Web Annex C. Estimates of the coverage of diagnosis and treatment for hepatitis B and C virus infection, by WHO region and income group, 2015

Centre for Disease Analysis

In: Global hepatitis report 2017
ESTIMATES OF THE COVERAGE OF DIAGNOSIS AND TREATMENT FOR HBV AND HCV INFECTION, BY WHO REGION AND INCOME GROUP, 2015

Online annex #3 to the 2017 WHO Global Hepatitis Report on the cascade of care – Version: 20 April 2017

Report prepared by the Center for Disease Analysis for the World Health Organization

BACKGROUND

The global health sector strategy (GHSS) on viral hepatitis calls for elimination of viral hepatitis as a public health threat by 2030 (reduction of 90% in incidence and of 65% in mortality). Chronic sequelae of HBV and HCV infection account for 95% of the mortality from viral hepatitis [1]. The monitoring and evaluation framework of the GHSS includes indicators for the five core interventions [2]. The four prevention interventions are already implemented and data are available to monitor coverage. For testing and treatment, data systems to generate information are not yet in place and estimates are not available to determine how far the world is from the 2030 target. By 2030, the proportion of persons living with HBV or HCV who have been diagnosed should reach 90% (30% in 2020), and among those diagnosed, 80% of eligible persons should be treated (5 million for HBV and 3 million for HCV in 2020) [3].

The cascade of care concept originates from HIV and quantifies the series of steps that occur between testing and the achievement of viral suppression or sustained virological response (SVR) [4]. The cascade of care for HBV and HCV infection [5, 6] addresses diagnosis, treatment and viral suppression (for HBV) and eventual cure (for HCV) [5, 7, 8]. Reports that address the cascade for HCV [9, 10, 11, 12, 13, 14] are mostly from high-income countries. Monitoring the cascade facilitates the identification of gaps in access to and engagement in care and treatment [15]. New direct-acting antivirals for HCV have already improved adherence and SVR rates. Reports quantifying the cascade of care for HBV are also mostly from high-income countries [16–22]. Among antinucleos(t)ides with a high barrier to resistance recommended by WHO for the treatment of chronic hepatitis B, tenofovir has been the most widely used. With full adherence to antinucleos(t)ides with a high barrier to resistance, viral suppression occurs at 48 weeks in 83–97% of patients. Disease progression stops in patients who respond to treatment [23–26]. However, older therapies such as lamivudine are still in use, even though they are not recommended by WHO as they induce resistances.

Before implementing the GHSS on viral hepatitis, a baseline quantification of the cascade of care for HBV and HCV was necessary to (a) identify priorities for action, and (b) compare regions in terms of access to diagnosis and treatment. We therefore abstracted the available data to estimate the number of patients infected with HBV and HCV who were (a) diagnosed, (b) treated and (c) virologically suppressed or cured at the regional and global levels, using 2015 as the reference year. WHO regions included the African Region, Region of the Americas, Eastern Mediterranean Region, European Region, South-East Asia Region and Western Pacific Region.
METHODS

General approach
To estimate the indicators that reflect the cascade of care regionally and globally, we proceeded through four steps (Fig. 1). First, we reviewed the data to estimate the indicators along the cascade by country. Second, we compiled data from countries that had data available and extrapolated these results to generate regional and global estimates. Third, we stratified results by WHO region and income level. Fourth, we calculated uncertainty intervals around the estimates.

Operational definitions
We estimated the indicators selected by WHO to quantify the various steps of the cascade of care [2].

Proportion of infected persons diagnosed (WHO core indicator C6)
We defined persons diagnosed (C.6) as persons living with chronic HBV (C.6.a) or HCV (C.6.b) infection who had been diagnosed through in vitro diagnostic methods. The proportion of diagnosed individuals was calculated as the number of persons with chronic infection diagnosed out of the total number of persons with chronic infection.

Treatment coverage (HBV) or initiation (HCV, WHO core indicator C7)
For HBV, we defined persons on treatment (C.7.a) as persons living with chronic HBV infection who were on treatment in 2015. For HCV, we defined persons initiating treatment (C.7.b) as persons living with chronic HCV infection who started any HCV antiviral treatment (including direct-acting antiviral regimens and non-direct-acting antiviral regimens) in the past 12 months. We calculated the treatment initiation rate for 2015 as the number of persons initiating treatment during that year out of the total number diagnosed.

