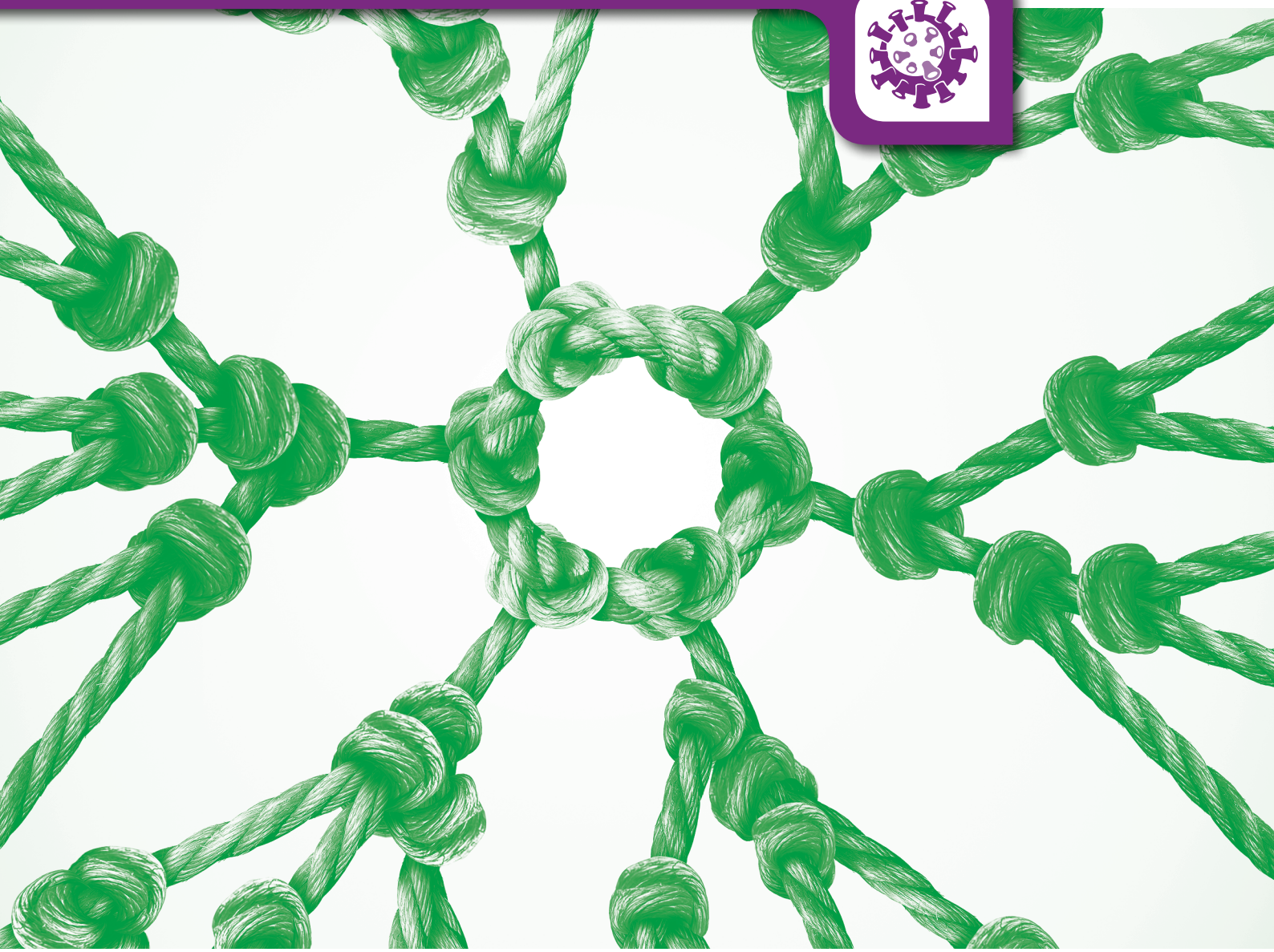
HIV DRUG RESISTANCE REPORT 2019



World Health Organization

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DEFINITIONS

HIV drug resistance (HIVDR) is caused by one or more changes (mutation/s) in the genetic structure of HIV that affects the ability of a specific drug or combination of drugs to block replication of the virus. All current antiretroviral (ARV) drugs, including newer classes, are at risk of becoming partly or fully inactive because of the emergence of drug-resistant virus. People receiving ART can acquire HIVDR, and people can also be infected with HIV that is already drug resistant. WHO commonly classify HIVDR into three main categories.

1. **Acquired HIV drug resistance (ADR)** develops because of viral replication in the presence of ARV drugs.
2. **Transmitted HIV drug resistance (TDR)** is detected among ARV drug–naive people with no history of ARV drug exposure. TDR occurs when previously uninfected individuals are infected with virus that has drug resistance mutations.
3. **Pretreatment HIV drug resistance (PDR)** refers to resistance that is detected among ARV drug–naive people initiating ART or people with previous ARV drug exposure initiating or reinitiating first-line ART. PDR is either TDR or ADR or both. PDR may have been transmitted at the time of infection (TDR) or may be acquired through previous ARV drug exposure (such as among women exposed to ARV drugs for preventing mother-to-child transmission of HIV, among people who have received pre-exposure prophylaxis or among individuals reinitiating first-line ART after a period of treatment interruption).

ARV drug–naive applies to people with no history of ARV drug exposure.

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Financial acknowledgements. This report has been supported in part by the Government of the Netherlands and the United States President's Emergency Plan for AIDS Relief (PEPFAR) through the United States Centers for Disease Control and Prevention (CDC). We also acknowledge the support of Global Fund and PEPFAR to fund the HIVDR surveys. The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the funders.

EXECUTIVE SUMMARY

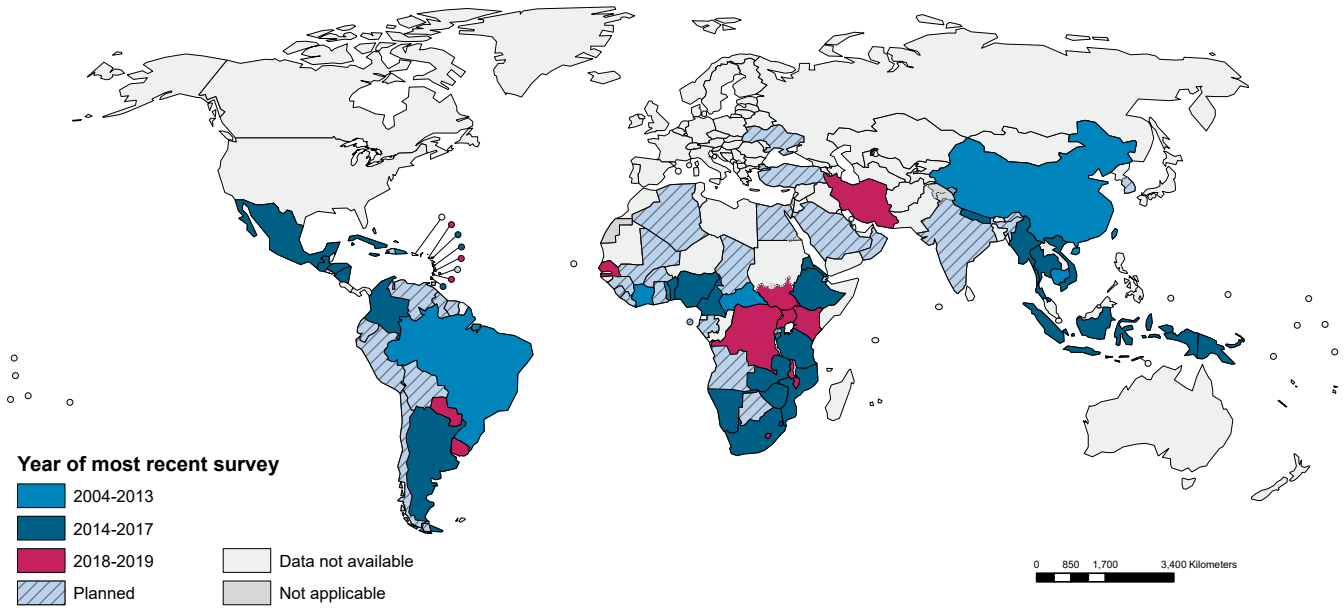
The rise in antimicrobial resistance (AMR) is one of the greatest threats to global health. If it is not urgently addressed, it may result in millions of deaths, an increase in new and hard-to-treat infections and increased health-care costs.[1] As a result, combatting AMR, including the threat posed by drug-resistant HIV, is a major goal for the global community. Prevention, monitoring and timely response to population levels of HIV drug resistance (HIVDR) is critical to achieving the WHO/UNAIDS 90–90–90 targets for 2020 that 90% of people living with HIV know their HIV status, 90% of those who know their HIV-positive status are accessing treatment and 90% of the people receiving treatment having suppressed viral loads. These targets reflect the global community's commitment to eliminating AIDS as a public health threat by 2030. In response to the threat of HIVDR to attaining these goals, the global health community launched a five-year Global Action Plan on HIVDR (2017–2021) that details a roadmap to prevent, monitor and respond to globally increasing levels of HIVDR. In response to the Global Action Plan, countries and funders are increasingly focusing on establishing robust and routine population-level monitoring of HIVDR to accompany the scaling up of antiretroviral therapy (ART) and supporting a safe transition to new antiretroviral (ARV) drugs in first- and second-line ART.

Substantial progress has been made in monitoring the population-level emergence and transmission of HIVDR. Between 2004 and 2018, 49 countries implemented surveys of HIVDR using WHO-recommended standard methods. A further 35 countries have plans to conduct surveys (**Fig. 1**). This report presents findings from 44 nationally representative HIVDR surveys implemented in 24 low- and middle-income countries using WHO standard survey methods.[2]

In 12 of 18 countries reporting survey data to WHO between 2014 and 2018, levels of pretreatment HIVDR (PDR) to efavirenz (EFV) and/or nevirapine (NVP) among adults initiating first-line ART exceeded 10% (**Fig. 2**). Overall, levels of NNRTI PDR are nearly twice as high among women as among men.

These findings are important, since women comprise a larger proportion of the population living with HIV globally and especially in sub-Saharan Africa, the region with the highest burden of HIV infection. Another subpopulation at high risk of PDR is individuals reinitiating first-line ART and reporting previous exposure to ARV drugs (for example, for preventing the mother-to-child transmission of HIV, previous ART for treating HIV infection, post-exposure prophylaxis (PEP) and pre-exposure prophylaxis (PrEP)

Fig. 1. Implementation of national HIV drug resistance surveys, 2004–2018



[1] No time to wait: securing the future from drug-resistant infections: report to the Secretary-General of the United Nations. New York: Ad Hoc Interagency Coordination Group on Antimicrobial Resistance; 2019 (https://www.who.int/antimicrobial-resistance/interagency-coordination-group/IACG_final_report_EN.pdf?ua=1, accessed 5 July 2019).

[2] HIV drug resistance surveillance guidance: 2015 update. Geneva: World Health Organization; 2015 (https://apps.who.int/iris/bitstream/handle/10665/204471/9789241510097_eng.pdf;jsessionid=42B6287D67B61D-47BC29C36FD598DAA8?sequence=1, accessed 5 July 2019).

Fig. 2. NNRTI pretreatment drug resistance in 18 countries reporting national survey data to WHO, 2014–2018

WHO region	Country	Survey year	Prevalence of NNRTI PDR				
			All (women and men)	Women	Men	ART initiators reporting being ARV drug naive	ART initiators reporting previous ARV drug exposure
African region	Cameroon	2015	<10%	10-30%	<10%	<10%	10-30%
	Eswatini	2016	10-30%	10-30%	<10%	<10%	10-30%
	Namibia	2015	10-30%	10-30%	10-30%	<10%	>30%
	Uganda	2016	10-30%	10-30%	10-30%	10-30%	10-30%
	South Africa	2017	10-30%	10-30%	10-30%		
	Zimbabwe	2015	10-30%	10-30%	<10%	10-30%	
Region of the Americas	Argentina	2014	10-30%	10-30%	10-30%	<10%	10-30%
	Brazil	2014	<10%	<10%	<10%	<10%	
	Colombia	2016	<10%	<10%	<10%	<10%	
	Cuba	2017	10-30%	>30%	10-30%	10-30%	
	Guatemala	2016	10-30%	10-30%	10-30%	10-30%	10-30%
	Honduras	2016	10-30%	>30%	10-30%	10-30%	>30%
	Mexico	2017	<10%	10-30%	<10%	<10%	10-30%
	Nicaragua	2016	10-30%	>30%	10-30%	10-30%	>30%
Western Pacific Region and South-East Asia Region	Myanmar	2016	<10%	<10%	<10%	<10%	10-30%
	Nepal	2016	10-30%	10-30%	10-30%		
	Papua New Guinea	2017	10-30%	10-30%	10-30%	10-30%	>30%
	Viet Nam	2017	<10%	<10%	<10%	<10%	10-30%

Prevalence of PDR to EFV and/or NVP: <10% 10-30% >30%

NNRTI resistance is defined as resistance to NVP or EFV. Previous ARV drug exposure: participants self-reporting being exposed to ARV drugs, such as women exposed to ARV drugs for preventing the mother-to-child transmission of HIV who interrupted ART after delivery and restarted care after a period of time; or defaulters restarting ART. Note that white (empty) cells represent lack of information because surveys excluded people with previous ARV drug exposure (Brazil, Colombia, Cuba and Zimbabwe) or no data on previous exposure were available (Nepal and South Africa).

Fig. 2. In 12 of 18 countries the NNRTI PDR prevalence had exceeded 10%. Among women, NNRTI PDR was >10% in 14/18 countries, while among men PDR NNRTI prevalence was >10% in 10/18 countries. The NNRTI PDR prevalence among individuals starting first-line ART and reporting previous ARV drug exposure exceeded 10% in all reporting countries.

believed to have been taken since the person became HIV positive). Twelve of 18 surveys included both ARV drug–naive ART initiators and ART starters reporting previous exposure to ARV drugs.

Among first-line ART initiators reporting prior ARV drug exposure, PDR to efavirenz and/or nevirapine is nearly three times higher than among ARV drug–naive individuals starting ART.

These findings are relevant, since the proportion of people starting treatment reporting previous ARV drug exposure ranged from 1.2% to 26.3% in countries reporting data and is projected to increase with the continuing global scale-up of ART.

A concerted global response to increasing levels of PDR is of paramount priority to WHO and its global partners. In 2017, WHO issued guidelines recommending using an alternative first-line regimen that does not contain efavirenz or nevirapine in countries in which resistance to these drugs exceeds 10%.[1] In addition, 2018 WHO ARV guidelines recommended the rapid adoption of dolutegravir (DTG)-based regimens as the preferred first-line treatment for adults and children that, if implemented, will help avert the negative effects of resistance to non-nucleoside reverse-transcriptase inhibitors (NNRTIs).

[1] Guidelines for the public heath response to pretreatment HIV drug resistance. Geneva: World Heath Organization; July 2017 (https://www.who.int/hiv/pub/guidelines/hivdr-guidelines-2017/en/)

The prevalence of PDR among children ≤18 months diagnosed with HIV through national early infant diagnosis programmes is alarmingly high. Based on surveys conducted in nine countries in sub-Saharan Africa between 2012 and 2018, over half of the infants newly diagnosed with HIV carry a virus that is resistant to efavirenz and/or nevirapine. Levels of PDR to nucleoside reverse-transcriptase inhibitors (NRTIs) also exceed 10% in some countries.

Since 2013, WHO has recommended using protease inhibitor (PI)-based ART regimens for children younger than three years old, and in 2018 WHO formally encouraged the phaseout of NNRTIs across age groups, with the introduction of DTG for children with approved dosing. However, in 2017, globally nearly 77% of young children were still receiving nevirapine in first-line ART because of limited supplies of child-friendly drug formulations.[1] Continual efforts to expand the capacity of manufacturing lopinavir/ritonavir pellets formulations and to accelerate the investigation and introduction of DTG across lower weight bands are required since the very high levels of PDR make NNRTI-based ART highly suboptimal. Levels of PDR to NRTIs, including abacavir (ABC), are also high in some countries, underscoring the need to routinely monitor population levels of resistance, especially when ABC is given in combination with drugs with relatively low genetic barriers to selecting drug resistance such as NNRTIs or raltegravir (a first-generation integrase inhibitor).

Achieving the third 90 target for maximal viral load suppression, thereby preventing the emergence and transmission of HIVDR, is critical for eliminating AIDS as a public health threat by 2030.

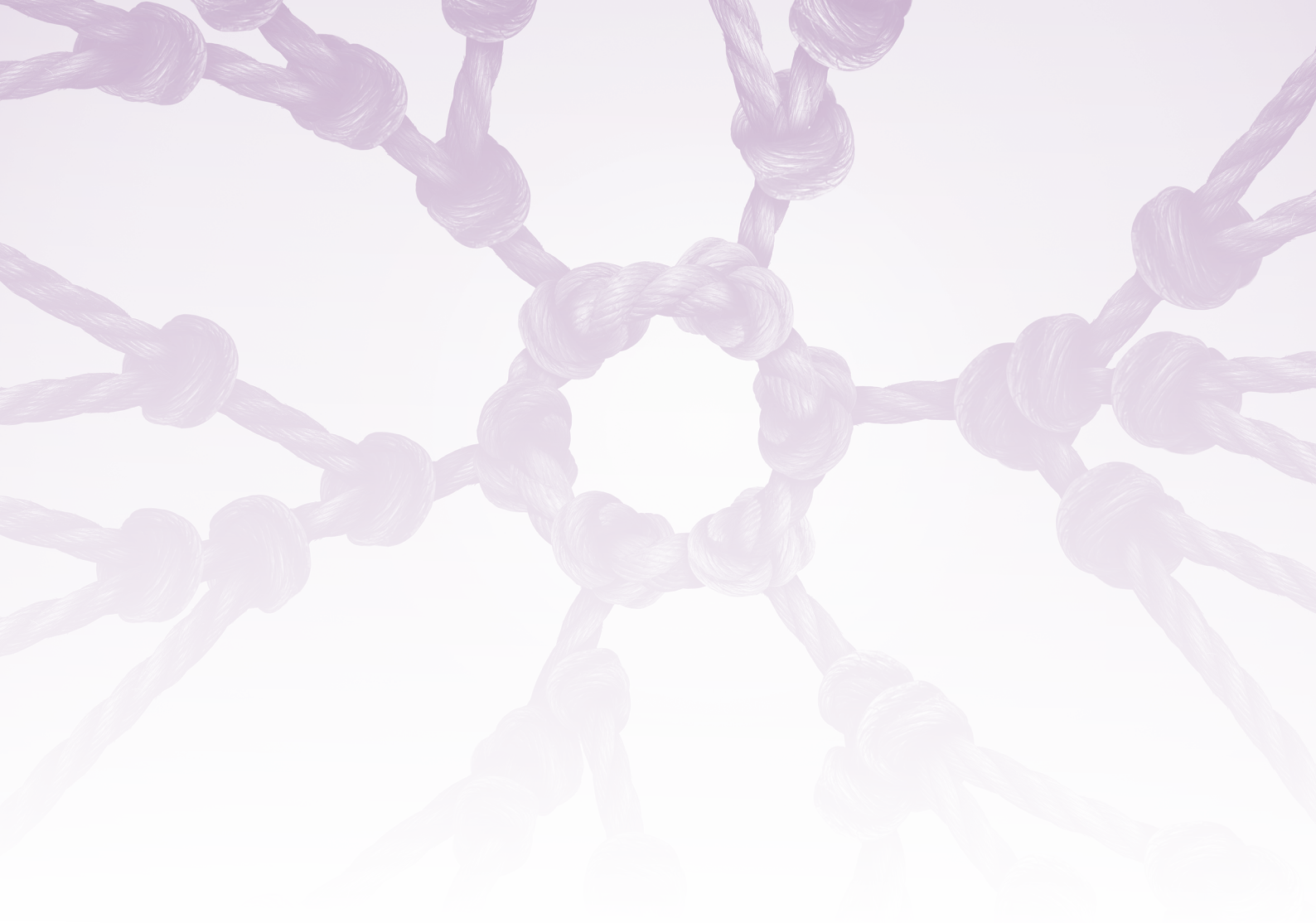
Three of the nine countries reporting findings from acquired drug resistance (ADR) surveys among adults receiving HIV treatment between 2014 and 2018 showed levels of viral suppression exceeding 90%. Across all the surveys, the prevalence of ADR among people receiving ART ranged from 3% to 29%. Among populations receiving NNRTI-based ART with viral non-suppression, the levels of NNRTI and NRTI resistance ranged from 50% to 97% and from 21% to 91%, respectively. Estimates of dual class resistance (NNRTI and NRTI) ranged between 21% and 91% of individuals for whom NNRTI-based first-line ART failed.

The high level of HIVDR among people with viral non-suppression on NNRTI-based first-line ART demonstrates the degree to which NNRTI-based regimens are compromised for people with viral non-suppression detected by a single viral load test, indicating the need for rapid switch to second-line ART once failure to suppress viral loads is identified. Equally, the high levels of NRTI resistance at time of treatment failure, including dual-class NRTI resistance, support the need for optimizing the NRTI backbone during treatment switch, as recommended in WHO's 2019 antiretroviral guidelines.

In addition to routine population-level monitoring of HIVDR, preventing drug-resistant HIV is one of the strategic objectives of the Global Action Plan on HIVDR. WHO recommends monitoring and responding to gaps in quality indicators at the clinic or programme level that are associated with the emergence of HIVDR. These indicators include: appropriate prescribing practices, on-time ART pill pick-up (a proxy measure of adherence), retention on ART at 12 months, viral load testing coverage, viral load suppression, ARV drug stock-outs and timely switch to second-line ART. Between 2014 and 2018, 44 of 45 countries with a high burden of HIV reported these data to WHO. Overall data reporting across all the indicators was incomplete suggesting the need for strengthening systems for monitoring data indicating programme quality.

Few countries are attaining the expected targets for quality-of-care indicators, suggesting the need for a proactive approach in addressing gaps in the quality of ART service delivery and minimizing the emergence and spread of HIVDR. Retention on ART at 12 months emerges as a programmatic area requiring significant attention and further improvement.

[1] ARV market report 2018: The state of the antiretroviral drug market in low- and middle-income countries, 2017–2022. Boston: Clinton Health Access Initiative; 2018 (https://clintonhealthaccess.org/content/uploads/2018/09/2018-HIV-Market-Report_FINAL.pdf, accessed 5 July 2019).



SECTION 1: PRETREATMENT HIV DRUG RESISTANCE AMONG ADULTS INITIATING FIRST-LINE ANTIRETROVIRAL THERAPY

Purpose and methods. PDR surveys provide evidence to inform the selection and effectiveness of first-line treatment, PEP and PrEP. The sample size estimation, sampling methods and statistical analysis are described in detail in the WHO concept note for PDR surveys among adults initiating first-line ART with and without previous ARV drug exposure.[1]

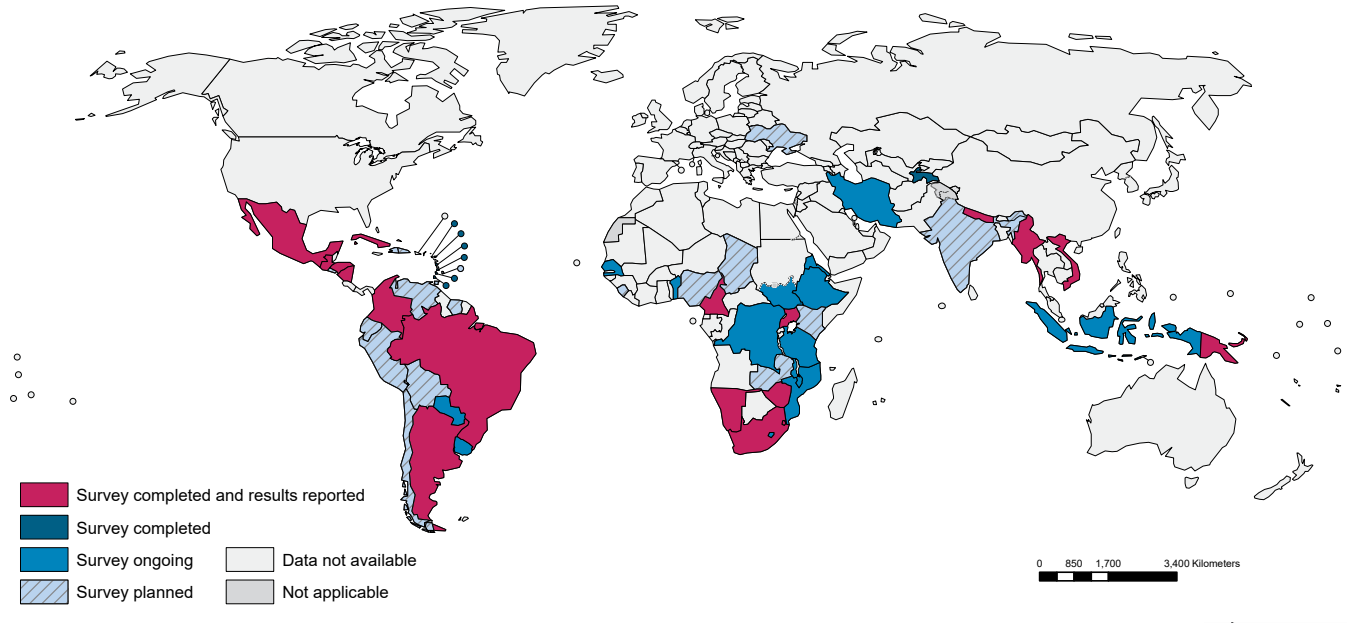
Goals. The overall goal of these surveys is to generate (1) nationally representative estimates for PDR among individuals initiating ART, regardless of previous ARV drug exposure, (2) nationally representative estimates of PDR among ARV drug–naive HIV treatment initiators and (3) estimates of the proportion of ART initiators reporting previous ARV drug exposure.

Survey implementation progress. Between 2014 and 2018, 39 countries implemented surveys of PDR among adults starting or restarting first-line ART; of those, 25 surveys are completed, and 14 surveys are ongoing. Eighteen countries have plans to initiate surveys of PDR (**Fig. 1.1**).

Geographical representation. This report summarizes the results from 18 countries that have completed PDR surveys and have reported data to WHO: six from sub-Saharan Africa;[2] nine from the WHO Region of the Americas, two from the Western Pacific Region and two from the South-East Asia Region (countries are listed in **Fig. 2**). In all countries, PDR surveys followed WHO standard methods, except in South Africa, where PDR estimates were generated from a national household survey.

Survey populations. Most of the survey participants from sub-Saharan Africa, Nepal and Papua New Guinea were women (ranging from 51% to 73%). Men predominated in surveys from the Americas, Myanmar and Viet Nam (ranging from 59% to 89%). Twelve of the 18 surveys included ART initiators reporting being both ARV drug–naive or previously exposed to ARV drugs (including women with previous ARV drug exposure for preventing the mother-to-child transmission of HIV and individuals reinitiating first-line ART after initial disengagement from care). In these 12 surveys, the proportion of ART starters

Fig. 1.1 Implementation of national pretreatment drug resistance surveys among adults initiating or re-initiating first-line ART, 2014–2018



[1] Surveillance of HIV drug resistance in adults initiating antiretroviral therapy (pre-treatment HIV drug resistance). Geneva: World Health Organization; 2014 (https://apps.who.int/iris/bitstream/handle/10665/112802/9789241507196_eng.pdf;jsessionid=CB4F92166CBA26A57EB421116A09658F? sequence=1, accessed 5 July 2019).

[2] Included a national household survey from South Africa. Participants in the PDR analysis were people with no detectable ARV drugs in blood and either self-reported not taking daily medication or this information was unknown (http://www.croiconference.org/sessions/ hiv-drug-resistance-south-africa- results-population-based-household-survey).

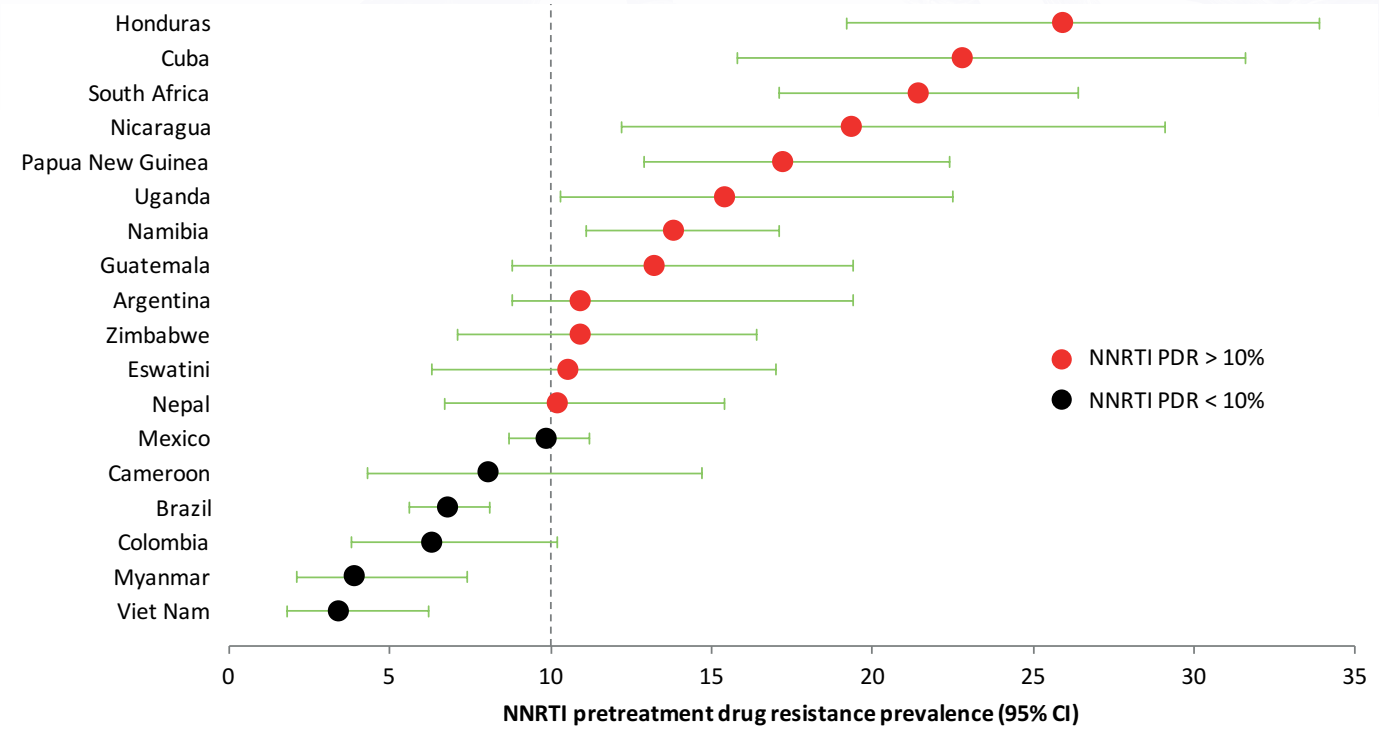
with self-reported previous exposure to ARV drugs ranged from 1.2% (95% confidence interval (CI) 0.4–3.7%) in Uganda to 26% (95% CI 20–34%) in Honduras. Previous use of ARV drugs for preventing the mother-to-child transmission of HIV was the most commonly reported type of previous ARV exposure in Cameroon, Eswatini and Uganda, while previous ART followed by treatment discontinuation and then ART re-initiation was more common in Argentina, Honduras, Mexico, Myanmar, Namibia, Papua New Guinea and Viet Nam. (**Tables 1.1a–1.1e**).

