Supplementary appendix

This appendix formed part of the original submission and has been peer reviewed. We post it as supplied by the authors.

Supplement to: Schaefer R, Schmidt H-MA, Ravasi G, et al. Adoption of guidelines on and use of oral pre-exposure prophylaxis: a global summary and forecasting study. Lancet HIV 2021; published online July 12. http://dx.doi.org/10.1016/S2352-3018(21)00127-2.
Global adoption of guidelines on and use of oral pre-exposure prophylaxis (PrEP): Current situation and future projections

Schaefer et al.

Details on data

The key indicators for this study were the number of people who have received oral PrEP at least once in a given year ('PrEP users') (having met local eligibility requirements and been provided PrEP) and the adoption the WHO recommendations on oral PrEP provision for populations at substantial risk of HIV acquisition in national HIV guidelines by countries ('adoption of the WHO PrEP recommendations'). Data on these indicators were obtained through the Global AIDS Monitoring (GAM). Countries report on these indicators in the GAM for the previous year in the first half of a given year. Details on the GAM can be found elsewhere [1]. Table S1 below lists the survey items used in the GAM to collect information. To validate GAM data and fill data gaps, WHO reached out to regional offices to collect information with the same survey instruments. Table S2 lists the data sources used for each indicator for each WHO member state by WHO region for 2019. If a country was known to have adopted the WHO PrEP recommendations in a previous year but reported missing data in a subsequent year, this was imputed. For numbers of PrEP users for 2016-2018, a validated WHO data set was used. Table S2 also lists the allocated step of on the ‘PrEP trajectory’ used for the PrEP user forecasting (see below).
**Table S1:** Survey items used to gather information on numbers of PrEP users and WHO PrEP recommendations adoption.

