A bitter pill to swallow: the problem of, and solutions to, Sub-Saharan Africa's counterfeit pharmaceutical trade

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Counterfeit pharmaceuticals pose a considerable threat to human health and well-being worldwide. Despite appearing indistinguishable from the genuine drugs that they imitate, fake drugs often have little therapeutic value, can seriously exacerbate the illness of patients by giving them a false sense of security and can sometimes even adversely affect the user's health. Their sub-therapeutic nature also contributes to the increasing problem of drug resistance, especially to chronic infectious diseases such as malaria, tuberculosis and HIV.

In spite of its global nature, the counterfeit pharmaceutical trade does not affect all parts of the world equally. The World Health Organization estimates that fake drugs account for up to 50% of drug sales in Sub-Saharan Africa but only 1% in the developed world1. This literature review will discuss the social, economic and legal reasons for the region's vulnerability to the counterfeit pharmaceutical trade.

This review concludes that the actual scale of the problem in Sub-Saharan Africa is inadequately evidenced. Methodologically poor research, commonly cited "estimates" with no empirical evidence, illegal activity and media sensationalism help conceal the true prevalence of fake drugs. However, a compilation of the most accurate data available suggests that counterfeit drugs account for a third of the pharmaceutical trade in the region.

Despite the repercussions of this trade for human health, the international and national policies necessary to tackle counterfeits in most of Sub-Saharan Africa have often been inadequate or nonexistent. In contrast, the Nigerian government has effectively tackled counterfeiting over the past decade by implementing multifaceted policies that have helped reduce the prevalence of counterfeit drugs by 80% between 2001 and 2006. This positive case study can potentially act as a model for improvement in other Sub-Saharan African countries.

Introduction

The huge threat posed by counterfeit medicines to global public health has become increasingly apparent over the last decade. Counterfeit medicines were first acknowledged as an international problem at the World Health Organization's (WHO) conference on 'The Rational Use of Drugs' in Nairobi in 1985.[1] However, it took until 2006 for the WHO to officially condemn the practice, by producing the Declaration of Rome. The Declaration of Rome was the first acknowledgement that tackling the issue of counterfeit drugs requires "effective coordination and cooperation at the international level for regional and national strategies to be more effective."[2]

Although counterfeit pharmaceuticals represent a truly globalized problem, the prevalence of fake drugs in different countries varies widely: counterfeit drugs account for up to half of drug sales in the poorest countries in Sub-Saharan Africa (SSA), but only about 1% in the developed world. In general, almost all types of drugs have been counterfeited, but different types are counterfeited in different regions of the world.[3] In the developed world, counterfeiters tend to focus on expensive life-style medications such as anti-allergic agents and Viagra.[3] However, in the developing world, where there is a huge burden of infectious disease, counterfeiters target life-saving drugs for deadly conditions like malaria, human immune deficiency virus (HIV) and tuberculosis (TB).[4] Thus, counterfeit medicines also play a role in magnifying global health inequalities.

The Scale of the Problem

Difficulties in estimating prevalence:

Due to the underground nature of the counterfeit drug business, it is difficult to get a valid figure for the global scale of the trade. The International Medical Products Anti-Counterfeiting Taskforce (IMPACT) asks how one can "measure a market, that, by its nature is illegal."[5] Therefore, all estimates have to be treated with caution. This data vacuum has caused published estimates of counterfeits to vary from one to 50% of all global pharmaceuticals.[6] Media speculation on the subject is frequently sensationalized. A commonly cited statistic originating from a Chinese state newspaper claims that "192,000 people die every year in China as a result of counterfeit drugs," but this has since been proven to be a mistranslation.[7] The actual statement was that "192,000 people die of irrational drug use every year in China", which includes deaths by inappropriate prescriptions and poor pharmaceutical compliance. Therefore, the figure cannot be used interchangeably with counterfeit pharmaceuticals. Even the data cited by