Key findings. In 12 of 18 countries that reported survey findings to WHO, PDR to nevirapine/efavirenz in populations initiating first-line ART had reached levels above 10% (Argentina, Eswatini, Cuba, Guatemala, Honduras, Namibia, Nepal, Nicaragua, Papua New Guinea, South Africa,5 Uganda and Zimbabwe) (**Fig. 1.2, Tables 1.2a–1.2e**). Overall, in a pooled analysis of data from all countries, the prevalence of PDR to efavirenz and/or nevirapine was much higher in specific subpopulations, notably:

- The prevalence of NNRTI PDR was nearly twice as high among women than men initiating ART: 11.8% (95%CI 9.4–14.8) versus 7.8% (95%CI 6.3-9.5) p=0.005. In addition, high levels of PDR to efavirenz and/or nevirapine were more common among women than among men across the surveys: 14 of 18 countries had NNRTI PDR ≥10% among women, and only 10 of 18 countries had NNRTI PDR ≥10% among men (**Fig. 1.3**).
- The prevalence of NNRTI PDR was nearly three times higher among people reinitiating first-line ART reporting previous exposure to ARV drugs than among ARV drug–naive people: 21.1% (95%CI 15.0–28.9) versus 7.8 (6.3–9.6), p≤0.0001 (**Fig. 1.4**).

The prevalence of PDR to NRTIs such as tenofovir (TDF) and XTC (emtricitabine (FTC) or lamivudine (3TC)) ranged from 0% to 4.5% and 0% to 5.7%, respectively (**Fig. 1.5**).

Fig. 1.2 NNRTI (EFV/NVP) pretreatment drug resistance (PDR) among first-line ART initiators



NNRTI PDR is defined as PDR to NVP and/or EFV.

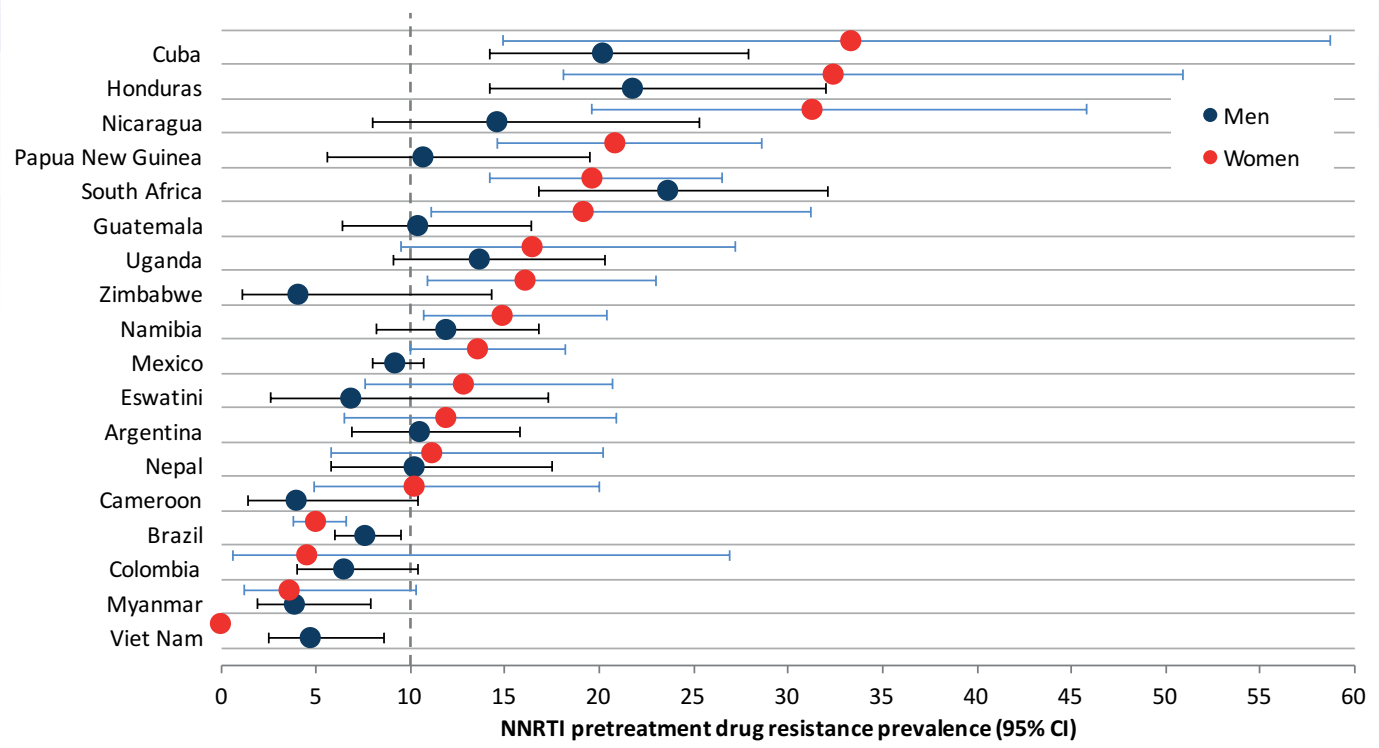
Fig 1.2 shows NNRTI PDR point prevalence and 95% confidence intervals among the 18 countries reporting data to WHO between 2014 and 2018. The dotted line (10% prevalence) indicates the NNRTI PDR prevalence above which WHO recommends moving away from NNRTI-based ART in first-line.[1] The prevalence of NNRTI PDR prevalence had exceeded 10% (vertical dotted line) in 12 countries. In all countries, PDR estimates are generated from nationally representative surveys using standard WHO survey methods, except in South Africa, where PDR estimates are generated from a national household survey. In 14 countries ART initiators regardless of previous ARV drug exposure were included in the PDR survey; in 4 countries (Brazil, Colombia, Cuba, Zimbabwe) only ARV drug-naive individuals starting ART were included in the PDR surveys.

[1] Guidelines for the public heath response to pretreatment HIV drug resistance. Geneva: World Heath Organization; July 2017 (https://www.who.int/hiv/pub/guidelines/hivdr-guidelines-2017/en/)

Drug resistance classification and analysis methods. HIVDR was assessed using the Stanford HIVdb algorithm Version 8.8. Sequences classified as low-, intermediate- or high-level resistance were designated as resistant. Data for all the outcomes were analysed in Stata software 14.0 (StataCorp LP, College Station, TX, USA)[1] to generate weighted estimates based on the study design as described in the survey guidance.[1]

Implication of the findings. The high levels of observed PDR to NNRTIs highlight the need to fast-track the transition to dolutegravir-based first-line regimens in adults and to use PIs in circumstances where levels of PDR are high and the use of dolutegravir is not feasible as per WHO recommendations. The response to high levels of PDR in countries is varied and is described in **Fig. 1.6**. In countries in Central and Latin America the levels of PDR to NNRTIs were particularly high, especially in women, suggesting the need to strengthening the health systems, and in particular, to increase access of women to continued and reliable ARV provision. The low prevalence of TDF/XTC resistance provides reassurance for using this drug combination in PrEP; however, since these two drugs are used in combination as PrEP and as a component of ART first-line regimens, routine surveillance is required to provide continual assurance that these two ARV drugs can be effectively used as both treatment and prophylaxis when PrEP programmes are scaled up in low- and middle-income countries.

Fig. 1.3 NNRTI (EFV/NVP) pretreatment drug resistance (by sex) among first-line ART initiators



NNRTI PDR is defined as PDR to NVP or EFV.

Fig. 1.3 shows the prevalence of NNRTI PDR by sex. In a pooled analysis of all surveys, women had significantly higher PDR prevalence than men: 11.8% (95%CI 9.4–14.8) versus 7.8% (95%CI 6.3–9.5) p=0.005. The dotted line (10% prevalence) indicates the NNRTI PDR prevalence above which WHO recommends moving away from NNRTI-based ART. The NNRTI PDR prevalence among women exceeded 10% in 14 of 18 countries versus 10 of 18 countries for men.

[1] StataCorp. 2015. Stata Statistical Software: Release 14. College Station, TX: StataCorp LP.

Fig. 1.4 NNRTI (EFV and/or NVP) pretreatment drug resistance (by previous ARV drug exposure) among first-line ART initiators

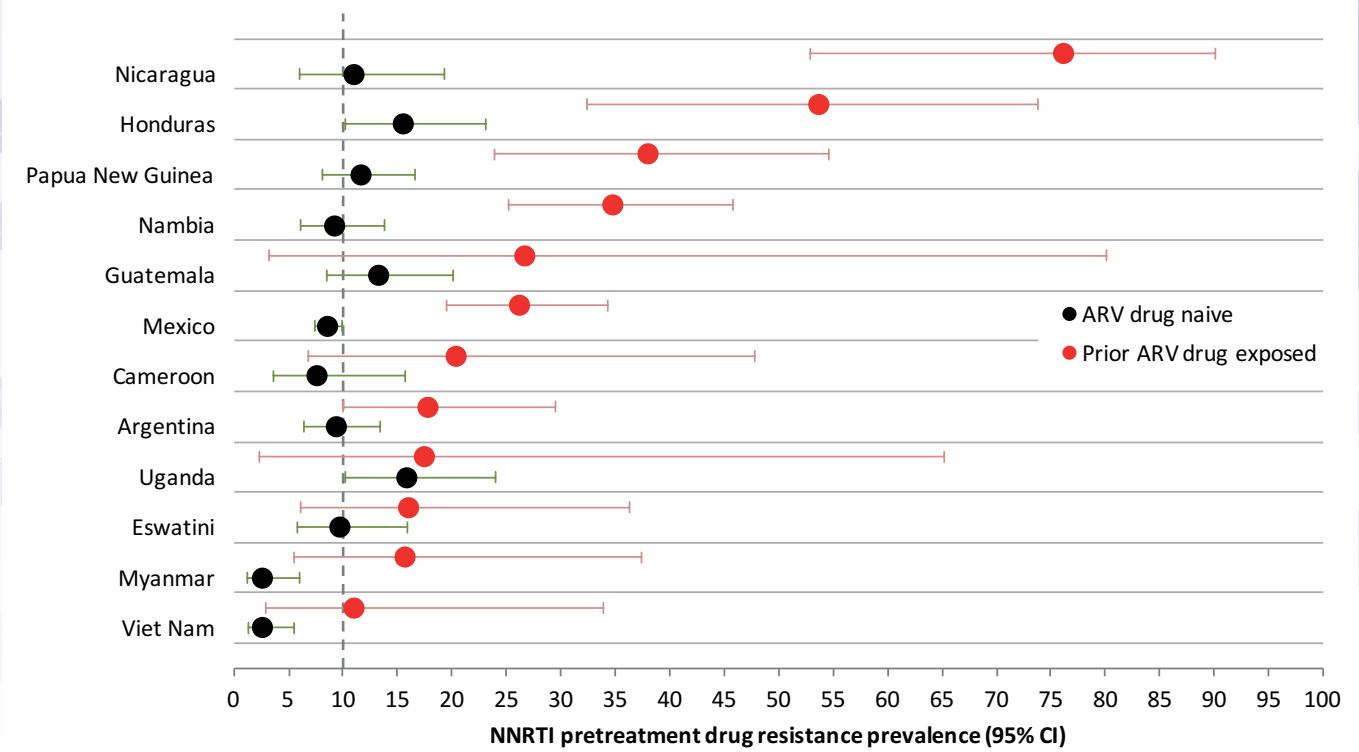
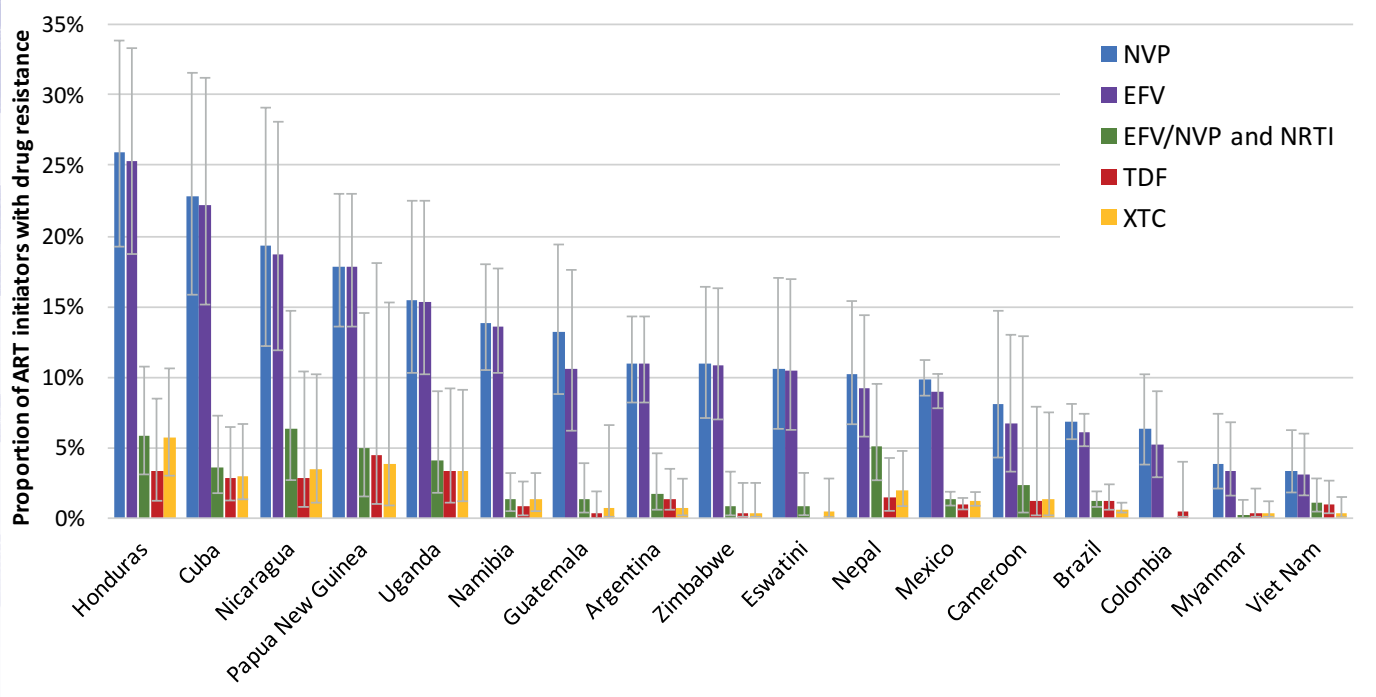


Fig. 1.4 shows the prevalence of NNRTI PDR among people initiating ART reporting previous ARV drug exposure and among ARV drug-naive people. The dotted line (10% prevalence) indicates the NNRTI PDR prevalence above which WHO recommends moving away from NNRTI-based ART. Compared with ARV drug naive-initiators, people reinitiating ART reporting previous exposure to ARV drugs had a significantly higher NNRTI PDR prevalence: 21.1% (95%CI 15.0–28.9) versus 7.8 (6.3–9.6), p≤0.0001 (pooled analysis form all surveys). Among people reporting previous ARV drug exposure, the prevalence of NNRTI PDR exceeded 10% in all 12 countries that included this group of people.

Fig. 1.5 Pretreatment drug resistance among first-line ART initiators, by country and by drug



EFV: efavirenz; NVP: nevirapine; NRTI: nucleoside reverse-transcriptase inhibitors; TDF: tenofovir disoproxil fumarate; XTC: emtricitabine (FTC) or lamivudine (3TC).

Fig. 1.5 shows the prevalence of PDR to the drugs used in first-line regimens. As expected, the prevalence of PDR is driven mainly by PDR to EFV and NVP. Across all countries, the prevalence of NRTI PDR was low and ranged from 0% to 6% for FTC/3TC and from 0% to 5% for TDF.

Fig. 1.6 Country response to levels of pretreatment drug resistance (PDR) to efavirenz/nevirapine >10%, as of July 2019

CUBA: PDR to EFV/NVP 22.8%.
National guidelines revised to include the use of DTG as preferred first-line ART for adults and adolescents (and in women of child-bearing potential who are on reliable and consistent contraception

HONDURAS: PDR to EFV/NVP 25.9%.
Revision of national guidelines to use DTG as preferred first-line ART planned

GUATEMALA: PDR to EFV/NVP 13.2%.
National guidelines revised to include the use of DTG as preferred first-line ART for adults and adolescents (and in women of child-bearing potential who are on reliable and consistent contraception

NICARAGUA: PDR to EFV/NVP 19.3%.
Revision of national guidelines to use DTG as preferred first-line ART planned

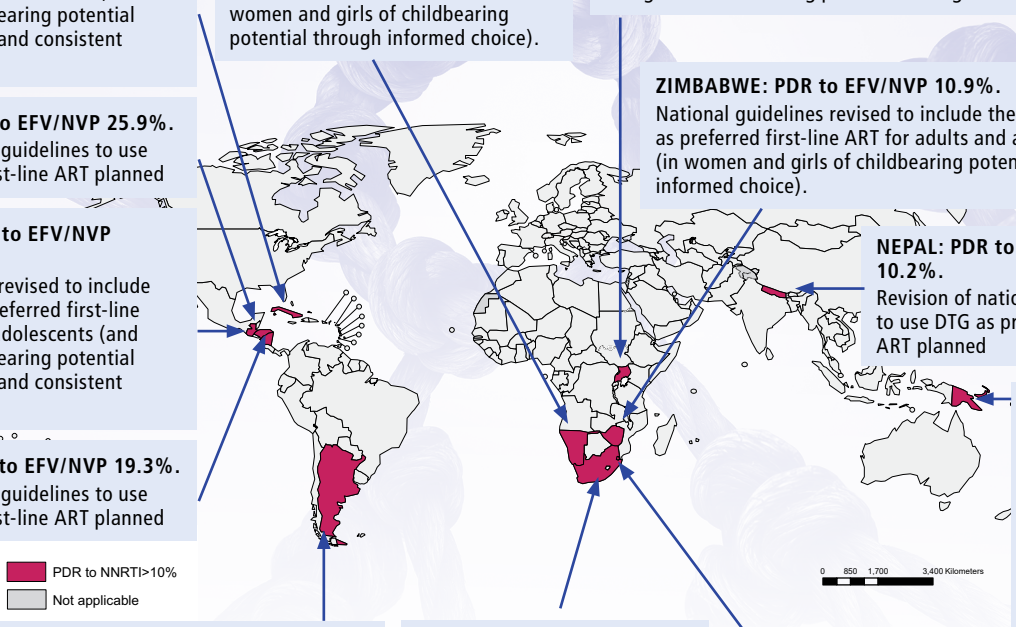
NAMIBIA: PDR to EFV/NVP 13.8%.
National guidelines revised to include the use of DTG as preferred first-line ART for adults and adolescents (in women and girls of childbearing potential through informed choice).

UGANDA: PDR to EFV/NVP 15.4%.
National guidelines revised to include the use of DTG as preferred first-line ART for adults and adolescents (in women and girls of childbearing potential through informed choice).

ZIMBABWE: PDR to EFV/NVP 10.9%.
National guidelines revised to include the use of DTG as preferred first-line ART for adults and adolescents (in women and girls of childbearing potential through informed choice).

NEPAL: PDR to EFV/NVP 10.2%.
Revision of national guidelines to use DTG as preferred first-line ART planned

PAPUA NEW GUINEA: PDR to EFV/NVP 17.8%.
National guidelines revised to include the use of DTG as preferred first-line ART



ARGENTINA: PDR to EFV/NVP 10.9%.
National guidelines revised to include the use of DTG as preferred first-line ART for adults and adolescents (and women of child-bearing potential who are on reliable and consistent contraception). Genotypic resistance testing used to guide treatment in women of child-bearing potential not eligible to use DTG

ESWATINI: PDR to EFV/NVP 10.5%.
National guidelines revised to include the use of DTG as preferred first-line ART for adults and adolescents (in women and girls of childbearing potential through informed choice).

SOUTH AFRICA: PDR to EFV/NVP 23.6%.
National guidelines revised to include the use of DTG as preferred first-line ART for adults and adolescents (in women and girls of childbearing potential through informed choice).

SECTION 2. PRETREATMENT HIV DRUG RESISTANCE AMONG TREATMENT-NAIVE INFANTS NEWLY DIAGNOSED WITH HIV

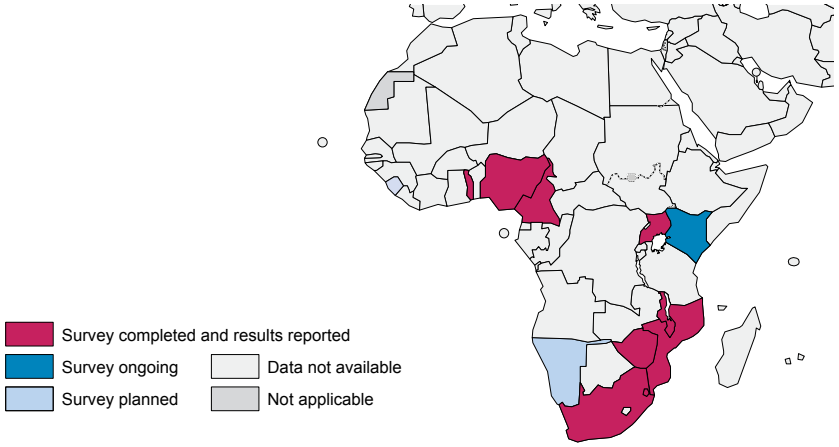
Purpose and methods. These surveys generate estimates of PDR among infants younger than 18 months who have been newly diagnosed with HIV through early infant diagnosis based on virological testing. Findings from these surveys inform the selection of standard first-line ART in children and accelerate the transition from NNRTI- to non-NNRTI-based first-line ART (dolutegravir or PI-based treatment, depending on the weight of the children). In addition, survey findings of NRTI resistance prevalence inform future optimal treatment strategies. The sample size estimation, sampling methods and statistical analysis are described in detail in the WHO guidance for PDR surveys for infants ≤18 months.[1]

Goal. The overall goal of these surveys for infants ≤18 months newly diagnosed with HIV through early infant diagnosis is to generate (1) nationally representative estimates of PDR among treatment-naive infants, regardless of exposure to prophylactic regimens used for preventing mother-to-child transmission of HIV, (2) nationally representative estimates of PDR among treatment-naive infants with known exposure to ARV drugs for preventing the mother-to-child transmission of HIV (maternal or neonatal portion), (3) nationally representative estimates of PDR among treatment-naive infants with no or unknown exposure to drugs for preventing the mother-to-child transmission of HIV, and (4) estimates of the proportion of infants newly diagnosed with HIV through early infant diagnosis with reported exposure to ARV drugs for preventing the mother-to-child transmission of HIV.

Progress in implementing the surveys and geographical representation. Between 2012 and 2018, 10 countries implemented surveys of PDR among treatment-naive infants ≤18 months. Nine countries have completed the survey, in one country the survey is still ongoing, and two countries are planning the survey. This report summarizes the findings from nine surveys conducted in sub-Saharan Africa (**Fig. 2.1**).

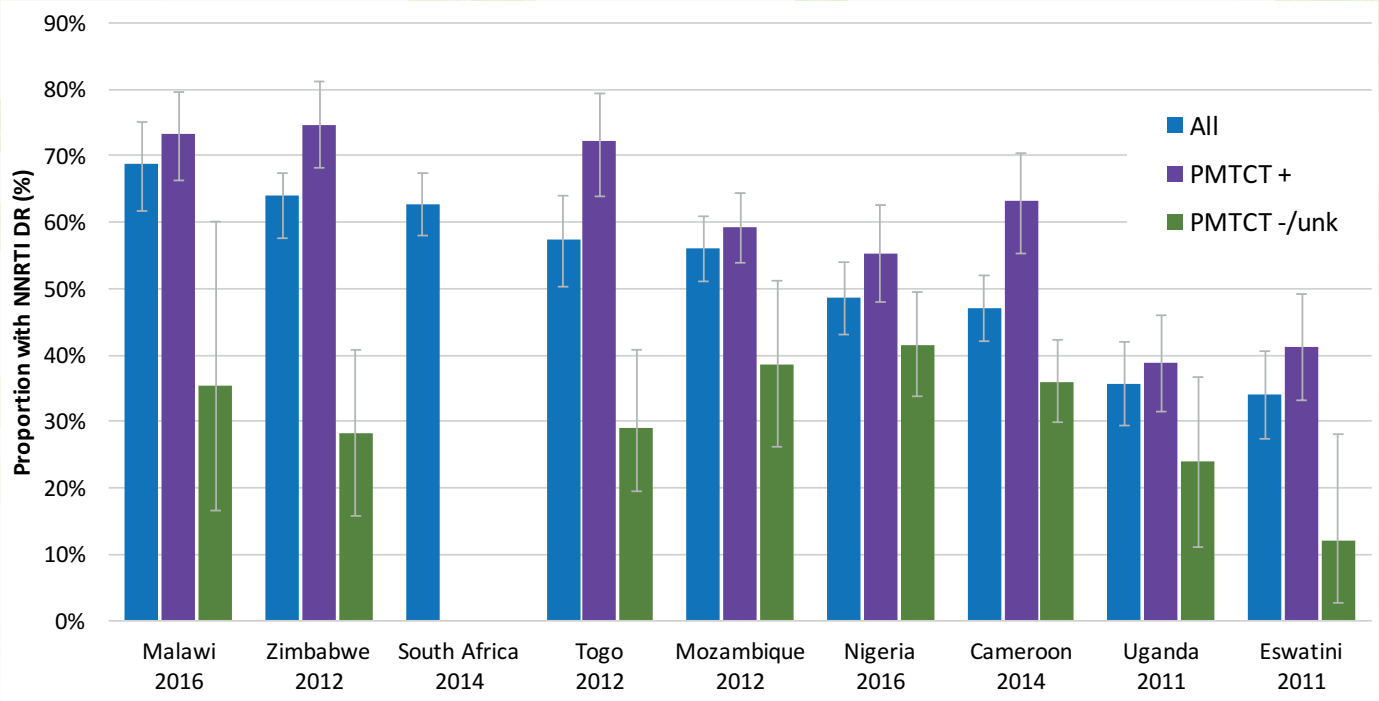
Survey populations. Most infants surveyed had prior ARV drug exposure(s), either ARV drugs taken by the mother to prevent transmission to the infant or taken by the infant to prevent infection. Overall ARV drug exposures ranged from 40% in Cameroon to 85% in Mozambique. Many of the infants, however, had missing information on ARV drugs for preventing the mother-to-child transmission of HIV exposure, ranging from a low of 3% in Zimbabwe to 28% in Nigeria (**Tables 2.1 a–b**).

Fig. 2.1 Implementation of WHO national pretreatment HIV drug resistance surveys among infants newly diagnosed with HIV and treatment naive, 2012–2018



[1] Surveillance of HIV drug resistance in children newly diagnosed with HIV by early infant diagnosis. Geneva: World Health Organization; 2017 (https://apps.who.int/iris/bitstream/handle/10665/259732/9789241512541-eng.pdf?sequence=1, accessed 5 July 2019).

Fig. 2.2 NNRTI (EFV and/or NVP) pretreatment drug resistance among treatment-naive infants newly diagnosed with HIV, 2012–2018



NNRTI PDR is defined as PDR to NVP or EFV.
PMTCT: prevention of mother-to-child HIV transmission; PMTCT+: exposed to maternal and neonatal PMTCT-prophylactic ARV drugs; PMTCT -/unk: either PMTCT unexposed or with missing information on PMTCT exposure; unk: unknown.

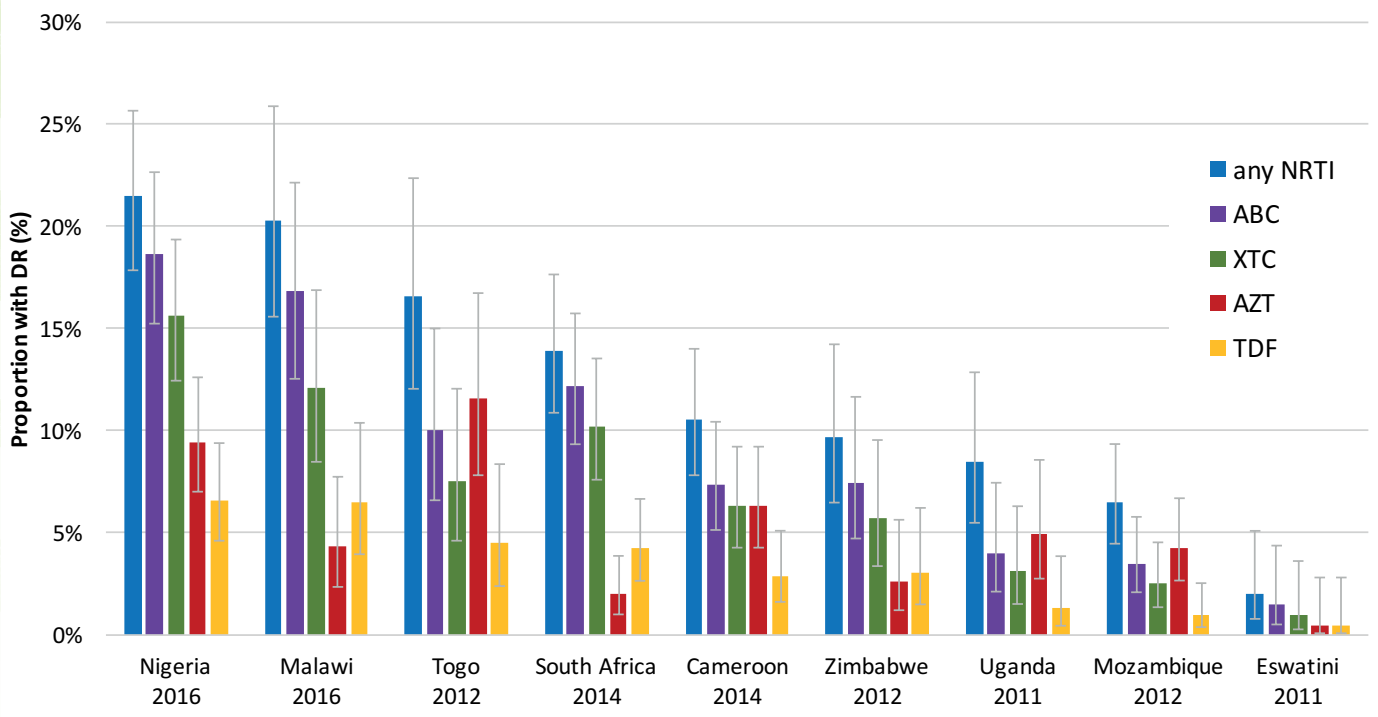
Fig. 2.2 shows the prevalence of NNRTI PDR among infants ≤18 months newly diagnosed with HIV and ARV naive. Overall, NNRTI PDR is alarmingly high with nearly half of young children having drug-resistant HIV before initiating treatment. Although the prevalence of NNRTI PDR is higher among those reporting exposure to PMTCT, children with unknown or no PMTCT exposure also have a high prevalence of NNRTI PDR.

Key findings. Overall, prevalence estimates of PDR to efavirenz and nevirapine were very high, ranging from 34% (95% CI 27–41%) in Eswatini to 69% (95% CI 62–75%) in Malawi, indicating that about half of infants newly diagnosed with HIV carry drug-resistant HIV before initiating treatment (**Fig. 2.2**). PDR to abacavir and lamivudine (the preferred NRTIs for infants) was also high and exceeded 10% in three and four of the nine countries, respectively (**Fig. 2.3**). (**Tables 2.2 a–b**)

Implications of the findings. Although more than half the infants newly diagnosed in these surveys carried NNRTI-resistant HIV, uptake of WHO recommendations for PI-based first-line regimens for young children is low. In 2017, nearly 77% of young children were receiving NNRTI-based regimens, because of limited supplies of appropriate child-friendly formulations.[1] **Fig. 2.4** shows the country responses to high levels of PDR among children ≤18 months. The results suggest the need to accelerate access to child-friendly non-NNRTI-based formulations in this vulnerable population to prevent poor treatment outcomes. Survey findings also highlight the increasing levels of PDR to NRTIs in some countries, suggesting the need for caution when using abacavir and lamivudine in combination with drugs that have a low genetic barrier for resistance (nevirapine (NVP) or raltegravir).

[1] ARV market report 2018: The state of the antiretroviral drug market in low- and middle-income countries, 2017–2022. Boston: Clinton Health Access Initiative; 2018 (https://clintonhealth access.org/content/uploads/2018/09/2018-HIV-Market-Report_ FINAL.pdf, accessed 5 July 2019).

