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MAJOR ARTICLE

Human Immunodeficiency Virus Continuum of Care in 11 European Union Countries at the End of 2016 Overall and by Key Population: Have We Made Progress?

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(See the Editorial Commentary by Granich and Gupta on pages 2917–9.)

Background. High uptake of antiretroviral treatment (ART) is essential to reduce human immunodeficiency virus (HIV) transmission and related mortality; however, gaps in care exist. We aimed to construct the continuum of HIV care (CoC) in 2016 in 11 European Union (EU) countries, overall and by key population and sex. To estimate progress toward the Joint United Nations Programme on HIV/AIDS (UNAIDS) 90-90-90 target, we compared 2016 to 2013 estimates for the same countries, representing 73% of the population in the region.

Methods. A CoC with the following 4 stages was constructed: number of people living with HIV (PLHIV); proportion of PLHIV diagnosed; proportion of those diagnosed who ever initiated ART; and proportion of those ever treated who achieved viral suppression at their last visit.

Results. We estimated that 87% of PLHIV were diagnosed; 92% of those diagnosed had ever initiated ART; and 91% of those ever on ART, or 73% of all PLHIV, were virally suppressed. Corresponding figures for men having sex with men were: 86%, 93%, 93%, 74%; for people who inject drugs: 94%, 88%, 85%, 70%; and for heterosexuals: 86%, 92%, 91%, 72%. The proportion suppressed of all PLHIV ranged from 59% to 86% across countries.

Conclusions. The EU is close to the 90-90-90 target and achieved the UNAIDS target of 73% of all PLHIV virally suppressed, significant progress since 2013 when 60% of all PLHIV were virally suppressed. Strengthening of testing programs and treatment support, along with prevention interventions, are needed to achieve HIV epidemic control.

Keywords. HIV infection; continuum of care; sex; key population; Europe.

Highly effective antiretroviral treatment (ART) reduces morbidity and increases the life expectancy of treated individuals living with human immunodeficiency virus (HIV), as it is highly effective in suppressing HIV viral load [1, 2]. Large studies on serodiscordant couples have provided evidence that virally suppressed individuals living with HIV have a negligible probability of transmitting the virus to their HIV-negative partner [3–5]. Nevertheless, in 2017 there were approximately 1.8 million new HIV infections worldwide, 160 000 of which were in the World Health Organization European region and 25 000 in the European Union (EU)/European Economic Area [6]. Given ART effectiveness, ongoing HIV transmission indicates gaps in HIV diagnosis and care, mainly attributed to late diagnosis [7], delayed ART initiation [8], and HIV care interruptions [9].

The HIV continuum of care (CoC) is a useful tool to provide a snapshot of the care continuum among people living with HIV

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(PLHIV) and to identify weaknesses and gaps within health systems. The 90-90-90 CoC target, 90% of PLHIV diagnosed, 90% of diagnosed being on ART, and 90% of those on ART being virally suppressed, sets important milestones toward achieving viral suppression for all PLHIV, thus saving lives and halting further transmission. Taken together, the target of 73% of those living with HIV being virally suppressed is expected to lead to a drastic decline in new infections by 2030 [10]. It is thus important for countries to regularly assess their progress toward achieving the 90-90-90 target.

Ideally, the HIV CoC should be informed uniformly by monitoring national cohorts. However, national cohorts are lacking. Thus, reduced cohorts that only include people accessing care are often used, risking to result in biased estimates [11, 12]. The EU CoC for 11 countries in 2013 was estimated using common definitions and recommendations to address these methodological and data challenges [13–15]. In 2013, Sweden and Denmark had reached the 90-90-90 target, whereas other countries had reached 90% in only 1 or 2 stages [15].

Since then, most European countries have adopted the test-and-treat guidelines [1, 16]; however, progress toward treatment and viral suppression targets may be uneven. Therefore, an assessment of the progress made in the EU is needed. Furthermore, national CoC figures are likely to mask differences between HIV key populations and sex within a given country; previous studies have reported such differences [17]. For example, men who have sex with men (MSM) have, in general, higher risk perception than other population groups and are consequently tested and diagnosed with HIV earlier after infection [18, 19]. Conversely, poor access to and retention in care for people who inject drugs (PWID) is a common problem worldwide, leading to potential lower levels of viral suppression in this group [20–23]. To date, there have not been studies on the HIV CoC stratified by sex in Europe.

Our aim was 2-fold: first, to provide updated estimates of national CoC for 2016 in 11 countries, representing 73% of the EU population, and to investigate country-specific progress toward the Joint United Nations Programme on HIV/AIDS (UNAIDS) 90-90-90 target since 2013, and second, to construct CoC by sex and key population in order to identify potential disparities in access to care and to assess the different needs of subgroups of PLHIV.

