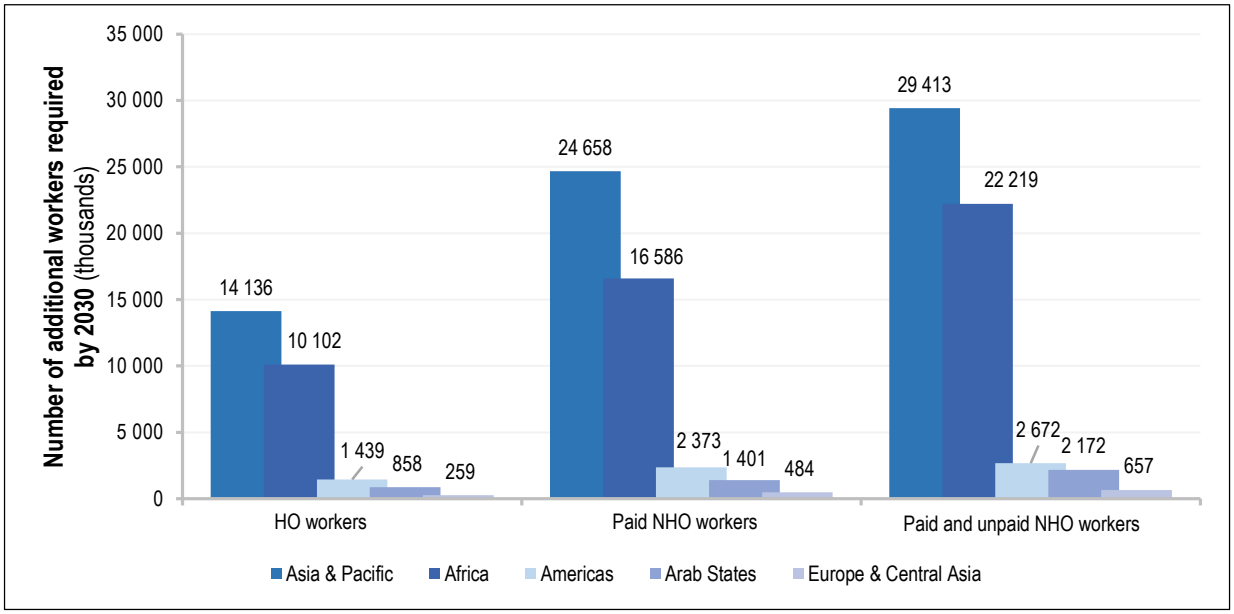
– 56 million paid and unpaid NHO workers.

The majority of jobs will need to be created in:

– Asia, where 43 million additional jobs will be required;

– Africa, with 32 million jobs additional will be needed (Figure 14).

Figure 14. Jobs to be created for the production of UHC by 2030, by region



Source: ILO calculations 2016.

V. Employment effects of investments in health protection

When assessing the evidence provided on current and future employment opportunities in national health economies and more broadly in the global health protection supply chain we find that investments in UHC and the related workforce can stimulate significant economic returns of investments besides the positive impacts on the health status of labour and populations at large:

- Applying a health economy and global supply chain perspective allows to conclude that the total number of the workers producing health objectives such as UHC is significantly higher than previously estimated: It amounts to 234 million workers employed in the global health protection supply chain. This includes 14 million jobs in Africa, 44 million jobs in the Americas, 5 million jobs in the Arab States, 109 million jobs in Asia and the Pacific and 62 million jobs in Europe and Central Asia. Thus, investing in health protection has an important potential to boost economic growth due to the high number of jobs needed in numerous economic sectors for the delivery of health care.

- The data suggest that economic returns of investments in UHC resulting in jobs for HO workers will yield high impacts on job creation for NHO workers. The current employment potential of addressing existing workforce shortages amounts to globally:

  – 18.3 million jobs for workers in health occupations;

  – 31.8 million jobs for workers in non-health occupations, particularly in low and middle income countries.

- Each investments in the creation of one HO job has the potential to result in 2.3 jobs for NHO workers. If only paid NHO work is considered, the ratio is still 1.5 meaning that each HO job could result in the creation of 1.5 NHO jobs. Thus, a direct effect of additional HO jobs is the generation and creation of NHO employment, from which the resultant incomes are used and re-used to contribute to the broader economy, leading to further employment and economic growth.

- Given demographic growth by 2030, the employment potential in the global health protection supply chain will further increase and involve additional jobs to address workforce shortages towards UHC for:

  – 27 million HO workers;

  – 45.5 million paid NHO workers; and

  – 57 million paid and unpaid NHO workers.

- Many unpaid workers are currently used to fill the workforce shortages. The assumption that these workers provide services for "free" does not hold true when taking into account that a large group of these workers gave up jobs or reduced working time. Thus, they are not contributing to the larger economy and might incur themselves economic costs if impoverished or sick.

- The lack of decent working conditions, such as unpaid work, and the wide use of unskilled workers allows concluding that the care delivered is of low quality and likely

to result in a deterioration of the health status and thus higher health care costs for care receivers at a later point in time.

- As the current employment to produce health objectives involves more than twice as many workers in non-health occupations than those in health occupations we conclude that the contribution of NHOs to economic growth and meeting health needs was largely overlooked in the past.

- Related investments in UHC and the needed workforce have important employment effects not only in the health sector, but particularly in other economic sectors constituting the broader health economy.

- The current shortages of jobs observed in the national health economies of 185 countries suggest that in the past due to insufficient investments in the health workforce much potential for economic growth has been lost and unemployment for a large range of high and low skilled workers within the health sector and many other economic sectors might have been reduced, particularly in Asia and Africa as well as in rural areas.

Further, we observe that HO and particularly NHO workers often work on low wages and lack decent working conditions in employment in the public and private sector, both within and beyond the health sector. Working conditions often do not respect human rights, including labour rights, social protection coverage, occupational safety and participatory processes through social dialogue (ILO, 2014-15).

VI. Policies developing returns of investments in UHC: Unlocking the potential of decent employment in health economies

Given the fact that over 200 million people are employed in health economies to achieve health objectives and millions of additional jobs particularly in low and middle income countries are needed, a rethinking of current policies in terms of investments in UHC is required: This is due to the fact that investments will not only contribute to global health security and better health outcomes of populations at large and on labour. They will also develop returns of investments in the large health economies given the creation of millions of jobs for workers in health occupations and non-health occupations, the transformation of informal into formal employment and the reduction of unemployment as well as indirect savings e.g. due to reduced expenditure for poverty alleviation due to the close link between health access deficits and poverty (ILO, 2014-15). On the other hand, the ignorance of growing health protection needs, the ageing of populations and poor working conditions for health worker will result in foregone returns of investment.

Thus, it is indispensable to unlock the potential of decent employment in producing UHC and to realize inclusive and sustainable growth based on investments in related employment. This requires to invest in the creation of decent employment opportunities with a view to achieving progress towards the SDGs 1, 3 and 8. Core activities to maximise returns on investments in UHC include:

1. Developing a sufficient number of jobs for workers required in global health protection supply chains to achieve UHC.

2. Creating decent working conditions for all global supply chain workers producing UHC.

3. Providing adequate support and decent working conditions for unpaid family members providing LTC.

Developing a sufficient number of jobs for workers required in global health protection supply chains to achieve UHC

Maximizing returns of investments to progress towards the SDGs and UHC [10] necessitates the development of a sufficient number of decent jobs for HO and NHO workers with due respect to gender issues both in the public and private sector.

The creation of employment opportunities should be linked to meeting national health objectives such as UHC. This involves thresholds estimating the number of workers needed per population respectively older persons. Such thresholds can serve as a reference for adequate service delivery and range at global level between 4.1 [11] and 4.5 full time paid

[10] Global Health Workforce Alliance, World Health Organization: A universal truth: No health without a workforce. Geneva, 2014. Available from: http://www.who.int/workforcealliance/knowledge/resources/hrhreport2013/en/.

[11] International Labour Organization: *World Social Protection Report 2014/15*, Geneva, 2014. Available from: http://www.ilo.ch/global/research/global-reports/world-social-security-report/2014/lang--en/index.htm.

workers per 100 persons and for LTC per 100 persons aged 65 [12] and over. This includes an adequate skill mix and training opportunities for health workers.

Areas with highest returns of investments are those that are underserved, mainly in low and middle income countries of Asia and Africa and in rural areas. Thus, job investments should be distributed with a view to meet needs in both rural and urban areas and allow for equitable access to quality health care for all in need. Further, when implementing investments to create jobs it is important to consider multiplier employment effects as each investment in jobs for HO workers will generate more than two additional jobs for NHO workers in global health protection supply chains. Finally, a focus should be set on developing national and local personnel rather than relying on migration and recruiting health workers from other countries.

Most promising investment policies in HO and NHO workers relate to efficient and effective labour and market and employment policies. They are important tools to trigger economic growth through the health economy and to provide incentives for private sector investments if embedded in enabling macroeconomic policies.

Such policies reverse the prioritization of fiscal policies aiming at reducing debts and financial deficits only. By using macro-economic frameworks that allow for higher budget deficits and inflation they have the potential to create inclusive growth by reducing unemployment, providing education, training, skill development, focusing on poverty alleviation and investments in social protection in health. If well designed, these objectives can be achieved without jeopardizing macro-economic stability as they are linked to employment generating growth. Thus, major efforts are needed to integrate macro-economic, employment and labour market policies with a view to stimulate inclusive economic growth based on investments in decent employment in the health economy.