| Survey item                                       | Response possibilities                                                                                                                                 |
|---------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|
| **Numbers of PrEP users**                         | Disaggregation:                                                                                                                                          |
| Number of people who received oral PrEP at least once during the reporting period | - People who received PrEP for the first time in their lives.                                                                                 |
|                                                   | - Gender (male, female or transgender).                                                                                                           |
|                                                   | - Age (<15, 15+, 15-19, 20-24-25-49 and 50+ years)                                                                                                 |
|                                                   | - Key population: (men who have sex with men, sex workers, people who inject drugs, and transgender people and prisoners)                           |
|                                                   | - Cities and other administrative areas of importance                                                                                              |
| **Adoption of the WHO PrEP recommendations**      | Yes, PrEP guidelines have been developed and are being implemented                                                                                 |
| Has the WHO recommendation on oral PrEP been adopted in your country’s national guidelines?     | Yes, PrEP guidelines have been developed but are not yet being implemented                                                                        |
|                                                   | No, guidelines have not been developed                                                                                                               |
| If the WHO recommendation on oral PrEP has not yet been adopted in the national guidelines, is there a plan to adopt a PrEP recommendation in the future? | Yes                                                                                                                                                |
|                                                   | No                                                                                                                                                    |
| If yes, please indicate the year when adoption of the PrEP recommendations is planned:       | No planned year                                                                                                                                     |
|                                                   | Year 1 (depending on year of data collection)                                                                                                       |
|                                                   | Year 2 (depending on year of data collection)                                                                                                       |
|                                                   | Year 3 (depending on year of data collection)                                                                                                       |
|                                                   | Year 4 (depending on year of data collection)                                                                                                       |
|                                                   | Other (please specify)                                                                                                                               |
| Country                  | Region             | WHO Regional Office for the African Region: AFRO | WHO PrEP user data source | WHO PrEP recommendation adoption data source | PrEP trajectory step (forecasting) [a] |
|-------------------------|--------------------|-----------------------------------------------|---------------------------|---------------------------------------------|---------------------------------------|
| Algeria                 | AFRO               | Algeria                                       | No data                   | No data                                     | NA [b]                                |
| Angola                  | AFRO               | Angola                                        | No data                   | GAM                                         | NA [b]                                |
| Benin                   | AFRO               | Angola                                        | WHO                       | GAM                                         | 3                                     |
| Botswana                | AFRO               | Angola                                        | GAM                       | GAM                                         | 4                                     |
| Burkina Faso            | AFRO               | Angola                                        | No data                   | GAM                                         | 0                                     |
| Burundi                 | AFRO               | Angola                                        | No data                   | GAM                                         | 0                                     |
| Cabo Verde              | AFRO               | Angola                                        | No data                   | WHO                                         | NA [b]                                |
| Cameroon                | AFRO               | Angola                                        | No data                   | GAM                                         | 2                                     |
| Central African Republic| AFRO               | Angola                                        | No data                   | GAM                                         | 0                                     |
| Chad                    | AFRO               | Angola                                        | No data                   | WHO                                         | NA [b]                                |
| Comoros                 | AFRO               | Angola                                        | No data                   | GAM                                         | 0                                     |
| Congo                   | AFRO               | Angola                                        | No data                   | WHO                                         | 0                                     |
| Côte d’Ivoire           | AFRO               | Angola                                        | No data                   | GAM                                         | 0                                     |
| Democratic Republic of the Congo | AFRO | Angola                                        | WHO                       | WHO                                         | 0                                     |
| Equatorial Guinea       | AFRO               | Angola                                        | No data                   | WHO                                         | 0                                     |
| Eritrea                 | AFRO               | Angola                                        | WHO                       | WHO                                         | 0                                     |
| Eswatini                | AFRO               | Angola                                        | GAM                       | WHO                                         | 4                                     |
| Ethiopia                | AFRO               | Angola                                        | GAM                       | GAM                                         | 2                                     |
| Gabon                   | AFRO               | Angola                                        | No data                   | GAM                                         | 0                                     |
| Gambia                  | AFRO               | Angola                                        | GAM                       | WHO                                         | 1                                     |
| Ghana                   | AFRO               | Angola                                        | No data                   | GAM                                         | 0                                     |
| Guinea                  | AFRO               | Angola                                        | No data                   | GAM                                         | 0                                     |
| Guinea-Bissau           | AFRO               | Angola                                        | No data                   | GAN                                         | 0                                     |
| Kenya                   | AFRO               | Angola                                        | WHO                       | GAM                                         | 6                                     |
| Lesotho                 | AFRO               | Angola                                        | GAM                       | GAM                                         | 6                                     |
| Liberia                 | AFRO               | Angola                                        | No data                   | WHO                                         | 0                                     |
| Madagascar              | AFRO               | Angola                                        | No data                   | WHO                                         | 0                                     |
| Malawi                  | AFRO               | Angola                                        | GAM                       | GAM                                         | 2                                     |
| Mali                    | AFRO               | Angola                                        | WHO                       | WHO                                         | 2                                     |
| Mauritania              | AFRO               | Angola                                        | No data                   | WHO                                         | 0                                     |
| Mauritius               | AFRO               | Angola                                        | GAM                       | GAM                                         | 3                                     |
| Mozambique              | AFRO               | Angola                                        | GAM                       | WHO                                         | 3                                     |
| Namibia                 | AFRO               | Angola                                        | WHO                       | GAM                                         | 4                                     |
| Niger                   | AFRO               | Angola                                        | No data                   | GAM                                         | 0                                     |
| Nigeria                 | AFRO               | Angola                                        | GAM                       | GAM                                         | 4                                     |
| Rwanda                  | AFRO               | Angola                                        | WHO                       | WHO                                         | 2                                     |
| Sao Tome and Principe   | AFRO               | Angola                                        | No data                   | WHO                                         | NA [b]                                |
| Senegal                 | AFRO               | Angola                                        | No data                   | GAM                                         | 0                                     |
| Seychelles              | AFRO               | Angola                                        | GAM                       | GAM                                         | 4                                     |
| Sierra Leone            | AFRO               | Angola                                        | No data                   | GAM                                         | 0                                     |
| South Africa            | AFRO               | Angola                                        | GAM                       | GAM                                         | 6                                     |
| South Sudan             | AFRO               | Angola                                        | No data                   | GAM                                         | 0                                     |
| Togo                    | AFRO               | Angola                                        | WHO                       | GAM                                         | 0                                     |
| Uganda                  | AFRO               | Angola                                        | GAM                       | WHO                                         | 6                                     |
| United Republic of Tanzania | AFRO | Angola                                        | WHO                       | GAM                                         | 4                                     |
| Zambia                  | AFRO               | Angola                                        | WHO                       | GAM                                         | 6                                     |
| Zimbabwe                | AFRO               | Angola                                        | WHO                       | GAM                                         | 4                                     |

[a] Each country was allocated a step on a ‘PrEP trajectory’ to forecast future PrEP user numbers. See below for details.

[b] The country was not included in the PrEP forecasting either because it was not considered to be on a ‘PrEP trajectory’ or because no ‘PrEP seed’ could be estimated due to lack of data on numbers of people living with HIV. See below for details.
| Country                  | Region          | PrEP user data source | WHO PrEP recommendation adoption data source | PrEP trajectory step (forecasting) |
|--------------------------|-----------------|-----------------------|---------------------------------------------|----------------------------------|
| Afghanistan              | EMRO            | No data               | WHO                                         | NA [b]                          |
| Bahrain                  | EMRO            | No data               | No data                                     | NA [b]                          |
| Djibouti                 | EMRO            | No data               | No data                                     | NA [b]                          |
| Egypt                    | EMRO            | No data               | GAM                                         | 0                               |
| Iran (Islamic Republic of)| EMRO            | No data               | GAM                                         | 0                               |
| Iraq                     | EMRO            | No data               | No data                                     | NA [b]                          |
| Jordan                   | EMRO            | No data               | GAM                                         | NA [b]                          |
| Kuwait                   | EMRO            | No data               | GAM                                         | NA [b]                          |
| Lebanon                  | EMRO            | WHO                   | WHO                                         | 1                               |
| Libya                    | EMRO            | No data               | No data                                     | NA [b]                          |
| Morocco                  | EMRO            | GAM                   | GAM                                         | 3                               |
| Oman                     | EMRO            | No data               | GAM                                         | 0                               |
| Pakistan                 | EMRO            | WHO                   | WHO                                         | 1                               |
| Qatar                    | EMRO            | No data               | No data                                     | NA [b]                          |
| Saudi Arabia             | EMRO            | No data               | GAM                                         | NA [b]                          |
| Somalia                  | EMRO            | No data               | GAM                                         | NA [b]                          |
| Sudan                    | EMRO            | No data               | GAM                                         | 0                               |
| Syrian Arab Republic     | EMRO            | No data               | GAM                                         | 0                               |
| Tunisia                  | EMRO            | No data               | WHO                                         | 0                               |
| United Arab Emirates     | EMRO            | No data               | No data                                     | NA [b]                          |
| Yemen                    | EMRO            | No data               | No data                                     | NA [b]                          |

