

Chapter 11: International Comparisons

- As they have done for the past decade, in 2015 Taiwan, the Jalisco region of Mexico, and the United States (U.S.) reported the highest incidence of treated ESRD, with rates of 476, 411, and 378 patients per million general population (PMP; Figure 11.2). Brunei, contributing to the chapter for the first time this year, also reported one of the highest global rates of treated ESRD incidence, at 393 patients PMP.
- The greatest proportionate increases in the incidence of treated ESRD over the interval from 2002/03 to 2014/15 ([Reference Table N.1](#)) were reported by Bangladesh (590%), Thailand (306%), Russia (246%), the Philippines (203%), Malaysia (154%), the Republic of Korea (92%), and the Jalisco region of Mexico (63%).
- Incidence rates of treated ESRD have remained relatively stable since 2002/03 in most high-income countries, and have declined by 2% to 10% in Austria, Finland, Sweden, Scotland, Denmark, and Iceland ([Reference Table N.1](#)). However, long-term trends are questionable because of year-to-year fluctuations.
- In 2015, countries identified diabetes mellitus (DM) as the primary cause of ESRD for greater than 50% of incident, treated ESRD patients in Singapore, Malaysia, the Jalisco region of Mexico, and Chile. Conversely, DM was listed as the primary cause for less than 20% of incident ESRD patients in the Netherlands, Indonesia, Switzerland, Italy (five regions), Norway, Russia, Latvia, Lithuania, Albania, and Romania (Figure 11.4).
- The greatest increases in diabetes-related ESRD incidence rates from 2002/03 to 2014/15 have occurred in Russia, the Philippines, Malaysia, and the Republic of Korea, where rates have more than doubled over this period ([Reference Table N.2](#)).
- Taiwan, Japan, and the U.S had the highest reported prevalence of treated ESRD in 2015, at 3317, 2529, and 2138 PMP (Figure 11.9).
- From 2002 to 2015, the prevalence of treated ESRD steadily increased in all countries with reported data. The largest proportionate increases in ESRD prevalence were in the Philippines, Thailand, and the Jalisco region of Mexico, and ranged from 299% to 785% ([Reference Table N.4](#)).
- Large international differences exist in the use of the different renal replacement therapies (RRT; Figure 11.12). In one-fourth of countries, 50-75% of treated ESRD patients are living with a kidney transplant—particularly in northern European countries. In contrast, less than 20% of treated ESRD patients are living with a kidney transplant in approximately one-third of countries. In most nations, in-center hemodialysis (HD) was the predominant RRT modality.
- In-center HD was the chosen modality for greater than 80% of dialysis provision in 82% of countries (Figure 11.15 and [Reference Table N.7](#)). The highest utilization of peritoneal dialysis (PD) in 2015 occurred in Hong Kong (70%), the Jalisco region of Mexico (51%), New Zealand (30%), Thailand (29%), Qatar (27%), and Colombia (27%).
- In 2015, the Jalisco region of Mexico, Spain, the U.S., and the Netherlands reported the highest rates of kidney transplantation, with 58-71 transplants PMP (Figure 11.16.a). When expressed relative to the size of the prevalent dialysis population, the highest rates of kidney transplantation per 1000 dialysis patients occurred in Norway (183 per 1000), the Netherlands, Latvia, Finland, and Scotland (from 119 to 151 per 1000). One-third of countries indicated less than 30 kidney transplants per 1000 dialysis patients (Figure 11.16.b).

Introduction

This chapter examines international trends in the treatment of end-stage renal disease (ESRD). The number of countries and regions represented in this

year's Annual Data Report (ADR) increased to 73 in 2016, with the addition of Albania, Brunei (Darussalam), Bulgaria, Egypt, Kazakhstan, Latvia, Lithuania, the Republic of Macedonia, and Peru. Welcome to our newest contributors.

This work is made possible by the substantial efforts of many individuals from all participating countries, through collecting and contributing data for this international collaboration. We applaud and sincerely thank all of the registries for their dedicated efforts in providing their data for this effort. We acknowledge the specific contributors to this effort at the end of the chapter. We intend for the information in this chapter to serve as a resource for the worldwide ESRD community—to inform health care policies, patient care, and the application of resources while stimulating meaningful research for improving ESRD patient care.

Our goal is for the presented comparisons to increase awareness of the international trends, similarities, and differences in key ESRD treatment measures. Participating countries provide data through completion of a standardized survey form. Actual data collection methods vary considerably across countries, however, therefore any direct comparisons should be made within this context.

In some countries (e.g., U.S.), data are based in part upon claims submitted for billing purposes; such data tends to provide nearly 100% ascertainment of ESRD. However, countries using other data collection methods have also been very successful in identifying ESRD in their populations. In some registries, however, it may not be feasible to obtain 100% ascertainment of persons treated for ESRD or receiving chronic dialysis therapy.

In addition, we do not adjust these international comparisons for demographic differences. Most European countries, Japan, and other nations have rapidly aging populations. As ESRD rates tend to increase with older age, such nations are likely to report higher rates of ESRD as compared to those with younger populations. The descriptions in this international chapter are intended to characterize global ESRD treatment broadly. Thus whether a registry achieves 90%, 95%, or >99% ascertainment within their country, the key messages in this chapter remain very relevant. In 2018, we plan to include survey results further describing the international variability in ascertainment of ESRD capture across registries.

The degree of unrecognized diagnosis of ESRD and access to renal replacement therapy (RRT) also widely

vary across countries. Where RRT access is limited, reported ESRD incidence and prevalence may substantially underestimate the true rates of irreversible kidney failure. Furthermore, in some countries where RRT is widely available, when patients decline dialysis or transplantation true ESRD incidence may be underestimated. The term “conservative kidney management” is used to describe patients who choose to forego or postpone RRT while continuing active medical care by nephrologists and other providers (Robinson et al, 2016). For these reasons, ‘true ESRD incidence’ may not be a meaningful concept. The information presented in this chapter reflects only treated cases of ESRD—patients started or currently on dialysis or transplantation. Thus, the data and trends reported represent “treated ESRD.”

We welcome any suggestions to further improve the content of this chapter for the benefit of the international community, and invite all renal registries to participate in this data collection and collaboration in the future. Feel free to contact us via email at USRDS@usrds.org—there are many countries not yet represented. Efforts to increase international engagement and enhance this chapter’s content will continue to be a focus of our work.

Methods

The findings presented in this chapter result from aggregate analyses each country’s response to a request by the USRDS for a country’s registry to complete a data collection form indicating various aspects of patients receiving RRT for ESRD. A copy of the [Data Collection Form](#) is available on the [USRDS website](#).

Data tables formerly presented within the content of this chapter are now located in [Reference Table N](#). See the [Analytical Methods Used in the ESRD Volume](#) section of the [ESRD Analytical Methods](#) chapter for an explanation of the analytical methods used to generate the study cohorts and figures in this chapter. Downloadable Microsoft Excel and PowerPoint files containing the data and graphics for these figures are available on the [USRDS website](#).

Incidence of Treated ESRD

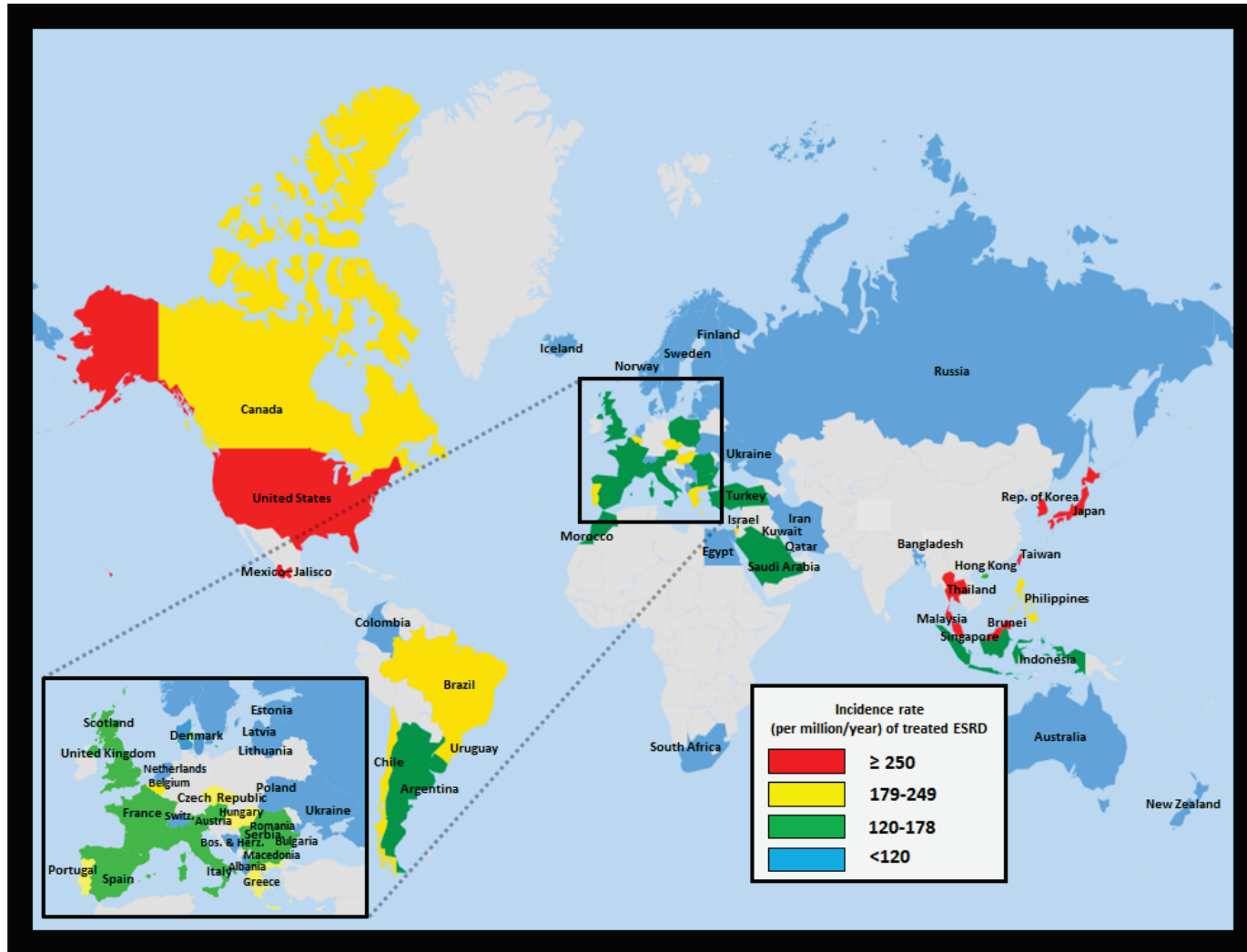
In 2015, reported incidence rates of treated ESRD varied greatly across countries (see Figures 11.1 and 11.2). Taiwan, the Jalisco region of Mexico, Brunei, and the U.S. reported the highest incidence of treated ESRD, at 476, 411, 393, and 378 individuals per million general population (PMP). The next highest rates, ranging from 223–338 PMP were reported by Thailand, Singapore, Japan, the Republic of Korea, Malaysia, Greece, Portugal, the Czech Republic, and Hungary. The lowest treated ESRD incidence rates, ranging from 28 to 99 PMP, were reported by South Africa, Bangladesh, Russia, Iceland, Latvia, Albania, Estonia, Finland, and Norway.

Trends in the incidence of treated ESRD also varied greatly across countries, as shown in Figure 11.3, and [Reference Table N.1](#). We evaluated the percentage

change in averaged ESRD incidence rates in 2014/15 versus that in 2002/03. The greatest increases in the incidence of treated ESRD were reported for Bangladesh (590%), Thailand (306%), Russia (246%), the Philippines (203%), Malaysia (154%), the Republic of Korea (92%), and the Jalisco region of Mexico (63%). In contrast, the ESRD incidence in 2014/15 was 2-10% lower than that in 2002/03 in Austria, Finland, Sweden, Scotland, Denmark, and Iceland.

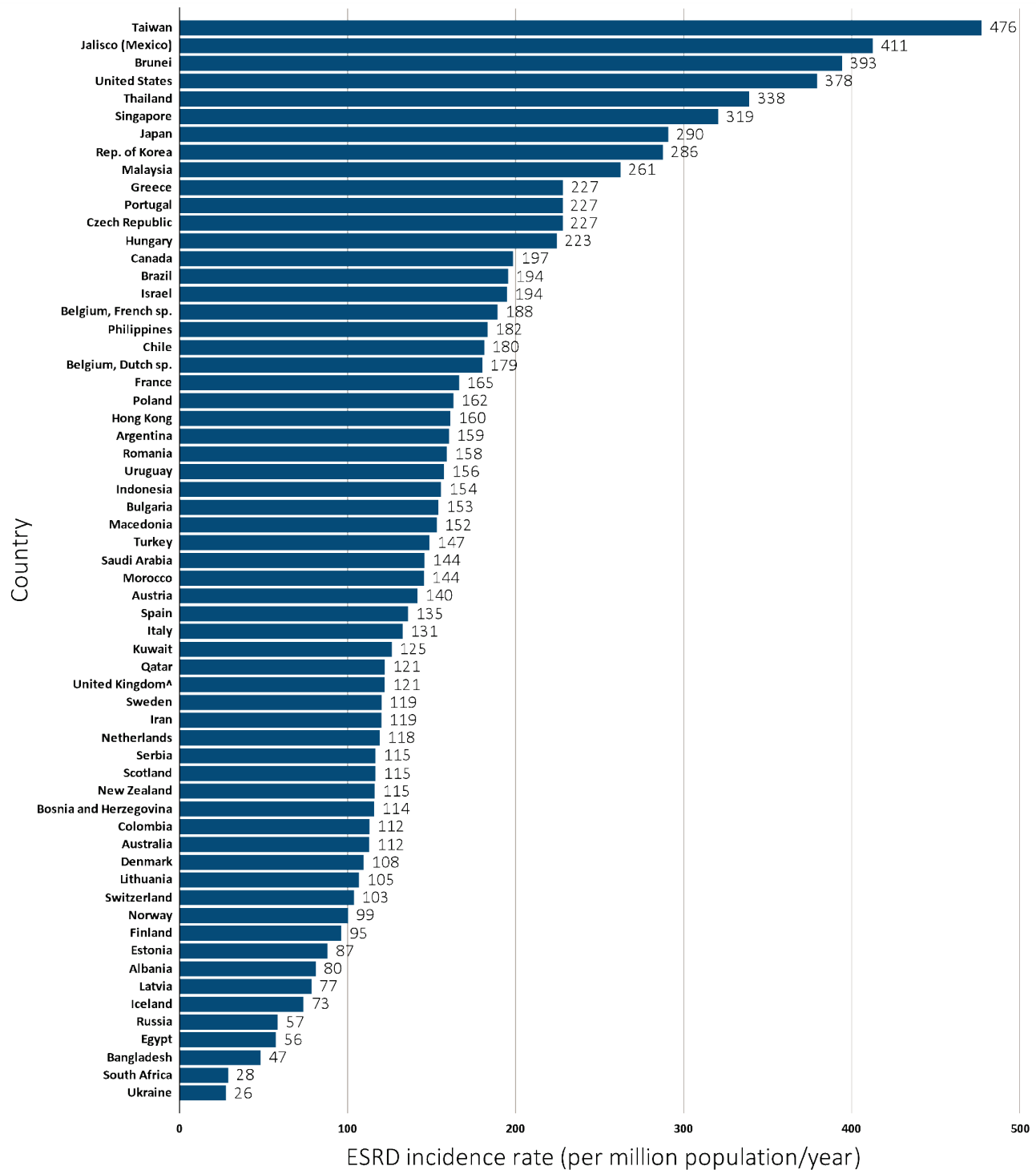
The incidence of treated ESRD was relatively stable in nearly half of all countries, displaying an overall increase of 1% to 31% when comparing the rates in 2014/15 with those in 2002/03. The U.S. displayed one of the more stable ESRD incidence rates over this period, with an overall 10% increase from 2002/03 to 2014/15. Most of this change occurred prior to 2006, with little change in U.S. incidence rates seen from 2006-2013, followed by a recent rise.

vol 2 Figure 11.1 Geographic variations in the incidence rate of treated ESRD (per million population/year), by country, 2015



Data source: Special analyses, USRDS ESRD Database. Data presented only for countries from which relevant information was available. All rates are unadjusted. United Kingdom: England, Wales, Northern Ireland (Scotland data reported separately). Data for Italy include five regions. Data for Indonesia represent the West Java region. Data for France exclude Martinique. Data for Canada excludes Quebec. Japan includes dialysis patients only. Abbreviation: ESRD, end-stage renal disease. NOTE: Data collection methods vary across countries, suggesting caution in making direct comparisons.