Fig. 2.3 Prevalence of NRTI HIV drug resistance among treatment-naive infants newly diagnosed with HIV, by drug and country



Legend: ABC: abacavir; AZT: zidovudine; NRTI: nucleoside reverse-transcriptase inhibitor; TDF: tenofovir disoproxil fumarate; XTC: emtricitabine (FTC) or lamivudine (3TC)

Fig. 2.3 shows the prevalence of NRTI HIVDR among ARV-naive children ≤18 months newly diagnosed with HIV. The prevalence of NRTI resistance is also high, exceeding 10% for ABC, XTC and AZT in some countries.

Fig. 2.4 Country response to high levels of pretreatment drug resistance (PDR) among infants, as of July 2019

NIGERIA: PDR to EFV/NVP 48.6%.
LPV-r is the preferred first-line ART for children <3 years in the national guidelines and discussions are ongoing to use DTG for children ≥20kg ; however, NNRTIs are still the most commonly used first-line pediatric regimens (~91% of children)

TOGO: PDR to EFV/NVP 57.3%.
LPV-r is the preferred first-line ART in the national guidelines

ZIMBABWE: PDR to EFV/NVP 63.9%.
LPV-r is the preferred first-line ART for children <3 years in the national guidelines and discussions are ongoing to use DTG for children ≥20kg ; however, NNRTIs are still the most commonly used first-line pediatric regimens

SOUTH AFRICA: PDR to EFV/NVP 63.7%.
LPV-r is the preferred and most-commonly used first-line ART for children <3 years. Discussions are ongoing to use DTG for children ≥20kg

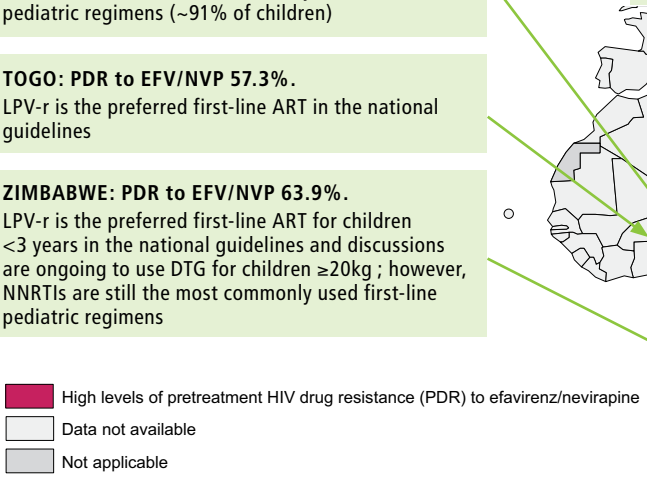
CAMEROON: PDR to EFV/NVP 47.0%.
LPV-r is the preferred first-line ART for children <3 years in the national guidelines and discussions are ongoing to use DTG for children ≥20kg; however, NNRTIs are still the most commonly used first-line pediatric regimens

UGANDA: PDR to EFV/NVP 35.7%.
LPV-r is the preferred and most commonly used first-line ART for children <3 years. Discussions are ongoing to use DTG for children ≥20kg

MALAWI: PDR to EFV/NVP 68.8%.
Adoption of LPV-r or INSTI as the preferred first-line ART in the national guidelines in process; NNRTIs are currently the first-line pediatric regimens

MOZAMBIQUE: PDR to EFV/NVP 56%.
LPV-r is the preferred first-line ART for children <3 years in the national guidelines and discussions are ongoing to use DTG for children ≥20kg ; however, NNRTIs are still the most commonly used first-line pediatric regimens

ESWATINI: PDR to EFV/NVP 34.0%.
LPV-r is the preferred and most-commonly used first-line ART for children <3 years. Discussions are ongoing to use DTG for children ≥20kg



SECTION 3. ACQUIRED HIV DRUG RESISTANCE AMONG ADULTS RECEIVING ANTIRETROVIRAL THERAPY

Purpose and methods. Surveys of acquired HIV drug resistance (ADR) provide information needed to assess the performance of programmes in maximizing population-level viral suppression and inform the optimal selection of second- and third-line ART. The sample size estimation, sampling methods and statistical analysis are described in detail in the WHO guidance for ADR surveys of adults receiving ART.[1]

Goal. The overall goal of these cross-sectional surveys is to generate nationally representative estimates of (1) viral load suppression and (2) HIVDR in populations receiving ART for 12 (±3) months (referred to as early time point surveys) and ≥48 months (referred to as late time point surveys).

Geographical representation. Between 2014 and 2018, 23 countries implemented 47 surveys of ADR among adults receiving ART; of these, 19 surveys have been completed and 26 are ongoing. Fifteen countries have plans to conduct ADR surveys (**Fig. 3.1**). This report summarizes the results from 17 surveys (nine surveys reporting data from the early time point and eight surveys from the late time point) conducted in nine countries: five from sub-Saharan Africa, three from the WHO Region of the Americas and one from the Western Pacific Region.

Survey populations. Most of the participants from sub-Saharan Africa in surveys from both time points were women (ranging from 60% to 78%); men were predominant in the surveys from the early time point in the WHO Region of the Americas and in Viet Nam (ranging from 65% to 70%). However, there were fewer men in surveys assessing ADR at the late time point in the Region of the Americas (ranging from 41% to 62%), with most participants being women in Honduras (59%).

The mean time on ART among participants enrolled in the early time point surveys ranged from 11.8 months in Viet Nam to 17.9 months in Cameroon;[2] the mean time on ART ranged from 52.2 months in Senegal to 102.3 months in Honduras among people enrolled in the late time point survey.

In all surveys, the most common regimen was TDF + 3TC or FTC + EFV. In surveys of people on ART for 12 months ±3 months, nearly all participants were receiving NNRTI-based first-line ART ranging from 88% in Nicaragua to 100% in Zambia.

In late time point surveys, the proportion of participants receiving NNRTI-based first-line ART ranged from 75% in Nicaragua to 99% in Senegal. In the late time point survey, TDF + XTC + EFV was the most common regimen in Cameroon, Guatemala, Senegal and Viet Nam, but NVP and zidovudine (AZT) were also substantially used in all countries. In particular, AZT + XTC + EFV was the most common regimen in Honduras and Nicaragua, and AZT + XTC + NVP was the predominant regimen in Eswatini and Uganda. The proportion of people receiving second-line regimens was low across all surveys, ranging from 0.2% in Eswatini to 2% in Nicaragua in the early time point survey and from 1% in Senegal to 14% in Nicaragua for participants in the late time point survey (**Tables 3.1 a–g**).

HIVDR classification and analysis methods. HIVDR was assessed using the Stanford HIVdb algorithm Version 8.8. Sequences classified as low-, intermediate- or high-level resistance were designated as resistant. Data for all the outcomes were analysed in Stata software 14.0 (StataCorp LP, College Station, TX, USA)[3] to generate weighted estimates based on the study design as described in the WHO ADR survey concept guidance.[4]

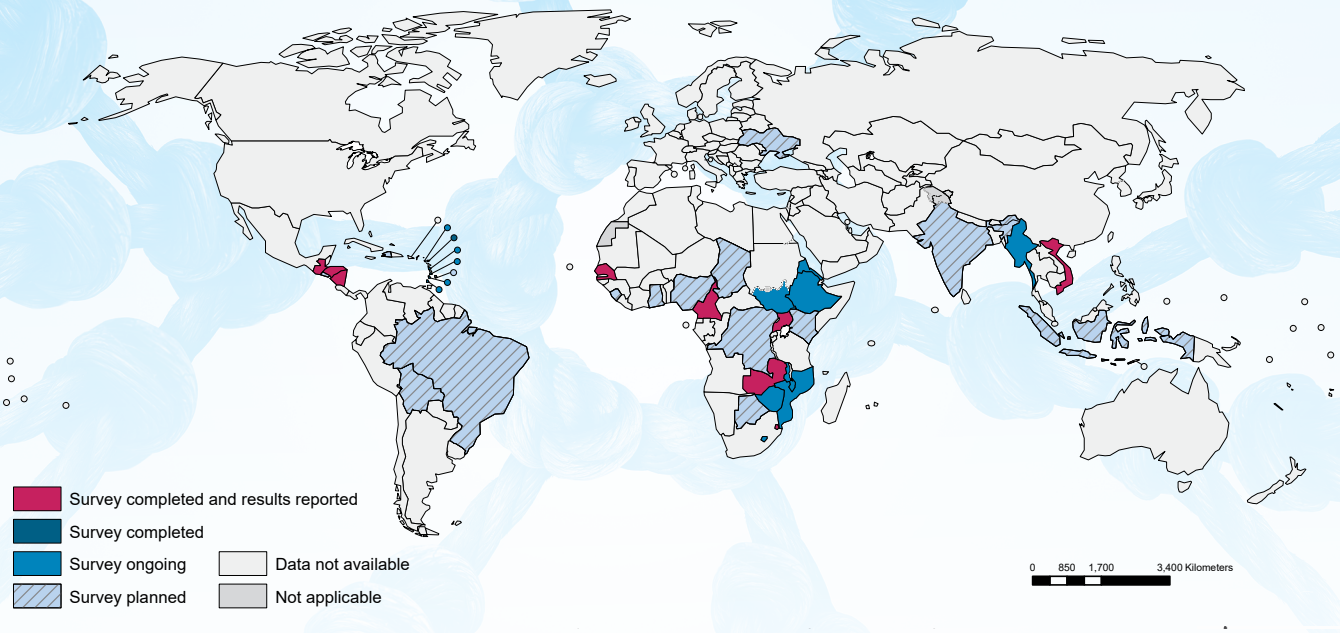
[1] Surveillance of HIV drug resistance in adults receiving ART (acquired HIV drug resistance). Geneva: World Health Organization; 2014 (https://apps.who.int/iris/bitstream/handle/10665/112801/9789241507073_eng.pdf?sequence=1, accessed 5 July 2019).

[2] In Cameroon, individuals receiving ART for 12–24 months were included in the 12-month ADR survey.

[3] StataCorp. 2015. Stata Statistical Software: Release 14. College Station, TX: StataCorp LP.

[4] HIV drug resistance surveillance guidance: 2015 update. Geneva: World Health Organization; 2015 (https://apps.who.int/iris/ bitstream/handle/10665/204471/9789241510097_eng.pdf;jsessionid=42B6287D67B61D47BC29C36FD598DAA8? sequence=1, accessed 5 July 2019).

Fig. 3.1 Implementation of WHO acquired HIV drug resistance national surveys among adults receiving antiretroviral therapy, 2014–2018

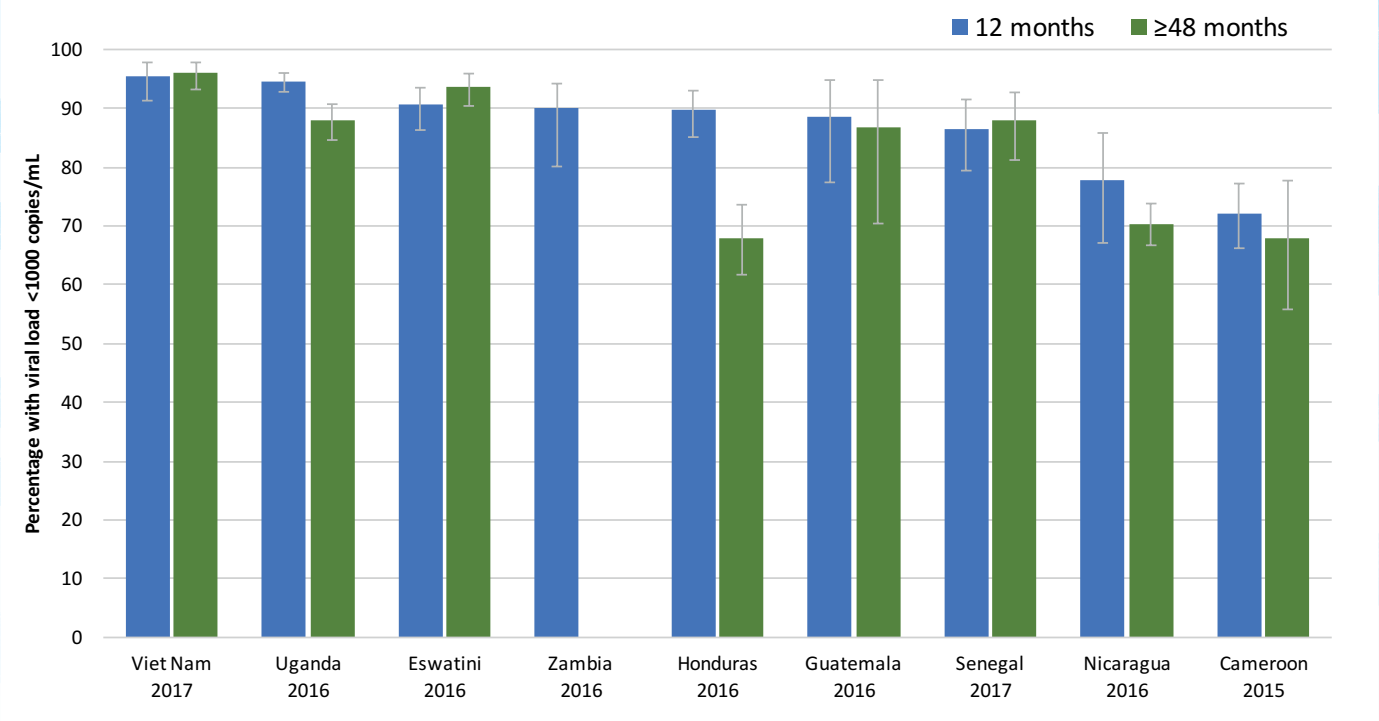


Key findings. Overall, four of nine countries achieved the third 90–90–90 target for viral load suppression of ≥90% in the early time point survey and three of eight in the late time point survey. However, in three of nine countries, viral load suppression fell below the 90% target by 10–20 percentage points (**Fig. 3.2**). The prevalence of viral load suppression for early time point surveys ranged from 72% in Cameroon to 95% in Vietnam. In contrast, the prevalence of viral load suppression in the late time point survey was comparatively lower in five of eight countries that reported data from both time points; these differences were significant in two countries: Honduras and Uganda (**Fig. 3.3 and 3.4 and Tables 3.2 a–h**). Considering a conservative approach when people not retained in care are classified as not having suppressed viral loads, the prevalence of viral load suppression among the four countries reporting reliable retention data dropped by between 12 and 22 percentage points (Guatemala from 89% to 67%, Honduras from 90% to 73%, Nicaragua from 78% to 57% and Viet Nam from 96% to 84%), highlighting the need to account for retention when estimating viral load suppression (**Tables 3.2 a–h**).

Overall, the prevalence of any HIVDR among all individuals receiving treatment ranged from 3% in Viet Nam to 29% in Honduras and was overall slightly higher in the late time point surveys (**Tables 3.3 a–h**).

Among populations for whom NNRTI-based first-line treatment failed, the level of NNRTI resistance in the early time point survey ranged from 50% in Eswatini to 97% in Uganda, and the prevalence of dual-class NNRTI and NRTI resistance ranged from 21% in Senegal to 91% in Uganda. In most late time point surveys, the prevalence of NNRTI, NRTI and dual-class NNRTI and NRTI resistance was higher than the estimates observed at the early time point (**Fig. 3.3–3.8**).

Fig. 3.2 Viral load suppression among adults receiving ART for 12 and ≥ 48 months (national ADR surveys), 2014–2018

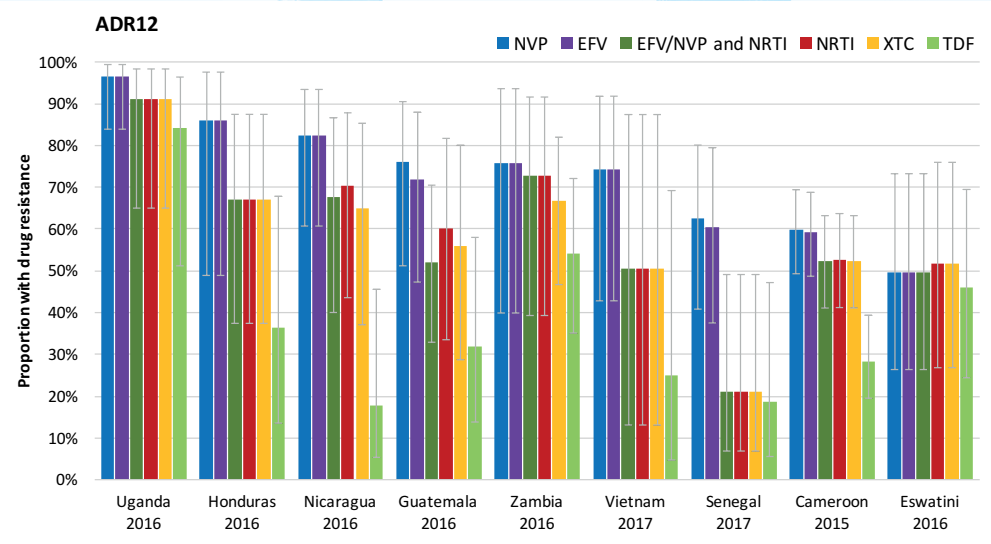


All surveys followed WHO standard survey methods. Survey methods adaptations: in Cameroon, participants who had been receiving treatment for 12–24 months were included in the early time point survey (12 months) i. In Senegal, participants who had been receiving treatment for ≥40 months were included in the late time point survey (≥48 months). Weighted estimates.

Fig. 3.2 shows the prevalence of viral load suppression across the two survey time points. Overall, the prevalence of viral load suppression was higher at the early time point (12 months) than the late time point (≥48 months), but the difference was only statistically significant in Honduras and Uganda.

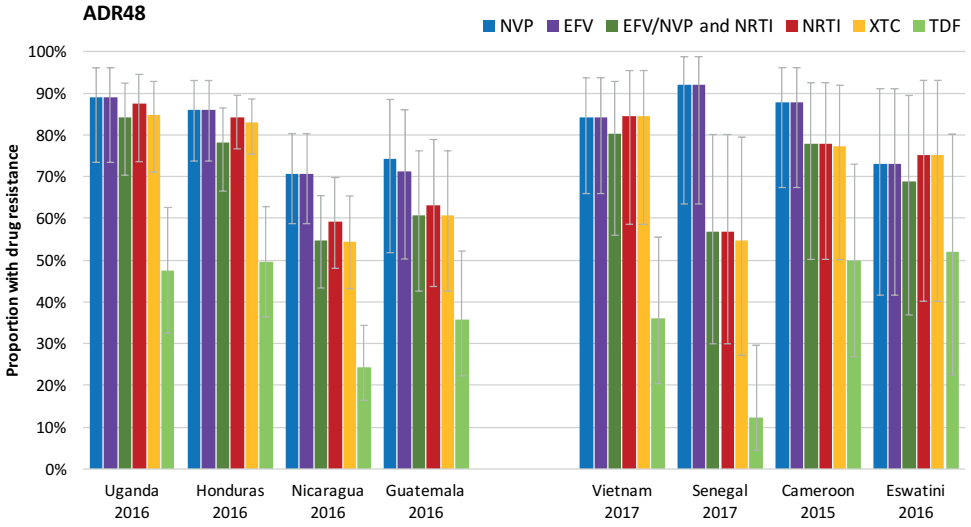
Implications of the findings. Although the observed high levels of viral load suppression are reassuring, some countries report much lower prevalence estimates of viral suppression especially among people on ART for a longer period of time. The heterogeneous levels of viral load suppression between countries demonstrate clear differences in programme performance between countries. Overall, the quality of service delivery needs to be strengthened, including addressing specific needs especially among long-term treated people to meet the 90% target for viral load suppression. The drop in viral load suppression estimates when people who were lost from care are considered as having viral non-suppression indicate the need to reinforce retention. The high levels of HIVDR to both NNRTI and NRTI among participants with viral non-suppression indicate the need to scale up viral load testing and promptly switch individuals with confirmed failure to second-line ART. The observed high levels of NRTI resistance, including dual-class TDF + XTC resistance, suggest the need to optimize the NRTI backbone when switch to second line ART is done among people with non-suppressed viral loads. Viral load monitoring before treatment substitutions including from TDF + XTC + NNRTI to TDF + XTC + DTG is encouraged and considered good practice, as a significant proportion of people failing NNRTI-based ART have resistance to both TDF and XTC.

Fig. 3.3 Prevalence of acquired HIV drug resistance by drug class and country (early time point survey, 12 months)



EFV: efavirenz; NVP: nevirapine; NRTI: nucleoside reverse-transcriptase inhibitors; TDF: tenofovir disoproxil fumarate; XTC: emtricitabine (FTC) or lamivudine (3TC).
The early time point survey in Cameroon included participants who had been receiving treatment for 12–24 months.
Weighted estimates.

Fig. 3.4 Prevalence of acquired HIV drug resistance by drug class and country (late time point survey, ≥48 months)



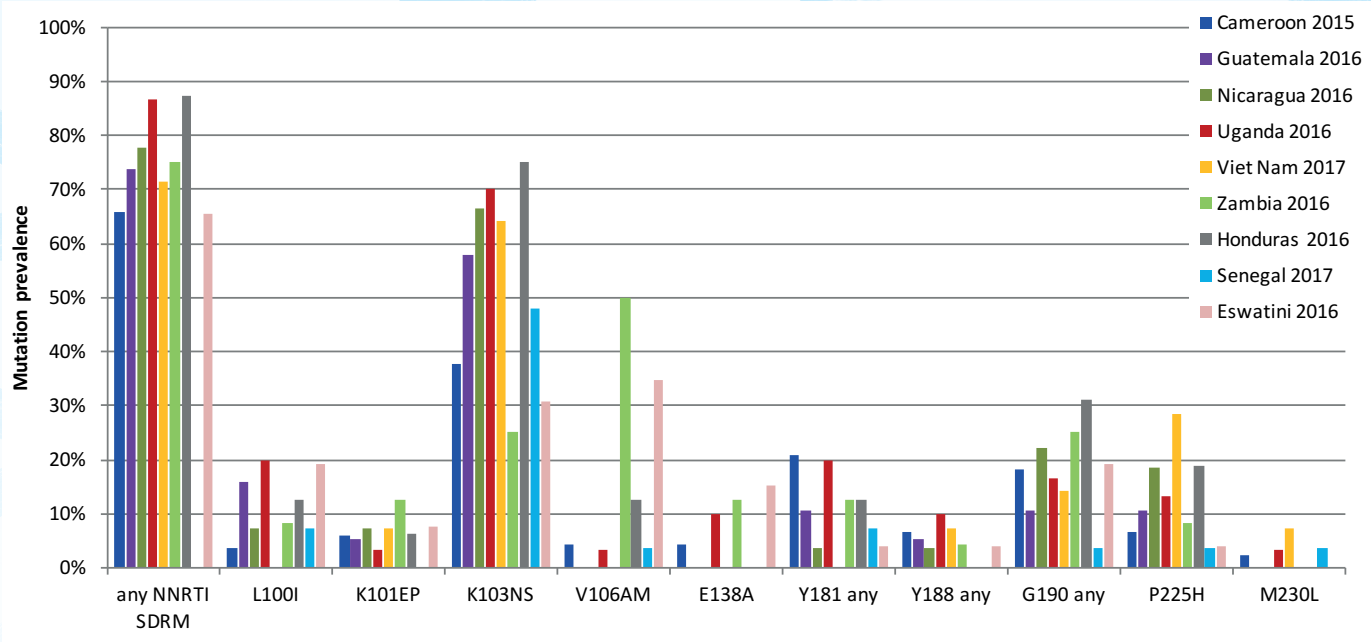
EFV: efavirenz; NVP: nevirapine; NRTI: nucleoside reverse-transcriptase inhibitors; TDF: tenofovir disoproxil fumarate; XTC: emtricitabine (FTC) or lamivudine (3TC).
The survey in Senegal included participants who had been receiving treatment for ≥40 months.
Weighted estimates.

Fig. 3.3 shows the prevalence of ADR for commonly used first-line drugs among participants for whom treatment failed in the early-time point survey. The prevalence of EFV and NVP ADR ranged from 50% in Eswatini to 97% in Uganda, and the prevalence of NRTI ADR ranged from 21% in Senegal to 91% in Uganda.

Fig. 3.4 shows the prevalence of ADR for commonly used first-line drugs among participants for whom treatment failed in the late-time point survey. The prevalence of EFV and NVP ADR ranged from 71% in Nicaragua to 92% in Senegal, and the prevalence of NRTI ADR ranged from 57% in Senegal to 87% in Uganda.

Overall HIVDR genotyping failure rates varied across the different surveys. It is therefore possible that HIVDR may be overestimated or underestimated if genotyping failures are correlated with the presence or absence of HIVDR. In addition, the small sample size for the ADR estimates may result in imprecise estimates necessitating caution in the interpretation.

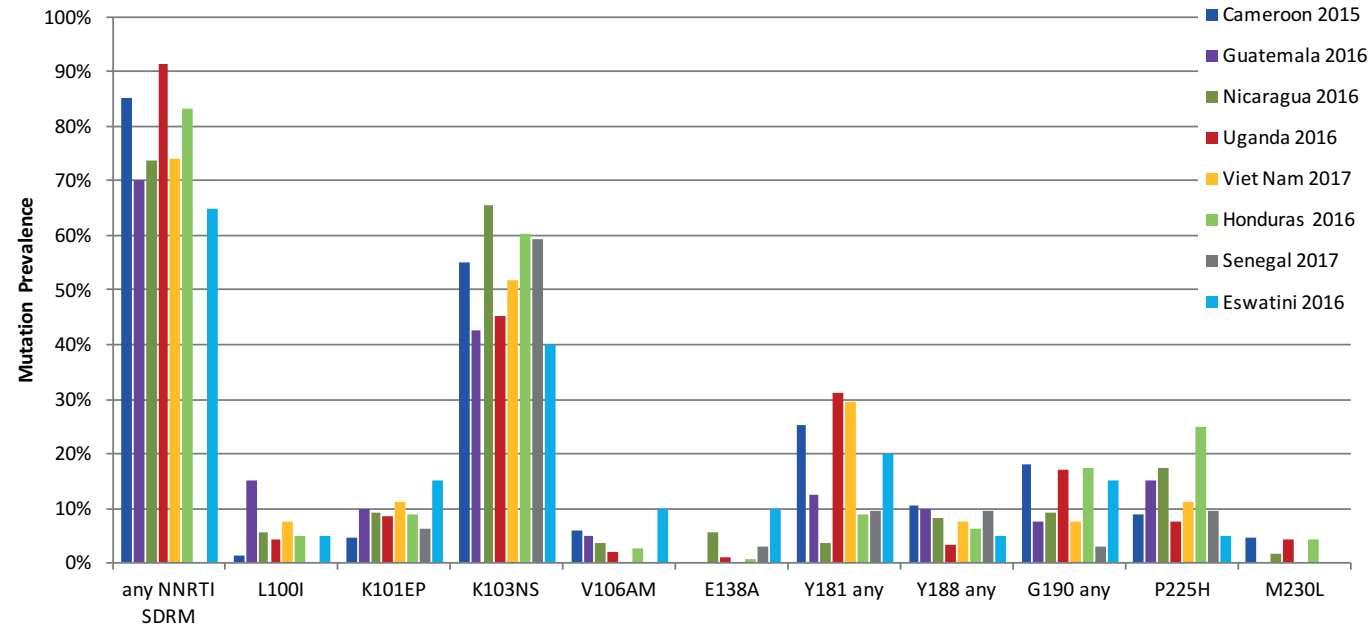
Fig. 3.5 NNRTI mutations associated with acquired drug resistance by country (early time point survey, 12 months)



NNRTI: non-nucleoside reverse-transcriptase inhibitors; SDRM: surveillance drug resistance mutations. Unweighted estimates.
The early-time point survey in Cameroon included participants who had been receiving treatment for 12–24 months.

Fig. 3.5 shows the patterns of NNRTI ADR mutations among individuals for whom treatment failed in the early time point survey. K103N/S was the predominant mutation in all countries except for Eswatini and Zambia, where V106A/M predominated.

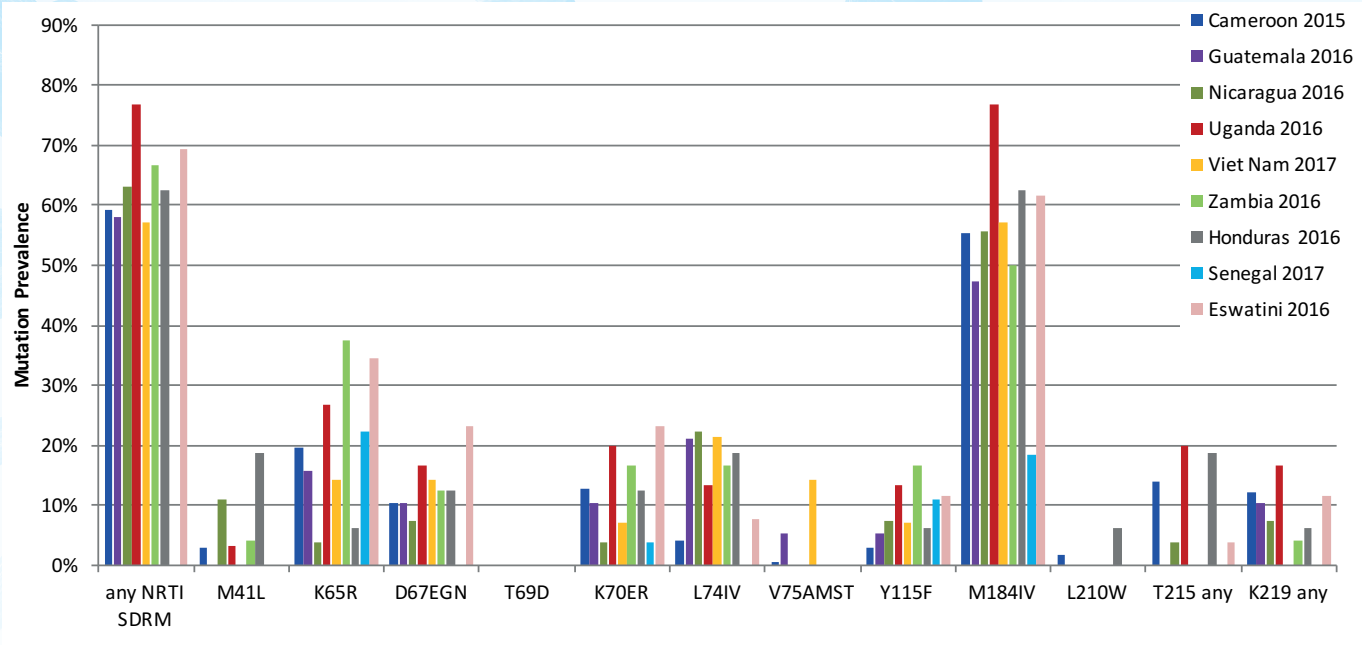
Fig. 3.6 NNRTI mutations associated with acquired drug resistance by country (late time point survey, ≥48 months)



NNRTI: non-nucleoside reverse-transcriptase inhibitors; SDRM: surveillance drug resistance mutations. Unweighted estimates.
The late time point survey in Senegal included participants who had been receiving treatment for ≥40 months.

Fig. 3.6 shows the patterns of NNRTI ADR mutations among individuals for whom treatment failed in the late time point survey. K103N/S was the predominant mutation in all countries.