[a] Each country was allocated a step on a ‘PrEP trajectory’ to forecast future PrEP user numbers. See below for details.

[b] The country was not included in the PrEP forecasting either because it was not considered to be on a ‘PrEP trajectory’ or because no ‘PrEP seed’ could be estimated due to lack of data on numbers of people living with HIV. See below for details.
Table S2 cont.

| Country                  | Region     | WHO PrEP user data source | WHO PrEP recommendation adoption data source | WHO Regional Office for the European Region: EURO |
|--------------------------|------------|---------------------------|---------------------------------------------|--------------------------------------------------|
| Albania                  | EURO       | No data                   | GAM                                         | WHO                                             |
| Andorra                  | EURO       | No data                   | No data                                     | NA [b]                                          |
| Armenia                  | EURO       | GAM                       | GAM                                         | 3                                               |
| Austria                  | EURO       | WHO                       | WHO                                         | 3                                               |
| Azerbaijan               | EURO       | No data                   | GAM                                         | 0                                               |
| Belarus                  | EURO       | WHO                       | GAM                                         | 0                                               |
| Belgium                  | EURO       | No data                   | DATA                                        | NA [b]                                          |
| Bosnia and Herzegovina   | EURO       | No data                   | WHO [c]                                     | NA [b]                                          |
| Bulgaria                 | EURO       | No data                   | WHO [c]                                     | NA [b]                                          |
| Croatia                  | EURO       | WHO                       | WHO                                         | 2                                               |
| Cyprus                   | EURO       | WHO                       | WHO [c]                                     | 2                                               |
| Czech Republic           | EURO       | WHO                       | WHO                                         | 2                                               |
| Denmark                  | EURO       | No data                   | WHO                                         | NA [b]                                          |
| Estonia                  | EURO       | No data                   | WHO                                         | NA [b]                                          |
| Finland                  | EURO       | No data                   | WHO                                         | NA [b]                                          |
| France                   | EURO       | WHO                       | WHO                                         | 4                                               |
| Georgia                  | EURO       | GAM                       | GAM                                         | 3                                               |
| Germany                  | EURO       | WHO                       | WHO [a]                                     | NA [b]                                          |
| Greece                   | EURO       | No data                   | WHO [a]                                     | NA [b]                                          |
| Hungary                  | EURO       | No data                   | WHO [a]                                     | NA [b]                                          |
| Iceland                  | EURO       | WHO                       | WHO                                         | 2                                               |
| Ireland                  | EURO       | No data                   | WHO                                         | 0                                               |
| Israel                   | EURO       | No data                   | WHO                                         | NA [b]                                          |
| Italy                    | EURO       | WHO                       | WHO [a]                                     | 2                                               |
| Kazakhstan               | EURO       | No data                   | GAM                                         | 0                                               |
| Kyrgyzstan               | EURO       | GAM                       | GAM                                         | 3                                               |
| Latvia                   | EURO       | No data                   | WHO [a]                                     | NA [b]                                          |
| Lithuania                | EURO       | No data                   | WHO [a]                                     | NA [b]                                          |
| Luxembourg               | EURO       | WHO                       | WHO [a]                                     | 3                                               |
| Malta                    | EURO       | No data                   | WHO                                         | NA [b]                                          |
| Monaco                   | EURO       | No data                   | WHO                                         | NA [b]                                          |
| Montenegro               | EURO       | No data                   | GAM                                         | NA [b]                                          |
| Netherlands              | EURO       | WHO                       | WHO                                         | 3                                               |
| North Macedonia          | EURO       | WHO                       | WHO                                         | NA [b]                                          |
| Norway                   | EURO       | WHO                       | WHO                                         | 5                                               |
| Poland                   | EURO       | WHO                       | WHO                                         | 2                                               |
| Portugal                 | EURO       | No data                   | WHO                                         | NA [b]                                          |
| Republic of Moldova      | EURO       | GAM                       | GAM                                         | 2                                               |
| Romania                  | EURO       | No data                   | WHO [a]                                     | NA [b]                                          |
| Russian Federation       | EURO       | No data                   | WHO [a]                                     | NA [b]                                          |
| San Marino               | EURO       | No data                   | No data                                     | NA [b]                                          |
| Serbia                   | EURO       | No data                   | GAM                                         | 0                                               |
| Slovakia                 | EURO       | No data                   | WHO [a]                                     | NA [b]                                          |
| Slovenia                 | EURO       | WHO                       | WHO [a]                                     | 1                                               |
| Spain                    | EURO       | WHO                       | WHO                                         | 2                                               |
| Sweden                   | EURO       | WHO                       | WHO                                         | 3                                               |
| Switzerland              | EURO       | WHO                       | WHO                                         | 4                                               |
| Tajikistan               | EURO       | No data                   | GAM                                         | 0                                               |
| Turkey                   | EURO       | No data                   | DATA                                        | NA [b]                                          |
| Turkmenistan             | EURO       | No data                   | DATA                                        | NA [b]                                          |
| Ukraine                  | EURO       | GAM                       | WHO                                         | 4                                               |
| United Kingdom of Great Britain and Northern Ireland | EURO | WHO | WHO | 4 |
| Uzbekistan               | EURO       | No data                   | GAM                                         | 0                                               |