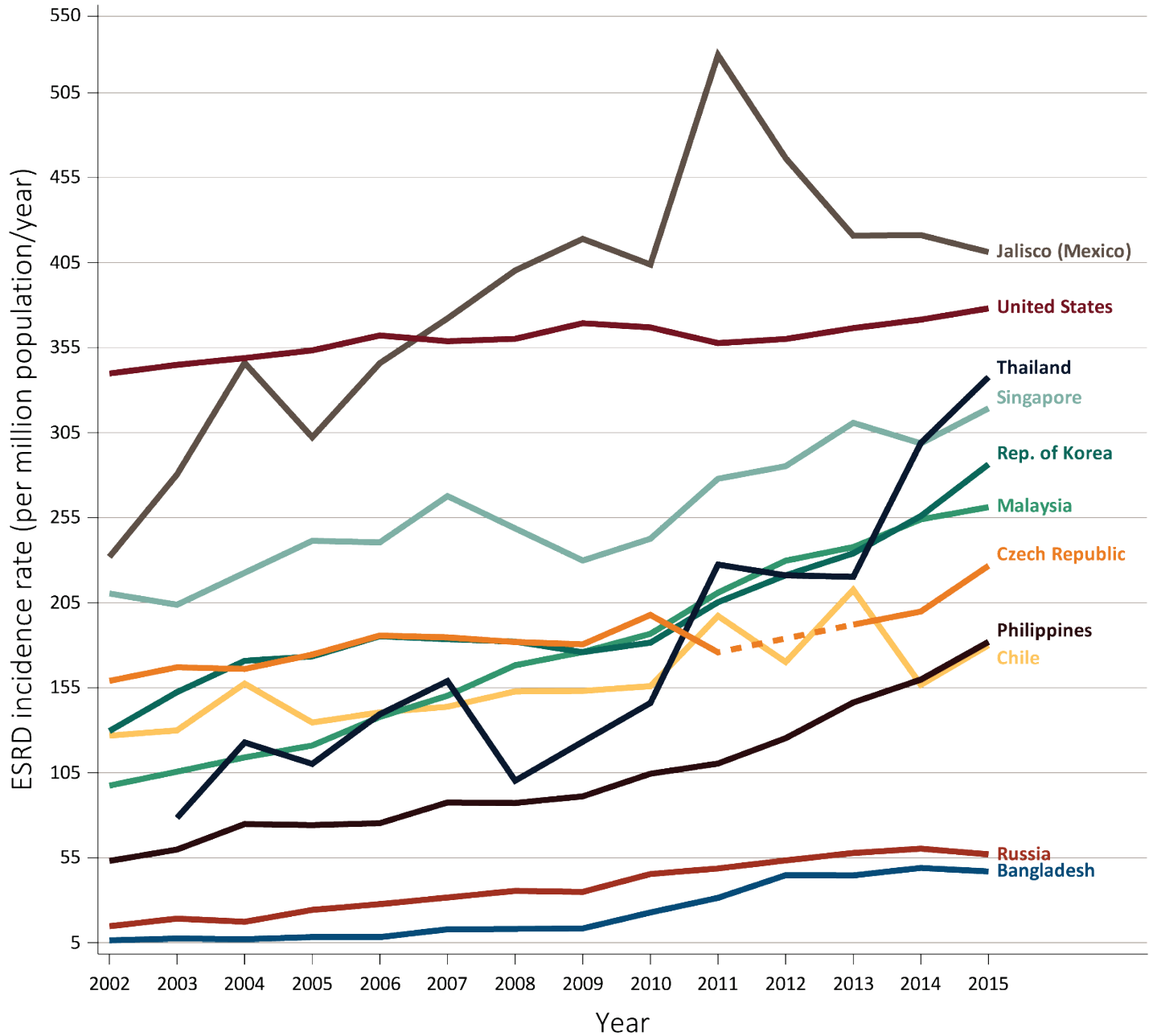
vol 2 Figure 11.2 Incidence rate of treated ESRD (per million population/year), by country, 2015



Data source: Special analyses, USRDS ESRD Database. Data presented only for countries from which relevant information was available. All rates are unadjusted. ^AUnited Kingdom: England, Wales, Northern Ireland (Scotland data reported separately). Data for Italy include five regions. Data for Indonesia represent the West Java region. Data for France exclude Martinique. Data for Canada excludes Quebec. Japan includes dialysis patients only. Data for Latvia represents 80% of the country's population. Abbreviations: ESRD, end-stage renal disease; sp., speaking. NOTE: Data collection methods vary across countries, suggesting caution in making direct comparisons.

vol 2 Figure 11.3 Trends in the incidence rate of treated ESRD (per million population/year), by country, 2002-2015

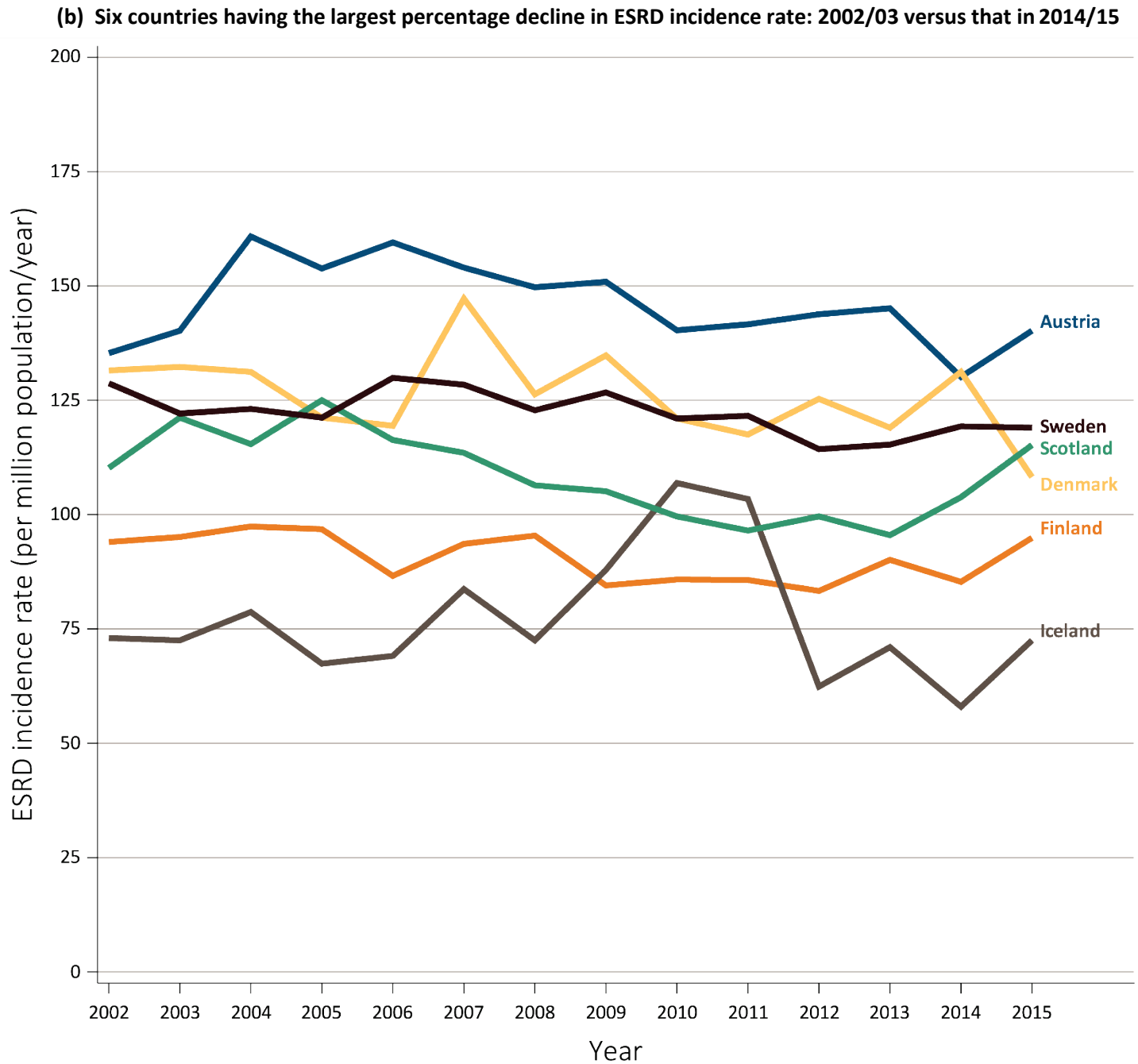
(a) Ten countries having the highest percentage rise in ESRD incidence rate in 2002/03 versus that in 2014/15, plus the U.S.



Data source: Special analyses, USRDS ESRD Database. All rates are unadjusted. Data for the Czech Republic are missing from 2012 indicated by the dashed line. Data for U.S. are shown for comparison purposes. Abbreviation: ESRD, end-stage renal disease. NOTE: Data collection methods vary across countries, suggesting caution in making direct comparisons.

Figure 11.3 continued on next page.

vol 2 Figure 11.3 Trends in the incidence rate of treated ESRD (per million population/year), by country, 2002-2015 (continued)



Data source: Special analyses, USRDS ESRD Database. All rates are unadjusted. Only six countries had a decrease in incidence from 2002/03-2014/15. Abbreviation: ESRD, end-stage renal disease. NOTE: Data collection methods vary across countries, suggesting caution in making direct comparisons.

DIABETES AS PRIMARY CAUSE OF END-STAGE RENAL DISEASE IN INCIDENT PATIENTS

In this section, we examine the relationship of diabetes mellitus (DM) to incidence of treated ESRD. We wish to note that other factors are related to ESRD incidence as a primary cause, including glomerulonephritis, other nephritis causes, hypertension, certain congenital disorders, immunological disorders, cancer, overuse of particular drugs, exposure to chemical nephrotoxic agents, and other environmental factors that may be particularly relevant in some regions.

Nearly 77% of the countries participating in this report provided data on the incidence of treated ESRD with a primary cause of DM—a key contributor to the global burden of ESRD. In 2015, Singapore, Malaysia, the Jalisco region of Mexico, and Chile reported the highest proportions of patients with new ESRD due to DM, at 66%, 64%, 62%, and 57% (Figure 11.4).

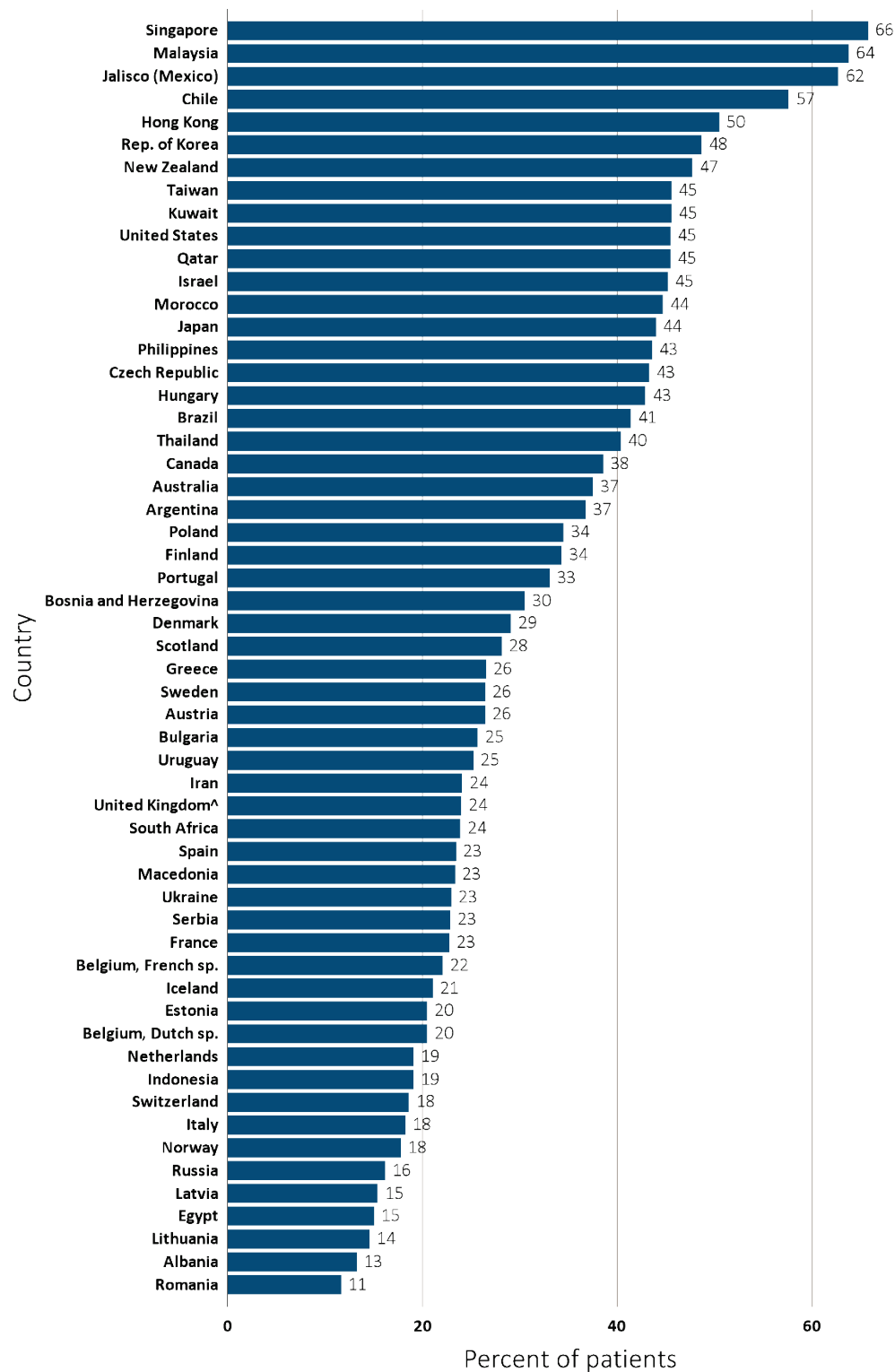
Furthermore, DM was the primary cause of new ESRD for 40-50% of patients in Hong Kong, the Republic of Korea, New Zealand, Taiwan, Kuwait, the U.S., Qatar, Israel, Morocco, Japan, the Philippines, the Czech Republic, Hungary, Brazil, and Thailand. In contrast, in 2015, DM was the primary cause of ESRD for less than 20% of new ESRD patients in the Netherlands, Indonesia, Switzerland, Italy (five regions), Norway, Russia, Latvia, Egypt, Lithuania, Albania, and Romania.

