Estimating the quantity of substandard and falsified medical products purchased online

PÉTER VAJDA[1], ESZTER ÁBRAHÁM[1], ZSOLT BODROGI[1], TÍMEA DERGEZ[2], ANDRÁS FITLER[1], RÓBERT GYÖRGY VIDA[1], LAJOS BOTZ[1]

[1]*University of Pécs, Department of Pharmaceutics and Central Clinical Pharmacy, Pécs, Hungary H-7624 Honvéd u. 3. Pécs, Hungary*
[2]*University of Pécs, Institute of Bioanalysis, Pécs, Hungary H-7624 Honvéd u. 1. Pécs, Hungary*

Corresponding author: Péter Vajda
Email: vajda.peter@gytk.pte.hu

Received: *24 November 2022* / ***Revised:*** *25 January 2023* ***Accepted:*** *26 January 2023*

Background: The increasing distribution of Substandard and Falsified Medical Products is a well-known health risk. The quantity of these medicines sent to consumers is not known, and it can only be accurately estimated with a specific sample collection study. These consignments ordered via mail from illegal online sources pose a great health risk on the population.

Methods: We used an observation-based cross-sectional study in order to obtain accurate data regarding the number of medicinal shipments from dubious origin. We collected data on-site to assess the number of Substandard and Falsified Medical Products arrived in Hungary via postal services in 2020.

Results: The therapeutic category (according to the Anatomical Therapeutic Chemical Classification (ATC) system of the WHO) of the most frequently shipped products contained active ingredients for treating erectile dysfunction. These substances were sildenafil (G04BE03), tadalafil (G04BE08), and other analgesics and antipyretics, such as anilides (N02BE). In 2020 we estimated that the real Defined Daily Dose of SFMP was 1.2 DDD per 1000 inhabitants per day. This value is equivalent to one third of Hungary's opioid analgesic use. We also calculated that the average exposure was approximately 4 ampoules per day and 40 oral preparations per day (without DDD value) for 1000 people in Hungary.

Conclusions: This study accurately estimates the number of consignments received by post containing Substandard and Falsified Medical Products, and determines the quantity per 1000 persons per day expressed in DDD. This parameter may be used as a benchmark that helps more detailed research in the future.

Keywords: substandard and falsified medical products, illegal internet sale, risk assessment, tracking method, postal items, customs border

Introduction

It is well known that the marketing of counterfeit and illegal medicines, or disguised medicinal products that mimic authorized medical or health products is a grave public health threat with various economic and legal consequences [1]. No data are available on the trade of these medicines through distribution channels other than the legal pharmaceutical supply route. Thus the proportion of the population exposed to these Substandard and Falsified Medical Products (SFMP) apart from the legal route is unknown.

In this thesis, we use the generic term Substandard and Falsified Medical Products, SFMP for short, to refer to all substandard, unregistered, unlicensed and falsified products. The term is also described by the WHO in details. These are illegal products which appear to be medicines, are not a copy of a legally marketed medicine, but rather a range of dangerous products marketed as a 'homemade drug product' for a particular indication and are manufactured under dubious conditions from raw materials of uncertain origin [2-4].

In the last decade many incidents of permanent health damages, fatalities, confiscated drugs, smuggled goods, shutdowns of illegal websites were published in the international press [5, 6, 7-12]. In 2018 Rahman et al. analyzed 48 reports in which counterfeit drugs caused serious adverse effects to patients. They reported 7,200 incidents of which 3,604 were fatal [6].

The latest "EU Progress Report on Infringements" (2020) estimates the European pharmaceutical industry suffered a loss of €9.6 billion due to counterfeiting between 2012 and 2016. This represents 3.9% of the total pharmaceutical sales [6,13].

According to a study by the World Health Organization (WHO) in 2017 the global SFMP industry is worth €73 billion per year. Other sources es-

DOI: 10.33892/aph.2023.93.1-8

timate that these activities could be worth €165 billion per year or 10% of the global pharmaceutical trade (€17.3 billion) [5, 14-19]. The WHO data derives from the national and regional authorities around the globe, and based on reports from police raids and confiscations. The quality of these data is largely dependent upon the monitoring, regulatory and enforcement systems in place in those countries or regions [5,15].