The implementation of related policies requires sufficient funds. For public investments funds should be generated from efficient and effective social protection financing mechanisms and guarantee an equitable delivery of goods and services ensuring social justice. An enabling framework taking into account the above as well as the need to strive towards the SDGs and achieving inclusive growth relates to ILO Recommendation No. 202 on national social protection floors (R.202). It also provides guidance on achieving coherence with social, economic and labour market policies and highlights the need to coordinate related policies with development policies such as rural development plans.

Efficient and effective social protection financing mechanisms consist of sources from taxes and contributions. If well designed they can generate sufficient domestic funds for inclusive health and long-term care protection systems and the delivery of services through paid care workers enjoying decent working conditions. It is important to ensure that out-of-pocket payments (OOP) are not considered as a health financing mechanism as they have the potential of impoverishment and often constitute barriers to access health services.

Further, fiscal space should be created to ensure adequate funds for investing in UHC. There are numerous ways to create fiscal space. They include particularly:

– addressing the evasion of tax and contribution payments;

– increasing the efficiency of resource utilization e.g. by fair distribution between rural and urban areas;

[12] X. Scheil-Adlung: *Long-term care protection for older persons – A review of coverage deficits in 46 countries*, ILO, Geneva, 2015.

– broadening the revenue base for health protection and increasing contributions to social health insurance;

– governing health funds more effectively;

– strengthening institutional effectiveness and efficiency.

In addition, fiscal space can be created in the context of existing budgets lines, e.g. by reallocating government budgets. It is also possible to introduce new sources and revised economic frameworks: This includes increasing tax revenues, developing innovative financing strategies such as earmarked tobacco taxes or adopting a more accommodating macroeconomic framework entailing higher budget deficits and levels of inflation while keeping macroeconomic stability e.g. due to reduced unemployment and poverty. Finally, fiscal space can be created by drawing on increased international aid and transfers. These strategies can also be combined to increase resource mobilization for expanding health sector employment.

Creating decent working conditions for all global supply chain workers producing UHC

Currently, many HO and NHO workers in the global health protection supply chain and related national health economies are suppressed from adequate wages, rights, and social protection such as the large group of unpaid LTC workers. However, poor working conditions lead to difficulties result in limitation in the delivery of quality care [13] and fail to attract and retaining skilled personnel.

Only if all workers in the health economy enjoy decent working conditions can inclusive and sustainable growth be developed and the delivery of quality services ensured: Jobs providing decent working conditions such as social protection and decent incomes have immediate beneficial effects for the economy e.g. due to improved health and the related productive potential, and in the longer term stabilized consumption based on regular income. Thus, creating returns of investments in health economy workers will not be possible without decent working conditions for health workers in areas where they are needed most.

Against this background, investments should not be limited to achieving solely higher numbers of jobs, but should also consider decent working conditions for both HO and NHO workers as an integral part of health employment. Decent working conditions include particularly adequate wages and are underpinned by rights at work such as freedom of association, but also equal remuneration, non-discrimination, social protection and social dialogue. Decent working conditions are anchored in numerous ILO Conventions and Recommendations. [14]

[13] C. Wiskow, T. Albreht, C. de Pietro: How to create an attractive and supportive working environment for health professionals. World Health Organization Euro. Copenhagen, 2010. Available from: http://www.euro.who.int/__data/assets/pdf_file/0018/124416/e94293.pdf.

[14] Among others relevant ILO Conventions and Recommendations include: Freedom of Association and Protection of the Right to Organise Convention, 1948 (No. 87), Right to Organise and Collective Bargaining Convention, 1949 (No. 98), Equal Remuneration Convention, 1951 (No. 100), Discrimination (Employment and Occupation) Convention, 1958 (No. 111), Nursing Personnel Convention, 1977 (No. 149) and Nursing Personnel Recommendation, 1977 (No. 157), Labour Relations (Public Service) Convention, 1978 (No. 151), Social Security (Minimum Standards) Convention, 1952 (No. 102) and the Social Protection Floor Recommendation, 2012 (No. 202) available from www.ilo.org/normlex.

In this context, it is also important to setting policy priorities on transforming unpaid and informal services into formal LTC jobs where such work is obliged by the absence of formal LTC workers. Further, adequate cash benefits and social protection coverage should be provided to unpaid care workers such as family members to alleviate their burden.

In addition, measures should be taken to ensure retention and full participation of health workers at all ages for women and men. Given the high proportion of women working in national health economies, part time work, special leave and other arrangements allowing to combine formal work with work in families should be foreseen.

It is also important to ensure a sufficient and adequate infrastructure that allows developing the full potential and quality of the workforce employed.

An essential foundation for ensuring that investments in UHC contribute fully to and benefit from progress towards decent work for related workers is improved national data on the size and composition of NHO workers. It should be closely monitored using adequate indicators, such as deficits in health workforce density. Results should be discussed and feedback given to governments through national and social dialogue that strengthens the voice of key stakeholders, such as workers, employers, women, the rural population, young and older persons.

Providing adequate support and decent working conditions for unpaid family members providing LTC

Currently, many policy and decision makers do not anticipate the need to transform informal LTC work into formal jobs due to "free" services being expected – mainly from female family members. The reliance on LTC being provided informally is unsustainable in the context of global ageing, particularly given that many are not trained for care giving, yet the work can be very demanding, e.g. caring for persons with mental disorders. Further, informal care giving has the potential to aggravate gender inequality as it is often provided without any remuneration or social protection coverage.

It is therefore crucial to transform care work provided informally and provided due to the absence of formal care workers, into formal jobs with decent working conditions. This will allow many women workers to return to the formal labour market and contribute to inclusive economic growth. At the same time it will allow for acceptable living conditions for those who currently provide informal care as well as preventing poverty and promoting gender equality. Most efficient and effective forms of formalizing LTC relate to the creation of decent jobs that provide adequate wages as well as skills development for the provision of quality care (ILO, 2015).

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Annex 1. Methodological remarks

The analyses are based on the conceptual framework illustrated in Table 2, i.e. that the workers of interest fall into five groups.

Table 2. Conceptual framework for estimating the workforce in health and non-health occupations

	Workers in health occupations (HO workers)	Workers in non-health occupations (NHO workers)	Health economy workers
Employed in the health sector	A	C	A+C
Employed outside the health sector	B	D	B+D
Unpaid informal workers		E	E
Total	A+B	C+D+E	A+B+C+D+E

The terms used in Table 2 are defined as follows:

- *Workers in health occupations* (HO workers) (groups A and B) = workers in occupations that require post-secondary education in a health field.
- *Workers in non-health occupations* (NHO workers) (groups C, D and E) = workers providing goods or services which support the work of HO workers.
- *Health economy workers* (HEWs) (groups A, B, C, D and E) = all HO workers and NHO workers contributing with or without pay to the provision of health services, whether within or outside the health sector.
- *Employed in the health sector* (groups A and C) = employed by an organisation whose primary purpose is to deliver preventive, promotive or curative health services, or self-employed in a job with this primary purpose.
- *Employed outside the health sector* (groups B and D) = employed by an organisation which provides goods or services to the health sector, or self-employed workers, in a job with this primary purpose.
- *Formal HEWs (groups A, B, C and D)* are workers engaged in any activity contributing to the production of goods or provision of services for pay or profit.
- *Unpaid informal workers* (group E) = Persons who worked without pay to provide health and LTC or to provide support to HO workers. In this study we specifically focus on unpaid LTC provided by family members providing long-term care.

Throughout, we used data based on headcounts rather than numbers of full-time time equivalent workers.

Three data sources were used:

(1) ILO's central statistics database: ILOSTAT (www.ilo.org/global/statistics-and-databases);

(2) WHO Global Health Observatory workforce statistics (http://apps.who.int/gho/data/node.main?showonly=HWF);

(3) National sources of data.

At present, there is no global data source that will allow the number of NHO workers outside the health sector (group D) to be counted. Only NHO workers within the health sector (group C) usually appear in global estimates, which is a major limitation because NHO workers can and do work in non-health sectors, and without them the health sector would not be able to operate to its full scope. Therefore, rather than ignoring this important group of workers and their contribution to the health economy, it was judged to be important to attempt to estimate their numbers, using the following method.

1. Estimate the size of the entire formal health economy workforce (A + B + C + D) for ILOSTAT countries

For the 68 countries in the ILOSTAT database, the number of workers in service industries (ISIC Rev. 4, categories G-U, or ISIC Rev. 3, categories G-Q) was extracted for the most recent available year. This number includes most types of formal HO workers and NHO workers (groups A-D), as well as people working in other service industries. Five countries were excluded at this stage because their ILOSTAT data were not disaggregated by industry sector (Algeria, Japan, Madagascar, Maldives, and Ukraine).

For the remaining 63 countries, workers in ISIC Rev. 4, category Q (or ISIC Rev. 3, category N), were assumed to represent workers employed in the health sector (groups A + C). Five countries were excluded at this stage because their data showed zero employees in the health sector (Albania, Belarus, Dominican Republic, Indonesia, and South Africa).

