Pharmacy Workforce Intelligence: Global Trends Report

2018

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Colophon

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Mr Christopher John spent 25 years in the UK's National Health Service: hospital pharmacy (in clinical and managerial roles), education and training (regional services) and workforce planning (for the NHS Workforce Review Team). Chris has been workforce development lead at the RPS since 2011, working on thought leadership, consultation responses and standards/guidance relating to the workforce. More recently he has been providing some additional support for the RPS's work on revalidation and has been an assessor on the Office for Students Teaching Excellence Framework subject pilot project, which assessed the quality of teaching and outcomes for students studying pharmacy, medicine, nursing and other healthcare subjects. Chris is the FIP Workforce Development Hub lead for Workforce Intelligence.

Ms Sherly Meilianti is a registered pharmacist in Indonesia. She obtained her pharmacy degree from the University of Indonesia and registered in 2011. She worked as the Head of Department of Pharmacy in Eka Hospital Pekanbaru, Indonesia, for four years. During that time, she was involved in the quality committee, patient safety committee and pharmacy and therapeutics committee. After completing her master's degree in Clinical Pharmacy International Practice and Policy from the UCL School of Pharmacy, Sherly decided to pursue a doctorate on pharmacy workforce development, which she is currently undertaking at the UCL-FIP Collaborating Centre in London. Her research is focused on developing frameworks for advanced pharmacy practice in Indonesia. Sherly has recently been appointed the academic liaison of the FIP Young Pharmacists Group and FIP*Ed*.

Dr Lina R. Bader is a UK trained and registered pharmacist and a member of the RPS. She obtained her MPharm degree from the University of Nottingham in 2010 before successfully completing her registration training to become a pharmacist. She returned to the University of Nottingham in 2012 for her doctoral training, specialising in international pharmaceutical workforce development, gaining her PhD in 2016. Lina is currently working with FIP, leading research, evaluation and development activities for FIP*Ed*. The principal focus of her work is with transformational development of the global pharmacy workforce, managing a large international team working across a wide scope of projects and activities. She has authored many high impact research publications and global reports and continues to lead the planning and implementation actions of the global Pharmaceutical Workforce Development Goals, launched by FIP in 2016.

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Foreword

The World Health Organization (WHO) states that there is "no health without a workforce". It is also true that we cannot shape the health workforce without workforce intelligence. Workforce intelligence provides the strategic analysis and information needed to support health workforce planning as a necessary requisite for the achievement of universal health coverage (UHC).

Recognising the importance of the availability, quality and use of health workforce data, the WHO — under the direction of its Department of Human Resources for Health — developed and launched in 2017 the concept and actions of "National Health Workforce Accounts" (NHWA). The NHWA Handbook* contains core indicators to support the national, regional and global standardisation and reporting of workforce intelligence. The International Pharmaceutical Federation (FIP), as the global leadership body for the pharmacy workforce, is now making significant and important contributions to this future-configuring body of work.

The capacity to deliver quality healthcare depends on having a sufficient, competent and flexible pharmaceutical workforce† that is able to deliver the pharmaceutical and medicines-related services needed to achieve UHC within our health systems. This, in part, explains why pharmacists have been recognised in the indicator selected by the United Nations to follow-up on the achievement of the Sustainable Development Goal 3: to ensure healthy lives and promote wellbeing for all at all ages‡.

It is therefore important to monitor trends in the global pharmaceutical workforce to better understand the supply of pharmacists, pharmacy technicians and pharmacy support workers, and to correlate these trends with population growth demographics and disease burden. FIP, through FIP Education (FIP*Ed*), has been collating and analysing global pharmacy workforce data regularly since 2006. The FIP Global Pharmacy Observatory proposes to build on this existing database to provide an integrated global pharmacy-related information hub, including workforce data, that can be used to inform advocacy work, policy development, decision-making, the advancement of pharmaceutical practice, sciences, education — and, critically, career development through continuing education. The FIP Observatory recognises the importance of the WHO NHWA indicators and is working to align its own workforce indicators with those of the NHWA. This will aid FIP member organisations to better understand their workforce monitoring mechanisms and map to the national and global policy themes introduced by the WHO.

This 2018 Trends Report provides an overview of global trends of the pharmaceutical workforce over the past decade, building on our previous reports in 2006, 2009, 2012 and the 2015 FIP*Ed* Global Report on Workforce Trends. The last of these was the first publication of its kind to provide a baseline on the global trends and pharmacy workforce around the world. These evidence-based resources are critical for national associations to assess the past, current and forecasted capacity of our workforce and to progress our shared Pharmaceutical Workforce Development Goals (PWDGs), particularly PWDG 12: Workforce Intelligence.

In collaboration with our member organisations, we share the findings of our analysis with all our members and beyond to support evidence-based policy development, to trigger greater investment in the capacity of the pharmaceutical workforce, and to encourage nations and member organisations to continue their workforce data collection and tracking efforts so FIP is able to continue to report on global trends of our critical workforce.

This report is only possible due to the collective expertise, time, effort and commitment of the principal authors, reviewers, staff, volunteers and the member organisations who have contributed evidence and data. On behalf of FIP*Ed*, I am sincerely grateful to all those groups, without whose contribution these influential and data-rich publications would not be possible.

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* National health workforce accounts: a handbook. Geneva: World Health Organization; 2017. Available at: http://www.who.int/hrh/documents/brief_nhwa_handbook/en/
† Pharmaceutical workforce refers to the whole of the pharmacy related workforce (e.g. registered pharmacist practitioners, pharmaceutical scientists, pharmacy technicians and other pharmacy support workforce cadres, preservice students/trainees) working in a diversity of settings (e.g. community, hospital, research and development, industry, military, regulatory, academia and other sectors) with a diversity of scope of practice.
‡ Particularly Target 3.c focusing on the healthcare workforce.

PART 1

KEY MESSAGES

1.1 This report describes the **global capacity trends observed in the pharmaceutical workforce from 2006 to 2016**, building on the FIP 2015 Global Pharmacy Workforce Intelligence Trends Report; this report **features additional analysis to track global and national trends, including gender distribution and capacity growth mapped to regional variation and country-level economic indicators**.

1.2 Pharmacist capacity data collected by FIP over the 2006–2016 period were collated and analysed for the **largest retrospective study of pharmaceutical workforce capacity** conducted by any organisation to date. The findings reported in this publication use improved visual charts and include forecasting and rates of growth calculations. To describe a complex global situation, the report uses a mixed-model approach to analyse and illustrate capacity variances across our sample nations and represented regions; using the global mean of sample nations allows for the description of global capacity trends over time but the real-world narratives operate at national levels. We use pharmacist density as a measure of workforce capacity (number of pharmacists per 10,000 population).

1.3 In addition to expanding the **evidence base on global capacity trends**, disaggregated by **WHO regions**, this report also provides an analysis of past, current and future trends linked to country economic status and income level, as well as a focus on **workforce gender distribution** and corresponding changes over the time period of the data.

1.4 Overall, **our analysis suggests an increase in the global capacity of pharmacists** with varying capacity changes across different WHO regions. The Eastern Mediterranean and Europe regions displayed the highest absolute changes in capacity between 2006 and 2016. Our forecasting analysis using this current sample of countries, and assuming no change in linearity, estimates a 40% projected growth of the global pharmacy workforce by 2030, from the last data collection point in 2016.

1.5 Analysis by country income levels indicates that **low income countries exhibited the slowest growth** in the capacity of pharmacists (measured as density – pharmacists per 10,000 population). Furthermore, our analysis points towards an **increasing income-based "capacity gap" between countries that will continue to widen into the future**.

1.6 **The proportion of women in the pharmacy workforce** between 2009 and 2016 shows **a steady increase** at a percentage rate of around 7.5% every decade. The South East Asia region showed the highest proportional increase in the sample period. Our analysis indicates that the average **female proportion of the total global pharmacy workforce will increase to around 72% by 2030**.

1.7 In addition to providing a comprehensive overview of capacity trends, this report and its findings provide a **significant contribution to understanding the current, and persistent, workforce capacity inequities** in pharmacy — including country income level and gender — and highlighting the future need to explore **implications of these inequities of access** to both medicines and the collective medicines expertise of the global pharmaceutical workforce; without adequate capacity there cannot be safe and effective use of medicines, globally, regionally, nationally or locally. However, using global means to help illustrate variance and complexity does have challenges, and relying on aggregated means may have unintended consequences with "over-generalisation" of local or national trends, particularly where we see large variance between countries and economic indicators.

1.8 **This report is a starting point** for further focused work in regions and to initiate specific discussions around needs-based approaches, including workforce demand and supply in line with WHO strategies. **A needs-based understanding** of shortages, particularly in low income and/or developing nations and the supply side influences in high income and/or developed nations need further detailed analysis.

1.9 The findings of this report are of **critical importance to global, regional and national pharmaceutical workforce planning** in the context of the WHO's predictions and expectations for 2030 on the global health workforce shortages (mainly affecting low income countries) and increased demand (largely by higher income countries).

PART 2

INTRODUCTION AND BACKGROUND

2.1 WORKFORCE INTELLIGENCE: A GLOBAL PRIORITY

Access to healthcare services and achieving universal health coverage (UHC) depends on enabling equitable access by people to a well-educated, trained and distributed health workforce. Meeting the pharmaceutical care needs of patients can only be achieved if a flexible and adaptable pharmaceutical workforce[§] is deployed appropriately to apply its knowledge, skills, attitudes, behaviours and abilities to the maximum as part of the multidisciplinary team.[1] The World Health Organization (WHO) has stated that there is "no health without a workforce".[2] However, it is also true that there is no health workforce without workforce intelligence, since effective deployment relies on the understanding of the state of the workforce in each nation: its quality, accessibility and availability.[1]

The International Pharmaceutical Federation (FIP) Global Vision for Education and Workforce[3] acknowledged the worldwide variability in the education, training and utilisation of pharmacists, pharmaceutical scientists and pharmacy support staff. The Global Vision is underpinned by its 13 Pharmaceutical Workforce Development Goals (PWDGs) — listed in Annex 1 — including one on workforce intelligence (PWDG 12) stating that without workforce intelligence there can be no strategic workforce planning and investment.[4] Workforce intelligence, therefore, provides the strategic evidence to support workforce planning. It may also be used for assessing the performance of the workforce, i.e., the impact on patient care. Workforce plans built on workforce data from local, regional and national perspectives may also ensure that the pharmacy workforce is effectively integrated into the health workforce to meet the health needs of patients and public.[1] This requires workforce intelligence systems and workforce planning models. PWDG 12: Workforce Intelligence therefore links closely to other goals such as PWDG 13: Workforce Policy Formation (strategies to implement needs-based workforce development), PWDG 11: Workforce Impact (evidence of the impact of the workforce on patient outcomes), and PWDG 10: Gender and Diversity Balances (strategies for addressing gender and diversity inequalities in pharmaceutical workforce).[5]

The WHO, in its vision to accelerate progress towards UHC, has also described an objective of strengthening data on human resources for health.[5] This links to other objectives focused on policy development and investment in human resources for health aligned with population health needs. Milestones include nations having in place workforce registries and processes for sharing data. Other WHO guidelines recommend governance and planning, including national plans to produce and retain graduates in the health workforce informed by needs and intelligence in the labour market.[6]

Of course, workforce intelligence is not an end in itself — there is little value in collating workforce data if the data are of no value, i.e., do not influence decisions on policy and planning. In a similar way, only data that effectively assess the impact of the workforce should be produced.[5] Workforce intelligence systems must deliver consistent, relevant data at the right time, in the right place. Unfortunately, data are often difficult to obtain and quality varies. Agreement between key stakeholders is needed to describe important workforce information that needs to be collected.[5]

The trajectory must be workforce intelligence informing workforce development policies and plans which, in turn, mobilise national investment in the health workforce.

Pharmaceutical Workforce Development Goal (PWDG)	PWDG general description. Countries/territories and member organisations should have:	Rationale, drivers and potential indicators
12. Workforce intelligence	A national strategy and corresponding actions to collate and share workforce data and workforce planning activities (skill mixes, advanced and specialist practice, capacity). Without workforce intelligence data there can be no strategic workforce development.	• FIP should aim to have a global workforce compendium of case studies developed by 2019. • Develop monitoring systems to identify workforce trends to enable decision making on deployment and supply of pharmaceutical workforce, noting that time-lags are often present in these activities. • Ideally, this should be linked with stewardship and leadership for professional leadership bodies.

§ Pharmaceutical workforce refers to the whole of the pharmacy related workforce (e.g. registered pharmacist practitioners, pharmaceutical scientists, pharmacy technicians and other pharmacy support workforce cadres, preservice students/trainees) working in a diversity of settings (e.g. community, hospital, research and development, industry, military, regulatory, academia and other sectors) with a diversity of scope of practice.

2.2 THE GLOBAL PHARMACY OBSERVATORY: WORKFORCE

Global pharmacy workforce data have been collated regularly since 2006.[7] Indeed, analysis of data from 2009[8] and 2012[9] enabled trends to be monitored over the period 2006–2012.[10] The pharmaceutical workforce is made up of medicines experts who play a vital role in improving health outcomes through the effective and responsible use of medicines. It is important to illustrate trends in the pharmacy workforce to understand if the supply of pharmacists, pharmacy technicians and pharmacy support workers is keeping pace with population growth and disease burden.[11] Alignment of workforce intelligence with an understanding of these factors is vital, as well as with developments in technology and social values.[1]

The FIP Global Pharmacy Observatory provides a global pharmacy-related information hub that can be used to inform advocacy work, policy development, decision-making, the advancement of pharmaceutical practice, sciences, education and, of course, workforce intelligence. This gateway to pharmacy workforce statistics informs more effective workforce development and workforce planning to transform and scale up the workforce, in particular for those countries that face workforce shortages, since they are able to benchmark themselves against other nations. For instance, the 2009 data highlighted the workforce shortage in Kenya that eventually supported the introduction of a residency training programme.[8]

The FIP 2017 survey of member organisations included questions on the pharmacy workforce, the aim of which was to collate a core data set, e.g., total number of practising pharmacists per nation. This, as in previous years, will provide a standardised measure of workforce capacity, i.e., density of pharmacists (number of pharmacists per 10,000 of a nation's population) for nations to benchmark against one another. If a country has a low density of pharmacists this does not, on its own, indicate a shortage. However, if a shortage is established and other core data, including numbers of pharmacy graduates, remain static over a period of time, it is unlikely that this will be addressed without investment in educating more pharmacists or increasing the pharmacy workforce via migration. Core data such as these examples can act as a trigger for research in order to further understand the profile of a country's workforce and the challenges and opportunities that it faces.

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PART 3

GLOBAL TRENDS ANALYSIS

3.1 METHODOLOGICAL APPROACH

Pharmacist capacity data were collected for four successive time points: 2006, 2009, 2012 and 2016. The data are derived from declared licensed pharmacists' registration data and are not disaggregated by practice areas. In this report, we use the term "capacity" to describe the concept of the overall size of the pharmacy workforce and, therefore, the general capability of the workforce to provide access to pharmacy-related services across all sectors. Consistent with our previous FIP reports, the standardised unit of measurement of capacity is pharmacists per 10,000 population.