Twenty-five countries provided incidence rates of ESRD due to DM for the entire period from 2002 to 2015. These data indicate an overall rise in the incidence of treated ESRD due to DM in most, but not all, of these nations ([Reference Table N.2](#)). In some countries, this increase has been especially large—from an 80-703% increase between 2002 and 2015

([Reference Table N.2](#), Figure 11.5). These included Russia, the Philippines, Malaysia, the Republic of Korea, the Jalisco region of Mexico, and Singapore. Furthermore, in Thailand the incidence of ESRD due to DM has more than doubled since 2007. Among the countries shown, the Jalisco region of Mexico had the highest incidence due to DM in 2015, at nearly 257 new ESRD patients PMP. It is conceivable that the practice of determining primary cause of ESRD may have altered in some countries over this reporting period, and thus methodology rather than true trends may have contributed to the observed changes. However, we currently have no information regarding the extent of this possibility for any of the countries.

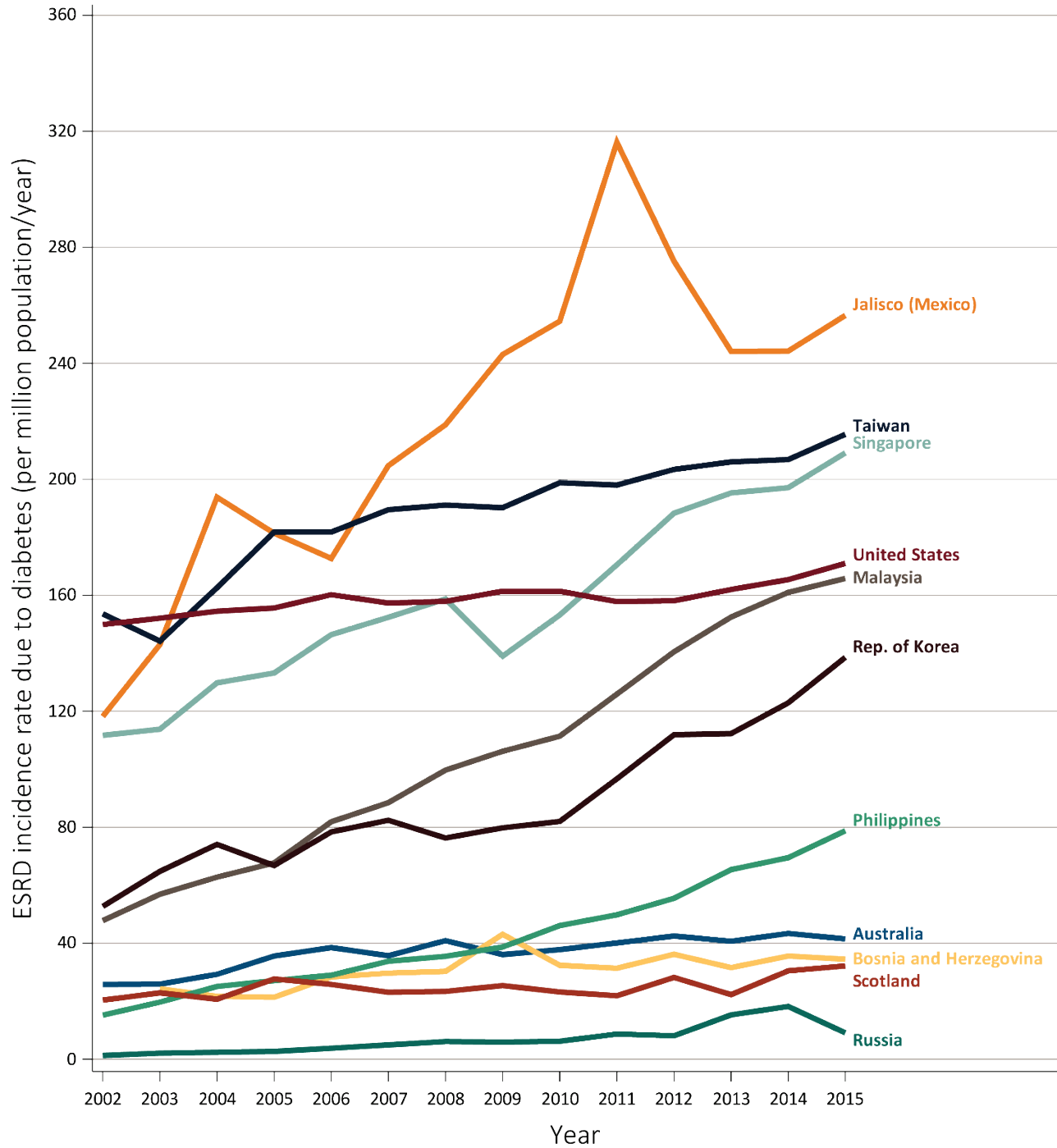
Figure 11.6 presents the relationship of percentage change in overall treated ESRD incidence to the change in treated incidence due to DM. Data represent 27 countries across three international regions, from 2002-2015. In each region, although not in all countries, a positive relationship was seen. Overall, from 2002-2015 the largest increases both in incidence due to DM and in overall ESRD incidence occurred in the region consisting of Asia and Russia. In contrast, five countries showed a decline in ESRD due to DM from 2002-2015, with four of these, Austria, Finland, Denmark, and Sweden, also reporting declines in overall treated ESRD incidence. It is noteworthy that this relationship differs considerably across countries, whereby in some nations the percentage change in treated ESRD incidence is of similar magnitude to the percentage change in treated ESRD incidence due to DM, while in others this positive relationship is of a much lower equivalence. Thus, the contribution of treated ESRD incidence due to DM to the overall treated ESRD incidence varies substantially across countries.

vol 2 Figure 11.4 Percentage of incident ESRD patients with diabetes as the primary cause of ESRD, by country, 2015



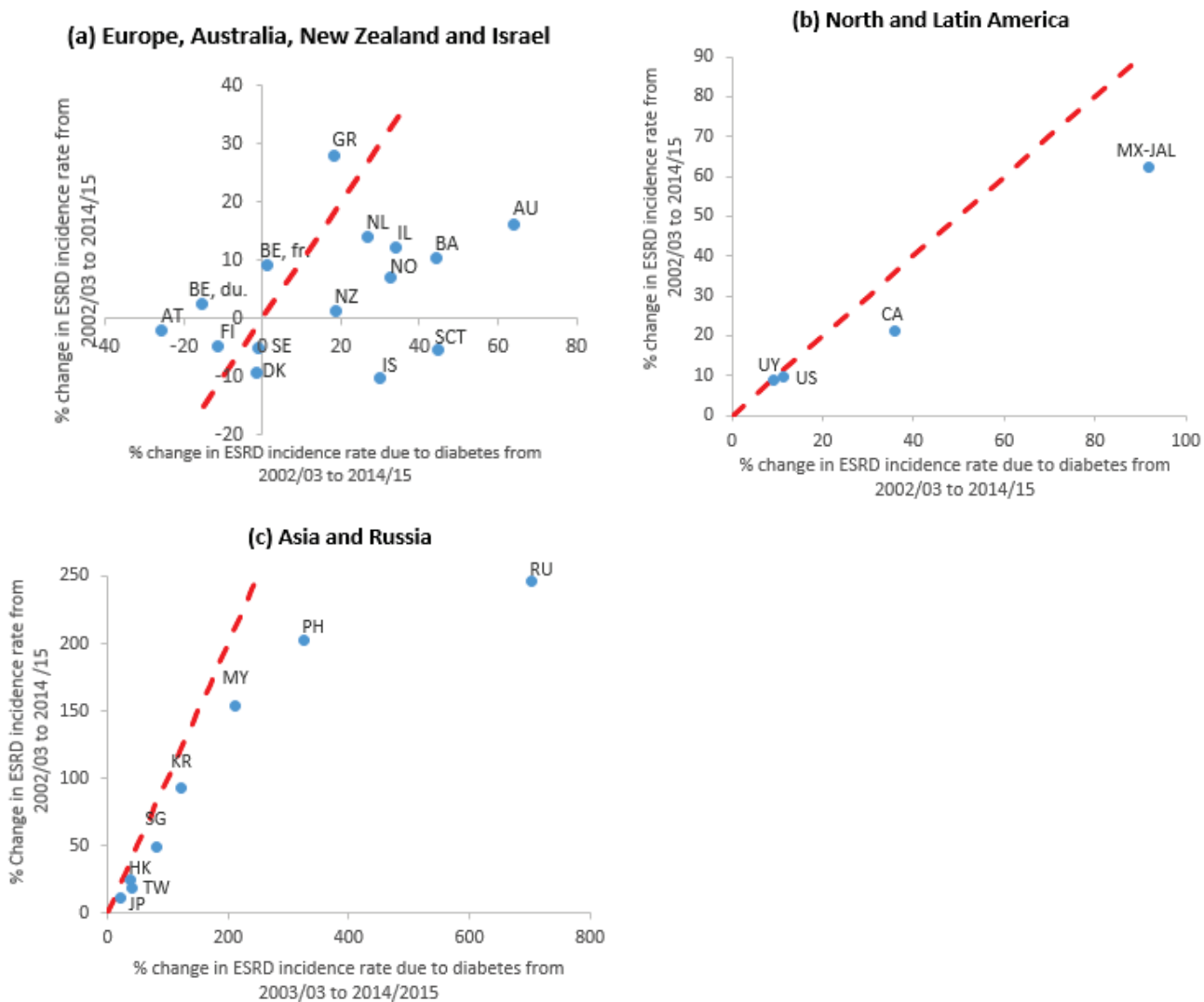
Data source: Special analyses, USRDS ESRD Database. Data presented only for countries from which relevant information were available. ^United Kingdom: England, Wales, Northern Ireland (Scotland data reported separately). Data for France exclude Martinique. Data for Indonesia represent the West Java region. Data for Italy includes five regions. Data for Canada excludes Quebec. Data for Latvia represents 80% of the country's population. Abbreviations: ESRD, end-stage renal disease; sp., speaking. NOTE: Data collection methods vary across countries, suggesting caution in making direct comparisons.

vol 2 Figure 11.5 Trends in the incidence rate of treated ESRD due to diabetes (per million population/year), by country, 2002-2015



Data source: Special analyses, USRDS ESRD Database. Ten countries having the highest percentage rise in 2014/15 versus that in 2002/03, plus the U.S. Data presented only for countries from which relevant information were available. Abbreviation: ESRD, end-stage renal disease. NOTE: Data collection methods vary across countries, suggesting caution in making direct comparisons.

vol 2 Figure 11.6 Correlation, by country, of the percentage change in ESRD incidence with the percentage change in ESRD incidence due to diabetes, from 2002-2015, with countries displayed by region



Data source: Special analyses, USRDS ESRD Database. Data presented only for countries from which relevant information was available. Reference line (in red) represents 1:1 ratio of percentage change in ESRD incidence rate due to diabetes and percentage change in ESRD incidence rate from 2002/03-2014/15. Countries listed in order of lowest to highest percentage change in ESRD incidence due to diabetes in each panel **(a) Europe, Australia, New Zealand, and Israel:** (1%-64%) Sweden (SE), Belgium (BE, French speaking), Denmark (DK), Finland (FI), Belgium (BE, Dutch Speaking) Greece (GR), New Zealand (NZ), Austria (AT), the Netherlands (NL), Iceland (IL), Norway (NO), Israel (IS), Bosnia and Herzegovina (BA), Scotland (SCT), Australia (AU).; **(b) North and Latin America:** (9%-92%) Uruguay (UY), United States (U.S.), Canada (CA), Jalisco (Mexico, MX-JAL); **(c) Asia and Russia:** (22%-703%) Japan (JP), Hong Kong (HK), Taiwan (TW), Singapore (SG), Rep. of Korea (KR), Malaysia (MY), Philippines (PH), Russia (RU). Abbreviation: ESRD, end-stage renal disease. NOTE: Data collection methods vary across countries, suggesting caution in making direct comparisons.

Incidence of Treated ESRD Disease by Age Group and Sex

Figure 11.7 presents the 2015 incidence of treated ESRD by age group. Among countries having higher treated ESRD incidence, in most the rates were highest among patients aged 75 years or older. The highest rates in this age group occurred in Taiwan, with 2804 PMP/year. This was twice the next highest rate as reported for the U.S., of 1400 PMP/year, followed by Israel and Singapore, at 1261 and 1128. In contrast, among countries having lower rates, treated ESRD incidence often was concentrated among patients 65-74 yrs old. In Latvia, Iceland, Romania, Finland, Scotland, Hong Kong, New Zealand, Malaysia, Albania, and Russia, the incidence of treated ESRD was 11-91% lower in the population aged 75 years or older, as compared to those aged 65-74 years. In 2015, the U.S. reported the highest ESRD incidence rate in younger adults aged 20-44 years, at 137 PMP/year. In Malaysia, reported rates of PMP/year were more than twice that of most other countries with available data.