For the remaining 58 countries, to estimate the number of workers in ISIC Rev. 4, categories G-P and R-U (or ISIC Rev. 3, categories G-M and O-Q), who are health workers outside the health sector (groups B + D), we used "total health expenditure (THE) as a percentage of gross domestic product (GDP) 2014" [1] as a proxy variable. Thus, the percentage of service workers in non-health sectors who provide health services was assumed to be the same as the per cent of GDP that is THE.

Limitations

- It was assumed that the numbers of workers recorded in the most recent year in ILOSTAT still apply. Although the data were fairly recent for most (49 out of 63 countries had data for 2014, 4 for 2013, 3 for 2012), the data for a few countries were slightly out of date (2009 or 2010).
- People working in the manufacture of pharmaceutical products are not counted (they are categorised under ISIC Rev. 4, category C, or ISIC Rev. 3, category D). However, those involved in research and development and retail of pharmaceutical products are counted.
- People working in construction are not counted (they are categorised under ISIC Rev. 4, category F, or ISIC Rev. 3, category F), so workers involved in construction of health facilities were not included in the counts of NHO workers.
- The lack of empirical data means that the assumption that THE/GDP is equal to NHO workers/all service workers cannot be verified and it should therefore be treated with an appropriate degree of caution.
- It is highly unlikely that the percentage of service industry workers who provide services to the health sector is constant across all service industry sectors G-P and R-U. The proxy variable assumes that, *on average*, the percentage who do is equal to the percentage of GDP that is THE.
- The use of THE/GDP as a proxy variable for estimating B + D means that we assume that the ratio of worker costs to goods/materials costs is similar for all service industry sectors, which may not be the case.

2. Estimate the number of formal HO workers (A + B) for ILOSTAT countries

For the 58 remaining ILOSTAT countries, the number of workers with ISCO08 code 22 or 32 (or ISCO88 222, 223, 322, 323 or 324) was extracted for the most recent available year. However, these ISCO codes do not include personal care workers (ISCO08 code 532). ILOSTAT does not disaggregate ISCO codes to the 3-digit level, so it was not possible to identify numbers of personal care workers. Because personal care workers are HO workers as defined in this study, and in many countries represent a significant proportion of HO workers, it was necessary to estimate their numbers. This was done using OECD data, [2] which showed that, for the 17 OECD countries with data from

[1] http://data.worldbank.org/indicator/SH.XPD.TOTL.ZS (accessed 22 April 2016).

[2] http://www.oecd.org/els/health-systems/health-data.htm (accessed 25 April 2016).

2012, 2013 or 2014 about both total employment in health and social care and the number of personal care workers, on average 10 per cent of all those employed in the health sector (groups A + C) are personal care workers.

The size of the formal HO workforce (groups A + B) was therefore estimated by taking 10 per cent of the number of workers in ISIC Rev. 4 category Q (or ISIC Rev. 3 category N) and adding this to the number of workers with ISCO08 code 22 or 32 (or ISCO88 222, 223, 322, 323 or 324).

Four countries (Azerbaijan, Bhutan, Botswana and Brazil) were excluded at the stage because they had no data for the relevant ISCO codes, and two more (Russia and Sri Lanka) were excluded because the number of workers with these ISCO codes was larger than the number of service industry workers counted in step 1. These two situations were taken as indicators of poor quality data.

This left a total of 52 countries with sufficient data in ILOSTAT to estimate the size of both the total number of health economy workers (groups A-D in Table 1) and the number of HO workers (Groups A + B).

Limitations

- The proportion of workers employed in the health sector who are personal care workers varies even within OECD countries, so the estimate of 10 per cent on average may not be representative of all countries. [3]
- The ISCO codes used to identify HO workers probably includes veterinary workers and some other categories that are not relevant for our study for at least some countries. Their numbers are much smaller than numbers of human health workers, so this is not thought to be a major limitation.

3. Estimate the number of formal NHO workers (C + D) for ILOSTAT countries

For the 52 remaining ILOSTAT countries, the size of the paid NHO workforce (Groups C + D) was estimated by subtracting the number of HO workers (see step 2) from the number of service industry workers (see step 1).

4. Calculate the ratio of HO workers to NHO workers ((A + B) ÷ (C + D)) for ILOSTAT countries

The ratio of HO workers to NHO workers in each country was calculated by dividing the number of NHO workers (see Step 3) by the number of HO workers (see Step 2).

Across all 52 countries, the median ratio was 1.62, i.e. for every HO in these countries, on average there were 1.62 NHO workers. The ratio was disaggregated by World Bank income group as shown in Table 3.

[3] We tried to work out a method of adjusting for this by referring to the WHO Global Health Observatory database, which includes personal care workers within its counts of "other health workers", but also provides separate counts of personal care workers as well as other health workers. However, only 15 countries had disaggregated data on personal care workers for a comparable year to the data on "other health workers", of which 5 recorded more personal care workers than "other health workers" which caused us to doubt the quality of the data.

Table 3. Median ratio of Non-health occupation workers to Health occupation workers in 52 ILOSTAT countries

Income group	No. of countries	Median number of NHO workers per HO workers
High	33	1.72
Low and middle *	19	1.38
All	52	1.62

* The low and middle income categories were combined because there were very few low-income countries in ILOSTAT, and the medians for the low, lower middle and upper middle income countries were very similar.

5. Estimate the number of HO workers (A+B) in countries with other data sources

ILOSTAT does not include data for enough countries to permit global and regional estimates of the number of HO workers. The WHO Global Health Observatory database contained data on health worker numbers for 182 countries, of which 133 were not included in ILOSTAT. The WHO database uses cadre definitions that do not directly match the ISCO codes used for the ILOSTAT countries, so we assumed the following:

Table 4. WHO database categories and their ISCO code equivalents

WHO category	ISCO-08 equivalent	Our classification
Physician	221	HO
Nursing & Midwifery	222, 322	HO
Dentistry	226	HO
Pharmaceutical	226	HO
Laboratory	321	HO
Environmental & public health	226	HO
Community & traditional health	223	HO
Other health workers (which includes personal care workers)	532 + 226 not mentioned above	HO
Management & support	various	NHO

Source: Author.

As with ILOSTAT, data were taken from the WHO database for the most recent available year. For one of the WHO database countries (Tanzania), the data showed zero physicians, which was taken as an indicator of poor quality data. An alternative data source was therefore used for Tanzania, [4] which used the same health worker categories as the WHO database (see Table 4).

Thus, estimates of the number of HO workers were made for 185 countries (52 from ILOSTAT, 132 from WHO and 1 from a national data source).

The numbers of HO workers in the WHO database were systematically lower than the numbers in the ILOSTAT database. It seems likely that this was due to undercounting of certain categories of worker, most notably associate health professionals (our analyses indicated that the numbers of health professionals were similar across the two databases, whereas ILOSTAT tended to include many more associate health professionals). It is also possible that, for some countries with data provided by

[4] http://www.hrh-observatory.afro.who.int/en/country-monitoring/89-tanzania.html (accessed 22 April 2016).

national governments, [5] private sector workers are undercounted [6] due to public data systems focusing on the public sector. For this reason, an upward adjustment was made to the WHO numbers to make them more comparable with the ILOSTAT numbers. This was done by examining the 45 countries which had data on the number of HO workers in both ILOSTAT and the WHO database. For these countries, the median ratio of WHO to ILOSTAT estimates was 0.59 (i.e. on average, the number of HO workers in the WHO database was 0.59 the number in ILOSTAT). For each of the 133 non-ILOSTAT countries, therefore, the number of HO workers in the database was divided by 0.59 to give an estimate of the actual number of HO workers.

Limitations

- The upward adjustment of HO numbers in the WHO database is based on an average, which is unlikely to apply to all individual countries. For this and other reasons, rather than assessing individual country estimates, aggregate figures and regional and/global levels only should be used for assessments.

6. Estimate the number of formal NHO workers in countries with other data sources

The median ratio of HO to NHO workers in high-income ILOSTAT countries (1.72) was applied to high-income countries in the WHO database, and the median ratio in low- and middle-income ILOSTAT countries (1.38) was applied to low- and middle-income countries in the WHO database. These ratios were applied to the number of HO workers (see step 5) to give an estimate of the number of formal NHO workers (groups C + D).

7. Estimate the number of unpaid care workers (E)

Estimates of total numbers of unpaid workers for 21 OECD countries were taken from a recent ILO paper. [7] For these 21 countries, we calculated the median "informal workers to population over 65" ratio [8] (on the assumption that most of those in need of informal care workers are people in this age bracket), and applied this ratio to all 185 countries included in the above calculations. This yielded an estimate of the number of informal workers in all 185 countries.

This was almost certainly an over-estimate of the number of unpaid workers according to our definition, because not all unpaid work can or should be transformed into formal jobs. To estimate the numbers who fit our definition of unpaid workers, we firstly assumed that the vast majority are family members, then used data from a 2015 UK survey of family members providing care [9] to estimate the proportion of unpaid work that could be converted to formal jobs. That survey found that 51 per cent of carers had given up work in order to provide long-term care for a family or household member, 12 per cent had taken early retirement and 21 per cent had reduced their working hours. Of those who gave up work, retired early or took reduced working hours, 30 per cent said it was because there were no suitable care services and 22 per cent because they could not afford to pay for the available services. This indicates that 44 per cent of all informal unpaid workers should be counted as part of the NHO workforce because the work that they do should be transformed into formal jobs ((51+12+21) x (0.3 + 0.22) = 44)).