METHODS

Continuums of HIV care were constructed using data from the national HIV surveillance systems of Austria, Denmark, the Netherlands, and the United Kingdom. In these countries, national surveillance systems collect data on new HIV diagnoses and on longitudinal data and thus provided all necessary information. For Croatia, Germany, Greece, Italy, Spain, and Sweden, national surveillance and HIV cohort data were combined, while for France national surveillance, health insurance data, and cohort data were combined. Participating cohorts have been approved by ethics committees, national data protection agencies, or institutional review boards. Informed consent was obtained in all countries where it was required.

The 4-stage CoC was constructed for PLHIV in the participating countries at the end of 2016 overall, as well as disaggregated by sex and by key population (MSM, PWID, and Other). The Other group consisted of non-MSM, non-PWID; these were mainly people presumed to have acquired HIV via sex between men and women and were thus referred to as "Heterosexual" in this analysis. No specific CoC was constructed for individuals with an unknown mode of infection.

The 4-stage CoC was produced using standardized definitions [13, 24]. Stage 1 includes the estimated number of all PLHIV, diagnosed and undiagnosed, who were alive in each participating country at the end of 2016. Diagnosed individuals who had died or out-migrated before 31 December 2016 were excluded. In countries where data on out-migration were not available, the sample of individuals no longer living in the country was, when possible, estimated and excluded from the continuum (Supplement 1). For the majority of countries, the number of PLHIV was estimated by applying the incidence method of the European Centre for Disease Prevention and Control (ECDC) HIV modeling tool to surveillance data on newly diagnosed HIV cases, and 95% confidence intervals (CIs) were calculated using bootstrapping techniques [25]. Methods that have been used in each country are described in detail in Supplement 1.

Stage 2 included the proportion of PLHIV who were diagnosed. Uncertainty in this proportion was obtained by dividing the number of diagnosed individuals by the upper and lower CIs of the estimated PLHIV, when available. In the majority of the participating countries, the number of diagnosed individuals was derived directly from historical HIV surveillance data (Supplement 1).

Stage 3 was obtained based on cohort data and was defined as the proportion of those diagnosed who ever initiated ART, irrespective of treatment guidelines or ART regimens. A lower estimate was calculated using all diagnosed individuals as the denominator and all individuals who had ever been treated as the numerator. An upper estimate was calculated excluding individuals lost to follow-up. The proportion of diagnosed PLHIV who ever initiated ART was estimated as the midpoint between the lower and upper estimates.

Stage 4 was obtained based on cohort data and was defined as the proportion of those ever on ART who achieved viral suppression, that is, those with an HIV-RNA measurement ≤200 copies/mL or below the current assay detection limit at their last visit between 15 July 2015 and 31 December 2016. The threshold of ≤200 copies/mL was chosen to allow for improvements of the assay detection limit over time and to allow for comparisons with the 2013 EU CoC [15]. Individuals in care and on treatment, but without a viral load measurement available during that period, were considered as adherent and thus suppressed,

while those without a viral load measurement during that period and not in care were considered as not virally suppressed. In a sensitivity analysis, assuming that all those without available measurements were not suppressed, the overall EU estimates remained unchanged (≤1% difference in any subgroup). As for stage 3, a lower estimate was calculated using all individuals who had ever been treated as the denominator and those virally suppressed as the numerator. An upper estimate was calculated excluding individuals lost to follow-up. The midpoint between these 2 estimates was considered the proportion of treated people who achieved viral suppression.

Estimates for stages 3 and 4 were provided directly from the cohorts' representatives, except for Germany and Italy where raw data were used by the study team to derive these estimates.

In addition to the 4 stages of the CoC, the proportion of all PLHIV who achieved viral suppression, also called the substantive target, was estimated [26].

To produce estimates for the 11 participating countries, the number of individuals at each stage of the CoC from all countries was added. For stages 3 and 4, where the estimates corresponded to proportions out of previous stages rather than numbers, the numbers were estimated by multiplying the estimated proportion at a given stage with the number of individuals included in the previous one. Once the total number of individuals per stage was estimated, the proportion of individuals out of the previous stage was calculated, corresponding to a weighted average of all participating countries.

For Croatia, only overall and MSM estimates were available. For Sweden, only overall estimates were produced. In addition, only point estimates (ie, without a range) were available for Italy for stage 1, for Sweden for stages 3 and 4, and for the United Kingdom for stage 3.

Adult prevalence was estimated based on the population estimates of Eurostat for the participating EU countries, excluding individuals aged <15 years [27].

RESULTS

At the end of 2016, the total number of estimated PLHIV in the 11 participating countries was 702 848, corresponding to an adult prevalence of 0.23%. Prevalence ranged from 0.04% in Croatia to 0.38% in Spain. MSM accounted for 43% of all PLHIV, heterosexuals for 38%, and PWID for 11%; 8% of all PLHIV had unknown modes of infection. Women accounted for 25% of all PLHIV.