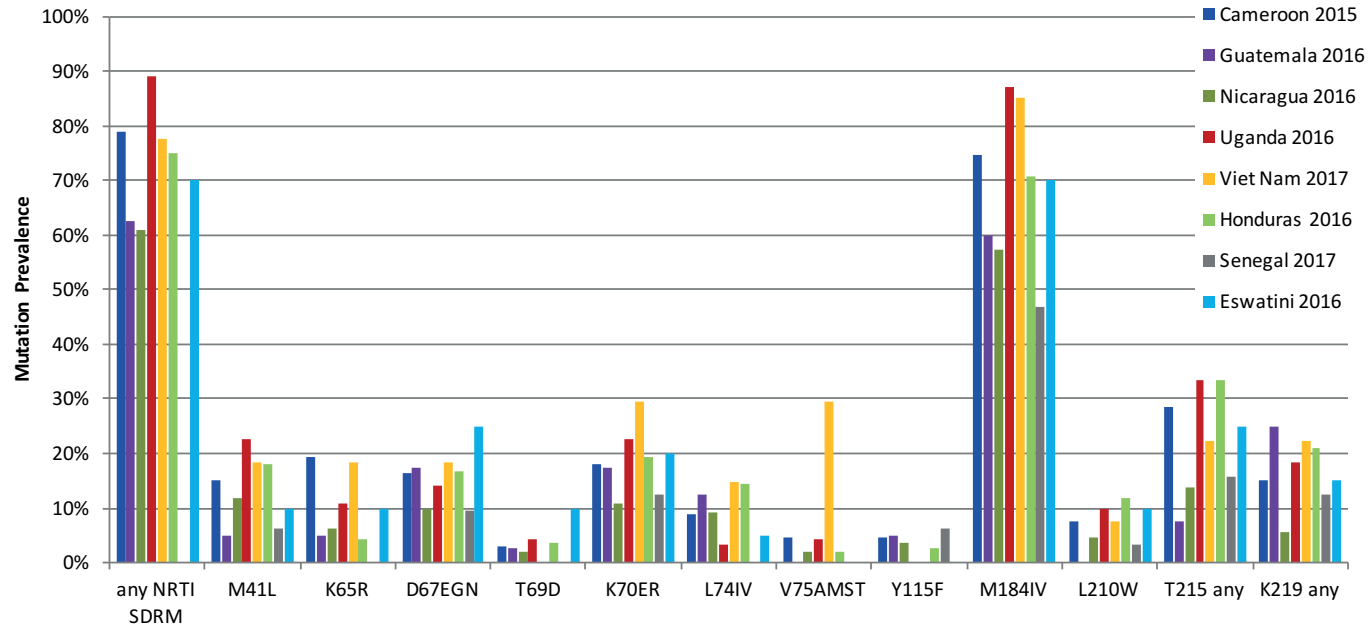
Fig. 3.7 NRTI mutations associated with acquired drug resistance by country (early time point survey, 12 months)



NRTI: nucleoside reverse-transcriptase inhibitors; SDRM: surveillance drug resistance mutations.
The early time point survey in Cameroon included participants who had been receiving treatment for 12–24 months. Unweighted estimates.

Fig. 3.7 shows the patterns of NRTI ADR mutations among individuals for whom treatment failed in the early time point survey. M184V was the most frequent NRTI mutation in all countries except for Senegal, where K65R predominated.

Fig. 3.8 NRTI mutations associated with acquired drug resistance by country (late time point survey, ≥48 months)



NRTI: nucleoside reverse-transcriptase inhibitors; SDRM: surveillance drug resistance mutations.
The late time point survey in Senegal included participants who had been receiving treatment for ≥40 months. Unweighted estimates.

Fig. 3.8 shows the patterns of NRTI ADR mutations among individuals for whom treatment failed in the early time point survey. M184V was the most frequent NRTI mutation in all countries.

SECTION 4. ASSESSMENT OF PROGRAMMATIC QUALITY INDICATORS ASSOCIATED WITH THE EMERGENCE OF HIVDR

Preventing HIVDR is critical for the long-term success of ART programmes and is achieved by optimizing the quality of ART service delivery. Attaining high-quality ART service delivery involves routinely monitoring quality-of-care indicators associated with and predictive of the emergence of drug-resistant HIV. Identifying gaps in service delivery and, if found to be present, swift implementation of specific and evidence-informed actions to improve clinic and programme performance are critical. Key quality-of-care indicators associated with the prevention of HIVDR include: appropriate prescribing practices (use of internationally recommended triple drug regimens), on-time ART pill pick-up (a proxy measure of appropriate adherence to ART), retention on ART 12 months after initiation, viral load testing coverage (assesses adequate treatment monitoring for identification and switch of regimen in people for whom ART is failing), viral load suppression, ARV drug stock-outs and timely switch to second-line ART (proxy measure on how well a country uses viral load testing results to identify failure and switch people in a timely manner to the next line of treatment).

Key findings

Country-level assessment. Between 2015 and 2018, 44 of 45 WHO focus countries reported data on programmatic quality indicators through the UNAIDS Global AIDS Monitoring system.[1] Where available, viral load suppression data from a PEPFAR (United States President's Emergency Plan for AIDS Relief) population health indicator survey were used.[2] The targets for the country-level programmatic quality indicators are classified based on the targets for clinic-level WHO early warning indicators of HIVDR.[3] To provide as minimally biased estimates as possible, only data from countries reporting nationally representative data or data from ≥70% of all ART clinics in the country are summarized below (**Fig. 4.1**).

Retention 12 months after ART initiation. The proportions of countries with classifiable data were 1 of 45 (2%) in 2015, 15 of 45 (33%) in 2016 and 18 of 45 (40%) in 2017. The proportion of reporting countries meeting the target of ≥85% retention was 100% (1 of 1) in 2015, 40% (6 of 15) in 2016 and 28% in 2017 (5 of 18).

Viral load testing coverage. The proportions of countries with data were 19 of 45 (42%) in 2015, 18 of 45 (40%) in 2016 and 29 of 45 (64%) in 2017. The proportions of reporting countries achieving the target of ≥70% were 16% (3 of 19) in 2015, 17% (3 of 18) in 2016 and 31% (9 of 29) in 2017.

Viral load suppression. The proportions of countries with classifiable data were 3 of 45 (6%) in 2015, 8 of 45 (18%) in 2016 and 15 of 45 (33%) in 2017. Among these countries, none met the target of ≥90% viral load suppression in 2015 (0 of 3), 50% (4 of 8) in 2016 and 13% (2 of 15) in 2017.

Drug stock-outs. The proportions of countries reporting were 28 of 45 (62%) in 2015, 32 of 45 (71%) in 2016 and 30 of 45 (67%) in 2017. The proportion of reporting countries meeting the target of zero drug stock-outs was 46% (13 of 28) in 2015, 50% in 2016 (16 of 32) and 53% in 2017 (16 of 30).

Proportion of people receiving second-line ART. The proportion of people switched to second-line ART is a proxy measure of how well a country identifies people failing treatment and switches them to a more effective regimen, thus preventing the accumulation of HIVDR. Programmatic and survey data show that about 5–30% of people receiving ART have viral non-suppression and thus may need to switch to second-line ART. The proportions of countries reporting the proportion of people receiving second-line ART were 17 of 45 (38%) in 2015, 16 of 45 (36%) in 2016 and 29 of 45 (64%) in 2017. The proportions of reporting countries that met the target of having at least 5% of people receiving a second-line regimen were 59% (10 of 17) in 2015, 56% (9 of 16) in 2016 and 45% (13 of 29) in 2017.

Clinic-level retention assessment. Between 2015 and 2018, nine countries reported clinic-level data (early warning indicators of HIV drug resistance)[3] to WHO: Benin, Burkina Faso, Dominican Republic, Egypt, Ethiopia, Ghana, Myanmar, Uganda, United Republic of Tanzania and Zimbabwe. All 10 countries reported data on adult populations; Myanmar and Zimbabwe reported separate data on adults and children. Data on most indicators were variedly reported since countries did not monitor all the indicators. Retention was widely reported and thus is included in this report.

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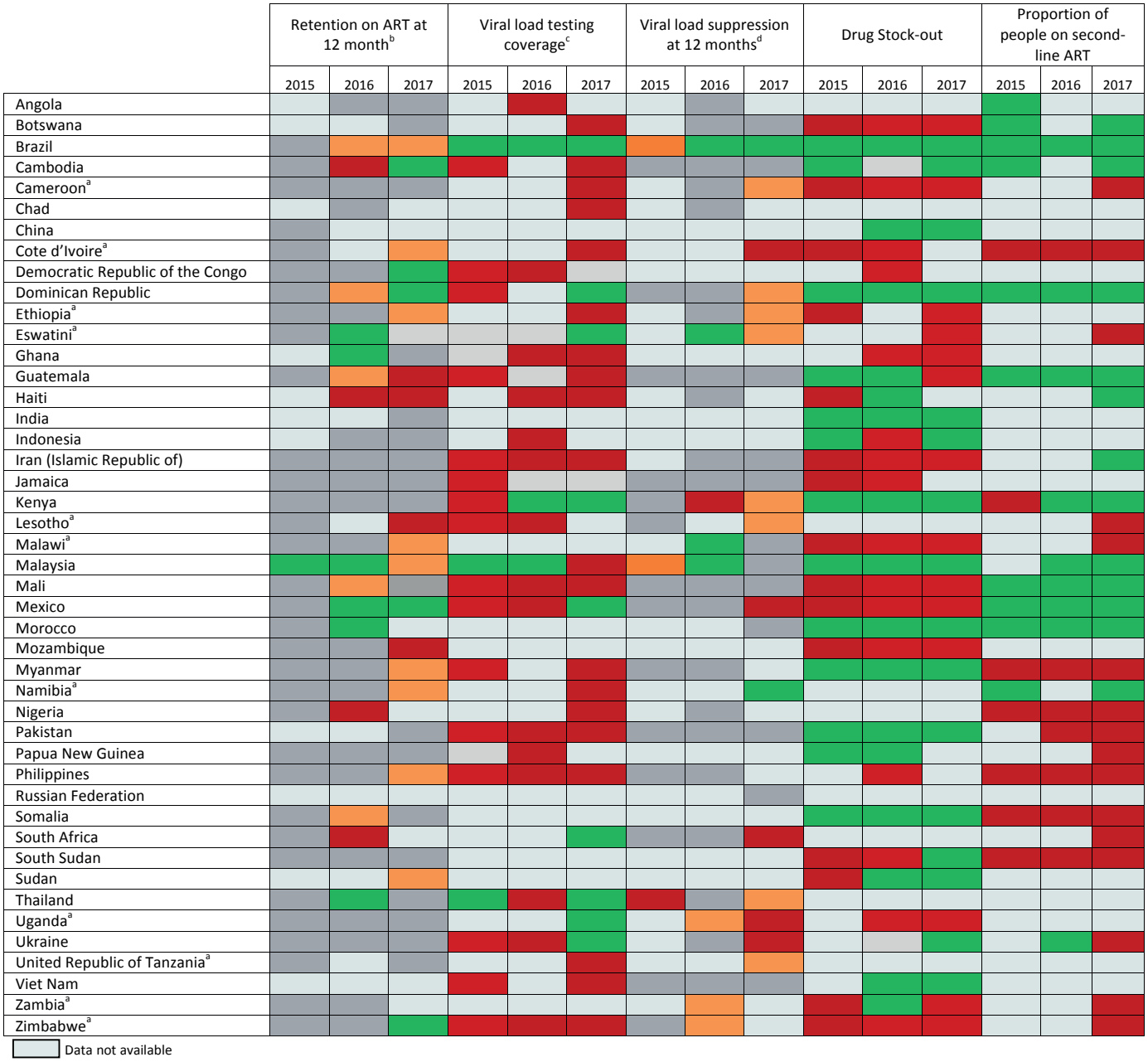
1 Global AIDS Monitoring [online database]. Geneva: UNAIDS; 2019 (https://www.unaids.org/en/dataanalysis/knowyour response/globalaidsprogressreporting, accessed 5 July 2019).

2 https://phia.icap.columbia.edu

3 Consolidated guidelines on person-centred HIV patient monitoring and case surveillance guidelines (section 2.4.6) and Annex 2.4.6: HIVDR EWI sampling, abstraction and reporting guidance. Geneva: World Health Organization; 2017 (https://www. who.int/hiv/pub/guidelines/WHO_Consolidated_Guidelines_Annexes_2.4.6.pdf?ua=1, accessed 5 July 2019).

Fig. 4.1 Countries with a high burden of HIV infection meeting targets for the quality-of-care indicators associated with the emergence of HIVDR, 2015–2017



Source: UNAIDSInfo, UNAIDS/WHO Global AIDS Monitoring tool and WHO/AIDS Medicines and Diagnostics Survey on the use of ARV medicines and laboratory technologies and implementation of WHO related Guidelines.

[a] Viral load suppression data (from 11 countries) were obtained from PHIA (Population health impact survey supported by PEPFAR)

[b] Countries' datasets were included if they comprise ≥70% of the people newly initiating ART or <70% but reported to be nationally representative

[c] The data originated from countries responding with the proportion of people receiving treatment who received a viral load test in the 12 months period. Countries' datasets were included if data were collected from everyone receiving ART or from a nationally representative data set. However, the results may overestimate viral load testing coverage in countries in which viral load testing coverage is estimated based on the number of tests done and thus may not be able to account for multiple tests per patient

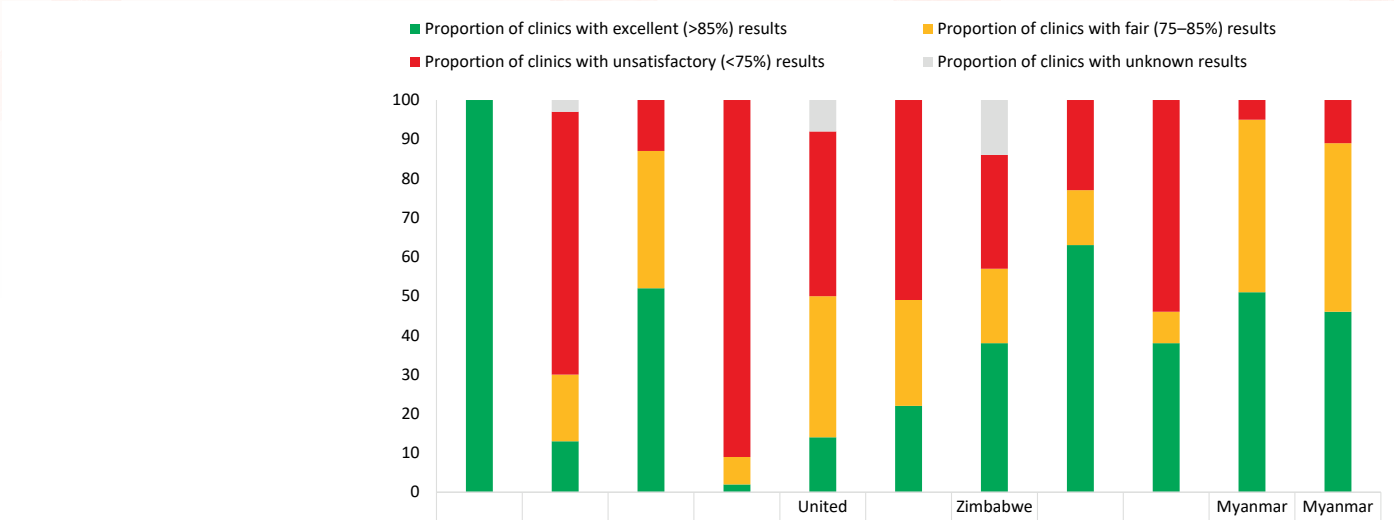
[e] Countries' datasets were included if viral load testing coverage was ≥70%; or <70% and reported to be nationally representative.

Figure 4.1 summarizes data on programmatic quality indicators associated with HIVDR from 45 WHO HIV focus countries. Overall data reporting was varied and not all countries met the reporting criteria for national-representativeness. Few countries attained the targets for quality of care indicators, but there was a signal of improvement for 2 of the 5 indicators: viral load testing coverage (number of countries meeting target improved from 16% in 2015 to 31% in 2017) and drug stock-outs (number of countries meeting target improved from 46% in 2015 to 53% in 2017). Of note, not all of the same countries reported the same indicators during the reporting period, limiting the ability to assess trends within and between countries over time.

All nine countries reported clinic-level data on 12-month retention[1] on ART among people newly initiating ART. The proportion of clinics that met the target of ≥85% exceeded 60% in eight of the 10 countries and ranged from a low of 2% in Ghana to 100% in Benin (**Fig. 4.2**).

Implication of the findings. Not all focus countries reported all quality of care indicators, and not all reported the same indicators over time; in addition, not all countries meet the reporting criteria for national representativeness. In general, data reporting was inadequate, suggesting the need for strengthening systems for collection and reporting data indicating programme quality. Few countries attained the targets for quality-of-care indicators, suggesting an urgent need for a proactive approach in addressing clear gaps in the quality of ART service delivery and in promoting practices which minimize the emergence and transmission of drug-resistant HIV. In particular, both programme- and clinic-level data indicate low rates of retention on ART; this may undermine the global efforts towards attaining epidemic control, since participants lost to follow up may be at a high risk of fuelling the HIV epidemic, including an HIVDR epidemic. More efforts are needed to elucidate the causes of low retention and implement context-specific interventions, including differentiated service delivery approaches, among others.

Fig. 4.2 Proportion of clinics achieving targets of quality of care indicators associated with the emergence of HIV drug resistance (Early Warning Indicators of HIVDR, EWI): focus on retention on ART at 12 months[1]



	Benin (2017)	Burkina Faso (2015)	Ethiopia (2016)	Ghana (2016)	United Republic of Tanzania (2016)	Uganda (2016)	Zimbabwe (adults and children, 2017)	Dominican Republic (2015)	Egypt (2017)	Myanmar (adults and children, 2014)	Myanmar (adults and children, 2015)
Proportion of clinics with unknown results		3			8		14				
Proportion of clinics with unsatisfactory (<75%) results		67	13	91	42	51	29	23	54	5	11
Proportion of clinics with fair (75–85%) results		17	35	7	36	27	19	14	8	44	43
Proportion of clinics with excellent (>85%) results	100	13	52	2	14	22	38	63	38	51	46
Number of clinics providing ART	114	108	1230		1800	1803	1573	72	13	141	141
Number of clinics reporting early warning indicators	7	30	94	203	36	304	43	22	13	41	41

Fig. 4.2 shows 12-month retention on ART among people newly initiating ART in 10 countries reporting data to WHO. The data are reported by clinic, and the figure indicates the proportion of clinics with unsatisfactory, fair and excellent retention outcomes. Overall, the levels of retention were suboptimal in most clinics; the proportion of clinics that met the target of ≥85% of people retained in care (excellent outcome) ranged from 2% in Ghana to 63% in the Dominican Republic. Only Benin reported achieving this target for all the clinics.

[1] Retention is defined as % of patients retained on ART 12 months after ART initiation (numerator: number of people who are alive and on ART 12 months after initiating treatment; denominator: number of people who initiated ART and who were expected to achieve the 12-month outcomes within the reporting period, including those who have died since starting therapy, those who have stopped ART and those who have died since starting therapy, and those recorded as lost to follow-up at month 12).

TABLES

Section 1. Pretreatment HIV drug resistance among adults initiating first-line antiretroviral therapy

Table 1.1a. Population characteristics of national PDR surveys – Africa

	Cameroon (start year 2015)		Eswatini (start year 2016)		Namibia (start year 2015)	
		N = 321		*N* = 398		*N* = 383
	n	% (95% CI)[a]	*n*	% (95% CI)[a]	*n*	% (95% CI)[a]
Gender						
Women	203	65.4 (60.0–70.6)	279	73.3 (63.2–81.5)	248	64.8 (59.3–69.8)
Men	118	34.6 (29.4–40.1)	119	26.7 (18.5–36.8)	135	35.2 (30.1–40.7)
Other	0	–	0	–	0	–
Unknown	0	–	0	–	0	–
Meanb age (95% CI), years[b] Initiated first-line	**37.7 (36.5–38.9)**		**34.4 (31.6–37.2)**		**35.3 (33.5–37.1)**	
NNRTI-based[c]	320	100.0 (99.7–100.0)	0	–	379	99.7 (98.0–100.0)
PI-based[d]	1	<0.5	0	–	0	–
DTG-based	0	–	0	–	0	–
Unknown	0	–	398	100.0	1	<0.5
Backbone: TDF-based	276	87.7 (78.0–93.5)	0	–	360	94.7 (91.8–96.7)
Backbone: AZT-based	45	12.3 (6.5–22.0)	0	–	15	3.9 (2.3–6.6)
Backbone: d4T-based	0	–	0	–	0	–
Previous ARV drug exposure						
Yes	29	7.8 (4.2–14.0)	40	10.7 (6.8–16.4)	69	18.0 (13.2–24.0)
No	223	80.6 (72.2–86.9)	358	89.3 (83.6–93.2)	313	81.7 (75.6–86.6)
Unknown	69	11.6 (6.2–20.9)	0	–	1	<0.5
Previous ARVdrug exposure (women)						
Yes	22	10.0 (5.1–18.7)	36	14.2 (8.7–22.5)	48	19.4 (14.7–24.5)
No	137	77.3 (67.4–84.5)	243	85.8 (77.5–91.4)	199	80.2 (74.6–84.9)
Unknown	44	12.7 (6.8–22.6)	0	–	1	<0.5
Previous ARV drug exposure (men)						
Yes	7	3.6 (1.1–11.0)	4	0.9 (0.2–3.2)	21	15.6 (10.1–23.1)
No	86	86.8 (77.1–92.7)	115	99.1 (96.8–99.8)	114	84.4 (76.9–89.9)
Unknown	25	9.6 (4.5–19.3)	0	–	–	–
Type of ARV drug exposure						
PMTCT	14	47.4 (17.2–79.7)	25	60.6 (29.7–84.9)	16	23.2 (13.3–37.1)
ART	9	24.0 (5.7–62.4)	11	16.1 (5.4–39.4)	53	76.8 (62.8–86.6)
Other	6	28.6 (4.6–76.9)	0	–	0	–
Unknown	0	–	4	23.3 (4.5–66.3)	0	–

[a] Study design – weighted proportion and 95% confidence interval.
[b] Study design – weighted mean and 95% confidence interval.
[c] NNRTI-based first-line regimens include EFV or NVP.
[d] PI-based first-line regimens include ATV/r, DRV/r or LPV/r.

Table 1.1.b. Population characteristics of national PDR surveys – Africa

	Uganda[a] (start year 2016)		Zimbabwe[b] (start year 2015)	
		N = 342		*N* = 353
	n	% (95% CI)[c]	*n*	% (95% CI)[c]
Gender				
Women	208	61.4 (51.8–70.2)	207	56.7 (50.1–63.0)
Men	133	38.4 (29.7–48.0)	145	43.3 (36.9–49.8)
Other	0	–	–	–
Unknown	0	–	1	<0.5
Mean age[d] (95% CI), years Initiated first-line	**34.1 (31.2–37.0)**		**34.7 (32.6–36.8)**	
NNRTI-based[e]	321	100.0	353	100.0
PI-based[f]	0	–	0	–
DTG-based	0	–	0	–
Unknown	0	–	0	–
Backbone: TDF-based	305	94.5 (86.8–97.8)	353	100.0
Backbone: AZT-based	16	5.5 (2.2–13.2)	0	–
Backbone: d4T-based	0	–	0	–
Previous ARV drug exposure				
Yes	9	1.2 (0.4–3.7)	NA	NA
No	296	88.9 (77.2–95.0)	NA	NA
Unknown	37	9.9 (4.2–21.2)	NA	NA
Previous ARV drug exposure (women)				
Yes	5	0.9 (0.2–3.8)	NA	NA
No	177	89.6 (74.9–96.1)	NA	NA
Unknown	26	9.5 (3.3–24.8)	NA	NA
Previous ARV drug exposure (men)				
Yes	4	1.8 (0.5–6.4)	NA	NA
No	118	87.8 (76.9–94.0)	NA	NA
Unknown	11	10.4 (4.9–20.9)	NA	NA
Type of ARV drug exposure				
PMTCT	14	47.4 (17.2–79.7)	NA	NA
ART	9	24.0 (5.7–62.4)	NA	NA
Other	6	28.6 (4.6–76.9)	NA	NA
Unknown	0	–	NA	NA

[a] One participant had missing data for gender and 21 participants had missing data for initiated first-line.
[b] Previously ARV drug–exposed participants were not included in the survey.
[c] Study design–weighted proportion and 95% confidence interval.
[d] Study design–weighted mean and 95% confidence interval.
[e] NNRTI-based first-line regimens include EFV or NVP.
[f] PI-based first-line regimens include ATV/r, DRV/r or LPV/r.

NA: not available, since individuals with previous ARV drug exposure were excluded from the survey.

Table 1.1.c. Population characteristics of national PDR surveys – the Americas

	Argentina (start year 2014)		Brazil[a] (start year 2014)[b]		Cuba[c] (start year 2017)		Colombia[d] (start year 2016)	
		N = 294		*N* = 1390		*N* = 150		*N* = 192
	n	% (95% CI)[e]	*n*	% (95% CI)[e]	*n*	% (95% CI)[e]	*n*	% (95% CI)[e]
Gender								
Women	97	33.3 (27.0–40.2)	380	30.3 (26.7–34.1)	30	20.3 (15.4–26.3)	22	11.5 (8.1–15.9)
Men	195	65.9 (58.8–72.4)	874	69.7 (65.8–73.3)	120	79.7 (73.7–84.6)	170	88.5 (84.1–91.9)
Other	2	0.8 (0.2–3.2)	0	–	0	–	0	–
Unknown	0	–	0	–	0	–	0	–
Mean[f] age (95% CI), years Initiated first-line		**36.2 (34.8–37.7)**		**35.6 (35.0–36.2)**		**35.1 (31.8–38.5)**		**31.7 (30.5–32.9)**
NNRTI-based[g]	202	68.4 (58.3–77.1)	NA	NA	94	62.1 (53.2–70.3)	NA	NA
PI-based[h]	89	30.1 (22.2–41.0)	NA	NA	26	17.2 (10.2–27.4)	NA	NA
Others	3	0.7 (0.2–2.3)	NA	NA	2	1.0 (0.2–4.1)	NA	NA
Backbone: TDF-based	219	71.0 (55.6–82.8)	NA	NA	96	62.3 (52.4–71.3)	NA	NA
Backbone: AZT-based	52	18.9 (12.4–27.7)	NA	NA	43	31.4 (22.3–42.1)	NA	NA
Backbone: d4T-based	0	–	NA	NA	0	–	NA	NA
Backbone: others	23	10.1 (3.5–25.8)	NA	NA	0	–	NA	NA
Previous ARV drug exposure								
Yes	54	18.6 (12.2–27.3)	NA	NA	NA	NA	NA	NA
No	239	81.0 (72.4–87.4)	NA	NA	NA	NA	NA	NA
Unknown	1	<0.5	NA	NA	NA	NA	NA	NA
Previous ARV drug exposure (women)								
Yes	27	29.0 (18.0–43.3)	NA	NA	NA	NA	NA	NA
No	70	71.0 (56.7–82.1)	NA	NA	NA	NA	NA	NA
Unknown	0	–	NA	NA	NA	NA	NA	NA
Previous ARV drug exposure (men)								
Yes	27	13.6 (8.4–21.3)	NA	NA	NA	NA	NA	NA
No	167	85.9 (78.3–91.1)	NA	NA	NA	NA	NA	NA
Unknown	1	<0.5	NA	NA	NA	NA	NA	NA
Type of ARV drug exposure								
PMTCT	10	20.7 (10.2–37.6)	NA	NA	NA	NA	NA	NA
ART	43	77.0 (62.1–87.3)	NA	NA	NA	NA	NA	NA
Other	1	<0.5	NA	NA	NA	NA	NA	NA
Unknown	0	–	NA	NA	NA	NA	NA	NA

[a] Previously ARV drug–exposed participants were not included in the survey; initiated first-line was not available; 137 participants had missing information for gender, and 185 had missing information for age.
[b] Survey enrolment between 2013 and 2016, with the majority (~80%) of survey participants enrolled in 2014.
[c] Previously exposed participants were not included in the survey.
[d] Previously exposed participants were not included in the survey; initiated first-line was not available.
[e] Study design–weighted proportion and 95% confidence interval.
[f] Study design–weighted mean and 95% confidence interval.
[g] NNRTI-based first-line regimens include EFV or NVP.
[h] PI-based first-line regimens include ATV/r, DRV/r or LPV/r.

NA: not available.

Table 1.1d. Characteristics of the population for PDR surveys – the Americas

	Guatemala[a] (start year 2016)		Honduras (start year 2016)		Mexico[b] (start year 2017)		Nicaragua[c] (start year 2016)	
	N = 241		*N* = 194		*N* = 2006		*N* = 171	
	n	% (95% CI)[d]	*n*	% (95% CI)[d]	*n*	% (95% CI)[d]	*n*	% (95% CI)[d]
Gender								
Women	66	32.7 (20.1–48.4)	61	36.1 (27.8–45.4)	328	15.2 (13.8–16.7)	48	28.1 (21.5–35.7)
Men	173	66.7 (51.0–79.4)	126	59.1 (50.5–67.1)	1676	84.6 (83.1–86.0)	123	71.9 (64.3–78.5)
Other	2	0.6 (0.2–2.3)	7	4.8 (2.1–13.0)	2	0.2 (0.1–0.7)	0	–
Unknown	0	–	0	–	0	–	0	–
Mean[e] age (95% CI), years Initiated first-line	**32.9 (31.8–34.1)**		**33.5 (31.7–35.2)**		**31.9 (31.4–32.3)**		**34.2 (32.5–35.9)**	
NNRTI-based[f]	220	96.7 (91.3–98.8)	172	86.3 (80.4–90.7)	415	19.3 (17.7–20.9)	165	97.1 (94.7–98.4)
PI-based[g]	5	2.9 (1.0–8.3)	2	0.5 (0.2–1.0)	64	3.1 (2.4–3.9)	5	2.9 (1.6–5.3)
DTG-based	0	–	0	–	53	2.5 (1.9–3.2)	0	–
Unknown	1	<0.5	19	13.0 (8.7–18.9)	1400	71.6 (69.7–73.4)	0	–
Backbone: TDF-based	215	94.0 (89.8–96.7)	144	69.7 (61.5–76.8)	548	25.8 (24.1–27.7)	152	89.4 (83.8–93.3)
Backbone: AZT-based	8	4.9 (2.5–9.3)	30	16.7 (11.7–23.3)	12	0.6 (0.4–1.1)	16	9.4 (5.8–15.0)
Backbone: d4T-based	0	–	0	–	0	–	0	–
Previous ARV drug exposure								
Yes	7	2.8 (0.7–11.1)	41	26.3 (20.1–33.5)	158	7.4 (6.3–8.7)	21	12.3 (5.8–24.3)
No	229	93.9 (81.9–98.1)	134	61.3 (53.3–68.7)	1848	92.6 (91.3–93.7)	146	85.4 (75.4–91.7)
Unknown	5	3.3 (0.8–12.9)	19	12.4 (8.1–18.7)	0	–	4	2.3 (1.0–5.4)
Previous ARV drug exposure (women)								
Yes	3	5.7 (1.1–9.3)	19	36.0 (22.3–52.4)	55	16.8 (12.9–21.5)	13	27.1 (16.6–40.9)
No	60	91.1 (79.3–96.4)	35	51.2 (34.1–68.1)	273	83.2 (78.5–87.1)	34	70.8 (56.5–82.0)
Unknown	3	3.3 (1.5–19.5)	7	12.8 (5.8–16.1)	0	–	1	2.1 (0.2–15.8)
Previous ARV drug exposure (men)								
Yes	4	2.6 (0.9–6.9)	22	22.5 (14.8–32.6)	103	5.7 (4.6–7.1)	8	6.5 (3.0–13.6)
No	167	95.3 (88.9–98.1)	92	64.3 (54.5–73.1)	1573	94.3 (92.9–95.4)	112	91.2 (83.7–95.3)
Unknown	2	2.1 (0.5–9.4)	12	13.2 (7.2–23.0)	0	–	3	2.4 (0.7–7.9)
Previous ARV drug exposure (others)								
Yes	NA	NA	0	–	0	–	NA	NA
No	NA	NA	7	100	2	100	NA	NA
Unknown	NA	NA	0	–	0	–	NA	NA
Type of ARV drug exposure								
PMTCT	1	12.0 (0.1–94.0)	3	7.9 (2.1–25.1)	0	–	8	38.1 (18.3–62.8)
ART	0	–	36	90.8 (74.7–97.1)	154	97.1 (91.6–99.0)	2	9.5 (1.2–47.6)
Other	0	–	0	–	4	2.9 (1.0–8.4)	1	4.8 (0.3–41.9)
Unknown	6	88.0 (6.0–99.9)	2	1.3 (0.3–6.8)	0	–	10	47.6 (34.9–60.6)

[a] 15 participants had missing data for initiated first-line.
[b] 23 participants had missing data for age.
[c] One participant had missing data for initiated first-line.
[d] Study design–weighted proportion and 95% confidence interval.
[e] Study design–weighted mean and 95% confidence interval.
[f] NNRTI-based first-line regimens include EFV or NVP.
[g] PI-based first-line regimens include ATV/r, DRV/r or LPV/r.