Viral suppression (HBV) or sustained virological response (HCV, WHO core indicator C8)
For HBV, we defined the proportion of persons virally suppressed (for C.8.a) as the number of persons with undetectable HBV DNA in the past 12 months out of the number of persons on HBV treatment in the past 12 months who were tested. For HCV, we defined the proportion of cure (for C.8.b.) as the number of persons with documented SVR out of the number of persons initiating treatment (within the past 12 months).

Time period
We estimated cascade indicators for the year 2015. Our literature search considered available published studies and ministry of health reports between January 1990 and November 2016 (HBV), and published studies and national databases between January 1950 and March 2016 (HCV).

Geographical scope
We considered all countries for the development of our global and regional cascade of care estimates. We included countries with prevalence data, as well as those without prevalence data but with a population of 1 million or more (HBV) and 1.5 million or more (HCV).
1. Country-level estimates

Number of infected persons

We used the 2015 WHO estimates of the total number of persons infected with HBV and HCV. The estimates for HBV were generated by the London School of Hygiene & Tropical Medicine for the WHO department of Immunization, Vaccines and Biologicals. The estimates for HCV were generated by the Center for Disease Analysis for the WHO Global Hepatitis Programme.

Proportion of infected persons diagnosed (WHO core indicator C6)

HBV
Methods to estimate the size of the population diagnosed included (in order of priority): (a) national notification or registry data; (b) studies that included estimates or data on the number of persons known to be living with HBV in a country and published in the peer-reviewed literature; (c) the number of people found to be infected through blood donation screening programmes; (d) extrapolations from other countries in the same region.

HCV
In countries where notifications led to a reliable number of newly diagnosed infections, we added all notifications by year and subtracted mortality. In countries without surveillance data, we used national reports or expert panel input (in that order). We also considered blood donor data (when available), under the assumption that the total number of diagnosed patients would at a minimum include those testing positive at a blood transfusion centre. We assumed that the proportion of anti-HCV-positive persons with viraemia was identical among persons diagnosed and in the total infected population, and that the newly diagnosed cases remained constant after the last reporting.

Treatment coverage (HBV) or initiation (HCV) (WHO core indicator C7)

HBV
We estimated the number of individuals treated annually for HBV through (in order of priority): (a) national databases or government reports; (b) sales audit data of generic tenofovir; (c) published data on the number of treated patients in the country; or (d) estimates provided by national experts. To use medicine sales audit data, we converted the annual number of units of treatment sold into the number of treated patients using the average number of units per patient.

HCV
We estimated the number of individuals initiating treatment for HCV each year through (in order of priority): (a) national databases or government reports; (b) medicine sales audit data; (c) publications or reports from major treatment centres; or (d) estimates provided by experts. We considered all therapies available in 2015, including older regimens containing interferon as well as newer direct-acting antiviral combinations (with or without ribavirin). To use medicine sales audit data, we converted the annual number of units of each
treatment sold into the number of treated patients using the average number of units per patient. To estimate
the average number of units per patient, we considered several factors that affect the speed and probability of
achieving an SVR, particularly when patients are treated with pegylated interferon. As the average SVR varies
by genotype, we considered the genotype distribution and the duration of treatment by genotype. We also
included the number of treatment units used per week and the proportion of treatment effectively completed.
We further adjusted the annual number of units to account for uses other than for treatment of HCV and for
any underreporting, using inputs from the expert panel in each country when possible. When reports from
individual treatment centres were used, experts provided input on the number and size of other treatment
centres in the country so that the numbers could be extrapolated to determine a countrywide estimate. We
assumed the annual number of patients initiating treatment was constant after the last year of reported data.

Projected treatment effectiveness (WHO core indicator C8)

**HBV**
We assumed that with full adherence to treatment, viral suppression would occur in 90% of individuals with
chronic hepatitis B [23, 27]. Assuming that 80% of those undergoing treatment were adherent, we assumed
that globally, 72% had effective viral suppression [16, 28–32].

**HCV**
We used the proportion of treated patients with SVR by genotype to estimate the number of patients with SVR
per year. In the absence of better information, we assumed that the genotype distribution of the treated
population was the same as the one of the total infected population. We interviewed national experts to
estimate the actual proportion of SVR for the different treatment regimens (with or without direct-acting
antivirals). Experts took into consideration the proportion of patients with prior treatment experience, disease
stage and reduced compliance.