[5] http://www.who.int/hrh/statistics/TechnicalNotes.pdf (accessed 10 May 2016).

[6] http://healthworkers.savethechildren.net/issues/health-workers-count-but-are-we-counting-them/ (accessed 10 May 2016).

[7] http://www.ilo.org/secsoc/information-resources/publications-and-tools/Workingpapers/WCMS_407620/lang--en/index.htm

[8] Estimates of the population aged over 65 for the year 2015 were taken from UN Population Division (http://esa.un.org/unpd/wpp/).

[9] https://www.carersuk.org/for-professionals/policy/policy-library/state-of-caring-2015

Limitations

- Most of the 21 countries in the ILO paper are in Europe and all are high-income countries, so the applicability of their data to other countries is questionable. It seems likely that the number of informal long-term carers (LTCs) is strongly negatively correlated with the number of paid LTCs, but very little data were available on the number of paid LTCs either. It is plausible that in low- and middle-income countries with less developed health and social care systems, a higher proportion of the population is performing LTC roles, in which case our estimates will be conservative rather than an over-exaggeration.
- The situation in the UK regarding the proportion of unpaid care work that could be transformed into formal employment is unlikely to be typical of all countries, but comparable data from other countries was not located in the time available.

8. Estimate the global number of HO workers to NHO workers and thus the global ratio of NHO workers to HO workers

For all 185 countries, the number of HO workers (A+B) and formal NHO workers (C+D) were summed to give a global total. The ratio of the global number of formal NHO workers to the global number of HO workers was 1.5. In other words, **for every HO worker in the world, we estimate that there are 1.5 paid NHO workers**.

Likewise, the numbers of paid + unpaid NHO workers (C+D+E) were summed across all 185 countries to give a global total. The ratio of the global number of paid + unpaid NHO workers to the global number of HO workers was 2.3. In other words**, for every HO in the world, we estimate that there are 2.3 NHO workers (formal + informal)**.

Effectively, these global ratios give the weighted mean of the individual country ratios (weighted by workforce size). We can also calculate the unweighted means: 1.5 excluding informal workers and 3.0 including informal workers. In other words, in the average country, there are 1.5 paid NHO workers for every HO worker, and there are 3 formal + informal NHO workers for every HO worker-

9. Disaggregate the global estimates by ILO region and income group

Estimated numbers of HO workers and NHO workers were summed for all countries in each ILO region and each income group. Within each region and each income group, the total number of NHO workers was divided by the total number of HO workers to yield a weighted average ratio for that region or income group.

10. Estimate the number of NHO workers missing and thus the employment potential

For all low-vulnerability countries (n=24), i.e. countries with low poverty levels and small informal economies, [10] the median number of HO workers per 1,000 population [11] was calculated. This calculation was also done for paid NHO workers and for paid and unpaid NHO workers, and the results are shown in Table 5.

[10] For detail on vulnerability classification, see: X. Scheil-Adlung, Health workforce benchmarks for universal health coverage and sustainable development, in: Bulletin of the World Health Organization, Vol. 91, No. 11, Geneva, 2013, and *World Social Protection Report 2014/15*, ILO, Geneva 2014.

[11] Using UN Population Division population estimates for 2015.

Table 5. Median number of workers per 1,000 population in low-vulnerability countries

HO workers (groups A+B)	**Paid NHO workers** (groups C+D)	**Paid + unpaid NHO workers** (groups C+D+E)
9.2	14.5	20.6

The above numbers were applied to the 2015 population in each of the 185 countries to estimate the number of each type of worker currently missing, and also applied to the UN Population Division's medium variant population projections for 2030 to estimate the related level of missing workers in 2030.

The gap for informal NHO workers was estimated by subtracting the gap of paid NHO workers from the gap of paid and unpaid NHO workers.

For each country, the shortage of workers of each type was estimated by subtracting the number currently in the workforce from the number needed. If the result was a negative number (i.e. availability was higher than need), the shortage was set at zero.

The individual country shortages were then summed to give global and regional totals.

Limitations

Changing age structures and changes in epidemiology are likely between now and 2030, which will affect the number of workers necessary per 1,000 population. In estimating the gap for workers in 2030 we have assumed that the worker-to-population ratio thresholds will be the same in 2030 as in 2015.

Annex 2. Global estimates of current employment and the employment potential of investments in UHC by 2030

A. Estimates of current employment in the health economies of 185 countries: Size of the workforce in 2016 or latest available year

Region, income group, and country	Current number of health economy workers in health occupations, in thousands (A+B) [1, 2]	Current number of health economy workers in non-health occupations, in thousands (C+D) [3, 4]	Current number of unpaid informal care workers fully or partly pulled out of the formal labour market to provide LTC, in thousands (E) [5, 6]	Current number of health economy workers in non-health occupations including unpaid care workers, in thousands (C+D+E) [3, 4, 5, 6]	Ratio of workers in non-health occupations excluding unpaid informal care workers to workers in health occupations {(C+D)/(A+B)} [1, 2, 3, 4]	Ratio of workers in non-health occupations including unpaid informal care workers to workers in health occupations {(C+D+E)/(A+B)} [1, 2, 3, 4, 5, 6]
Africa	4 377	5 958	3 707	9 665	1.36	2.21
Americas	13 404	21 312	9 627	30 939	1.59	2.31
Arab States	1 203	1 914	445	2 359	1.59	1.96
Asia and the Pacific	32 918	47 117	29 314	76 431	1.43	2.32
Europe and Central Asia	18 715	29 719	13 567	43 286	1.59	2.31
High-Income countries	27 873	46 655	20 804	67 459	1.67	2.42
Upper-Middle Income countries	26 383	36 744	19 694	56 438	1.39	2.14
Lower-Income countries	15 695	21 741	14 618	36 358	1.39	2.32
Low-Income countries	716	902	1 550	2 452	1.26	3.42
Afghanistan	62	85	77	162	1.38	2.63
Albania	31	43	34	78	1.38	2.48
Algeria	426	590	226	815	1.38	1.91
Andorra	2	3	–	3	1.72	1.72
Angola	39	54	56	110	1.38	2.80
Argentina	497	580	455	1 035	1.17	2.08
Armenia	51	70	31	102	1.38	2.00
Australia	751	1211	346	1 557	1.61	2.07

Region, income group, and country	Current number of health economy workers in health occupations, in thousands (A+B) [1, 2]	Current number of health economy workers in non-health occupations, in thousands (C+D) [3, 4]	Current number of unpaid informal care workers fully or partly pulled out of the formal labour market to provide LTC, in thousands (E) [5, 6]	Current number of health economy workers in non-health occupations including unpaid care workers, in thousands (C+D+E) [3, 4, 5, 6]	Ratio of workers in non-health occupations excluding unpaid informal care workers to workers in health occupations {(C+D)/(A+B)} [1, 2, 3, 4]	Ratio of workers in non-health occupations including unpaid informal care workers to workers in health occupations {(C+D+E)/(A+B)} [1, 2, 3, 4, 5, 6]
Austria	228	384	154	537	1.68	2.36
Azerbaijan	168	232	53	285	1.38	1.70
Bahamas	5	9	3	12	1.72	2.35
Bahrain	10	17	3	20	1.72	2.05
Bangladesh	260	360	768	1 128	1.38	4.33
Barbados	4	7	4	11	1.72	2.65
Belarus	248	343	127	470	1.38	1.90
Belgium	271	561	198	759	2.07	2.80
Belize	2	3	1	4	1.38	1.99
Benin	24	34	30	64	1.38	2.63
Bhutan	7	10	4	14	1.38	1.91
Bolivia (Plurinational States of)	48	67	67	133	1.38	2.76
Bosnia and Herzegovina	29	38	56	94	1.32	3.28
Botswana	30	42	8	50	1.38	1.64
Brazil	3 203	4 433	1 564	5 997	1.38	1.87
Brunei Darussalam	8	14	2	16	1.72	1.94
Bulgaria	115	160	137	297	1.38	2.57
Burkina Faso	19	27	42	68	1.38	3.53
Burundi	10	13	26	40	1.38	4.13
Cabo Verde	1	1	2	4	1.38	3.88
Cambodia	26	50	62	111	1.94	4.33
Cameroon	64	88	72	160	1.38	2.51
Canada	1 063	1 831	556	2 388	1.72	2.25
Central African Republic	6	8	18	27	1.38	4.34
Chad	9	13	33	46	1.38	5.03