Data were collected from successive surveys of national agencies (which included professional leadership bodies, healthcare workforce regulators, and ministries) using a consistent methodology, which has been replicated at specific calendar intervals since 2006. This repeat survey sought data relating to pharmacy workforce capacity and was available in English, French and Spanish. It was conducted using member organisation email contacts obtained from FIP and website information, and conducted at repeat intervals over the time period 2007–17 (2006 data was collected in 2007, 2009 data was collected in 2010 and so on), with follow up for non-responders.

The survey used mixed methods in selecting, collating and analysing country data, including national population size at specified year dates (as reported by the World Bank), pharmacist registries, WHO regional comparisons, and with national demographic and economic data such as Gross National Income & Expenditure obtained from World Bank data[**]. As a consequence of the data collection method and archiving processes at country-level, including unavailability of certain historical data, the data set inevitably has some missing values for some countries at some time points; the use of a mixed-methods repeat measures analysis model provides a statistical contingency for dealing with this reality. As a minimum, an individual country case data set had a minimum of two data points out of a possible four (2006, 2009, 2012, 2016) — See Data Table in Annex 2 for a full list of data included. Four countries were excluded from some components of the capacity analysis due to data inconsistency. Limitations also include a reliance on published and secondary sources for some national data.

Where possible, statistically outlying data entries were validated with country respondents before being prepared for analysis[††]. Basic headcount capacity data for each valid country case was standardised with date-specific country population for each data point to provide a measure of capacity (capacity is measured as "density", the number of pharmacists per 10,000 population). A mixed-model repeat measures analysis was performed to assess changes in trend for the pharmacy workforce of each country in relation to workforce size and capacity (standardised by population) and sub-trends associated with economic status and gender distribution.

3.2 SAMPLE COUNTRY CHARACTERISTICS AND OVERVIEW

After quality control and validation, data from 75 countries were included in the overall general analysis, across the four principal time points of 2006, 2009, 2012 and 2016; not all of these 75 case countries contribute data to all of the four time points, which is a key influence on the data analysis approach adopted.

Table 1 and Table 2 show sample country responses by WHO region and World Bank income classification (with the known global representation included for contrast). The data sample mapped to WHO regions shows the highest relative response rates to be from the Europe, Africa and Western Pacific regions, with lower response rates reported from South East Asia and Eastern Mediterranean. Comparatively, however, the sample proportions from the data sample are all close to the WHO global membership proportions, providing supporting evidence that our data sample (at country level) is representative. A comparison of our sample with World Bank income level classification shows a similar representative spread.

Future work will aim to further enhance our engagement with all member organisations as this programme of workforce intelligence continues to expand the global evidence base.

** The World Bank, World Development Indicators. [Data file]. Retrieved from: http://data.worldbank.org in May 2018.

†† Statistical analysis software used: SPSS Statistics V25.0

Table 1: Sample responses and WHO regional comparison

WHO region	Sample response (%)	WHO member states in each region (%)
Africa	14 (18.7)	47 (24.2)
Americas	9 (12.0)	35 (18.0)
Eastern Mediterranean	6 (8.0)	21 (10.8)
Europe	26 (34.7)	53 (27.3)
South East Asia	6 (8.0)	11 (5.7)
Western Pacific	14 (18.7)	27 (13.9)
TOTAL	**75 (100)**	**194 (100)**

Table 2: Sample responses and World Bank income level comparison

Country income level	Sample response (%)	Number of countries in each World Bank income level (%)
Low income	9 (12.0)	31 (14.2)
Lower middle income	16 (21.3)	53 (24.3)
Upper middle income	19 (25.3)	56 (25.7)
High income	31 (41.3)	78 (35.8)
TOTAL	**75 (100)**	**218 (100)**

The arithmetic mean (and standard deviation) of standardised pharmacist density at each time point is shown in Table 3. The row numbers show the total number of contributing case countries at each time data point, with 75 countries in total contributing to at least two of these time points, as set out in the inclusion criteria. Within these case countries, there are 34 countries that contribute contiguous data — in other words, contributing to all four time data points; the difference with the time row sample size represents the additional countries for each time data point. From 2006 to 2016, the absolute change in aggregated density derived from the arithmetic means is 0.73 (pharmacists per 10,000 population), which represents an approximate 11% increase in pharmacy workforce in this sample over 10 years. From Table 3, using the data drawn from the 34 contiguous country cases, this represents an additional 920,986 pharmacists within the combined workforce (a 57% increase in headcount from 2006).

Looking ahead, Figure 1 illustrates the global trends over time and Figures 2a and 2b illustrate the variance in distribution of workforce for the most recent data set in 2016 (pharmacist density per capita and relative proportional changes over the time period, respectively) as reported previously in 2017[‡‡]. A key observation from these data is the extremely wide variance evident across countries, ranging from 0.11 to 26.87 pharmacists per 10,000 population (note also the large standard deviations of the means reported in Table 3). Using a "mean" to describe the global picture will tend to hide the implications of this evidence; in addition, using these data to suggest a global "benchmarking" approach would similarly run the risk of overlooking the local challenges encountered by nations. Faced with this range in workforce capacity, the current FIP approach of "needs-based" development, which acknowledges the individual national challenges associated with workforce capacity, is advocated.

Table 3: Mean and standard deviation of pharmacist density

	Number of countries	Sample Mean[1] (SD)	Number of contiguous countries	Sample Mean[2] (SD)
Density 2006	45	6.63 (4.63)	34	7.12 (4.63)
Density 2009	51	6.56 (5.06)	34	7.90 (4.84)
Density 2012	66	6.57 (5.65)	34	8.81 (5.70)
Density 2016	67	7.36 (5.93)	34	9.92 (6.17)

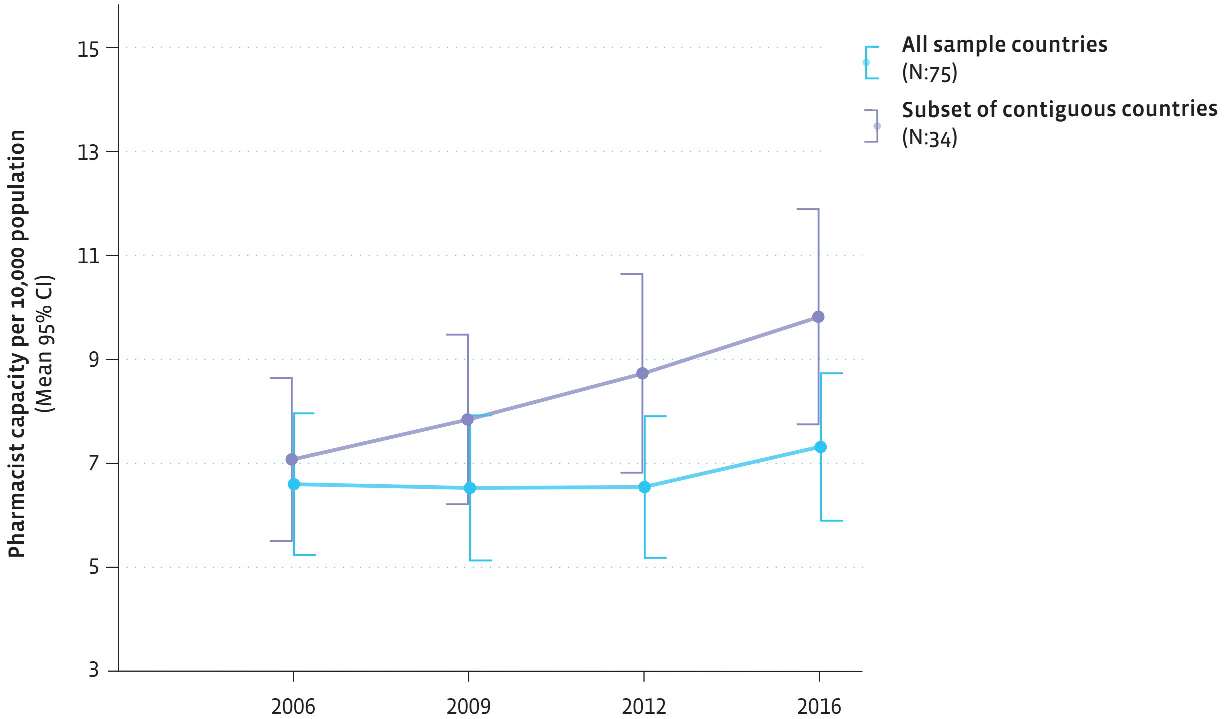
[1] These are the arithmetic means derived from the sample at each time point.
[2] These are the arithmetic means derived from the 34 contiguous countries at each time point.

‡‡ FIP 2017. Pharmacy at a glance — 2015–2017. The Hague, The Netherlands: International Pharmaceutical Federation. A full version of this report, "Pharmacy: A global overview — workforce, medicines distribution, practice, regulation and remuneration. 2015–17", is available for FIP member organisations.

3.3 PHARMACIST WORKFORCE TRENDS BETWEEN 2006 AND 2016

The pharmacist density trends from 2006 to 2016 can be seen Figure 1. This chart presents a more complex picture of the aggregated global trends for the total sample of 75 case countries (noting variable contribution to the time data points) and additionally for the 34 countries that have all four contiguous time points. We have chosen to do this in order to exemplify the global variance inherent in the dataset. On the one hand, we see a general increase in pharmacist density across 75 countries (with a wide variance) as reported above, but in the contiguous sub-sample we see the influence of some country cases that have accelerated growth in the past 10 years, seen as the upper data points on the scale axis. These 34 contiguous cases have a combined growth rate of 2.8 pharmacists per 10,000); some countries in this sub-sample are exhibiting accelerated capacity growth rates (see Figure 2b for examples). See Annex 3 for a reference table of the ISO 3-Digit country codes.A further comparative analysis of these trends is provided in section 3.4 using a mixed-model approach that provides contingency for the wide variances in observed data and varying case-contributions to the overall picture.