2. Extrapolations to generate regional and global estimates
We estimated the proportion of patients diagnosed and treated for the Global Burden of Disease (GBD)
regions, weighted by the sizes of the populations infected and diagnosed, respectively. We used GBD regional
diagnosis and treatment estimates for countries without estimates. If a GBD region did not have any countries
with data, we used the weighted average of neighbouring GBD regions as a surrogate. All GBD regions were
then added to generate a global estimate.

3. Stratifications
We stratified our outputs based on the six WHO-defined regions and four World Bank income groups.

4. Uncertainty analysis
We conducted a sensitivity analysis and developed 95% uncertainty intervals (UI) for our regional and global
outcomes. To this effect, we ran a Monte Carlo analysis that turned off and on the inclusion of each country in
the regional and global estimates. After completing the Monte Carlo analysis, we used the resulting
uncertainty ranges by country to calculate the regional and global levels. This allowed us to determine the
impact of including each country’s forecast in the regional cascade of care estimate, which in turn estimated the numbers diagnosed, treated and suppressed/cured for all countries with missing data in the same region. We conducted these analyses using Crystal Ball®, an Excel® add-in by Oracle® with a binomial distribution to include or exclude countries [33].

RESULTS

Cascade of care for HBV infection (see Cascade 1)

Data availability

Data on diagnosis were available for 163 countries (94% of the population) with 46% coming from blood donor data, 31% from registries or published data, 10% from WHO registries (particularly in the European Region and Western Pacific Region), and 7% utilizing a combination of registry and blood donor data (Fig. 2). Data on diagnosis accounted for >99% of the population in the Western Pacific, European and American regions. The South-East Asia Region (94% of the population with data on diagnosis, 98% of which was from blood donations) and African Region (85% of the population with data on diagnosis, 91% from blood donor donations) had intermediate data availability. The Eastern Mediterranean Region had the lowest proportion of the population with data on diagnosis (69%, with 71% of the information coming from blood donations).

Treatment data were available for 59 countries, representing 43% of the global population, ranging from 90% in the South-East Asia Region to 10% in the European Region. In all but six countries, we used sales data of generic tenofovir to estimate the number of treated patients. In New Zealand, Poland, Slovakia and Viet Nam, experts estimated the total number of those treated. These estimates include non-tenofovir treatments. For Greece and China, previously published estimates were utilized and also include non-tenofovir treatments [19, 34].

No data were available regarding treatment in the Andean Latin America, Southern Latin America and tropical Latin America; nor were they available for the high-income Asia Pacific subregions. The weighted average of the proportion treated in a neighbouring region was extrapolated and applied. Sufficient diagnosis and treatment data for inclusion were available for countries in all the other subregions.

Diagnosis of chronic HBV infection

Overall, in 2015, of the 257 million persons with HBV infection, we estimated that 21 million persons (95% UI: 20–22 million, 9% of the infected population) had been diagnosed (Table 1). The proportion of those infected who were diagnosed was highest in the Western Pacific Region (25%, 17 million diagnosed) and lowest in the African Region (0.3%, 153 000 diagnosed). The highest number of diagnosed individuals was in the upper–middle-income group (2 million, with the lowest in the low-income group, with 312 000 diagnosed. Upper–middle-income countries also had the highest proportion diagnosed (18.7%), while low-income countries had the lowest (0.8%).
Treatment coverage for chronic HBV infection

Overall, in 2015, 1.7 million (95% UI: 1.5–1.7 million) persons (8% of those diagnosed) were on treatment for chronic hepatitis B (Table 1). This proportion varied from 0.5% to 18% by region. Treatment coverage was the highest in high-income countries (14%) and the lowest in lower–middle-income countries (3%).

Projected viral suppression for chronic HBV infection

Of the 1.7 million on treatment in 2015, an estimated 1.2 million individuals (95% UI: 1.2–1.6 million) achieved viral suppression globally.

Sensitivity analysis

Globally, 97% of the variation in the total number diagnosed was due to the Western Pacific, South-East Asia and European regions, with 75% being due to the Western Pacific Region alone. With respect to treatment, 76% of the variation in the total number treated was due to the Western Pacific Region, followed by the European and South-East Asia regions, which together account for 94% of the variation (Fig. 4).