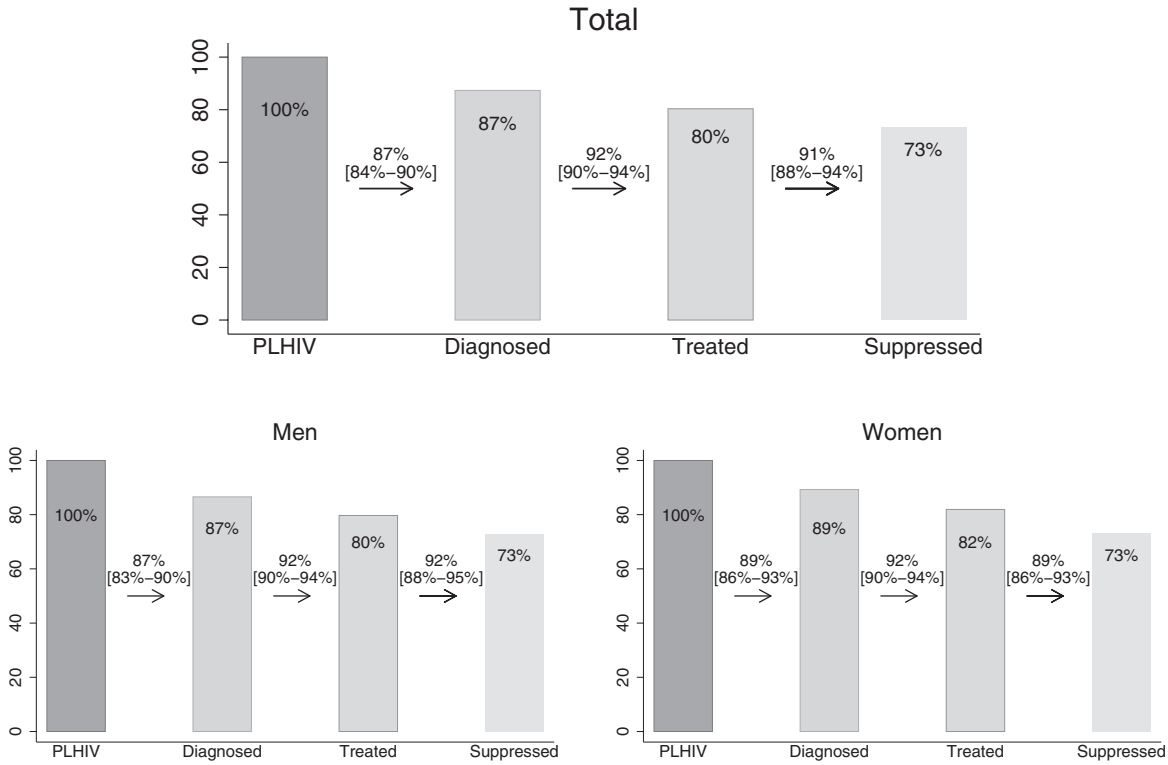

Figure 1. Continuum of HIV care for 2016, overall and by sex in 11 European countries. The numbers between the bars correspond to proportions of the previous stage, while the numbers on the bars correspond to proportions of all PLHIV. Estimates by sex were not available for Croatia and Sweden. A slight underestimation of the variability is expected since only point estimates were available for Italy (stage 1) and Sweden (total population, stages 2, 3, and 4). The third bar corresponds to those ever treated. For the last bar, individuals with HIV-RNA measurement ≤200 copies/mL at last visit are considered suppressed. Abbreviation: PLHIV, people living with human immunodeficiency virus.

Overall, we estimated that 87% of PLHIV were diagnosed, 92% of those diagnosed had ever initiated ART, and 91% of those who had ever initiated ART were virally suppressed (Figure 1).

Of the total PLHIV, 73% were estimated to be virally suppressed. The 2013 corresponding CoC estimates for 10 of the 11 countries that participated (ie, all countries except Croatia) were 84%, 84%, and 85%, respectively. This shows a significant increase for the 2 last percentages between 2013 and 2016. Between 2013 and 2016, the absolute number of diagnosed individuals in these 10 countries increased by approximately 60 000 (from 552 631 in 2013 to 612 896 in 2016), the number undiagnosed decreased by almost 15 500 (103 869 in 2013 to 88 464 in 2016), and the number ever on ART increased by approximately 100 000 (from 464 256 in 2013 to 564 150 in 2016), leading to an increase in the number virally suppressed of approximately 120 000 (from 393 666 in 2013 to 513 691 in 2016).

There were no marked differences across the outcomes of the CoC between women (89% of female PLHIV were diagnosed, 92% of those diagnosed had ever initiated ART, and 89% of those who had ever initiated ART were virally suppressed) and men (87%, 92%, and 92%, respectively; Table 1, Figure 1).