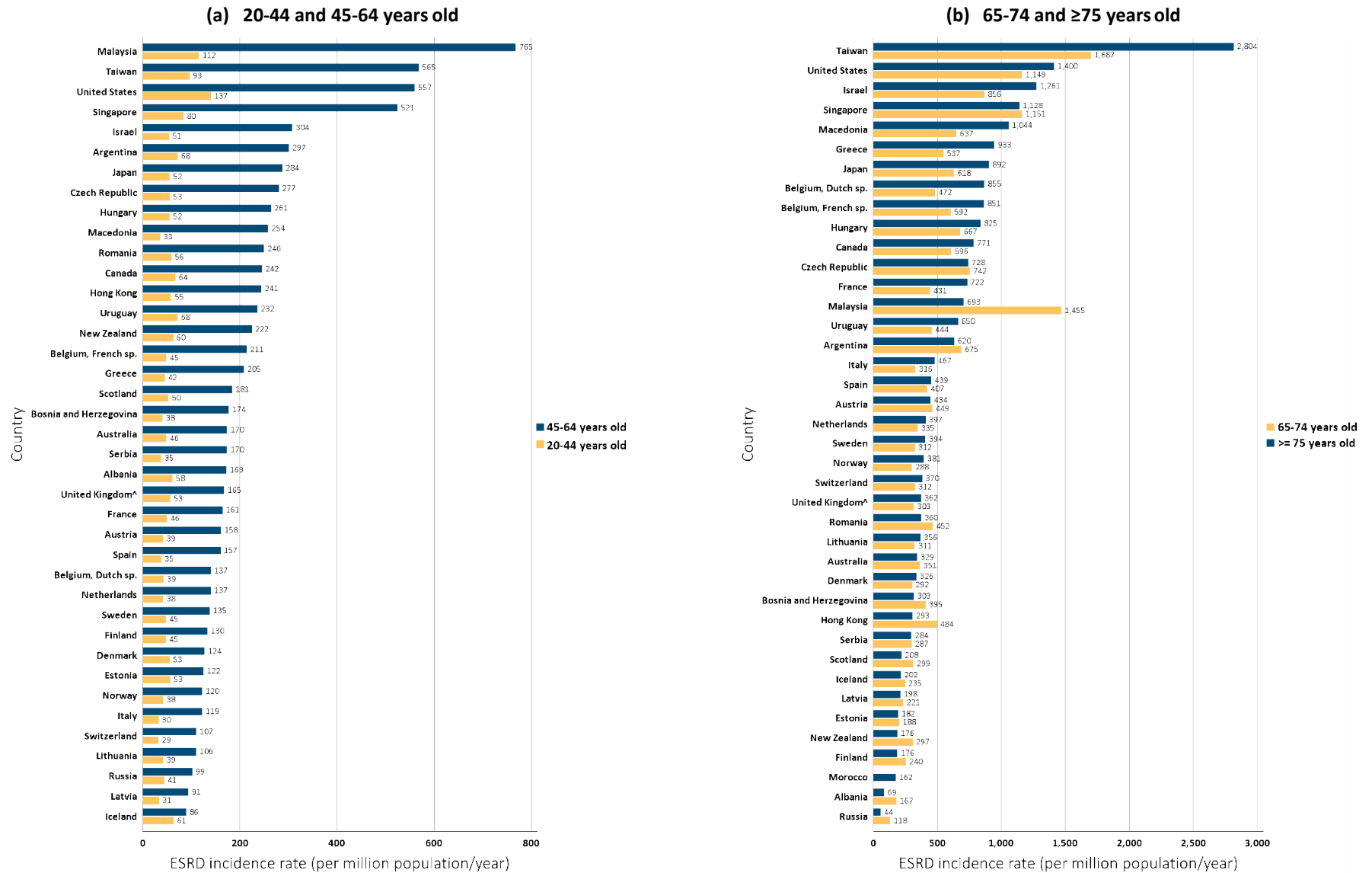
Trends in the incidence of treated ESRD by age group are provided in [Reference Table N.3](#). These are expressed as the percentage change for years 2014/15 versus 2006/07, in the 29 countries for which these data have been contributed. It is noteworthy that both in the U.S. and nearly half of the 29 countries, an overall decline in the treated ESRD incidence rate was seen among persons aged 75 years or older. In 21 of the 29 countries, a corresponding decline was seen in the 65-74 year age group. These latter trends are especially meaningful, since in many countries nearly half of all new ESRD patients are 65 years or older. It is notable that in several countries ESRD incidence rates increased 23-65% from 2006/07 to 2014/15 in the youngest age group of 0-19 years of age, while showing declines or little change in the older age groups. This pattern was observed in Norway, Finland, Hong Kong, and Australia.

In Figure 11.8, we compare the incidence of treated ESRD by sex. In almost every country, the rate was substantially higher for males than for females, with the exception of Estonia and Colombia. ESRD incidence was at least two times higher for males in

Italy (five regions), Greece, Lithuania, Spain, Japan, and Iceland, and was 1.1-1.9 times higher for males in most other countries. The ratios of male to female ESRD incidence in Estonia and Colombia were 0.86 and 0.91 respectively. In the U.S., males had a higher ESRD incidence rate, despite CKD being less prevalent among males than females, as reported in Volume 1, Chapter 1 of the ADR, [CKD in the General Population](#).

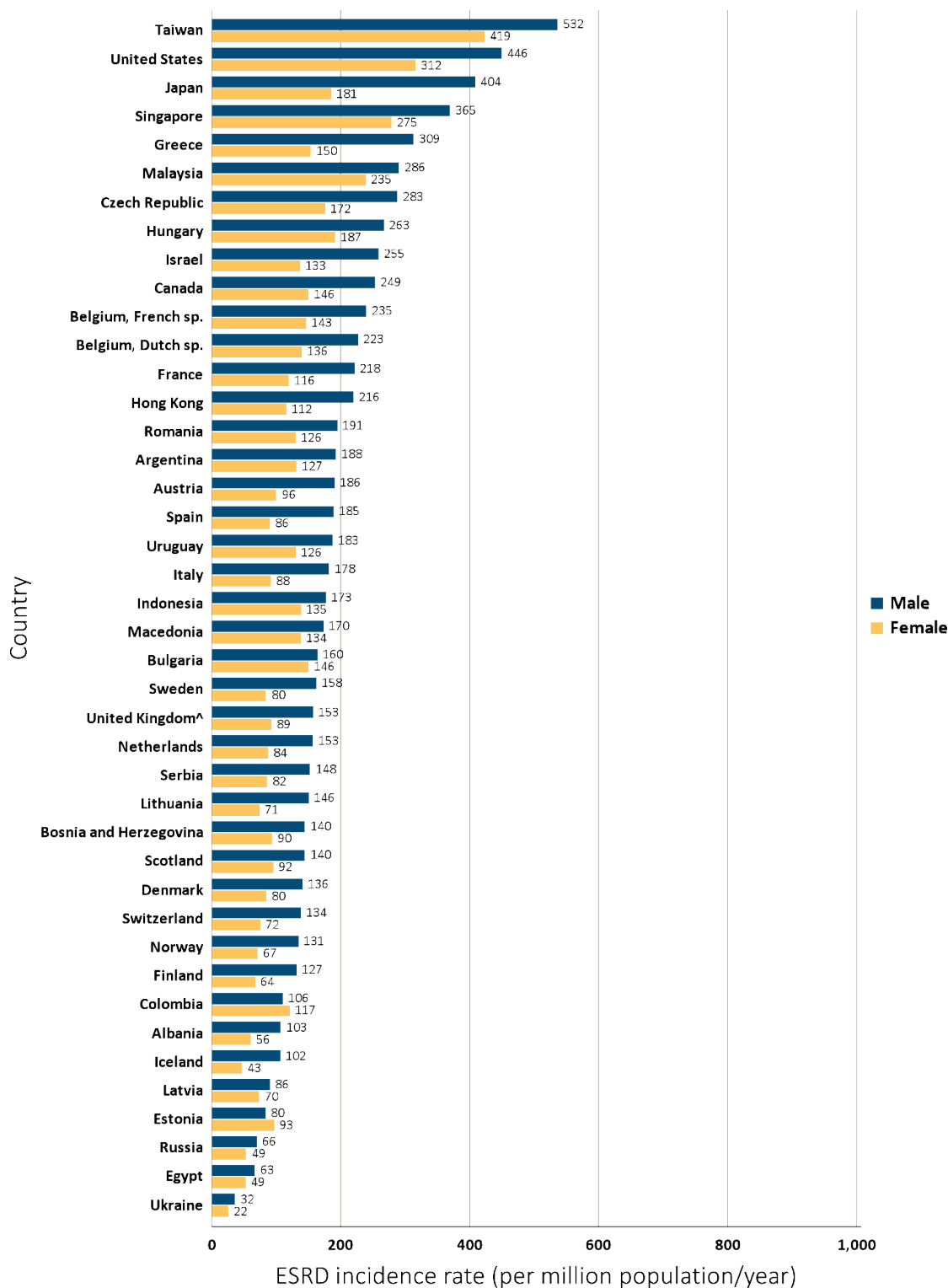
The considerably lower ESRD incidence for females in nearly all countries shown in Figure 11.8 is consistent with the recent paper by Hecking et al (2014), who observed considerably fewer women than men being treated with HD for ESRD in 12 of the countries participating in the Dialysis Outcomes and Practice Patterns Study (DOPPS) from 2002-2012. In conjunction with the prior findings by Hecking et al (2014), the sex differences in incidence rates from the great majority of countries shown in this report support investigation of the broader question of which factors are responsible for the differential ESRD incidence in males versus females. At this time, it is unknown whether the drivers of this sex difference are due to differences in biologic, environmental, or other factors.

vol 2 Figure 11.7 Incidence rate of treated ESRD (per million population/year), by age group and country, 2015



Data source: Special analyses, USRDS ESRD Database. Data presented only for countries from which relevant information was available. ^United Kingdom: England, Wales, Northern Ireland (Scotland data reported separately). Data for Italy include five regions. Data for France exclude Martinique. Data for Canada excludes Quebec. Japan includes dialysis patients only. Data for Latvia represents 80% of country's population. For graph (a), data for Spain include patients 15-64 years old, and data for the United States include patients 22-64 years old. (b) data for Morocco include patients 65 years old and older. Abbreviations: ESRD, end-stage renal disease; sp., speaking. NOTE: Data collection methods vary across countries, suggesting caution in making direct comparisons.

vol 2 Figure 11.8 Incidence rate of treated ESRD (per million population/year), by sex and country, 2015



Data source: Special analyses, USRDS ESRD Database. Data presented only for countries from which relevant information was available. ^United Kingdom: England, Wales, Northern Ireland (Scotland data reported separately). Data for France exclude Martinique. Data for Indonesia represent the West Java region. Data for Italy represent five regions. Data for Canada excludes Quebec. Japan includes dialysis patients only. Data for Latvia represents 80% of country's population. Abbreviations: ESRD, end-stage renal disease; sp., speaking. NOTE: Data collection methods vary across countries, suggesting caution in making direct comparisons.

Prevalence of ESRD

In 2015, 2,450,740 patients were treated for ESRD across all reporting countries. The number was by far the highest in the U.S., with 687,093 treated patients accounting for 28% of the total ([Reference Table N.4.b](#)), and followed by Japan and Brazil with approximate cohorts of 321,000 and 170,000 prevalent patients. The Republic of Korea, Taiwan, Thailand, Turkey, Egypt, France, Spain, the United Kingdom (U.K.), and Iran reported between 50,000 to 98,000 treated ESRD patients in 2015, while all other countries indicated smaller populations, with approximately 10,000 treated patients in the median country of South Africa.

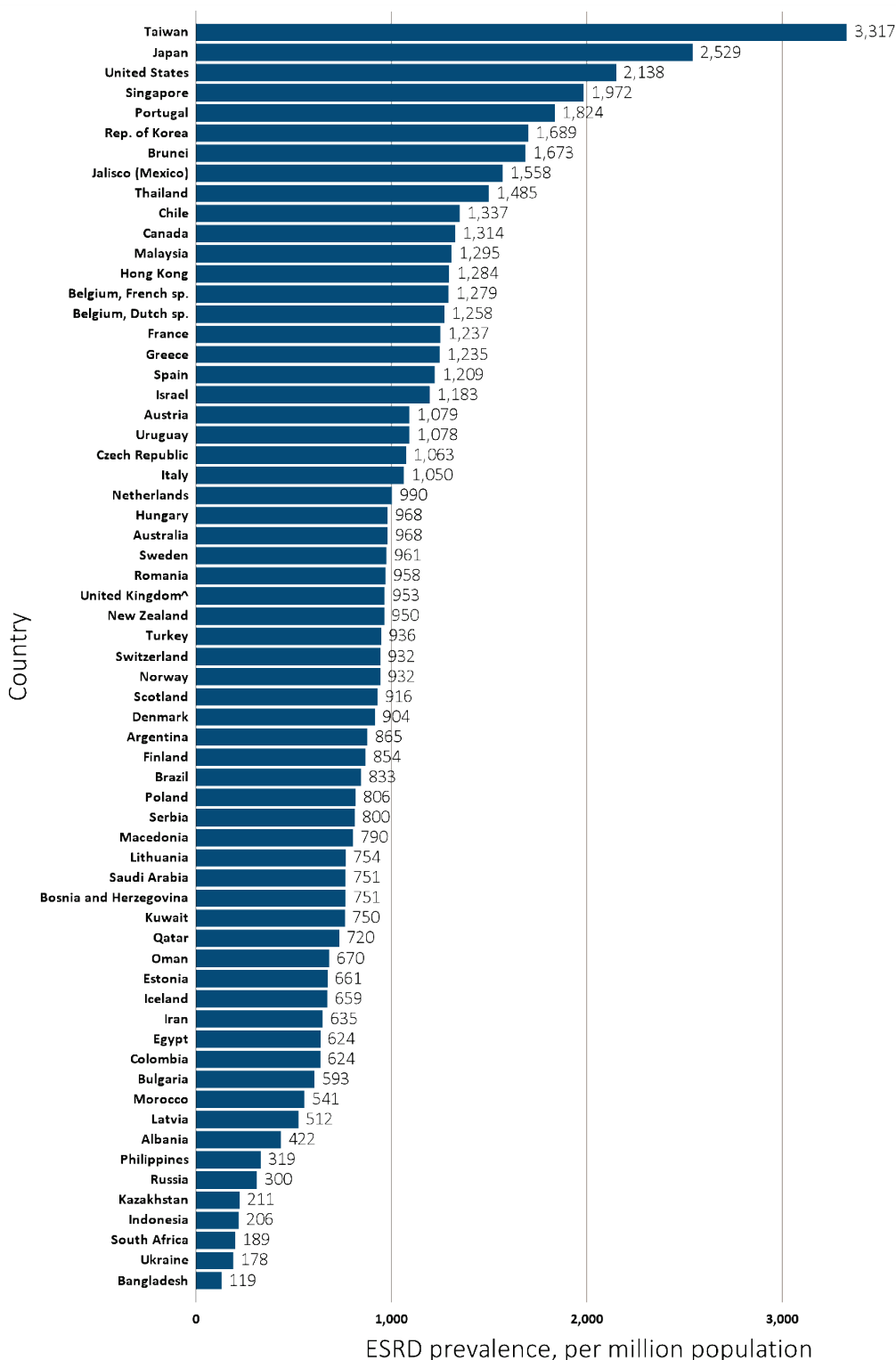
In 2015, ESRD prevalence varied nearly 30-fold across represented countries (see [Figure 11.9](#) and [Reference Table N.4.a](#)). Taiwan reported the highest treated ESRD prevalence of 3317 PMP, followed by Japan (2529 PMP), and the U.S. (2138 PMP). Singapore, Portugal, the Republic of Korea, Brunei, and the Jalisco region of Mexico also reported a very high prevalence, ranging from 1558-1972 PMP. In nearly 30% of countries, prevalence ranged from 1,000 to 1,500 PMP, while approximately 45% reported 600 to 999 prevalent ESRD patients PMP. These included many countries in Western, Central, and Eastern Europe, Australia and New Zealand, the South American countries of Argentina, Brazil, and Colombia, and the Middle Eastern nations of Egypt,

Iran, Kuwait, Oman, Qatar, and Saudi Arabia. Lowest prevalence rates ranging from 119 to 540 PMP were reported by Bangladesh, Ukraine, Indonesia, South Africa, Russia, the Philippines, Albania, Latvia, and Morocco.