* Each country was allocated a step on a ‘PrEP trajectory’ to forecast future PrEP user numbers. See below for details.
* The country was not included in the PrEP forecasting either because it was not considered to be on a ‘PrEP trajectory’ or because no ‘PrEP seed’ could be estimated due to lack of data on numbers of people living with HIV. See below for details.
* Data were obtained by the WHO Regional Office for Europe through the European Centre for Disease Prevention and Control (ECDC) as published here: https://www.ecdc.europa.eu/sites/default/files/documents/HIV-pre-exposure-prophylaxis-evidence-2019_0.pdf
* Data for PrEP users in Germany were based on a publication by the Robert Koch Institute, Germany: https://www.researchsquare.com/article/rs-156075/v2
Table S2 cont.

| Country                                | Region | PrEP user data source | WHO PrEP recommendation adoption data source | PrEP trajectory step (forecasting) |
|----------------------------------------|--------|-----------------------|---------------------------------------------|-----------------------------------|
| Antigua and Barbuda                    | PAHO   | No data               | GAM                                        | NA [b]                            |
| Argentina                              | PAHO   | WHO                   | WHO                                        | 1                                 |
| Bahamas                                | PAHO   | WHO                   | WHO                                        | 4                                 |
| Barbados                               | PAHO   | GAM                   | WHO                                        | 3                                 |
| Belize                                 | PAHO   | No data               | WHO                                        | NA [b]                            |
| Bolivia (Plurinational State of)       | PAHO   | No data               | GAM                                        | 0                                 |
| Brazil                                 | PAHO   | GAM                   | GAM                                        | 3                                 |
| Canada                                 | PAHO   | WHO                   | GAM                                        | 3                                 |
| Chile                                  | PAHO   | GAM                   | GAM                                        | 1                                 |
| Colombia                               | PAHO   | GAM                   | WHO                                        | 1                                 |
| Costa Rica                             | PAHO   | No data               | WHO                                        | 0                                 |
| Cuba                                   | PAHO   | GAM                   | WHO                                        | 2                                 |
| Dominica                               | PAHO   | No data               | WHO                                        | NA [b]                            |
| Dominican Republic                     | PAHO   | GAM                   | WHO                                        | 2                                 |
| Ecuador                                | PAHO   | GAM                   | GAM                                        | 2                                 |
| El Salvador                            | PAHO   | No data               | GAM                                        | NA [b]                            |
| Grenada                                | PAHO   | WHO                   | WHO                                        | NA [b]                            |
| Guatemala                              | PAHO   | GAM                   | GAM                                        | 3                                 |
| Guyana                                 | PAHO   | No data               | WHO                                        | 0                                 |
| Haiti                                  | PAHO   | GAM                   | WHO                                        | 2                                 |
| Honduras                               | PAHO   | No data               | WHO                                        | NA [b]                            |
| Jamaica                                | PAHO   | No data               | WHO                                        | 0                                 |
| Mexico                                 | PAHO   | WHO                   | GAM                                        | 2                                 |
| Nicaragua                              | PAHO   | No data               | GAM                                        | NA [b]                            |
| Panama                                 | PAHO   | No data               | WHO                                        | NA [b]                            |
| Paraguay                               | PAHO   | WHO                   | WHO                                        | 1                                 |
| Peru                                   | PAHO   | GAM                   | WHO                                        | 2                                 |
| Saint Kitts and Nevis                  | PAHO   | No data               | WHO                                        | NA [b]                            |
| Saint Lucia                            | PAHO   | No data               | WHO                                        | NA [b]                            |
| Saint Vincent and the Grenadines       | PAHO   | No data               | WHO                                        | NA [b]                            |
| Suriname                               | PAHO   | No data               | WHO                                        | NA [b]                            |
| Trinidad and Tobago                    | PAHO   | No data               | WHO                                        | NA [b]                            |
| United States of America               | PAHO   | WHO [a]               | WHO                                        | 8                                 |
| Uruguay                                | PAHO   | GAM                   | WHO                                        | 4                                 |
| Venezuela (Bolivarian Republic of)     | PAHO   | WHO                   | WHO                                        | 0                                 |

*a* Each country was allocated a step on a ‘PrEP trajectory’ to forecast future PrEP user numbers. See below for details.