Figure 1: Trends in global workforce capacity over time



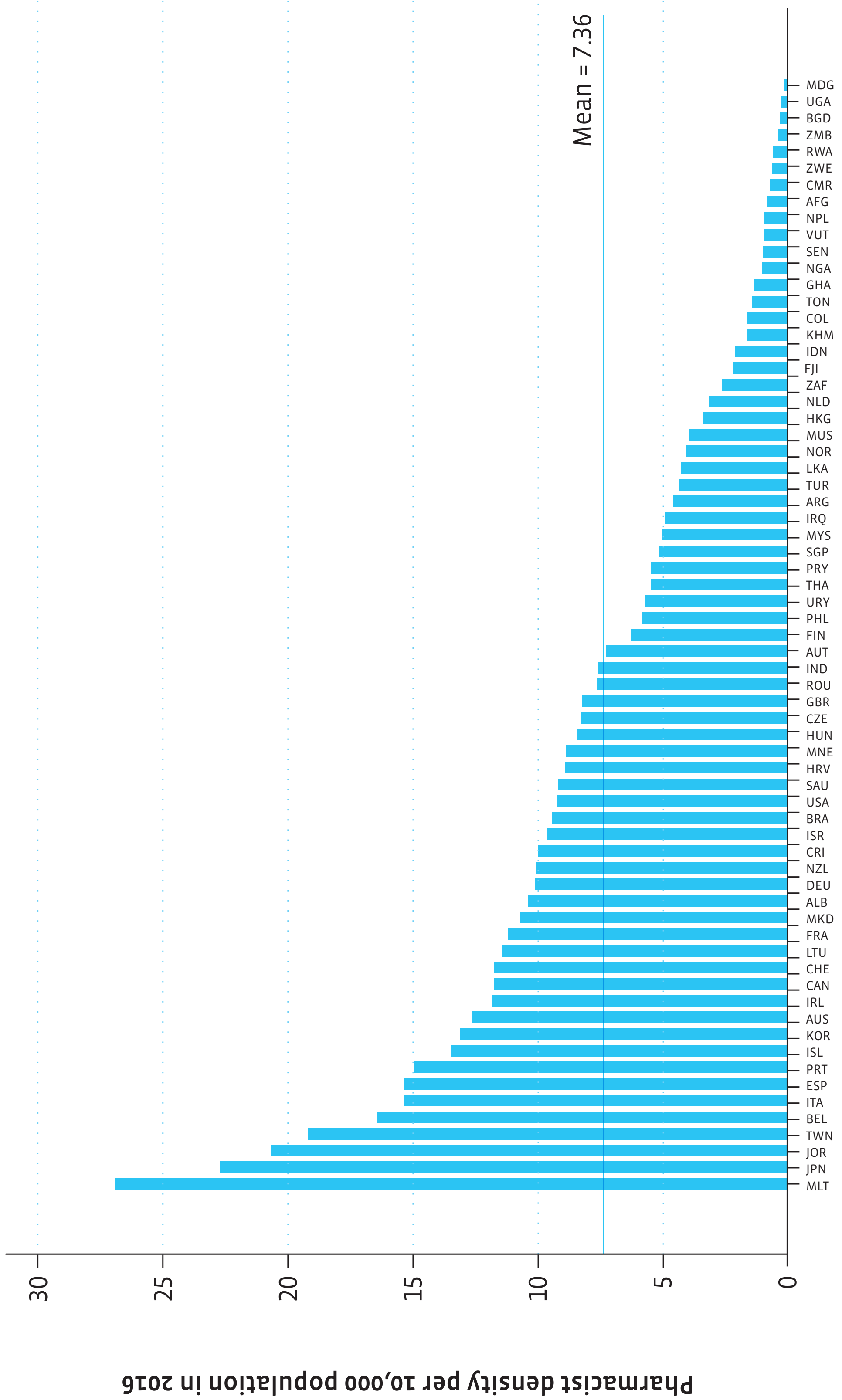


Figure 2a: Pharmacist density per capita in 2016 by individual countries

Figure 2b: Proportional change in capacity 2006–2016 by individual countries

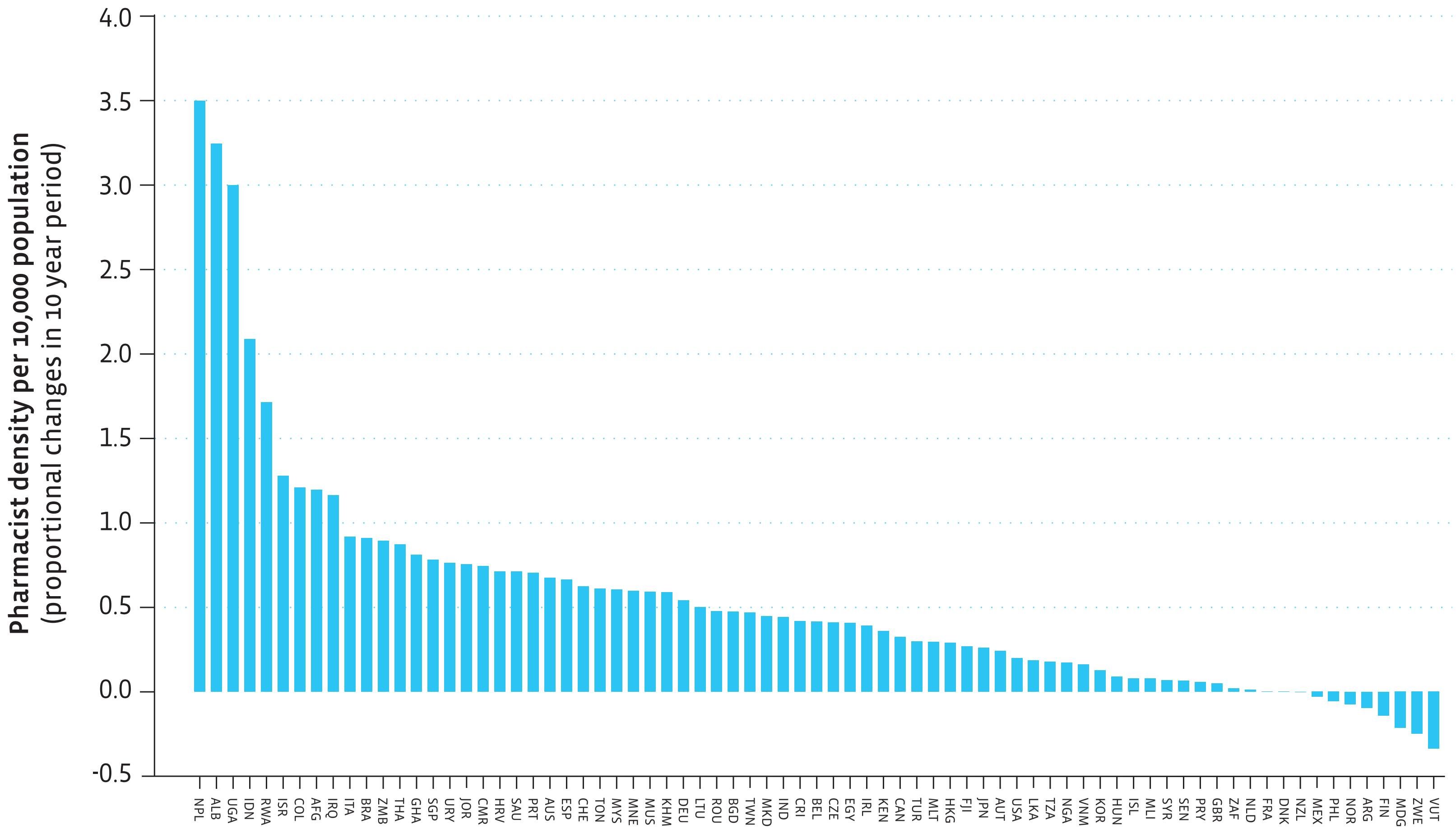


Figure 2a and 2b provide a wider contextual view of the global snapshot. Figure 2a shows the most recent density data, which illustrate the global variance and the inherent challenge of using means or any benchmarking process to set workforce targets. Figure 2b is an extension of Figure 1 and shows the proportional changes in pharmacist density at country level drawn from our available sample; the scale axis measures proportional change per country (as a proportion calculated from the earliest time point for each country, displayed as pharmacists per 10,000 population). This graphic avoids the pitfalls of using arithmetic means and indicates that for most sample countries there has been an increase in workforce capacity as measured by pharmacist density — although not for all. Changes in overall population denominators may be contributing to the negative relative change seen for some countries, as may changes to pharmacists' migration patterns, and, for other countries, large increases in initial education and training capacity through new schools and faculties of pharmacy may now be influencing the larger changes seen.

More detailed pharmacist capacity trends are shown in section 3.5.

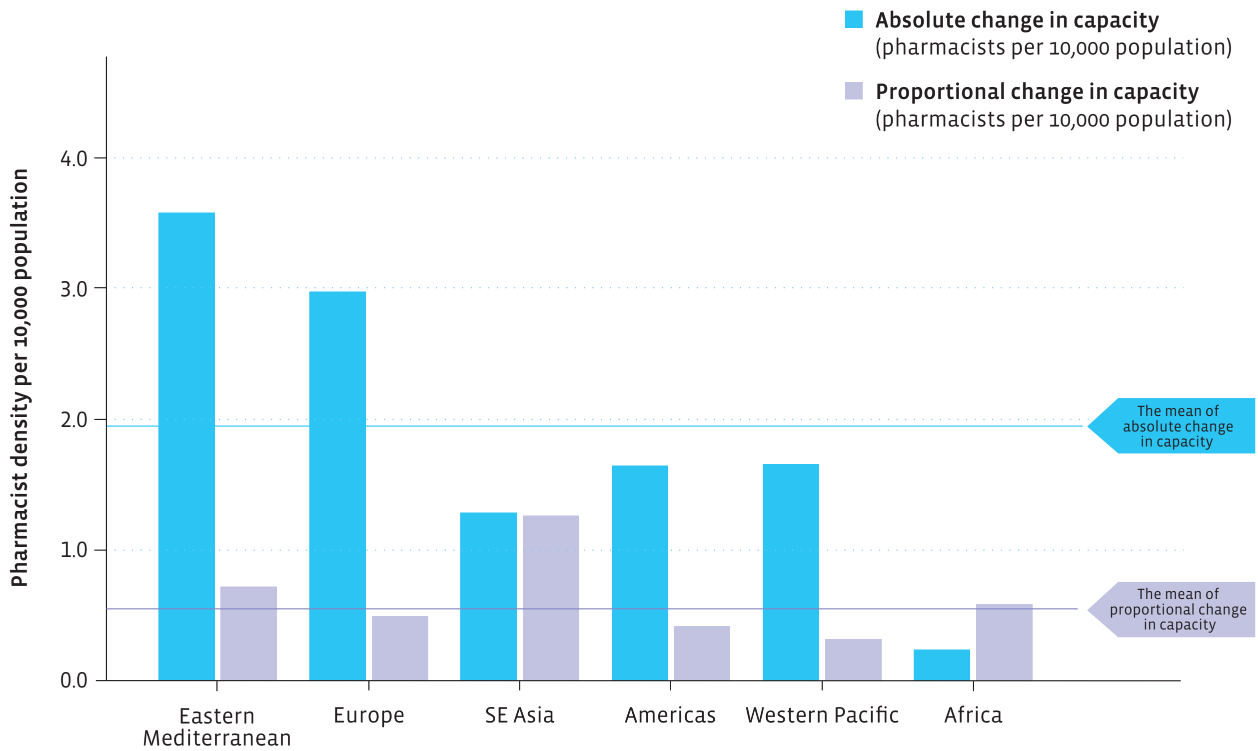
Comparison of absolute and proportional change by WHO region

The comparison of absolute change in capacity and relative proportional change in density, based on WHO regions, is shown in Figure 3.

Figure 3 indicates that the highest absolute time-related increase in pharmacist capacity (as measured by standardised density) is in the Eastern Mediterranean region. In the South East Asia region, although the proportional change[§§] is relatively high compared with that in other regions, the absolute workforce capacity remains relatively low overall and this lack of capacity remains a significant workforce challenge in this region. A similar trend can be seen in the Africa region, which as a whole has a higher proportional change compared with the absolute change but nonetheless has the lowest global workforce capacity — again, a significant "real world" issue. Relative growth of pharmacist capacity in the Europe, Americas and Western Pacific regions is lower. The absolute capacity change in the Europe region is larger than the sample mean, and this has contributed to the smaller change in relative capacity as a proportion of the regional workforce.

The percentage of absolute change and proportional change for each region around the world is provided in Table 4.

Figure 3: Changes in capacity 2006–2016 by WHO region



§§ Calculation based on subtraction of the latest time point to the earliest time point for each country, displayed as pharmacists per 10,000 population

Table 4: Absolute and proportional change for each WHO region 2006–2016

WHO REGION	Sample response (%)	Absolute change	Proportional change
		Mean (%)	Mean (%)
Africa	14	0.24 (2.1)	0.58 (15.4)
Americas	9	1.62 (14.3)	0.42 (11.1)
Eastern Mediterranean	6	3.58 (31.5)	0.72 (18.9)
Europe	26	2.98 (26.2)	0.49 (13.0)
South East Asia	6	1.29 (11.3)	1.26 (33.3)
Western Pacific	14	1.66 (14.6)	0.32 (8.4)

The Eastern Mediterranean and Europe regions represent more than half of the total absolute global growth in capacity. In addition, the Eastern Mediterranean and South East Asia regions represent more than half of the increase in capacity change (as a proportion of the workforce).

Overall, the data illustrate a wide variance in the aggregated statistics, which should not be surprising; having a wide range of low to high income countries, in addition to a range of low to high country population values and geographies across our sample, we would expect to have outlying data points in this data set. This sample variance is accounted for in the use of the linear mixed model method of analysis.

Comparison of absolute and proportional change by country level income

Figure 4 shows the absolute change in capacity split by country income level***.

In low income countries, a small increase in absolute capacity is shown. Figure 4 shows that the absolute growth in capacity in low income countries is lower compared with that seen in higher income countries.

Global trends in female workforce proportions

Forty-one (out of 75 countries) included in this analysis provided data on gender. The initial starting date for the data trend analysis was 2009††† because no gender-related data were captured from the 2006 survey, resulting in a reduction to three discrete time data points (2009, 2012, 2016). In this sample, we have contiguous data for only 18 country cases, spanning all three of these date points. For this report, we have used the 41 case data set for the mixed-models approach (which has built-in statistical contingency for non-contiguous data; see section 3.4) but have included only the 18 contiguous cases for Figure 5, in order to illustrate the trend direction.

The grouped case countries included in this section of the analysis are shown in Table 5: Sample responses grouped for WHO regional comparison.

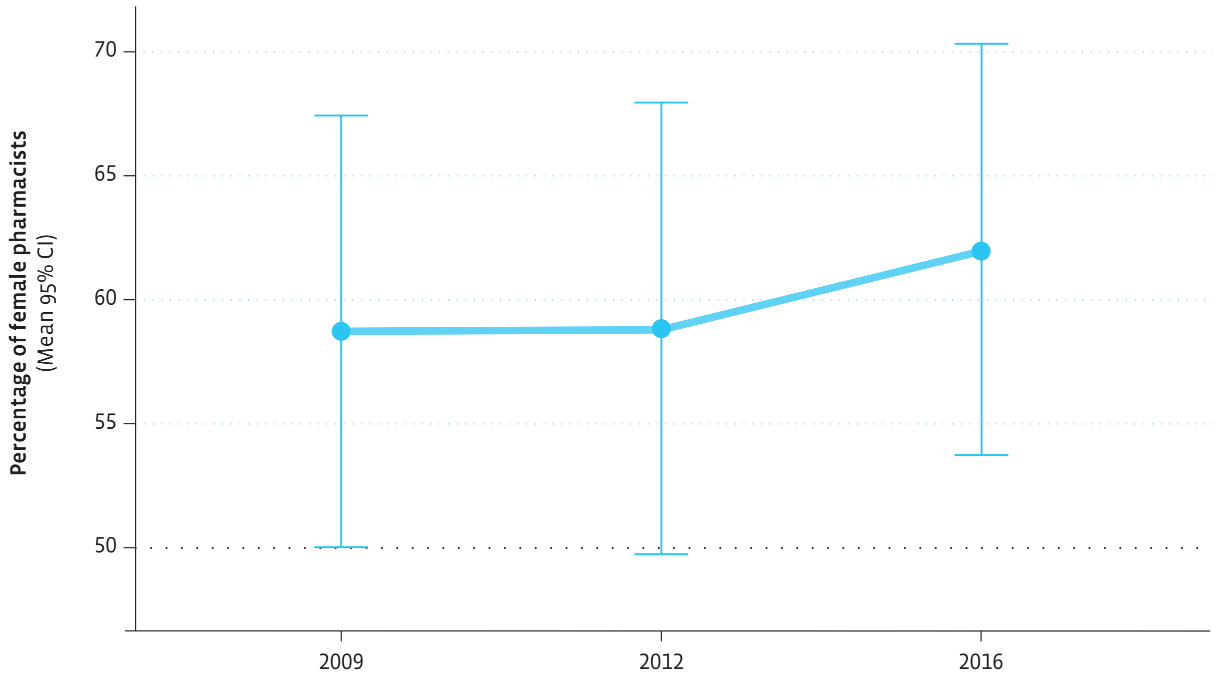
Figure 4: Absolute change in pharmacist capacity based on country income level 2006–2016

*** Income level using World Bank classification.
††† The initiation date for the data trend analysis is 2009 because there was no global information on gender proportions in the global workforce collected prior to this. A further five countries were excluded from the gender analysis due to data outliers: Afghanistan, China Taiwan, Malaysia, Mexico and Romania.

Table 5: Sample responses grouped for WHO regional comparison

REGION	Sample response (%)	WHO member states (%)
Africa	7 (17.1)	47 (24.2)
Americas	5 (12.2)	35 (18)
Eastern Mediterranean	1 (2.4)	21 (10.8)
Europe	18 (43.9)	53 (27.3)
South East Asia	1 (2.4)	11 (5.7)
Western Pacific	9 (22)	27 (13.9)
TOTAL	**41 (100)**	**194 (100)**

Figure 5: Trends in global aggregated female pharmacist workforce proportion (as a percentage in this sample) from 2009 to 2016



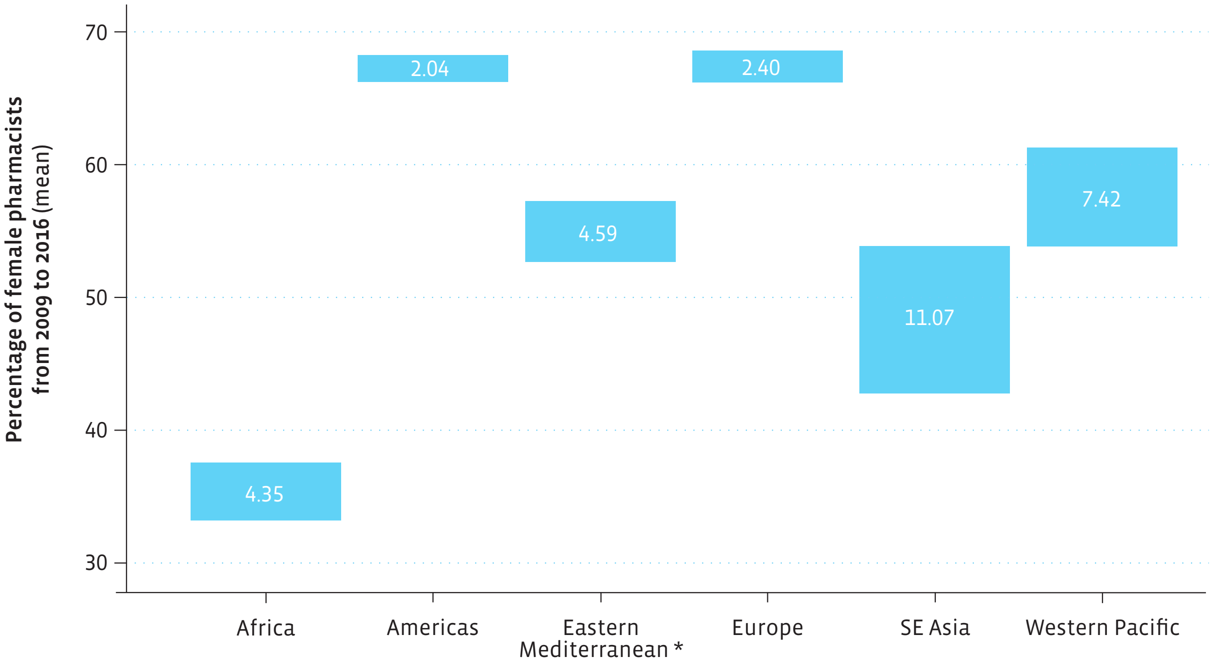
There is under-representation in the sample for some regions; future reports and data collation activities by FIP should encourage more countries to contribute to this emerging data set.

