GLOBAL REPORT ON ANTIMALARIAL DRUG EFFICACY AND DRUG RESISTANCE: 2000–2010

World Health Organization

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For more information, please contact:
Dr Pascal Ringwald
Drug Resistance and Containment Unit
Global Malaria Programme
World Health Organization
20 avenue Appia
1211 Geneva 27
Switzerland
Tel.: +41 22 791 3469
Fax: +41 22 791 4878
E-mail: ringwaldp@who.int

Abbreviations

ACT	artemisinin-based combination therapy
ARC3	artemisinin resistance project: pilot studies to confirm, characterize and plan for containment
DNA	deoxyribonucleic acid
HIV	human immunodeficiency virus
IC_{50}, IC_{90}, IC_{99}	50%, 90%, 99% inhibitory concentration
PCR	polymerase chain reaction
PfATPase6	gene encoding *P. falciparum* sarco-endoplasmic reticulum calcium ATPase 6
Pfcrt	gene encoding *P. falciparum* chloroquine resistance transporter
Pfdhfr	gene encoding *P. falciparum* dihydrofolate reductase
Pfdhps	gene encoding *P. falciparum* dihydropteroate synthase
Pfmdr1	gene encoding *P. falciparum* multidrug resistance 1 protein
Pfnhe-1	gene encoding *P. falciparum* Na^+/H^+ exchanger
Pfubp-1	gene encoding *P. falciparum* deubiquitinating enzyme
Pvdhfr	gene encoding *P. vivax* dihydrofolate reductase
Pvdhps	gene encoding *P. vivax* dihydropteroate synthase
Pvmdr1	gene encoding *P. vivax* multidrug resistance 1 protein
USA	United States of America
WHO	World Health Organization

Executive summary

BACKGROUND

Plasmodium resistance to antimalarial medicines is one of the major obstacles in the fight against malaria. Comprehensive, up-to-date understanding of the scope of antimalarial resistance is essential for protecting the recent advances in malaria control. Without regular monitoring and reporting of antimalarial drug resistance, the disease burden and the economic costs of malaria will rise dramatically. In addition, ineffective treatment resulting from drug resistance might lead more patients to rely on the unregulated private sector, increasing the risk of reliance on monotherapy, substandard and counterfeit medicines and subsequently leading to the emergence or further spread of drug resistance.

Measurement of drug resistance in malaria is complex. The tools that are used to monitor drug efficacy and evaluate drug resistance are described in this report. Studies of clinical and parasitological outcomes are the main sources of information on which national malaria control programmes base treatment policy; however, other studies are needed to confirm drug resistance. The aim of in vitro studies is to measure the intrinsic sensitivity of parasites to antimalarial drugs; molecular markers are used to identify genetic mutations related to antimalarial drug resistance in the parasite genome; and pharmacokinetic studies characterize antimalarial drug absorption, distribution, metabolism and elimination in the body. While each method makes a contribution to a more complete understanding of antimalarial drug resistance, therapeutic efficacy studies remain the gold standard for guiding drug policy. This report is therefore based primarily on the results of therapeutic efficacy studies.

WHO GLOBAL DATABASE ON ANTIMALARIAL DRUG EFFICACY

The results of therapeutic efficacy studies conducted within national malaria control programmes and in research institutes in which antimalarial treatment efficacy was diligently monitored, were systematically collected and analysed for the WHO global database on antimalarial drug efficacy. As of June 2010, the database contained the clinical and parasitological outcomes of 3932 studies conducted between 1996 and June 2010 on *P. falciparum* malaria; however, only those studies conducted during the past 10 years and which met the inclusion criteria were included in this report. The analysis was thus based on 1120 studies representing 91 848 patients. The results are presented for monotherapy and for combination therapy, by