*b* The country was not included in the PrEP forecasting either because it was not considered to be on a ‘PrEP trajectory’ or because no ‘PrEP seed’ could be estimated due to lack of data on numbers of people living with HIV. See below for details.

*e* Data for PrEP users in the US were based on information provided by Gilead Sciences, Inc., in the quarterly investors’ earnings call for the fourth quarter of 2019.
| Country                                      | Region                | PrEP user data source | WHO PrEP recommendation adoption data source | PrEP trajectory step (forecasting) |
|----------------------------------------------|-----------------------|-----------------------|---------------------------------------------|-----------------------------------|
| Bangladesh                                   | SEARO                 | WHO                   | WHO                                         | NA [b]                           |
| Bhutan                                       | SEARO                 | WHO                   | WHO                                         | NA [b]                           |
| Democratic People’s Republic of Korea        | SEARO                 | WHO                   | WHO                                         | NA [b]                           |
| India                                        | SEARO                 | WHO                   | WHO                                         | 4                                |
| Indonesia                                    | SEARO                 | WHO                   | GAM                                         | NA [b]                           |
| Maldives                                     | SEARO                 | WHO                   | WHO                                         | NA [b]                           |
| Myanmar                                      | SEARO                 | WHO                   | GAM                                         | 0                                |
| Nepal                                        | SEARO                 | WHO                   | WHO                                         | 2                                |
| Sri Lanka                                    | SEARO                 | WHO                   | WHO                                         | NA [b]                           |
| Thailand                                     | SEARO                 | WHO                   | GAM                                         | 3                                |
| Timor-Leste                                  | SEARO                 | WHO                   | WHO                                         | NA [b]                           |
| WHO Regional Office for the South-East Asia Region: SEARO |
| Australia                                    | WPRO                  | WHO                   | WHO                                         | 4                                |
| Brunei Darussalam                            | WPRO                  | GAM                   | No data                                      | NA [b]                           |
| Cambodia                                     | WPRO                  | GAM                   | WHO                                         | 1                                |
| China                                        | WPRO                  | WHO                   | WHO                                         | 2                                |
| Cook Islands                                 | WPRO                  | No data               | No data                                      | NA [b]                           |
| Fiji                                         | WPRO                  | WHO                   | WHO                                         | 0                                |
| Japan                                        | WPRO                  | WHO                   | WHO                                         | 2                                |
| Kiribati                                     | WPRO                  | No data               | WHO                                         | NA [b]                           |
| Lao People’s Democratic Republic             | WPRO                  | WHO                   | WHO                                         | 0                                |
| Malaysia                                     | WPRO                  | WHO                   | WHO                                         | 3                                |
| Marshall Islands                             | WPRO                  | No data               | WHO                                         | NA [b]                           |
| Micronesia (Federated States of)             | WPRO                  | No data               | WHO                                         | NA [b]                           |
| Mongolia                                     | WPRO                  | GAM                   | WHO                                         | 4                                |
| Nauru                                        | WPRO                  | No data               | WHO                                         | NA [b]                           |
| New Zealand                                  | WPRO                  | WHO                   | GAM                                         | 3                                |
| Niue                                         | WPRO                  | No data               | No data                                      | NA [b]                           |
| Palau                                        | WPRO                  | No data               | WHO                                         | NA [b]                           |
| Papua New Guinea                             | WPRO                  | WHO                   | WHO                                         | 0                                |
| Philippines                                  | WPRO                  | WHO                   | GAM                                         | 2                                |
| Republic of Korea                            | WPRO                  | No data               | WHO                                         | NA [b]                           |
| Samoa                                        | WPRO                  | No data               | WHO                                         | NA [b]                           |
| Singapore                                    | WPRO                  | WHO                   | WHO                                         | 1                                |
| Solomon Islands                              | WPRO                  | No data               | WHO                                         | NA [b]                           |
| Tonga                                        | WPRO                  | No data               | WHO                                         | NA [b]                           |
| Tuvalu                                       | WPRO                  | No data               | WHO                                         | NA [b]                           |
| Vanuatu                                      | WPRO                  | No data               | WHO                                         | NA [b]                           |
| Viet Nam                                     | WPRO                  | GAM                   | WHO                                         | 3                                |
| WHO Regional Office for the Western Pacific Region: WPRO |

[a] Each country was allocated a step on a ‘PrEP trajectory’ to forecast future PrEP user numbers. See below for details.