There was a general increase in the percentage of female pharmacists in the global workforce within the seven-year time period reported here, for this sample. At the start of the data trend period in 2009, the pharmacy workforce had a majority proportion of female pharmacists.

The changes in the proportion of female pharmacists, aggregated within the WHO regions, are shown in Figure 6. The aggregated percentage change per region, over time, is the difference between the highest and the lowest data point (the upper and lower edges of the bars in Figure 6; each bar shows the quantitative arithmetic difference). There has been an incremental increase in female workforce proportions across all regions. The largest increase in this sample is found in the South East Asia region. It is interesting to note the smaller proportional increases for Europe and Americas, but these two regions are both starting with a relatively larger female workforce proportion compared with other regions.

Figure 6: Changes in female workforce proportion (as a %) over time, compared by WHO region

Lower and upper edges of the bars represent change over time; the numbers in the bars represent quantified changes (as a %)



* The starting data of the percentage of female pharmacists in Eastern Mediterranean Countries is from 2012

3.4 RATE OF CHANGE IN THE GLOBAL PHARMACY WORKFORCE CAPACITY[‡‡‡]

The data set time series, using four sequential time points (2006, 2009, 2012 and 2016) allows for a regression analysis to be applied. Since there is a single dependent variable (density of pharmacists, standardised by country population), a linear mixed model analysis (a form of repeat measures design) can be used to estimate the rate of change of pharmacist density, across the country level data, over time. In this type of analysis, we can compensate for any non-contiguous values in the time series (missing values) and hence maximise the use of all country cases in our sample; this brings greater optimisation of this unique data set for predicting future trends, all other variables remaining unchanged. The resulting regression coefficient for this analysis is therefore the "rate of trend" (represented as a gradient against time) for each country included in the sample.

The result of this modelling indicates a significant correlational relationship ($p<0.001$) between global pharmacist density and time, with a coefficient magnitude of 0.234 (95% CI 0.170 to 0.297) and accounting for variability within the individual countries. This regression coefficient can be described as an average (aggregated) increase in global pharmacist density, in any one year, of 0.234 pharmacists per 10,000 population.

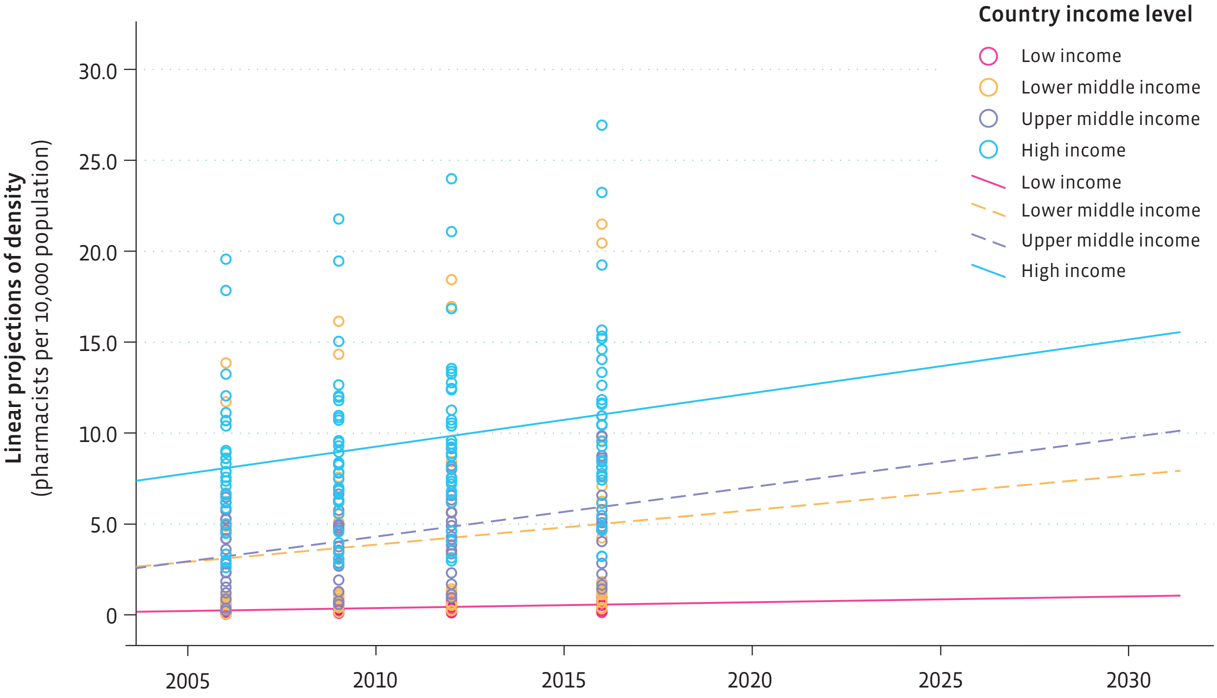
If we use this result as a trend prediction to project a forward look at standardised density of pharmacists, assuming no change in other influential variables, then by 2030 (a WHO policy milestone) the aggregated mean global pharmacist density is estimated to be 10.47 pharmacists per 10,000 population. From the perspective of the 2016 density measure of pharmacists (a current global average of 7.4 pharmacists per 10,000 population) this would represent an estimated average global growth of around 40% up to 2030 in this sample, assuming no change in the linearity of the model or in other variables.

Linear trends model based on country income level classification

This analysis was repeated using country-level income (World Bank classification) as a factor for capacity trends regression. Figure 7 shows the outcomes of this analysis as a series of regression lines (coefficients) and corresponding predicted values of pharmacy density based on income level classification. This projection indicates that the "capacity gap" between countries, based on income level, is increasing over time (assuming no change in linearity). The gap between pharmacist capacity in low income countries has a significantly lower gradient (and corresponding trend increase) compared with higher income countries ($p<0.05$) and this gap is widening over time based on these current projections. Assuming no change in linearity or other influential variables, this global capacity gap between high and low income countries will have increased, on average, by 35% over this time period.

‡‡‡ Data analysis using a Linear mixed-model regression design

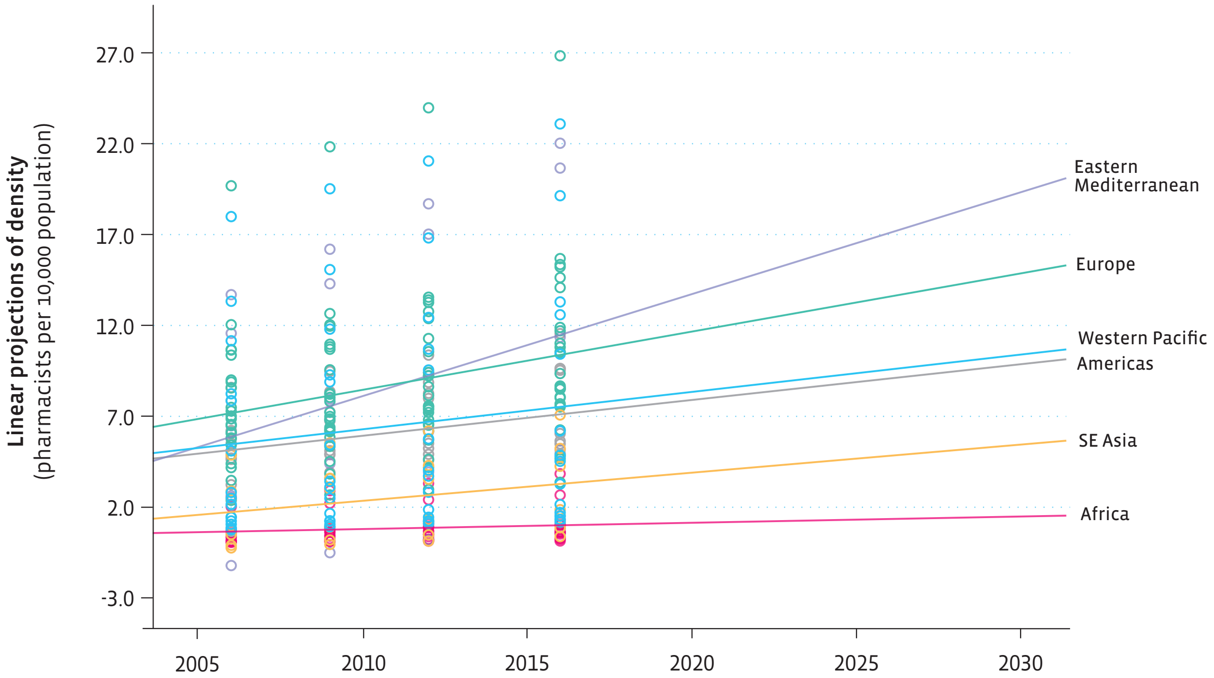
Figure 7: Projections of trend increases in capacity over time compared by country income level classification



Linear trends model based on WHO regions

Using regional geography as a factor for capacity trends, Figure 8 shows the outcomes of the linear mixed-model analysis as a series of regression lines (coefficients) and corresponding predicted values of pharmacy density. Using our sample in this analysis, the WHO Africa region has the lowest rate of growth in pharmacy capacity compared with other regions. The Eastern Mediterranean region, in this sample, has the highest rate of growth in pharmacist density compared with all other regions ($p<0.05$). In addition, this 2030 projection indicates that the Eastern Mediterranean region will have the highest aggregated pharmacist density compared with all other regions. The projections to 2030, assuming no change in linearity, indicate that the global variance in pharmacist density will continue to widen (see also Figure 2b) which will have implications associated with a rise in inequity of accessing medicines expertise, and pharmaceutical service provision, as these workforce density gaps continue to widen.

Figure 8: Projections of trend increases in capacity over time compared by WHO regions

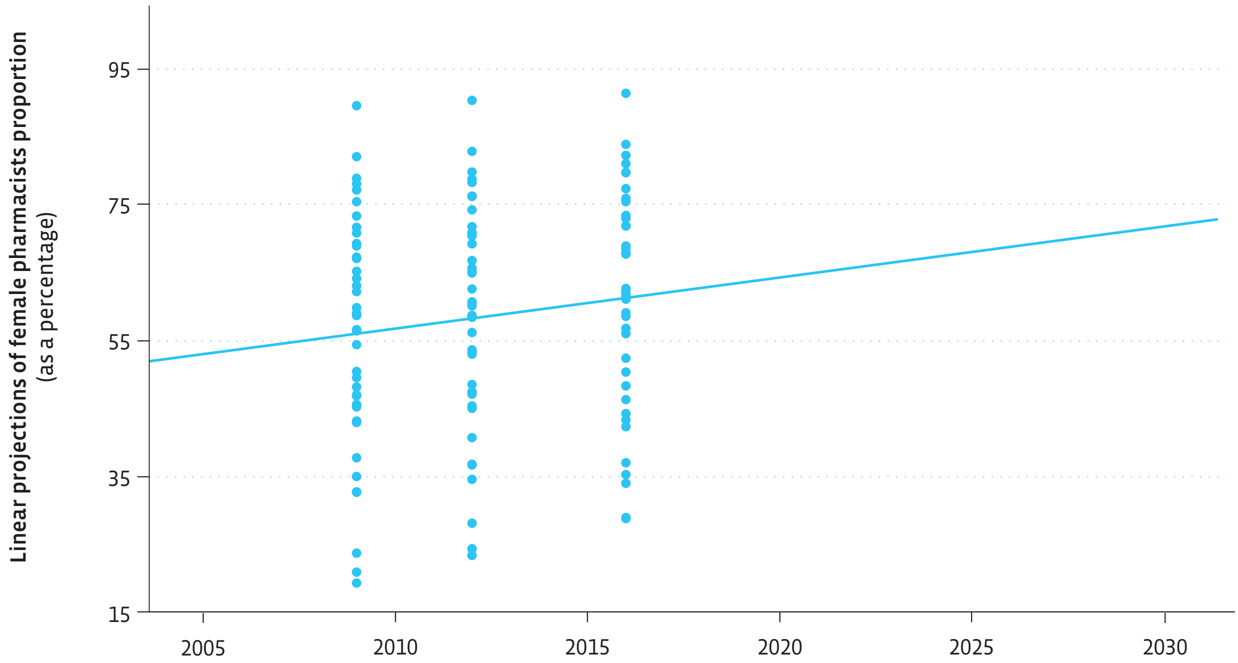


Linear trends model based on workforce gender composition

The linear mixed model analysis was used to investigate changes in female participation in pharmacist workforce composition across the sample countries during the period 2009 to 2016. There is a significant trend for the proportion of female pharmacists in the workforce to be increasing against time (p=0.001); the analysis indicates that the proportion of women in the workforce, as a current global average, is increasing by around 7.5% per decade (95% CI 3.2 to 11.8) assuming no change in linearity or other influencing variables. During the period of data collection, between 2009 and 2016, there has been an observed aggregated increase of 3.3% in global female participation.

Using the properties of the regression analysis, we can predict an overall global increase of 15.8% in female workforce participation by 2030, resulting in an estimated proportion of 71.9% for the total global workforce (see Figure 9).

Figure 9: Predicted linear trend of the global female workforce proportion (as a percentage)



3.5 TRENDS IN THE GLOBAL PHARMACY WORKFORCE CAPACITY BY WHO REGION AND COUNTRY

This section shows visual displays of the country level data derived from time points of 2006, 2009, 2012 and 2016 as described earlier in the report. There are, inevitably, missing values for some data points despite efforts by the analysis team to track historical archived data.

Where possible, data entries were validated with country respondents before being prepared for analysis. In the following charts, "headcount" capacity data for each valid country case were standardised with date-specific country population for each data point to provide a measure of capacity (capacity is measured as "density": the number of pharmacists per 10,000 population). If two validated data points were available for any country, the data have been included where possible.

Figure 10 shows the capacity trends of all included countries in the data set; Figure 11 is a sub-set of the data, showing an exploded view of the low-capacity countries indicated below the dashed-line in Figure 10. Figure 10 illustrates the general upward trend in country level pharmacist capacity across this time period, which has been quantitatively described in section 3.2.