Region, income group, and country	Current number of health economy workers in health occupations, in thousands (A+B) [1, 2]	Current number of health economy workers in non-health occupations, in thousands (C+D) [3, 4]	Current number of unpaid informal care workers fully or partly pulled out of the formal labour market to provide LTC, in thousands (E) [5, 6]	Current number of health economy workers in non-health occupations including unpaid care workers, in thousands (C+D+E) [3, 4, 5, 6]	Ratio of workers in non-health occupations excluding unpaid informal care workers to workers in health occupations {(C+D)/(A+B)} [1, 2, 3, 4]	Ratio of workers in non-health occupations including unpaid informal care workers to workers in health occupations {(C+D+E)/(A+B)} [1, 2, 3, 4, 5, 6]
Chile	51	88	189	277	1.72	5.45
China	15 520	21 482	12 607	34 088	1.38	2.20
Colombia	248	343	326	669	1.38	2.70
Comoros	2	3	2	5	1.38	2.45
Congo	12	17	16	33	1.38	2.71
Costa Rica	47	108	41	149	2.32	3.21
Côte d'Ivoire	33	46	66	112	1.38	3.36
Croatia	82	80	77	157	0.98	1.91
Cuba	459	635	153	788	1.38	1.72
Cyprus	11	21	14	35	1.99	3.35
Czech Republic	227	248	183	430	1.09	1.89
Denmark	182	462	103	565	2.54	3.11
Djibouti	2	3	4	6	1.38	3.16
Dominican Republic	53	73	67	140	1.38	2.65
Ecuador	95	229	104	333	2.41	3.50
Egypt	1 135	1571	458	2 029	1.38	1.79
El Salvador	42	122	48	170	2.89	4.02
Equatorial Guinea	3	6	2	8	1.72	2.41
Eritrea	7	9	13	23	1.38	3.34
Estonia	25	34	24	58	1.39	2.35
Ethiopia	101	37	332	369	0.37	3.66
Fiji	6	8	5	13	1.38	2.29
Finland	165	334	108	443	2.03	2.69
France	1 386	3 652	1 181	4 833	2.64	3.49
Gabon	14	19	8	27	1.38	2.00

Region, income group, and country	Current number of health economy workers in health occupations, in thousands (A+B) [1, 2]	Current number of health economy workers in non-health occupations, in thousands (C+D) [3, 4]	Current number of unpaid informal care workers fully or partly pulled out of the formal labour market to provide LTC, in thousands (E) [5, 6]	Current number of health economy workers in non-health occupations including unpaid care workers, in thousands (C+D+E) [3, 4, 5, 6]	Ratio of workers in non-health occupations excluding unpaid informal care workers to workers in health occupations {(C+D)/(A+B)} [1, 2, 3, 4]	Ratio of workers in non-health occupations including unpaid informal care workers to workers in health occupations {(C+D+E)/(A+B)} [1, 2, 3, 4, 5, 6]
Gambia	8	12	4	16	1.38	1.91
Georgia	76	105	54	159	1.38	2.09
Germany	3 360	3 467	1 644	5 111	1.03	1.52
Ghana	56	77	89	166	1.38	2.99
Greece	125	176	225	401	1.41	3.21
Grenada	1	1	1	2	1.38	2.17
Guatemala	90	159	76	235	1.76	2.60
Guinea	12	16	37	53	1.38	4.60
Guinea-Bissau	5	7	6	12	1.38	2.51
Guyana	1	2	4	6	1.38	3.86
Honduras	34	47	38	85	1.38	2.49
Hungary	183	234	168	402	1.28	2.20
Iceland	10	18	4	22	1.79	2.23
India	7 506	10 390	7 063	17 453	1.38	2.33
Indonesia	1 116	1 545	1 278	2 823	1.38	2.53
Iran, Islamic Republic of	799	1 106	384	1 490	1.38	1.87
Iraq	51	71	107	177	1.38	3.48
Ireland	114	200	59	259	1.76	2.28
Israel	153	351	87	438	2.29	2.86
Italy	997	1 450	1 285	2 736	1.45	2.74
Jamaica	12	16	24	40	1.38	3.51
Japan	4 060	6 991	3 198	10 190	1.72	2.51
Jordan	96	132	28	160	1.38	1.67
Kazakhstan	367	508	114	622	1.38	1.69
Kenya	84	116	124	240	1.38	2.86

Region, income group, and country	Current number of health economy workers in health occupations, in thousands (A+B) [1, 2]	Current number of health economy workers in non-health occupations, in thousands (C+D) [3, 4]	Current number of unpaid informal care workers fully or partly pulled out of the formal labour market to provide LTC, in thousands (E) [5, 6]	Current number of health economy workers in non-health occupations including unpaid care workers, in thousands (C+D+E) [3, 4, 5, 6]	Ratio of workers in non-health occupations excluding unpaid informal care workers to workers in health occupations {(C+D)/(A+B)} [1, 2, 3, 4]	Ratio of workers in non-health occupations including unpaid informal care workers to workers in health occupations {(C+D+E)/(A+B)} [1, 2, 3, 4, 5, 6]
Kiribati	1	1	0	2	1.38	1.81
Kuwait	69	118	7	126	1.72	1.83
Kyrgyzstan	78	108	24	132	1.38	1.69
Lao People's Democratic Republic	26	37	25	61	1.38	2.33
Latvia	30	50	37	86	1.68	2.91
Lebanon	64	89	46	135	1.38	2.09
Lesotho	3	4	8	12	1.38	4.67
Liberia	5	6	13	19	1.38	4.18
Libyan Arab Jamahiriya	103	143	27	170	1.38	1.65
Lithuania	67	63	52	115	0.94	1.71
Luxembourg	10	25	8	33	2.44	3.18
Macedonia, the former Yugoslav Republic of	28	25	25	49	0.88	1.75
Madagascar	32	44	66	110	1.38	3.48
Malawi	35	49	57	106	1.38	3.00
Malaysia	259	319	170	490	1.23	1.89
Maldives	6	9	2	11	1.38	1.64
Mali	30	42	43	85	1.38	2.78
Malta	8	17	8	25	2.06	2.98
Marshall Islands	1	1	–	1	1.38	1.38
Mauritania	9	12	13	25	1.38	2.83
Mauritius	18	25	12	36	1.38	2.04
Mexico	950	1507	788	2 295	1.59	2.42
Micronesia	2	2	0	3	1.38	1.63
Moldova, Republic of	48	65	39	104	1.36	2.16

Region, income group, and country	Current number of health economy workers in health occupations, in thousands (A+B) [1, 2]	Current number of health economy workers in non-health occupations, in thousands (C+D) [3, 4]	Current number of unpaid informal care workers fully or partly pulled out of the formal labour market to provide LTC, in thousands (E) [5, 6]	Current number of health economy workers in non-health occupations including unpaid care workers, in thousands (C+D+E) [3, 4, 5, 6]	Ratio of workers in non-health occupations excluding unpaid informal care workers to workers in health occupations {(C+D)/(A+B)} [1, 2, 3, 4]	Ratio of workers in non-health occupations including unpaid informal care workers to workers in health occupations {(C+D+E)/(A+B)} [1, 2, 3, 4, 5, 6]
Monaco	3	4	–	4	1.72	1.72
Mongolia	34	19	11	30	0.55	0.89
Montenegro	8	11	8	20	1.38	2.38
Morocco	107	148	203	352	1.38	3.28
Mozambique	24	33	90	123	1.38	5.14
Myanmar	160	221	277	498	1.38	3.12
Namibia	13	18	8	26	1.38	2.02
Nauru	0	0	–	0	1.38	1.38
Nepal	66	92	152	244	1.38	3.67
Netherlands	546	1075	296	1 371	1.97	2.51
New Zealand	7	13	65	77	1.72	10.34
Nicaragua	53	73	30	103	1.38	1.95
Niger	5	7	49	56	1.38	11.11
Nigeria	592	819	478	1 297	1.38	2.19
Niue	0	0	–	0	1.38	1.38
Norway	220	420	82	502	1.91	2.28
Oman	75	130	11	141	1.72	1.87
Pakistan	736	1019	814	1 833	1.38	2.49
Palau	0	0	–	0	1.38	1.38
Panama	44	74	29	103	1.69	2.35
Papua New Guinea	19	26	22	48	1.38	2.55
Paraguay	55	76	38	114	1.38	2.08
Peru	357	494	205	699	1.38	1.96
Philippines	478	583	442	1 025	1.22	2.14
Poland	642	655	575	1 230	1.02	1.92

Region, income group, and country	Current number of health economy workers in health occupations, in thousands (A+B) [1, 2]	Current number of health economy workers in non-health occupations, in thousands (C+D) [3, 4]	Current number of unpaid informal care workers fully or partly pulled out of the formal labour market to provide LTC, in thousands (E) [5, 6]	Current number of health economy workers in non-health occupations including unpaid care workers, in thousands (C+D+E) [3, 4, 5, 6]	Ratio of workers in non-health occupations excluding unpaid informal care workers to workers in health occupations {(C+D)/(A+B)} [1, 2, 3, 4]	Ratio of workers in non-health occupations including unpaid informal care workers to workers in health occupations {(C+D+E)/(A+B)} [1, 2, 3, 4, 5, 6]
Portugal	192	379	206	585	1.97	3.05
Qatar	30	51	3	53	1.72	1.81
Romania	296	232	324	556	0.78	1.88
Russian Federation	1 988	3423	1 839	5 262	1.72	2.65
Rwanda	21	29	31	60	1.38	2.86
Saint Kitts and Nevis	1	1	–	1	1.72	1.72
Saint Lucia	0	0	2	2	1.38	35.19
Saint Vincent and the Grenadines	2	2	1	3	1.38	1.88
Samoa	2	3	1	4	1.38	1.89
San Marino	1	2	–	2	1.72	1.72
Sao Tome and Principe	2	3	1	4	1.38	1.61
Saudi Arabia	512	882	87	968	1.72	1.89
Senegal	23	32	43	74	1.38	3.25
Serbia	122	95	145	240	0.78	1.97
Seychelles	3	4	1	5	1.72	1.97
Sierra Leone	3	4	17	20	1.38	7.26
Singapore	84	145	63	208	1.72	2.47
Slovakia	106	131	72	203	1.23	1.91
Slovenia	44	51	36	87	1.16	1.97
Solomon Islands	2	3	2	5	1.38	2.32
Somalia	2	3	29	32	1.38	15.25
South Africa	721	998	263	1 262	1.38	1.75
Spain	851	1351	831	2 182	1.59	2.56
Sri Lanka	93	129	185	314	1.38	3.37
Sudan	164	227	128	356	1.38	2.17