[b] The country was not included in the PrEP forecasting either because it was not considered to be on a ‘PrEP trajectory’ or because no ‘PrEP seed’ could be estimated due to lack of data on numbers of people living with HIV. See below for details.
Details on PrEP user forecasting

PrEP trajectories
In order to project numbers of PrEP users to 2023, each country was allocated a ‘step’ along a ‘PrEP trajectory’ based on the year they first adopted WHO PrEP recommendations and reported PrEP users (whichever came first), with increasing steps as per the number of continuous years of reported PrEP users up to and including 2019. For instance, a country reporting PrEP use first in 2019 was on ‘step 1’, while a country reporting PrEP use in both 2018 and 2019 was on ‘step 2’. Countries that did not report any PrEP users in 2019 (either zero use or missing data) were considered on ‘step 0’ if the WHO PrEP recommendations were adopted or ‘pending’ adoption (regardless of any PrEP users reported in years before 2019). Countries that did not report any PrEP users in 2019 and where WHO PrEP recommendations were not adopted or pending were not considered to be on a PrEP trajectory (regardless of any PrEP users reported before 2019). These countries were excluded from the forecasting. Table S2 lists the PrEP trajectory steps for each country and countries that were excluded from the forecasting.

Example PrEP trajectories
To forecast PrEP user trends in countries, two to three example countries with at least three years’ of current PrEP user data available were selected per region as ‘example PrEP trajectories’. These represented different HIV epidemics and PrEP programme histories (Table S3). The selection of example countries was driven by availability of historic PrEP data in countries as a greater number of data points improves the estimation of the example PrEP trajectories. Where possible, example countries were those with four years of PrEP user data (from 2016-2019). Countries with small numbers of PrEP users in 2019 (under 100) were not considered as candidates for example countries as PrEP user numbers were likely to fluctuate from year to year. Countries with a considerable decrease in reported PrEP users between any two consecutive years (10% or more) were not considered example country candidates as this may have suggested the ending a PrEP study or pilot project without subsequent implementation of a national programme. Example countries were also selected to represent different HIV epidemics and PrEP programme histories as well as different sub-regions within regions. Where there were insufficient numbers of countries with four years of current PrEP user data, countries with three years (2017-2019) were considered as candidates for example countries. There were only two instances where there were more than three candidate countries per region as per these selection criteria. In the African region, Kenya, Nigeria, South Africa, and Zimbabwe were identified as possible example countries. Nigeria and Kenya were selected to represent the western and eastern African sub-regions, respectively. South Africa was selected over Zimbabwe due to the fact that the observed trajectory in Zimbabwe was very similar to the trajectory in Kenya. In the European region, France and the UK were both possible candidates to represent the western Europe (high-income) sub-region; however, at the time of the implementation of the forecasting methodology, the data from the UK had not yet been received in full, so it France was selected.

In the regions where there were insufficient numbers of example country candidates, example countries from other regions were selected based on similarity in HIV epidemics, PrEP programme histories, and geographic proximity. For the Eastern Mediterranean region, where there were no data that met our criteria, Nigeria and Georgia were selected due to their similarly concentrated HIV epidemics and geographic proximity. Other example countries in the African region (South Africa and Kenya) and European region (France and Ukraine) were considered less suitable example candidates for this region. Similarly, for the South-East Asia region, Viet Nam was selected as a suitable candidate due to its similar epidemic profile and geographic proximity.

Given historic trends in PrEP user growth that indicate exponential growth, logistic growth curves (initial slow growth that turns into exponential growth and then increasing flattening of the curve) were fitted to the PrEP user data and an assumed ‘PrEP equilibrium’ in each example country by minimising the squared error between data and fitted curve. The PrEP user equilibrium represents the number of PrEP users will be reached by 2030. PrEP equilibria were calculated as a share of an assumed global level of five million PrEP users in 2030 depending on the number of people living with HIV (PLHIV) in the country. For instance, 7.5 million of the global 38 million PLHIV in 2019 (19.7%) were living in South Africa [2], so the PrEP equilibrium was 986,842 PrEP users in 2030 (which is 19.7% of all those assumed to be on PrEP in 2030). Numbers of PLHIV instead of HIV incidence was used due to better global data availability. PrEP equilibria do not represent PrEP targets. The PrEP equilibrium in 2030 were necessary for example trajectory curve fitting but effects on forecasting of PrEP user trends in countries were limited as this was restricted to 2023 (see results of a sensitivity analysis below). Logistic growth curves were fitted as

$$PrEP_t = \frac{PrEP_{max}}{1 + e^{-a(t-t_{max})}}$$
Where $\text{PrEP}_t$ is the number of PrEP users at time $t$, $\text{PrEP}_{\text{max}}$ is the maximum number of PrEP users that will be reached by 2030 (the pre-specified PrEP equilibrium), $t_{\text{max}}$ is the time point of maximum growth (after which the growth curve starts to flatten), and $a$ is growth parameter. The squared difference between the fitted curve and the observed difference was the error for the curve fitting. The parameters $a$ and $t_{\text{max}}$ were optimised to minimise the error with a Generalized Reduced Gradient (GRG) Nonlinear method using Microsoft Excel Solver. Since it was considered important that the growth rates early in the fitted example PrEP trajectories appropriately reflect the PrEP number growth observed in these countries (given that these early growth rates was most important for global projections until 2023), the first value of the fitted curve was constrained to be the same as the first observed number of PrEP users in the example country. This ensured that the fitted curve accurately reflects the growth observed in the first few years after PrEP introduction in the example countries.