NA: not available, since individuals with previous ARV drug exposure were excluded from the survey.

Table 1.1e. Characteristics of the population for PDR surveys – South-East Asia and the Western Pacific

	Myanmar[a] (start year 2016)		Nepal (start year 2016)		Papua New Guinea[b] (start year 2017)		Viet Nam (start year 2017)	
	N = 327		*N* = 274		*N* = 337		*N* = 409	
	n	% (95% CI)[c]	*n*	% (95% CI)[c]	*n*	% (95% CI)[c]	*n*	% (95% CI)[c]
Gender								
Women	115	36.6 (29.8–43.9)	143	50.8 (44.2–57.3)	207	62.5 (57.9–66.8)	122	29.9 (22.8–38.0)
Men	206	63.4 (56.1–70.2)	123	46.4 (39.9–53.1)	128	37.0 (33.0–41.3)	287	70.1 (62.0–77.2)
Other	0	–	1	0.2 (0.0–0.6)	0	–	0	–
Unknown	0	–	7	2.7 (1.6–4.5)	2	0.5 (0.1–2.3)	0	–
Mean[d] age (95% CI), years Initiated first-line	**35.6 (34.1–37.2)**		**34.7 (33.6–35.7)**		**31.4 (30.4–32.5)**		**34.2 (32.8–35.6)**	
NNRTI-based[e]	263	100.0	0	–	312	100.0 (98.8–100.0)	0	–
PI-based[f]	0	–	0	–	0		0	–
DTG-based	0	–	00	–	0		0	-
Unknown	0	–	274	100.0	0		409	100.0
Backbone: TDF-based	250	93.9 (88.9–96.8)	0	–	267	84.0 (63.1–94.2)	0	–
Backbone: AZT-based	7	3.7 (1.5–8.8)	0	–	43	15.4 (5.7–35.4)	0	–
Backbone: d4T-based	3	0.8 (0.2–2.9)	0	–	2	0.5 (0.1–3.5)	0	–
Others	3		0	–	0	–	0	–
Previous ARV drug exposure								
Yes	32	8.4 (5.0–13.8)	0	–	69	20.9 (13.8–30.3)	28	7.0 (4.1–11.7)
No	287	90.0 (83.7–94.0)	0	–	268	79.1 (69.7–86.2)	371	89.8 (82.7–94.2)
Unknown	8	1.6 (0.5–5.6)	274	100.0	0	–	10	3.2 (0.8–12.6)
Previous ARV drug exposure (women)								
Yes	19	9.0 (4.8–16.1)	0	–	51	25.4 (19.2–32.9)	14	12.3 (5.6–24.9)
No	185	90.2 (82.2–94.8)	0	–	156	74.6 (67.1–80.8)	107	85.9 (72.9–93.2)
Unknown	2	0.8 (0.2–4.4)	143	100.0	0	–	1	1.8 (0.8–12.6)
Previous ARV drug exposure (men)								
Yes	13	7.6 (2.9–18.9)	0	–	17	12.8 (4.7–30.2)	14	4.7 (2.3–9.5)
No	102	92.4 (81.1–97.1)	0	–	111	87.2 (69.8–95.3)	264	91.5 (83.2–95.9)
Unknown	0	–	123	100.0	0	–	9	3.8 (1.0–13.8)
Previous ARV drug exposure (others)								
Yes	NA	NA	0		1	51.8 (5.3–95.4)	NA	NA
No	NA	NA	0		1	48.2 (4.6–94.7)	NA	NA
Unknown	NA	NA	1	100.0	0	–	NA	NA
Type of ARV drug exposure								
PMTCT	4	10.1 (2.9–29.7)	NA		0		7	30.9 (9.7–65.1)
ART	24	76.3 (41.2 –93.7)	NA		68	100.0 (94.7–100.0)	21	69.1 (34.9–90.4)
Other	3	13.2 (2.7–45.5)	NA		0		0	–
Unknown	1	<0.5	NA		0		0	–

[a] Six participants had missing information for age and gender, and 64 participants had missing information for initiated first-line.
[b] One participant had missing information on data for type of previous ARV drug exposure, and 25 participants had missing information for initiated first-line.
[c] Study design–weighted proportion and 95% confidence interval.
[d] Study design-weighted mean and 95% confidence interval.
[e] NNRTI-based first-line regimens include EFV or NVP.
[f] PI-based first-line regimens include ATV/r, DRV/r or LPV/r.

NA: not available.

Table 1.2a. National prevalence estimates of PDR – Africa

	Cameroon		Eswatini		Namibia[b]	
	n/N	Prevalence % (95% CI)	*n/N*	Prevalence % (95% CI)	*n/N*	Prevalence % (95% CI)
All[a]						
Any	24/321	8.3 (4.4–15.0)	34/266	11.6 (7.1–18.4)	56/383	14.6 (11.6–18.2)
NNRTI	23/321	8.1 (4.3–14.7)	31/266	10.5 (6.3–17.0)	53/383	13.8 (11.1–17.1)
NRTI	5/321	2.4 (0.4–12.9)	4/266	1.0 (0.3–3.3)	6/383	1.6 (0.6–3.8)
PI	1/321	0.2 (0.0–1.7)	2/266	0.9 (0.2–4.2)	2/383	0.5 (0.1–2.2)
NNRTI+NRTI	5/321	2.4 (0.4–12.9)	3/266	0.8 (0.2–3.2)	5/383	1.3 (0.5–3.6)
Women						
Any	17/203	10.6 (5.2–20.3)	24/173	14.6 (9.1–22.6)	39/248	15.7 (11.3–21.5)
NNRTI	16/203	10.2 (4.9–20.0)	21/173	12.8 (7.6–20.7)	37/248	14.9 (10.7–20.4)
NRTI	4/203	3.6 (0.6–18.7)	4/173	1.7 (0.5–5.1)	4/248	1.6 (0.5–5.3)
PI	1/203	0.3 (0.0–2.6)	2/173	1.5 (0.3–6.4)	2/248	0.8 (0.2–3.2)
NNRTI+NRTI	4/203	3.6 (0.6–18.7)	3/173	1.3 (0.4–5.0)	4/248	1.6 (0.5–5.3)
Men						
Any	7/118	4.0 (1.4–10.4)	10/93	6.9 (2.6–17.3)	17/135	12.6 (9.1–17.2)
NNRTI	7/118	4.0 (1.4–10.4)	10/93	6.9 (2.6–17.3)	16/135	11.9 (8.2–16.8)
NRTI	1/118	0.1 (0.0–0.8)	0/93	–	2/135	1.5 (0.3–6.2)
PI	0/118	–	0/93	–	0/135	–
NNRTI+NRTI	1/118	0.1 (0.0–0.8)	0/93	–	1/135	0.7 (0.1–6.0)
Treatment naive						
Any	13/223	7.9 (3.8–15.9)	29/240	11.0 (6.6–17.6)	31/313	9.9 (6.5–14.9)
NNRTI	12/223	7.7 (3.6–15.7)	26/240	9.7 (5.8–15.9)	29/313	9.3 (6.1–13.8)
NRTI	2/223	2.8 (0.4–16.3)	3/240	0.8 (0.2–3.1)	1/313	0.3 (0.0–2.5)
PI	1/223	0.3 (0.0–2.1)	2/240	1.0 (0.2–4.8)	2/313	0.6 (0.2–2.6)
NNRTI+NRTI	2/223	2.8 (0.4–16.3)	2/240	0.5 (0.1–3.2)	1/313	0.3 (0.0–2.5)
Treatment naive (women)						
Any	11/137	11.8 (5.5–23.3)	19/150	13.9 (8.5–21.8)	22/199	11.1 (7.3–16.5)
NNRTI	10/137	11.3 (5.2–22.9)	16/150	11.7 (6.9–19.1)	20/199	10.1 (6.4–15.4)
NRTI	2/137	4.5 (0.8–21.8)	3/150	1.3 (0.3–5.2)	1/199	0.5 (0–3.9)
PI	1/137	0.4 (0–3.2)	2/150	1.8 (0.4–7.6)	2/199	1.0 (0.2–4.3)
NNRTI+NRTI	2/137	4.5 (0.8–21.8)	2/150	0.9 (0.2–5.2)	1/199	0.5 (0–3.9)
Treatment naive (men)						
Any	2/86	1.5 (0.4–5.9)	10/90	7.1 (2.6–18.2)	9/114	7.9 (4.0–15.0)
NNRTI	2/86	1.5 (0.4–5.9)	10/90	7.1 (2.6–18.2)	9/114	7.9 (4.0–15.0)
NRTI	0/86	–	0/90	–	0/114	–
PI	0/86	–	0/90	–	0/114	–
NNRTI+NRTI	0/86	–	0/90	–	0/114	–
Previously exposed						
Any	8/29	20.5 (6.8–47.8)	5/26	16.1 (6.1–36.3)	25/69	36.2 (25.6–48.5)
NNRTI	8/29	20.5 (6.8–47.8)	5/26	16.1 (6.1–36.3)	24/69	34.8 (25.2–45.8)
NRTI	3/29	1.6 (0.2–9.9)	1/26	2.8 (0.4–17.3)	5/69	7.2 (2.7–18.2)
PI	0/29	–	0/26	–	0/69	–
NNRTI+NRTI	3/29	1.6 (0.2–9.9)	1/26	2.8 (0.4–17.3)	4/69	5.8 (1.7–17.9)
Previously exposed (women)						
Any	4/22	12.9 (3.1–40.9)	5/23	17.7 (6.7–39.2)	17/48	35.4 (22.7–50.6)
NNRTI	4/22	12.9 (3.1–40.9)	5/23	17.7 (6.7–39.2)	17/48	35.4 (22.7–50.6)
NRTI	2/22	1.2 (0.2–7.1)	1/23	3.1 (0.4–18.8)	3/48	6.3 (2.0–18.3)
PI	0/22	–	0/23	–	0/48	–
NNRTI+NRTI	2/22	1.2 (0.2–7.1)	0/23	–	3/48	6.3 (2.0–18.3)
Previously exposed (men)						
Any	4/7	60.6 (12.7–94.2)	0/3	–	8/21	38.1 (19.4–61.2)
NNRTI	4/7	60.6 (12.7–94.2)	0/3	–	7/21	33.3 (15.9–56.9)
NRTI	1/7	3.3 (0.4–21.1)	0/3	–	2/21	9.5 (2.2–32.9)
PI	0/7	–	0/3	–	0/21	–
NNRTI+NRTI	1/7	3.3 (0.4–21.1)	0/3	–	1/21	4.8 (0.6–29.5)

[a] Estimates of HIVDR for all ART initiators include ARV-naive individuals, those with previous ARV drug exposure and those with unknown ARV drug exposure.
[b] Unweighted estimates differs from the weighted estimate that has been reported elsewhere (doi: 10.1093/jac/dky278)

NA: not available, since individuals with previous ARV drug exposure were excluded from the survey.
NNRTI resistance is defined as resistance to nevirapine (NVP) efavirenz (EFV); NRTI resistance is defined as resistance to any NRTI and any PI resistance is defined as resistance to atazanavir/ritonavir (ATV/r), lopinavir/ritonavir (LPV/r) or darunavir/ritonavir (DRV/r).
Any HIVDR is defined as resistance to NVP/EFV, any NRTI, ATV/r, LPV/r or DRV/r.
HIVDR is determined using the Stanford HIVdb algorithm: sequences classified as having low-, intermediate- or high-level resistance are considered resistant.

Table 1.2b. National prevalence estimates of PDR – Africa

	Uganda		Zimbabwe	
	n/N	Prevalence % (95% CI)	*n/N*	Prevalence % (95% CI)
All[a]				
Any	48/342	17.4 (12.1–24.3)	NA	NA
NNRTI	43/342	15.4 (10.3–22.5)	NA	NA
NRTI	11/342	5.1 (2.4–10.3)	NA	NA
PI	2/342	1.0 (0.2–4.6)	NA	NA
NNRTI+NRTI	8/342	4.1 (1.8–9.0)	NA	NA
Women				
Any	31/208	19.2 (11.8–29.8)	NA	NA
NNRTI	28/208	16.5 (9.5–27.2)	NA	NA
NRTI	9/208	7.3 (3.3–15.4)	NA	NA
PI	1/208	1.3 (0.2–7.5)	NA	NA
NNRTI+NRTI	7/208	5.9 (2.4–13.9)	NA	NA
Men				
Any	17/133	14.5 (9.9–20.7)	NA	NA
NNRTI	15/133	13.7 (9.1–20.3)	NA	NA
NRTI	2/133	1.5 (0.3–7.1)	NA	NA
PI	1/133	0.4 (0.0–3.6)	NA	NA
NNRTI+NRTI	1/133	1.2 (0.2–8.1)	NA	NA
Treatment naive				
Any	44/296	18.1 (12.7–25.2)	34/353	10.9 (7.1–16.4)
NNRTI	39/296	15.9 (10.2–24.0)	34/353	10.9 (7.1–16.4)
NRTI	11/296	5.7 (2.7–11.5)	3/353	0.8 (0.2–3.3)
PI	2/296	1.1 (0.2–5.4)	0/353	–
NNRTI+NRTI	8/296	4.6 (2.1–9.9)	3/353	0.8 (0.2–3.3)
Treatment naive (women)				
Any	27/177	19.2 (11.5–30.3)	26/207	16.1 (10.9–23.0)
NNRTI	24/177	16.1 (8.3–29.0)	26/207	16.1 (10.9–23.0)
NRTI	9/177	8.2 (3.7–16.9)	3/207	1.4 (0.4–5.6)
PI	1/177	1.4 (0.2–8.6)	0/207	–
NNRTI+NRTI	7/177	6.6 (2.7–15.1)	3/207	1.4 (0.4–5.6)
Treatment naive (men)				
Any	17/118	16.5 (11.4–23.2)	8/145	4.1 (1.1–14.3)
NNRTI	15/118	15.7 (10.5–22.6)	8/145	4.1 (1.1–14.3)
NRTI	2/118	1.7 (0.3–8.3)	0/145	–
PI	1/118	<0.5	0/145	–
NNRTI+NRTI	1/118	1.4 (0.2–9.4)	0/145	–
Previously exposed				
Any	2/9	17.5 (2.3–65.2)	NA	NA
NNRTI	2/9	17.5 (2.3–65.2)	NA	NA
NRTI	0/9	–	NA	NA
PI	0/9	–	NA	NA
NNRTI+NRTI	0/9	–	NA	NA
Previously exposed (women)				
Any	2/5	38.4 (9.4–79.0)	NA	NA
NNRTI	2/5	38.4 (9.4–79.0)	NA	NA
NRTI	0/5	–	NA	NA
PI	0/5	–	NA	NA
NNRTI+NRTI	0/5	–	NA	NA
Previously exposed (men)				
Any	0/4	–	NA	NA
NNRTI	0/4	–	NA	NA
NRTI	0/4	–	NA	NA
PI	0/4	–	NA	NA
NNRTI+NRTI	0/4	–	NA	NA

[a] Estimates of HIVDR in all ART initiators include ARV-naive individuals, those with previous ARV drug exposure and those with unknown ARV drug exposure.

NA: not available, since individuals with previous ARV drug exposure were excluded from the survey.
NNRTI resistance is defined as resistance to nevirapine (NVP) or efavirenz (EFV); NRTI resistance is defined as resistance to any NRTI and any PI resistance is defined as resistance to atazanavir/ritonavir (ATV/r), lopinavir/ritonavir (LPV/r), or darunavir/ritonavir (DRV/r).
Any HIVDR is defined as resistance to NVP/EFV, any NRTI, ATV/r, LPV/r or DRV/r.
HIVDR is determined using the Stanford HIVdb algorithm: sequences classified as having low-, intermediate- or high-level resistance are considered resistant.

Table 1.2c. National prevalence estimates of PDR – the Americas

	Argentina		Brazil		Cuba		Colombia	
	n/N	Prevalence % (95% CI)	*n/N*	Prevalence % (95% CI)	*n/N*	Prevalence % (95% CI)	*n/N*	Prevalence % (95% CI)
All[a]								
Any	41/294	13.8 (10.3–18.3)	NA	NA	NA	NA	NA	NA
NNRTI	33/294	10.9 (8.2–14.3)	NA	NA	NA	NA	NA	NA
NRTI	10/294	3.7 (1.9–7.0)	NA	NA	NA	NA	NA	NA
PI	6/294	1.9 (0.7–4.8)	NA	NA	NA	NA	NA	NA
NNRTI+NRTI	5/294	1.7 (0.6–4.6)	NA	NA	NA	NA	NA	NA
Women								
Any	14/97	15.5 (9.7–24.0)	NA	NA	NA	NA	NA	NA
NNRTI	12/97	11.9 (6.5–20.9)	NA	NA	NA	NA	NA	NA
NRTI	5/97	6.2 (2.3–15.4)	NA	NA	NA	NA	NA	NA
PI	1/97	1.2 (0.1–8.3)	NA	NA	NA	NA	NA	NA
NNRTI+NRTI	4/97	3.7 (1.1–12.2)	NA	NA	NA	NA	NA	NA
Men								
Any	27/195	13.1 (8.8–19.2)	NA	NA	NA	NA	NA	NA
NNRTI	21/195	10.5 (6.9–15.8)	NA	NA	NA	NA	NA	NA
NRTI	5/195	2.4 (0.9–6.4)	NA	NA	NA	NA	NA	NA
PI	5/195	2.3 (0.9–5.4)	NA	NA	NA	NA	NA	NA
NNRTI+NRTI	1/195	0.6 (0.1–4.4)	NA	NA	NA	NA	NA	NA
Treatment naive								
Any	31/239	12.8 (9.2–17.4)	137/1391	9.8 (8.1–12.0)	42/141	29.1 (22.8–36.3)	19/192	9.9 (7.5–12.9)
NNRTI	24/239	9.4 (6.4–13.4)	94/1391	6.8 (5.6–8.1)	33/141	22.8 (15.8–31.6)	12/192	6.3 (3.8–10.2)
NRTI	8/239	3.6 (1.7–7.6)	50/1391	3.6 (2.8–4.7)	15/141	9.9 (6.2–15.6)	7/192	3.6 (1.7–7.6)
PI	5/239	2.1 (0.7–5.9)	13/1391	0.9 (0.6–1.5)	2/141	1.4 (0.3–5.7)	0/192	–
NNRTI+NRTI	3/239	1.1 (0.3–3.6)	17/1391	1.2 (0.8–1.9)	6/141	3.6 (1.8–7.3)	0/192	–
Treatment naive (women)								
Any	11/70	17.1 (9.8–28.1)	26/380	6.8 (5.5–8.5)	10/27	39.5 (20.3–62.6)	2/22	9.1 (2.1–31.5)
NNRTI	9/70	11.9 (6.0–22.3)	19/380	5.0 (3.8–6.6)	8/27	33.3 (14.9–58.7)	1/22	4.5 (0.6–26.9)
NRTI	3/70	5.5 (1.5–18.2)	11/380	2.9 (1.7–4.9)	5/27	15.4 (5.9–34.6)	1/22	4.5 (0.5–30.5)
PI	1/70	1.6 (0.2–11.4)	1/380	0.3 (0.0–2.1)	1/27	4.2 (0.5–27.0)	0/22	–
NNRTI+NRTI	2/70	2.0 (0.5–8.2)	5/380	1.3 (0.7–2.5)	3/27	9.2 (2.6–27.7)	0/22	–
Treatment naive (men)								
Any	20/167	11.2 (7.0–17.4)	100/874	11.4 (9.2–14.2)	32/114	26.5 (20.2–34.0)	17/170	10.0 (7.5–13.3)
NNRTI	15/167	8.4 (5.0–14.0)	66/874	7.6 (6.0–9.5)	25/114	20.2 (14.2–27.9)	11/170	6.5 (4.0–10.4)
NRTI	5/167	2.8 (1.0–7.5)	37/874	4.2 (3.2–5.6)	10/114	8.6 (4.4–16.2)	6/170	3.5 (1.5–7.9)
PI	4/167	2.3 (0.9–6.1)	11/874	1.3 (0.7–2.3)	1/114	0.8 (0.1–6.1)	0/170	–
NNRTI+NRTI	1/167	0.7 (0.1–5.3)	11/874	1.3 (0.7–2.3)	3/114	2.3 (0.7–6.9)	0/170	–
Previously exposed (all)								
Any	10/54	18.6 (10.7–30.4)	NA	NA	NA	NA	NA	NA
NNRTI	9/54	17.8 (10.0–29.5)	NA	NA	NA	NA	NA	NA
NRTI	2/54	4.1 (0.7–20.7)	NA	NA	NA	NA	NA	NA
PI	1/54	0.9 (0.1–4.9)	NA	NA	NA	NA	NA	NA
NNRTI+NRTI	2/54	4.1 (0.7–20.7)	NA	NA	NA	NA	NA	NA
Previously exposed (women)								
Any	3/27	11.8 (3.8–31.3)	NA	NA	NA	NA	NA	NA
NNRTI	3/27	11.8 (3.8–31.3)	NA	NA	NA	NA	NA	NA
NRTI	2/27	7.8 (1.5–32.3)	NA	NA	NA	NA	NA	NA
PI	0/27	–	NA	NA	NA	NA	NA	NA
NNRTI+NRTI	2/27	7.8 (1.5–32.3)	NA	NA	NA	NA	NA	NA
Previously exposed (men)								
Any	7/27	26.0 (11.9–47.8)	NA	NA	NA	NA	NA	NA
NNRTI	6/27	24.2 (10.7–46.1)	NA	NA	NA	NA	NA	NA
NRTI	0	–	NA	NA	NA	NA	NA	NA
PI	1/27	1.8 (0.3–9.5)	NA	NA	NA	NA	NA	NA
NNRTI+NRTI	0	–	NA	NA	NA	NA	NA	NA

[a] Estimates of HIVDR in all ART initiators include ARV-naive individuals, those with previous ARV drug exposure and those with unknown ARV drug exposure.

NA: not available, since individuals with previous ARV drug exposure were excluded from the survey.
NNRTI resistance is defined as resistance to nevirapine (NVP) or efavirenz (EFV); NRTI resistance is defined as resistance to any NRTI and any PI resistance is defined as resistance to atazanavir/ritonavir (ATV/r), lopinavir/ritonavir (LPV/r), or darunavir/ritonavir (DRV/r).
Any HIVDR is defined as resistance to NVP/EFV, any NRTI, ATV/r, LPV/r or DRV/r.
HIVDR is determined using the Stanford HIVdb algorithm: sequences classified as having low-, intermediate- or high-level resistance are considered resistant.

Table 1.2d. National prevalence estimates of PDR – the Americas

	Guatemala		Honduras		Mexico		Nicaragua	
	n/N	Prevalence % (95% CI)	*n/N*	Prevalence % (95% CI)	*n/N*	Prevalence % (95% CI)	*n/N*	Prevalence % (95% CI)
All[a]								
Any	34/241	15.1 (11.5–19.6)	48/161	26.9 (20.2–34.9)	261/2006	12.6 (11.2–14.0)	40/171	23.4 (14.4–35.6)
NNRTI	29/241	13.2 (8.8–19.4)	45/161	25.9 (19.2–33.9)	205/2006	9.9 (8.7–11.2)	33/171	19.3 (12.2–29.1)
NRTI	9/241	3.2 (1.5–6.8)	15/161	6.9 (4.0–11.7)	64/2006	3.2 (2.5–4.1)	18/171	10.5 (4.9–21.1)
PI	2/241	0.6 (0.1–3.7)	0/161	–	29/2006	1.4 (1.0–2.0)	0/171	–
NNRTI+NRTI	4/241	1.3 (0.4–3.9)	12/161	5.8 (3.1–10.7)	25/2006	1.3 (0.9–1.9)	11/171	6.4 (2.7–14.7)
Women								
Any	10/66	19.2 (11.1–31.2)	18/50	32.4 (18.1–50.9)	56/328	17.5 (13.4–22.6)	18/48	37.5 (20.8–57.8)
NNRTI	10/66	19.2 (11.1–31.2)	18/50	32.4 (18.1–50.9)	43/328	13.6 (10.0–18.2)	15/48	31.3 (19.6–45.8)
NRTI	1/66	1.0 (0.1–9.1)	6/50	9.2 (3.1–24.1)	16/328	4.7 (2.8–7.9)	7/48	14.6 (5.0–35.5)
PI	0/66	–	0/50	–	7/328	2.4 (1.1–5.2)	0/48	–
NNRTI+NRTI	1/66	1.0 (0.1–9.1)	6/50	9.2 (3.1–24.1)	7/328	2.2 (1.0–4.6)	4/48	8.3 (2.8–22.4)
Men								
Any	24/173	13.2 (9.6–17.9)	27/105	23.5 (15.7–33.7)	205/1676	11.7 (10.3–13.3)	22/123	17.9 (9.9–30.2)
NNRTI	19/173	10.4 (6.4–16.4)	24/105	21.8 (14.2–32.0)	162/1676	9.2 (8.0–10.7)	18/123	14.6 (8.0–25.3)
NRTI	8/173	4.3 (2.1–8.5)	8/105	5.5 (2.8–10.6)	48/1676	2.9 (2.2–3.9)	11/123	8.9 (4.0–18.8)
PI	2/173	0.9 (0.1–5.1)	0/105	–	22/1676	1.2 (0.8–1.9)	0/123	–
NNRTI+NRTI	3/173	1.4 (0.7–3.1)	5/105	3.8 (0.2–8.9)	18/1676	1.1 (0.7–1.8)	7/123	5.7 (2.4–13.1)
Treatment naive								
Any	31/229	14.9 (11.0–19.9)	26/112	16.9 (11.2–24.6)	206/1848	11.1 (9.7–12.6)	23/146	15.8 (8.8–26.6)
NNRTI	27/229	13.3 (8.5–20.1)	24/112	15.6 (10.2–23.1)	161/1848	8.6 (7.4–9.9)	16/146	11.0 (6.0–19.3)
NRTI	8/229	3.0 (1.5–6.0)	10/112	6.4 (3.4–11.6)	39/1848	2.3 (1.7–3.1)	10/146	6.8 (2.7–16.1)
PI	2/229	0.6 (0.1–3.8)	0/112	–	22/1848	1.2 (0.8–1.8)	0/146	–
NNRTI+NRTI	4/229	1.4 (0.4–4.2)	8/112	5.1 (2.6–10.0)	9/1848	0.5 (0.3–1.1)	3/146	2.1 (0.6–7.0)
Treatment naive (women)								
Any	9/60	19.9 (9.8–36.3)	7/28	13.5 (5.2–30.7)	37/273	13.9 (9.9–19.2)	7/34	20.6 (7.8–44.4)
NNRTI	9/60	19.9 (9.8–36.3)	7/28	13.5 (5.2–30.7)	28/273	10.4 (7.0–15.2)	4/34	11.8 (5.7–22.7)
NRTI	1/60	1.1 (0.4–3.0)	3/28	6.1 (1.4–22.6)	7/273	2.3 (1.0–5.2)	3/34	8.8 (1.7–35.2)
PI	0/60	–	0/28	–	4/273	1.6 (0.6–4.6)	0/34	–
NNRTI+NRTI	1/60	1.1 (0.4–3.0)	3/28	6.1 (1.4–22.6)	2/273	0.4 (0.1–1.7)	0/34	–
Treatment naive (men)								
Any	22/167	12.7 (9.3–17.3)	16/78	16.9 (9.6–27.9)	169/1573	10.7 (9.2–12.3)	16/112	14.3 (7.6–25.3)
NNRTI	18/167	10.3 (7.1–14.7)	14/78	14.9 (8.3–25.3)	133/1573	8.3 (7.0–9.8)	12/112	10.7 (5.3–20.5)
NRTI	7/167	4.0 (2.5–6.3)	6/78	6.5 (2.7–14.7)	32/1573	2.3 (1.6–3.2)	7/112	6.3 (2.4–15.2)
PI	2/167	0.9 (0.4–2.0)	0/78	–	18/1573	1.1 (0.7–1.8)	0/112	–
NNRTI+NRTI	3/167	1.5 (0.8–2.8)	4/78	4.5 (1.6–12.0)	7/1573	0.6 (0.3–1.2)	3/112	2.7 (0.8–9.1)
Previously exposed								
Any	3/7	38.7 (12.6–73.4)	18/33	54.8 (33.3–74.6)	55/158	31.3 (24.1–39.7)	16/21	76.2 (52.9–90.1)
NNRTI	2/7	26.7 (3.2–80.1)	17/33	53.8 (32.4–73.8)	44/158	26.2 (19.5–34.3)	16/21	76.2 (52.9–90.1)
NRTI	1/7	12.0 (1.6–53.8)	4/33	10.6 (2.8–33.3)	25/158	15.0 (10.1–21.8)	7/21	33.3 (13.9–60.8)
PI	0/7	–	0/33	–	7/158	4.0 (1.8–8.5)	0/21	–
NNRTI+NRTI	0/7	–	3/33	9.6 (2.2–33.4)	16/158	10.8 (6.6–17.2)	7/21	33.3 (13.9–60.8)
Previously exposed (women)								
Any	1/3	34.5 (6.3–80.6)	10/16	64.8 (29.7–88.9)	19/55	35.5 (22.4–51.2)	10/13	76.9 (54.8–90.2)
NNRTI	1/3	34.5 (6.3–80.6)	10/16	64.8 (29.7–88.9)	15/55	29.5 (17.4–45.6)	10/13	76.9 (54.8–90.2)
NRTI	0/3	–	2/16	14.5 (2.5–52.7)	9/55	16.8 (8.5–30.5)	3/13	23.1 (8.3–49.8)
PI	0/3	–	0/16	–	3/55	6.2 (1.8–19.2)	0/13	–
NNRTI+NRTI	0/3	–	2/16	14.5 (2.5–52.7)	5/55	10.8 (4.3–24.3)	3/13	23.1 (8.3–49.8)
Previously exposed (men)								
Any	2/4	41.4 (12.2–78.2)	8/17	43.6 (17.2–74.3)	36/103	29.1 (20.5–39.5)	6/8	75 (37.5–93.8)
NNRTI	1/4	21.8 (36.9–66.9)	7/17	41.5 (15.7–72.9)	29/103	24.5 (16.8–34.2)	6/8	75 (37.5–93.8)
NRTI	1/4	19.6 (5.6–50.0)	2/17	6.3 (1.2–27.4)	16/103	14.1 (8.5–22.4)	4/8	50 (17.9–82.2)
PI	0/4	–	0/17	–	4/103	2.8 (1.1–7.3)	0/8	–
NNRTI+NRTI	0/4	–	1/17	4.2 (0.5–29.1)	11/103	10.8 (6.0–18.8)	4/8	50 (17.9–82.2)

[a] Estimates of HIVDR in all ART initiators include ARV-naive individuals, those with previous ARV drug exposure, and those with unknown ARV drug exposure; NNRTI resistance is defined as resistance to nevirapine (NVP) efavirenz (EFV); NRTI resistance is defined as resistance to any NRTI, and any PI resistance is defined as resistance to atazanavir/ritonavir, lopinavir/ritonavir (LPV/r), or darunavir/ritonavir (DRV/r); Any HIVDR is defined as resistance to NVP/EFV, any NRTI, ATV/r, LPV/r or DRV/r. HIVDR is determined using the Stanford HIVdb algorithm: sequences classified as having low-, intermediate- or high-level resistance are considered "resistant".