Figure 10: Individual trends in all sample case countries 2006–2016

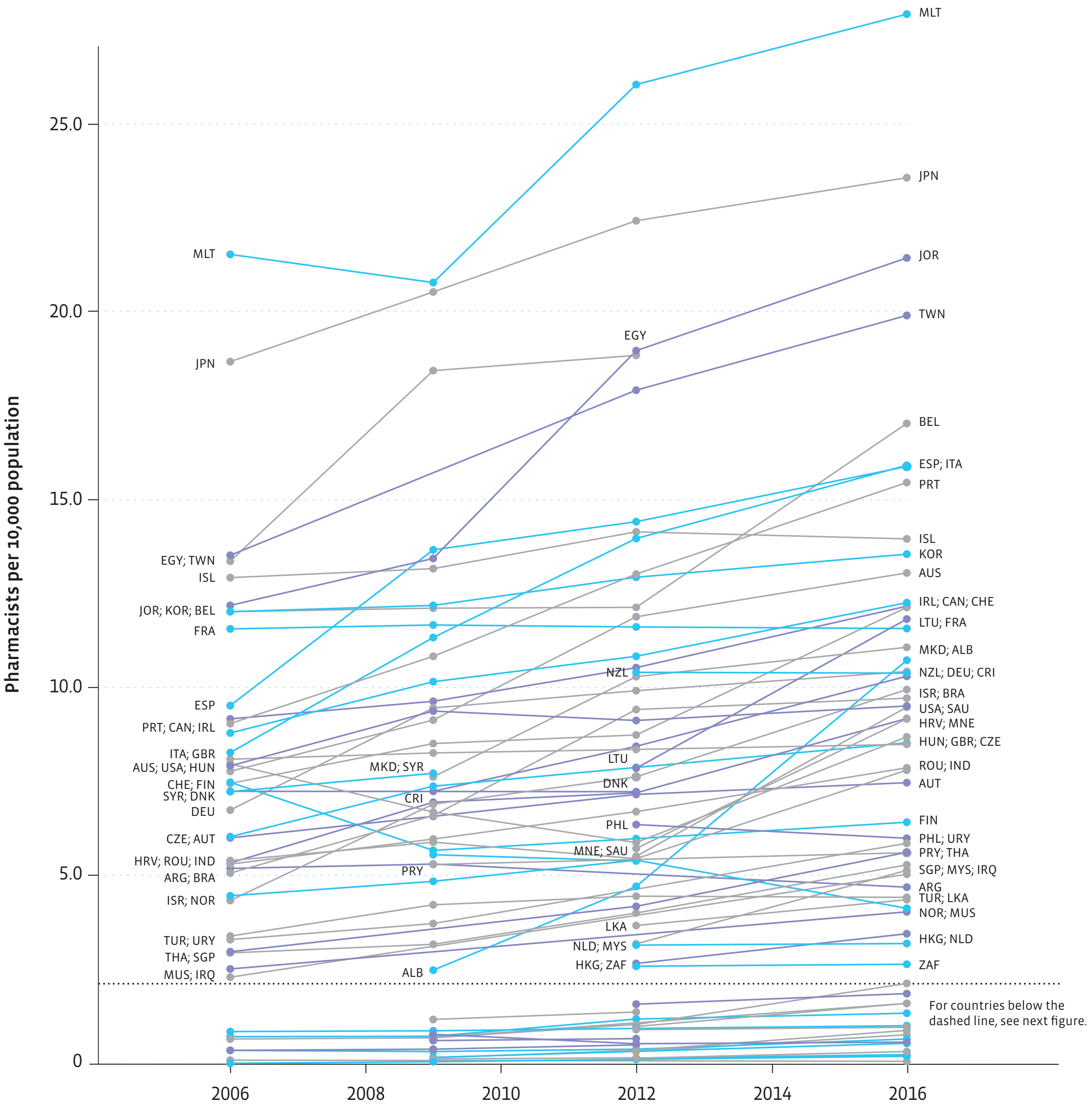
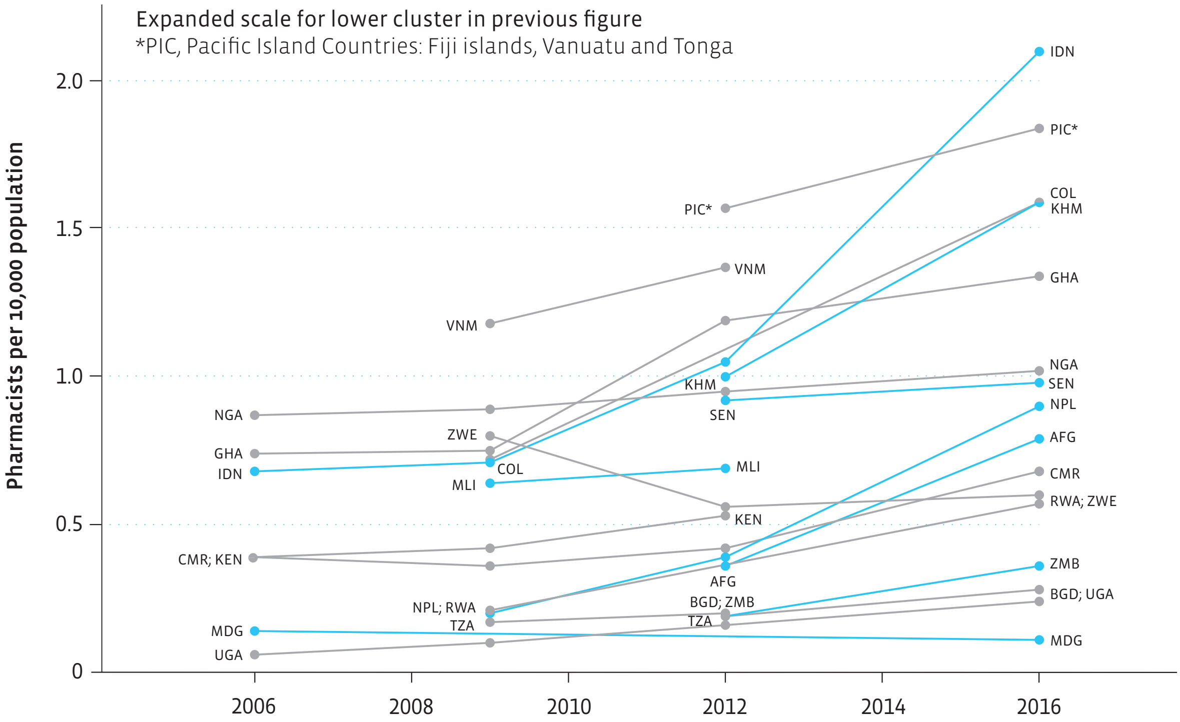


Figure 11: Individual trends for current low capacity data case countries (data sub-set of Figure 10)



Figures 12 to 17 show data sub-sets collated by WHO region of the 2006–2016 pharmacist density data. These segregated charts more clearly indicate where there are contrary trends, such as shown by Zimbabwe (ZWE) in Figure 12.

Figure 12: Individual trends for case countries in WHO Africa region

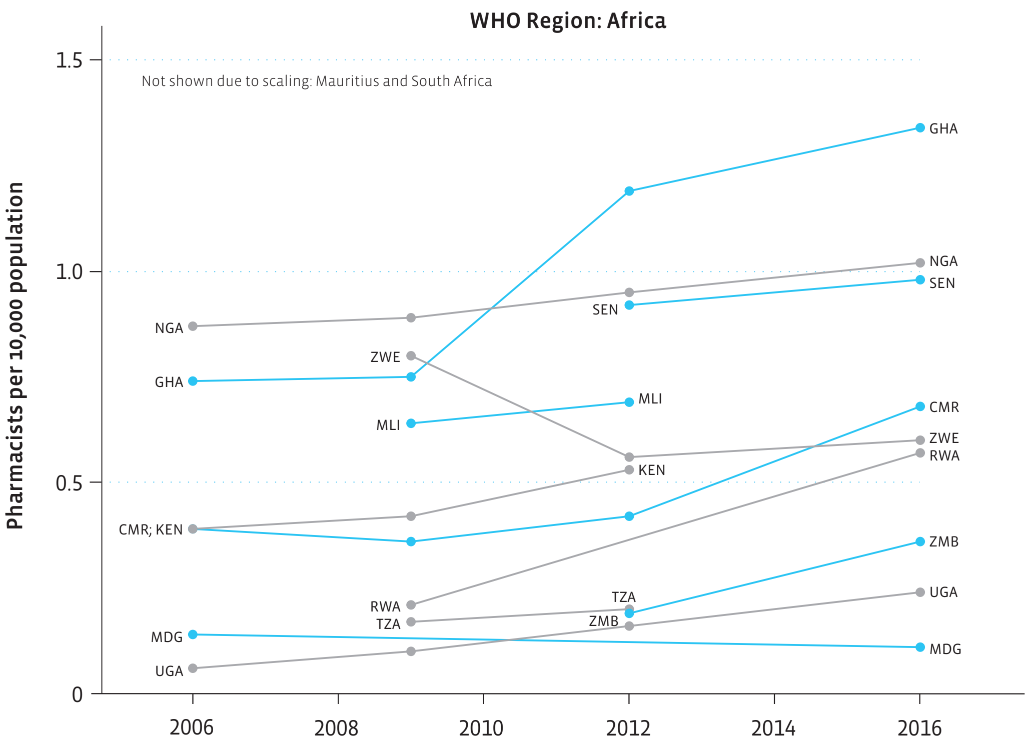


Figure 13: Individual trends for case countries in WHO Americas region

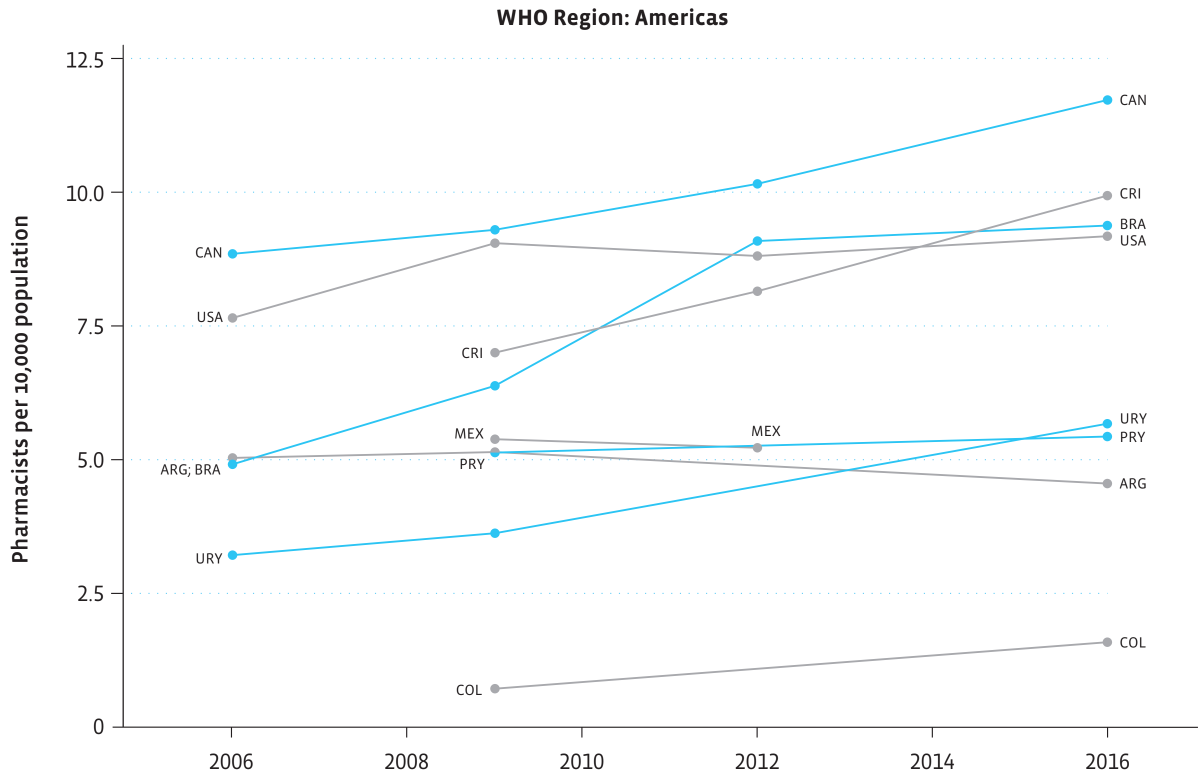


Figure 14: Individual trends for case countries in WHO Eastern Mediterranean region