This information generally originates from organized police raids in the EU, and in the USA. These raids are successfully coordinated by the International Criminal Police Organization (INTERPOL) in cooperation with the national authorities of many countries. It is important to note these are planned raids on a specific area and not random inspections [1, 7-9]. Petersen et al. noted that the simplest and cheapest way to estimate the amount of SFMP is to collaborate with local authorities in a country [10]. During our research, we have kept this principle in mind when establishing contact with the National Tax and Customs Administration.

The Figure 1 shows how the routes of consignments differ between illegal and legal drug provisions.

The NTCA works on the basis of a well-established, experience developed, internal criteria. Based on the knowledge and experience gained from package opening and the focus on specific externalities, the Authority continuously develops and periodically re-evaluates the inspection criteria, which it incorporates into the fine-tuning and re-tuning of the system. This ensures continuous renewal and adaptation to new challenges, as well as the detection vigilance of the system. The NTCA package inspection process is illustrated in Figure 2.

The legal route is simple and transparent. Its mediating actors are known, and the safety of the patient is ensured. The illegal route is obscure. The products are made from raw materials of dubious origin in factories without official approval. Often the Good Manufacturing Practice (GMP) inspection appear on various websites, in social media and in online advertisements. These attract unwary customers. The vendor sends the product to the buyer by surface mail or by air. During the transport, ideal storage conditions are not met. The products sold as medicine arrive in bulk bags which contain many other postal items. They are inspected by customs officers. Then domestic post office delivers the items to the destination addresses. The best place assessing the consignment containing medicinal product is the location of customs checks prior to delivery to the consignee. This is why we chose to carry out our study in the National Tax and Customs Administration of Hungary (NTCA) at the International Post Exchange Centre of the Hungarian Post on the site of the Airport Directorate. The customer receives the items through the Hungarian Post (HP). The

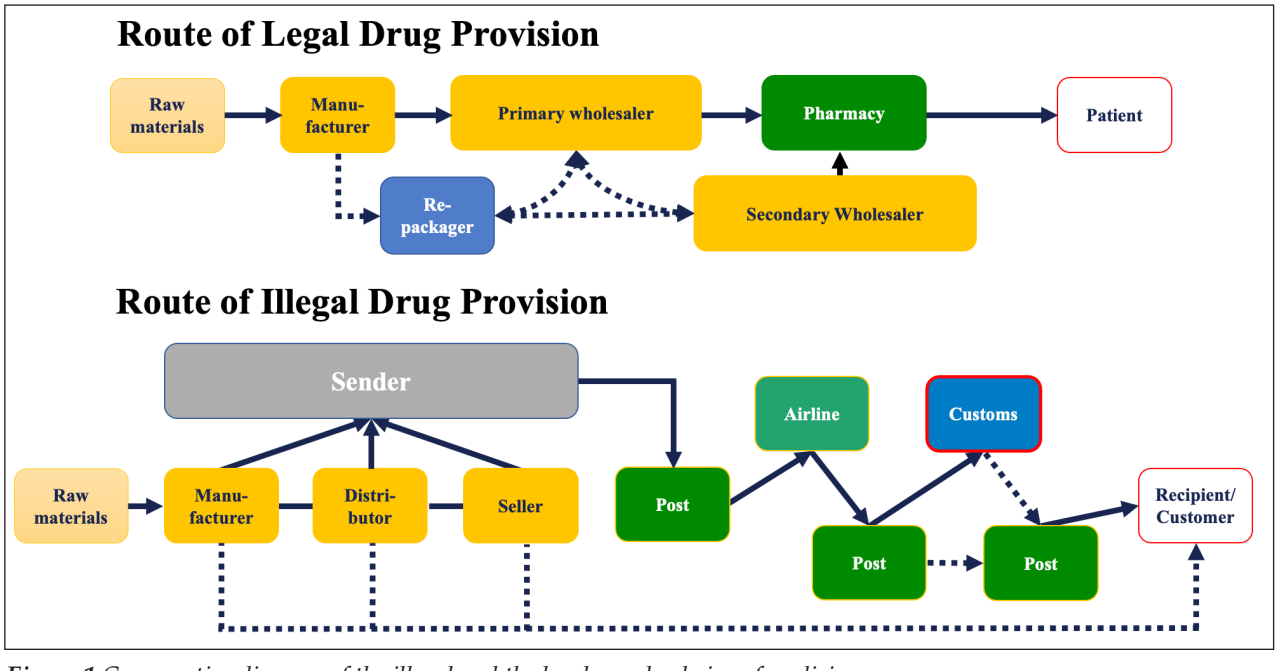

Figure 1 *Comparative diagram of the illegal and the legal supply chains of medicines*