After fitting the logistic growth curve to each example country, the growth rate between each two successive years was calculated for the example trajectory. In addition to the ‘observed growth trajectory’ in each example country, a lower growth example trajectory was estimated by multiplying the growth rate between each two years by 0.75. In the Eastern Mediterranean and South-East Asia region, only two countries had sufficient PrEP user data to calculate example trajectories in the Eastern Mediterranean and South East-East Asia regions, so there would only be four example trajectories (two observed and two reduced growth trajectories). The example countries in these regions had relatively low growth rates compared to some other example countries in other regions. For instance, in Nigeria (an example country for the Eastern Mediterranean region), the average growth per year in the first three years after PrEP introduction (based on the available data) was 117%, compared to 287% in South Africa or 188% in Kenya (the two other example countries for the African region). This is similarly true for Thailand (116%) in the South-East Asia region. To model the possibility that countries in these two regions experience higher growth than in these example countries, an additional ‘higher growth trajectory’ was created by multiplying the observed growth rate by 1.25 at each time point. This means that there were a total of six trajectories per region. The impact of including this additional higher growth rate trajectory on global estimates of PrEP users was relatively limited as only about 1.8% of PrEP users were projected to reside in these two regions in 2023 (see main article).

**Applying example PrEP trajectories**

The relative PrEP user growth rates between each year was were applied to all countries in the corresponding region, depending on the country’s step on the PrEP trajectory. For instance, for a country on ‘step 1’ of the PrEP trajectory, growth rates between the first two years of the example trajectories were applied to the number of PrEP users in that country in 2019 to estimate PrEP users in 2020, followed by growth rates between the second and third years of the example trajectories, and so on.

All PrEP trajectories in a region were also applied to the example countries. The PrEP equilibria for these example countries only constrained one of the fitted trajectory for these countries (as well as the 25% lower trajectory); the other four trajectories in the region where applied to the example country without being constrained by the PrEP equilibrium. The PrEP equilibrium was also only relevant for the fitting of the example trajectories in the example countries. Projections in other countries were not constrained by the equilibrium.

**PrEP seeding**

For countries without PrEP user data for 2019 but that were on step 0 of the PrEP trajectory, a ‘PrEP seed’ was estimated for 2020 to which example growth rates were applied. PrEP seeds were estimated as the mean number of PrEP users reported in the first year of data availability per PLHIV in a region multiplied by the number of PLHIV in a country (using 2019 data for PLHIV). After PrEP seeding, example growth rates were applied for subsequent years of projected growth.

**Calculating future PrEP user numbers in different scenarios**

With the six example trajectories applied, the average number of PrEP users in each year in each country was calculated for the three observed growth rate example trajectories and the three 25%-reduced trajectories. These means were summed up per region and globally. Additionally, a linear growth scenario was modelled in which the increase observed between the last two years of data was added every year until 2023 and no new countries were assumed to have PrEP services. Finally, one COVID-19 disruption scenario was modelled in which no growth in 2020 was assumed and PrEP seeding in countries was postponed until 2021. After the 2020 disruption, PrEP user growth was modelled with the same trajectories as in scenarios without disruptions.
Table S3: PrEP example trajectories and average PrEP seeds per WHO region for PrEP user forecasting.

| Region  | Regional PrEP seed per 100,000 PLHIV \(^a\) | Example PrEP trajectories | Assumed PrEP equilibrium in 2030 for example country \(^b\) |
|---------|---------------------------------------------|---------------------------|--------------------------------------------------|
| AFRO    | 176.8                                       | South Africa              | 986842                                           |
|         |                                              | Kenya                     | 197368                                           |
|         |                                              | Nigeria                   | 236842                                           |
| EMRO    | 533.3 \(^c\)                                | Nigeria \(^d\)             | 236842                                           |
|         |                                              | Georgia \(^d\)             | 1197                                             |
| EURO    | 1785.7                                      | France                    | 50000 \(^e\)                                     |
|         |                                              | Ukraine                   | 32894                                            |
|         |                                              | Georgia                   | 1197                                             |
| PAHO    | 333.4                                       | Guatemala                  | 4737                                             |
|         |                                              | Brazil                    | 121053                                           |
|         |                                              | USA                       | 315789 \(^f\)                                    |
| SEARO   | 139.3                                       | Thailand \(^g\)            | 61842                                            |
|         |                                              | Viet Nam \(^h\)           | 30263                                            |
| WPRO    | 5376.6                                      | Australia                 | 76316 \(^i\)                                     |
|         |                                              | Viet Nam                  | 30263                                            |
|         |                                              | Thailand \(^i\)            | 61842                                            |

Regions refer to the WHO regions: AFRO: African Regional Office; EMRO: Eastern Mediterranean Regional Office; EURO: European Regional Office; PAHO: Pan-American Health Organization (Americas region); SEARO: South-East Asia Regional Office; WPRO: Western Pacific Regional Office.