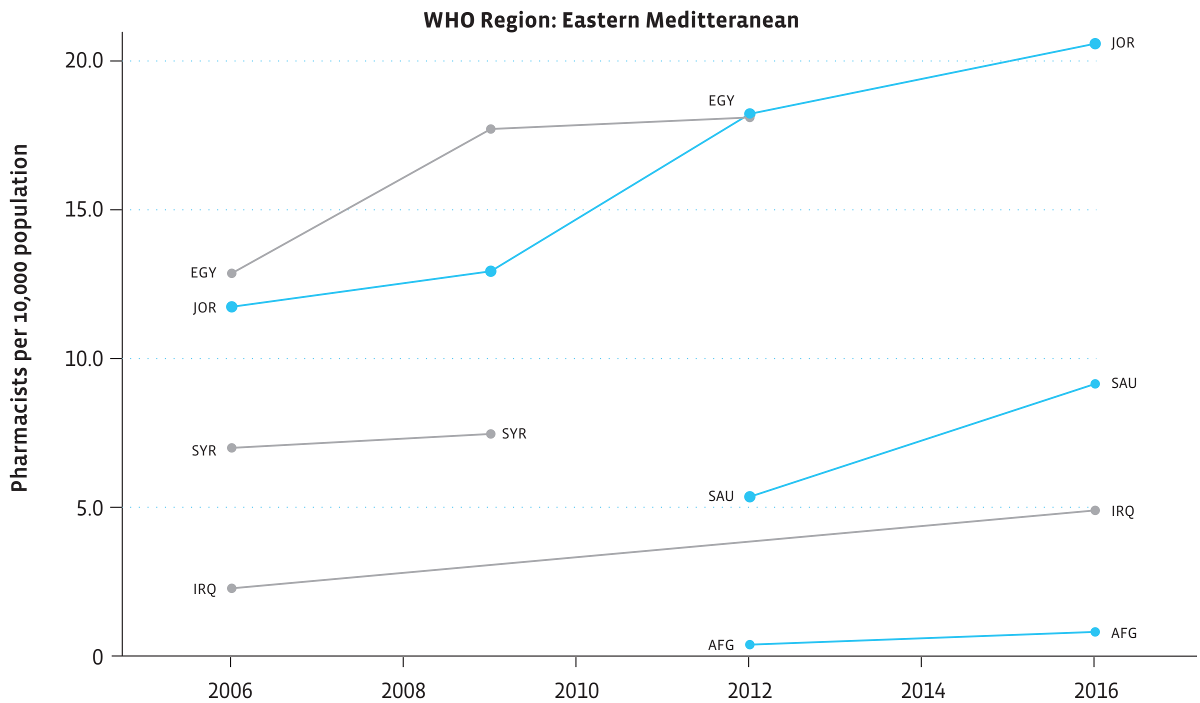


Figure 15: Individual trends for case countries in WHO Europe region

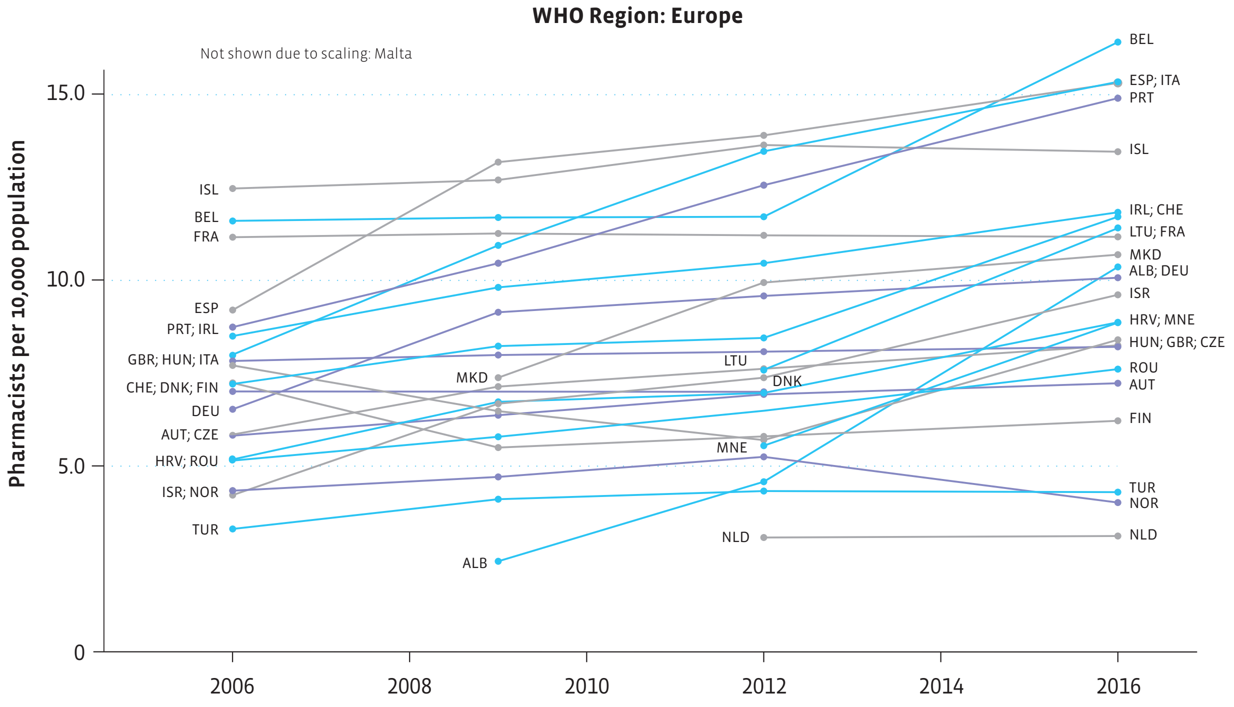


Figure 16: Individual trends for case countries in WHO South East Asia region

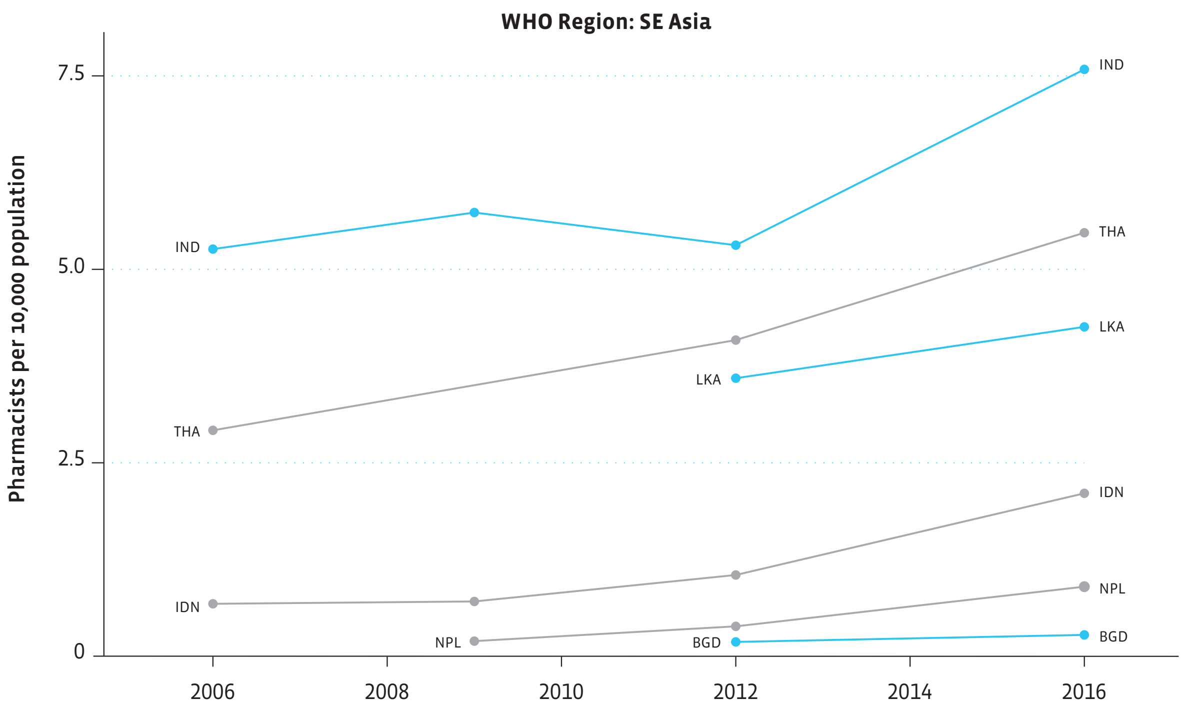
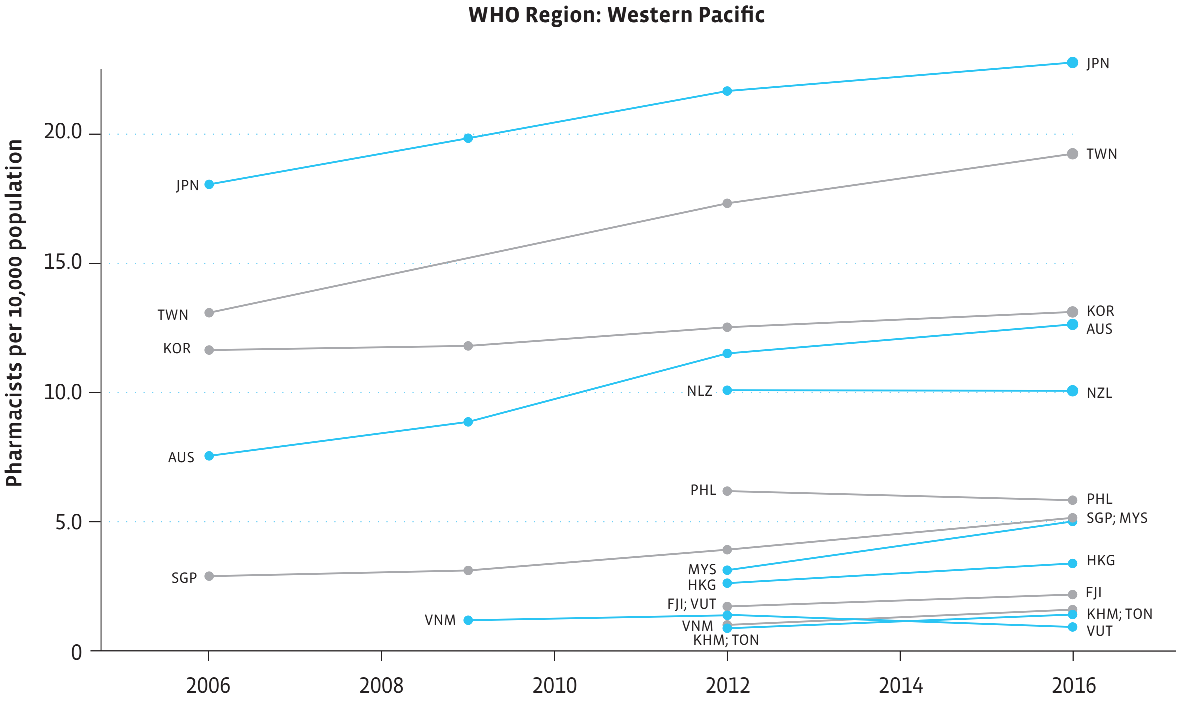


Figure 17: Individual trends for case countries in WHO Western Pacific region



Figures 18 and 19 show density trends by country income level (as defined by World Bank classification). In addition to noting the different ordinate scaling range between these economic groupings (with low and lower middle income having significantly lower pharmacist density measures) the charts also help to illustrate the differing rates of growth, with Figure 18 showing a flatter profile for most low and lower middle income countries displayed. Some exceptions in Figure 18 include Indonesia (IDN), which shows, based on these data, accelerated increases in pharmacist density per 10,000 population.

Figure 18 Individual trends for low and lower middle income case countries (World Bank Classification)

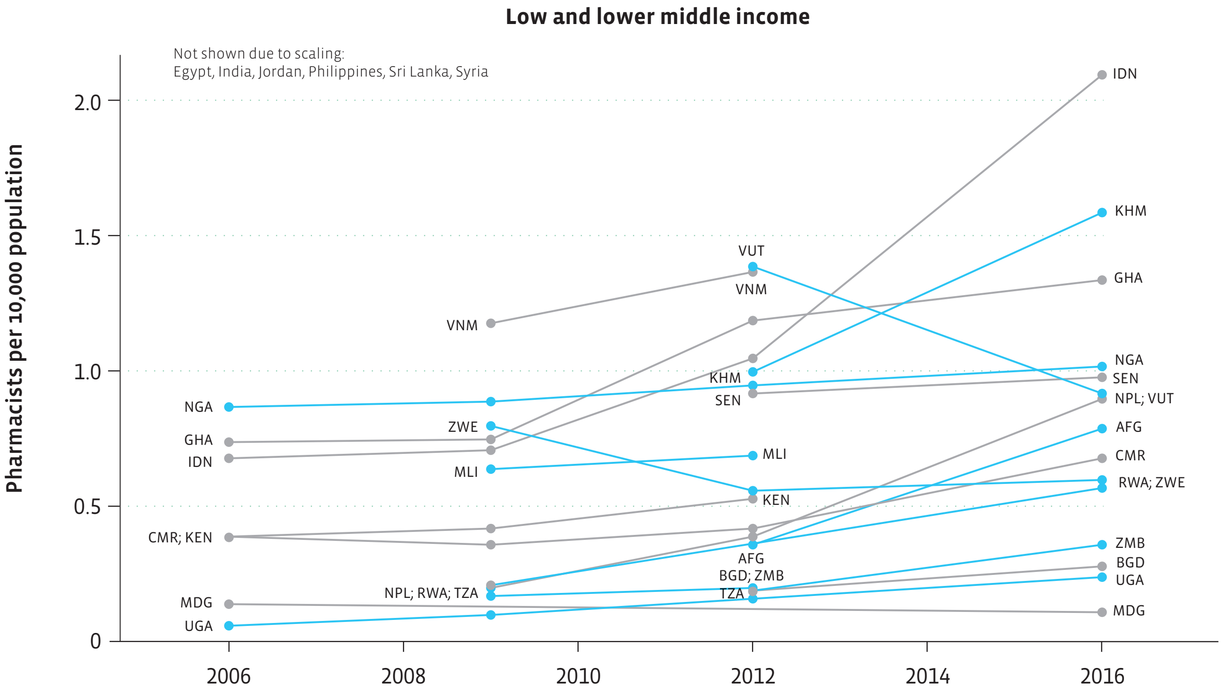
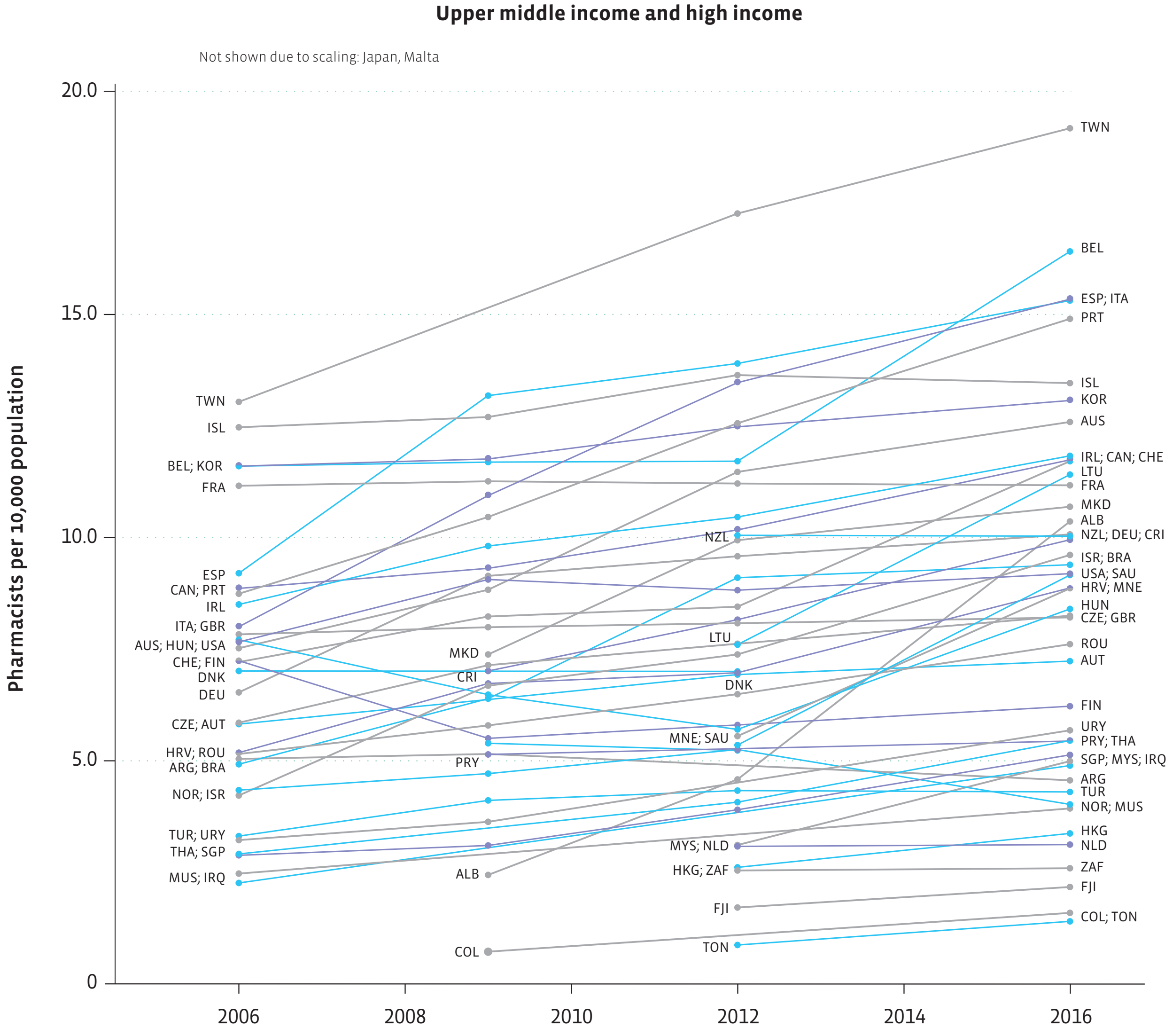


Figure 19: Individual trends for upper-middle income and high-income case countries (World Bank classification)



PART 4

DISCUSSION

The countries identified as having data corresponding to the time points 2006, 2009, 2012 and 2016 were present in all the WHO regions, with Europe having the most countries with data available and South East Asia and Eastern Mediterranean the fewest across this time range. If the sample is compared against the actual number of WHO member states per region it could be argued that Europe, South East Asia and Western Pacific are over-represented and the other regions (Africa, Americas and Eastern Mediterranean) are under-represented. Viewing the sample by World Bank classification shows that high income countries are over-represented but the remaining classifications are under-represented (although in all cases this is only by a small margin). All WHO regions have experienced an increase in the density of pharmacists per 10,000 population over the period 2006–16.