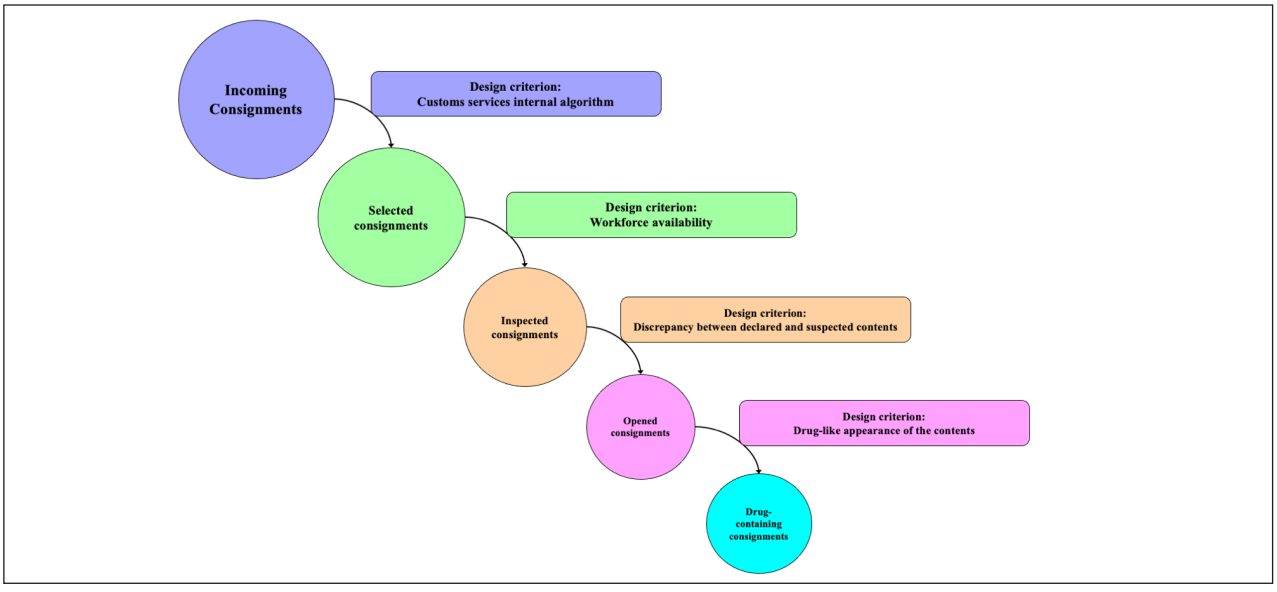

Figure 2 *Shipments filter system of NTCA*

Universal Postal Convention allows items under 2kg to be sent by the sender to the consignee as a conventional letter item [21, 22]. In contrast, courier and parcel delivery companies do not provide such favorable conditions to illegal drug distributors. This was not always the case. The legal cases successfully won against FEDEX in the USA "deterred and put courier companies on track" [23]. The legal case lasted nine years, and eventually FEDEX was fined for €674 million. Today the only remaining option for these illegal traders is to send counterfeit medicines via conventional postal services. Post offices are still not obliged to collect the contact details of the senders or the recipients.

Aims

The aim of this study is to develop a novel method in order to obtain accurate estimate of the Substandard and Falsified Medical Products (SFMP) sent from online stores. Furthermore, we would like to quantify the real proportion of dubious medicines and health products which enter the country via the postal and customs services of Hungary in 2020.

Methods

In our study use the term Substandard and Falsified Medical Products as used by the WHO, as this encompasses the problem we encountered in our research.

In our study we use the combination of three specified terms (substandard, unregistered, unlicensed, falsified) and illegal drug products collectively as "Substandard and Falsified Medical Products or SFMP" [4].

Our method is an observation-based cross-sectional study [24]. We examined the occurrence and characteristics of mail orders which were processed by postal services in 2020. We collected volume and characteristics data of consignments which potentially contained SFMP.

We used non-destructive (organoleptic) identification of SFMP received in the form of letters. We followed the recommendations of the WHO and the National Board Against Counterfeiting in Hungary. These guidelines ensured the reliable identification of the illicit letters and parcels which contained SFMP [2, 25].

In order to determine the consignments that contained SFMP we obtained additional data from the customs services (NTCA) who examined, identified, and classified the mail products.