Cascade of care for HCV (see Cascade 2)

Data availability

Expert panels approved estimates of the HCV cascade in 59 countries. Published and unpublished data were available for another 41 countries. For 74 countries (79% of the world population), we estimated the number of patients diagnosed through expert consensus (39 countries, 36% of the population), published studies (10 countries, 8% of the population) and surveillance (25 countries, 35% of the population, Fig. 3). Surveillance accounted for >50% of the population in the Region of the Americas and Western Pacific Region (Fig. 3).

We were able to estimate the number of patients with hepatitis C treated in 76 countries (81% of the global population) through the use of expert consensus (29 countries, 16% of the population), published studies (6 countries, 3% of the population), medicine sales audit data (34 countries, 41% of the population) and surveillance (7 countries, 22% of the population, Fig. 3). In two regions (Eastern Mediterranean and European), more than 50% of estimates came from medicine sales audit data or national treatment databases (5% of the population). National treatment databases were available in the European and the Western Pacific regions (Fig. 3).

Three GBD regions (Latin America, Andean; Oceania; sub-Saharan Africa, central) lacked country data for diagnosis and two (Oceania; sub-Saharan Africa, central) lacked country data for treatment and SVR. We estimated the data for the Andean Latin America region using the population-weighted averages from Latin America, central/southern/tropical; sub-Saharan Africa, central was estimated using the population-weighted average from sub-Saharan Africa, east/south/west; and Oceania was assumed to have the same proportion diagnosed and treated as Australasia.
**Diagnosis of chronic HCV infection**

Of the 71 million persons with chronic HCV infection in 2015, 20% (95% UI: 19–21%) had been diagnosed (14 million, 95% UI: 13–15, Table 2). The European Region had the largest total diagnosed population (4.3 million) and the African Region had the smallest (582 000). The Region of the Americas had the highest proportion of infected persons diagnosed (36%). The high-income group had the largest number of persons diagnosed (6 million, 43% of all). In the high-income group, 46% of infections were diagnosed, compared with 17% in the upper-middle-income and 14% in the lower-middle-income groups.

**Treatment initiation rate for chronic HCV infection**

In 2015, of 14 million diagnosed with HCV infection, an estimated 7% (95% UI: 7–8%) initiated treatment in 2015 (1 million, 95% UI: 1.0–1.1, Table 2). The Eastern Mediterranean Region had the largest number of persons initiating treatment (326 000) and the highest treatment initiation rate (12%), followed by the Region of the Americas (11%). The high-income group accounted for the largest number of patients initiating treatment (483 000), followed by the lower-middle-income group (398 000). Globally, a cumulative 5 million persons (95% UI: 5.4–5.6) have initiated treatment since 2004.

**Projected sustained virological response for HCV infection**

The SVR among patients treated in 2015 was 80% overall (95%UI: 76–82%), highest in the Region of the Americas (88%) and lowest in the Western Pacific Region (63%, Table 2). The high-income group had the highest SVR (88%) and the upper-middle-income group the lowest (62%).

**Sensitivity analysis**

For the proportion diagnosed, the European, South-East Asia and African regions accounted for 95% of variation (Fig. 5). The Western Pacific and Eastern Mediterranean regions accounted for less than 1% of individuals diagnosed globally. By income, the lower-middle-income and lower-income groups accounted for approximately 95% of uncertainty. For treatment initiation rate, the European, Eastern Mediterranean and South-East Asia regions accounted for more than 98% of variation (Fig. 5). The Region of the Americas and Western Pacific Region accounted for less than 1% of treatment initiation globally. By income, the lower-middle-income and upper-middle-income groups accounted for 99% of uncertainty. Lower-middle-income countries alone accounted for about 94% of the uncertainty. For SVR, the European, Eastern Mediterranean and South-East Asia regions accounted for 95% of variation (Fig. 5). The American and Western Pacific regions accounted for less than 1% of variation. By income, the lower-middle-income and upper-middle-income groups accounted for 99% of uncertainty.

