



## Falsified Antimicrobial Medicine: A Neglected Global Health Crisis Contributing to Drug Resistance

Opinion Editorial

Erin Slade, BSc. Biology, MSc. Global Health

### Introduction

Falsified antimicrobial medicine is a neglected and growing threat to global health. Such medicines may misrepresent the identity, composition or source of the medication, and may contain too little, too much, or entirely the wrong active ingredients. It is a lucrative, multi-billion dollar criminal industry on par with human and illicit drug trafficking that robs the poorest populations of lifesaving medication. It disproportionately affects low and middle-income countries (LMICs) in Africa and Southeast Asia struggling to control the influx of false medicine from India or China amid limited drug regulation capacity and high consumer demand.<sup>1</sup> This poses significant risks to health, and flies in the face of health targets set by the Sustainable Development Goals (SDGs), especially the HIV, TB, and malaria epidemics.<sup>2</sup> Together these three diseases are a massive global burden and victim to the type of medications most often falsified. This article will first describe the global burden of falsified medicines before exploring the connection to antimicrobial resistance (AMR), health consequences, and will conclude by recommending a greater presence of falsified medicines among AMR policies and practice.

### Global Burden

In a globalized world, the supply chain to purchase, manufacture, regulate, distribute, and sell falsified antimicrobial medicine is convoluted. It becomes much easier to insert and hide false medicine amidst the chaos, costing the global economy US\$75 billion each year, a 90% increase since 2005.<sup>3</sup> Falsified drugs are often detected in illegitimate street pharmacies or bought online, but even legitimate sources are not safe. Because of the complicated supply chain, hospitals, clinics and registered pharmacies have falsified medicine infiltration often unbeknownst to the service providers and patients.<sup>1,4</sup> The types of medicines most often falsified are antimicrobial drugs, especially those used to treat HIV, TB and malaria.<sup>5</sup> These medicines are in high demand, can be relatively expensive or inaccessible, used

chronically, and may be associated with stigma – all factors good for business.

The global burden of falsified medicine has been estimated by the World Health Organization (WHO) to be 10% of medicine on the global market, and 30% across LMICs (Figure 1).<sup>6</sup> However, the reality is often much higher than the WHO average as falsified medicines are notoriously under-reported. For example, increased surveillance in Nigeria has detected a high prevalence of false anti-malarials where over 60% of medicine failed quality testing.<sup>8,9</sup> Another report estimates that one in six TB medications are falsified in LMIC hotspots,<sup>10</sup> and one in five for falsified HIV medications in Tanzania.<sup>5</sup> Alarming, both older monotherapies and newer combination therapies have been compromised.



Figure 1. Global burden of falsified medicines<sup>7</sup>

### The Link

It is well known that taking antimicrobial medicine inconsistently or prematurely ending a prescribed treatment regimen contributes to the development of antimicrobial resistance (AMR).<sup>3,11</sup> Falsified medicine has essentially the same effect, where the majority of these medicines contains sub-therapeutic doses and/or incorrect mixtures of the active pharmaceutical ingredient.<sup>5</sup> The mechanism leading to drug resistant pathogens involves a 'mutant selection window' – a range where the active ingredient is high enough to kill susceptible pathogens, but not high enough to eliminate mutant pathogens.<sup>12</sup> If the mutation



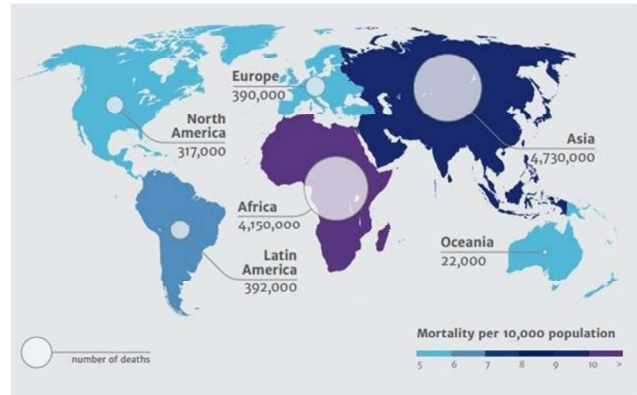
confers resistance, the remaining microbes have a reproductive advantage against susceptible microbes, and so they will multiply more rapidly and accumulate. This scenario would be considered an acquired infection, but resistant pathogens can also be transmitted from person-to-person by air or bodily fluids.

