TECHNICAL REPORT

HIV DRUG RESISTANCE REPORT 2021

NOVEMBER 2021

HIV DRUG RESISTANCE

© WHO / Blink Media - Gareth Bentley

World Health Organization

TECHNICAL REPORT

HIV DRUG RESISTANCE REPORT 2021

NOVEMBER 2021

HIV DRUG RESISTANCE

World Health Organization

HIV drug resistance report 2021

ISBN 978-92-4-003860-8 (electronic version)
ISBN 978-92-4-003861-5 (print version)

Suggested citation. HIV drug resistance report 2021. Geneva: World Health Organization; 2021. Licence: CC BY-NC-SA 3.0 IGO.

Cataloguing-in-Publication (CIP) data. CIP data are available at http://apps.who.int/iris.

Design and layout by ACW

CONTENTS

ACKNOWLEDGEMENTS

This technical report is the result of collaboration between the WHO Department of Global HIV, Hepatitis and STI Programmes and contributing member states.

Amalia Giron, Seth Inzaule, Neil Parkin and Michael Jordan (WHO consultants) analyzed and interpreted the data and wrote the report. The development of the document was led by the WHO Department of Global HIV, Hepatitis and STI Programmes, coordinated by **Silvia Bertagnolio** (before July 2021) and by **Marco Vitoria** (after July 2021) under the leadership of **Meg Doherty**.

Contributors included: **Martina Penazzato** (Global HIV, Hepatitis and STI Programmes) provided technical input and guidance. **Urvi Parikh** and **John Mellors** (University of Pittsburgh School of Medicine) wrote the section on HIV drug resistance among populations receiving pre-exposure prophylaxis for preventing HIV. **Paul Weiss** (WHO consultant) developed the aggregate analysis plan and developed code for the statistical pool analysis. **Kathleen Krupinski** (WHO consultant) developed the maps.

HIV drug resistance survey data were provided by participating national ministries of health with the support of WHO regional and country offices. The WHO HIVResNet Laboratory Network was essential in producing high-quality drug resistance surveillance data.

The following members of the WHO HIVResNet steering group performed external review: **Solange Baptiste, Mohamed Chakroun, John Mellors, Irene Mukui, Andrew Phillips and Jonathan Schapiro.** The following WHO regional advisors supported survey implementation: S**andra Jones, Linh Le, Fausta Mosha, Giovanni Ravasi, B.B. Rewari,** and **Omar Sued**.

ACRONYMS AND ABBREVIATIONS

3TC	lamivudine
ABC	abacavir
ART	antiretroviral therapy
ARV	antiretroviral drug
ATV/r	atazanavir/ritonavir
BIC	bictegravir
CAB	cabotegravir
CI	confidence interval
DBS	dried blood spots
DPV	dapivirine
DRV/r	darunavir/ritonavir
DTG	dolutegravir
EFV	efavirenz
FTC	emtricitabine
INSTI	integrase strand-transfer inhibitor
NNRTI	non-nucleoside reverse-transcriptase inhibitor
NRTI	nucleoside reverse-transcriptase inhibitor
NVP	nevirapine

PEPFAR	United States President's Emergency Plan for AIDS Relief
PI/r	ritonavir-boosted protease inhibitor
PrEP	pre-exposure prophylaxis
TDF	tenofovir disoproxil fumarate
TLD	TDF in combination with 3TC and DTG as a fixed-dose combination
TLE	TDF in combination with 3TC and EFV as a fixed-dose combination
ZDV	zidovudine

DEFINITIONS

- **ARV drug–naive** applies to people with no history of ARV drug exposure.
- **HIV drug resistance** is caused by one or more changes (mutations) in the genetic structure of HIV that affect the ability of a specific drug or combination of drugs to block replication of HIV. All current ARV drugs, including newer classes, are at risk of becoming partly or fully inactive because of the emergence of drug-resistant virus. For the purpose of this report, HIV drug resistance was assessed using the Stanford HIVdb algorithm version 9.0, with virus predicted to have low-, intermediate- or high-level resistance categorized as resistant (penalty score ≥15). The following are the three main categories of HIV drug resistance.