Region, income group, and country	Current number of health economy workers in health occupations, in thousands (A+B) [1, 2]	Current number of health economy workers in non-health occupations, in thousands (C+D) [3, 4]	Current number of unpaid informal care workers fully or partly pulled out of the formal labour market to provide LTC, in thousands (E) [5, 6]	Current number of health economy workers in non-health occupations including unpaid care workers, in thousands (C+D+E) [3, 4, 5, 6]	Ratio of workers in non-health occupations excluding unpaid informal care workers to workers in health occupations {(C+D)/(A+B)} [1, 2, 3, 4]	Ratio of workers in non-health occupations including unpaid informal care workers to workers in health occupations {(C+D+E)/(A+B)} [1, 2, 3, 4, 5, 6]
Suriname	5	7	4	11	1.38	2.09
Swaziland	22	30	4	35	1.38	1.59
Sweden	318	721	187	908	2.26	2.85
Switzerland	302	519	144	663	1.72	2.20
Syrian Arab Republic	175	242	72	314	1.38	1.80
Tajikistan	86	119	24	144	1.38	1.67
Tanzania, United Republic of	29	41	164	205	1.38	6.99
Thailand	453	735	683	1 418	1.62	3.13
Timor-Leste	4	6	6	12	1.38	2.90
Togo	14	19	19	38	1.38	2.81
Tonga	1	2	1	2	1.38	1.84
Trinidad and Tobago	12	21	12	33	1.72	2.73
Tunisia	90	125	82	207	1.38	2.29
Turkey	572	896	569	1 465	1.57	2.56
Turkmenistan	124	172	21	194	1.38	1.56
Uganda	112	154	93	248	1.38	2.22
Ukraine	901	1 247	658	1 905	1.38	2.11
United Arab Emirates	42	72	10	82	1.72	1.96
United Kingdom	1 731	3 599	1 102	4 702	2.08	2.72
United States	5 762	9 923	4 564	14 487	1.72	2.51
Uruguay	57	119	48	167	2.10	2.94
Uzbekistan	790	1 094	134	1 228	1.38	1.55
Vanuatu	1	2	1	3	1.38	2.20
Venezuela, Bolivarian Republic	151	260	187	447	1.72	2.96
Viet Nam	371	513	604	1 118	1.38	3.01

Region, income group, and country	Current number of health economy workers in health occupations, in thousands (A+B) [1, 2]	Current number of health economy workers in non-health occupations, in thousands (C+D) [3, 4]	Current number of unpaid informal care workers fully or partly pulled out of the formal labour market to provide LTC, in thousands (E) [5, 6]	Current number of health economy workers in non-health occupations including unpaid care workers, in thousands (C+D+E) [3, 4, 5, 6]	Ratio of workers in non-health occupations excluding unpaid informal care workers to workers in health occupations {(C+D)/(A+B)} [1, 2, 3, 4]	Ratio of workers in non-health occupations including unpaid informal care workers to workers in health occupations {(C+D+E)/(A+B)} [1, 2, 3, 4, 5, 6]
Yemen	79	110	72	182	1.38	2.29
Zambia	47	65	45	110	1.38	2.35
Zimbabwe	48	66	44	110	1.38	2.32
TOTAL	**70 631**	**106 042**	**56 665**	**162 707**		
Median					1.38	2.35
Mean					1.49	2.88
Weighted average ratio					1.50	2.30

B. Estimates of the additional employment potential in the global health protection supply chain producing UHC by 2030 (2016 or latest available year, 2030)

Region, income group, and country	Current number of jobs for health economy workers in health occupations missing, in thousands (A+B) [1, 2, 7]	Current number of jobs for health economy workers in non-health occupations missing, in thousands (C+D) [3, 4, 7]	Current number of jobs for care workers missing, in thousands (E) [5, 6, 7]	Current number of jobs for health economy workers in non-health occupations including care workers missing in 2016 or latest available year, in thousands (C+D+E) [3, 4, 5, 6, 7]	Number of jobs for health economy workers in health occupations missing in 2030 in thousands (A+B) [1, 2, 7, 8]	Number of jobs for health economy workers in non-health occupations missing in 2030, in thousands (C+D) [3, 4, 7, 8]	Number of jobs for care worker missing by 2030, in thousands (E) [5, 6, 7, 8]	Number of jobs for health economy workers in non-health occupations including care workers missing in 2030 in thousands (C+D+E) [3, 4, 5, 6, 7, 8]
Africa	6 368	10 494	2 949	13 443	10 102	16 586	5 634	22 219
Americas	966	1 510	47	1 558	1 439	2 373	299	2 672
Arab States	499	829	462	1 291	858	1 401	771	2 172
Asia and the Pacific	10 347	18 575	2 264	20 893	14 136	24 658	4755	29 413
Europe and Central Asia	160	353	104	457	259	484	173	657
High-Income Countries	335	539	205	744	437	784	315	1 099
Upper-Middle Income Countries	1 401	2 459	473	2 933	2 201	3 917	1 053	4 971
Lower-Income Countries	12 583	22 208	3 587	25 795	17 982	30 856	7 288	38 144
Low-Income Countries	4 021	6556	1 562	8 118	6 173	9 945	2 977	12 921
Afghanistan	238	387	120	507	343	552	189	741
Albania	–	–	–	–	–	–	–	–
Algeria	–	–	15	15	20	112	67	179
Andorra	–	–	0	0	–	–	0	0
Angola	192	309	96	405	324	517	183	700
Argentina	–	51	–	51	–	137	–	137
Armenia	–	–	–	–	–	–	–	–
Australia	–	–	–	–	–	–	–	–
Austria	–	–	–	–	–	–	–	–
Azerbaijan	–	–	7	7	–	–	12	12
Bahamas	–	–	–	–	–	–	–	–
Bahrain	3	3	5	8	5	7	7	14

Region, income group, and country	Current number of jobs for health economy workers in health occupations missing, in thousands (A+B) [1, 2, 7]	Current number of jobs for health economy workers in non-health occupations missing, in thousands (C+D) [3, 4, 7]	Current number of jobs for care workers missing, in thousands (E) [5, 6, 7]	Current number of jobs for health economy workers in non-health occupations including care workers missing in 2016 or latest available year, in thousands (C+D+E) [3, 4, 5, 6, 7]	Number of jobs for health economy workers in health occupations missing in 2030 in thousands (A+B) [1, 2, 7, 8]	Number of jobs for health economy workers in non-health occupations missing in 2030, in thousands (C+D) [3, 4, 7, 8]	Number of jobs for care worker missing by 2030, in thousands (E) [5, 6, 7, 8]	Number of jobs for health economy workers in non-health occupations including care workers missing in 2030 in thousands (C+D+E) [3, 4, 5, 6, 7, 8]
Bangladesh	1 225	1 979	208	2 187	1 460	2 349	362	2 712
Barbados	–	–	–	–	–	–	–	–
Belarus	–	–	–	–	–	–	–	–
Belgium	–	–	–	–	–	–	–	–
Belize	1	2	1	3	2	4	2	5
Benin	76	125	36	160	120	193	64	257
Bhutan	–	–	–	–	–	–	–	–
Bolivia	51	89	–	89	73	125	13	138
Bosnia and Herzegovina	6	17	–	17	4	14	–	14
Botswana	–	–	6	6	–	–	9	9
Brazil	–	–	–	–	–	–	–	–
Brunei Darussalam	–	–	1	1	–	–	1	1
Bulgaria	–	–	–	–	–	–	–	–
Burkina Faso	148	236	68	304	232	369	124	493
Burundi	94	149	41	190	151	239	79	318
Cabo Verde	4	6	1	7	5	8	1	9
Cambodia	118	176	33	209	149	226	54	280
Cameroon	152	251	70	321	240	391	128	519
Canada	–	–	–	–	–	–	–	–
Central African Republic	39	63	12	74	54	86	21	107
Chad	120	191	52	244	193	306	100	406
Chile	115	173	–	173	136	207	–	207
China	–	–	–	–	–	–	–	–
Colombia	197	358	–	358	243	430	–	430
Comoros	5	9	3	11	8	13	4	17
Congo	30	50	12	62	50	82	25	107