The proportion diagnosed among estimated PLHIV ranged from 74% in Croatia to 93% in Denmark. Three of the 11 countries had achieved the first 90 target (Austria, Denmark, and the United Kingdom), and 8 countries were below it (Netherlands 89%, Sweden 89%, Italy 88%, Germany 87%, France 86%, Spain 86%, Greece 81%, and Croatia 74%). Of those diagnosed, the proportion ever on ART ranged from 88% in Greece to 97% in the Netherlands. Nine countries (Austria, Croatia, Denmark, France, Germany, Spain, Sweden, the Netherlands, and the United Kingdom) achieved ≥90% of those diagnosed ever on ART. The proportions virally suppressed among those who ever initiated ART ranged from 82% in Greece to 96% in Denmark. Eight countries (Croatia, Denmark, France, Germany, Italy, the Netherlands, Sweden, and the United Kingdom) achieved ≥90% of viral suppression. Only Denmark achieved ≥90% for each of the 3 continuum stages. For the substantive target, Austria, Denmark, France, Germany, the Netherlands, Sweden, and the United Kingdom reached ≥73% of all PLHIV virally suppressed, while Italy was very close at 71% (Supplements 2 and 3).

Regarding key population estimates, the highest percentage of PLHIV diagnosed was estimated among PWID (94%), followed by heterosexuals (86%) and MSM (86%) (Figure 2). PWID, however, had the lowest percentage of people diagnosed ever on ART and viral suppression after treatment initiation (88% treated and 85% virally suppressed). MSM and heterosexuals achieved higher percentages for these 2 stages; these figures were 93% and 93%, respectively, for MSM and 92% and 91% for heterosexuals. Overall, 74% of MSM, 72% of heterosexuals, and 70% of PWID living with HIV achieved viral suppression (Figure 2). There was considerable variation between key populations across countries (Table 1, Supplements 2 and 3). The largest differences were observed among PWID in all CoC stages. In Greece, 60% were diagnosed, 81% were treated, and 74% achieved viral suppression, while in the Netherlands, 99% were diagnosed, 97% were treated, and 92% achieved viral suppression. The proportion diagnosed among heterosexuals was also low in Greece (74%) and Spain (83%) compared with Denmark (94%), Austria, and the United Kingdom (91% in both). A low diagnosis proportion was estimated among MSM in Croatia (70%) as well (Supplements 2 and 3).

DISCUSSION

At the end of 2016, the 11 participating countries, which represent close to three quarters of the EU population, were very close to reaching the UNAIDS 90-90-90 goal, with 87% of all PLHIV diagnosed, 92% of all diagnosed ever treated, and 91% of those ever treated being virally suppressed. Overall, an estimated 73% of PLHIV were virally suppressed, meaning that the substantive UNAIDS target was achieved; this proportion was 60% in 2013 [15]. A comparison of proportions and, most importantly, of absolute numbers of treated and virally suppressed individuals gives optimism that a decline in the number of new infections, as a result of an increase of PLHIV virally suppressed, is most likely in the participating EU countries.

In all stages of the CoC, substantial variation between countries was found: the percentage of diagnosed individuals varied between 74% in Croatia and 93% in Denmark, while the percentage of ever treated among diagnosed individuals varied between 88% in Greece and 98% in the Netherlands. Overall, the percentage of virally suppressed individuals ranged from 59% in Greece to 86% in Denmark. Some of these differences may be explained by the different percentages of missing data for viral load, especially when the lack of such data is informative. In Greece, for example, in 2016, due to bureaucratic/funding issues, mostly individuals with impaired health were prompted for an HIV-RNA measurement. In such cases, the percentage of PLHIV virally suppressed is expected to be underestimated. Thus, differences across countries partly reflect differences in healthcare systems and testing policies. Country-specific CoC estimates can point at specific weaknesses and lead the relevant authorities to adopt best practices. Ideally, these estimates are based on real-time or at least recent data (ie, previous year) so that corrective actions can be taken in time.

We found that a higher percentage of PWID had been diagnosed compared with MSM and heterosexuals. However, as MSM and heterosexuals had higher proportions of ever treated and virally suppressed, the proportion of PLHIV virally suppressed for these 2 groups was higher than for PWID (MSM, 74%; heterosexuals, 72%; PWID, 70%). Variation across countries within key populations partly reflects temporal differences in the epidemics. Unlike in the Netherlands, the outbreak in Greece among PWID is very recent, and most PWID still inject drugs, consequently they are less likely to be compliant with ART and achieve viral suppression.