In the presence of the customs officers of the NTCA we photo-recorded the consignments which were unpacked by a postal officer of the postal services (HP). If the medicinal products were identifiable we determined the ATC codes of WHO for those active ingredients. This allowed us to calculate the DDD for each drug product.

Our sample collection was carried out in the territory of the Hungarian public authority, the NTCA. As a state body, the NTCA performs its work in compliance with both domestic and inter-

national legislation. The data processing of the customs services (NTCA) is governed by Chapter 5 of Act CXXII of 2010 on the National Tax and Customs Administration (NTCA Act), the Act CXII of 2011 on the Right of Information Self-Determination and Freedom of Information (Info Act) and the General Data Protection Regulation of the European Union. We signed an agreement of understanding with NTCA that our sample collection was conducted according to their regulatory framework. Therefore all members of our research team complied with the relevant pieces of international and domestic legislation. Consequently, we did not receive, record or process any personal information. The customs services (NTCA) provided us only with anonymised statistical data. Due to their anonymous nature, our research team was not able to identify any individuals [26-30].

Results

1. Data collection

Our research group collected the data by closely collaborating with the customs services (NTCA) and the postal services (HP) at the NTCA site of International Post Exchange Centre of HP on two occasions: 22 - 23 of September 2020 and 17 December 2020 (Figure 3).

Figure 3 *Photo of the inspection of pharmaceutical consignments during customs check*

The contents of 101 consignments were photo documented over one day and one and a half days. The inspected consignments contained 205 preparations of which 95.1% were illegal according to the checklist, while 4.9% were legal.

2. Composition of SFMP in the consignments

After recording the active pharmaceutical ingredients or active substances (in the case of non-medical products) in the drug-containing consign-

main active ingredients (n)	carisoprodol	tadalafil	ibuprofen	sildenafil	chloroquine
	800	540	370	202	195
salbutamol	0	7%	0	0	0
hydroxy-chloroquine	0	15%	0	0	0
armodafinil	0	15%	0	31%	0
sildenafil	0	8%	0	0	0
dutasteride	0	8%	0	0	0
metformin	0	7%	0	0	0
metronidazole	0	0	0	14%	0
prednisone	0	0	6%	9%	0
amoxicillin and clavulanic acid	0	0	0	14%	0
chlor-zoxazone	0	0	3%	0	0
diclofenac	0	0	3%	0	0
paracetamol	0	0	3%	0	0
calcium carbonate	0	0	24%	0	0
ciprofloxacin	0	0	1%	0	0
vitamin B complex	0	0	6%	0	0
lopinavir and ritonavir	0	0	0	0	24%
tramadol	33%	0	0	0	0

Figure 4 *The top 5 active and additional ingredients in our September 2020 survey*

