Supplementary data:

Table 1: Search strategy

No.	Searches	Results		
		Embase	**Medline**	**International Pharmaceutical Abstract**
1	Counterfeit*	477	296	301
2	Fake	631	491	22
3	Substandard	1017	874	78
4	Falsified	211	182	10
5	**1 or 2 or 3 or 4**	2230	1765	375
6	Drug*	2942573	1240863	248285
7	Medicine*	517065	379325	23766
8	Pharmaceutical*	62754	74697	47666
9	Antimicrobial*	61758	48954	7876
10	Antimalaria*	16651	14579	3147
11	Antibiotic*	311391	146476	24572
12	**6 or 7 or 8 or 9 or 10 or 11**	3520198	1708464	302874
13	**5 and 12**	833	522	346

Table 2: Categories of different issues of tested medicines

Stated problem	**Description**
Content assay of active ingredient: Inadequate active ingredient excessive active ingredient No active Ingredient	Quantification of the active ingredient content of a drug with regard to claim content declared on the packaging; the result should be within the specified range.
Wrong active ingredient	Detection of active ingredient in the drug that is not declared on the packaging
Dissolution failure	Solubility or release of active ingredients is not within the specified time range.
Presence of impurity	Coexistence of a substance with a drug, such as starting material, intermediates or that is formed as a result of any side reactions.
Fake packaging	Packaging has mislabelling information about a drug origin or authenticity
Mass uniformity test failure	The weight of a tablet or capsule is not within the average range specified
Unknown ingredient	Extraneous contaminants that should not present in a drug

Table 3: Studies excluded after applying quality assessment criteria

No.	Studies	Methodological strength scoring (0-12)
1	Stenson B, et al. The quality of drugs in private pharmacies in the Lao People's Democratic Republic. *Int J Risk Saf Med* 1998;**11**(4):243-9.	5
2	Atemnkeng MA, et al. Quality control of active ingredients in artemisinin-derivative antimalarials within Kenya and DR Congo.*Trop Med Int Health* 2007;**12**(1):68-74	5
3	Ogwal-Okeng J, et al. Quality of oral and parenteral chloroquine in Kampala. *East Afr Med J* 1998;**75**(12):692-4	5
4	Ofori-Kwakye K, et al. Quality of Artesunate Tablets Sold in Pharmacies in Kumasi, Ghana. *Trop J Pharm Res* 2008;**7**(4):1179-84	5
5	Minzi OMS, et al. Evaluation of the quality of amodiaquine and sulphadoxine/pyrimethamine tablets sold by private wholesale pharmacies in Dar Es Salaam Tanzania. *J Clin Pharm Ther* 2003;**28**(2):117-22	5
6	Tipke M, et al. Substandard anti-malarial drugs in Burkina Faso. *Malar J* 2008;**7**(1):95	5
7	Newton PN, et al. A Collaborative Epidemiological Investigation into the Criminal Fake Artesunate Trade in South East Asia. *PLoS Med* 2008;**5**(2):e32	5
8	Newton P, et al. Fake artesunate in southeast Asia. *Lancet* 2001;**357**(9272):1948-50	5
9	Laserson K, et al. Substandard tuberculosis drugs on the global market and their simple detection. *Int J Tuberc Lung Dis* 2001;**5**(5):448-54	5
10	ReMeD. La Qualite´ des me´dicaments sur le marche´ pharmaceutique africain: e´tude analytique dans trois pays: Cameroun, Madgascar, Tchad. Action Programme on Essential Drugs. In: WHO, ed. Geneva, 1995.	5
11	Baratta F, et al. Diffusion of counterfeit drugs in developing countries and stability of galenics stored for months under different conditions of temperature and relative humidity. *Croat Med J* 2012;**53**(2):173-84	5
12	Seear M, et al. The need for better data about counterfeit drugs in developing countries: a proposed standard research methodology tested in Chennai, India. *J Clin Pharm Ther* 2011;**36**(4):488-95	5
13	Amin AA, et al. The quality of sulphadoxine-pyrimethamine and amodiaquine products in the Kenyan retail sector. *J Clin Pharm Ther* 2005;**30**(6):559-65	4
14	Odunfa O, et al. Pharmaceutical Equivalence of Some Commercial Samples of Artesunate and Amodiaquine Tablets Sold in Southwestern Nigeria. *Trop J Pharm Res* 2009;**8**(6):491-99	4
15	Kyriacos S, et al. Quality of amoxicillin formulations in some Arab countries. *J Clin Pharm Ther* 2008;**33**(4):375-79	4
16	Pribluda V, et al. Implementation of basic quality control tests for malaria medicines in Amazon Basin countries: results for the 2005-2010 period. *Malar J* 2012;**11**(1):202	4
17	Obodozie OO, et al. A comparative study on the prevalence of substandard ampicillin/cloxacillin preparations in the	3