Table 1. Estimates of the 4 Stages of the Continuum of Human Immunodeficiency Virus care for 2016 in 11 European Countries by Key Population and Sex

Country	Population	PLHIV [95% CI]	% Diagnosed [Estimated Range]	% Ever Treated [Estimated Range]	% Suppressed[a] [Estimated Range]	% Suppressed of PLHIV [Estimated Range]
Austria						
	MSM	2920 [2781–3058]	92.8 [88.6–97.4]	93.9 [90.2–97.6]	86.1 [77.3–95.0]	75.0 [64.2–86.7]
	PWID	1030 [997–1062]	96.8 [93.9–100]	92.8 [88.0–97.6]	81.7 [74.9–88.4]	73.4 [61.5–86.1]
	Heterosexuals[b]	2786 [2648–2989]	91.2 [85.0–95.9]	95.0 [91.4–98.7]	86.2 [78.5–93.9]	74.7 [64.6–87.3]
	Men	5338 [5134–5542]	91.9 [88.5–95.6]	93.2 [88.8–97.7]	85.0 [76.4–93.6]	72.8 [62.9–83.2]
	Women	1739 [1631–1846]	93.8 [88.4–100]	94.0 [89.8–98.3]	85.6 [78.5–92.7]	75.5 [64.7–87.5]
	Total	7079 [6946–7330]	92.3 [89.2–94.1]	93.4 [89.0–97.8]	85.2 [76.9–93.4]	73.4 [65.0–83.4]
Croatia						
	MSM	1112 [1012–1268]	69.6 [61.0–76.5]	95.9 [93.9–97.9]	92.3 [90.6–94.1]	61.6 [60.5–62.7]
	Total	1488 [1356–1708]	74.1 [64.5–81.3]	96.2 [94.2–98.2]	92.1 [90.2–94.1]	65.7 [64.2–67.0]
Denmark						
	MSM	2934 [2598–3270]	88.5 [79.4–100]	98.4 [98.1–98.8]	97.6 [97.1–98.2]	85.1 [84.6–85.6]
	PWID	452 [411–567]	90.7 [72.3–99.8]	95.0 [93.3–96.6]	92.0 [89.8–94.1]	79.3 [81.1]
	Heterosexuals	2454 [1997–2919]	94.2 [88.3–100]	97.7 [97.2–98.2]	94.7 [93.4–96.1]	86.8 [85.1–88.0]
	Men	4706 [4342–5269]	90.1 [80.5–97.6]	97.2 [96.7–97.6]	96.8 [95.8–97.7]	84.7 [83.8–85.5]
	Women	1704 [1536–1872]	90.1 [82.1–100]	97.2 [96.7–97.6]	93.6 [92.3–94.9]	82.0 [80.8–83.1]
	Total	6233 [5775–6690]	92.7 [86.3–100]	97.2 [96.7–97.6]	95.9 [94.8–97.0]	86.4 [85.4–87.3]
France						
	MSM	64 900 [63 600–66 200]	85.9 [84.7–87.3]	90.6 [85.9–91.9]	96.8 [96.5–96.9]	75.3 [74.6–76.0]
	PWID	11 900 [11 500–12 300]	97.4 [96.3–98.1]	90.6 [87.2–93.9]	95.3 [94.7–95.9]	83.7 [82.0–86.2]
	Heterosexuals	95 700 [93 500–98 100]	84.9 [83.2–86.7]	89.4 [88.6–90.3]	93.9 [93.7–94.2]	71.3 [70.8–71.8]
	Men	115 600 [113 700–117 300]	85.1 [84.0–86.4]	89.8 [89.0–90.5]	95.6 [95.5–95.8]	73.1 [72.8–73.5]
	Women	57 000 [56 000–57 900]	88.2 [87.3–89.4]	89.5 [88.1–90.9]	93.8 [93.5–94.0]	74.0 [73.2–74.9]
	Total	172 700 [170 800–174 500]	86.1 [85.2–87.1]	89.7 [89.6–89.8]	95.0 [94.9–95.2]	73.4 [73.2–73.5]
Germany						
	MSM	545,00 [51 200–58 300]	85.1 [85.1–90.6]	94.2 [90.6–97.8]	93.3 [90.2–96.5]	74.8 [72.3–77.4]
	PWID	8,800 [7,900–9,700]	89.7 [81.4–100]	91.8 [86.1–97.4]	81.8 [75.0–88.5]	67.4 [61.8–72.9]