\(^a\) The PrEP seed was calculated as the average number of PrEP users in the year of first data availability across WHO member states in a region per people living with HIV (PLHIV).

\(^b\) PrEP targets for each example PrEP trajectory was based on the ‘PrEP need’, calculated as the number of PLHIV in the country as a share of all PLHIV multiplied by an assumed global PrEP target of five million PrEP users by 2030.

\(^c\) Due to limited data availability in the EMRO region, the PrEP seed was based on the two countries with available data (Morocco and Pakistan) and the data from the example countries Nigeria and Georgia.

\(^d\) No example country with at least three years of PrEP user data was available for the EMRO region. Nigeria (AFRO) and Georgia (EURO) were selected as example countries to represent concentrated HIV epidemics. To generate six example trajectories, PrEP user growth rates of fitted trajectories for both example countries were multiplied by 0.75 and 1.25, respectively, at each time point.

\(^e\) As a proportion of global PLHIV, the PrEP target for the France was 25000. This was multiplied by 2 given that the country was already close to that target.

\(^f\) As a proportion of global PLHIV, the PrEP target for the USA was 157895. This was multiplied by 2 given that the country already surpassed that target.

\(^g\) Only one example country with at least three years of PrEP user data was available for the SEARO region (Thailand). Viet Nam (WPRO) was selected as an additional model example. To generate six example trajectories, PrEP user growth rates of fitted trajectories for both example countries were multiplied by 0.75 and 1.25, respectively, at each time point.

\(^h\) As a proportion of global PLHIV, the PrEP target for Australia was 3816. This was multiplied by 20 given that the country already surpassed that target by a factor of 10.

\(^i\) Only two example countries with at least three years of PrEP user data were available for the WPRO region (Australia and Viet Nam). Thailand (SEARO) was selected as an additional example country.
Sensitivity analysis for the PrEP forecasting

As outlined above, a global PrEP equilibrium of 5 million PrEP users was used to estimate PrEP users in the example countries by 2030, which was necessary for fitting example curves. It did not constrain global projections, and, as shown in the main article, under one growth scenario there were more than 5 million PrEP users already in 2023. A sensitivity analysis was conducted in which the global PrEP equilibrium was set at 30% lower (3.5 million) and 30% higher (6.5 million). Figure S1 show the results of the forecasting. The means of the observed growth scenarios were within the range of scenarios presented in the main article and the mean was about 13% higher with the higher equilibrium assumption (Figure S1A) and about 19% lower with the lower equilibrium assumption (Figure S1B). With these different assumed equilibria, twelve additional PrEP trajectories were estimated that were higher or lower than the ones presented in the main article. This underscores the importance of considering the range of possible future outcomes and uncertainty around the estimates.

**A: Global PrEP user forecast scenarios without COVID disruptions: 3.5 million equilibrium**

![Graph A](image)

**B: Global PrEP user forecast scenarios without COVID disruptions: 6.5 million equilibrium**

![Graph B](image)

**Figure S1:** Forecasted numbers of people who have received oral pre-exposure prophylaxis (PrEP) at least once (PrEP users) globally per year until 2023 without assumed COVID-19 disruptions with an assumed global PrEP equilibrium for example trajectory fitting of 3.5 million (A) and 6.5 million (B). The projected growth (orange) was based on three observed example trajectories for each region applied to all countries in the corresponding region. The projected lower growth (blue) was based on the example trajectories with 25% lower growth at each time step. Countries that had adopted the WHO PrEP recommendations or were pending the adoption were assumed to introduce PrEP services in 2020. In the linear growth scenario, the same number of PrEP users was added to each country as observed between the last two years of data availability and no country was assumed to introduce PrEP services.
References for the Research in context panel

Balaya T, Begovac J, Skrzat-Klapaczyńska A, et al. Where are we with pre-exposure prophylaxis use in Central and Eastern Europe? Data from the Euroguidelines in Central and Eastern Europe (ECEE) Network Group. HIV Med 2021; 22: 67–72.

Haldar P, Reza-Paul S, Arokiam Daniel R, et al. A rapid review of pre-exposure prophylaxis for HIV in the Asia-Pacific region: recommendations for scale up and future directions. Sex Health 2021; 18: 31–40.

Hodges-Mameletzis I, Dalal S, Msimanga-Radebe B, Rodolph M, Baggaley R. Going global: the adoption of the World Health Organization's enabling recommendation on oral pre-exposure prophylaxis for HIV. Sex Health 2018; 15: 489–500.

Moseholm E, Gilleece Y, Collins B, et al. Achievements and gaps to provide pre-exposure prophylaxis (PrEP) for women across the European Region - Results from a European survey study. J Virus Erad 2020; 7: 100026.