Table 1.2e. National prevalence estimates of PDR – South-East Asia and the Western Pacific

	Myanmar		Nepal		Papua New Guinea		Viet Nam	
	n/N	Prevalence % (95% CI)	*n/N*	Prevalence % (95% CI)	*n/N*	Prevalence % (95% CI)	*n/N*	Prevalence % (95% CI)
All[a]								
Any	21/327	5.4 (3.1–9.2)	26/184	12.9 (8.8–18.5)	51/315	18.4 (13.8–24.3)	22/340	5.8 (3.4–9.5)
NNRTI	16/327	3.9 (2.1–7.4)	21/184	10.2 (6.7–15.4)	49/315	17.8 (13.6–23.0)	15/340	3.4 (1.8–6.2)
NRTI	5/327	1.4 (0.5–3.7)	14/184	7.8 (4.7–12.6)	13/315	5.6 (1.6–17.1)	13/340	3.5 (1.8–6.8)
PI	1/326	0.2 (0.0–1.8)	0/184	–	0/315	–	0/333	–
NNRTI+NRTI	1/327	0.2 (0.0–1.3)	9/184	5.1 (2.7–9.5)	11/315	4.9 (1.5–14.5)	6/340	1.2 (0.5–2.8)
Women								
Any	7/115	5.2 (2.1–12.2)	12/84	13.4 (7.5–22.8)	36/193	21.7 (16.7–27.7)	2/95	2.5 (0.5–11.5)
NNRTI	5/115	3.6 (1.2–10.3)	10/84	11.1 (5.8–20.2)	36/193	21.7 (16.7–27.7)	0/95	–
NRTI	2/115	1.6 (0.3–7.4)	7/84	9.4 (4.4–18.8)	7/193	5.0 (1.2–18.3)	2/95	2.5 (0.5–11.5)
PI	0/115	–	0/84	–	0/193	–	0/93	–
NNRTI+NRTI	0/115	–	5/84	7.1 (2.9–16.4)	7/193	5.0 (1.2–18.3)	0/95	–
Men								
Any	13/206	5.3 (2.9–9.7)	13/94	12.1 (7.2–19.7)	14/120	12.3 (5.3–26.0)	20/245	7.0 (3.9–12.3)
NNRTI	10/206	3.9 (1.9–7.9)	11/94	10.2 (5.8–17.5)	12/120	10.5 (4.5–22.6)	15/245	4.7 (2.5–8.6)
NRTI	3/206	1.3 (0.4–4.5)	6/94	5.7 (2.7–11.3)	6/120	6.5 (2.1–18.3)	11/245	3.9 (1.7–8.5)
PI	1/205	0.4 (0.0–2.9)	–	–	0/120	–	0/240	–
NNRTI+NRTI	1/206	0.3 (0.0–2.1)	4/94	3.8 (1.6–8.9)	4/120	4.8 (1.7–12.3)	6/245	1.6 (0.6–4.0)
Treatment naive								
Any	14/287	4.3 (2.3–8.0)	NA	NA	30/254	12.3 (7.8–18.9)	16/310	4.6 (2.5–8.4)
NNRTI	9/287	2.7 (1.2–6.0)	NA	NA	28/254	11.5 (7.0–18.5)	10/310	2.7 (1.3–5.5)
NRTI	5/287	1.5 (0.6–4.2)	NA	NA	6/254	2.7 (1.0–7.1)	10/310	2.7 (1.2–6.1)
PI	1/286	0.3 (0.0–2.0)	NA	NA	0/254	–	0/305	–
NNRTI+NRTI	1/287	0.2 (0.0–1.4)	NA	NA	4/254	1.8 (0.6–5.9)	4/310	0.9 (0.3–2.8)
Treatment naive (women)								
Any	6/102	5.5 (2.2–13.1)	NA	NA	17/145	12.7 (7.8–20.2)	2/87	2.7 (0.6–12.3)
NNRTI	4/102	3.8 (1.2–11.1)	NA	NA	17/145	12.7 (7.8–20.2)	0/87	–
NRTI	2/102	1.7 (0.4–8.0)	NA	NA	1/145	0.7 (0.1–5.5)	2/87	2.7 (0.6–12.3)
PI	0/102	–	NA	NA	0/145	–	0/87	–
NNRTI+NRTI	0/102	–	NA	NA	1/145	0.7 (0.1–5.5)	0/87	–
Treatment naive (men)								
Any	8/185	3.6 (1.6–8.0)	NA	NA	12/108	11.0 (4.3–25.3)	14/223	5.3 (2.6–10.6)
NNRTI	5/185	2.1 (0.8–5.7)	NA	NA	10/108	9.1 (3.2–23.4)	10/223	3.8 (1.9–7.5)
NRTI	3/185	1.4 (0.4–5.0)	NA	NA	5/108	5.4 (1.9–14.2)	8/223	2.7 (1.0–7.5)
PI	1/185	<0.05	NA	NA	0/108	–	0/218	–
NNRTI+NRTI	1/185	<0.05	NA	NA	3/108	3.5 (1.1–10.3)	4/223	1.2 (0.4–4.0)
Previously exposed								
Any	6/32	15.7 (5.5–37.4)	NA	NA	21/61	42.4 (29.1–56.9)	4/20	11.1 (2.9–33.9)
NNRTI	6/32	15.7 (5.5–37.4)	NA	NA	21/61	42.4 (29.1–56.9)	4/20	11.1 (2.9–33.9)
NRTI	0/32	–	NA	NA	7/61	16.9 (4.1–49.1)	2/20	6.5 (1.4–24.7)
PI	0/32	–	NA	NA	0/61	–	0/18	–
NNRTI+NRTI	0/32	–	NA	NA	7/61	16.9 (4.1–49.1)	2/20	6.5 (1.4–24.7)
Previously exposed (women)								
Any	1/13	1.1 (0.2–7.5)	NA	NA	19/48	46.8 (33.4–60.7)	0/7	–
NNRTI	1/13	1.1 (0.2–7.5)	NA	NA	19/48	46.8 (33.4–60.7)	0/7	–
NRTI	0/13	–	NA	NA	6/48	17.1 (4.2–49.5)	0/7	–
PI	0/13	–	NA	NA	0/48	–	0/5	–
NNRTI+NRTI	0/13	–	NA	NA	6/48	17.1 (4.2–49.5)	0/7	–
Previously exposed (men)								
Any	5/19	22.8 (8.3–49.1)	NA	NA	2/12	24.6 (7.2–57.7)	4/13	16.6 (3.9–49.1)
NNRTI	5/19	22.8 (8.3–49.1)	NA	NA	2/12	24.6 (7.2–57.7)	4/13	16.6 (3.9–49.1)
NRTI	0/19	–	NA	NA	1/12	17.2 (2.8–60.0)	2/13	9.7 (2.2–33.9)
PI	0/19	–	NA	NA	0/12	–	0/13	–
NNRTI+NRTI	0/19	–	NA	NA	1/12	17.2 (2.8–60.0)	2/13	9.7 (2.2–33.9)

[a] Estimates of HIVDR in all ART initiators include ARV-naive individuals, those with previous ARV drug exposure and those with unknown ARV drug exposure.

NA: not available, since individuals with previous ARV drug exposure were excluded from the survey.
NNRTI resistance is defined as resistance to nevirapine (NVP) efavirenz (EFV).
NRTI resistance is defined as resistance to any NRTI, and any PI resistance is defined as resistance to atazanavir/ritonavir (ATV/r), lopinavir/ritonavir (LPV/r), or darunavir/ritonavir (DRV/r).
Any HIVDR is defined as resistance to NVP/EFV, any NRTI, ATV/r, LPV/r or DRV/r.
HIVDR is determined using the Stanford HIVdb algorithm: sequences classified as having low-, intermediate- or high-level resistance are considered resistant.

Section 2. Pretreatment HIV drug resistance among treatment-naive infants newly diagnosed with HIV

Table 2.1a. Population characteristics of PDR surveys in infants – Africa

	Cameroon (start year 2014)[a]		Eswatini (start year 2011)		Malawi (start year 2016)[b]		Mozambique (start year 2012)	
		N = 380		*N* = 197		*N* = 405		*N* = 400
	n	Prevalence % (95% CI)[c]	*n*	Prevalence % (95% CI)	*n*	Prevalence % (95% CI)	*n*	Prevalence % (95% CI)
Gender								
Female	–	–	96	48.7 (41.7–55.8)	176	38.2 (32.8–43.8)	195	48.8 (43.8–53.7)
Male	–	–	91	46.2 (39.2–53.2)	167	47.2 (41.5–53.0)	170	42.5 (37.6–47.4)
Unknown	–	–	10	5.1 (2.0–8.2)	62	14.6 (11.0–19.2)	35	8.8 (6.0–11.5)
Mean age (95% CI), years	**5.8 (5.3–6.3)[d]**		**5.87 (5.28–6.45)**		**5.1 (4.6–5.6)[d]**		**4.55 (4.20–4.90)**	
≤6 months	136	38.9 (34.0–44.1)	82	41.6 (34.7–48.6)	147	37.7 (32.0–43.8)	97	24.3 (20.0–28.5)
>6 months	226	61.1 (55.9–66.0)	115	58.4 (51.4–65.3)	252	62.3 (56.2–68.0)	300	75.8 (71.5–80.0)
PMTCT exposure status								
Yes	158	40.3 (35.4–45.3)	148	75.1 (69.0–81.2)	308	77.3 (71.9–81.9)	338	84.5 (80.9–88.1)
No	148	41.0 (36.2–46.1)	22	11.2 (6.7–15.6)	3	1.6 (0.5–5.3)	16	4.0 (2.1–5.9)
Unknown	74	18.7 (15.1–22.9)	27	13.7 (8.9–18.6)	94	21.1 (16.7–26.3)	46	11.5 (8.4–14.6)
Breastfeeding status								
Yes	270	71.1 (66.3–75.5)	123	62.4 (55.6–69.3)	265	66.2 (60.2–71.8)	0	–
No	18	4.8 (3.0–7.5)	66	33.5 (26.9–40.2)	140	33.8 (28.2–39.8)	0	–
Unknown	92	24.1 (20.0–28.8)	8	4.1 (1.3–6.8)	0	–	400	100
Type of PMTCT exposure status								
Maternal prophylaxis	101	24.3 (20.4–28.5)	125	63.5 (56.7–70.2)	302	76.0 (70.5–80.7)	260	65.0 (60.3–69.7)
Infant prophylaxis	119	30.9 (26.4–35.8)	128	65.0 (58.3–71.7)	141	31.5 (26.5–37.0)	304	76.0 (71.8–80.2)
Both maternal ART and infant prophylaxis	62	17.7 (14.1–22.1)	105	53.3 (46.3–60.3)	135	30.4 (25.4–35.8)	226	56.5 (51.6–61.4)

[a] All participants had missing data for gender and 18 participants had missing data for age.
[b] Six infants missing data on age.
[c] Study design–weighted proportion and 95% confidence interval.
[d] Study design–weighted mean and 95% confidence interval.

Table 2.1b. Population characteristics of PDR surveys in infants – Africa

	Nigeria (start year 2016)[a]		Togo (start year 2012)		Uganda (start year 2011)		Zimbabwe (start year 2012)	
		N = 547		N = 201		N = 224		N = 201
	n/N	Prevalence % (95% CI)[b]	*n/N*	Prevalence % (95% CI)[b]	*n/N*	Prevalence % (95% CI)[b]	*n/N*	Prevalence % (95% CI)[b]
Gender								
Female	242	43.7 (39.0–48.4)	105	52.2 (45.3–59.1)	121	54.0 (47.4–60.6)	116	51.1 (44.5–57.7)
Male	252	44.9 (40.1–49.8)	95	47.3 (40.4–54.2)	103	46.0 (39.4–52.6)	105	46.3 (39.7–52.8)
Unknown	53	11.4 (8.8–14.8)	1	<0.5	0		6	2.6 (0.05–4.75)
Mean age (95% CI), years	**6.04 (5.60–6.47)[c]**		**6.03 (5.40–6.66)[c]**		**6.70 (6.07–7.34)**		**5.99 (5.38–6.61)**	
≤6 months	200	40.4 (35.4–45.6)	81	40.3 (33.7–47.3)	99	44.2 (37.6–50.8)	99	43.6 (37.1–50.1)
>6 months	288	59.6 (54.4–64.6)	120	59.7 (52.7–66.3)	125	55.8 (49.2–62.4)	128	56.4 (49.9–62.9)
PMTCT exposure status								
Yes	259	52.1 (47.7–56.5)	131	65.2 (58.3–71.5)	178	79.5 (74.1–84.8)	174	76.7 (71.1–82.2)
No	117	20.3 (16.7–24.4)	41	20.4 (15.3–26.6)	35	15.6 (10.8–20.4)	46	20.3 (15.0–25.5)
Unknown	171	27.6 (24.1–31.5)	29	14.4 (10.2–20.0)	11	4.9 (2.1–7.8)	7	3.1 (0.8–5.3)
Breastfeeding status								
Yes	414	79.2 (75.4–82.5)	156	77.6 (71.3–82.9)	162	72.3 (66.4–78.2)	172	75.8 (70.2–81.4)
No	44	5.2 (3.8–7.0)	18	9.0 (5.7–13.8)	41	18.3 (13.2–23.4)	35	15.4 (10.7–20.2)
Unknown	89	15.7 (12.7–19.2)	27	13.4 (9.3–18.9)	21	9.4 (5.5–13.2)	20	8.8 (5.1–12.5)
Type of PMTCT exposure status								
Maternal prophylaxis	209	41.2 (36.9–45.6)	90	44.8 (38.0–51.8)	164	73.2 (67.3–79.1)	134	60.8 (54.4–67.2)
Infant prophylaxis	183	37.3 (33.1–41.7)	111	55.2 (48.2–62.0)	142	63.4 (57.0–69.8)	151	66.5 (60.3–72.7)
Both maternal ART and infant prophylaxis	133	28.3 (24.3–32.6)	70	44.8 (38.0–51.8)	128	57.1 (50.6–63.7)	115	50.7 (44.1–57.2)

[a] 59 infants missing data on age.
[b] Study design–weighted proportion and 95% confidence interval.
[c] Study design–weighted mean and 95% confidence interval.

Table 2.2a. Prevalence estimates of PDR in infants – Africa

	Cameroon		Eswatini		Malawi		Mozambique	
	n/N	Prevalence % (95% CI)	*n/N*	Prevalence % (95% CI)	*n/N*	Prevalence % (95% CI)	*n/N*	Prevalence % (95% CI)
All								
Any	189/380	48.8 (43.9–53.8)	69/197	35.0 (28.3–41.7)	146/232	69.2 (62.1–75.5)	229/400	57.3 (52.4–62.1)
NNRTI	182/380	47.0 (42.1–52.0)	67/197	34.0 (27.4–40.6)	145/232	68.8 (61.7–75.1)	224/400	56.0 (51.1–60.9)
NRTI	40/380	10.3 (7.6–13.8)	4/197	2.0 (0.04–4.0)	47/232	25.8 (17.5–36.4)	26/400	6.5 (4.1–8.9)
PI	0/380	–	NA	NA	0/232	–	NA	NA
NNRTI+NRTI	33/380	8.5 (6.1–11.7)	2/197	1.0 (0.04–2.4)	46/232	25.4 (17.1–36.0)	21/400	5.3 (3.1–7.4)
PMTCT exposed								
Any	101/158	63.8 (55.9–71.0)	63/148	41.9 (34.5–50.6)	133/199	73.9 (66.7–80.0)	205/338	60.7 (55.4–65.9)
NNRTI	100/158	63.2 (55.3–70.4)	61/148	41.2 (33.2–49.2)	132/199	73.4 (66.3–79.6)	200/338	59.2 (53.9–64.4)
NRTI	21/158	13.1 (8.7–19.4)	4/148	2.7 (0.1–5.3)	42/199	27.8 (18.7–39.3)	21/338	6.2 (3.6–8.8)
PI	0/158	–	NA	NA	0/199	–	NA	NA
NNRTI+NRTI	20/158	12.5 (8.2–18.7)	2/148	1.4 (–0.1–3.2)	41/199	27.4 (18.3–38.9)	16/338	4.7 (2.5–7.0)
PMTCT unexposed or unknown								
Any	88/222	38.5 (32.4–45.0)	6/49	12.2 (2.7–21.8)	13/30	35.4 (16.6–60.1)	24/62	38.7 (26.2–51.2)
NNRTI	82/222	35.8 (29.9–42.3)	6/49	12.2 (2.7–21.8)	13/30	35.4 (16.6–60.1)	24/62	38.7 (26.2–51.2)
NRTI	19/222	8.3 (5.4–12.8)	0/49	–	5/30	10.1 (2.4–33.7)	5/62	8.1 (1.09–15.0)
PI	0/222	–	NA	NA	0/30	–	NA	NA
NNRTI+NRTI	13/222	5.7 (3.3–9.6)	0/49	–	5/30	10.1 (2.4–33.7)	5/62	8.1 (1.09–15.0)

NNRTI resistance is defined as resistance to nevirapine (NVP) or efavirenz (EFV).
NRTI resistance is defined as resistance to any NRTI, and any PI resistance is defined as resistance to atazanavir/ritonavir (ATV/r), lopinavir/ritonavir (LPV/r), or darunavir/ritonavir (DRV/r).
Any HIVDR is defined as resistance to NVP/EFV, any NRTI, ATV/r, LPV/r or DRV/r.
HIVDR is determined using the Stanford HIVdb algorithm: sequences classified as having low-, intermediate- or high-level resistance are considered resistant.

Table 2.2b. Prevalence estimates of PDR among infants – Africa

	Nigeria		Togo		Uganda		Zimbabwe	
	n/N	Prevalence % (95% CI)	*n/N*	Prevalence % (95% CI)	*n/N*	Prevalence % (95% CI)	*n/N*	Prevalence % (95% CI)
All								
Any	198/423	50.1 (44.6–55.6)	123/199	61.8 (54.8–68.3)	86/224	38.4 (32.0–44.8)	145/227	63.9 (57.6–70.2)
NNRTI	192/423	48.6 (43.1–54.0)	114/199	57.3 (50.3–64.0)	80/224	35.7 (29.4–42.0)	145/227	63.9 (57.6–70.2)
NRTI	91/423	22.9 (18.4–28.0)	33/199	16.6 (12.0–22.5)	19/224	8.5 (4.8–12.2)	22/227	9.7 (5.8–13.6)
PI	0/423	–	NA	NA	NA	NA	NA	NA
NNRTI+NRTI	85/423	21.3 (17.0–26.4)	24/199	12.1 (8.2–17.4)	13/224	5.8 (2.7–8.9)	22/227	9.7 (5.8–13.6)
PMTCT exposed								
Any	110/194	57.2 (49.7–64.4)	97/130	74.6 (66.4–81.4)	73/178	41.0 (33.7–48.3)	130/174	74.7 (68.2–81.2)
NNRTI	107/194	55.4 (48.0–62.6)	94/130	72.3 (63.9–79.4)	69/178	38.8 (31.5–46.0)	130/174	74.7 (68.2–81.2)
NRTI	61/194	30.5 (23.9–38.0)	21/130	16.2 (10.7–23.6)	15/178	8.4 (4.3–12.5)	21/174	12.1 (7.2–16.9)
PI	0/286	–	NA	NA	NA	NA	NA	NA
NNRTI+NRTI	58/194	28.6 (22.2–36.0)	18/130	13.8 (8.9–21.0)	11/178	6.2 (2.6–9.7)	21/174	12.1 (7.2–16.9)
PMTCT unexposed or unknown								
Any	88/229	42.6 (34.9–50.6)	26/69	37.7 (27.0–49.7)	13/46	28.3 (14.7–41.8)	15/53	28.3 (15.8–40.8)
NNRTI	85/229	41.4 (33.8–49.5)	20/69	29.0 (19.5–40.8)	11/46	23.9 (11.1–36.7)	15/53	28.3 (15.8–40.8)
NRTI	30/229	14.8 (9.6–22.2)	12/69	17.4 (10.1–28.3)	4/46	8.7 (0.2–17.2)	1/53	1.9 (0–5.7)
PI	0/229	–	NA	NA	NA	NA	NA	NA
NNRTI+NRTI	27/229	13.7 (8.6–21)	6/69	8.7 (3.9–18.1)	2/46	4.3 (0–10.5)	1/53	1.9 (0–5.7)

NNRTI resistance is defined as resistance to nevirapine (NVP) efavirenz (EFV). NRTI resistance is defined as resistance to any NRTI, and any PI resistance is defined as resistance to atazanavir/ritonavir (ATV/r), lopinavir/ritonavir (LPV/r), or darunavir/ritonavir (DRV/r).
Any HIVDR is defined as resistance to NVP/EFV, any NRTI, ATV/r, LPV/r or DRV/r.
HIVDR is determined using the Stanford HIVdb algorithm: sequences classified as having low-, intermediate- or high-level resistance are considered "resistant".

Section 3. Acquired HIV Drug Resistance among adults receiving antiretroviral treatment

Table 3.1a. Population characteristics of early time point (12 months) for ADR surveys – Africa

	Cameroon (12–24 months)		Eswatini (12 ±3 months)		Senegal (12 ±3 months)	
	N = 1064 (start year 2015)		*N* = 375 (start year 2016)		*N* = 255 (start year 2017)	
	n	% (95% CI)[a]	*n*	% (95% CI)[a]	*n*	% (95% CI)[a]
Gender						
Women	808	77.9 (75.4–80.2)	270	72.1 (65.4–77.9)	184	72.7 (63.6–80.3)
Men	256	22.1 (19.8–24.6)	105	27.9 (22.1–34.6)	71	27.3 (19.7–36.4)
Mean[b] age (95% CI), years	**40.0 (39.4–40.7)**		**36.0 (34.5–37.6)**		**42.1 (38.8–45.4)**	
Individuals on first-line ART	**1050**	**99.0 (98.1–99.5)**	**374**	**99.8 (98.8–100.0)**	**252**	**99.3 (96.7–99.9)**
Individuals on NNRTI-based first-line ART	**1048**	**98.9 (97.8–99.4)**	**368**	**98.1 (95.7–99.1)**	**249**	**95.4 (86.6–98.5)**
Individuals on second-line ART	**14**	**1.0 (0.6–1.9)**	**1**	**0.2 (0.0–1.2)**	**1**	**0.5 (0.1–3.7)**
Current ART						
TDF + XTC + EFV	758	71.4 (63.3–78.4)	330	87.4 (81.8–91.5)	236	88.9 (80.1–94.1)
TDF + XTC + NVP	109	9.0 (6.1–13.0)	7	1.6 (0.7–3.5)	2	0.6 (0.1–2.9)
AZT + XTC + EFV	32	3.6 (2.1–6.3)	12	3.9 (2.1–7.3)	0	0
AZT + XTC + NVP	148	14.8 (10.5–20.4)	5	1.7 (0.6–4.6)	0	0
D4T + XTC + EFV	0	0	2	0.5 (0.1–2.1)	0	0
D4T + XTC + NVP	0	0	0	0	0	0
PI-based regimen	16	1.1 (0.6–2.2)	1	0.2 (0.0–1.2)	1	0.5 (0.1–3.7)
INI-based regimen	0	0	0	0	0	0
Other	1	<0.5	12	2.9 (1.3–6.6)	14	8.8 (4.0–18.2)
Unknown	0	0	6	1.8 (0.7–4.2)	2	1.2 (0.2–5.5)
Mean time on ART (95% CI), months	17.9 (17.4–18.4)		12.5 (12.3–12.7)		12.3 (11.9–12.7)	

[a] Study design–weighted proportion and 95% confidence interval.
[b] Study design–weighted mean and 95% confidence interval.

Table 3.1b. Population characteristics of early time point (12 months) for ADR surveys – Africa

	Uganda[a] (12 ±3 months)		Zambia[b] (12 ±3 months)	
	N = 533 (start year 2016)		*N* = 454 (start year 2016)	
	n	% (95% CI)[c]	*n*	% (95% CI)[c]
Gender				
Women	351	65.9 (59.3–72.0)	257	60.0 (56.3–63.4)
Men	182	34.1 (28.0–40.7)	197	40.1 (36.6–43.7)
Mean[d] age (95% CI), years	**33.2 (31.1–35.2)**		**37.9 (36.4–39.4)**	
Individuals on first-line ART	**533**	**100.0**	**453**	**100.0 (99.6–100)**
Individuals on NNRTI-based first-line ART	**533**	**100.0**	**453**	**100.0 (99.6–100)**
Individuals on second-line ART	**0**		**1**	**<0.5**
Current ART				
TDF + XTC + EFV	473	96.4 (86.7–99.1)	450	99.8 (99.3–100.0)
TDF + XTC + NVP	0	0	3	<0.5
AZT + XTC + EFV	25	2.3 (0.5–9.8)	0	0
AZT + XTC + NVP	33	1.3 (0.4–4.5)	0	0
D4T + XTC + EFV	0	0	0	0
D4T + XTC + NVP	0	0	0	0
PI-based regimen	0	0	1	<0.5
INI-based regimen	0	0	0	0
Other	2	0.1 (0.0–0.6)	0	0
Unknown	0	0	0	0
Mean time on ART (95% CI), months	**12.6 (12.2–12.9)**		**12.2 (11.8–12.6)**	

[a] Included only participants on first-line ART.
[b] Three participants had missing data for age.
[c] Study design–weighted proportion and 95% confidence interval.
[d] Study design–weighted mean and 95% confidence interval.

Table 3.1c. Population characteristics of early time point (12 months) for ADR surveys – the Americas

	Guatemala (12 ± 3 months)		Honduras (12 ± 3 months)		Nicaragua (12 ± 3 months)	
	N = 222 (start year 2016)		*N* = 168 (start year 2016)		*N* = 114 (start year 2016)	
	n	% (95% CI)[a]	*n*	% (95% CI)[a]	*n*	% (95% CI)[a]
Gender						
Women	66	29.7 (21.1–40.1)	61	35.0 (28.6–42.1)	38	33.5 (24.3–44.0)
Men	156	70.3 (59.9–78.9)	107	65.0 (57.9–71.4)	76	66.6 (56.0–75.7)
Mean[b] age (95% CI), years	**35.7 (33.8–37.6)**		**34.9 (34.9–36.3)**		**32.3 (30.9–33.8)**	
Individuals on first-line ART	**220**	**99.1 (96.4–99.8)**	**167**	**99.1 (95.3–99.8)**	**110**	**97.8 (97.7–97.9)**
Individuals on NNRTI-based first-line ART	**216**	**97.3 (93.8–98.9)**	**166**	**98.5 (95.2–99.5)**	**104**	**88.4 (76.2–94.8)**
Individuals on second-line ART	**2**	**0.9 (0.4–2.1)**	**1**	**0.9 (0.2–4.7)**	**4**	**2.2 (2.1–2.3)**
Current ART						
TDF + XTC + EFV	199	89.6 (74.5–96.2)	157	93.0 (89.5–95.5)	91	75.2 (64.7–83.3)
TDF + XTC + NVP	0	–	1	0.8 (0.2–4.3)	0	
AZT + XTC + EFV	3	1.4 (0.4–4.8)	4	1.9 (1.0–3.5)	13	13.3 (10.6–16.4)
AZT + XTC + NVP	3	1.4 (0.3–5.2)	0	–	0	–
D4T + XTC + EFV	0	–	0	–	0	–
D4T + XTC + NVP	0	–	0	–	0	–
PI-based regimen	6	2.7 (1.1–6.2)	1	0.6 (0.1–2.8)	8	10.5 (4.3–23.2)
INI-based regimen	0	–	1	0.6 (0.1–2.8)	0	–
Other	11	5.0 (1.2–17.7)	4	3.0 (1.3–6.6)	2	1.1 (1.0–1.1)
Unknown	0	–	0	–	0	–
Mean time on ART (95% CI), months	**12.2 (12.0–12.4)**		**12.1 (11.8–12.4)**		**12.1 (11.7–12.4)**	

[a] Study design–weighted proportion and 95% confidence interval.
[b] Study design–weighted mean and 95% confidence interval.

Table 3.1d. Population characteristics of early time point (12 months) for ADR surveys – Western Pacific

	Viet Nam (12 ± 3 months)	
	N = 429 (start year 2017)	
	n	% (95% CI)[a]
Gender		
Women	139	31.4 (23.9–40.0)
Men	290	68.6 (60.0–76.1)
Mean age[b] (95% CI), years	**35.7 (33.8–37.6)**	
Individuals on first-line ART	**423**	**98.4 (95.5–99.4)**
Individuals on NNRTI-based first-line ART	**423**	**98.4 (95.5–99.4)**
Individuals on second-line ART	**6**	**1.6 (0.6–4.5)**
Current ART		
TDF + XTC + EFV	419	97.5 (94.7–98.9)
TDF + XTC + NVP	2	0.2 (0.1–1.0)
AZT + XTC + EFV	2	0.7 (0.2–2.6)
AZT + XTC + NVP	3	0.7 (0.2–2.3)
D4T + XTC + EFV	0	0
D4T + XTC + NVP	1	0.3 (0.0–2.4)
PI-based regimen	1	0.3 (0.0–2.0)
INI-based regimen	0	0
Other	1	0.3 (0.0–2.0)
Unknown	0	0
Mean time on ART (95% CI), months	**11.8 (11.4–12.2)**	

[a] Study design–weighted proportion and 95% confidence interval.
[b] Study design–weighted mean and 95% confidence interval

Table 3.1e. Population characteristics of late time point (≥48 months) for ADR surveys – Africa

	Cameroon (48–60 months)		Eswatini (≥48 months)		Senegal (≥40 months)		Uganda[a] (≥48 months)	
	N = 388 (start year 2015)		*N* = 500 (start year 2016)		*N* = 315 (start year 2017)		*N* = 1062 (start year 2017)	
	n	% (95% CI)[b]	*n*	% (95% CI)[b]	*n*	% (95% CI)[b]	*n*	% (95% CI)[b]
Gender								
Women	287	75.3 (66.6–82.3)	359	70.3 (65.4–74.7)	239	76.5 (69.2–82.4)	693	65.6 (62.2–68.9)
Men	101	24.7 (17.7–33.4)	141	29.8 (25.3–34.7)	76	23.5 (17.6–30.8)	369	44.4 (31.1–37.8)
Mean[c] age (95% CI), years	**43.1 (42.0–44.3)**		**43.4 (41.3–45.6)**		**43.8 (42.0–45.6)**		**44.6 (43.7–45.5)**	
Individuals on first-line ART	**364**	**94.4 (83.9–98.2)**	**468**	**93.6 (90.4–95.8)**	**311**	**98.8 (96.4–99.6)**	**1062**	**100.0 (99.6–100.0)**
Individuals on NNRTI-based first-line ART	**364**	**94.4 (83.9–98.2)**	**464**	**92.7 (89.4–95.0)**	**311**	**98.8 (96.4–99.6)**	**1061**	**99.9 (99.2–100.0)**
Individuals on second-line ART	**24**	**5.6 (2.0–15.1)**	**32**	**6.4 (4.2–9.6)**	**3**	**1.1 (0.3–3.6)**	**0**	**0**
Current ART								
TDF + XTC + EFV	229	58.8 (46.2–70.3)	148	29.4 (23.7–35.9)	235	75.1 (64.6–83.2)	244	23.0 (18.3–28.5)
TDF + XTC + NVP	58	16.0 (7.9–29.8)	23	5.1 (3.2–7.8)	1	0.4 (0.1–2.5)	122	10.4 (7.7–13.8)
AZT + XTC + EFV	4	1.0 (0.1–6.5)	50	11.1 (7.6–16.0)	13	7.1 (2.1–20.8)	106	9.7 (7.2–12.9)
AZT + XTC + NVP	73	18.6 (9.1–34.3)	178	33.4 (27.8–39.4)	62	16.2 (11.2–23.0)	586	56.6 (49.6–63.4)
D4T + XTC + EFV	0	0	24	5.2 (3.4–7.9)	0	0	0	0
D4T + XTC + NVP	0	0	31	6.6 (4.6–9.2)	0	0	0	0
PI-based regimen	23	5.4 (1.8–15.4)	25	5.0 (3.0–8.2)	4	1.2 (0.4–3.6)	1	0.1 (0–0.8)
Other	1	<0.5	10	2.0 (1.1–3.6)	0	0	3	0
Unknown	0	0	11	2.3 (1.2–4.3)	0	0	0	0
Mean time on ART (95% CI), months	**53.3 (52.1–54.6)**		**85.2 (81.5–88.9)**		**52.2 (48.4–56.0)**		**88.5 (80.3–96.6)**	

[a] Included only participants on first-line ART.
[b] Study design–weighted proportion and 95% confidence interval.
[c] Study design–weighted mean and 95% confidence interval.