Although ESRD incidence rates have been stable or decreasing in many countries during recent years, ESRD prevalence PMP has steadily increased in all 33 countries that provided data from 2002 to 2014 and/or 2015 ([Reference Table N.4.a](#) and [Figure 11.11](#)). Over this period, the median increase in ESRD prevalence was 47%, varying from 24% to 785% in rise. These trends are indicative of the increasing worldwide need for additional dialysis and kidney transplantation services to meet the health needs of individuals with ESRD. The largest proportionate increases in ESRD prevalence between 2002/03 and 2014/15 were observed in the Philippines, Thailand, and the Jalisco region of Mexico, ranging from 299% to 785%, followed by rises of 118% to 242% in Russia, Malaysia, Turkey, Brazil, and Republic of Korea. In the U.S., ESRD prevalence increased 42% overall from 2002/03 to 2014/15, with a nearly constant annual increase of 3.6%.

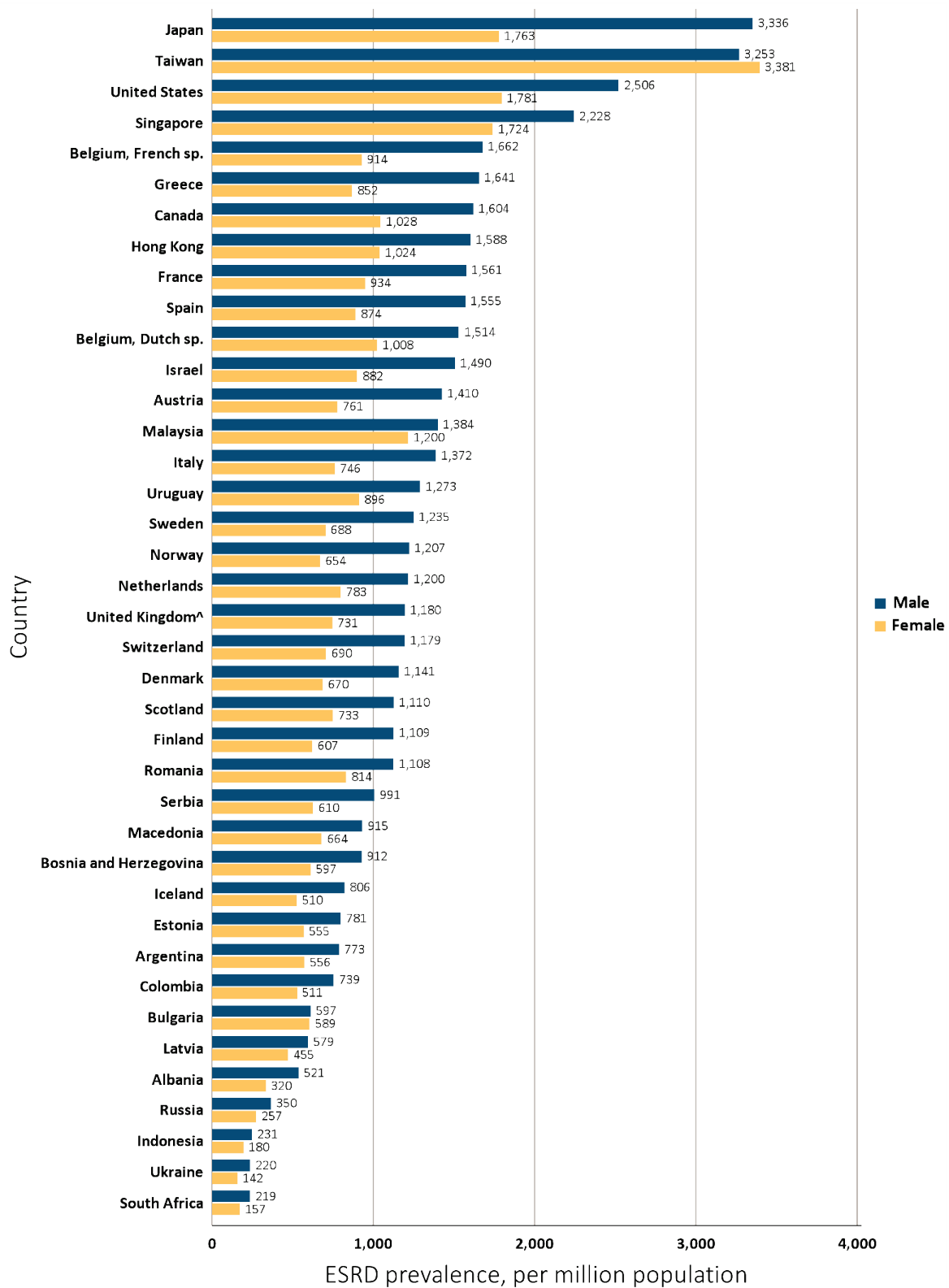
Similar to incidence of ESRD typically being higher among males than females in nearly every country, prevalence of ESRD PMP was higher for males than females in every country except in Taiwan ([Figure 11.10](#)).

vol 2 Figure 11.9 Prevalence of treated ESRD per million population, by country, 2015



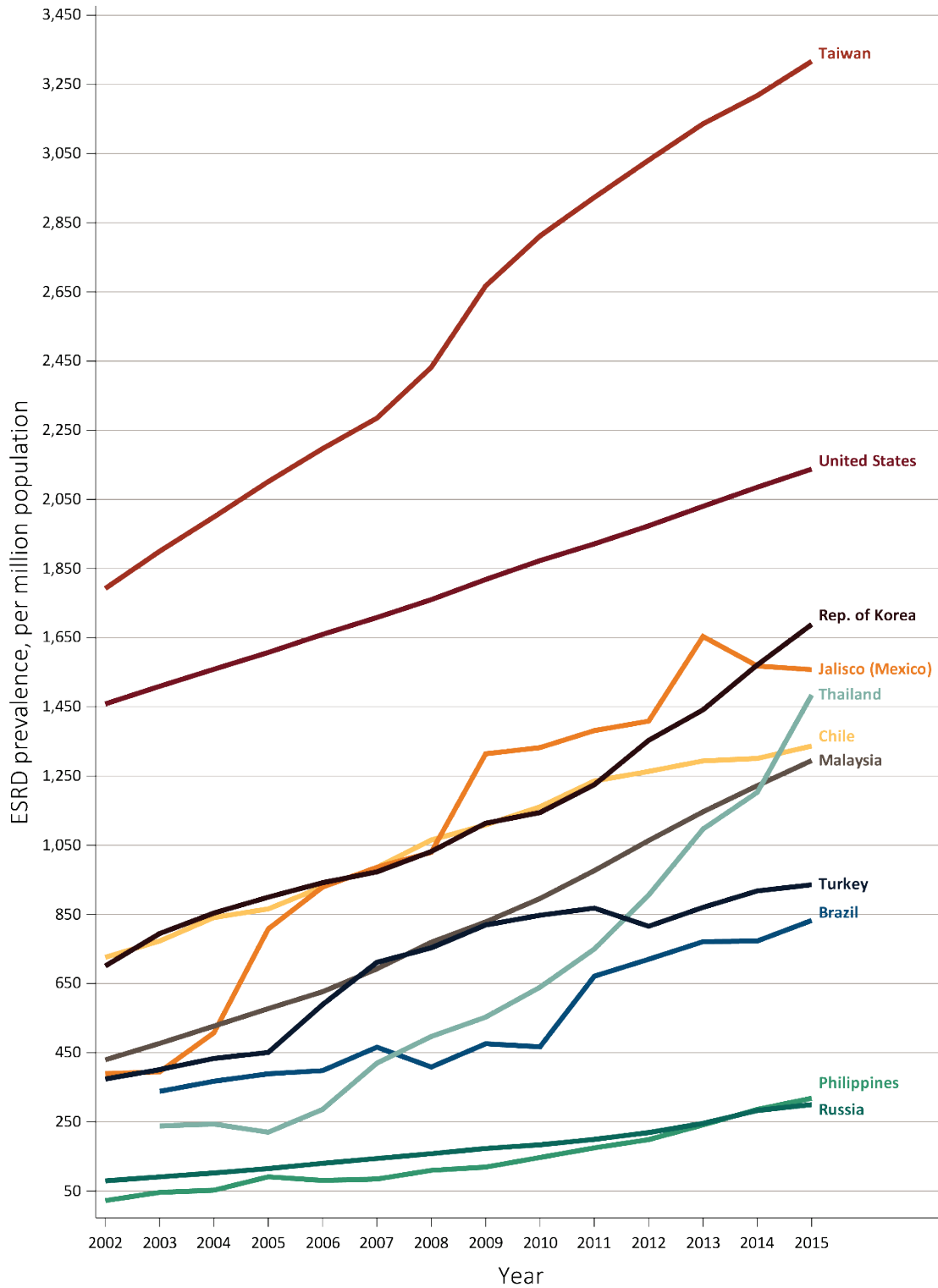
Data source: Special analyses, USRDS ESRD Database. Data presented only for countries from which relevant information was available. ^United Kingdom: England, Wales, Northern Ireland (Scotland data reported separately). The prevalence is unadjusted and reflects prevalence at the end of 2015. Switzerland includes dialysis patients only. Data for Indonesia represent the West Java region. Data for France exclude Martinique. Data for Italy includes five regions. Data for Canada excludes Quebec. Data for Latvia represents 80% of country's population. Abbreviations: ESRD, end-stage renal disease; sp., speaking. NOTE: Data collection methods vary across countries, suggesting caution in making direct comparisons.

vol 2 Figure 11.10 Prevalence of treated ESRD per million population, by sex and country, 2015



Data source: Special analyses, USRDS ESRD Database. Data presented only for countries from which relevant information was available. ^United Kingdom: England, Wales, Northern Ireland (Scotland data reported separately). Switzerland includes dialysis patients only. Data for France exclude Martinique. Data for Italy include five regions. Data for Canada excludes Quebec. Data for Latvia represents 80% of country's population. Abbreviations: ESRD, end-stage renal disease; sp., speaking. NOTE: Data collection methods vary across countries, suggesting caution in making direct comparisons.

vol 2 Figure 11.11 Trends in the prevalence of treated ESRD per million population, by country, 2002-2015



Data source: Special analyses, USRDS ESRD Database. Ten countries having the highest percentage rise in ESRD prevalence: 2014/15 versus that in 2002/03, plus the U.S. ESRD prevalence is unadjusted. U.S. is shown for comparison purposes. Abbreviation: ESRD, end-stage renal disease. NOTE: Data collection methods vary across countries, suggesting caution in making direct comparisons.

Variations in Use of Different Renal Replacement Therapies for ESRD

In-center HD, home HD, PD, and kidney transplantation are the RRT options available for persons with ESRD. As shown in Figure 11.12, the proportionate use of the different RRT forms differs considerably across countries. Dialysis is the most commonly utilized therapeutic approach for treatment of ESRD in the majority of countries, followed by kidney transplantation. Many eligible ESRD patients view kidney transplantation as their first choice due to substantially higher quality of life and longer median survival as compared with dialysis therapy.

In 2015, transplantation for patients with ESRD ranged from less than 10% in some Asian and eastern European countries to 51–72% in the Nordic countries of Denmark, Finland, Iceland, Norway, and Sweden, and in Estonia, Latvia, the Netherlands, Switzerland, the U.K. (including Scotland), Spain, Austria, and Qatar. Not surprisingly, countries with the highest proportion of kidney transplants among ESRD patients also tended to have lower treated ESRD incidence rates of approximately 70 (Iceland) to 140 (Austria) PMP/year (Figure 11.12 and [Reference Table N.1](#)). Additional information regarding trends since 2002 in the percentage of ESRD patients living with a kidney transplant is provided by country in [Reference Table N.10](#). Hong Kong, the Jalisco region of Mexico, Iceland, and Norway had the lowest use of in-center HD (17% to 29%) to treat ESRD patients; this was achieved through a combination of greater use of kidney transplantation and/or home dialysis.