**DISCUSSION**

Globally, we estimated that in 2015, 9% of the 257 million infected with HBV had been diagnosed, a 21% gap from the GHSS 2020 target of 30%. With widespread diagnosis campaigns documented with registries, the Region of the Americas, European and Western Pacific regions could meet the 2020 target for diagnosis. However, given the difficulties in documentation in the African, Eastern Mediterranean and South-East Asia
regions, meeting the 2020 and 2030 targets would be difficult, even with a massive increase in the number of individuals diagnosed. Registries often suffer from limitations. They do not operate at the national level, do not differentiate between acute and chronic cases, and exclude the private sector. In addition, a registry would need to link diagnosis to treatment and continue follow up for patients not yet eligible for treatment until they are suppressed. With regard to treatment, in 2015, we estimated that 1.7 million individuals (8% of those diagnosed) were being treated (34% of the 5 million targeted to be on treatment by 2020). However, given the absence of population-based estimates of the proportion of infected individuals eligible for treatment [35, 36], it is difficult to determine how far the world is from the 2020 target [16]. As treatment is limited by the number of individuals diagnosed, the regions that will require the largest scale up of diagnosis will also require large scale up of treatment. Thus, the African, Eastern Mediterranean and South-East Asia regions have the greatest need for focused strategies to diagnose and treat chronic HBV. The Western Pacific Region has made progress in diagnosis, but needs to follow up diagnosis with treatment.

Globally, we estimated that in 2015, 20% of the 71 million infected with HCV had been diagnosed. This presents a 10% gap from the 30% targeted for 2020. However, the degree of effort necessary to achieve these targets varies by region. In the African Region, only 6% of HCV infections are diagnosed. Laboratory facilities equipped to test for HCV are sparse in the Region, and many countries send specimens abroad for testing. This is both expensive and inefficient for large-scale screening programmes. Although the proportion diagnosed varies by WHO region, it varies even more by income group. The high-income group has already achieved or exceeded the 2020 targets. Lack of quality data in low-income and lower-middle-income groups may explain the variation by income group. While the low-income group had the smallest number of data sources for those diagnosed, the lower-middle-income group accounted for the largest variation in diagnosis estimates due to the limited sources available for a large number of included countries. With respect to treatment, worldwide in 2015, 7.4% of diagnosed patients initiated any kind of treatment. Given the 2020 GHSS target for treatment (3 million people have received treatment) [3], these results suggest that at a global level, diagnosis and treatment must be scaled up. Cumulatively, an estimated 5.5 million patients initiated treatment between 2004 and 2015, which means that 20% of these patients were treated in 2015 alone. In the low-income group, this proportion was much higher at 88% due to emerging treatment efforts in the African Region where 81% of patients who cumulatively initiated treatment since 2004 did so in 2015. Overall, 80% of those who started treatment in 2015 were cured. This proportion of those cured is expected to continue to rise as countries switch to direct-acting antiviral therapies. Although we are unable to provide quantifiable estimates of patients treated by therapy type at a regional level, approximately 50% of patients treated globally in 2015 and approximately 10–15% of the cumulative number of patients treated globally from 2004 to 2015 were treated with direct-acting antivirals. The annual proportion of cure reflects the uptake of direct-acting antiviral therapies across regions, as well as the change in treatment over time. More than 80% of treated patients were cured in the Region of the Americas, African, Eastern Mediterranean and South-East Asia regions, while less than 80% were cured among those treated in the Western Pacific and European regions. The high proportion of cure in the Region of the Americas (88%) is largely due to access to direct-acting antivirals in the
USA and Brazil, which account for a majority of treatment in the Region. The scarcity of data and small number of treated patients in the African Region may indicate that prior to the launch of direct-acting antivirals, there was very little treatment available in that Region. Variations in treatment onset rates and cure rates by income group highlighted the need for expanded treatment and improved access to direct-acting antivirals in middle-income and low-income countries.