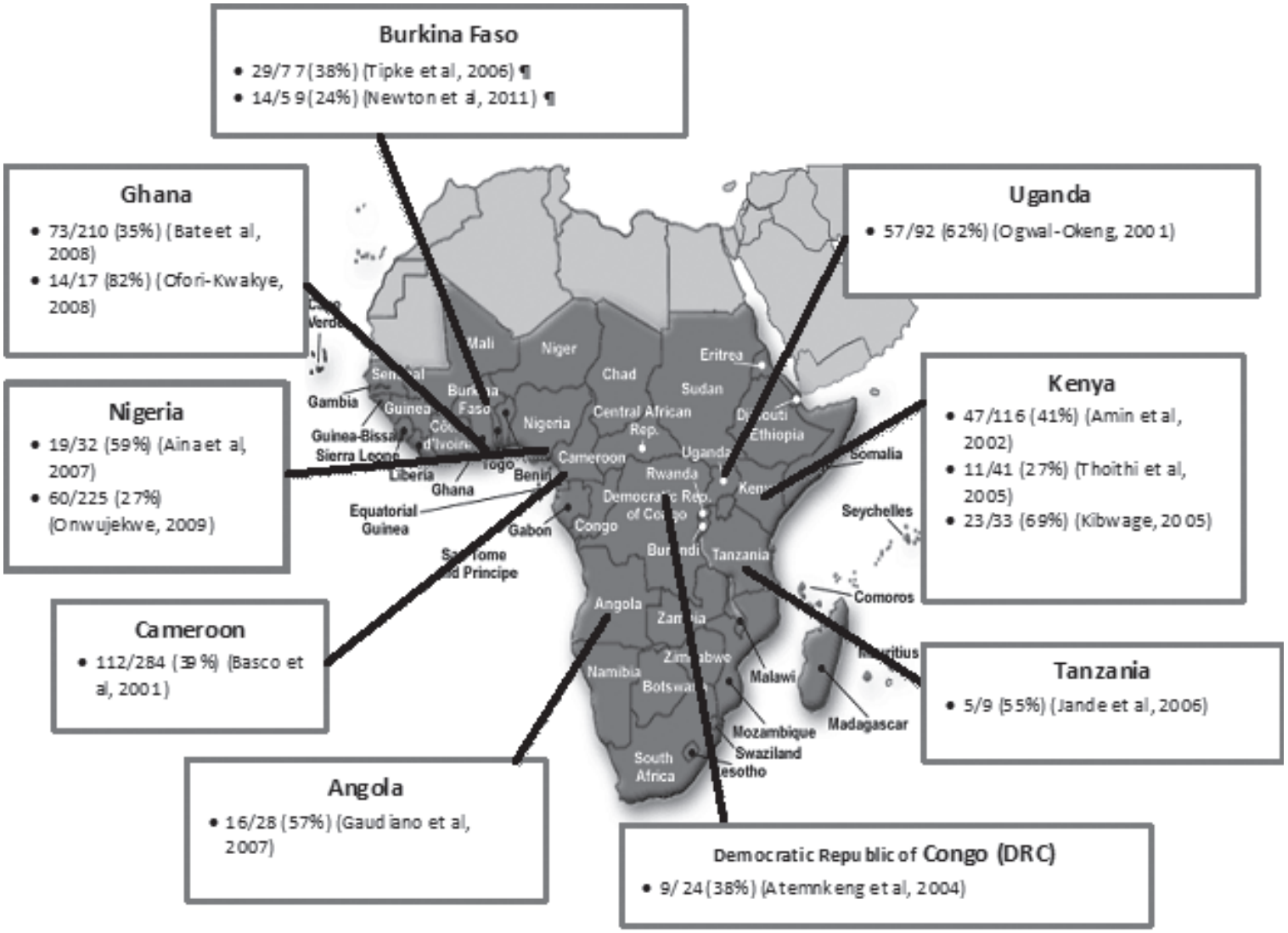

Figure 1 Comparison of 14 studies of counterfeit anti-malarials in the region of SSA between 1999-2011:
(Number of sub therapeutic anti-malarials/number of sampled anti-malarials) Collation of 14 studies measuring the prevalence of poor-quality anti-malarials in SSA by chemical analysis.
¶ = Also used packaging analysis (Appendix 1)

trusted international agencies are based on little more than informed guesswork: the WHO estimates that 10% of the world drug trade is counterfeit and IMPACT put the figure between 10 and 30%, but neither of these figures is based on published scientific research.[8]

In addition to problems with the reliability of the available research, there are also claims that important data about counterfeit drugs are being kept secret.[4] The WHO does not mandate countries to keep records or report incidences of drug counterfeiting. Thus, nearly all prevalence records in the public domain come from those detected by private pharmaceutical companies. It has been argued that a large amount of data regarding false drugs is being withheld from the public,[9] as fake drugs damage the brand image of pharmaceutical companies.[10] This issue was highlighted by a spokesperson for the Association of the British Pharmaceutical Industry (ABPI) who said that it is a challenge to declare a counterfeit drug problem without "damaging legitimate business."[9]

Estimating the global market of counterfeits

The worldwide exposure to counterfeit drugs can be estimated by referring to drug seizures. The Pharmaceutical Security Institute (PSI), a network of the security divisions of 25 major pharmaceutical companies, claims that it has made counterfeit drug seizures at customs checkpoints in 123 different countries: according to them, no region of the world is exempt from the trade.[11] The increasingly globalized nature of the pharmaceutical market, the proliferation of free trade agreements worldwide and the spread of internet pharmacies have all but left very few areas affected by counterfeit medication.