Evidence is emerging from the WHO that investment in the health workforce has a positive impact on a nation's economy and the increases may have been a result of investment in the workforce. Therefore funding of the pharmacy workforce will also have an effect on national workforce density and economic growth. Adequate funding is required for workforce expansion, possibly through financial incentives such as higher wages for pharmacists where there is a shortage — although this is, of course, dependent on the strength of a country's economy, or the creation of employment opportunities for pharmacists. This general pharmacy labour market could be adjusted through progressive regulatory changes that affect the recruitment of pharmacists in community and hospital pharmacies and in other sectors where the expertise of pharmacists may provide added value (for example, the pharmaceutical industry, clinical biology laboratories, governmental and other public agencies). The World Bank classifications have generally remained static over the period analysed. However, an increase in income may not necessarily result in an increase in the density of pharmacists. Some national decreases observed in the density of pharmacists may be a result of net migration to other countries or other factors such as changes in national health policy.

Although not a focus of this report, a consideration of the impact of these workforce trends on transnational professional migration in the global workforce — both the direct and indirect effects, should be a priority for further FIP workforce intelligence analysis . For many countries and professional leadership bodies, accessing data and trends on professional migration patterns is difficult and unclear and there is little systematic research in this area[§§§].

Our data and current analysis indicates that professional migration should become an active area of interest for FIP and its member organisations.

Mapping pharmacists per capita with the World Bank classification gives an indication of the relationship of the workforce with economic indicators. This report and previous reports[****] of the global pharmacy workforce have shown an association with total pharmacist numbers and World Bank classification; the higher the level of a country's income, the greater the number of pharmacists. Figure 4 illustrates that the capacity change over the period 2006–16 (i.e., the change in the mean number of pharmacists per 10,000 population) showed the largest increase for the high income countries compared with all other country income groups. This may reflect a greater increase in the growth in the economies classified as high income compared with other country income groups.

The "income level" classification may not be a sensitive enough measure since it will not necessarily identify economic downturns and recession (leading to budget cuts and service reductions in the health system, often resulting in redundancies and freezes on recruitment of staff) in individual countries. It is important to consider that the lead time for initial education and training of a pharmacist is five years on average, so increases in the training of pharmacists will take at least five years to be translated into a workforce increase (although workforce attrition is also a factor).

Although the density of pharmacists has increased substantially in many lower-income countries, their baseline still remains low compared with those of higher income countries. For both lower income countries and higher income countries, overall workforce numbers should be determined by strategic goals set by health policy-makers considering demand for health services.

However, in reality, reaching these goals may be challenging because of variations in the production of the workforce (e.g. numbers of schools and faculties of pharmacy and the lag time between educating and deploying staff) leaving lower income countries with chronically low numbers in comparison with higher income countries. In addition, an important factor in understanding the demand for pharmacists is consideration of workforce drivers and the impact of the pharmacy support and technician workforce. The influential 2016 FIP report[††††] that focused on the pharmacy support cadres clearly indicated that

§§§ Wuliji T, Carter S, Bates I. Migration as a form of workforce attrition: a nine-country study of pharmacists. *Human Resources for Health* 2009, 7: 32. doi:10.1186/1478-4491-7-32

**** Global Pharmacy Workforce Intelligence: Trends Report. The Hague: International Pharmaceutical Federation; 2015. Available at: https://www.ucl.ac.uk/pharmacy/documents/fip-globaltrends-2015

†††† International Pharmaceutical Federation (FIP). Technicians and pharmacy support workforce cadres working with pharmacists: An introductory global descriptive study. The Hague: International Pharmaceutical Federation; 2017.

utilisation of pharmacy technicians and other pharmacy support workers is often driven by gaps or demands for pharmacists. In lower income countries, particularly in rural areas with acute limitations of access to pharmacist services, pharmacy technicians carry out roles to support safer access to medicines. In higher income countries, pharmacy technicians tend to fulfil roles that allow pharmacists to extend their services towards a greater scope of practice. The WHO recognises the important role of mid-level cadres in meeting global workforce demands; given the role that pharmacy technicians and support workers play in some countries, it is becoming increasingly necessary to collate and integrate workforce data for the full range of the pharmaceutical workforce (including due consideration of pharmaceutical scientists) to more accurately understand the wider extent of what integrated workforce intelligence can do to develop evidence-driven policy to address workforce planning for the future.

The changes in the proportion of female pharmacists are more difficult to explain — particularly the "static" mean as a proportion of the workforce between 2009 and 2012 (Figure 5). This may have arisen by chance or sampling bias, or because a significant number of female pharmacists were not practising (and therefore not registered) because they were looking after their families instead. It is also possible that national gender policies may have impacted on the proportion of female pharmacists; FIP Workforce Development Goal 10 identifies the need for strategies to address gender (and diversity) imbalances. A number of nations may be actively addressing these issues but this is currently beyond the scope of the data collated for this report. As of 2016, Africa is the only WHO region where the average aggregated proportion of female pharmacists is below 50% — this may be due to economic or cultural reasons, or sampling insufficiency. This requires investigation with a larger data set.

The regression analysis of the capacity trends indicates the mean density of pharmacists is forecast to increase annually for each region. The WHO is projecting a shortage of 18 million health workers in low and middle income countries. Although the capacity for all income levels is predicted to increase, this may not keep pace with epidemiological and demographic changes globally. The projected increase in the proportion of female pharmacists is important to note because this could mean a lower participation rate for the pharmacy workforce and therefore a greater headcount will be required to deliver the same output (assuming no gains in productivity). Of concern is the projected widening gap in pharmacist capacity between lower and higher income countries.

As discussed in the previous Global Pharmacy Workforce Intelligence Trends Report of 2015, other influences that contribute to the dynamics of the workforce are the flows of pharmacists into and out of countries (immigration and emigration), part-time/interrupted practice and the proportion of workers reaching retirement age, all of which impact on the number of pharmacists available to nations. Achieving a higher density of pharmacists also depends, in part, on the capacity of strategic workforce planners in Ministries of Health and structural issues such as recruitment and distribution of workers (including direct investment in the production of the workforce). It is hoped that the recently published WHO National Health Workforce Accounts Handbook[‡‡‡‡] will support countries with transforming their workforce with a methodical, evidence-based approach that goes beyond the usual focus on medical and nursing professions but also includes the pharmacy workforce.

When considering changes in the density of pharmacists per country over time, it is useful to consider these effects on the pharmacy workforce balance. Variations in pharmacist density should not necessarily be considered a workforce imbalance. When there is a national "gap" between supply and demand for the pharmacy workforce imbalances occur. Changes in pharmacist density may also reflect differences in role since pharmacists may be contributing to a nation's healthcare in non-patient facing roles in academia, the pharmaceutical industry, pharmaceutical manufacturing units or other roles. Relating pharmacist density to accessibility of medicines is, therefore, a difficult outcome to assess without further segmentation of the data.

Additionally, density of pharmacists does not describe the productivity or distribution (and therefore accessibility, because generally healthcare workers tend to be more concentrated in urban areas than rural areas) of the workforce. For instance, as health demand increases the healthcare workforce needs to shift either by increasing its supply or by increasing its productivity. Absolute numbers of pharmacists do not reflect the issue of part-time workers, especially if their proportion has a greater increase relative to the growth in the number of pharmacists. Failure to respond to increased health demand results in workforce imbalances and risks non-achievement of positive health outcomes.

Other factors may have an effect on changes in pharmacist density. For some nations, changes may result from migration of the workforce to other countries. Some countries actively train health workers and export them (further evidence of this needs to be established for the pharmacy workforce). There may also be unplanned migration of health workers and this is evidenced by the percentage of pharmacists employed in countries in which they did not qualify (this information is often available from a nation's register of pharmacists, but not always and remains a data challenge for workforce intelligence).

‡‡‡‡ National health workforce accounts: a handbook. Geneva: World Health Organization; 2017. Available at: http://www.who.int/hrh/documents/brief_nhwa_handbook/en/

The WHO's National Health Workforce Accounts describe a consistent and integrated approach to workforce intelligence so that nations can put in place appropriate workforce strategies and plans. The consideration of the following equally applies to the pharmacy workforce and will impact on its development and therefore capacity: active workforce stock; workforce in education; education regulation; education finances; labour market flows; employment characteristics and working conditions; workforce spending and remuneration; skill mix composition for models of care; performance and productivity; and workforce governance, information systems and planning.

In addition, FIP's Workforce Development Goals (particularly WDGs 10–13) identify a methodical approach to workforce intelligence, gender and diversity balances, workforce impact and workforce policy impact. These underpin the FIP global vision for education and workforce, which articulates that all patients will have access to the best pharmaceutical care through a high quality pharmacy workforce.

PART 5

CONCLUSIONS AND FUTURE STEPS

This report, the largest retrospective study of pharmaceutical workforce capacity conducted by any organisation to date, describes the general global capacity trends of the pharmaceutical workforce from 2006 to 2016, including gender distribution and capacity growth mapped to regional variation, economic status and country income levels.

The report not only expands the evidence base on general capacity trends but also highlights the current, and persistent, workforce capacity inequities in pharmacy, including gender, raising important questions on the implications of these inequities on access to the medicines expertise of the workforce and therefore the population use of safe and effective medicines. This is of particular importance in developing countries, which are predicted by the WHO to experience a shortage of about 18 million health workers by 2030[§§§§]. Using workforce intelligence to inform national pharmaceutical and health workforce planning is, therefore, essential to address these predicted shortages; this is similarly important in more developed countries, where demand is projected to increase further.

Further understanding and analysis of pharmaceutical workforce migration, gender distribution, practice area distribution (including public and private sector employment), pharmacy technicians support workforce capacity, pharmaceutical scientists capacity (including career pathways) and workforce interactions with national or regional disease burden (as well as the impact of disease trends on workforce capacity trends) are all needed in order to inform national strategic pharmacy workforce planning. It is worth noting that the gender analysis in this report is based on a total head count of the active workforce without consideration of full-time versus part-time distribution, which is an important distinction in order to understand gender equity using capacity analysis. The data in this report pertain to the number of pharmacists only, and an understanding of the pharmacy technicians and pharmacy support workforce capacity trends is needed for a more comprehensive understanding of the capacity of the pharmaceutical workforce.

To describe a complex global situation, the report uses a mixed-model approach to analyse and illustrate capacity variances across our sample nations and represented regions; using the global mean of sample nations allowed for the description of global capacity trends over time. However, further focused work in regions (i.e., regional means) is needed to initiate specific discussions around needs-based approaches, including workforce demand and supply in line with WHO strategies. A needs-based understanding of shortages, particularly in low income and developing nations and the supply side influences in high income and developed nations need further detailed analysis.

Through workforce intelligence activities, FIP will continue to monitor and assess the global pharmacy workforce in order to shape workforce development and capacity, thereby realising the Pharmaceutical Workforce Development Goals and aligning with the WHO global agenda on health workforce intelligence. Workforce intelligence can directly contribute to realistic policy formation for the advancement of practice, of science and of education.

§§§§ World Health Organization (WHO). Health in 2015: from MDGs, Millennium Development Goals to SDGs, Sustainable Development Goals. Geneva: WHO, 2015. Available from: http://www.who.int/gho/publications/mdgs-sdgs/MDGs-SDGs2015_toc.pdf?ua=1

Annexes

Annex 1. Pharmaceutical Workforce Development Goals (PWDGs)

Cluster	PWDG	PWDG general description. Countries/territories and member organisations should have:	Rationale, drivers, and potential indicators
Academy Focus on the schools, universities and education providers	1. Academic capacity	Engagement with pharmaceutical higher education development policies and ready access to leaders in pharmaceutical science and clinical practice in order to support supply-side workforce development agendas.	• Increase the capacity to provide a competent pharmaceutical workforce by developing initial education and training programmes that are fit for purpose, according to national health resource needs (clinical practice, pharmaceutical science areas and stakeholders across all cadres). • Develop new and innovative ways to attract young pharmacists into all areas of pharmaceutical practice and science (e.g., encourage young pharmacists to consider careers in clinical academia, as preceptors/trainers, in industrial pharmacy, regulatory sciences, nuclear and veterinary pharmacy, among others). • Capacity building should include the ability to meet minimum national standards of facilities, educators and student support in order to ensure access to quality education for all students. • Enhance interprofessional education and collaboration with key stakeholders, including governments, national and international pharmacy/pharmaceutical organisations and patient advocacy groups to achieve sustainable solutions for capacity development. • The clinical academic educator workforce needs more attention to training, career development and capacity building, which must, importantly, include research capacity enhancement.
	2. Foundation training and early career development	Foundation training infrastructures in place for the early post-registration (post-licensing) years of the pharmaceutical workforce* as a basis for consolidating initial education and training and progressing the novice workforce towards advanced practice.	• Create clear and purposeful education and training pathways/programmes to support post-registration (post-graduation) foundation training (clinical practice and pharmaceutical science areas). • Develop early career maps and frameworks to support a seamless transition into early career practice and towards advanced practice. • Develop structured approaches to early career mentoring systems to support novice practitioners to engage with peers and preceptors (in clinical practice and pharmaceutical science areas across the pharmaceutical workforce).
	3. Quality assurance	Transparent, contemporary and innovative processes for the quality assurance of needs-based education and training systems.	• Ensure the quality of the workforce by quality assuring the continuous development and the delivery of adequate and appropriate education and training; quality assurance needs to address academic and institutional infrastructure in order to deliver the required needs and competency-based education and training. • Establish standards-based global guidance for quality assurance of pharmacy and pharmaceutical science education in the context of local needs and practice. • Implement fair, effective and transparent policies and procedures for quality assurance of pharmacy and pharmaceutical science education and training. • Define critical stakeholder input on development of adequate education and training and fair and effective policies, including necessary student input.

Cluster	PWDG	PWDG general description. Countries/territories and member organisations should have:	Rationale, drivers, and potential indicators
Professional development Focus on the pharmaceutical workforce	4. Advanced and specialist expert development	Education and training infrastructures in place for the recognised advancement of the pharmaceutical workforce as a basis for enhancing patient care and health system deliverables.	• Need for a common and shared understanding of what is meant by “specialisation” and “advanced practice” in the context of scope of practice and the responsible use of medicines. • Ensure competency and capability of an advanced and expert pharmacist in all sectors (including specialisations extending into industry and administration settings) for greater optimisation of complex pharmaceutical patient care. This may now include prescribing roles within a recognised scope of practice. • Systematic use of professional recognition programmes/systems as markers for advancement and specialisation across the workforce, including advanced pharmaceutical scientists.
	5. Competency development	Clear and accessible developmental frameworks describing competencies and scope of practice for all stages of professional careers. This should include leadership development frameworks for the pharmaceutical workforce.	• Use of evidence-based developmental frameworks to support the translation of pharmaceutical science within scope of practice, across all settings and according to local/national needs. • Support professional career development by using tools, such as competency frameworks, describing competencies and behaviours across all settings. • Evidence of clear policy that links leadership development (from early years) with competence attainment for the advancement of practice activities.
	6. Leadership development	Strategies and programmes in place that develop professional leadership skills (including clinical and executive leadership) for all stages of career development, including pharmaceutical sciences and initial education and training.	• Creation of programmes/strategies for the development of leadership skills (including tools and mentoring systems), to support pharmacists and pharmaceutical scientists through their careers. • Advocacy for leadership development in healthcare teams, linked to collaborative working activities (for example, promotion of team-based approaches to healthcare service delivery). • Ideally, this should be linked with competency and foundation and early year career development activities.
	7. Service provision and workforce education and training	A patient-centred and integrated health services foundation for workforce development, relevant to social determinants of health and needs-based approaches to workforce development.	• Systematic development of education and training activities based on local healthcare systems, their capacity and funding. • Evidence of systematic development policies and strategies for the strengthening and transforming pharmaceutical workforce education and the systematic training of trainers/educators. • Education providers must ensure, by the provision of evidence-based approaches, that lecturers/teachers/trainers are themselves appropriately trained for capability and competency. • Enable the pharmaceutical workforce and key stakeholders to promote health equity through actions related to social determinants of health.
	8. Working with others in the healthcare team	Clearly identifiable elements of collaborative working and interprofessional education and training which should be a feature of all workforce development programmes and policies.	• Evidence of policy formation to demonstrate how healthcare professionals can develop and engage in partnerships to achieve better health outcomes. • Develop education and training strategies/programmes to ensure collaboration within the pharmaceutical workforce and training on medicines for other healthcare professionals. • Ideally, this should be linked with formal professional development activities.