These estimates suffer from a number of limitations. First, the number of individuals diagnosed may have been underestimated. Underreporting may occur in public health-care facilities. Some countries do not include data from the private sector. Second, the number of patients treated could be overestimates. For HBV, in 53 countries with available data, we estimated the number of individuals on treatment based on generic tenofovir sales. In low-income countries that account for the largest proportion of infected persons and where most of the tenofovir used is from generic manufacturers, this may have led to an overestimation of treatment coverage, as some tenofovir could have been used for the prevention or treatment of HIV infection. In contrast, in upper–middle-income and high-income countries, data on the sales of generic tenofovir may not represent all the sales of tenofovir, which could have led to an underestimation of the number on treatment. In addition, we were not able to capture the use of other types of treatment that are not recommended by WHO, such as lamivudine. Use of these treatments can lead to resistance and wastage of resources. As a consequence of these limitations of the treatment data for HBV, WHO decided not to consider the regional breakdown in the indicator reflecting treatment coverage for HBV (Core indicator C.7.a) but only the global aggregated data. For HCV, we were unable to provide specific estimates of breakdown according to the type of treatment, such as the use of interferon-based regimens versus direct-acting antivirals. Where the exact proportion of patients treated with direct-acting antivirals was available in a country, it was reflected in the average SVR by genotype, as described above. Third, our data on viral suppression for HBV and SVR for HCV were not based on national systems to monitor patients from diagnosis through evaluation of treatment effectiveness. Instead, we used multiple sources to project an estimate of the viral suppression or SVR indirectly, through published studies of the efficacy and observance that can be expected (HBV) or in-country expert opinions based on their own case series (HCV). Finally, as the situation is developing fast, 2015 estimates reflected a situation that has evolved substantially since. Unfortunately, as of March 2017, 2016 estimates were not yet available for all countries, even though preliminary data suggest that there is increasing availability of direct-acting antivirals in many countries, and that the number of patients treated is increasing [37]. For example, Egypt started 500 000 patients on treatment in the first nine months of 2016 (an increase from October 2014 to December 2015 when 170 000 patients were treated) [37]. These patients are not reflected in these 2015 estimates. The recent WHO report on access to hepatitis C treatment suggests that 1 million patients have been treated with direct-acting antivirals since these drugs were first released in 2014 [37]. This is generally compatible with our estimate that half a million patients were treated in 2015, with between 550 000 and 825 000 patients treated with direct-acting antivirals in 2014 and 2015 combined. However, once we include data from 2016, our estimates are likely to exceed 1.1 million treated with direct-acting antivirals between 2014 and 2016.
In conclusion, in 2015, some information is available to provide initial baseline estimates of the cascade of care. Only 9% and 20% of those with chronic HBV and HCV infection, respectively, have been diagnosed. Of those infected with HBV, 8% are on treatment. Of those infected with HCV, 7% initiated treatment in 2015. Based on what is known of the effectiveness of these treatments, we estimate that the majority of those treated are virally suppressed (in the case of HBV) or cured (in the case of HCV). However, most countries do not monitor the effectiveness of treatment. To achieve the GHSS impact targets of reduced mortality and incidence, scaling up testing and treatment will be necessary in all regions. In some cases, a switch is needed from older and less safe therapies such as lamivudine for HBV and pegylated interferon for HCV, and further research required to develop therapies for chronic HBV infection that would lead to a functional cure. A test-and-treat policy may avoid post-diagnosis attrition in the future as it is estimated that up to 30% of people who are not eligible when they are first diagnosed will become treatment eligible within three years [38]. Despite the availability of surveillance systems and registries in many countries, more work is needed to identify best practices that lead to improved accuracy and reliability of data systems to monitor the cascade of care. The implementation of patient registries, especially in the African and South-East Asia regions, will be a necessary consideration in the development of national strategies as countries move toward eliminating HBV and HCV. In the absence of such registries, countries may want to consider other mechanisms that will provide preliminary estimates of the indicators that reflect the cascade of care. Finally, to document SVR or viral suppression, effective systems of follow up to assess and document the effectiveness of treatment are needed in order to replace estimates with empirical data collected in-country.

ACKNOWLEDGEMENTS

We would like to acknowledge the 400+ country collaborators who provided and analysed data, participated in meetings, provided guidance on methodology, and/or critically reviewed the model.

Country-level analyses were funded by industry research grants, the John C. Martin Foundation, and/or the World Health Organization regional offices through the Center for Disease Analysis and the Polaris Observatory.

The development of WHO regional estimates, and the analysis to ensure adherence to the Guidelines for Accurate and Transparent Health Estimates Reporting (GATHER) process were funded by the World Health Organization through the Polaris Observatory.