Estimating the prevalence in SSA

While the richest countries offer the most lucrative market for counterfeiters, they also have the most advanced techniques for combatting them.[12] In contrast, the poorest third of WHO member states have either no means or very limited means of controlling counterfeit medicines.[13] Many of these countries are found in the Sub-Saharan region of Africa, which is home to the 15 poorest countries in the world according to the Human Development Index (HDI).[14] The WHO estimates that 30% of all medicines in Sub-Saharan Africa (SSA) as opposed to 1% in the developed world may be counterfeit, suggesting a link between impoverished regions and their inability to restrict counterfeit medicines.[12]

Unfortunately, the Sub-Saharan region of Africa offers minimal or no national reporting on seizures of counterfeit drugs.[15] Published data seems to underestimate the prevalence of falsified drugs in SSA. To provide a more accurate picture of the counterfeit drug problem in SSA, 14 small-scale domestic studies looking at the prevalence of fake anti-malarials in the region were analyzed (Figure 1). Over 90% of worldwide malaria deaths occur in Africa, creating a huge market for criminals to produce counterfeit anti-malarials in the region.[16] In addition, in 2006, the WHO changed their official guidelines for treating malaria to Artemisinin Combination Therapy (ACT), which although more efficacious than chloroquine, costs between five and 23 times as much to manufacture.[17] As a result, this market has become particularly lucrative for counterfeiters. Nayyar's survey published in the Lancet found that 35% of 2297 anti-malarials sampled from across SSA were

of sub-therapeutic quality.[18]

This comparison study (Figure 1) found that 489 out of 1247 (39.2%) of anti-malarials in nine Sub-Saharan countries failed chemical analyses, reaffirming Nayyar's previous estimate of 35%.[18] Although there is a huge problem of poor-quality anti-malarials in SSA, they are not all necessarily counterfeits. According to the WHO's definition of counterfeit drugs, both chemical and packaging analyses are needed to label drugs as counterfeit. Only the two studies in Burkina Faso used both analyses and could therefore confidently predict that the failures in the sample were falsified. Together these two studies showed that 32% of the sampled pharmaceuticals were counterfeit, highlighting that a large proportion of the anti-malarials, which failed chemical analyses in the other seven countries, could indeed be counterfeit.[19, 20]

The best estimation of the burden of counterfeit drugs in SSA would be from a large, multi-country study using systematic random samples from a representative sample of drug sellers.[21] There are few such studies because they are logistically complicated and expensive, so collations of small-scale prevalence studies are the best current approximation of the scale of the problem.[21]

Factors encouraging pharmaceutical counterfeiting

High prices, low overheads:

Pharmaceuticals represent a financially attractive field for counterfeiters. They are high-priced in relation to their bulk and have an infinite capacity for demand.[1] According to the WHO, over 70% of counterfeit drugs contain insufficient or no active pharmaceutical ingredients (API), so ingredient costs are minimal,[1] and some of the more rudimentary fake pills contain just flour or chalk.[22] Production does not require large infrastructure and the necessary technology is readily accessible to many counterfeiters who use only crude facilities to produce drugs: many are made in small cottages or backyards.[1] Unlike legitimate pharmaceutical producers, counterfeiters do not have to go through quality assurance procedures, meet Good Manufacturing Practices (GMP) standards or have an outlay on future research and development, all of which result in lower overhead costs.[1]

High drug prices are the predominant barrier to patients accessing legitimate medicines in the developing world. Because criminals can make fake drugs so cheaply, they are able to sell them at marked-down prices. Noam Chomsky, one of America's most prominent political commentators, argued that counterfeiting is simply a reaction to the extortionate prices imposed by the pharmaceutical industry.[15] Pharmaceutical companies assert that they are not responsible for the high prices.[15] In fact, the existence of import tariffs has been identified as a major reason why good-quality, legitimate drugs cannot compete with fake ones on price. In an effort to expand their economies, many governments in low-income countries impose tariffs on good-quality, imported drugs, and as a result drive up the costs for the overseas pharmaceutical companies, preventing them in some cases from entering the market at all.[5] In contrast, the WHO found that 72% of economically developed nations did not impose import tariffs on pharmaceuticals, which helps to prevent counterfeit drugs from entering these markets.[5]

Up to 90% of inhabitants in SSA have to pay for essential medicines,[23] so those seeking treatment choose the cheapest medicines available, a position often filled by counterfeits.[12] In addition, many people are oblivious to the danger of buying the cheapest drugs: a qualitative study in Tanzania reported that 96% of people had never heard that drugs could contain lower than advertised amounts of ingredients.[24] Even consumers who are aware of the correlation between reduced costs and increasingly poor-quality pharmaceuticals may be willing to overlook this correlation if the price is low enough. Whilst investigating the 'Consumer Behaviour Towards Counterfeit Drugs (CBTCD),' pharmaceutical analyst Dr. Abubakr Alfadl invented a scale to empirically quantify CBTCD, which he tested on 100 Sudanese consumers.[25] He concluded that consumers in Sudan may "intentionally buy counterfeits" if they are cheap enough, because they are still believed to have some therapeutic qualities.[25] Policy makers have traditionally focused on improving regulation on the supply side of counterfeit drugs, but this study highlights the need to focus on increasing public awareness of the health risks about counterfeit drugs to reduce their demand.