The risk of developing resistance is heightened for drugs that are long-lasting and slow to eliminate from the host because mutant microbes are under selection pressure longer and without competition; such is the case for TB medication. Regarding combination therapies, falsified first-line drugs leave the co-ingredient unprotected so both medications may develop resistance. Thus, lower and inconsistent doses of medicine drive selection favoring mutant, drug-resistant microbes.

### Consequences

The consequences of falsified antimicrobial medicine are profound. It goes without saying that patients face significant disability, morbidity, and mortality when their disease is left untreated. For example, conservative mathematical modelling estimates that falsified anti-malarials contribute to 72,000-267,000 deaths annually, or about 2-5% of total malaria deaths.<sup>6</sup> Because false drugs escape quality control, poisoning and drug toxicity can cause adverse reactions and dangerous side-effects.<sup>5</sup> They can also lead to misdiagnosis.<sup>5,6</sup> For example, a patient who is not responding to treatment may cause a health professional to shift away from the correct diagnosis and treatment regimen. This leads to further inadequate treatment, progression of disease, and an opportunity for infection transmission.

Beyond these consequences, the link between falsified antimicrobial medicine and AMR is clear.<sup>3,5,6</sup> Antimicrobial resistance is quite possibly the greatest health threat of our time – the loss of effective medicine would erase decades of improvements to public health causing the death of millions. Going under the surgical knife would become a dicey game of chance, chronic infections would increase, treatment regimens would be more costly and toxic, and many patients would go without treatment waiting to slowly die. Globally, it is estimated that by 2050 AMR will amount to US\$100 trillion loss from global GDP and an additional 10 million deaths per year (Figure 2).<sup>13</sup>



**Figure 2.** Estimated deaths per year due to antimicrobial resistance by 2050<sup>13</sup>

### Call for Integration

In order to reach the health-related SDGs by 2030 and stem the tide of AMR, it is important that falsified medicine is acknowledged as part of the problem and integrated as part of the solution to combat AMR. Currently, the literature on falsified drugs has ample discussion about AMR, but even the most prestigious and comprehensive AMR reports neglect to mention the impacts of drug quality, let alone falsified medicine.<sup>11,13</sup> This double-standard in policy and practice should be re-examined and brought to light; doing so may elicit a fuller understanding of the drivers behind AMR and provide an important piece of the puzzle towards an effective solution. The WHO and World Bank could lead development of an inclusive strategy for other nations to model. In particular, regular drug quality testing needs to occur alongside routine drug susceptibility testing so that misdiagnosis is limited while simultaneously improving surveillance and awareness.

### Conclusion

Falsified antimicrobial medicine is a global crisis – a neglected link between successful treatment, therapeutic failure, and growing AMR among malaria, TB and HIV patients in LMICs. So far, the dire consequences to health, solid connection to drug resistance, and gross economical costs associated with falsified medicine has not been enough to make it a priority on the global agenda. If unaddressed, this is a lost opportunity by the AMR community to add to their arsenal in the fight against resistance.