The unit data for medicine sales audit data were reported by QuintilesIMS, which is a vendor of de-identified prescription sales data.
CASCADES

Cascade 1. HBV cascade of care estimates by WHO region, 2015

Cascade 2. HCV cascade of care estimates by WHO region, 2015

- **Western Pacific**
- **South-East Asia**
- **European**
- **Eastern Mediterranean**
- **American**
- **African**

**Cascade of cure**

- **Infected**
- **Diagnosed**
- **Started on treatment in 2015**
- **Cured in 2015**

Thousands of persons
### TABLES

#### Table 1. HBV cascade of care estimates by WHO region and income categories, 2015

<table>
<thead>
<tr>
<th>Region</th>
<th>Total number (000)</th>
<th>Diagnosed (000)</th>
<th>Treated (000)</th>
<th>Viral suppression (000)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Best estimate</td>
<td>Range</td>
<td>Best estimate</td>
<td>Range</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WHO region</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>African</td>
<td>60 000</td>
<td>45 000–84 000</td>
<td>153</td>
<td>110–200</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The Americas</td>
<td>7 000</td>
<td>4 000–16 000</td>
<td>669</td>
<td>589–743</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eastern Mediterranean</td>
<td>21 000</td>
<td>17 000–28 000</td>
<td>351</td>
<td>173–486</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>European</td>
<td>15 000</td>
<td>11 000–23 000</td>
<td>1 965</td>
<td>1 728–2 218</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>South-East Asia</td>
<td>39 000</td>
<td>29 000–77 000</td>
<td>888</td>
<td>848–1 552</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Western Pacific</td>
<td>115 000</td>
<td>93 000–160 000</td>
<td>17 484</td>
<td>15 975–17 621</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>World Bank income group</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>10 000</td>
<td>8 000–15 000</td>
<td>1 874</td>
<td>1 664–2 375</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Upper-middle</td>
<td>119 000</td>
<td>95 000–153 000</td>
<td>16 132</td>
<td>15 452–16 295</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lower-middle</td>
<td>87 000</td>
<td>67 000–133 000</td>
<td>3 195</td>
<td>2 265–3 920</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>40 000</td>
<td>30 000–66 000</td>
<td>312</td>
<td>273–333</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Global</td>
<td>257 000</td>
<td>199 000–367 000</td>
<td>21 513</td>
<td>19 887–22 285</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Given the limitations of the estimates of HBV treatment, WHO decided not to use the estimates at the regional level but to only use the worldwide, aggregated estimates.
<table>
<thead>
<tr>
<th>WHO region</th>
<th>Total cases (000)</th>
<th>Diagnosed</th>
<th></th>
<th>Treatment initiation (annual)</th>
<th>Cumulative number of persons started on treatment (000)</th>
<th>Sustained virological response (annual)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total number (000)</td>
<td>Proportion (%)</td>
<td>Number (000)</td>
<td>Rate (%)</td>
<td>Best estimate</td>
<td>Range</td>
</tr>
<tr>
<td>African</td>
<td>10 284</td>
<td>399–718</td>
<td>5.7</td>
<td>3.9–7.0</td>
<td>13</td>
<td>315</td>
</tr>
<tr>
<td>The Americas</td>
<td>7 237</td>
<td>2 446–2 707</td>
<td>36.3</td>
<td>33.8–37.4</td>
<td>290</td>
<td>286–290</td>
</tr>
<tr>
<td>Eastern Mediterranean</td>
<td>15 190</td>
<td>2 644–2 732</td>
<td>17.7</td>
<td>17.4–18.0</td>
<td>326</td>
<td>302–331</td>
</tr>
<tr>
<td>European</td>
<td>13 641</td>
<td>3 443–3 735</td>
<td>31.2</td>
<td>25.2–34.7</td>
<td>208</td>
<td>186–302</td>
</tr>
<tr>
<td>South-East Asia</td>
<td>10 391</td>
<td>627–1 016</td>
<td>8.7</td>
<td>6.0–9.8</td>
<td>64</td>
<td>45–69</td>
</tr>
<tr>
<td>Western Pacific</td>
<td>13 898</td>
<td>2 815–2 998</td>
<td>21.5</td>
<td>20.3–21.6</td>
<td>144</td>
<td>141–145</td>
</tr>
<tr>
<td>Non-WHO</td>
<td>506</td>
<td>221–223</td>
<td>43.8</td>
<td>43.7–44.0</td>
<td>8</td>
<td>8–8</td>
</tr>
<tr>
<td>High</td>
<td>13 499</td>
<td>6 169–6 257</td>
<td>46.2</td>
<td>45.7–46.4</td>
<td>483</td>
<td>479–483</td>
</tr>
<tr>
<td>Upper-middle</td>
<td>18 439</td>
<td>2 885–3 139</td>
<td>16.6</td>
<td>15.6–17.0</td>
<td>164</td>
<td>148–176</td>
</tr>
<tr>
<td>Lower-middle</td>
<td>33 341</td>
<td>3 792–4 913</td>
<td>13.8</td>
<td>11.4–14.7</td>
<td>398</td>
<td>354–461</td>
</tr>
<tr>
<td>Low</td>
<td>5 846</td>
<td>182–445</td>
<td>6.1</td>
<td>3.1–7.6</td>
<td>7</td>
<td>1–9</td>
</tr>
<tr>
<td>Other</td>
<td>20</td>
<td>1.8–5.0</td>
<td>21.5</td>
<td>8.6–24.5</td>
<td>0.3</td>
<td>0.0–0.4</td>
</tr>
<tr>
<td>Global</td>
<td>71 146</td>
<td>13 166–14 638</td>
<td>20.0</td>
<td>18.5–20.6</td>
<td>1 053</td>
<td>987–1 116</td>
</tr>
</tbody>
</table>
Fig. 1. Conceptual framework to extrapolate country-level estimates to regions for the cascade of care for HBV and HCV infection.
Fig. 2. Data available on diagnosis and treatment of HBV infection, by region, adjusted for population size, 2015