	Heterosexuals	18 500 [16 800–20 200]	87.6 [80.2–96.4]	94.7 [91.3–98.0]	89.2 [86.1–92.3]	74.0 [71.4–76.5]
	Men	66 100 [61 400–71 200]	85.8 [79.6–92.3]	93.8 [90–97.5]	91.7 [88.2–95.2]	73.8 [71.0–76.6]
	Women	15 600 [14 000–17 100]	88.5 [80.7–98.6]	94.4 [90.8–98.0]	87.3 [83.5–91.2]	72.9 [69.7–76.2]
	Total	82 900 [77 100–89 400]	86.6 [80.3–93.1]	93.9 [90.2–97.6]	90.8 [87.2–94.3]	73.8 [70.9–76.7]
Greece						
	MSM	6767 [6519–7066]	88.5 [84.8–91.9]	89.0 [85.4–92.4]	84.4 [80.1–88.7]	66.5 [63.1–69.9]
	PWID	2156 [2027–2336]	59.9 [55.3–63.7]	81.2 [74.1–88.3]	73.7 [68.6–78.8]	35.9 [33.4–38.3]
	Heterosexuals	4406 [3922–4889]	73.8 [66.5–82.9]	91.3 [88.7–93.8]	79.6 [69.7–89.5]	53.6 [47.0–60.3]
	Men	11 040 [10 627–11 624]	79.7 [75.7–82.8]	88.2 [84.2–92.1]	82.2 [76.5–87.8]	57.8 [53.8–61.8]
	Women	2404 [2135–2680]	72.0 [64.6–81.0]	87.1 [82.0–92.2]	79.5 [70.5–88.4]	49.8 [44.2–55.4]
	Total	12 953 [12 582–13 619]	81.3 [77.3–83.7]	88.3 [84.4–92.1]	81.8 [75.6–87.9]	58.7 [54.3–63.1]
Italy						
	MSM	48 458	83.9	88.7 [85.5–91.9]	92.4 [91.2–93.5]	68.8 [67.9–69.6]
	PWID	26 481	95.9	85.3 [78.5–92.1]	84.5 [78.3–90.7]	69.1[64.0–74.2]
	Heterosexuals	57 569	86.7	91.8 [89.0–94.6]	89.6 [87.4–91.7]	71.3 [69.6–73.0]
	Men	104 255	86.7	89.2 [85.7–92.8]	91.2 [89.1–93.2]	70.6 [68.9–72.1]
	Women	36 397	91.7	90.2 [86.4–94.0]	86.4 [83.3–89.6]	71.4 [68.9–74.1]
	Total	140 652	88.0	89.4 [85.9–93.0]	90.1 [87.8–92.4]	70.9 [69.1–72.7]
Netherlands						
	MSM	13 876 [13 674–14 127]	89.8 [88.2–91.1]	97.8 [97.4–98.2]	96.8 [95.7–97.9]	84.4 [83.4–85.3]
	PWID	360 [358–364]	98.6 [97.5–99.2]	96.7 [94.9–98.4]	92.0 [88.1–95.8]	87.5 [83.9–91.4]
	Heterosexuals	7557 [7362–7757]	87.6 [85.3–89.9]	97.0 [96.0–97.9]	92.4 [89.7–95.2]	78.5 [76.2–80.1]
	Men	18 588 [18 327–18 995]	88.2 [86.3–89.5]	97.5 [96.9–98.2]	95.9 [94.2–96.9]	81.6 [80.3–83.0]
	Women	4257 [4157–4396]	91.3 [88.4–93.5]	97.1 [96.3–98.0]	92.1 [89.5–94.8]	80.6 [78.3–82.9]
	Total	22 845 [22 530–23 269]	88.8 [87.2–90.0]	97.5 [96.8–98.1]	95.1 [93.3–96.9]	82.4 [80.8–83.9]
Spain						
	MSM	58 936 [56 222–63 156]	83.5 [78.4–86.6]	92.9 [91.3–94.6]	88.6 [83.3–93.8]	68.7 [64.6–72.7]
	PWID	20 278 [20 091–20 614]	97.6 [96.0–98.5]	86.4 [82.0–90.8]	79.2 [69.6–88.9]	66.8 [58.7–75.0]
	Heterosexuals	30 404 [28 620–32 270]	83.0 [79.4–86.2]	93.3 [91.0–95.6]	83.9 [76.5–91.3]	64.9 [59.2–70.7]
	Men	119 937 [110 455–131 380]	86.2 [82.3–88.8]	92.5 [90.5–94.5]	87.3 [81.3–93.2]	69.6 [64.8–74.3]