Dialysis Therapy for ESRD

In 2015, the number of ESRD patients receiving dialysis PMP varied nearly 30-fold across countries, from 113 to 205 in Bangladesh, Ukraine, South Africa, Kazakhstan, Iceland, and Indonesia to 2464 to 3185 in Japan and Taiwan (Figure 11.13). Some countries have experienced very large rises in the prevalence of dialysis since 2002/03, with an approximately 802% and 499% increase in the Philippines and Thailand,

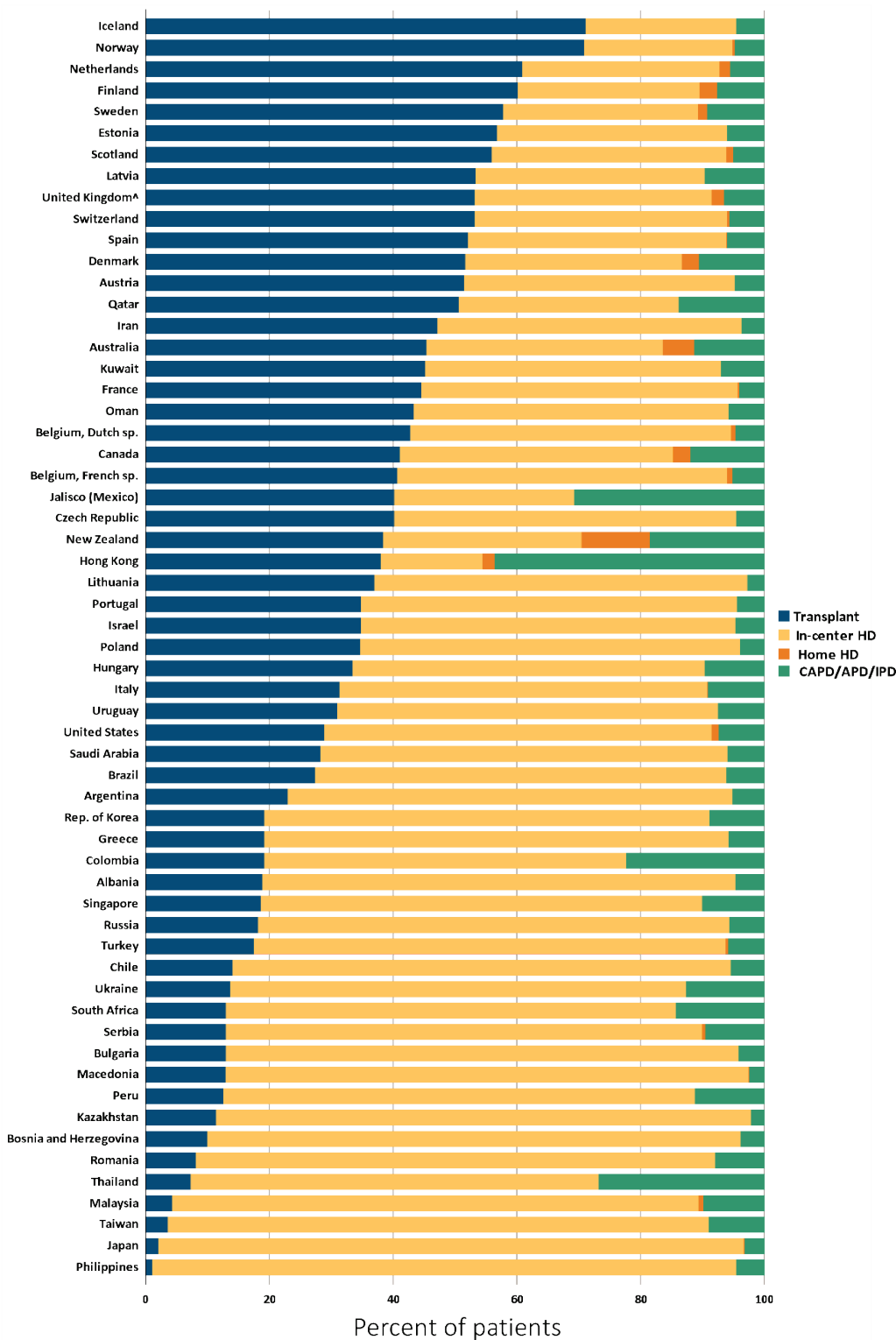
and a rise ranging from 143% to 268% reported by Russia, Malaysia, and the Jalisco region of Mexico ([Reference Table N.6](#)).

However, during the last five years approximately 20% of all countries have seen a plateauing or decline in the prevalence of patients receiving dialysis ([Reference Table N.6](#)). These nations included Iceland, Denmark, Uruguay, Scotland, Sweden, the Netherlands, Bangladesh, Austria, Hungary, Italy, and Spain—most of which also tended to have a corresponding higher percentage use of kidney transplantation, as noted in the prior section.

Hemodialysis continues to be the most common form of dialysis therapy in nearly all countries (Figure 11.15). In nearly four-fifths of reporting countries, at least 80% of chronic dialysis patients were receiving in-center HD in 2015. However, in 2015, PD was used by 70% of dialysis patients in Hong Kong and by 51% in the Jalisco region of Mexico (Figure 11.15, [Reference Table N.7.b](#)).

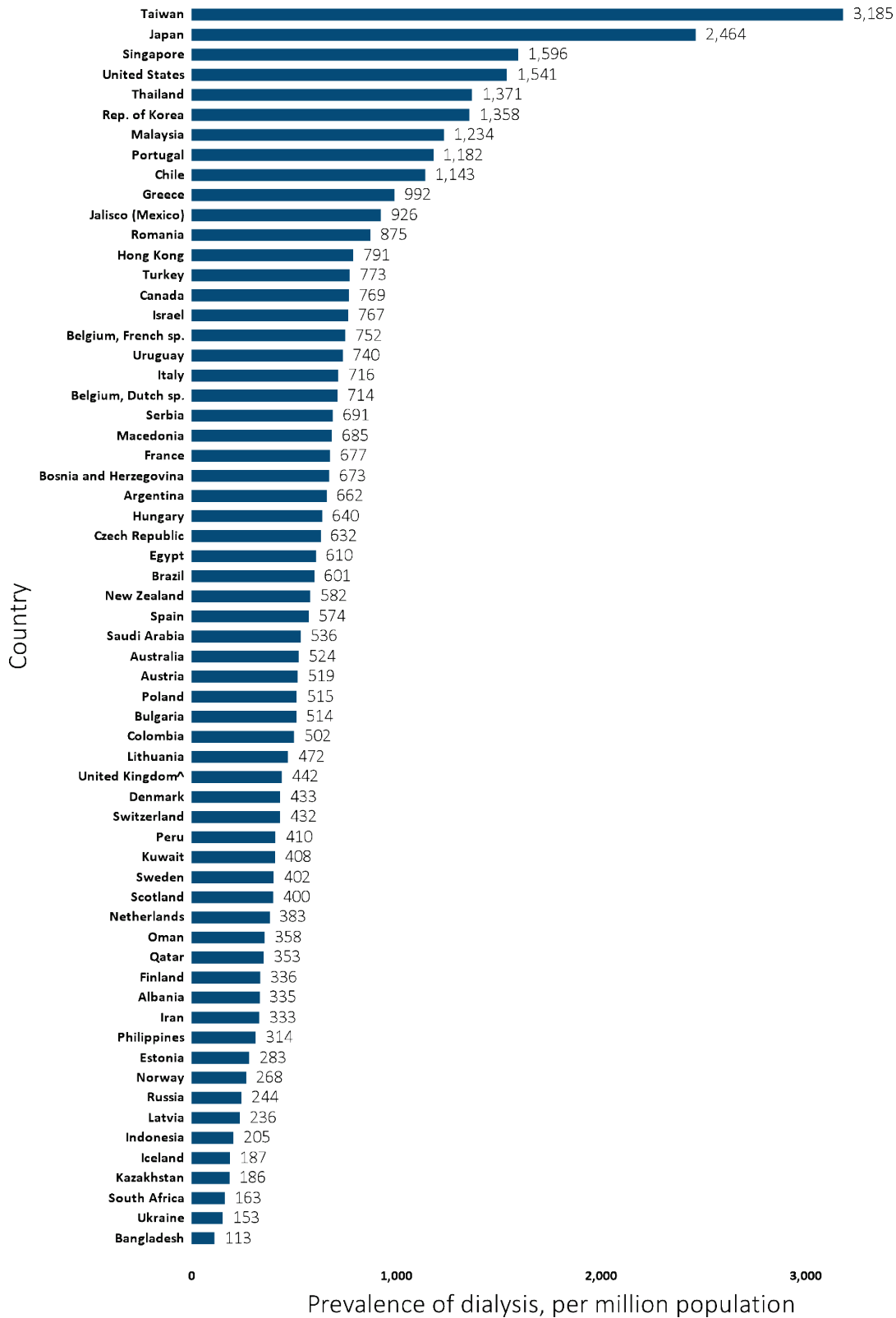
Furthermore, 27%–30% PD use was reported in New Zealand, Thailand, Qatar, and Colombia, with 16% to 21% PD use seen in South Africa, Finland, Canada, Latvia, Australia, Denmark, and Sweden. Since 2007, an overall trend of increasing PD use as a percentage of all chronic dialysis has been seen in the countries of Argentina, Bangladesh, Chile, Kuwait, Oman, Spain, Taiwan, Thailand, the U.S., and Uruguay ([Reference Table N.7.b](#)). In contrast, PD use has declined over this same time period in countries such as Belgium, Bosnia and Herzegovina, Brazil, Colombia, Croatia, Denmark, Finland, France, Greece, Hong Kong, Jalisco (Mexico), Republic of Korea, the Netherlands, New Zealand, Norway, Romania, Russia, Saudi Arabia, Scotland, Singapore, Turkey, and the U.K.. In 2015, home HD therapy was provided to 9.3% and 18.0% of dialysis patients in Australia and New Zealand. Home HD was also used by 2.5 to 7.2% of dialysis patients in Canada, Denmark, Finland, Hong Kong, the Netherlands, Sweden, the U.K., and Scotland. However, in all other countries, home HD was either not provided, or was used by fewer than 2.5% of dialysis patients.

vol 2 Figure 11.12 Percentage distribution of type of renal replacement therapy modality used by ESRD patients, by country, in 2015



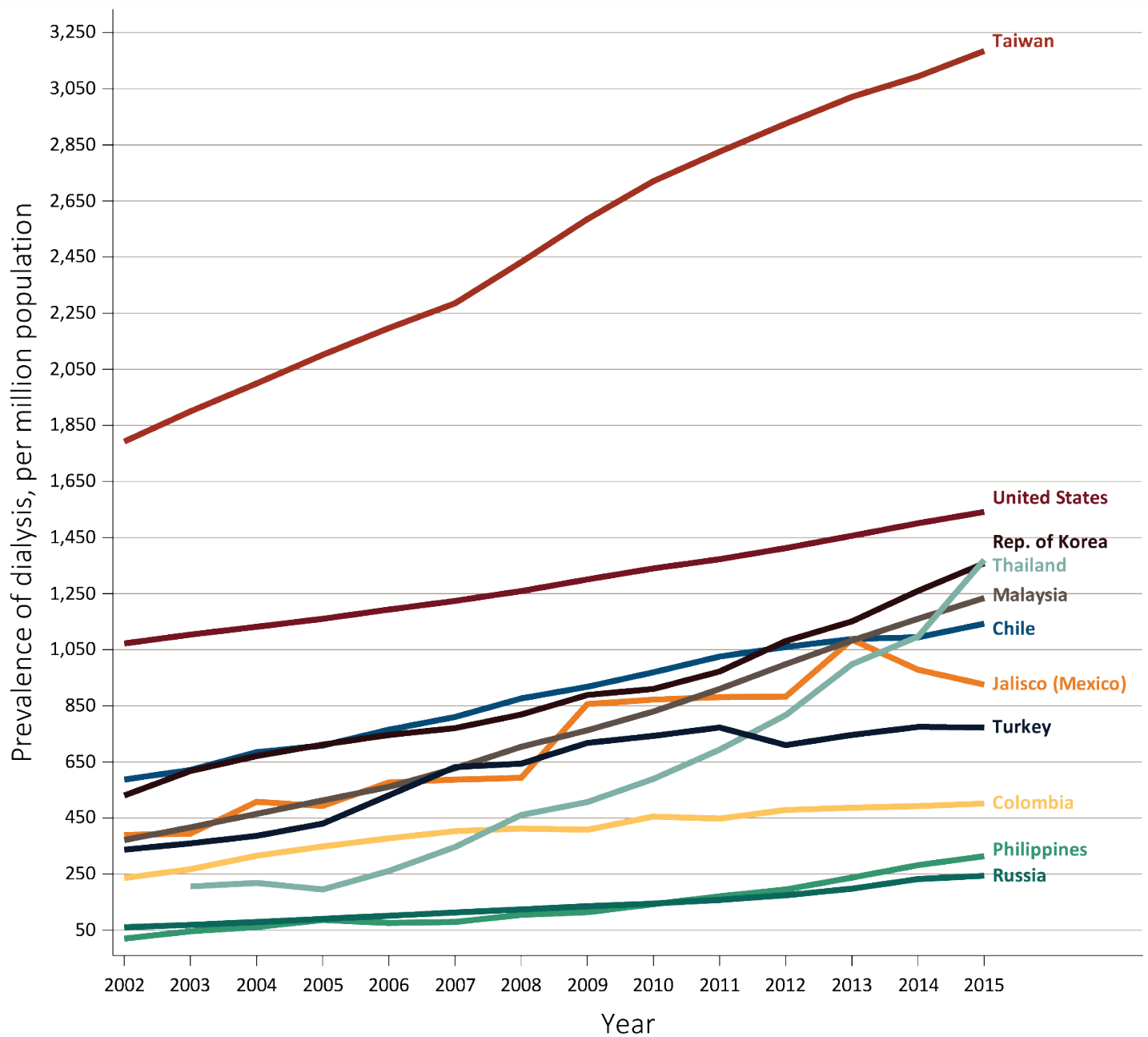
Data source: Special analyses, USRDS ESRD Database. Denominator is calculated as the sum of patients receiving HD, PD, Home HD, or treated with a functioning transplant; does not include patients with other/unknown modality. Data for France exclude Martinique. Data for Italy include five regions. Data for Canada excludes Quebec. Data for Latvia represents 80% of country's population; transplant data for Latvia is nationally representative. Abbreviations: CAPD, continuous ambulatory peritoneal dialysis; APD, automated peritoneal dialysis; IPD, intermittent peritoneal dialysis; ESRD, end-stage renal disease; HD, hemodialysis; PD, peritoneal dialysis; sp., speaking. NOTE: Data collection methods vary across countries, suggesting caution in making direct comparisons.

vol 2 Figure 11.13 Prevalence of dialysis per million population, by country, 2015