AFR: African Region; AMR: Region of the Americas; EMR: Eastern Mediterranean Region; EUR: European Region; SEAR: South-East Asia Region; and WPR: Western Pacific Region.
Fig. 3. Data available on diagnosis and treatment of HCV infection, by region, adjusted for population sizes

<table>
<thead>
<tr>
<th>Region</th>
<th>AMR (989 million)</th>
<th>AFR (1,000 million)</th>
<th>EMR (654 million)</th>
<th>EUR (914 million)</th>
<th>SEAR (1,945 million)</th>
<th>WPR (1,867 million)</th>
<th>Non-WHO (25 million)</th>
<th>High (1,408 million)</th>
<th>Upper middle (2,393 million)</th>
<th>Lower middle (2,946 million)</th>
<th>Low (644 million)</th>
<th>Other (3 million)</th>
<th>Global (7,394 million)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Diagnosis data</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Expert Consensus</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Published Study</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>National Surveillance</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Region</th>
<th>AMR (989 million)</th>
<th>AFR (1,000 million)</th>
<th>EMR (654 million)</th>
<th>EUR (914 million)</th>
<th>SEAR (1,945 million)</th>
<th>WPR (1,867 million)</th>
<th>Non-WHO (25 million)</th>
<th>High (1,408 million)</th>
<th>Upper middle (2,393 million)</th>
<th>Lower middle (2,946 million)</th>
<th>Low (644 million)</th>
<th>Other (3 million)</th>
<th>Global (7,394 million)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Treatment data</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Expert Consensus</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Published Study</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IMS data</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>National Surveillance</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

AFR: African Region; AMR: Region of the Americas; EMR: Eastern Mediterranean Region; EUR: European Region; SEAR: South-East Asia Region; and WPR: Western Pacific Region.
**AFRO**: Regional office for the African Region; **AMRO**: Regional office for the Region of the Americas; **EMRO**: Regional office for the Eastern Mediterranean Region; **EURO**: Regional office for the European Region; **SEARO**: Regional office for the South-East Asia Region; and **WPRO**: Regional office for the Western Pacific Region.

---

**Fig. 4.** Sensitivity analysis to estimate the impact of regional uncertainties on the global cascade of care for HBV infection, by region, 2015
Fig. 5. Sensitivity analysis to estimate the impact of regional uncertainties on the global cascade of care for HCV infection, 2015

AFR: African Region; AMR: Region of the Americas; EMR: Eastern Mediterranean Region; EUR: European Region; SEAR: South-East Asia Region; and WPR: Western Pacific Region.
Reference List


36. in Guidelines for the Prevention, Care and Treatment of Persons with Chronic Hepatitis B Infection. 2015: Geneva.