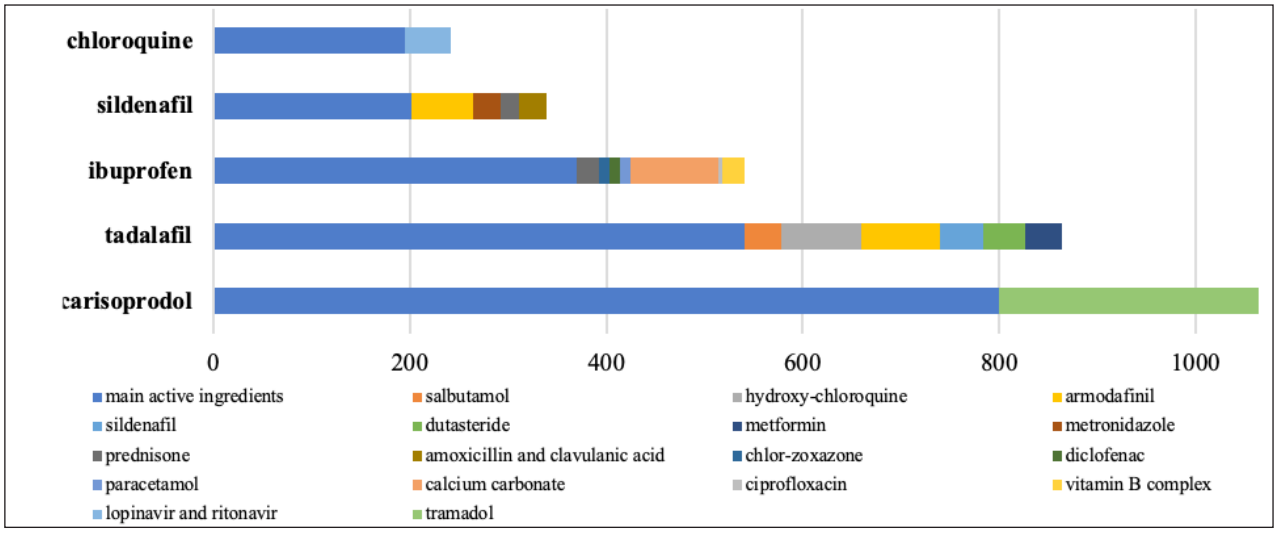

Figure 5 *The top 5 active and additional ingredients in our December 2020 survey*

ments we identified their ATC code and calculated their DDD values, if it was possible.

Our findings demonstrated how dynamically the counterfeit industry responds to the demands of the rapidly changing markets. In the middle of the COVID epidemic in 2020 there were frequent sightings of chloroquine, hydroxychloroquine, lopinavir, ritonavir and ivermectin in the parcels.

We examined not only the active pharmaceutical ingredients, but also the accompanying ingredients. Our finding is shown in Figure 4 and 5.

When two or more formulations appear in one unit in the package some of the ingredients inevitably overlap. The active substance occurring in the highest quantity is considered the primary (main active substance), while the active substance in lower quantity are considered non-primary. A given active substance can be considered primary active substance in one instance, and a non-primary active substance in other instances. It is also possible that some products or active ingredients co-packaged with the primary active ingredients were not ordered by the user, but were sent in the form of a "gift".

3. Definition of sets of consignments

In order to carry out detailed data analysis on the number of consignments which contained illegal medicines we requested historic data from the customs services (NTCA).

These data illustrated the quantity of SFMP arrived in Hungary through the postal system. Based on the data from the customs services (NTCA) 29,058,747 items arrived in Hungary via the postal route in 2020. According to our calculations the total number of pharmaceutical shipments arriving in Hungary by post was approximately 50 SFMP shipments daily or about 20,000 SFMP shipments annually.

4. Counts of consignment sets for the annual and the sample periods

We determined the DDD values for the active ingredients in 101 opened shipments which contained 205 products. We used the total number of items received (eg. tablet, capsule and ampoules) in our calculations. We could not identify ATC codes for 22 products. These products were not included in our calculations.

From our 1 + 1,5 day sample collection at customs services (NTCA) and postal services (HP) 1.2 DDD of SFMP medicines per 1000 inhabitants per day could reach the Hungarian population (Figure 6).

We estimated that the Hungarian population was exposed to 4 ampoules per 1000 person-day and 40 solid dosage form (tablet, capsule) per 1000 person-day of unidentified SFMP without DDD value.

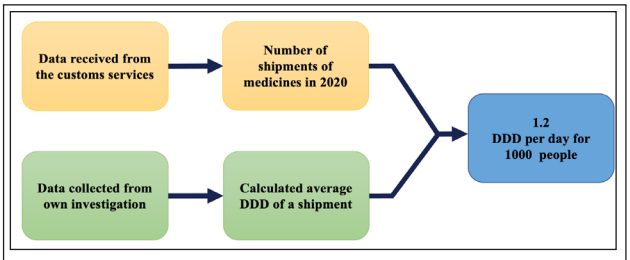

Figure 6 *Description of the calculation process for the estimated daily DDD value of SFMP*

Discussion

According to the WHO any medicinal preparations with false labelling or appearance are considered counterfeit [2, 29, 30]. Non-destructive risk assessments are able to identify the origin or legitimacy of a medicinal product sent in a mail shipment [31].

We designed a rapid, effective and non-destructive risk assessment checklist that determines the legal nature of the medicinal drugs or preparations in a consignment.

We know now that the courier services are subject to stricter regulations than postal services around the world [21-23], therefore we based our studies on data obtained from postal services.

The 0.07% of all incoming mail in 2020 (approximately 20,000 items) may contain SFMP. This is 50 items per day, or 1.2 DDD per 1000 inhabitants per day. This value is equivalent to one third of Hungary's opioid analgesic use (3.984 DDD per 1000 people per day) based on a 2016 study [32]. According to our study, in 2020, at least 1 in 1000 people in Hungary were exposed to SFMP products. This is a serious public health problem that needs to be addressed.