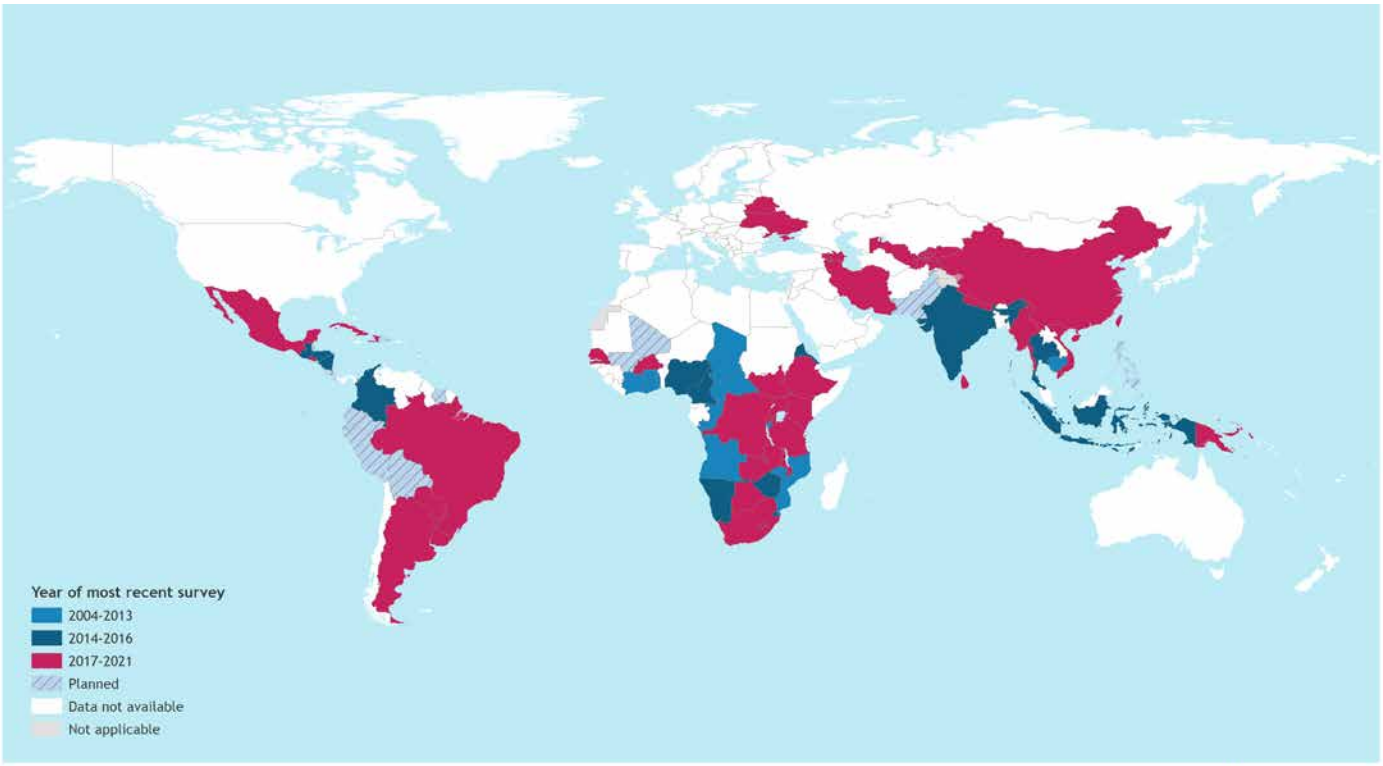
    1. **Acquired HIV drug resistance** develops when HIV mutations emerge because of viral replication among individuals receiving ARV drugs.
    2. **Transmitted HIV drug resistance** occurs when individuals are infected with HIV that has drug resistance mutations.
    3. **Pretreatment HIV drug resistance** refers to drug-resistant virus detected in ARV drug–naive individuals initiating ART or individuals with previous ARV drug exposure initiating or reinitiating first-line ART. Thus, for the purpose of this report, pretreatment HIV drug resistance is either transmitted or acquired resistance or both. Resistant virus may have been transmitted at the time of infection (transmitted HIV drug resistance) or may be selected (acquired HIV drug resistance) through previous ARV drug exposure (such as among women who received ARV drugs for the prevention of 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).

- **NNRTI-based ART regimens** are defined as regimens containing efavirenz or nevirapine for the purpose of this report.
- **PI-based ART regimens** are defined as regimens containing ritonavir-boosted atazanavir, ritonavir-boosted darunavir or ritonavir-boosted lopinavir for the purpose of this report.

EXECUTIVE SUMMARY

Antiretroviral therapy (ART) has been scaled up: at the end of 2020, 27.5 million people were receiving ART globally. However, HIV drug resistance can compromise the effectiveness of antiretroviral (ARV) drugs in reducing HIV incidence and HIV-associated morbidity and mortality. To minimize the emergence and transmission of drug-resistant HIV, WHO recommends that ART and pre-exposure prophylaxis (PrEP) programmes be accompanied by measures to monitor the quality of ART and PrEP delivery and the routine surveillance of HIV drug resistance. Between 2004 and 2021, 66 countries implemented surveys of HIV drug resistance using WHO-recommended methods (**Map 1**). As of late 2021, 34 countries plan to conduct HIV drug resistance surveys during 2022–2024.

MAP 1. Implementation of national HIV drug resistance surveys, 2004–2021



The designations employed and the presentation of the material in this publication do not imply the expression of any opinion whatsoever on the part of WHO concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted and dashed lines on maps represent approximate border lines for which there may not yet be full agreement.

Data Source: World Health Organization
Map Production: WHO GIS Centre for Health, DNA/DDI
Map Creation Date: **12 October 2021**

World Health Organization