Region, income group, and country	Current number of jobs for health economy workers in health occupations missing, in thousands (A+B) [1, 2, 7]	Current number of jobs for health economy workers in non-health occupations missing, in thousands (C+D) [3, 4, 7]	Current number of jobs for care workers missing, in thousands (E) [5, 6, 7]	Current number of jobs for health economy workers in non-health occupations including care workers missing in 2016 or latest available year, in thousands (C+D+E) [3, 4, 5, 6, 7]	Number of jobs for health economy workers in health occupations missing in 2030 in thousands (A+B) [1, 2, 7, 8]	Number of jobs for health economy workers in non-health occupations missing in 2030, in thousands (C+D) [3, 4, 7, 8]	Number of jobs for care worker missing by 2030, in thousands (E) [5, 6, 7, 8]	Number of jobs for health economy workers in non-health occupations including care workers missing in 2030 in thousands (C+D+E) [3, 4, 5, 6, 7, 8]
Costa Rica	–	–	–	–	3	–	–	–
Côte d'Ivoire	176	284	72	355	263	421	129	550
Croatia	–	–	–	–	–	–	–	–
Cuba	–	–	–	–	–	–	–	–
Cyprus	0.19	–	–	–	1	–	–	–
Czech Republic	–	–	–	–	–	–	–	–
Denmark	–	–	–	–	–	–	–	–
Djibouti	6	10	2	12	8	13	3	15
Dominican Republic	44	80	–	80	59	102	6	108
Ecuador	54	5	–	5	85	55	15	70
Egypt	–	–	97	97	–	131	252	383
El Salvador	14	–	–	–	17	–	–	–
Equatorial Guinea	4	6	3	9	8	12	5	17
Eritrea	41	67	19	85	61	97	31	128
Estonia	–	–	–	–	–	–	–	–
Ethiopia	816	1 407	270	1 677	1 175	1 972	506	2 479
Fiji	3	5	0	6	3	6	1	7
Finland	–	–	–	–	–	–	–	–
France	–	–	–	–	–	–	–	–
Gabon	2	6	2	8	8	15	6	21
Gambia	10	17	8	25	20	34	14	48
Georgia	–	–	–	–	–	–	–	–
Germany	–	–	–	–	–	–	–	–
Ghana	197	321	77	398	285	459	134	593
Greece	–	–	–	–	–	–	–	–
Grenada	0.1	0.3	–	0.3	0	0	–	0

Region, income group, and country	Current number of jobs for health economy workers in health occupations missing, in thousands (A+B) [1, 2, 7]	Current number of jobs for health economy workers in non-health occupations missing, in thousands (C+D) [3, 4, 7]	Current number of jobs for care workers missing, in thousands (E) [5, 6, 7]	Current number of jobs for health economy workers in non-health occupations including care workers missing in 2016 or latest available year, in thousands (C+D+E) [3, 4, 5, 6, 7]	Number of jobs for health economy workers in health occupations missing in 2030 in thousands (A+B) [1, 2, 7, 8]	Number of jobs for health economy workers in non-health occupations missing in 2030, in thousands (C+D) [3, 4, 7, 8]	Number of jobs for care worker missing by 2030, in thousands (E) [5, 6, 7, 8]	Number of jobs for health economy workers in non-health occupations including care workers missing in 2030 in thousands (C+D+E) [3, 4, 5, 6, 7, 8]
Guatemala	60	79	23	102	107	152	54	206
Guinea	105	167	39	207	157	250	74	323
Guinea-Bissau	12	20	6	26	18	30	10	40
Guyana	6	9	1	10	6	10	1	11
Honduras	41	70	11	82	56	94	21	116
Hungary	–	–	–	–	–	–	–	–
Iceland	–	–	–	–	–	–	–	–
India	4 591	8 660	887	9 547	6 590	11 807	2 200	14 007
Indonesia	1 261	2 198	283	2 481	1 610	2 749	513	3 262
Iran, Islamic Republic of	–	44	96	140	18	181	153	334
Iraq	285	459	114	573	448	715	221	936
Ireland	–	–	–	–	–	–	–	–
Israel	–	–	–	–	–	–	–	–
Italy	–	–	–	–	–	–	–	–
Jamaica	14	25	–	25	15	26	–	26
Japan	–	–	–	–	–	–	–	–
Jordan	–	–	18	18	–	–	28	28
Kazakhstan	–	–	–	–	–	–	8	8
Kenya	341	553	155	708	520	834	273	1 107
Kiribati	0	0	0	1	0	1	0	1
Kuwait	–	–	16	16	–	–	23	23
Kyrgyzstan	–	–	12	12	–	–	19	19
Lao People's Democratic Republic	36	62	16	79	52	87	27	113
Latvia	–	–	–	–	–	–	–	–
Lebanon	–	–	–	–	–	–	–	–

Region, income group, and country	Current number of jobs for health economy workers in health occupations missing, in thousands (A+B) [1, 2, 7]	Current number of jobs for health economy workers in non-health occupations missing, in thousands (C+D) [3, 4, 7]	Current number of jobs for care workers missing, in thousands (E) [5, 6, 7]	Current number of jobs for health economy workers in non-health occupations including care workers missing in 2016 or latest available year, in thousands (C+D+E) [3, 4, 5, 6, 7]	Number of jobs for health economy workers in health occupations missing in 2030 in thousands (A+B) [1, 2, 7, 8]	Number of jobs for health economy workers in non-health occupations missing in 2030, in thousands (C+D) [3, 4, 7, 8]	Number of jobs for care worker missing by 2030, in thousands (E) [5, 6, 7, 8]	Number of jobs for health economy workers in non-health occupations including care workers missing in 2030 in thousands (C+D+E) [3, 4, 5, 6, 7, 8]
Lesotho	17	27	4	32	20	33	7	39
Liberia	37	59	14	73	55	87	26	113
Libyan Arab Jamahiriya	–	–	11	11	–	–	18	18
Lithuania	–	–	–	–	–	–	–	–
Luxembourg	–	–	–	–	–	–	–	–
Macedonia, the former Yugoslav Republic of	–	–	–	–	–	–	–	–
Madagascar	192	308	81	389	300	479	152	631
Malawi	124	201	48	249	210	337	104	442
Malaysia	21	122	14	135	74	205	49	254
Maldives	–	–	1	1	–	–	1	1
Mali	132	214	64	278	222	356	123	479
Malta	–	–	–	–	–	–	–	–
Marshall Islands	–	–	0	0	–	–	0	0
Mauritania	29	47	12	59	44	70	22	92
Mauritius	–	–	–	–	–	–	–	–
Mexico	222	338	–	338	417	645	110	755
Micronesia	–	–	0	0	–	–	0	0
Moldova, Republic of	–	–	–	–	–	–	–	–
Monaco	–	–	0	0	–	–	0	0
Mongolia	–	24	6	31	–	32	10	42
Montenegro	–	–	–	–	–	–	–	–
Morocco	210	351	5	356	260	430	38	467
Mozambique	234	373	80	453	358	569	161	730
Myanmar	337	562	50	611	396	654	88	742
Namibia	10	18	7	24	17	30	12	41

Region, income group, and country	Current number of jobs for health economy workers in health occupations missing, in thousands (A+B) [1, 2, 7]	Current number of jobs for health economy workers in non-health occupations missing, in thousands (C+D) [3, 4, 7]	Current number of jobs for care workers missing, in thousands (E) [5, 6, 7]	Current number of jobs for health economy workers in non-health occupations including care workers missing in 2016 or latest available year, in thousands (C+D+E) [3, 4, 5, 6, 7]	Number of jobs for health economy workers in health occupations missing in 2030 in thousands (A+B) [1, 2, 7, 8]	Number of jobs for health economy workers in non-health occupations missing in 2030, in thousands (C+D) [3, 4, 7, 8]	Number of jobs for care worker missing by 2030, in thousands (E) [5, 6, 7, 8]	Number of jobs for health economy workers in non-health occupations including care workers missing in 2030 in thousands (C+D+E) [3, 4, 5, 6, 7, 8]
Nauru	–	–	–	–	–	–	–	–
Nepal	197	322	21	343	239	389	49	438
Netherlands	–	–	–	–	–	–	–	–
New Zealand	34	53	–	53	40	61	–	61
Nicaragua	3	15	7	22	12	29	13	42
Niger	179	282	71	354	327	516	169	684
Nigeria	1 090	1 829	626	2 455	1 832	2 997	1 114	4 111
Niue	–	–	–	–	–	–	–	–
Norway	–	–	–	–	–	–	–	–
Oman	–	–	16	16	–	–	21	21
Pakistan	1 007	1 727	331	2 058	1 524	2 540	671	3 211
Palau	–	–	0	0	–	0	0	0
Panama	–	–	–	–	0	–	0	0
Papua New Guinea	51	85	24	109	74	120	39	159
Paraguay	6	20	2	22	17	38	9	47
Peru	–	–	–	–	–	41	18	59
Philippines	451	881	168	1 049	662	1 213	307	1 520
Poland	–	–	–	–	–	–	–	–
Portugal	–	–	–	–	–	–	–	–
Qatar	–	–	11	11	–	–	14	14
Romania	–	52	–	52	–	25	–	25
Russian Federation	–	–	–	–	–	–	–	–
Rwanda	86	140	39	179	125	200	65	265
Saint Kitts and Nevis	–	–	0	0	–	–	0	0
Saint Lucia	2	3	–	3	2	3	–	3