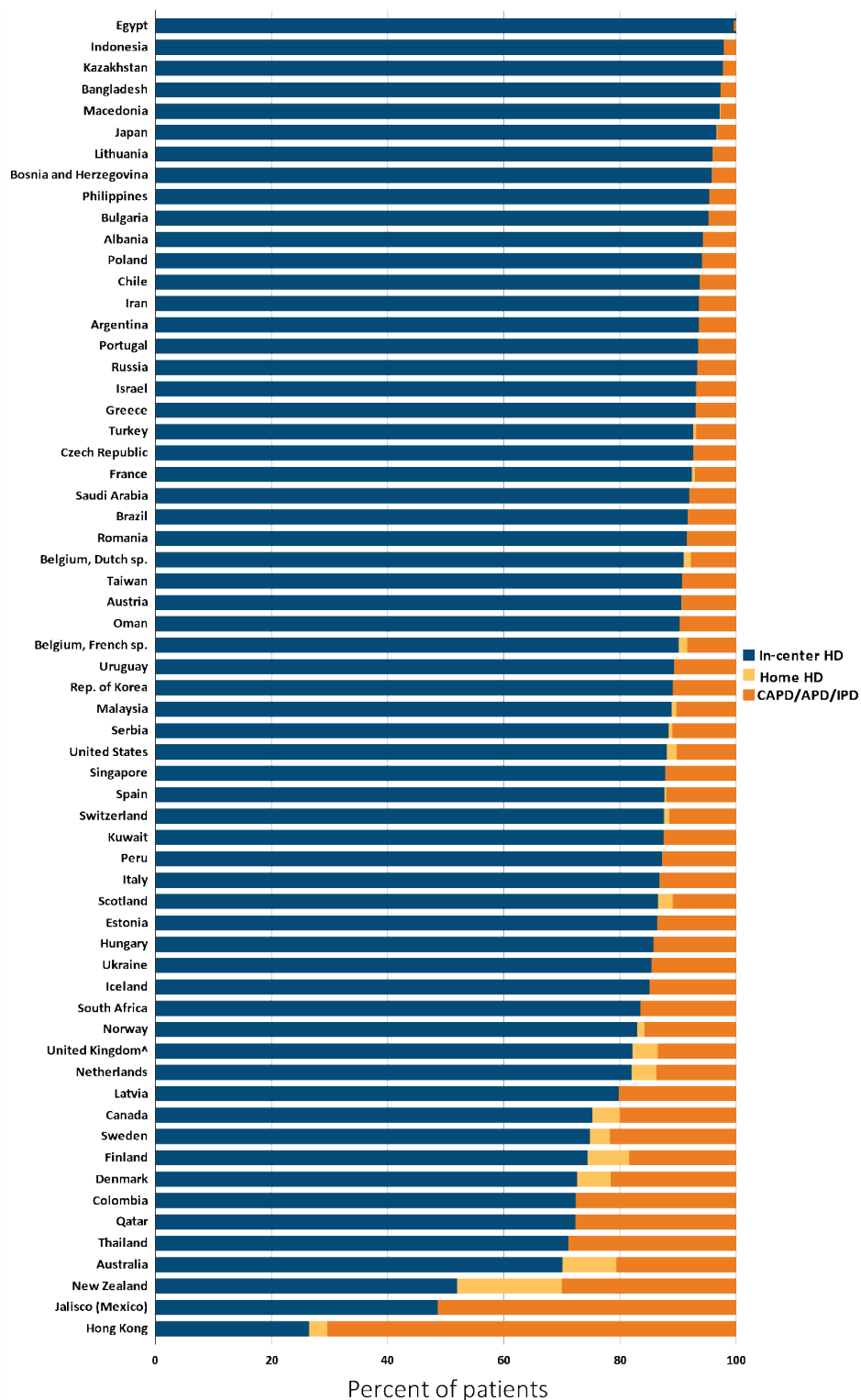
Data source: Special analyses, USRDS ESRD Database. ESRD prevalence is unadjusted and reflects prevalence at the end of 2015. United Kingdom: England, Wales, Northern Ireland (Scotland data reported separately). Data for Indonesia represent the West Java region. Data for France exclude Martinique. Data for Italy include five regions. Data for Canada excludes Quebec. Data for Latvia represents 80% of country's population. Abbreviation: sp., speaking. NOTE: Data collection methods vary across countries, suggesting caution in making direct comparisons.

vol 2 Figure 11.14 Trends in the prevalence of dialysis per million population, by country, 2002-2015



Data source: Special analyses, USRDS ESRD Database. Ten countries having the highest percentage rise in dialysis prevalence: 2014/15 versus that in 2002/03, plus the U.S. The prevalence is unadjusted and reflects prevalence of dialysis at the end of each year. Abbreviation: ESRD, end-stage renal disease. NOTE: Data collection methods vary across countries, suggesting caution in making direct comparisons.

vol 2 Figure 11.15 Distribution of the percentage of prevalent dialysis patients using in-center HD, home HD, or peritoneal dialysis (CAPD/APD/IPD), 2015



Data source: Special analyses, USRDS ESRD Database. Denominator was calculated as the sum of patients receiving HD, PD, Home HD; does not include patients with other/unknown modality. ^United Kingdom: England, Wales, & Northern Ireland (Scotland data reported separately). Data for France exclude Martinique. Data for Italy include five regions. Data for Canada excludes Quebec. Data for Latvia represents 80% of country's population. Abbreviations: CAPD, continuous ambulatory peritoneal dialysis; APD, automated peritoneal dialysis; IPD, intermittent peritoneal dialysis. NOTE: Data collection methods vary across countries, suggesting caution in making direct comparisons.

Kidney Transplantation

International kidney transplantation rates vary greatly, which may reflect not only geographic variations in ESRD incidence and prevalence but also differences in national health care systems, infrastructure for transplantation services, organ availability, degree of genetic homogeneity or heterogeneity within a country's population, and cultural beliefs. Kidney transplantation rates when expressed PMP serve to standardize rates according to the size of a country's population and thus, to some extent account for the potential kidney donor pool size (Figure 11.16.a).

However, it is also of interest to understand transplantation rates in relationship to the size of the population in need. Towards this purpose, we also display kidney transplantation rates per 1000 dialysis patients in a country (Figure 11.16.b). Such a comparison indicates that the relative rates differ considerably between the two metrics. For example, the U.S. ranks third in the world in terms of transplants PMP, yet ranks 37th of 59 reporting countries in transplants per 1000 dialysis patients. This may be due, in part, to the high numbers of dialysis patients in the U.S.

Kidney transplant rates varied more than 30-fold across countries, from less than one to 71 PMP in 2015 (Figure 11.16.a). The highest rates were reported in the Jalisco region of Mexico, Spain, the U.S., and the Netherlands, with 58-71 kidney transplants PMP. Rates ranged from 29-52 kidney transplants PMP for 45% of

countries, 11-27 transplants PMP for 23% of countries, and 1-10 PMP for the remaining 26%. Countries reporting the lowest rates of kidney transplantation, at 1-5 PMP, included Bangladesh, Ukraine, Malaysia, Morocco, the Philippines, and South Africa.

Kidney transplant rates when expressed per 1000 dialysis patients also varied greatly across countries, from three to 183 in 2015 (Figure 11.16.b). The highest rates per 1000 dialysis patients occurred in Norway (183), the Netherlands (151), Latvia (138), Finland (133), and Scotland (119). Transplant rates of 102 to 113 per 1000 dialysis patients were reported in Estonia, Sweden, Denmark, Spain (five regions), the U.K. (excluding Scotland), and Iceland. One-third of countries reported rates of 53 to 96 per 1000 dialysis patients, 22% had rates of 26-46, and the remaining 27% of countries reported rates of less than 24 transplants per 1000 dialysis patients in 2015. During 2015 in the U.S., 38 kidney transplants were performed per 1000 dialysis patients.

Since 2002, some countries have shown a substantial increase in kidney transplant rates PMP ([Reference Table N.8](#), Figure 11.17). When comparing transplant rates in 2014/15 to 2002/03, Iceland, Turkey, the Republic of Korea, Russia, Thailand, Bangladesh, Scotland, the Netherlands, and Brazil demonstrated the largest increases of from 54% to 1203%. Additionally, during the same period, kidney transplantation rates PMP were 33-44% higher in Columbia, Singapore, Denmark, Australia, Uruguay, Finland, Bosnia and Herzegovina, and the Jalisco region of Mexico.

vol 2 Figure 11.16 Kidney transplantation rate, by country, 2015

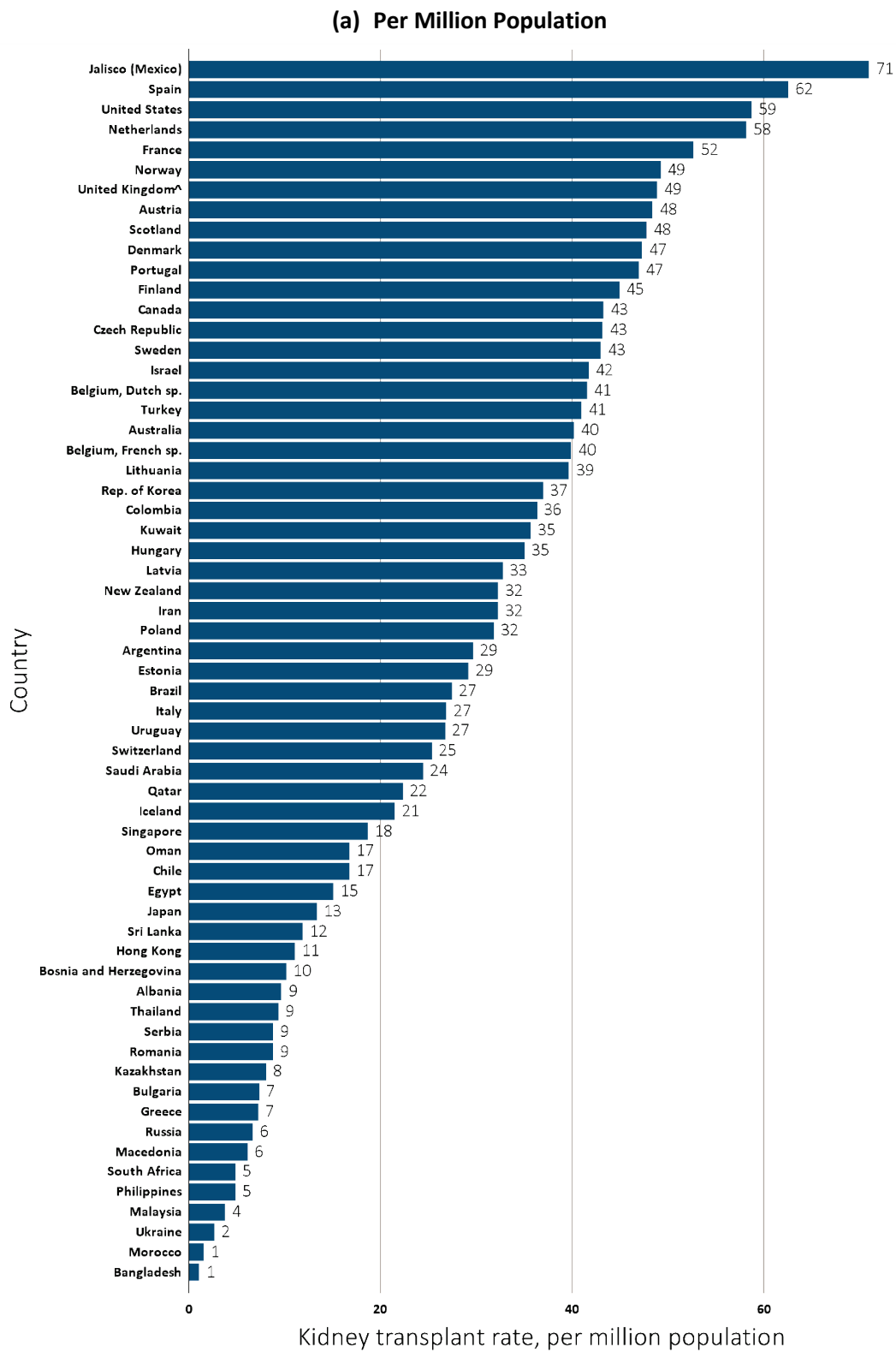
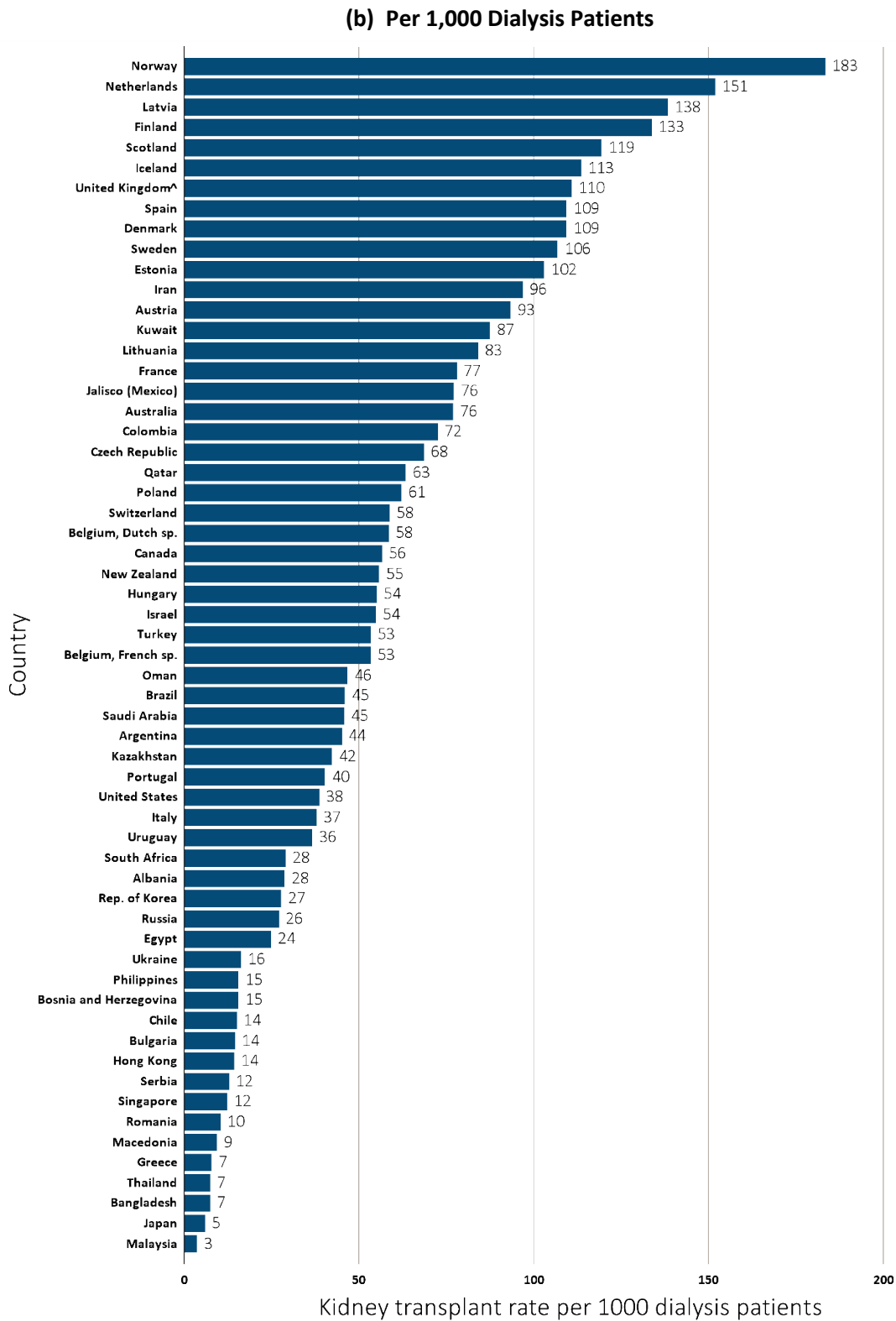