### REFERENCES

1. United Nations Office on Drugs and Crime. The globalization of crime: a transnational organized



- crime threat assessment. Vienna, Austria: UNODC; 2010. 303 p. Available from: [https://www.unodc.org/documents/data-and-analysis/tocta/TOCTA\\_Report\\_2010\\_low\\_res.pdf](https://www.unodc.org/documents/data-and-analysis/tocta/TOCTA_Report_2010_low_res.pdf)
- United Nations. Transforming our world: the 2030 agenda for sustainable development. New York City, New York: UN; 2015. 41 p. Available from: <https://sustainabledevelopment.un.org/post2015/transformingourworld/publication>
  - Elder D, Kuentz M, Holm R. Antibiotic resistance: the need for a global strategy. *J Pharm Sci* [internet]. 2016 [cited 2019 Jan 09]; 105(2016): 2278-2287. Available from: <https://www.ncbi.nlm.nih.gov/pubmed/27397433> DOI: 10.1016/j.xphs.2016.06.002
  - Mackey T, Liang B, York P, Kubic T. Counterfeit drug penetration into global legitimate medicine supply chains: a global assessment. *Am J Trop Med Hyg* [internet]. 2015 [cited 2019 Jan 09]; 92(6): 59-67. Available from: <https://www.ncbi.nlm.nih.gov/pubmed/25897059> DOI: 10.4269/ajtmh.14-0389
  - Kelesidis T, Falagas M. Substandard/counterfeit antimicrobial drugs. *Clin Microbiol Rev* [internet]. 2015 [cited 2019 Jan 09]; 28(2): 443-464. Available from: <https://cmr.asm.org/content/28/2/443> DOI: 10.1128/CMR.00072-14
  - World Health Organization. Study on the public health and socioeconomic impact of substandard and falsified medical products. Geneva, Switzerland: WHO; 2017. 67 p. Available from: <http://www.who.int/medicines/regulation/ssffc/publications/se-study-sf/en/>
  - Akinyandenu O. Counterfeit drugs in Nigeria: a threat to public health. *Afr J Pharm Pharmaco* [internet]. 2013 [cited 2019 Jan 09]; 7(36): 2571-2576. Available from: DOI: 10.5897/AJPP12.343
  - World Health Organization. Survey of the quality of selected antimalarial medicines circulating in six countries of Sub-Saharan Africa. Geneva, Switzerland: WHO; 2011. 114 p. Available from: [https://extranet.who.int/prequal/sites/default/files/documents/WHO\\_QAMSA\\_report\\_1.pdf](https://extranet.who.int/prequal/sites/default/files/documents/WHO_QAMSA_report_1.pdf)
  - Bate R, Jensen R., Hess K, Mooney L, Milligan J. Substandard and falsified anti-tuberculosis drugs: a preliminary field analysis. *Int J Tuberc Lung Dis* [internet]. 2013 [cited 2019 Jan 09]; 17(3): 308-311. Available from: <https://www.ncbi.nlm.nih.gov/pubmed/23321423> DOI: 10.5588/ijtld.12.0355
  - World Health Organization. Antimicrobial resistance: global report on surveillance. Geneva, Switzerland: WHO; 2014. 232 p. Available from: [http://apps.who.int/iris/bitstream/handle/10665/112642/9789241564748\\_eng.pdf?sequence=1](http://apps.who.int/iris/bitstream/handle/10665/112642/9789241564748_eng.pdf?sequence=1)
  - O'Neil J. Tackling drug-resistant infections globally: final report and recommendations. London, UK: Government of the United Kingdom; 2016. 80 p. Available from: [https://amr-review.org/sites/default/files/160525\\_Final%20paper\\_with%20cover.pdf](https://amr-review.org/sites/default/files/160525_Final%20paper_with%20cover.pdf)



## Privatization to Preserve Canadian Public Healthcare

### Opinion Editorial

Alexander Babony, Bachelor of Arts and Social Sciences, English and Political Science at University of Windsor

#### Introduction

The debate over the benefits of public vs. private healthcare services in Canada is stifled by passion, ignorance, and an obscure concept of national identity. While most Canadians agree there should be some form of taxpayer-funded health insurance, disagreements arise over what extent the government should be involved in providing this. The prospect of further privatizing healthcare is something few politicians have had the courage to address. Ontario Premier Doug Ford was recently forced to comment on leaked documents which, according to the opposition New

Democratic Party, suggested that his administration was scheming to implement some degree of increased privatization in Ontario.<sup>1</sup> The public backlash to the alleged plan was swift and harsh. Directly contrary to popular opinion, this article will make the case for Canadians to embrace a new dynamic which allows for a private healthcare industry while preserving the public system that many in our country currently rely on. It will address the merits of this rationale from a values-based and economic perspective in an attempt to convince readers on both sides of the political spectrum.