Table 3.1f. Population characteristics of late time point (≥48 months) for ADR surveys – the Americas

	Guatemala (≥48 months)		Honduras (≥48 months)		Nicaragua (≥48 months)	
	N = 377 (start year 2016)		*N* = 367 (start year 2016)		*N* = 350 (start year 2016)	
	n	% (95% CI)[a]	*n*	% (95% CI)[a]	*n*	% (95% CI)[a]
Gender						
Women	161	42.7 (35.0–50.7)	212	58.8 (51.8–65.5)	134	43.0 (35.8–50.5)
Men	214	56.8 (48.5–64.7)	154	41.0 (34.3–48.1)	219	57.0 (49.5–64.2)
Others	2	0.5 (0.1–2.1)	1	0.1 (0.1–0.1)	0	0
Mean[b] age (95% CI), years	**42.7 (41.4–43.9)**		**43.4 (41.7–45.0)**		**38.7 (37.2–39.0)**	
Individuals on first-line ART	**350**	**92.9 (81.8–97.4)**	**298**	**86.0 (81.8–89.4)**	**303**	**84.8 (79.2–89.1)**
Individuals on NNRTI-based first-line ART	**323**	**85.7 (78.3–90.9)**	**290**	**84.2 (79.9–87.6)**	**264**	**74.9 (69.2–79.9)**
Individuals on second-line ART	**27**	**7.1 (5.4–9.4)**	**62**	**12.5 (9.3–16.7)**	**49**	**14.4 (10.4–19.5)**
Current ART						
TDF + XTC + EFV	185	49.0 (43.5–54.6)	57	12.3 (9.7–15.5)	117	32.4 (26.8–38.6)
TDF + XTC + NVP	27	7.2 (4.1–12.3)	9	1.7 (1.2–2.4)	2	0.8 (0.2–3.0)
AZT + XTC + EFV	70	18.5 (14.7–23.1)	210	65.3 (60.1–70.3)	130	36.6 (30.3–43.4)
AZT + XTC + NVP	14	3.7 (1.8–7.7)	1	0.4 (0.1–2.0)	3	1.5 (0.5–4.8)
D4T + XTC + EFV	0	0	0	0	0	0
D4T + XTC + NVP	0	0	0	0	0	0
PI-based regimen	52	13.8 (8.5–21.6)	67	13.6 (10.3–17.8)	59	18.6 (14.1–24.1)
Other	29	7.7 (3.6–15.9)	23	6.7 (4.5–10.0)	42	10.0 (7.3–13.6)
Unknown	0	0	0	0	0	0
Mean time on ART (95% CI), months	**91.8 (84.5–99.1)**		**102.3 (97.5–107.0)**		**82.1 (76.8–87.4)**	

[a] Study design–weighted proportion and 95% confidence interval.
[b] Study design–weighted mean and 95% confidence interval.

Table 3.1g. Population characteristics of late time point (≥48 months) for ADR surveys – Western Pacific

	Viet Nam (≥48 months)	
	N = 723 (start year 2017)	
	n	% (95% CI)[a]
Gender		
Women	267	37.6 (33.2–42.1)
Men	456	62.4 (57.9–66.8)
Mean[b] age (95% CI), years	**41.0 (40.1–41.8)**	
Individuals on first-line ART	**688**	**94.8 (92.1–96.7)**
Individuals on NNRTI-based first-line ART	**658**	**91.7 (88.1–94.2)**
Individuals on second-line ART	**35**	**5.2 (3.3–7.9)**
Current ART		
TDF + XTC + EFV	436	62.6 (55.6–69.1)
TDF + XTC + NVP	6	0.9 (0.4–1.9)
AZT + XTC + EFV	81	11.0 (7.8–15.2)
AZT + XTC + NVP	134	17.1 (13.0–22.1)
D4T + XTC + EFV	1	0.1 (0.0–1.0)
D4T + XTC + NVP	0	0
PI-based regimen	58	7.2 (5.0–10.3)
Other	7	1.1 (0.4–3.1)
Unknown	0	0
Mean time on ART (95% CI), months	**87.8 (83.1–92.5)**	

[a] Study design–weighted proportion and 95% confidence interval.
[b] Study design–weighted mean and 95% confidence interval.

Table 3.2a. Prevalence of viral load suppression for individuals on ART, early time point (12 months), ADR surveys – Africa

	Cameroon (12–24 months)		Eswatini[a] (12±3 months)		Senegal (12±3 months)	
	n	Prevalence % (95% CI)	*n*	Prevalence % (95% CI)	*n*	Prevalence % (95% CI)
Cut-off viral load <1000 copies/mL						
Viral load suppression among individuals on ART	796/1064	72.1 (66.2–77.2)	340/375	90.5 (86.3–93.5)	211/255	86.5 (79.4–91.5)
Viral load suppression among individuals on first-line ART	786/1050	72.1 (66.5–77.2)	340/375	90.6 (86.5–93.6)	208/252	86.4 (79.2–91.4)
Viral load suppression among individuals on first-line NNRTI-based ART	785/1048	72.1 (66.4–77.2)	335/368	90.8 (86.6–93.8)	206/249	86.0 (78.8–91.0)
Viral load suppression among individuals on TDF-based first-line NNRTI-based ART	668/887	74.9 (70.2–79.1)	303/334	90.7 (86.4–93.7)	196/238	85.4 (78.0–90.6)
Viral load suppression among individuals on AZT-based first-line NNRTI-based ART	117/180	60.2 (49.1–70.4)	15/17	85.9 (58.4–96.3)	0/238	0
Viral load suppression among individuals on PI-based second-line ART	10/14	65.5 (34.9–87.1)	0/1	0	1/1	100.0
Viral load suppression among women on ART	624/808	75.0 (69.4–79.9)	249/270	92.0 (88.2–94.7)	154/184	86.8 (78.9–92.0)
Viral load suppression among men on ART	172/256	61.6 (51.7–70.6)	91/105	86.5 (74.1–93.5)	57/71	85.8 (72.0–93.5)

[a] Viral suppression defined as viral load ≤2005 copies/mL based on DBS, lower limit of detection by the Roche free viral elution platform.

Table 3.2b. Prevalence of viral load suppression for individuals on ART, early time point (12 months), ADR surveys – Africa

	Uganda (12±3 months)		Zambia (12±3 months)	
	n/N	Prevalence % (95% CI)	*n/N*	Prevalence % (95% CI)
Cut-off viral load <1000 copies/mL				
Viral load suppression among individuals on ART	493/533	94.6 (92.8–96.0)	409/454	90.0 (80.1–94.2)
Viral load suppression among individuals on first-line ART	493/533	94.6 (92.8–96.0)	408/453	88.9 (80.2–94.1)
Viral load suppression among individuals on first-line NNRTI-based ART	493/533	94.6 (92.8–96.0)	408/453	88.9 (80.2–94.1)
Viral load suppression among individuals on TDF-based first-line NNRTI-based ART	493/533	94.6 (92.8–96.0)	408/453	88.9 (80.2–94.1)
Viral load suppression among individuals on AZT-based first-line NNRTI-based ART	53/58	94.9 (86.9–98.1)	0/453	0
Viral load suppression among individuals on PI-based second-line ART	NA	NA	1/1	100.0
Viral load suppression among women on ART	324/351	93.1 (91.4–94.5)	228/257	86.3 (74.1–93.3)
Viral load suppression among women on men	169/182	97.6 (90.8–99.4)	181/197	92.9 (83.5–97.1)
Cut-off viral load <400 copies/mL				
Viral load suppression among individuals on ART	NA	NA	397/454	85.3 (68.1–94.0)
Viral load suppression among individuals on first-line ART	NA	NA	396/453	85.3 (68.1–94.0)
Viral load suppression among individuals on first-line NNRTI-based ART	NA	NA	396/453	85.3 (68.1–94.0)
Viral load suppression among individuals on TDF-based first-line NNRTI-based ART	NA	NA	396/453	85.3 (68.1–94.0)
Viral load suppression among individuals on AZT-based first-line NNRTI-based ART	NA	NA	0	0
Viral load suppression among individuals on PI-based second-line ART	NA	NA	1/1	100
Viral load suppression among women on ART	NA	NA	223/257	83.4 (64.7–93.2)
Viral load suppression among men on ART	NA	NA	174/197	88.1 (70.2–95.9)
Cut-off viral load <50 copies/mL				
Viral load suppression among individuals on ART	NA	NA	350/454	75.3 (56.1–87.9)
Viral load suppression among individuals on first-line ART	NA	NA	350/453	75.3 (56.0–87.9)
Viral load suppression among individuals on first-line NNRTI-based ART	NA	NA	349/453	75.2 (56.0–87.9)
Viral load suppression among individuals on TDF-based first-line NNRTI-based ART	NA	NA	349/453	75.2 (56.0–87.9)
Viral load suppression among individuals on AZT-based first-line NNRTI-based ART	NA	NA	0	0
Viral load suppression among individuals on PI-based second-line ART	NA	NA	1/1	100
Viral load suppression among women on ART	NA	NA	196/257	76.3 (58.2–88.1)
Viral load suppression among men on ART	NA	NA	154/197	73.7 (49.2–89.1)

Table 3.2c. Prevalence of viral load suppression for individuals on ART, early time point (12 months), ADR surveys – the Americas

	Guatemala[a] (12±3 months)		Honduras[b] (12±3 months)		Nicaragua[c] (12±3 months)	
	n/N	Prevalence % (95% CI)	*n/N*	Prevalence % (95% CI)	*n/N*	Prevalence % (95% CI)
Cut-off viral load <1000copies/mL						
Viral load suppression among individuals on ART (on treatment analysis)[d]	197/222	88.7 (77.4–94.8)	150/168	89.7 (85.1–93.0)	86/114	77.8 (67.1–85.8)
Viral load suppression among individuals on ART (intention-to-treat analysis)[e]	197/222	66.9 (60.2–73.6)	150/168	72.7 (68.6–76.7)	86/114	57.1 (49.2–65.1)
Viral load suppression among individuals on first-line ART	195/220	88.6 (77.1–94.7)	149/167	89.6 (85.0–93.0)	82/110	77.3 (66.4–85.5)
Viral load suppression among individuals on first-line NNRTI-based ART	193/216	89.3 (79.2–94.9)	148/166	89.6 (84.9–92.9)	78/104	80.7 (76.1–84.7)
Viral load suppression among individuals on TDF-based first-line NNRTI-based ART	181/199	91.0 (81.6–95.8)	142/158	90.4 (85.8–93.6)	67/91	80.0 (75.9–83.6)
Viral load suppression among individuals on AZT-based first-line NNRTI-based ART	4/6	66.7 (13.8–96.2)	5/7	66.1 (35.0–87.7)	15/19	68.3 (37.7–88.5)
Viral load suppression among individuals on PI-based second-line ART	2/2	100	1/1	100.0	4/4	100.0
Viral load suppression among women on ART	56/66	84.8 (73.0–92.0)	52/61	87.0 (77.4–92.9)	28/38	66.4 (42.7–84.0)
Viral load suppression among men on ART	141/156	90.4 (76.0–96.5)	98/107	91.2 (83.6–95.5)	58/76	83.5 (73.8–90.2)
Cut-off viral load <400 copies/mL						
Viral load suppression among individuals on ART	196/222	88.3 (76.1–94.7)	149/168	89.4 (84.5–92.7)	81/114	74.8 (64.4–83.0)
Viral load suppression among individuals on first-line ART	194/220	88.2 (75.9–94.7)	148/167	89.3 (84.7–92.6)	79/110	75.4 (64.6–83.7)
Viral load suppression among individuals on first-line NNRTI-based ART	192/216	88.9 (77.9–94.8)	147/166	89.2 (84.6–92.6)	75/104	78.6 (73.8–82.7)
Viral load suppression among individuals on TDF-based first-line NNRTI-based ART	180/199	90.5 (80.0–95.7)	141/158	90.0 (85.5–93.3)	65/91	78.5 (74.2–82.2)
Viral load suppression among individuals on AZT-based first-line NNRTI-based ART	4/6	66.7 (13.8–96.2)	5/7	66.1 (35.0–87.7)	14/19	65.1 (36.8–85.6)
Viral load suppression among individuals on PI-based second-line ART	2/2	100	1/1	100.0	2/4	50 (50–50)
Viral load suppression among women on ART	56/66	84.8 (73.0–92.0)	51/61	86.0 (78.3–91.3)	26/38	63.0 (42.9–79.4)
Viral load suppression among men on ART	140/156	89.7 (73.7–96.5)	98/107	91.2 (83.6–95.5)	55/76	80.8 (76.7–84.3)
Cut-off viral load <50 copies/mL						
Viral load suppression among individuals on ART	178/222	80.2 (70.2–87.4)	125/168	73.1 (65.9–79.3)	71/114	67.9 (57.8–76.6)
Viral load suppression among individuals on first-line ART	177/220	80.5 (71.0–87.4)	125/167	73.8 (66.5–80.0)	69/110	68.3 (57.9–77.1)
Viral load suppression among individuals on first-line NNRTI-based ART	175/216	81.0 (72.7–87.2)	124/166	73.6 (66.3–79.8)	65/104	70.7 (65.4–75.6)
Viral load suppression among individuals on TDF-based first-line NNRTI-based ART	165/199	82.9 (75.5–88.5)	119/158	74.1 (66.6–80.5)	56/91	70.2 (64.9–75.0)
Viral load suppression among individuals on AZT-based first-line NNRTI-based ART	4/6	66.7 (13.8–96.2)	4/7	55.2 (28.5–79.2)	13/19	61.9 (35.7–82.6)
Viral load suppression among individuals on PI-based second-line ART	1/1	50.0 (33.2–96.7)	0/1	<0.5	2/4	50 (50–50)
Viral load suppression among women on ART	53/66	80.3 (61.8–91.1)	41/61	67.4 (56.2–76.9)	23/38	57.4 (39.2–73.8)
Viral load suppression among men on ART	125/156	80.1 (70.1–87.4)	84/107	76.2 (66.5–83.6)	48/76	73.2 (67.5–78.1)

National retention prevalence for adults ≥15 years old: [a]75%, [b]81% and [c]73%. Source: UNAIDS/WHO Global AIDS Monitoring tool.

[d] Prevalence of viral load suppression assessed from participants in the survey.

[e] Prevalence of viral load suppression extrapolated to the 12-month cohort that initiated treatment together with the individuals participating in the survey: adjusting for loss to follow-up and accounting for deaths and transfers out.

Table 3.2d. Prevalence of viral load suppression for individuals on ART, early time point (12 months), ADR surveys – Western Pacific

	Viet Nam[a] (12±3 months)	
	n	Prevalence % (95% CI)
Cut-off viral load <1000 copies/mL		
Viral load suppression among individuals on ART (on treatment analysis)[b]	411/429	95.5 (91.3–97.8)
Viral load suppression among individuals on ART (intention-to-treat analysis)[c]	411/429	84.0 (78.4–88.4)
Viral load suppression among individuals on first-line ART	407/423	96.0 (91.7–98.1)
Viral load suppression among individuals on first-line NNRTI-based ART	407/423	96.0 (91.7–98.1)
Viral load suppression among individuals on TDF-based first-line NNRTI-based ART	404/421	95.7 (91.4–97.9)
Viral load suppression among individuals on AZT-based first-line NNRTI-based ART	6/7	87.7 (42.3–98.6)
Viral load suppression among individuals on PI-based second-line ART	4/6	69.0 (30.8–91.7)
Viral load suppression among women on ART	133/139	94.2 (83.7–98.1)
Viral load suppression among men on ART	278/290	96.2 (92.9–98.0)
Cut-off viral load <400 copies/mL		
Viral load suppression among individuals on ART	406/429	94.0 (89.4–96.5)
Viral load suppression among individuals on first-line ART	402/423	94.3 (89.7–96.9)
Viral load suppression among individuals on first-line NNRTI-based ART	402/423	94.3 (89.7–96.9)
Viral load suppression among individuals on TDF-based first-line NNRTI-based ART	399/421	94.0 (89.4–96.6)
Viral load suppression among individuals on AZT-based first-line NNRTI-based ART	6/7	87.7 (42.3–98.6)
Viral load suppression among individuals on PI-based second-line ART	4/6	69.0 (30.8–91.7)
Viral load suppression among women on ART	130/139	91.0 (81.1–95.9)
Viral load suppression among men on ART	276/290	95.2 (91.6–97.3)
Cut-off viral load <50 copies/mL		
Viral load suppression among individuals on ART	369/429	84.6 (78.7–89.1)
Viral load suppression among individuals on first-line ART	366/423	85.1 (78.8–90.0)
Viral load suppression among individuals on first-line NNRTI-based ART	366/423	85.1 (78.8–90.0)
Viral load suppression among individuals on TDF-based first-line NNRTI-based ART	363/421	84.7 (78.5–89.4)
Viral load suppression among individuals on AZT-based first-line NNRTI-based ART	5/7	74.2 (38.3–93.0)
Viral load suppression among individuals on PI-based second-line ART	3/6	53.0 (27.6–76.9)
Viral load suppression among women on ART	120/139	85.5 (75.6–91.7)
Viral load suppression among men on ART	249/290	84.2 (73.3–91.1)

[a] National retention prevalence 89% (95% CI: 85–92%) estimated from sites participating in the survey.
[b] Prevalence of viral load suppression assessed from participants in the survey.
[c] Prevalence of viral load suppression extrapolated to the 12-month cohort that initiated treatment together with the individuals participating in the survey: adjusting for loss to follow-up and accounting for deaths and transfers out.

Table 3.2e. Prevalence of viral load suppression for individuals on ART, late time point (≥48 months), national ADR surveys – Africa

	Cameroon (48–60 months)		Eswatini[a] (≥48 months)		Senegal (≥40 months)	
	n/N	Prevalence % (95% CI)	*n/N*	Prevalence % (95% CI)	*n/N*	Prevalence % (95% CI)
Cut-off viral load <1000 copies/mL						
Viral load suppression among individuals on ART	267/388	67.8 (55.8–77.7)	468/500	93.7 (90.4–95.9)	270/315	88.1 (81.2–92.7)
Viral load suppression among individuals on first-line ART	255/364	68.7 (56.0–79.1)	443/468	94.7 (91.3–96.8)	267/311	88.2 (81.2–92.8)
Viral load suppression among individuals on first-line NNRTI-based ART	255/364	68.7 (56.0–79.1)	441/464	95.1 (91.6–97.2)	267/311	88.2 (81.2–92.8)
Viral load suppression among individuals on TDF-based first-line NNRTI-based ART	210/287	70.8 (57.4–81.4)	164/171	96.0 (90.6–98.3)	206/236	88.5 (80.6–93.5)
Viral load suppression among individuals on AZT-based first-line NNRTI-based ART	45/77	60.6 (42.7–76.1)	217/228	95.1 (90.6–97.5)	61/75	87.1 (73.6–94.2)
Viral load suppression among individuals on PI-based second-line ART	12/24	51.1 (34.6–67.5)	25/32	78.8 (62.1–89.4)	2/3	83.2 (32.4–98.1)
Viral load suppression among women on ART	202/287	69.4 (57.2–79.3)	339/359	94.1 (89.6–96.7)	208/239	89.3 (81.9–93.8)
Viral load suppression among men on ART	65/101	62.7 (41.8–79.7)	129/141	92.6 (86.9–96.0)	62/76	84.4 (69.7–92.8)

[a] Viral suppression defined as viral load ≤2005 copies/mL based on DBS, lower limit of detection by the Roche free viral elution platform.

Table 3.2f. Prevalence of viral load suppression for individuals on ART, late time point (≥48 months), national ADR surveys – Africa

	Uganda (≥48 months)	
	n/N	Prevalence % (95% CI)
Cut-off viral load <1000 copies/mL		
Viral load suppression among individuals on ART	923/1062	88.0 (84.6–90.7)
Viral load suppression among individuals on first-line ART	923/1062	88.0 (84.6–90.7)
Viral load suppression among individuals on first-line NNRTI-based ART	922/1061	88.0 (84.6–90.7)
Viral load suppression among individuals on TDF-based first-line NNRTI-based ART	328/366	90.7 (84.9–94.4)
Viral load suppression among individuals on AZT-based first-line NNRTI-based ART	591/692	86.6 (82.4–89.9)
Viral load suppression among individuals on PI-based second-line ART	0/0	0
Viral load suppression among women on ART	606/693	88.3 (85.2–90.8)
Viral load suppression among men on ART	317/369	87.4 (81.6–91.6)

Table 3.2g. Prevalence of viral load suppression for individuals on ART, late time point (≥48 months), national ADR surveys – the Americas

	Guatemala (≥48 months)		Honduras (≥48 months)		Nicaragua (≥48 months)	
	n/N	Prevalence % (95% CI)	*n/N*	Prevalence % (95% CI)	*n/N*	Prevalence % (95% CI)
Viral load <1000 copies/mL						
Viral load suppression among individuals on ART	328/377	86.9 (70.4–94.8)	246/367	67.9 (61.7–73.6)	240/353	70.3 (66.7–73.8)
Viral load suppression among individuals on first-line ART	308/350	87.9 (71.5–95.4)	203/298	68.9 (61.7–75.3)	208/303	70.9 (66.8–74.6)
Viral load suppression among individuals on first-line NNRTI-based ART	286/323	88.4 (71.8–95.8)	198/290	69.2 (61.8–75.7)	182/264	70.3 (65.7–74.4)
Viral load suppression among individuals on TDF-based first-line NNRTI-based ART	188/212	88.6 (72.8–95.7)	38/60	64.6 (54.0–73.9)	77/113	70.4 (64.8–75.6)
Viral load suppression among individuals on AZT-based first-line NNRTI-based ART	72/84	85.5 (59.2–96.0)	161/227	71.9 (63.2–79.2)	112/159	71.9 (65.8–77.3)
Viral load suppression among individuals on PI-based second-line ART	20/27	74.1 (54.0–87.4)	41/62	66.5 (54.4–76.8)	31/49	65.3 (53.9–75.2)
Viral load suppression among women on ART	137/161	85.0 (67.2–94.0)	141/212	69.4 (61.3–76.5)	92/134	72.5 (65.2–78.8)
Viral load suppression among men on ART	189/214	88.2 (71.8–95.7)	105/154	66.1 (54.9–75.7)	148/219	68.7 (62.2–74.5)
Viral load <400 copies/mL						
Viral load suppression among individuals on ART	323/377	85.6 (69.5–93.9)	233/367	63.9 (57.1–70.1)	229/353	66.9 (61.7–71.8)
Viral load suppression among individuals on first-line ART	304/350	86.7 (70.9–94.6)	194/298	65.0 (57.4–72.0)	199/303	67.8 (62.6–72.4)
Viral load suppression among individuals on first-line NNRTI-based ART	283/323	87.5 (70.7–95.3)	189/290	65.2 (57.4–72.3)	174/264	66.9 (61.3–72.1)
Viral load suppression among individuals on TDF-based first-line NNRTI-based ART	185/212	87.1 (70.7–95.0)	38/60	64.6 (54.0–73.9)	75/113	69.1 (61.0–76.2)
Viral load suppression among individuals on AZT-based first-line NNRTI-based ART	72/84	85.5 (59.2–96.0)	152/227	67.1 (57.9–75.1)	106/159	67.4 (60.4–73.6)
Viral load suppression among individuals on PI-based second-line ART	19/27	70.4 (51.2–84.3)	37/62	60.8 (47.8–72.4)	29/49	60.6 (44.9–74.3)
Viral load suppression among women on ART	134/161	83.1 (67.0–92.2)	133/212	64.1 (55.0–72.3)	89/134	69.1 (60.0–77.0)
Viral load suppression among men on ART	187/214	87.3 (69.6–95.4)	100/154	63.8 (53.8–72.8)	140/219	65.2 (59.4–70.7)
Viral load <50 copies/mL						
Viral load suppression among individuals on ART	301/377	79.7 (61.4–90.7)	204/367	57.6 (50.9–64.0)	180/353	52.2 (46.9–57.5)
Viral load suppression among individuals on first-line ART	286/350	81.6 (63.3–91.9)	174/298	59.5 (51.9–66.7)	158/303	53.6 (48.3–58.9)
Viral load suppression among individuals on first-line NNRTI-based ART	266/323	82.2 (63.1–92.6)	170/290	59.8 (52.0–67.1)	139/264	53.8 (48.2–59.4)
Viral load suppression among individuals on TDF-based first-line NNRTI-based ART	174/212	82.0 (64.0–92.1)	34/60	58.6 (47.7–68.7)	63/113	59.2 (50.6–67.3)
Viral load suppression among individuals on AZT-based first-line NNRTI-based ART	68/84	80.8 (52.8–94.0)	139/227	62.3 (53.2–70.6)	81/159	52.1 (44.7–59.4)
Viral load suppression among individuals on PI-based second-line ART	15/27	55.6 (30.0–78.5)	29/62	49.7 (35.3–64.2)	21/49	41.0 (26.0–57.8)
Viral load suppression among women on ART	125/161	77.5 (59.4–89.0)	121/212	60.2 (51.2–68.6)	69/134	52.7 (43.1–62.0)
Viral load suppression among men on ART	174/214	81.2 (61.7–92.1)	83/154	54.0 (44.2–63.5)	111/219	51.9 (45.8–57.9)

Table 3.2h. Prevalence of viral load suppression for individuals on ART, late time point (≥48 months), national ADR surveys – Western Pacific

	Viet Nam (≥48 months)	
	n	Prevalence % (95% CI)
Viral load <1000 copies/mL		
Viral load suppression among individuals on ART	691/723	96.1 (93.2–97.8)
Viral load suppression among individuals on first-line ART	658/688	96.2 (93.6–97.8)
Viral load suppression among individuals on first-line NNRTI-based ART	632/658	96.4 (93.6–98.0)
Viral load suppression among individuals on TDF-based first-line NNRTI-based ART	431/443	97.7 (94.8–99.0)
Viral load suppression among individuals on AZT-based first-line NNRTI-based ART	213/228	93.2 (87.9–96.3)
Viral load suppression among individuals on PI-based second-line ART	33/35	94.6 (69.6–99.3)
Viral load suppression among women on ART	257/267	96.8 (94.0–98.3)
Viral load suppression among men on ART	434/456	95.7 (91.9–97.7)
Viral load <400 copies/mL		
Viral load suppression among individuals on ART	688/723	95.7 (93.0–97.4)
Viral load suppression among individuals on first-line ART	535/562	95.9 (93.6–97.4)
Viral load suppression among individuals on first-line NNRTI-based ART	509/532	96.1 (93.6–97.7)
Viral load suppression among individuals on TDF-based first-line NNRTI-based ART	428/443	97.1 (94.5–98.5)
Viral load suppression among individuals on AZT-based first-line NNRTI-based ART	213/228	93.2 (87.9–96.3)
Viral load suppression among individuals on PI-based second-line ART	33/35	94.6 (69.6–99.3)
Viral load suppression among women on ART	256/267	96.6 (93.8–98.1)
Viral load suppression among men on ART	432/456	95.2 (91.6–97.3)
Viral load <50 copies/mL		
Viral load suppression among individuals on ART	646/723	89.8 (86.1–92.7)
Viral load suppression among individuals on first-line ART	504/562	90.4 (86.0–93.6)
Viral load suppression among individuals on first-line NNRTI-based ART	482/532	90.9 (86.3–94.1)
Viral load suppression among individuals on TDF-based first-line NNRTI-based ART	409/443	92.5 (88.3–95.3)
Viral load suppression among individuals on AZT-based first-line NNRTI-based ART	197/228	86.1 (79.1–91.0)
Viral load suppression among individuals on PI-based second-line ART	28/35	80.8 (57.7–92.9)
Viral load suppression among women on ART	242/267	91.0 (86.2–94.3)
Viral load suppression among men on ART	404/456	89.1 (84.3–92.6)

Table 3.3a. Prevalence of ADR among individuals on ART, early time point (12 months), national ADR surveys – Africa

	Cameroon (12–24 months)		Eswatini[a] (12±3 months)		Senegal (12±3 months)	
	n/N	Prevalence % (95% CI)	*n/N*	Prevalence % (95% CI)	*n/N*	Prevalence % (95% CI)
HIVDR among individuals on ART						
Any	111/960	17.1 (14.0–20.7)	18/366	4.7 (2.5–8.6)	15/238	7.0 (3.9–12.4)
NNRTI	109/960	16.7 (13.7–20.2)	17/366	4.5 (2.4–8.1)	15/238	7.0 (3.9–12.4)
NRTI	97/960	14.7 (11.3–18.9)	18/366	4.7 (2.5–8.6)	8/238	2.4 (1.0–5.3)
PI	1/960	0.3 (0.0–2.2)	0/366	0	0/238	0
NNRTI+NRTI	96/960	14.6 (11.3–18.7)	17/366	4.5 (2.4–8.1)	8/238	2.4 (1.0–5.3)
HIVDR among individuals on ART with viral load ≥1000 copies/mL						
Any	111/164	61.1 (50.3–70.9)	18/26	51.8 (26.8–76.0)	15/27	62.5 (40.8–80.1)
NNRTI	109/164	59.7 (49.3–69.4)	17/26	49.7 (26.4–73.2)	15/27	62.5 (40.8–80.1)
NRTI	97/164	52.6 (41.2–63.7)	18/26	51.8 (26.8–76.0)	8/27	21.0 (6.9–49.1)
PI	1/164	1.1 (0.1–7.5)	0/26	0	0/27	0
NNRTI+NRTI	96/164	52.3 (41.1–63.2)	17/26	49.7 (26.4–73.2)	8/27	21.0 (6.9–49.1)
HIVDR among individuals on first-line ART with viral load ≥1000 copies/mL						
Any	110/162	61.2 (50.3–71.0)	17/25	50.8 (26.2–75.0)	15/27	62.5 (40.8–80.1)
NNRTI	108/162	59.8 (49.3–69.5)	17/25	50.8 (26.2–75.0)	15/27	62.5 (40.8–80.1)
NRTI	96/162	52.6 (41.2–63.7)	17/25	50.8 (26.2–75.0)	8/27	21.0 (6.9–49.1)
PI	1/162	1.1 (0.1–7.5)	0/25	0	0/27	0
NNRTI+NRTI	95/162	52.3 (41.0–63.3)	17/25	50.8 (26.2–75.0)	8/27	21.0 (6.9–49.1)
HIVDR among individuals on first-line NNRTI ART with viral load ≥1000 copies/mL						
Any	109/161	61.1 (50.2–70.9)	17/24	52.7 (2.71–76.9)	15/27	62.5 (40.8–80.1)
NNRTI	107/161	59.7 (49.2–69.4)	17/24	52.7 (2.71–76.9)	15/27	62.5 (40.8–80.1)
NRTI	95/161	52.5 (41.1–63.6)	17/24	52.7 (2.71–76.9)	8/27	21.0 (6.9–49.1)
PI	1/161	1.1 (0.1–7.6)	0/24	0	0/27	0
NNRTI+NRTI	94/161	52.2 (40.9–63.2)	17/24	52.7 (2.71–76.9)	8/27	21.0 (6.9–49.1)
HIVDR among individuals on first-line NNRTI and TDF-based ART with viral load ≥1000 copies/mL						
TDF resistance	42/115	28.8 (18.5–42.0)	15/24	48.9 (25.5–72.7)	7/26	19.1 (5.6–48.6)
FTC or 3TC resistance	61/115	45.2 (34.1–56.8)	17/24	52.7 (27.3–76.7)	8/26	21.5 (6.9–50.5)
TDF + XTC resistance	42/115	28.8 (18.5–42.0)	15/24	48.9 (25.5–72.7)	7/26	19.1 (5.6–48.6)
TDF + XTC + AZT resistance	6/115	3.0 (1.1–8.1)	1/24	2.2 (0.3–15.4)	0/26	0
HIVDR among individuals on first-line NNRTI and AZT-based ART with viral load ≥1000 copies/mL						
AZT resistance	12/45	22.5 (13.6–34.7)	NA	NA	NA	NA
FTC or 3TC resistance	32/45	68.4 (51.2–81.7)	NA	NA	NA	NA
AZT + XTC resistance	12/45	22.5 (13.6–34.7)	NA	NA	NA	NA
AZT + XTC + TDF resistance	11/45	21.0 (12.6–32.9)	NA	NA	NA	NA

[a] Failure to suppress viral loads defined as ≥2005 copies/mL instead of ≥1000 copies/mL. This is due to the use of DBS with the Roche free viral elution platform, which has a limit of detection of 2005 copies/mL. Weight trimming approach used to adjust for excessively large sampling variances in the estimation of ADR prevalence.