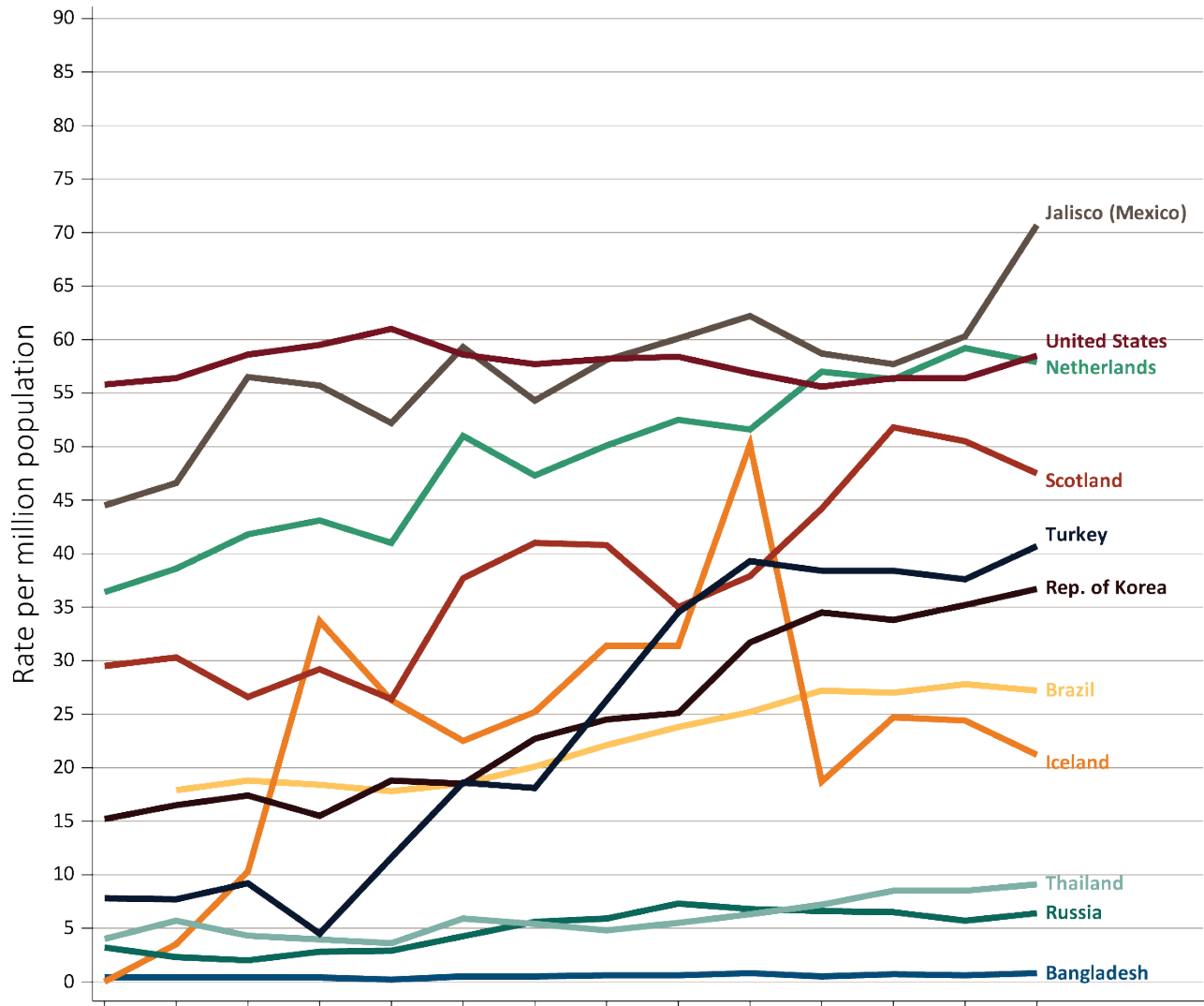
Figure 11.16 continued on next page.

vol 2 Figure 11.16 Kidney transplantation rate, by country, 2015 (continued)



Data source: Special analyses, USRDS ESRD Database. Data presented only for countries from which relevant information was available. All rates are unadjusted. ^United Kingdom: England, Wales, & Northern Ireland (Scotland data reported separately). Data for France exclude Martinique. Data from Italy represent five regions. Data for Sri Lanka is from seven government hospitals. Data for Canada excludes Quebec. Abbreviation: sp., speaking. NOTE: Data collection methods vary across countries, suggesting caution in making direct comparisons.

vol 2 Figure 11.17 Trends in kidney transplantation rates per million population, by country 2015



Data source: Special analyses, USRDS ESRD Database. Ten countries having the highest percentage rise in kidney transplantation rate: 2014/15 versus that in 2002/03, plus the U.S. All rates are unadjusted. Abbreviations: ESRD, end-stage renal disease. NOTE: Data collection methods vary across countries, suggesting caution in making direct comparisons.

Large international differences were also seen in the types of kidney donors. Rates of living donor transplantation ranged from 80%-100% in Qatar, Turkey, Japan, the Philippines, Bangladesh, Iceland, Saudi Arabia, Sri Lanka, Egypt and the Jalisco region of Mexico, to 10% or lower in Poland, Belgium (Dutch), Finland, Italy, Lithuania, and Estonia (Figure 11.18). In nearly 60% of countries, donation from deceased individuals was the predominant form of kidney donation during 2015.

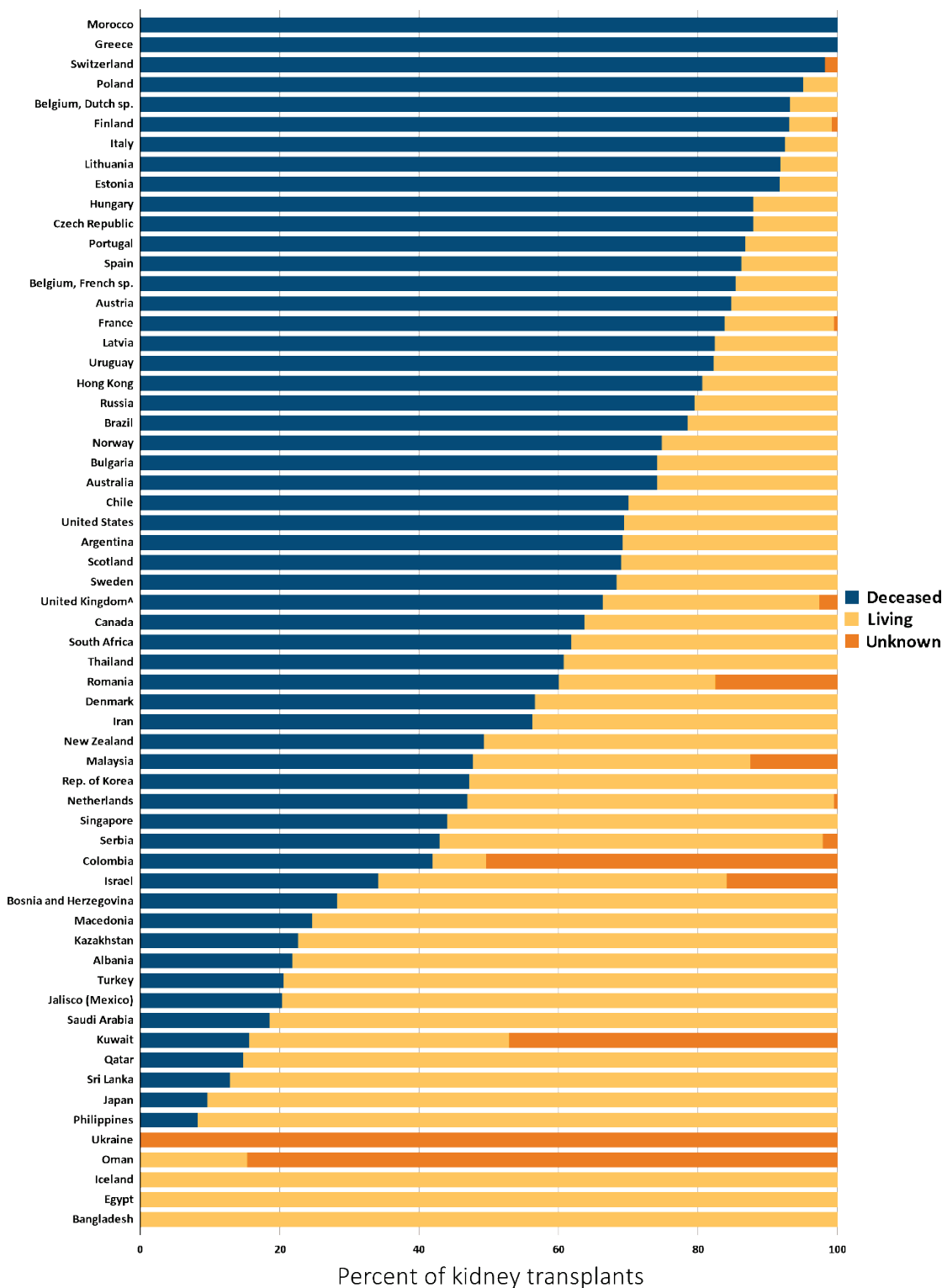
In 2015, Norway, the U.S., Portugal, Spain, and the Jalisco region of Mexico reported the highest prevalence of ESRD patients living with a kidney transplant, at 632 to 664 PMP (Figure 11.19 and [Reference Table N.9](#)). Twenty-nine percent of countries indicated 416 to 607 prevalent ESRD patients PMP living with a kidney transplant, while the remaining 61% of countries were nearly evenly divided between having less than 202, or 202-378 PMP. However, as noted earlier in this chapter, countries having a high *prevalence* of ESRD patients living with a kidney transplant PMP may not

necessarily have a high *fraction* of ESRD patients living with a kidney transplant.

In comparisons of data from 2014/15 to 2002/03, the prevalence of ESRD patients living with a kidney transplant PMP has increased in every country with available data, rising from 50% to 293% in approximately one-half of all countries, and by 4%-48% in the remaining nations ([Reference Table N.9](#)). Russia, Bosnia and Herzegovina, Uruguay, Thailand, and Turkey reported the largest increases during this period—from 162% to 293%.

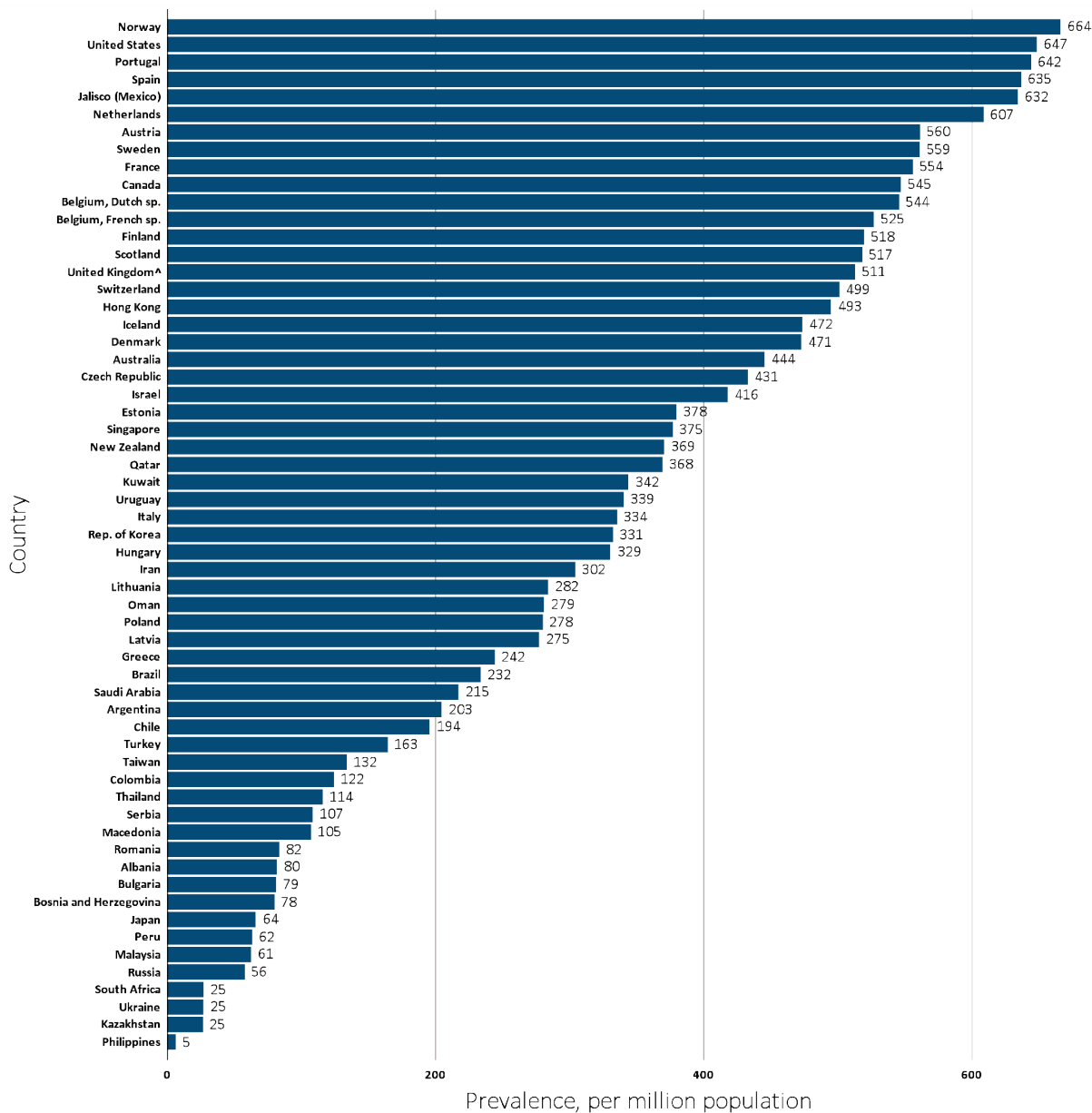
From 2002-2015 the percentage of all ESRD patients living with a kidney transplant remained relatively constant within most countries ([Reference Table N.10](#)). However, some nations have demonstrated a continuing increase, particularly in Denmark, Iceland, the Netherlands, Scotland, Sweden, the U.K., Bosnia and Herzegovina, Turkey, Argentina, Columbia, and Uruguay. In contrast, during this period the percentage of ESRD patients living with a kidney transplant declined substantially in Malaysia, Russia, and the Philippines.

vol 2 Figure 11.18 Distribution of the percentage of kidney transplantations by kidney donor type and country, 2015



Data source: Special analyses, USRDS ESRD Database. Denominator is calculated as the sum of deceased, living donor, and unknown transplants. ^United Kingdom: England, Wales, & Northern Ireland (Scotland data reported separately). Data for France exclude Martinique. Data from Canada excludes Quebec. Data from Italy represent five regions. Data from Sri Lanka is from seven government hospitals. Abbreviation: ESRD, end-stage renal disease. NOTE: Data collection methods vary across countries, suggesting caution in making direct comparisons.

vol 2 Figure 11.19 Prevalence of treated ESRD patients with a functioning kidney transplant, per million population, by country, 2015



Data source: Special analyses, USRDS ESRD Database. Data presented only for countries from which relevant information was available. The prevalence is unadjusted. ^United Kingdom: England, Wales, & Northern Ireland (Scotland data reported separately). Data for France exclude Martinique. Data for Italy includes five regions. Data for Canada excludes Quebec. Abbreviations: ESRD, end-stage renal disease; sp., speaking. NOTE: Data collection methods vary across countries, suggesting caution in making direct comparisons.

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Notes