Lack of regulation

Pharmaceutical manufacturing and supply systems are particularly susceptible to corruption as they consist of many different stages and suppliers. Manufacturers, importers, wholesalers, prescribers and pharmacists are all part of the pharmaceutical supply chain, and each needs regulation and transparency to ensure that counterfeits cannot enter at their level.[26] To improve pharmaceutical regulation, the WHO stated in its 1999 'Guidelines for the Development of Measures to Combat Counterfeit Drugs' that it was paramount for every country to establish a National Medicine Regulatory Authority (NMRA) to be "accountable for the overall effectiveness of medicine regulation".[27] The core roles of an NMRA include controlling pharmaceutical registration and post-production surveillance as well as governing the licensing and inspection of manufacturers, distributors and sellers of drugs.

Despite many countries in SSA having NMRAs, the WHO estimates that many of them are not operating effectively enough to prevent counterfeits from infiltrating the market. Currently, of the 191 WHO member states, only 20% are known to have well-developed drug regulatory bodies, all of which are in the most economically developed nations.[28] A study published by the WHO in 2010 collated assessments of the effectiveness of NMRAs in 26 Sub-Saharan countries in identifying the problems in pharmaceutical regulation; they found that there was a common lack of sustainable funding and a shortage of qualified staff in all 26 NMRAs.[18] More specifically, 81% of the NMRAs had either inadequate or no quality-monitoring programs in place to detect counterfeit and substandard medicines.[27] Even if poor-quality batches of medicine were detected, only 12% of the NMRAs were able to perform an effective pharmaceutical recall.[27] This lack of official traceability explains how drug counterfeiters often escape with no punishment even when seizures are made.[4]

The WHO also recommends that all NMRAs should run specific anti-counterfeiting inspection programs with chemical and packaging analyses to differentiate falsified medicines from substandard ones.[27] However, only five of 26 (19%) of the NMRAs in the study (Zambia, Botswana, Senegal, Cameroon, Djibouti) had implemented these programs and none of them were comprehensive enough to meet the WHO's guidelines.[27]

Corruption

Just as the complex, multi-layer structure of the worldwide pharmaceutical system makes it difficult to regulate, this structure also provides many openings for exploitation. According to a senior economist at the World Bank, corruption within the healthcare systems of developing nations is widespread and opens the door for the bribery of customs officials.[12] One unnamed NMRA within SSA was found guilty of taking bribes to allow the passage of falsified drugs into pharmacies by charging wholesalers $65 a month to allow their illegal business to continue.[6]

The often-unstable economic and political environments in SSA have not only created an opening for corrupt pharmaceutical sellers, but also have offered a means of supplementing the meager incomes of individuals working in the pharmaceutical sector.[26] A study in Uganda found that 68-77% of pharmaceutical workers had stolen and resold publicly procured drugs at least once and that 80% would be open to the possibility of taking bribes from drug distributors.[26] The unlawful nature of corruption means that empirical evidence rarely exists to prove its presence. However, anecdotal evidence and assumptions from informally published literature suggest that the practice is widespread.[1] Corruption is also present in developed nations, but with more transparent reporting systems, the threat of severe punishments and higher incomes for health professionals the problem is vastly reduced.[5]

Problems with jurisdiction

Unlike many other counterfeit products, medicines are almost always destroyed upon ingestion; Wertheimer describes this as the "perfect crime" because the victim eradicates any evidence of wrongdoing.[4] Even on the rare occasions when authorities are able to catch criminals involved in this industry, they tend to receive lighter penalties than those involved in other illegal trades, attracting criminals previously involved in narco-trafficking to drug-counterfeiting.[12] As the head of corporate security for the multinational pharmaceutical company, Novartis, puts it: "if you get caught with a pound of cocaine, you can expect to do serious time. But if you are found with counterfeit medicines, you might only do six months".[12] The WHO echoed this perspective when they stated that "weak penal sanctions" for counterfeiters was a major factor in the proliferation of spurious drugs.[1]