NNRTI resistance is defined as resistance to nevirapine (NVP) or efavirenz (EFV).
NRTI resistance is defined as resistance to any NRTI, and any PI resistance is defined as resistance to atazanavir/ritonavir (ATV/r), lopinavir/ritonavir (LPV/r), or darunavir/ritonavir (DRV/r).
Any HIVDR is defined as resistance to NVP/EFV, any NRTI, ATV/r, LPV/r or DRV/r.
HIVDR is determined using the Stanford HIVdb algorithm: sequences classified as having low-, intermediate- or high-level resistance are considered resistant.

Table 3.3b. Prevalence of ADR among individuals on ART, early time point (12 months), national ADR surveys – Africa

	Uganda (12±3 months)		Zambia[a] (12±3 months)	
	n/N	Prevalence % (95% CI)	*n/N*	Prevalence % (95% CI)
HIVDR among individuals on ART				
Any	27/523	4.5 (3.6–5.6)	18/433	2.8 (0.8–9.4)
NNRTI	27/523	4.5 (3.6–5.6)	18/433	2.8 (0.8–9.4)
NRTI	23/523	4.2 (3.3–5.4)	17/433	2.6 (0.7–9.1)
PI	0/523	0	0/433	0
NNRTI+NRTI	23/523	4.2 (3.3–5.4)	17/433	2.6 (0.7–9.1)
HIVDR among individuals on ART with viral load ≥1000 copies/mL				
Any	27/30	96.6 (83.9–99.4)	18/24	75.8 (39.9–93.6)
NNRTI	27/30	96.6 (83.9–99.4)	18/24	75.8 (39.9–93.6)
NRTI	23/30	91.3 (65.0–98.3)	17/24	72.7 (39.3–91.6)
PI	0/30	0	0/24	0
NNRTI+NRTI	23/30	91.3 (65.0–98.3)	17/24	72.7 (39.3–91.6)
HIVDR among individuals on first-line ART with viral load ≥1000 copies/mL				
Any	27/30	96.6 (83.9–99.4)	18/24	75.8 (39.9–93.6)
NNRTI	27/30	96.6 (83.9–99.4)	18/24	75.8 (39.9–93.6)
NRTI	23/30	91.3 (65.0–98.3)	17/24	72.7 (39.3–91.6)
PI	0/30	0	0/24	0
NNRTI+NRTI	23/30	91.3 (65.0–98.3)	17/24	72.7 (39.3–91.6)
HIVDR among individuals on first-line NNRTI ART with viral load ≥1000 copies/mL				
Any	27/30	96.6 (83.9–99.4)	18/24	75.8 (39.9–93.6)
NNRTI	27/30	96.6 (83.9–99.4)	18/24	75.8 (39.9–93.6)
NRTI	23/30	91.3 (65.0–98.3)	17/24	72.7 (39.3–91.6)
PI	0/30	0	0/24	0
NNRTI+NRTI	23/30	91.3 (65.0–98.3)	17/24	72.7 (39.3–91.6)
HIVDR among individuals on first-line NNRTI and TDF-based ART with viral load ≥1000 copies/mL				
TDF resistance	14/30	84.1 (51.2–96.4)	13/24	54.2 (35.1-72.1)
FTC/3TC resistance	23/30	91.3 (65.0–98.3)	16/24	66.7 (46.7-82.0)
TDF+XTC resistance	14/30	84.1 (51.2–96.4)	12/24	50.0 (31.4-68.6)
TDF+XTC+AZT resistance	5/30	15.6 (3.0–52.2)	0/24	0
HIVDR among individuals on first-line NNRTI and AZT-based ART with viral load ≥1000 copies/mL				
AZT resistance	1/3	16.8 (1.0–80.6)	NA	NA
FTC or 3TC resistance	3/3	100	NA	NA
AZT + XTC resistance	1/3	16.8 (1.0–80.6)	NA	NA
AZT + XTC + TDF resistance	1/3	16.8 (1.0–80.6)	NA	NA

[a] Updated analysis from the 2017 HIVDR report using adjusted weights (weight trimming to adjust for excessively large sampling variances)

NNRTI resistance is defined as resistance to nevirapine (NVP) or efavirenz (EFV).
NRTI resistance is defined as resistance to any NRTI, and any PI resistance is defined as resistance to atazanavir/ritonavir (ATV/r), lopinavir/ritonavir (LPV/r), or darunavir/ritonavir (DRV/r).
Any HIVDR is defined as resistance to NVP/EFV, any NRTI, ATV/r, LPV/r or DRV/r.
HIVDR is determined using the Stanford HIVdb algorithm: sequences classified as having low-, intermediate- or high-level resistance are considered resistant.

Table 3.3c. Prevalence of ADR among individuals on ART, early time point (12 months), national ADR surveys – the Americas

	Guatemala (12±3 months)		Honduras (12±3 months)		Nicaragua (12±3 months)	
	n/N	Prevalence % (95% CI)	*n/N*	Prevalence % (95% CI)	*n/N*	Prevalence % (95% CI)
HIVDR among individuals on ART						
Any	16/216	9.5 (4.1–20.2)	14/166	7.6 (5.0–11.5)	22/113	18.3 (10.7–29.4)
NNRTI	15/216	8.6 (4.1–17.1)	14/166	7.6 (5.0–11.5)	21/113	17.7 (10.2–28.9)
NRTI	11/216	6.8 (2.6–16.7)	10/166	5.9 (3.5–9.9)	17/113	15.1 (8.0–26.7)
PI	0/216	0	1/166	0.3 (0.2–0.6)	0/113	0
NNRTI+NRTI	10/216	5.9 (2.6–12.8)	10/166	5.9 (3.5–9.9)	16/113	14.5 (7.5–26.3)
HIVDR among individuals on ART with viral load ≥1000 copies/mL						
Any	16/19	84.0 (57.4–95.3)	14/16	86.1 (48.9–97.6)	22/27	85.1 (66.1–94.4)
NNRTI	15/19	76.0 (51.2–90.5)	14/16	86.1 (48.9–97.6)	21/27	82.4 (60.7–93.4)
NRTI	11/19	60.0 (33.5–81.7)	10/16	67.1 (37.4–87.5)	17/27	70.2 (43.6–87.8)
PI	0/19	0	1/16	3.8 (0.5–25.2)	0/27	0
NNRTI+NRTI	10/19	52.0 (32.9–70.5)	10/16	67.1 (37.4–87.5)	16/27	65.7 (40.0–86.6)
HIVDR among individuals on first-line ART with viral load ≥1000 copies/mL						
Any	16/19	84.0 (57.4–95.3)	14/16	86.1 (48.9–97.6)	22/27	85.1 (66.1–94.4)
NNRTI	15/19	76.0 (51.2–90.5)	14/16	86.1 (48.9–97.6)	21/27	82.4 (60.7–93.4)
NRTI	11/19	60.0 (33.5–81.7)	10/16	67.1 (37.4–87.5)	17/27	70.2 (43.6–87.8)
PI	0/19	0	1/16	3.8 (0.5–25.2)	0/27	0
NNRTI+NRTI	10/19	52.0 (32.9–70.5)	10/16	67.1 (37.4–87.5)	16/27	65.7 (40.0–86.6)
HIVDR among individuals on first-line NNRTI ART with viral load ≥1000 copies/mL						
Any	15/17	88.9 (58.4–97.9)	14/16	86.1 (48.9–97.6)	21/25	84.9 (65.4–94.4)
NNRTI	14/17	80.0 (51.0–93.9)	14/16	86.1 (48.9–97.6)	20/25	81.3 (58.2–93.2)
NRTI	10/17	62.2 (37.5–81.9)	10/16	67.1 (37.4–87.5)	16/25	65.3 (42.2–82.9)
PI	0/17	0	1/16	3.8 (0.5–25.2)	0/25	0
NNRTI+NRTI	9/17	53.3 (37.5–68.5)	10/16	67.1 (37.4–87.5)	15/25	61.7 (38.0–80.9)
HIVDR among individuals on first-line NNRTI and TDF-based ART with viral load ≥1000 copies/mL						
TDF resistance	5/15	42.1 (18.3–70.3)	5/14	42.8 (15.1–75.8)	4/23	16.4 (4.7–44.2)
FTC or 3TC resistance	8/15	57.9 (31.1–80.7)	9/14	72.8 (41.9–90.9)	13/23	56.2 (31.0–78.5)
TDF + XTC resistance	5/15	42.1 (18.3–70.3)	5/14	42.8 (15.1–75.8)	4/23	16.4 (4.7–44.2)
TDF + XTC + AZT resistance	0/15	0	3/14	21.5 (4.8–59.8)	1/23	4.1 (0.6–24.5)
HIVDR among individuals on first-line NNRTI and AZT-based ART with viral load ≥1000 copies/mL						
AZT resistance	0/2	0	0/2	0	1/2	73.0 (0.0–100)
FTC or 3TC resistance	1/2	57.1 (17.4–89.4)	0/2	0	1/2	73.0 (0.0–100)
AZT + XTC resistance	0/2	0	0/2	0	1/2	73.0 (0.0–100)
AZT + XTC + TDF resistance	0/2	0	0/2	0	1/2	73.0 (0.0–100)

NNRTI resistance is defined as resistance to nevirapine (NVP) or efavirenz (EFV).
NRTI resistance is defined as resistance to any NRTI, and any PI resistance is defined as resistance to atazanavir/ritonavir (ATV/r), lopinavir/ritonavir (LPV/r), or darunavir/ritonavir (DRV/r).
Any HIVDR is defined as resistance to NVP/EFV, any NRTI, ATV/r, LPV/r or DRV/r.
HIVDR is determined using the Stanford HIVdb algorithm: sequences classified as having low-, intermediate- or high-level resistance are considered resistant.

Table 3.3d. Prevalence of ADR among individuals on ART, early time point (12 months), national ADR surveys – Western Pacific

	Viet Nam (2017) (12±3 months)	
	n/N	Prevalence % (95% CI)
HIVDR among individuals on ART		
Any	11/425	3.0 (1.6–5.7)
NNRTI	11/425	3.0 (1.6–5.7)
NRTI	9/425	2.1 (1.0–4.2)
PI	0/424	0
NNRTI+NRTI	9/425	2.1 (1.0–4.2)
HIVDR among individuals on ART with viral load ≥1000 copies/mL		
Any	11/14	74.3 (42.8–91.8)
NNRTI	11/14	74.3 (42.8–91.8)
NRTI	9/14	50.5 (13.1–87.4)
PI	0/14	0
NNRTI+NRTI	9/14	50.5 (13.1–87.4)
HIVDR among individuals on first-line ART with viral load ≥1000 copies/mL		
Any	9/12	70.7 (39.1–90.0)
NNRTI	9/12	70.7 (39.1–90.0)
NRTI	8/12	51.1 (10.1–90.6)
PI	0/11	0
NNRTI+NRTI	8/12	51.1 (10.1–90.6)
HIVDR among individuals on first-line NNRTI ART with viral load ≥1000 copies/mL		
Any	9/12	70.7 (39.1–90.0)
NNRTI	9/12	70.7 (39.1–90.0)
NRTI	8/12	51.1 (10.1–90.6)
PI	0/11	0
NNRTI+NRTI	8/12	51.1 (10.1–90.6)
HIVDR among individuals on first-line NNRTI and TDF-based ART with viral load ≥1000 copies/mL		
TDF resistance	4/13	26.5 (4.8–72.2)
FTC or 3TC resistance	8/13	47.5 (11.4–86.4)
TDF + XTC resistance	4/13	26.5 (4.8–72.2)
TDF + XTC + AZT resistance	0/13	0
HIVDR among individuals on first-line NNRTI and AZT-based ART with viral load ≥1000 copies/mL		
AZT resistance	NA	NA
FTC or 3TC resistance	NA	NA
AZT + XTC resistance	NA	NA
AZT + XTC + TDF resistance	NA	NA

NNRTI resistance is defined as resistance to nevirapine (NVP) or efavirenz (EFV).
NRTI resistance is defined as resistance to any NRTI, and any PI resistance is defined as resistance to atazanavir/ritonavir (ATV/r), lopinavir/ritonavir (LPV/r), or darunavir/ritonavir (DRV/r).
Any HIVDR is defined as resistance to NVP/EFV, any NRTI, ATV/r, LPV/r or DRV/r.
HIVDR is determined using the Stanford HIVdb algorithm: sequences classified as having low-, intermediate- or high-level resistance are considered resistant.

Table 3.3e. Prevalence of ADR among individuals on ART, late time point (≥48 months), national ADR surveys – Africa

	Cameroon (48–60 months)		Eswatini (≥48 months)	
	n/N	Prevalence % (95% CI)	*n/N*	Prevalence % (95% CI)
HIVDR among individuals on ART				
Any	59/334	28.3 (17.4–42.5)	15/488	4.9 (2.7–8.7)
NNRTI	59/334	28.3 (17.4–42.5)	13/488	4.5 (2.3–8.4)
NRTI	53/334	25.2 (14.0–40.9)	14/488	4.6 (2.4–8.5)
PI	1/334	0.3 (0.0–3.7)	1/488	0.2 (0.0–1.2)
NNRTI+NRTI	53/334	25.2 (14.0–40.9)	12/488	4.2 (2.1–8.2)
HIVDR among individuals on ART with viral load ≥1000 copies/mL				
Any	59/67	87.7 (67.4–96.1)	15/20	79.0 (44.7–94.6)
NNRTI	59/67	87.7 (67.4–96.1)	13/20	72.9 (41.6–91.1)
NRTI	53/67	77.9 (50.2–92.5)	14/20	75.0 (40.2–93.1)
PI	1/67	0.8 (0.1–9.4)	1/20	2.6 (0.3–20.6)
NNRTI+NRTI	53/67	77.9 (50.2–92.5)	12/20	69.0 (36.9–89.5)
HIVDR among individuals on first-line ART with viral load ≥1000 copies/mL				
Any	57/63	89.5 (71.0–96.7)	12/13	91.4 (48.0–99.2)
NNRTI	57/63	89.5 (71.0–96.7)	12/13	91.4 (48.0–99.2)
NRTI	51/63	79.3 (50.4–93.5)	11/13	85.7 (47.8–97.5)
PI	1/63	0.8 (0.1–10.1)	0/13	0
NNRTI+NRTI	51/63	79.3 (50.4–93.5)	11/13	85.7 (47.8–97.5)
HIVDR among individuals on first-line NNRTI ART with viral load ≥1000 copies/mL				
Any	57/63	89.5 (71.0–96.7)	11/12	90.6 (45.2–99.1)
NNRTI	57/63	89.5 (71.0–96.7)	11/12	90.6 (45.2–99.1)
NRTI	51/63	79.3 (50.4–93.5)	10/12	84.5 (44.6–97.4)
PI	1/63	0.8 (0.1–10.1)	0/12	0
NNRTI+NRTI	51/63	79.3 (50.4–93.5)	10/12	84.5 (44.6–97.4)
HIVDR among individuals on first-line NNRTI and TDF-based ART with viral load ≥1000 copies/mL				
TDF resistance	22/43	51.8 (25.9–76.8)	1/3	28.9 (2.5–86.4)
FTC or 3TC resistance	33/43	77.4 (44.1–93.7)	1/3	28.9 (2.5–86.4)
TDF + XTC resistance	22/43	51.8 (25.9–76.8)	1/3	28.9 (2.5–86.4)
TDF + XTC + AZT resistance	7/43	21.3 (7.0–49.4)	0/3	0
HIVDR among individuals on first-line NNRTI and AZT-based ART with viral load ≥1000 copies/mL				
AZT resistance	10/20	50.1 (25.2–75.0)	2/5	29.7 (6.4–72.3)
FTC or 3TC resistance	18/20	86.7 (50.1–97.7)	5/5	100.0
AZT + XTC resistance	10/20	50.1 (25.2–75.0)	2/5	29.7 (6.4–72.3)
AZT + XTC + TDF resistance	10/20	50.1 (25.2–75.0)	2/5	29.7 (6.4–72.3)

NNRTI resistance is defined as resistance to nevirapine (NVP) or efavirenz (EFV).
NRTI resistance is defined as resistance to any NRTI, and any PI resistance is defined as resistance to atazanavir/ritonavir (ATV/r), lopinavir/ritonavir (LPV/r), or darunavir/ritonavir (DRV/r).
Any HIVDR is defined as resistance to NVP/EFV, any NRTI, ATV/r, LPV/r or DRV/r.
HIVDR is determined using the Stanford HIVdb algorithm: sequences classified as having low-, intermediate- or high-level resistance are considered resistant.

Table 3.3f. Prevalence of ADR among individuals on ART, late time point (≥48 months), national ADR surveys – Africa

	Senegal (≥40 months)		Uganda (≥48 months)	
	n/*N* n/N	Prevalence % (95% CI)	*n*/*N*	Prevalence % (95% CI)
HIVDR among individuals on ART				
Any	28/302	9.6 (5.3–16.8)	87/1016	7.6 (5.9–9.7)
NNRTI	28/302	9.6 (5.3–16.8)	85/1016	7.3 (5.5–9.6)
NRTI	16/302	5.9 (2.9–11.1)	83/1016	7.2 (5.5–9.2)
PI	NA	NA	NA	NA
NNRTI+NRTI	16/302	5.9 (2.9–11.1)	81/1016	6.9 (5.2–9.1)
HIVDR among individuals on ART with viral load ≥1000 copies/mL				
Any	28/32	92.1 (63.5–98.7)	87/93	92.2 (76.5–97.7)
NNRTI	28/32	92.1 (63.5–98.7)	85/93	89.1 (73.4–96.0)
NRTI	16/32	56.8 (30.0–80.1)	83/93	87.4 (73.6–94.5)
PI	NA	NA	NA	NA
NNRTI+NRTI	16/32	56.8 (30.0–80.1)	81/93	84.3 (70.4–92.4)
HIVDR among individuals on first-line ART with viral load ≥1000 copies/mL				
Any	28/32	92.1 (63.5–98.7)	87/93	92.2 (76.5–97.7)
NNRTI	28/32	92.1 (63.5–98.7)	85/93	89.1 (73.4–96.0)
NRTI	16/32	56.8 (30.0–80.1)	83/93	87.4 (73.6–94.5)
PI	NA	NA	–	–
NNRTI+NRTI	16/32	56.8 (30.0–80.1)	81/93	84.3 (70.4–92.4)
HIVDR among individuals on first-line NNRTI ART with viral load ≥1000 copies/mL				
Any	28/32	92.1 (63.5–98.7)	87/93	92.2 (76.5–97.7)
NNRTI	28/32	92.1 (63.5–98.7)	85/93	89.1 (73.4–96.0)
NRTI	16/32	56.8 (30.0–80.1)	83/93	87.4 (73.6–94.5)
PI	NA	NA	NA	NA
NNRTI+NRTI	16/32	56.8 (30.0–80.1)	81/93	84.3 (70.4–92.4)
HIVDR among individuals on first-line NNRTI and TDF-based ART with viral load ≥1000 copies/mL				
TDF resistance	3/22	12.6 (4.0–33.0)	14/21	60.8 (31.4–84.0)
FTC or 3TC resistance	8/22	38.3 (18.4–63.2)	16/21	68.5 (30.0–91.7)
TDF + XTC resistance	3/22	12.6 (4.0–33.0)	14/21	60.8 (31.4–84.0)
TDF + XTC + AZT resistance	1/22	8.0 (1.4–35.3)	3/21	12.6 (2.7–43.2)
HIVDR among individuals on first-line NNRTI and AZT-based ART with viral load ≥1000 copies/mL				
AZT resistance	5/10	69.4 (23.5–94.4)	37/72	55.0 (42.2–67.1)
FTC or 3TC resistance	7/10	83.2 (36.9–97.7)	66/72	89.8 (74.6–96.3)
AZT + XTC resistance	4/10	63.6 (17.6–93.5)	36/72	51.8 (37.8–65.5)
AZT + XTC + TDF resistance	2/10	11.9 (1.5–53.9)	26/72	40.0 (24.3–57.9)

NNRTI resistance is defined as resistance to nevirapine (NVP) or efavirenz (EFV).
NRTI resistance is defined as resistance to any NRTI, and any PI resistance is defined as resistance to atazanavir/ritonavir (ATV/r), lopinavir/ritonavir (LPV/r), or darunavir/ritonavir (DRV/r).
Any HIVDR is defined as resistance to NVP/EFV, any NRTI, ATV/r, LPV/r or DRV/r.
HIVDR is determined using the Stanford HIVdb algorithm: sequences classified as having low-, intermediate- or high-level resistance are considered resistant.

Table 3.3g. Prevalence of ADR among individuals on ART, late time point (≥48 months), national ADR surveys – the Americas

	Guatemala (≥48 months)		Honduras (≥48 months)		Nicaragua (≥48 months)	
	n/N	Prevalence % (95% CI)	*n/N*	Prevalence % (95% CI)	*n/N*	Prevalence % (95% CI)
HIVDR among individuals on ART						
Any	30/368	9.5 (3.0–26.2)	89/349	29.2 (23.3–36.0)	87/350	22.4 (18.5–26.8)
NNRTI	29/368	9.2 (2.9–25.6)	86/349	27.3 (21.7–33.7)	82/350	21.0 (17.3–25.1)
NRTI	25/368	7.8 (2.5–22.2)	79/349	26.7 (20.9–33.5)	68/350	17.6 (14.4–21.4)
PI	1/368	0.3 (0.0–4.1)	3/349	2.3 (0.6–7.9)	6/350	1.4 (0.8–2.3)
NNRTI+NRTI	24/368	7.5 (2.4–21.4)	76/349	24.8 (19.3–31.2)	63/350	16.2 (13.2–19.7)
HIVDR among individuals on ART with viral load ≥1000 copies/mL						
Any	30/40	76.5 (55.6–89.4)	89/103	92.0 (86.8–95.3)	87/110	75.5 (63.5–84.5)
NNRTI	29/40	74.2 (51.8–88.5)	86/103	86.0 (73.7–93.0)	82/110	70.7 (58.7–80.3)
NRTI	25/40	63.0 (43.7–78.9)	79/103	84.1 (76.7–89.5)	68/110	59.4 (48.1–69.8)
PI	1/40	2.6 (0.3–21.6)	3/103	7.3 (1.8–25.1)	6/110	4.6 (2.2–9.5)
NNRTI+NRTI	24/40	60.7 (42.6–76.2)	76/103	78.1 (66.6–86.5)	63/110	54.6 (43.3–65.4)
HIVDR among individuals on first-line ART with viral load ≥1000 copies/mL						
Any	29/35	83.8 (57.8–95.1)	75/80	96.6 (91.9–98.6)	75/93	77.3 (63.3–87.0)
NNRTI	28/35	81.1 (59.3–92.6)	73/80	94.8 (89.1–97.6)	70/93	71.6 (57.7–82.3)
NRTI	25/35	71.6 (42.4–89.6)	67/80	88.0 (79.7–93.2)	58/93	59.7 (46.8–71.4)
PI	1/35	2.9 (0.3–23.4)	1/80	0.6 (0.1–3.8)	2/93	1.8 (0.5–6.0)
NNRTI+NRTI	24/35	68.9 (44.3–86.1)	65/80	86.2 (77.6–91.9)	53/93	54.0 (41.3–66.2)
HIVDR among individuals on first-line NNRTI ART with viral load ≥1000 copies/mL						
Any	27/31	87.3 (67.8–95.7)	74/79	96.6 (91.9–98.6)	69/80	82.4 (66.4–91.8)
NNRTI	26/31	84.3 (69.4–92.7)	72/79	94.8 (89.0–97.6)	66/80	78.1 (62.3–88.4)
NRTI	24/31	76.9 (47.1–92.5)	67/79	87.9 (79.4–93.1)	53/80	63.8 (49.5–76.0)
PI	1/31	3.3 (0.3–26.5)	1/79	0.6 (0.1–3.9)	2/80	1.8 (0.4–7.3)
NNRTI+NRTI	23/31	73.9 (49.6–89.0)	65/79	86.1 (77.3–91.8)	50/80	59.4 (45.3–72.2)
HIVDR among individuals on first-line NNRTI and TDF-based ART with viral load ≥1000 copies/mL						
TDF resistance	11/21	48.2 (30.4–66.5)	10/20	53.6 (27.7–77.7)	11/35	33.9 (19.0–52.9)
FTC or 3TC resistance	18/21	85.2 (63.2–95.1)	15/20	79.1 (53.8–92.5)	20/35	59.5 (39.6–76.7)
TDF + XTC resistance	11/21	48.2 (30.4–66.5)	10/20	53.6 (27.7–77.7)	11/35	33.9 (19.0–52.9)
TDF + XTC + AZT resistance	3/21	13.1 (5.0–30.4)	4/20	28.7 (8.4–63.7)	1/35	2.3 (0.4–13.8)
HIVDR among individuals on first-line NNRTI and AZT-based ART with viral load ≥1000 copies/mL						
AZT resistance	4/9	46.0 (24.1–69.6)	30/56	66.2 (49.8–79.4)	8/42	15.9 (6.9–32.5)
FTC or 3TC resistance	5/9	57.6 (35.4–77.1)	48/56	89.2 (78.1–95.0)	28/42	57.0 (35.4–76.3)
AZT + XTC resistance	3/9	35.5 (16.4–60.7)	30/56	66.2 (49.8–79.4)	7/42	14.3 (5.8–31.2)
AZT + XTC + TDF resistance	3/9	35.5 (16.4–60.7)	22/56	55.8 (37.9–72.2)	4/42	8.2 (2.7–22.3)

NNRTI resistance is defined as resistance to nevirapine (NVP) or efavirenz (EFV).
NRTI resistance is defined as resistance to any NRTI, and any PI resistance is defined as resistance to atazanavir/ritonavir (ATV/r), lopinavir/ritonavir (LPV/r), or darunavir/ritonavir (DRV/r).
Any HIVDR is defined as resistance to NVP/EFV, any NRTI, ATV/r, LPV/r or DRV/r.
HIVDR is determined using the Stanford HIVdb algorithm: sequences classified as having low-, intermediate- or high-level resistance are considered resistant.

Table 3.3h. Prevalence of ADR among individuals on ART, late time point (≥48 months), national ADR surveys – Western Pacific

	Viet Nam (≥48 months)	
	n/N	Prevalence % (95% CI)
HIVDR among individuals on ART		
Any	24/718	3.4 (1.9–6.1)
NNRTI	23/718	3.3 (1.8–5.9)
NRTI	23/718	3.3 (1.8–5.9)
PI	1/716	0.1 (0.0–0.7)
NNRTI+NRTI	22/718	3.1 (1.7–5.7)
HIVDR among individuals on ART with viral load ≥1000 copies/mL		
Any	24/27	88.5 (70.7–96.1)
NNRTI	23/27	84.3 (66.0–93.7)
NRTI	23/27	84.4 (58.6–95.4)
PI	1/25	2.5 (0.3–21.1)
NNRTI+NRTI	22/27	80.2 (56.0–92.8)
HIVDR among individuals on first-line ART with viral load ≥1000 copies/mL		
Any	22/25	87.6 (67.6–96.0)
NNRTI	21/25	83.1 (63.1–93.4)
NRTI	21/25	83.2 (55.6–95.2)
PI	1/24	2.6 (0.3–21.6)
NNRTI+NRTI	20/25	78.7 (53.2–92.3)
HIVDR among individuals on first-line NNRTI ART with viral load ≥1000 copies/mL		
Any	20/22	90.9 (71.2–97.6)
NNRTI	19/22	85.9 (66.1–95.0)
NRTI	19/22	86.1 (55.0–96.9)
PI	0/21	0
NNRTI+NRTI	18/22	81.1 (53.6–94.1)
HIVDR among individuals on first-line NNRTI and TDF-based ART with viral load ≥1000 copies/mL		
TDF resistance	5/9	53.8 (20.4–84.1)
FTC or 3TC resistance	7/9	76.1 (28.1–96.3)
TDF + XTC resistance	5/9	53.8 (20.4–84.1)
TDF + XTC + AZT resistance	0/9	0
HIVDR among individuals on first-line NNRTI and AZT-based ART with viral load ≥1000 copies/mL		
AZT resistance	7/13	55.8 (24.6–83.1)
FTC or 3TC resistance	12/13	92.8 (61.5–99.1)
AZT + XTC resistance	7/13	55.8 (24.6–83.1)
AZT + XTC + TDF resistance	4/13	23.8 (5.7–61.6)

NNRTI resistance is defined as resistance to nevirapine (NVP) or efavirenz (EFV).
NRTI resistance is defined as resistance to any NRTI, and any PI resistance is defined as resistance to atazanavir/ritonavir (ATV/r), lopinavir/ritonavir (LPV/r), or darunavir/ritonavir (DRV/r).
Any HIVDR is defined as resistance to NVP/EFV, any NRTI, ATV/r, LPV/r or DRV/r.
HIVDR is determined using the Stanford HIVdb algorithm: sequences classified as having low-, intermediate- or high-level resistance are considered resistant.

Table. HIV subtype distribution for all sequences from HIVDR surveys conducted between 2014 and 2018

Country	n	Subtype (%)														
		A	B	C	D	F	F2	G	CRF01_AE	CRF02_AG	CRF06_cpx	CRF11_cpx	CRF12_BF	CRF18_cpx	CRF20_BG	URF, other
Argentina	294	–	49.0	3.7	–	1.7	–	–	–	–	–	–	22.8	–	–	22.8
Brazil	1566	0.1	70.3	13.9	0.2	11.1	–	–	–	0.3	–	–	0.6	–	–	3.5
Cameroon	960	9.1	0.4	0.2	1.7	0.1	3.0	5.5	1.0	68.9	0.5	2.4	–	1.1	–	6.0
Colombia	196	–	98.5	–	–	0.5	–	–	–	0.5	–	–	–	–	–	0.5
Cuba	141	0.7	35.5	2.1	19.1	–	–	1.4	–	–	–	–	–	14.9	7.1	19.1
Eswatini	312	0.6	–	99.0	–	–	–	–	–	–	–	–	–	–	–	0.3
Ethiopia	240	–	–	99.2	0.4	–	–	–	–	0.4	–	–	–	–	–	–
Guatemala	310	–	99.0	–	0.3	–	–	–	–	–	–	–	0.3	0.3	–	–
Honduras	325	–	98.8	0.9	–	–	–	–	–	0.3	–	–	–	–	–	–
Malawi	288	0.3	–	99.7	–	–	–	–	–	–	–	–	–	–	–	–
Mexico	2270	–	99.0	–	–	–	–	–	0.2	0.1	–	0.1	0.0	0.1	0.1	0.2
Myanmar	352	3.7	15.1	29.0	–	–	–	–	45.5	–	–	–	–	–	–	6.8
Namibia	388	2.3	–	92.5	–	–	–	0.3	0.3	3.9	0.3	–	–	0.3	–	0.3
Nepal	215	0.9	0.5	94.4	–	–	–	–	1.9	1.9	–	–	–	–	–	0.5
Nicaragua	317	–	99.1	0.3	–	–	–	–	–	0.3	–	–	0.3	–	–	–
Nigeria	430	5.8	0.5	0.5	0.5	–	0.2	40.7	–	46.5	4.4	–	–	–	–	0.9
Papua New Guinea	317	0.3	0.3	99.4	–	–	–	–	–	–	–	–	–	–	–	–
Senegal	63	14.3	3.2	6.3	–	–	–	1.6	–	68.3	1.6	–	–	–	–	4.8
South Africa	402	–	–	99.8	0.2	–	–	–	–	–	–	–	–	–	–	–
Togo	201	6.0	–	–	–	–	–	11.9	–	60.7	18.4	–	–	–	–	3.0
Uganda	506	62.1	3.4	2.8	29.1	–	–	2.0	–	0.2	–	–	–	0.2	–	0.4
Viet Nam	403	0.2	0.2	0.7	–	–	–	–	96.5	–	–	–	–	–	–	2.2
Zambia	27	–	–	100.0	–	–	–	–	–	–	–	–	–	–	–	–
Zimbabwe	361	–	–	100.0	–	–	–	–	–	–	–	–	–	–	–	–

CRF: circulating recombinant forms; URF: unique recombinant forms; URF and other includes B+F (Cuba, Brazil), B+C (Brazil, Myanmar), B+G (Cuba).

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