	Nigerian market: Mid 1990's and present. Journal of Phytomedicine and Therapeutics 2006;**11**(2006):1-8	
18	Prazuck T, et al. Quality Control of Antibiotics Before the Implementation of an STD Program in Northern Myanmar. *Sex Transm Dis* 2002;**29**(11):624-627.	3
19	Bate R, et al. Antimalarial drug quality in the most severely malarious parts of Africa - a six country study. *PLoS One* 2008;**3**:e2132	3
20	Atemnkeng MA, et al. Quality evaluation of chloroquine, quinine, sulfadoxine–pyrimethamine and proguanil formulations sold on the market in East Congo DR. *J Clin Pharm Ther* 2007;**32**(2):123-132.	3
21	Obaid A. Quality of ceftriaxone in Pakistan: reality and resonance. *Pak J Pharm Sci* 2009;**22**(2):220-9.	3
22	Abdo-Rabbo A, et al. The quality of antimalarials available in Yemen. *Malar J* 2005;**4**(1):28.	3
23	Roy J. The menace of substandard drugs. World Health Forum 1994;**15**:406-407.	2
24	Bate R, et al. Pilot Study of Essential Drug Quality in Two Major Cities in India. *PLoS One* 2009;**4**(6):e6003.	2
25	Iwuagwu MA, et al. In vitro assessment of ampicillin capsules marketed in Nigeria. International Journal of Pharmacy Practice 1992;**1**(3):167-171.	2
26	Abdullah M, et al. Report: in vitro dissolution studies of different brands of sustained release diclofenac sodium matrix tablet available in Bangladesh. *Pak J Pharm Sci* 2008;**21**(1):70-77.	1
27	Zaheer M, et al. In vitro Analysis and Data Comparison of Market Brands of Ciprofloxacin, Ofloxacin and Levofloxacin. *Pak J Sci Ind Res* 2009;**52**(4):186-190.	1
28	Alfadl A, et al. quality of antimalarial drugs in sudan: results of post-marketing surveillance. *Sudanese Journal of Public Health* 2006;**1**(2):108-111.	1
29	Kibwage IO, et al. Drug quality control work in Daru: observations during 1983-1986. *East Afr Med J* 1992;**69**(10):577-80.	1

Table 4: The prevalence of counterfeit/substandard medicines.

Country [Reference]	Drugs (n=number of various products tested)	Setting	Formulation studied	Labeled Origin	Method of testing/location*	Stated problems	% (substandard or counterfeit)	Methodological strength scoring (0-12)
The prevalence of counterfeit and substandard medicines in low-income countries in Asia and Africa.								
Lao PDR (17)	Ampicillin, tetracycline, Chloroquine and aspirin (n=300)	Private outlets	Tablets and capsules	Laos, Thailand, France and unknown origin.	HPLC, colorimetric test , ultraviolet spectrophotometry, thin-layer chromatography and mass uniformity analysis / National Food and Drug Quality Control Centre	No active Ingredient, Inadequate/ excessive active ingredient and mass uniformity failure	22% (Substandard / Counterfeit)	10
Tanzania (16)	Antimalarial drugs (sulfadoxine-pyrimethamine, sulfamethoxypyrazine-pyrimethamine, amodiaquine, quinine, artemisinin derivative (n=304)	Public and private outlets	Tablets	Local and imported	HPLC and dissolution test with US pharmacopeia standards/ Ifakara Health Research and Development Centre, Tanzania	Dissolution failure, Inadequate active ingredient.	12.2% (Substandard / Counterfeit)	9
Cambodia (15)	Antimalarial drugs (Quinine, artesunate, mefloquine, chloroquine and tetracycline) (n=451)	Public ,private and informal outlets	Tablets	16 countries	HPLC, disintegration test, thin-layer chromatography and packaging analysis/ National Laboratory for Drug Quality Control (NLDQC) in Cambodia	Failed in dissolution or inadequate active ingredient. ,no active ingredient, wrong active ingredient	27% (50/451 substandard and 72/451 counterfeit)	6
Uganda (18)	Chloroquine (n=92)	Private and informal outlets	Tablets, injection	Not stated	HPLC/ Makerere University laboratory	Inadequate/ excessive active ingredient	44.5 % (Substandard / Counterfeit)	6