Table 1. Continued

Country	Population	PLHIV [95% CI]	% Diagnosed [Estimated Range]	% Ever Treated [Estimated Range]	% Suppressed[a] [Estimated Range]	% Suppressed of PLHIV [Estimated Range]
	Women	26 559 [23 962–29 527]	86.3 [77.6–95.6]	92.2 [89.7–94.6]	82.6 [74.7–90.4]	65.7 [59.4–71.9]
	Total	146 500 [134 417–160 908]	86.3 [82.1–88.8]	92.5 [90.4–94.5]	86.5 [80.2–92.8]	68.8 [63.9–73.9]
Sweden						
	MSM	…	…	98.4	92.2	…
	PWID	…	…	93.4	87.8	…
	Heterosexuals	…	…	96.0	91.6	…
	Men	…	…	96.9	91.3	…
	Women	…	…	96.2	92.1	…
	Total	8,098 [8,143–8,061]	89.2 [88.8–89.6]	96.6	91.6	…
United Kingdom						
	MSM	48 800 [46 400–53 600]	88.0 [80.0–92.0]	97.0	93.5 [90.0–97.0]	79.3 [76.2–82.4]
	PWID	2,500 [2,300–2,800]	75.0 [67.0–81.0]	93.0	88.0 [83.0–93.0]	61.0 [57.6–64.5]
	Heterosexuals	49 900 [49 100–51 700]	91.0 [88.0–93.0]	96.0	91.9 [87.0–96.0]	79.9 [76.0–78.8]
	Men	70 500 [67 800–75 400]	90.0 [84.0–94.0]	96.0	93.0 [89.0–97.0]	80.4 [77.0–78.8]
	Women	30 900 [30 300–31 700]	92.0 [90.0–94.0]	95.0	91.7 [87.0–96.0]	80.5 [76.5–84.4]
	Total	101 400 [98 600–106 400]	91.0 [86.0–93.0]	96.0	92.5 [88.0–97.0]	80.4 [76.8–84.0]
All countries[c]						
	MSM	303 203	86.0 [81.0–89.0]	93.0 (91.0–95.0)	93.0 [90.0–96.0]	73.8 [71.5–76.1]
	PWID	74 007	94.0 [91.0–96.0]	88.0 [83.0–93.0]	85.0 [78.0–91.0]	69.6 [64.2–75.1]
	Heterosexuals	269 571	86.0 [84.0–89.0]	92.0 [91.0–94.0]	91.0 [88.0–93.0]	72.5 [70.1–73.9]
	Men	516 064	87.0 [83.0–90.0]	92.0 [90.0–94.0]	92.0 [88.0–95.0]	73.0 [70.3–75.5]
	Women	176 560	89.0 [92.0–94.0]	92.0 [90.0–94.0]	89.0 [86.0–93.0]	73.2 [70.2–76.2]
	Total	702 848	87.0 [84.0–90.0]	92.0 [90.0–94.0]	91.0 [88.0–94.0]	73.2 [70.7–75.7]

Percentages correspond to proportions of individuals out of the previous stage, except for the last column where the percentage suppressed out of the total PLHIV is presented.

Abbreviations: CI, confidence interval; MSM, men who have sex with men; PLHIV, people living with human immunodeficiency virus; PWID, people who inject drugs.

[a]HIV-RNA measurement ≤200 copies/mL at last visit.

[b]Non-MSM, non-PWID, that is, mainly people presumed to have acquired HIV via sex between men and women.

[c]Based on available data: for Croatia only overall estimates and estimates for MSM were produced, and for Sweden only overall estimates were produced. The range of the number of PLHIV was not estimated since not all countries have provided lower and upper estimates. For stages 2–4, ranges were estimated based on available data.

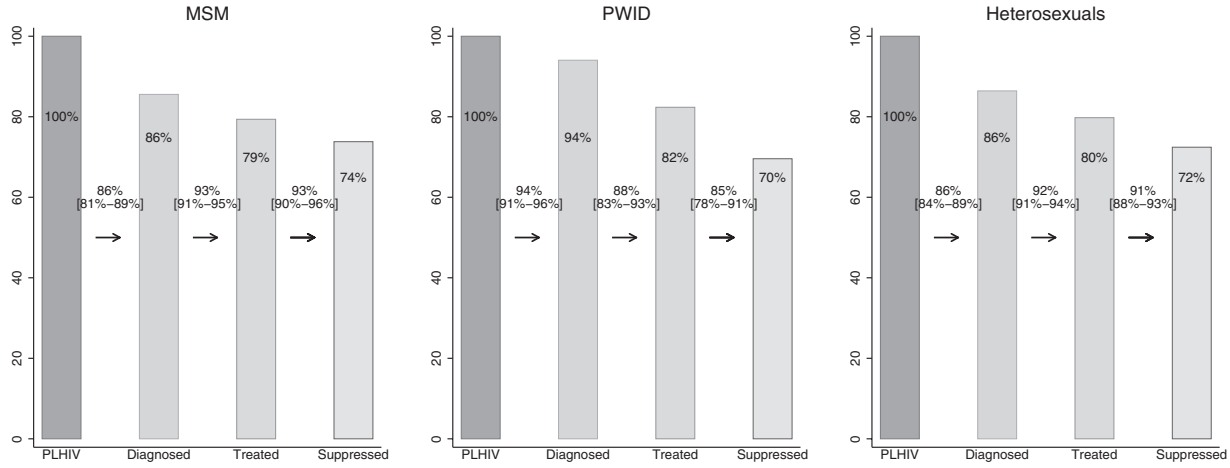

Figure 2. Continuum of HIV care for 2016, by key population in 11 European countries. The numbers between the bars correspond to proportions of the previous stage, while the numbers on the bars correspond to proportions of PLHIV. Estimates by key population were not available for Sweden, while only estimates for MSM were available for Croatia. A slight underestimation of the variability of stage 1 is expected since only the point estimate was available for Italy. The third bar corresponds to those ever treated. For the last bar, individuals with HIV-RNA measurement ≤200 copies/mL at last visit are considered suppressed. Abbreviations: MSM, sex with men; PLHIV, people living with human immunodeficiency virus; PWID, persons who inject drugs.