Figure 1 Comparison of 14 studies of anti-malarial quality in SSA

Author (Publication date)	Country	Year(s) sample collected	Drugs sampled	Method of testing	Sampling technique	Packaging analysis
Tipke et al (2008)[19]	Burkina Faso	2006	Artesunate, Quinine, Pyrimethamine	Disintegration analysis, colorimetry, TLC	Convenience	Yes
Newton et al (2011)[20]	Burkina Faso	2002-2010	Artesunate, Dihydroartemisinin, Halofantrine	HPLC, Mass spectrometry	Convenience	Yes
Ogwal-Okeng (2003)[38]	Uganda	2001	Chloroquine	HPLC	Convenience	No
Amin et al (2005)[29]	Kenya	2002	Sulfaxdoxine-Pyrimethamine	HPLC, Dissolution tests	Convenience	No
Thoithi et al (2008)[39]	Kenya	2001-2005	Dihydroartemisinin, Quinine, Pyrimethamine	Uniformity of weight, API testing	Convenience	No
Kibwage (2005)[40]	Kenya	Not provided	Sulfadoxine-Pyrimethamine	Dissolution analysis	Convenience	No
Jande et al (2006)[24]	Tanzania	Not provided	Sulfadoxine-Pyrimethamine	Dissolution analysis	Convenience	No
Atemnkeng et al (2007)[41]	DRC	2004	Artesunate, Dihydroartemisinin	HPLC	Convenience	No
Guadiano et al (2007)[42]	Angola	Not provided	Quinine, Chloroquinine, Mefloquine	HPLC, Disintegration analysis	Convenience	No
Basco et al (2004)[43]	Cameroon	2001	Chloroquine, Quinine, Pyrimethmine	Coloriemtry, TLC	Convenience	No
Onwujekwe et al (2009)[44]	Nigeria	Not provided	Artesunate, Chloroquine, Quinine	HPLC, Dissolution analysis	Convenience	No
Aina et al (2007)[45]	Nigeria	Not provided	Chloroquine	Dissolution tests, API testing, Disintegration analysis	Convenience	No
Ofori-Kwakye et al (2008)[46]	Ghana	Not provided	Artesunate	Colorimetry, Disintegration analysis	Convenience	No
Bate et al (2008)	Ghana	Not provided	Artesunate, Dihydroartemisin, Sulfadoxine-Pyrimethamine	TLC, Dissolution analysis	Convenience	No

Attaran argues that the root of the problem stems from the lack of an international legal framework to punish counterfeiters in what is an increasingly globalized trade.[2] As it stands, if a criminal from one country produces and exports falsified drugs to another country, only the exporting country has the jurisdiction to prosecute the counterfeiter because the crime was committed on that country's territory. In contrast, the importing country, whose citizens have been harmed by the drugs, can only prosecute the people who have, sometimes unknowingly, let the drugs enter the domestic supply chain.[2] If caught, which is rare, these middlemen are charged with lesser crimes such as fraud, which will not carry a penalty appropriate for the damage caused.[2]

The inconsistencies in the national penalties for counterfeiting medicine make internationalizing the jurisdiction even more difficult.[18] In some developing nations, where strong judicial and policing systems are not yet in place (e.g. Somalia), counterfeiting pharmaceuticals is not even considered criminal.[5] On the other hand, others have introduced draconian criminal punishments: both China and India have introduced the death penalty for certain offences related to drug counterfeiting, but neither have invoked it.[5] Extradition laws require "dual criminality," in which a person is only extraditable from a country if he or she and the country requesting extradition have comparable penalties for the crime.[2] With such different national penalties for pharmaceutical counterfeiting, criminals often can avoid extradition and hence face the charges.[2]relatively light charges[2]

Impact on Health

The growing disparity in pharmaceutical access between the "Global North" and "Global South" is one of the biggest factors contributing to global health inequalities. Approximately two billion people lack access to essential medicines worldwide with the majority of these living in SSA and South-East Asia.[26] The higher prevalence of counterfeit medicines within these nations only worsens health inequalities. The most common effect of fake drugs on health is prolonged or unsuccessful treatment, but in the case of malaria, where disease progression is rapid, giving sub-therapeutic drugs is said to be "tantamount to murder".[29] Overall, Harris estimates that 700,000 deaths a year from malaria and TB in SSA are attributable to fake drugs.[5]

Counterfeit drugs with low doses of APIs have a greater potential for causing harm than those containing no APIs at all because of the damaging consequences of drug resistance to the entire community.[3] For diseases that are treated with combination therapies (e.g. malaria, TB and HIV), counterfeit medications have contributed to the emergence of resistance in these infectious organisms.[1] The correlation between counterfeit pharmaceuticals and drug resistance has been explored in the most detail with respect to malaria in which drug resistance has hampered attempts to eradicate the disease.[18] Of the twelve most prescribed anti-malarial drugs, there are confirmed reports of eight being counterfeited.[20] Within SSA, Plasmodium falciparum, the most deadly strain of malarial parasites for humans, is now frequently resistant to two previously effective therapies: chloroquine and pyrimethamine.[3] Molecular research has shown that the parasites, resistant to chloroquine and pyrimethamine developed in Africa, result from poor-quality pharmaceuticals produced in South-East Asia.[30] These two drugs are the most affordable treatments for malaria, so resistance to them is particularly threatening for the resource-poor nations of SSA where malaria is endemic and 90% of global malaria mortality occurs.[16]

Bate argues that the problem of TB resistance caused by counterfeit medicines poses an even greater threat than that of malaria but is being comparatively neglected by the public health community.[31] Poorly treated malaria can lead to the death of an infected child within 48 hours of disease onset, so the strains have fewer opportunities to develop resistance from counterfeits.[31] TB is less acutely fatal than malaria, but treatment courses are significantly longer (minimum of 6 months). Therefore, the risk of developing resistance is increased.[32] The reality of this problem has been highlighted in a study of rifampicin samples in 19 African cities, which found that 55.4% of 713 samples contained intermediate doses of the API, an amount insufficient to kill the drug-resistant bacilli that cause resistant strains of TB.[33]