Cluster	PWDG	PWDG general description. Countries/territories and member organisations should have:	Rationale, drivers, and potential indicators
Systems **Focus on policy development, governmental strategy and planning, and monitoring systems**	9. Continuing professional development strategies 9 CPD STRATEGIES	All professional development activity clearly linked with needs-based health policy initiatives and pharmaceutical career development pathways	• Evidence of an effective continuing professional development strategy according to national and local needs. • Development of programmes to support professional development across all settings of practice and all stages of a pharmacist's career. • Ideally, this should be linked with all professional development activities across the workforce. • Education in continuing professional development strategies and self-directed behaviours should be initiated at the student level.
	10. Pharmaceutical workforce gender and diversity balances 10 GENDER AND DIVERSITY BALANCES	Clear strategies for addressing gender and diversity inequalities in pharmaceutical workforce* development, continued education and training, and career progression opportunities.	• Demonstration of strategies to address the gender and diversity inequalities across all pharmaceutical workforce and career development opportunities. • Ensure full and effective participation and equal opportunities for leadership at all levels of decision-making in pharmaceutical environments; avoidable barriers to participation for all social categories are identified and addressed. • Engagement and adoption of workforce development policies and enforceable legislation for the promotion of gender and diversity equality; policies and cultures for the empowerment of all without bias. • This should be applicable to academic capacity and leadership development activities.
	11. Workforce impact and effect on health improvement 11 WORKFORCE IMPACT	Evidence of the impact of the pharmaceutical workforce within health systems and health improvement.	• Engagement with systems to measure the impact of the pharmaceutical workforce on health improvement and healthcare outcomes. Links with needs-based education, training and workforce planning. • Gather continuous data points to monitor the performance of the pharmaceutical workforce. • Ideally, this should be linked with strategies to enhance workforce intelligence.
	12. Workforce intelligence 12 WORKFORCE INTELLIGENCE	A national strategy and corresponding actions to collate and share workforce data and workforce planning activities (skill mixes, advanced and specialist practice, capacity). Without workforce intelligence data there can be no strategic workforce development.	• FIP should aim to have a global workforce compendium of case studies developed by 2019. • Develop monitoring systems to identify workforce trends to enable decision making on deployment and supply of pharmaceutical workforce noting that time-lags are often present in these activities. • Ideally, this should be linked with stewardship and leadership for professional leadership bodies.
	13. Workforce policy formation 13 WORKFORCE POLICY FORMATION	Clear and manageable strategies to implement comprehensive needs-based development of the pharmaceutical workforce from initial education and training through to advanced practice.	• Adopt and strengthen sound policies and enforceable legislation for holistic needs-based approaches to professional development across all settings and stages. • Develop strategies where pharmaceutical science and professional services are the driving forces for this activity.

* **Pharmaceutical workforce** refers to the whole of the pharmacy related workforce (e.g. registered pharmacist practitioners, pharmaceutical scientists, pharmacy technicians and other pharmacy support workforce cadres, preservice students/trainees) working in a diversity of settings (e.g. community, hospital, research and development, industry, military, regulatory, academia and other sectors) with a diversity of scope of practice.

Annex 2. Data table

Country	WBC *	Data 2006		Data 2009		Data 2012		Data 2016	
		Population **	Pharmacist density ***	Population **	Pharmacist density ***	Population **	Pharmacist density ***	Population **	Pharmacist density ***
Afghanistan	1	25,070,798	no data	27,294,031	no data	32,358,000	0.36	34,656,032	0.79
Albania	3	3,011,487	no data	3,241,000	2.44	3,197,000	4.58	2,876,101	10.36
Argentina	3	38,747,000	5.04	39,746,000	5.15	40,728,738	no data	43,847,430	4.56
Australia	4	20,394,800	7.52	21,347,000	8.83	22,670,000	11.47	24,127,159	12.59
Austria	4	8,151,000	5.82	8,352,000	6.37	8,406,187	6.93	8,633,169	7.23
Bangladesh	2	143,431,101	no data	148,805,814	no data	150,685,000	0.19	162,951,560	0.28
Belgium	4	10,480,000	11.60	10,695,000	11.69	10,970,000	11.71	11,348,159	16.41
Brazil	3	184,184,000	4.92	195,138,000	6.39	196,900,000	9.10	207,652,865	9.39
Cambodia	2	13,270,201	no data	13,880,509	no data	14,702,000	1.00	15,762,370	1.59
Cameroon	2	18,137,734	0.39	19,595,026	0.36	20,052,000	0.42	23,439,189	0.68
Canada	4	32,225,000	8.86	33,304,000	9.31	34,468,000	10.17	36,286,425	11.74
China Hong Kong	4	6,813,200	no data	6,957,800	no data	7,130,000	2.61	7,346,700	3.37
China Taiwan	4	22,731,000	13.04	22,770,383	no data	23,176,000	17.26	23,500,000	19.17
Colombia	3	43,285,634	no data	44,447,000	0.72	46,406,646	no data	48,653,419	1.59
Costa Rica	3	4,320,130	no data	4,429,508	7.01	4,600,474	8.16	4,857,274	9.95
Croatia	3	4,442,000	5.18	4,433,000	6.73	4,405,000	6.97	4,170,600	8.87
Czech Republic	4	10,212,000	5.85	10,428,000	7.14	10,546,000	7.62	10,561,633	8.25
Denmark	4	5,418,000	7.01	5,490,000	no data	5,574,000	7.00	5,731,118	no data
Egypt	2	71,777,678	12.89	74,946,000	17.76	82,637,400	18.15	95,688,681	no data
Fiji	3	821,817	no data	843,340	no data	852,000	1.71	898,760	2.17
Finland	4	5,246,096	7.24	5,312,000	5.50	5,387,000	5.80	5,495,096	6.22
France	4	63,179,356	11.16	64,374,990	11.26	65,342,776	11.21	66,896,109	11.17
Germany	4	82,490,000	6.53	82,170,000	9.14	81,755,000	9.58	82,667,685	10.07
Ghana	2	22,019,000	0.74	23,947,000	0.75	24,965,800	1.19	28,206,728	1.34
Hungary	4	10,086,000	7.71	10,034,000	6.48	9,972,000	5.70	9,817,958	8.40
Iceland	4	296,734	12.47	317,414	12.70	319,014	13.64	334,252	13.46
India	2	1,103,596,000	5.24	1,149,285,000	5.71	1,241,275,000	5.29	1,324,171,354	7.55
Indonesia	2	221,932,000	0.68	239,945,000	0.71	243,801,639	1.05	261,115,456	2.10
Iraq	3	28,807,000	2.26	29,492,000	no data	31,760,020	no data	37,202,572	4.89
Ireland	4	4,125,000	8.50	4,535,000	9.81	4,584,000	10.46	4,773,095	11.83
Israel	4	7,105,000	4.22	7,482,000	6.68	7,856,000	7.38	8,547,100	9.61
Italy	4	58,742,000	8.00	59,865,000	10.94	60,769,000	13.47	60,600,590	15.34

Country	WBC *	Data 2006		Data 2009		Data 2012		Data 2016	
		Population **	Pharmacist density ***	Population **	Pharmacist density ***	Population **	Pharmacist density ***	Population **	Pharmacist density ***
Japan	4	127,728,000	17.99	127,720,000	19.77	128,100,000	21.59	126,994,511	22.69
Jordan	2	5,714,111	11.76	6,489,822	12.96	7,574,943	18.27	9,455,802	20.64
Kenya	2	33,830,000	0.39	37,954,000	0.42	41,609,700	0.53	48,461,567	no data
Korea, Rep of	4	48,138,077	11.60	48,607,000	11.76	48,989,000	12.48	51,245,707	13.07
Lithuania	4	3,322,528	no data	3,198,231	no data	3,211,000	7.60	2,872,298	11.41
Macedonia	3	2,090,044	no data	2,049,000	7.38	2,059,000	9.94	2,081,206	10.69
Madagascar	1	18,336,724	0.14	19,996,469	no data	21,743,949	no data	24,894,551	0.11
Malaysia	3	25,659,393	no data	27,111,069	no data	28,885,000	3.11	31,187,265	4.99
Mali	1	11,941,258	no data	12,716,000	0.64	15,394,000	0.69	17,994,837	no data
Malta	4	403,834	20.73	409,379	20.01	412,000	25.07	436,947	26.87
Mauritius	3	1,221,003	2.47	1,244,121	no data	1,286,000	no data	1,263,473	3.93
Mexico	3	112,100,000	no data	107,677,000	5.39	114,793,300	5.23	127,540,423	no data
Montenegro	3	614,261	no data	616,969	no data	620,079	5.55	622,781	8.86
Nepal	1	25,292,058	no data	26,997,000	0.20	30,486,000	0.39	28,982,771	0.90
Netherlands	4	16,319,868	no data	16,445,593	no data	16,694,000	3.08	17,018,408	3.12
New Zealand	4	4,133,900	no data	4,259,800	no data	4,417,000	10.05	4,692,700	10.03
Nigeria	2	143,300,000	0.87	148,071,000	0.89	162,265,000	0.95	185,989,640	1.02
Norway	4	4,620,000	4.34	4,661,000	4.71	4,952,000	5.25	5,232,929	4.02
Paraguay	3	5,904,170	no data	6,230,000	5.14	6,573,097	no data	6,725,308	5.44
Philippines	2	86,274,237	no data	90,751,864	no data	95,739,000	6.16	103,320,222	5.81
Portugal	4	10,576,000	8.74	10,621,000	10.46	10,653,000	12.56	10,324,611	14.90
Romania	3	21,319,685	5.15	20,537,875	5.79	21,408,000	6.49	19,705,301	7.61
Rwanda	1	9,429,457	no data	9,609,000	0.21	11,144,315	no data	11,917,508	0.57
Saudi Arabia	4	23,905,654	no data	25,940,770	no data	27,897,000	5.35	31,742,308	9.16
Senegal	1	11,251,266	no data	12,203,957	no data	12,767,600	0.92	15,411,614	0.98
Singapore	4	4,296,000	2.88	4,790,000	3.10	5,167,000	3.90	5,607,283	5.13
South Africa	3	47,606,670	no data	49,557,573	no data	50,460,000	2.54	55,908,865	2.59
Spain	4	44,710,000	9.20	46,501,000	13.18	46,178,000	13.90	46,443,959	15.31
Sri Lanka	2	19,373,000	no data	19,817,000	no data	20,198,353	3.58	21,203,000	4.24
Switzerland	4	7,446,000	7.21	7,633,000	8.23	7,868,000	8.45	8,372,098	11.71
Syria	2	18,167,367	7.00	19,933,000	7.47	21,961,676	no data	18,430,453	no data
Tanzania	1	38,824,384	no data	40,213,000	0.17	46,218,500	0.20	55,572,201	no data

Country	WBC *	Data 2006		Data 2009		Data 2012		Data 2016	
		Population **	Pharmacist density ***	Population **	Pharmacist density ***	Population **	Pharmacist density ***	Population **	Pharmacist density ***
Thailand	3	65,002,000	2.91	66,185,340	no data	69,519,000	4.07	68,863,514	5.45
Tonga	3	101,041	no data	103,005	no data	104,000	0.87	107,122	1.40
Turkey	3	72,907,000	3.31	74,766,000	4.11	73,950,000	4.33	79,512,426	4.30
Uganda	1	28,724,869	0.06	29,194,000	0.10	34,543,300	0.16	41,487,965	0.24
United Kingdom ****	4	60,068,000	7.83	61,291,000	7.99	62,736,000	8.08	65,637,239	8.21
United States	4	296,483,000	7.66	304,486,000	9.06	311,695,000	8.82	323,127,513	9.19
Uruguay	4	3,419,000	3.22	3,334,000	3.63	3,383,486	no data	3,444,006	5.68
Vanuatu	2	209,370	no data	225,340	no data	252,000	1.39	270,402	0.92
Vietnam	2	82,392,100	no data	86,185,000	1.18	87,850,000	1.37	92,701,100	no data
Zambia	2	12,052,156	no data	13,082,517	no data	13,475,000	0.19	16,591,390	0.36
Zimbabwe	1	12,710,589	no data	13,481,000	0.80	12,084,000	0.56	16,150,362	0.60

Notes:
* WBC – World Bank Classification. The World Bank classifies countries incomes as: high (4) upper middle (3); lower middle (2); and low (1).
** Population data source: World Bank.
*** Density as pharmacists per 10,000 population.
**** The United Kingdom is composed of Great Britain and Northern Ireland.
The source for the data in the FIP 2017 survey is the General Pharmaceutical Council who is the regulator and holds the register of pharmacists in Great Britain.
The Pharmaceutical Society of Northern Ireland is the regulator and holds the register of pharmacists in Northern Ireland.

Annex 3. ISO 3-digit table

COUNTRY	ISO 3-DIGIT COUNTRY CODE	COUNTRY	ISO 3-DIGIT COUNTRY CODE
Afghanistan	AFG	Madagascar	MDG
Albania	ALB	Malaysia	MYS
Argentina	ARG	Mali	MLI
Australia	AUS	Malta	MLT
Austria	AUT	Mauritius	MUS
Bangladesh	BGD	Mexico	MEX
Belgium	BEL	Montenegro	MNE
Brazil	BRA	Nepal	NPL
Cambodia	KHM	Netherlands	NLD
Cameroon	CMR	New Zealand	NZL
Canada	CAN	Nigeria	NGA
China Hong Kong	HKG	Norway	NOR
China Taiwan	TWN	Pacific Islands	PIC
Colombia	COL	Paraguay	PRY
Costa Rica	CRI	Philippines	PHL
Croatia	HRV	Portugal	PRT
Czech Republic	CZE	Romania	ROU
Denmark	DNK	Rwanda	RWA
Egypt	EGY	Saudi Arabia	SAU
Fiji	FJI	Senegal	SEN
Finland	FIN	Singapore	SGP
France	FRA	South Africa	ZAF
Germany	DEU	Spain	ESP
Ghana	GHA	Sri Lanka	LKA
Hungary	HUN	Switzerland	CHE
Iceland	ISL	Syria	SYR
India	IND	Tanzania	TZA
Indonesia	IDN	Thailand	THA
Iraq	IRQ	Tonga	TON
Ireland	IRL	Turkey	TUR
Israel	ISR	Uganda	UGA
Italy	ITA	United Kingdom	GBR
Japan	JPN	United States	USA
Jordan	JOR	Uruguay	URY
Kenya	KEN	Vanuatu	VUT
Korea, Rep of	KOR	Vietnam	VNM
Lithuania	LTU	Zambia	ZMB
Macedonia	MKD	Zimbabwe	ZWE

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