The data on the number of pharmaceutical shipments arriving by post were not available before. Several years of data and samples would be required in order to obtain a more accurate estimate than our research provided. Our data analysis is able to underline the scale and severity of the health damage of the online purchase of SFMP may inflict on the population.

The European Union Intellectual Property Office (EUIPO) identified the top 5 active ingredient categories of counterfeit products:

1. genitourinary products,
2. central nervous system products,
3. anti-infectives,
4. cytostatics
5. cardiovascular products.

In our study we established that the genitourinary and the central nervous system product categories were the most frequent. Active substances involved in the management of the coronavirus infections also frequently occurred as our data collection took place during the COVID epidemic in 2020. Our data shows that some of the active substance categories are persistently in the top 5 in all circumstances [17]. The pieces of information on the origin and shipment of the products are usually not reliable, but the name of the manufacturer on the product itself is a better indicator if it is stated on the items [33, 34].

Conclusions

The illegal online commerce still gives complete anonymity for the distributors. The package usually will not give any information on the sender, only on the country of dispatch, therefore customs officers are not able to locate and prosecute distributors of illegal shipments.

The market for SFMP reacts extremely fast to rising demands. Several consignments contained chloroquine, hydroxychloroquine, lopinavir, ritonavir and ivermectin during the COVID epidemic in 2020. This illustrates the serious health risks to which the buyers of these products expose themselves. The e-commerce of medicinal drugs is a thriving and potentially very dangerous service.

Our work sought to answer two questions:

1. *Will quality of SFMP arrived by post pose a public health problem?*

2. *Can the quantity of SFMP arrived by post estimated?*

Our results show that the SFMP products are not only illegal but also very dangerous to public health. Urgent preventive actions of governments and authorities are required

Our novel investigation in collaboration with customs and postal services has not been carried out neither internationally or domestically. Governments and authorities have not been fully aware how large amount of SFMP products enter the Hungary every year.

The 1 and 1.5 day sampling periods, even if they seem short, were a reasonable 'first approach'. These small sample analyses were projected to precisely counted annual data of incoming parcels. The postal route represents the primary route of entry (96%) of counterfeit and illegal medicines according to the previous reports [2]. The result of our research is a novel calculation of the real volume of these products, based on measured data. We chose the opioid analgesic consumption as a basis of comparison for illustration purposes. Practising pharmacists and doctors can easily relate to this reference value: the quantity of counterfeit and illicit medicines expressed in DDD represents approximately one third of the opioid analgesic group.

Acknowledgments:

We are grateful to the members of the Airport Cus-

toms Directorate of the National Tax and Customs Administration of Hungary for their generous assistance and cooperation in our investigations.

Statement of Conflict of Interests:

All authors declare that they have no conflicts of interest.

Contributorship statement:

PV, AF and LB participated in data collection, LB and PV were involved in planning and in on-site investigations, developed the concept of data analysis and supervised the work, PV, ZsB, and EÁ processed the experimental data, performed the analysis, drafted the manuscript, TD designed the figures. PV, EÁ, ZsB and LB performed the DDD calculations. EÁ, ZsB and RV aided in interpreting the results and drafted the manuscript. PV wrote the manuscript with support from RV and LB. LB approved the final version of the manuscript and supervised the whole project. All authors discussed the results and commented on the manuscript.

Funding:

The project was supported by the Scholarship of Doctoral Student Association of the University of Pécs (László János PhD Research Scholarship). Grant ID: 16/04/2020