Implications for policy

The WHO is a major stakeholder in the campaign against the counterfeit pharmaceutical trade, because fake drugs breach the patient's right to health, which is enshrined in the WHO's constitu-

tion.[15] In 1999, the agency released 'Guidelines for the Development of Measures to Combat Counterfeit Drugs', which proposed national strategies to tackle the practice.[15] Then in 2006, the 'International Conference on Combating Counterfeit Medicines' produced 'The Declaration of Rome'. This was the first acknowledgement that tackling the issue of counterfeit drugs requires "effective coordination and cooperation at the international level for regional and national strategies to be more effective".[2]

Following the Declaration, the WHO member-states pledged to work together to address the global challenge of pharmaceutical counterfeiting by founding IMPACT.[12] This was the first multi-lateral partnership set up specifically to tackle this increasingly worldwide issue; it included representatives of 193 national governments and their NMRAs, pharmaceutical manufacturers, NGOs and Interpol, the largest global police organization.[12] IMPACT's founding intention was to eradicate counterfeit drugs from all supply chains by 2015.[4] To accomplish this mandate, IMPACT focuses on five specific areas that are in need of international action:[34]

1. Encouraging national governments to establish laws, or strengthen existing legislation, against pharmaceutical counterfeiters.
2. Improving regulation to ensure that suitable agencies (NMRAs) are responsible for monitoring all manufacturers, exporters, distributors and retailers of pharmaceuticals.
3. Working with Interpol to break up counterfeit smuggling networks and track the flow of drugs. IMPACT offers courses to national police services on how to tackle the problem and trains 300 law enforcers specializing in anti-drug counterfeiting every year.
4. Offering education on how technology can be used in specific countries for detecting counterfeit drugs.
5. Raising awareness of the risk of counterfeit pharmaceuticals for both government policy makers and the general public.

The WHO has achieved some successes in harmonizing and coordinating the fight to eradicate counterfeit pharmaceuticals. As well as universally defining counterfeit pharmaceuticals and founding IMPACT, they have also taken innovative steps to improve the reporting of counterfeit pharmaceuticals around the world through the online Rapid-Alert System (RAS), allowing NMRAs to quickly report batches of counterfeit pharmaceuticals.[18] RAS has been piloted successfully in the Western Pacific region where it is said to have improved up to date monitoring of the situation and promoted the swift follow up of reported cases by the police.[28] A worldwide expansion of RAS will help improve coordination of the global response against fake drugs.

However, after examining the prevalence of counterfeit pharmaceuticals currently in worldwide circulation, it is fair to assume that the WHO's goal of eradicating counterfeit drugs by 2015 will not be achieved, even though their representatives still believe it is achievable in the near future.[34] Moreover, the international trade lawyer Amanda Chaves argues that the WHO's current focus on improving national awareness and legislation will not alone be effective in eliminating counterfeit drugs from the supply chain.[35] She claims that a more effective solution would be to enact a multi-lateral treaty to make pharmaceutical counterfeiting an international crime.[35] In legal terms, crimes are escalated to international crimes if they "amount to an offence against the entire international community", and since they increase drug resistance, falsified pharmaceuticals fall under this rubric.[2] Aircraft hijackings and narcotics trafficking have been made international crimes by way of international treaties in recent decades, and Attaran argues that drug counterfeiting confers similar dangers to life.[2] The WHO Constitution of 1948 permits the organization to "propose conventions, regulations and recommendations" on matters of public health, and if a 'supermajority' of two thirds of member states agree, a treaty can be adopted.[2] The WHO has only once exercised its power to make treaties with the 'Framework Convention on Tobacco Control (FCTC)', which included drafting an international law against the illicit trade of tobacco products.[2] This treaty set a public health precedent that the WHO should be able to use in the future to make pharmaceutical counterfeiting an international crime.

International governance is particularly important for stopping counterfeits in SSA because many of the drugs are imported into the continent via bilateral and multi-lateral donors and aid agencies. Many of these philanthropic agents do not ensure that the quality of the drugs they send is reliable.[12] The Global Fund to Fight AIDS, TB and Malaria (GFATM) spends millions of pounds every year to distribute essential drugs to Africa, but only 56% of these drugs come through suppliers approved by the WHO.[12] Although no studies have examined the quality of the medicines brought into SSA by donors, the lack of regulation may lead to them unknowingly bringing counterfeit medicines into the supply chain. It is essential that WHO and IMPACT hold these aid agencies accountable for the sourcing of their drugs.

Despite this being a globalized issue, it is over-simplistic to suggest that there is a standard solution applicable to all countries trying to eradicate the problem. Alongside the work done by the international community, every country has its own role to play in tackling the counterfeit of pharmaceuticals.[36] All nations within SSA have different degrees of dependency on domestic and overseas manufacturing of drugs as well as uniquely different supply chains and distributors, which impact the frequency and dissemination of counterfeit drugs within that country. Therefore, each country has to develop policies based on its own situation, infrastructure and resources.[36].