Region, income group, and country	Current number of jobs for health economy workers in health occupations missing, in thousands (A+B) [1, 2, 7]	Current number of jobs for health economy workers in non-health occupations missing, in thousands (C+D) [3, 4, 7]	Current number of jobs for care workers missing, in thousands (E) [5, 6, 7]	Current number of jobs for health economy workers in non-health occupations including care workers missing in 2016 or latest available year, in thousands (C+D+E) [3, 4, 5, 6, 7]	Number of jobs for health economy workers in health occupations missing in 2030 in thousands (A+B) [1, 2, 7, 8]	Number of jobs for health economy workers in non-health occupations missing in 2030, in thousands (C+D) [3, 4, 7, 8]	Number of jobs for care worker missing by 2030, in thousands (E) [5, 6, 7, 8]	Number of jobs for health economy workers in non-health occupations including care workers missing in 2030 in thousands (C+D+E) [3, 4, 5, 6, 7, 8]
Saint Vincent and the Grenadines	–	–	–	–	–	–	–	–
Samoa	–	0	0	0	0	0	0	1
San Marino	–	–	0	0	–	–	0	0
Sao Tome and Principe	–	–	1	1	–	0	1	1
Saudi Arabia	–	–	105	105	–	–	151	151
Senegal	117	188	49	237	188	300	96	395
Serbia	–	33	–	33	–	25	–	25
Seychelles	–	–	–	–	–	–	–	–
Sierra Leone	57	90	23	112	77	121	36	157
Singapore	–	–	–	–	–	–	–	–
Slovakia	–	–	–	–	–	–	–	–
Slovenia	–	–	–	–	–	–	–	–
Solomon Islands	3	6	2	7	5	8	3	11
Somalia	97	154	36	190	150	237	71	308
South Africa	–	–	67	67	–	–	101	101
Spain	–	–	–	–	–	–	–	–
Sri Lanka	98	172	–	172	106	184	–	184
Sudan	207	357	116	473	357	593	214	807
Suriname	–	1	–	1	0	2	0	2
Swaziland	–	–	3	3	–	–	5	5
Sweden	–	–	–	–	–	–	–	–
Switzerland	–	–	–	–	–	–	–	–
Syrian Arab Republic	–	27	40	67	89	174	102	276
Tajikistan	–	4	27	31	16	42	43	85

Region, income group, and country	Current number of jobs for health economy workers in health occupations missing, in thousands (A+B) [1, 2, 7]	Current number of jobs for health economy workers in non-health occupations missing, in thousands (C+D) [3, 4, 7]	Current number of jobs for care workers missing, in thousands (E) [5, 6, 7]	Current number of jobs for health economy workers in non-health occupations including care workers missing in 2016 or latest available year, in thousands (C+D+E) [3, 4, 5, 6, 7]	Number of jobs for health economy workers in health occupations missing in 2030 in thousands (A+B) [1, 2, 7, 8]	Number of jobs for health economy workers in non-health occupations missing in 2030, in thousands (C+D) [3, 4, 7, 8]	Number of jobs for care worker missing by 2030, in thousands (E) [5, 6, 7, 8]	Number of jobs for health economy workers in non-health occupations including care workers missing in 2030 in thousands (C+D+E) [3, 4, 5, 6, 7, 8]
Tanzania, United Republic of	464	736	160	896	736	1 164	339	1 503
Thailand	175	252	–	252	177	257	–	257
Timor-Leste	7	11	1	12	10	17	3	20
Tonga	–	–	0	0	–	–	0	0
Trinidad and Tobago	0.32	–	–	–	0	–	–	–
Tunisia	14	38	–	38	27	59	–	59
Turkey	154	247	–	247	237	378	–	378
Turkmenistan	–	–	11	11	–	–	16	16
Uganda	249	413	143	556	460	746	282	1 028
Ukraine	–	–	–	–	–	–	–	–
United Arab Emirates	42	61	46	106	59	87	57	144
United Kingdom	–	–	–	–	–	–	–	–
United States	–	–	–	–	–	–	–	–
Uruguay	–	–	–	–	–	–	–	–
Uzbekistan	–	–	48	48	–	–	75	75
Vanuatu	1	2	1	3	2	3	1	4
Venezuela, Bolivarian Republic	136	192	2	193	187	272	35	308
Viet Nam	491	844	–	844	600	1 016	34	1 049
Yemen	168	280	91	371	256	418	149	567
Zambia	103	171	53	224	187	303	108	411
Zimbabwe	96	161	50	211	149	244	85	329
Total	**18 340**	**31 762**	**5 827**	**37 642**	**26 794**	**45 502**	**11 632**	**57 133**

Notes

[1] Workers in health occupations (A+B) are defined as paid formal and informal health economy workers who are:

(a) employed in the public and private sector (including self-employed) within the health sector; and

(b) outside the health sector in other economic sectors contributing to the health sector.

These workers have received higher or vocational education in a health field as outlined in the International Standard Classification of Occupations (ISCO) groups 22 (health professionals) and 32 (health associate professionals). These groups include the ISCO-88 unit groups 222 (health professionals other than nursing including medical doctors; dentists; veterinarians; pharmacists; and health professionals not elsewhere classified), 223 (nursing and midwifery professionals), 322 (health associate professionals other than nursing including medical assistants; hygienists, health and environmental officers; dieticians and nutritionists; optometrists and opticians; dental assistants; physiotherapists and related associate professionals; veterinary assistants; pharmaceutical assistants; health associate professionals not elsewhere classified), 323 (nursing and midwifery associate professionals) and 324 (traditional medicine practitioners and faith healers).

[2] To estimate the number of health economy workers in health occupations (A+B) for ILOSTAT countries, the most recent numbers of workers in ISCO groups 22 (Health Professionals) and 32 (Health Associate Professionals) were extracted from the ILOSTAT database and resulted in data for 52 countries. For the 133 countries not included in ILOSTAT, data from the WHO Global Health Observatory was used, matched to the ISCO groups and adjusted as it did not include private sector workers. For the USA, data was obtained from the US Department of health and human services and matched to the ISCO groups. Since ILOSTAT does not disaggregate ISCO codes to the three-digit level, it was not possible to identify numbers for personal care workers (ISCO code 532). Because personal care workers are workers in health occupations, OECD health statistics data was used to estimate their numbers. The data from the 17 OECD countries from 2012, 2013 or 2014 revealed that 10 per cent of the total employment in health and social care are personal care workers. 10 per cent of the number of workers in the International Standard Industrial Classification (ISIC) Revision 4, category Q (Human Health and Social Work Activities) was thus added to the numbers extracted from ILOSTAT and the WHO Global Health Observatory databases.

[3] Workers in non-health occupations are paid formal and informal health economy workers who are engaged in public and private (including self-employed) work within the health sector (C) as well as outside the health sector (D).

Through the delivery of goods and services they support the work of workers in health occupations. These workers are among the ISIC Revision 4, categories G to P and R to U:

- wholesale and retail trade and repair of motor vehicles and motorcycles (G);
- transportation and storage (H);
- accommodation and food service activities (I);
- information and communication (J);
- financial and insurance activities (K);
- real estate activities (L);
- professional, scientific and technical activities (M);
- administrative and support service activities (N);
- public administration and defence; compulsory social security (O);
- education (P);
- arts, entertainment and recreation (R);
- other service activities (S);
- activities of households as employers; undifferentiated goods- and services-producing activities of households for own use (T); and
- activities of extraterritorial organizations and bodies (U).

[4] To estimate the number of health economy workers in non-health occupations (C+D) for counties in the ILOSTAT database, the most recent numbers from ISIC Revision 4, category Q (Human Health and Social Work Activities), were assumed to represent health economy workers employed in the health sector (A+C).

To estimate the number of health economy workers outside the health sector (B+D), i.e. the ISIC Revision 4, categories G to P and R to U, the total health expenditure (THE) as percentage of the gross domestic product (GDP) was used as proxy variable. Thus, the percentage of service workers outside the health sector who provide health services was assumed to be the same as the percentage of the GDP that is spent on health. In a final step, the number of health economy workers in health occupations (A+B) was subtracted from the number of all health economy workers (A+B+C+D) to generate the numbers of workers in non-health occupations only (C+D).

[5] Unpaid informal care workers who gave up on work due to the unavailability of affordable long-term care services are persons who may be family members, friends or neighbours and who provide unpaid services informally to persons who are in need of long-term care (E).

[6] In a first step, to estimate the number of unpaid informal care workers, whose work needs to be converted into formal labour, the numbers of unpaid informal care workers in 21 countries that were published in a recent ILO paper based on OECD data were taken. For these 21 countries, the median ratio of unpaid informal workers to the population 65+ was calculated and applied to all 185 countries. In a second step and based on a 2015 UK survey of family members providing care, the proportion of unpaid work that should be converted into formal jobs was estimated. The survey found that 51 per cent of carers had given up work in order to provide long-term care for a family or household member, 12 per cent had taken early retirement and 21 per cent had reduced their working hours. Of those who gave up work, retired early or took reduced working hours, 30 per cent said it was because there were no suitable care services and 22 per cent because they could not afford to pay for the available services. This indicates that 44 per cent of all unpaid informal workers should be counted as part of the health economy workforce because the work that they do should be transformed into formal jobs ((51+12+21) x (0.3 + 0.22) = 44)). Thus, the numbers generated in the first step were multiplied by 0.4 taking into account that not all unpaid work should be transformed into formal jobs.

[7] Based on a group of low-vulnerability countries, i.e. countries with low poverty levels and small informal economies, median values were calculated for workers in health and non-health occupations. This yielded thresholds for all health economy workers. These were applied to the 2015 population in each of the 185 countries to estimate the number of each type of worker currently missing. By subtracting the number currently in the workforce with the number needed, the shortage of workers was estimated. If this resulted in a negative number, the shortage was set as zero.

[8] The numbers from the current gaps of workers in health and non-health occupations were applied to the UN Population Division's medium variant population projections for 2030 to estimate the related level of missing workers in 2030.

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