In accordance with previous studies, the proportion of men who had been diagnosed was slightly lower than among women (87% in men vs 89% women) [28, 29]. HIV testing as a part of obstetrics exams may explain this small difference, although missed testing opportunities for women still exist [30]. The proportion diagnosed who had started treatment was the same (92% for both), and the proportion virally suppressed was slightly higher among men (92% for men vs 89% for women), resulting in the same overall proportions for men and women (73% for both).

The main challenge for all participating countries was the percentage of diagnosed individuals among PLHIV, overall and across key populations, except PWID. Among MSM, the ongoing higher HIV incidence may not be sufficiently covered by the recommendations for early testing [18, 19], which explains the higher undiagnosed percentage of MSM compared with PWID [20, 31, 32].

An important contribution of this analysis is that estimation of all stages of the CoC has been performed using unified definitions and common methods in the majority of participating countries. Nevertheless, there are some limitations. Estimation of the percentage ever treated among those diagnosed was based on cohort data. In some of the participating countries, cohorts represent a selected sample of diagnosed individuals [33]. In these countries, the percentage of individuals who ever initiated ART may have been overestimated. In Germany, for example, following a different methodology, the proportion of those ever treated has been estimated as 91% (84%–98%), slightly lower than the 94% (90%–98%) estimated by this analysis.

A significant challenge was how to accurately capture the number of PLHIV alive in each country, which required information on vital and migration status for all diagnosed individuals. Although, death numbers are expected to be accurate for most countries, data on out-migration are lacking. Therefore, the reported number of PLHIV may be slightly overestimated. Also, for small populations, PLHIV estimates have high levels of uncertainty, indicated by wider CIs. Another limitation of this study is its cross-sectional design. Recent studies have highlighted the importance of investigating, next to the standard CoC, time intervals that PLHIV spend in each stage [34]. A longitudinal CoC has been recently constructed [20, 34, 35].

Despite differences across countries, the 11 participating countries are on track to meet the 90-90-90 target by 2020. However, the participating countries mainly represent the Western EU countries, that seem to be closer to the 90-90-90 target compared with the Central and Eastern European countries [14]. In addition, as transmission due to undiagnosed HIV or unsuppressed viremia continues, both in the EU region and in neighboring countries, it may be difficult to substantially reduce HIV incidence without additional prevention measures, such as increased condom use, harm reduction programs for PWID, and national preexposure prophylaxis programs [36–39]. Indeed, the HIV epidemic has not been sufficiently restricted, with data indicating a slower than expected incidence decline [6]. It has been shown that for MSM, who represent more than 40% of all PLHIV in the participating countries, given immediate ART at diagnosis and no increase in condomless sex, an increase of up to 90% in the proportion of virally suppressed PLHIV within 1 year of infection is needed in order to reduce HIV incidence from 6/1000 to 1/1000 person-years in the United Kingdom [40]. In addition, late presentation remains high in most European countries, highlighting the need for timely HIV diagnosis [41]. Thus, strengthening of testing programs, including self-testing, and stronger treatment and adherence support, along with HIV transmission preventive measures, are needed to achieve epidemic control and, ultimately, zero new HIV transmission.

Supplementary Data

Supplementary materials are available at *Clinical Infectious Diseases* online. Consisting of data provided by the authors to benefit the reader, the posted materials are not copyedited and are the sole responsibility of the authors, so questions or comments should be addressed to the corresponding author.

Notes

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Croatia: Croatian HIV Cohort

This work was supported by the Croatian Science Foundation (project IP-2014–09-4461; principal investigator, Josip Begovac).

The Croatian HIV Cohort includes patients treated at the University Hospital of Infectious Diseases in Zagreb, Croatia (Josip Begovac, Davorka Lukas, Šime Zekan, Vanja Romih Pintar). This is the only treatment center in the country, and an electronic database is updated regularly and has been in use since 1997. Surveillance data were provided by the Croatian Institute of Public Health, Unit for HIV, Sexually Transmitted and Blood-Borne Infections, and HIV Registry (Tatjana Nemeth Blažić).

Denmark: Danish HIV Cohort Study

This work was supported by the Preben og Anne Simonsens Foundation.

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