The experience of Nigeria provides an instructive case study for SSA. Nigeria is commonly cited as a nation that has gained notoriety for saturating the African pharmaceutical market with fake drugs but has recently attempted to regain its reputation in world markets by implementing innovative policies to thwart counterfeiters.

National Case Study: Nigeria

During the latter part of the 20th century, Nigeria had the biggest market of counterfeit pharmaceuticals in the world.[12] In 1987, a nation-wide study of the quality of Nigeria's pharmaceuticals found that 70% of drugs in the country were falsified.[10] The problem was brought to the attention of the worldwide media following the 'paracetamol syrup disaster' of 1989, in which 109 children died in the Jos region of Nigeria after taking counterfeit paracetamol syrup containing the toxic solvent, diethylene glycol.[47] In response, the Nigerian government established 'The National Agency for Food and Drug Administration and Control (NAFDAC)' to combat the spread of fake drugs.[12]

In 1998, the Nigerian government introduced 'Decree No.21', which criminalized the manufacture and sale of counterfeit drugs.[37] However, with inadequate infrastructure and political will, NAFDAC did little to enforce 'Decree No.21'. Officials estimated that, in 2001, counterfeits still accounted for half of the available drugs in Nigeria.[12] It was not until neighboring nations Cameroon and Niger banned imports of Nigeria's drugs because of their poor quality that Nigerian authorities took drastic domestic action.[12] In August 2001, the Nigerian president overhauled the whole management team of NAFDAC and installed Dr. Dora Akunyili as its new director general, with the aim of restructuring the organization to "safeguard the health of the nation".[37] Akunyili's policy changes, combined with increased political will, had the desired effect: fake drug circulation was reported to have dropped by over 80% between 2001 and 2006.[37] Four of NAFDAC's policy changes under Akunyili will now be explored.

Safeguarding imports

The Nigerian pharmaceutical industry has the potential for meeting 75% of the nation's pharmaceutical needs, through its 130 manufacturers.[37] Due to a lack of maintenance and high running costs, only 60 are actively manufacturing domestic drugs, meeting only less than 30% of the country's pharmaceutical needs.[37] Consequently, the majority of the country's medicines had to be imported, with the bulk of these coming from India.[37] The European Commission estimated that Indian exports were responsible for three quarters of the fake drugs in Nigeria.[3] The exporting and importing countries' lax enforcement of their laws at customs' points clearly allowed counterfeit medicines into the supply chain. In 2003, in response to this finding, NAFDAC banned the importation of all drugs apart from those arriving at two ports and two airports so that all measures to check the efficacy of drug imports could be focused in these four areas. In the five years after this policy implementation, Nigerian customs officials destroyed $109 million worth of counterfeit pharmaceuticals.[12] NAFDAC has also be-

gun working more closely with the Indian authorities to prevent the problem at source. India's minister for commerce has said that "Indian pharmaceutical companies are constantly in touch with NAFDAC" and that the Indian government has "institutionalized pre-export inspections" of drugs to Nigeria.[37] On top of this, India has started sending NAFDAC a list of "blacklisted" pharmaceutical companies, to prevent their products from being bought.[37]

Enforcing existing laws

Although 'Decree no. 21' had criminalized the act of making or selling counterfeit pharmaceuticals in Nigeria since 1998, the sentences under this law were lenient.[37] Prior to Akunyili's appointment, the law stipulated that someone convicted under 'Decree no. 21' could not be fined more than 5000 Nigerian Naira ($43), which did little to deter criminals, especially considering the large potential profits to be gained from this illegal trade.[47] In 2002, Akunyili repealed the previous laws on drug counterfeiting and, with the help of the Nigerian government, passed a law that stated that those found guilty of the production or knowing distribution of fake drugs could be fined up to 500,000 Nigerian Naira ($4300) and serve a prison sentence of 5-15 years.[47] Considering that the GDP per capita of Nigeria in 2013 was $2722 the hundred-fold increase in the fine and new prison ruling would seem more likely to discourage counterfeiting.[2] In 2006, NAFDAC secured 45 convictions for drug counterfeiters with another 56 pending trial, which Akunyili claims are more than those charged during the previous decade.[47]

Educating pharmacists:

Drug distribution within Nigeria has been described as "chaotic", with patent medicine stores, community pharmacies, wholesalers and public and private hospitals making up the recognized pharmaceutical vendors.[47] Pharmacists have an integral role in protecting the supply chain from counterfeit drugs because of their presumed expertise in drugs, and they are the last point of contact before the patients in the supply chain. However, before 2001 the only academic requirement for community pharmacists (who sell nearly 50% of Nigeria's pharmaceuticals) was a secondary school leaving-certificate, which did not equip them to spot the fake drugs within their stock.[36] Therefore in 2004, NAFDAC increased the length of training for community pharmacists with a specific focus on identifying fake drugs using visual aids including the size and shape of tablets and the quality of the printing and holograms on the packaging.[37] This is the quickest and cheapest way to detect counterfeits and, if implemented successfully, can reduce the need for expensive chemical analysis by chromatography and spectroscopy.[6] A descriptive study by Odili found that after the policy changes, 100% of community pharmacists in Lagos state undertook a visual examination (including checking embossments, printing and holograms) of new drugs bought from distributors.[48]