References

1. Dominic Peltier-Rivest, Carl Pacini. Detecting counterfeit pharmaceutical drugs: A multi-stakeholder forensic accounting strategy. Journal of Financial Crime, Vol. 26 No. 4, pp. 1027-1047. https://doi.org/10.1108/JFC-06-2018-0057
2. European Union Intellectual Property Office(2020). 2020 status report on IPR infringement. Why IP rights are important, IPR infringement and the fight against counterfeiting and piracy. [Internet] [cited 2020 Dec 07]. Available from: https://euipo.europa.eu/tunnel-web/secure/webdav/guest/document_library/observatory/documents/reports/2020_Status_Report_on_IPR_infringement/2020_Status_Report_on_IPR_infringement_en.pdf
3. LaKeisha Williams, Ellen McKnight. The Real Impact of Counterfeit Medications. [Internet] [cited 2020 Dec 07]. Available from: https://www.uspharmacist.com/article/counterfeit-meds
4. Erwin A Blackstone, Joseph P Fuhr Jr, Steve Pociask. The health and economic effects of counterfeit drugs. Am Health Drug Benefits. 2014 Jun;7(4):216-24.
5. World Health Organization. Growing threat from counterfeit medicines. [Internet] [cited 2020 Dec 07]. Available from: https://www.who.int/bulletin/volumes/88/4/10-020410/en/
6. Victoria Rees. The impact of counterfeit drugs in south and south-east Asia. [Internet] [cited 2020 Dec 07]. Available from: https://www.europeanpharmaceuticalreview.com/article/92194/the-impact-of-counterfeit-drugs-in-south-and-south-east-asia/
7. Petersen A, Held N, Heide L. Surveillance for falsified and substandard medicines in Africa and Asia by local organizations using the low-cost GPHF Minilab. PLOS ONE 12(9): e0184165. https://doi.org/10.1371/journal.pone.0184165
8. Europol. Rise of fake 'corona cures' revealed in global counterfeit medicine operation. [Internet] [cited 2020 Dec 07]. Available from: https://www.europol.europa.eu/newsroom/news/rise-of-fake-%E2%80%98corona-cures%E2%80%99-revealed-in-global-counterfeit-medicine-operation
9. Gazdasági Együttműködési és Fejlesztési Szervezet és az Európai Unió Szellemi Tulajdoni Hivatala. A hamis gyógyszerkészítmények kereskedelme - Vezetői összefoglaló. [Internet] [cited 2020 Dec 07]. Available from: https://www.euipo.europa.eu/tunnel-web/secure/webdav/guest/document_library/observatory/documents/reports/Trade_in_Counterfeit_Pharmaceutical_Products/Trade_in_Counterfeit_Pharmaceutical_Products_exec_hu.pdf
10. Bayer AG. Background Information on Counterfeit Drugs. [Internet] [cited 2020 Dec 07]. Available from: https://www.bayer.com/en/products/background-information-on-counterfeit-drugs
11. Peter Mwai. Fake drugs: How bad is Africa's counterfeit medicine problem? [Internet] [cited 2020 Dec 07]. Available from: https://www.bbc.com/news/world-africa-51122898
12. [Abi Millar. The rise of fake medicines in Africa. [Internet] [cited 2020 Dec 07]. Available from: https://www.pharmaceutical-technology.com/features/counterfeit-drugs-africa/
13. European Union Intellectual Property Office. Trade in Counterfeit Pharmaceutical Products. [Internet] [cited 2020 Dec 07]. Available from: https://euipo.europa.eu/ohimportal/en/web/observatory/trade-in-counterfeit-pharmaceutical-products
14. [Organisation for Economic Cooperation and Development. Impact of counterfeit medicines. [Internet] [cited 2020 Dec 07]. Available from: https://www.oecd-ilibrary.org/sites/ad927008-en/index.html?itemId=/content/component/ad927008-en
15. [Division of Drug Management and Policies. Summary of Counterfeit Drug Database as of April 1999 [unpublished manuscript]. Geneva, Switzerland. World Health Organization. 1999.
16. Koczwara A, Dressman J. Poor-Quality and Counterfeit Drugs: A Systematic Assessment of Prevalence and Risks Based on Data Published From 2007 to 2016. J Pharm Sci. 2017 Oct;106(10):2921-2929. https://doi.org/10.1016/j.xphs.2017.05.018
17. Centers for Disease Control and Prevention. Counterfeit Medicines. [Internet] [cited 2020 Dec 07]. Available from: https://wwwnc.cdc.gov/travel/page/counterfeit-medicine
18. World Health Organization (WHO). Substandard and falsified medical products. [Internet] [cited 2020 April 25]. Available from: https://www.who.int/news-room/fact-sheets/detail/substandard-and-falsified-medical-products