The prevalence of counterfeit and substandard medicines in low-middle-income countries in Asia and Africa								
Indonesia (20)	Amoxicillin, chloramphenicol, ciprofloxacin, cotrimoxazole, tetracycline. (n=104)	Public ,private and informal outlets	Tablets, capsules	Indonesia	HPLC/ Farmalyse BV laboratories (certified laboratory registered in the European Union as a pharmaceutical control laboratory for chemical physical analyses)	Inadequate active ingredient	18% (Substandard / counterfeit)	8
Nigeria (19)	Artesunate, dihydroartemisinin, sulphadoxine-pyrimethamine, quinine and chloroquine (n=225)	Public ,private and informal outlets	Tablets	Not stated	HPLC and dissolution test, US pharmacopeia standards were used/ London School of Hygiene and Tropical Medicine laboratory	No active ingredient, wrong active ingredient, inadequate active ingredient.	37% (Substandard / Counterfeit)	7
Nigeria(22)	Antimalarial drugs, antibacterials, antituberculosis, antihelmitics and antifungals (n = 581)	Private outlet	Tablets, capsules, suspension and injection.	12 countries (Europe, Asia and Africa)	HPLC and dissolution test, British Pharmacopeia standards were used/ The Robert Gordon University School of Pharmacy laboratories	Inadequate/ excessive active ingredient, no active ingredient	48% (Substandard/ Counterfeit)	6
Cameroon (21)	Antimalarial drugs (Antifolates, quinine, chloroquine) (n=284)	Informal outlets	Tablets, capsules	Not stated	Thin-layer chromatography and Colorimetric test/ Unité de Recherche Paludologie Afro-tropicale, Institut de Recherche pour le Développement	No active ingredient, inadequate active ingredient, wrong ingredient, unknown ingredient	39.4% (Substandard/ Counterfeit)	6
The prevalence of counterfeit and substandard medicines in the mixed group								
Myanmar, Cambodia, Vietnam, Lao PDR, Thailand. (28)	Artesunate and mefloquine (n=232)	Public ,private and informal outlets	Tablets	China	HPLC, colorimetric testing (fast red dye) and packaging analysis/ Not stated	Fake packaging, no active ingredient	44% (4 /232 substandard and 99/232 counterfeit)	7

Cameroon, Ghana, Kenya, Nigeria, Tanzania (26)	Antimalarial drugs (sulphadoxine-pyrimethamine, sulfamethoxypyrazine-pyrimethamine, artemisinin-based combination) (n=267)	Public ,private and informal outlets	Tablets	Local and imported (India, USA, Bangladesh, China, Mauritius, Vietnam and the UK)	Compendial quality testing according to US pharmacopeia standards/ WHO collaborating laboratory in South Africa	Inadequate/ excessive active ingredient, no active ingredient, mass uniformity, impurity and dissolution test failure	28.5% (Substandard/ Counterfeit)	7
Uganda, Madagascar, Senegal (27)	Antimalarial drugs (Artemisinin-based combination, sulphadoxine-pyrimethamine) (n=188)	Public ,private and informal outlets	Tablets	Not stated	Compendial quality testing according to US pharmacopeia standards/ National Medicine Control Laboratory and laboratories at USP Headquarters	Dissolution failure, Impurity, Failure in the assay of active ingredient., mass uniformity test failure	32% (Substandard/ Counterfeit)	7
Gabon, Ghana, Kenya, Mali, Mozambique, Sudan, Zimbabwe (24)	Antimalarial drugs (chloroquine and sulphadoxine-pyrimethamine) (n = 278)	Public ,private and informal outlets	Tablets, syrup	Local and Imported	HPLC, drug-specific c Assays and dissolution Test/ WHO collaborating laboratory in South Africa	inadequate active ingredient	23% Substandard/ Counterfeit	6
Myanmar (Burma) and Vietnam (23)	Amoxicillin,ampicillin, metronidazole, paracetamol, salbutamol, tetracycline, chloroquine , chloramphenicol rifampicin and diazepam co-trimoxazole and ranitidine (n=500)	Public ,private and informal outlets	Tablets and capsules	More than 20 countries (Asia, Canada, Europe, USA and Australia)	Compendial quality testing according to British pharmacopeia standards/ WHO collaborating laboratory in Thailand	Inadequate/ excessive active ingredient, wrong active ingredient	11% (Substandard/ counterfeit)	6
Nigeria and Thailand (25)	Chloroquine, amoxicillin, ampiclox cotrimoxazole, tetracycline, (n = 96)	Private and informal outlets	Tablets, capsules, suspension and injection.	Not stated	HPLC / Not stated	Inadequate/ excessive active ingredient	36.5% (Substandard/ counterfeit)	6

Armenia, Azerbaijan, Belarus, Kazakhstan, Ukraine, and Uzbekistan (29)	anti-tuberculosis medicines (n = 291)	Public and private outlets	Tablets, capsules, injections	12 countries	HPLC, dissolution and mass uniformity test, US pharmacopeia standards were used/ Four WHO collaborating laboratories in Austria, Germany, Belgium and France	Content, mass uniformity, dissolution and related substances tests failures.	11.3% (Substandard/ counterfeit)	6

HPLC: High-performance liquid chromatography; **USP**: United state pharmacopeia; **location***: Location where is the analysis carried out.