Technology

NAFDAC has also used innovative technology to stay one step ahead of counterfeit drug manufacturers. The earliest defense against counterfeits used trademarked branding and distinctive pill designs, but counterfeit manufacturers have quickly adapted their technology to replicate these techniques.[5] Even the use of highly complex holograms can now be copied with such detail that it may be impossible to detect counterfeits with the naked eye, thus making instrumental analysis essential.[4]

In 2007, The Global Pharma Health Fund (a German public-private partnership) invented a mobile device, called the "minilab", to identify counterfeit drugs.[12] The "minilab" uses two visual analyses, visual inspections and a disintegration test, as well as two chemical analyses, colorimetry and chromatography; it has a reported accuracy of 99% in detecting counterfeits.[19] The "minilab" has reagents that are stable in hot temperatures and can be run without electricity, so is particularly valuable in the equatorial climates of SSA.[19] In 2011, NAFDAC purchased 100 "minilabs", costing $6000 each, and distributed them to customs officials, enabling them to analyze drugs entering the country without the need to send them to the NAFDAC laboratory in Lagos.[37]

Limitations

There are several limitations to this paper. The first is that because of the clandestine nature of pharmaceutical counterfeiting, the available research is restricted. Many of the victims of drug counterfeiting never know that they have been exposed and so estimates of the scale of the problem tend to be "shrouded in ignorance and confusion".[6] There is also a dearth of official documents that analyze the prevalence of fake drugs around the world, since only 5-15% of the 191 WHO member-states report cases of pharmaceutical counterfeiting; the remainder is concealed.[6] Secondly, the accumulation of small-scale prevalence studies in SSA (Figure 1) were all compiled using different methodologies, so they are not directly comparable. Only two of these studies used packaging analyses, so substandard drugs could be misclassified as counterfeit drugs. Nevertheless, the comparison study was a valuable tool to highlight the fact that the problem of counterfeit pharmaceuticals is not limited to one or two countries, but represents a problem that is endemic throughout SSA.

Conclusion

This paper has highlighted how the counterfeit pharmaceutical trade is a truly globalized public health problem: fake drugs have a detrimental impact on the health of those who take them, cause a loss of faith in healthcare systems and put the whole population at risk through increased drug resistance. Counterfeit pharmaceuticals widen health inequalities between the richest and poorest nations in the world.

Although the adverse health implications of fake drugs are well documented, the exact scale of the problem in SSA is yet to be established. Due to the discrepancies in national definitions for counterfeit pharmaceuticals, misclassification of substandard drugs and a reliance on the results of studies with poor methodological quality, the figures cited for the global and regional prevalence of counterfeit pharmaceuticals need to be treated with caution. Despite this uncertainty, this paper's collation of small-scale prevalence studies, Nayyar's systematic review and the WHO's cited figure all demonstrate similar rates for counterfeit pharmaceuticals in SSA (39.2%, 35% and 30% respectively). The globalization of the pharmaceutical market, high prices for genuine drugs, a lack of pharmaceutical regulation, chaotic distribution chains, inadequate jurisdiction against counterfeiters and per-

vasive corruption all contribute to the high prevalence of fake drugs in SSA.

There is no simple solution to the problem of counterfeit medicines, as policies have to be implemented at both the national and international levels. Governments within SSA should be encouraged to undertake drug regulatory reforms similar to those in Nigeria, which have reduced the national prevalence of counterfeit drugs by 80% over a five-year period.[37] Nigeria has been at the forefront of establishing policies to eradicate counterfeit pharmaceuticals by improving surveillance at entry points for imports, forging partnerships with exporting countries to reduce counterfeits at its source, increasing the punishments for convicted counterfeiters and reducing corruption within NAFDAC.[47] However, domestic solutions alone cannot solve this transnational problem. Partnerships between importing and exporting countries need to be formed to tackle the problem at all levels of the supply chain. International governance organizations also have a central role to play in eradicating counterfeit pharmaceuticals. The WHO has been successful in harmonizing and coordinating the global community through their definition of counterfeit medicines and the formation of IMPACT. However, because their mandate in public health does not extend to law enforcement, the problem of transnational jurisdiction continues to be a barrier to bringing the criminals involved to justice. The WHO has a duty to use the precedent that it set with the creation of the FCTC to draft and enable a multilateral treaty, which can make pharmaceutical counterfeiting an international crime.

In conclusion, I would like to quote Dr Dora Akunyili, who has waged a successful campaign against fake drugs in Nigeria. In an interview with WHO, she said that having even 1% of drugs counterfeits is "unacceptable, because every life is important".[47]

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