19. Isles M. What's in a Word? Falsified/Counterfeit/Fake Medicines - The Definitions Debate. Medicine Access @ Point of Care. January 2017. https://doi.org/10.5301/maapoc.0000008
20. World Health Organization (WHO). Definitions of Substandard and Falsified (SF) Medical Products. [Internet] [cited 2022 August 10]. Available from: https://www.who.int/teams/regulation-prequalification/incidents-and-SF/background/definitions#:~:text=Falsified%3A%20Medical%20products%20that%20deliberately,their%20identity%2C%20composition%20or%20source
21. Magyar Posta Zrt. Nemzetközi levél, levelezőlap [Internet] [cited 2020 Dec 07]. Available from: https://www.posta.hu/kuldemeny_feladasa/level_kulfoldre/nemzetkozi_level_levelezolap
22. Universal Postal Union. Member countries. [Internet] [cited 2020 Dec 07]. Available from: https://www.upu.int/en/Universal-Postal-Union/About-UPU/Member-Countries
23. Shabbir Imber. FEDEX Indicted By Federal Grand Jury For Supplying Shipping Services To Fake Online Pharmacies. [Internet] [cited 2020 Dec 07]. Available from: https://www.safemedicines.org/2014/07/fedex-indicted-by-federal-grand-jury-for-supplying-shipping-services-to-fake-online-pharmacies-7-22-14.html
24. Fidy Judit, Makara Gábor. Biostatisztika - Bevezetés a klinikai vizsgálatokba. [Internet] [cited 2020 Dec 07]. Available from: https://regi.tankonyvtar.hu/hu/tartalom/tkt/biostatisztika-1/ch03s08.html
25. Hamisítás Elleni Nemzeti Testület: Miért veszélyes a hamis gyógyszer? Hogyan ismerhetem fel? [Internet] [cited 2020 April 25]. Available from: http://www.hamisitasellen.hu/fogyasztoknak/miert-veszelyes-a-hamis-gyogyszer-hogyan-ismerhetem-fel/
26. 2010. évi CXXII. törvény a Nemzeti Adó- és Vámhivatalról. [Internet] [cited 2022 August 10]. Available from: https://net.jogtar.hu/jogszabaly?docid=a1000122.tv
27. 2011. évi CXII. törvény az információs önrendelkezési jogról és az információszabadságról. [Internet] [cited 2022 August 10]. Available from: https://net.jogtar.hu/jogszabaly?docid=a1100112.tv
28. Az Európai Parlament és a Tanács (EU) 2016/679 Rendelete (2016. április 27.) a természetes személyeknek a személyes adatok kezelése tekintetében történő védelméről és az ilyen adatok szabad áramlásáról, valamint a 95/46/EK irányelv hatályon kívül helyezéséről (általános adatvédelmi rendelet) (a továbbiakban: GDPR). [Internet] [cited 2022 August 10]. Available from: https://eur-lex.europa.eu/legal-content/HU/TXT/PDF/?uri=CELEX:32016R0679&from=PT
29. Mi a hamisított gyógyszer? Országos Gyógyszerészeti és Élelmezés-egészségügyi Intézet. [Internet] [cited 2021 Jan 31]. Available from: https://ogyei.gov.hu/hamis_gyogyszer
30. Az Európai Parlament és Tanács 2001/83/EK irányelve az emberi felhasználásra szánt gyógyszerek közösségi kódexéről. [Internet] [cited 2021 Jan 31]. Available from: https://ec.europa.eu/health//sites/health/files/files/eudralex/vol-1/dir_2001_83_consol_2012/dir_2001_83_cons_2012_hu.pdf
31. 52nd report of the WHO Expert Committee on Specifications for Pharmaceutical Preparations (WHO Technical Report Series, No. 1010) ISBN 978-92-4-121019-5 ISSN 0512-3054. [Internet] [cited 2020 Dec 07]. Available from: https://www.who.int/publications/i/item/9789241210195]
32. [Berterame S, Erthal J, Thomas J, Fellner S, Vosse B, Clare P, Hao W, Johnson DT, Mohar A, Pavadia J, Samak AK, Sipp W, Sumyai V, Suryawati S, Toufiq J, Yans R, Mattick RP. Use of and barriers to access to opioid analgesics: a worldwide, regional, and national study. Lancet. 2016 Apr 16;387(10028):1644-56. https://doi.org/10.1016/S0140-6736(16)00161-6
33. Mackey TK, Liang BA, York P, Kubic T. Counterfeit drug penetration into global legitimate medicine supply chains: a global assessment. Am J Trop Med Hyg. 2015 Jun;92(6 Suppl):59-67. https://doi.org/10.4269/ajtmh.14-0389
34. Fincham JE. Negative Consequences of the Widespread and Inappropriate Easy Access to Purchasing Prescription Medications on the Internet. Am Health Drug Benefits. 2021 Mar;14(1):22-28.