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FIP STATEMENT OF POLICY ON MEDICINES SHORTAGES

THE INTERNATIONAL PHARMACEUTICAL FEDERATION (FIP) RECOMMENDS THAT:

1. **Each country establishes a publicly accessible means of providing information on medicine shortages.**

   This must be timely, as complete as possible, focused on current shortages and their reasons, based on a harmonised definition of root causes to make the analysis comparable, and provide details of expected duration and responses.

   This information and possibly early warnings system may involve the ministry of health, the medicines regulatory authority, professional bodies, pharmaceutical supply chain associations and other stakeholders. The mid- to long-term aim should be to aggregate this information at the international level. National portals should be available and linked to prescribing systems. This would make information more transparent for prescribers and for health care systems, including pharmacies and the public in general.

   There are several pharmacy-led information systems at national level where pharmacists collect and share information, thus contributing to the early adoption of mitigating measures. These systems may include the automatic reporting of shortages at the pharmacy level and use algorithms and machine-learning tools to allow for an early detection of shortages. The timely adoption of measures informed by the early detection of medicines shortages is key for health authorities to mitigate their impact.

   Examples of such systems include Spain's *Medicines Information System on Shortages*[a], France's *Dossier Pharmaceutique DP-Ruptures*[b], Portugal's *Medicines Unavailability Barometer*[c], the Netherlands' *KNMP Farmanco*[d], and the United States' *ASHP's Current Drug Shortages and Management Bulletin*[e].

   Pharmacists should be given greater authority to solve medicines shortages at community or hospital pharmacies when they occur. Governments should as soon as possible instruct medicines regulatory authorities to investigate and develop proposals for extended powers for pharmacists, in order to resolve residual situations for individual patients. A recent example of support for this role came from

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[a] By the Medicines Supply Information Centre (CISMED) of the General Pharmaceutical Council of Spain: https://www.portalfarma.com/Profesionales/medicamentos/CISMED/Paginas/default.aspx [Accessed 7 May 2020]

[b] By the French Chamber of Pharmacists: http://www.ordre.pharmacien.fr/Le-Dossier-Pharmaceutique/Ruptures-d-approvisionnement-et-DP-Ruptures [Accessed 7 May 2020]

[c] By the Center for Health Studies and Evaluation (CEFAR) of the National Association of Pharmacies (ANF): https://www.pgeu.eu/wp-content/uploads/2019/03/170201E-Supply-chain-Statement-on-Information-on-Med-Short.pdf [Accessed 7 May 2020]

[d] By the Royal Dutch Pharmacists' Association (KNMP): https://www.knmp.nl/producten/farmanco/knmp-farmanco-website-geneesmiddelentekorten [Accessed 7 May 2020]

[e] By the American Association of Health-System Pharmacists: https://www.ashp.org/Drug-Shortages/Current-Shortages?loginreturnUrl=SSOCheckOnly, [Accessed 7 May 2020]

the British Medical Association, which adopted a policy proposing that pharmacists should be able to dispense an equivalent dose of an appropriate and available alternative medicine when the prescribed dose is unavailable. (1) Likewise, pharmacists are allowed to perform therapeutic interchange[f] in several jurisdictions in Canada (2) and several other countries around the world. (3)

2. **A global process to determine the list of critical or vulnerable products should be developed.**

   This would be most easily done by a multilateral organisation within the United Nations structure and with inputs from ministries of health, medicines regulatory authorities, professional bodies like FIP, and industry and other supply chain associations. Definitions and criteria for the designation as critical or vulnerable products would be based on the vulnerability of supply, the complexity of production, the number and location of sites of active pharmaceutical ingredient (API) and finished pharmaceutical products manufacture, medical necessity and the ability to substitute.

   This list will require continuous revision and will inform regulatory responses, procurement practices and risk mitigation strategies. Each country could adapt the list to local conditions.

3. **All procurers of medicines are urged to move towards active procurement processes that assure the continuity of supply of quality medicines.**

   Elements of high-quality active procurement processes would include:
   - Improved quantification of demand including forecasting and considering the real lead-times associated with demand and supply;
   - Direct communication between procurement agencies and manufacturers around issues of sustainable capacity;
   - Encouraging sustainable supply from diverse sources;
   - Deliberate and considered approaches tailored to the specific situation for each product (long-term, short-term, split contracts);
   - Responsible pricing that values relevant non-price factors; and
   - Meaningful binding contracting.

   When medicines are in short supply, it is essential that purchasing is in line with need; uncoordinated local stockpiling risks compounding supply problems.

4. **All countries are encouraged to remove unnecessary variability of regulatory practices within and between countries.**

   All regulatory authorities need to advance responsible transparency in relation to all regulatory processes.
   Manufacturers are encouraged to find a non-threatening means to share non-competitive aspects of audits of suppliers and contractors in order to improve transparency and enable coordinated responses.

5. **Medicines regulatory agencies should gather and share information about demand for, and supply of medicines (and particularly essential medicines) within their jurisdictions. Countries without a medicines regulatory agency should investigate the potential to establish a national body charged with this task.**

   This agency or body should also develop an ethical framework for decision making relating to resource allocation at times of scarcity.

[f] Therapeutic interchange is the act of dispensing a pharmaceutical product containing different active ingredient(s) which are of the same pharmacological class, and which have similar therapeutic effects as the prescribed pharmaceutical product. (36)

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This body should also coordinate the dissemination of information about the national available stock throughout the entire supply chain.

6. **All countries are encouraged to develop evidence-based risk mitigation strategies which might include contingency plans, pandemic planning and capacity redundancy appropriate to their national needs and strategic buffer stockpiles**.

Recommendations to Governments

FIP specifically recommends that governments:

1. Develop an interregional cooperation mechanism to define medicines shortages based on duration of shortage, and health and economic impacts from the perspective of patients.

2. Create policies at an interregional level (e.g., ASEAN, EU) encouraging the production of APIs and medicines inherently and consistently reported for shortages in the region in order to build resilience in times of public health emergencies.

3. Implement measures to create a regulatory and economic framework that promotes the diversification of production of APIs, raw materials and medicines in order to improve resilience in the supply chain and guarantee that all markets, regardless of their size or resources, are able to provide equitable access to medicines for their citizens.

4. Develop harmonised reporting criteria in order to guarantee interoperability of the national reporting systems on medicines shortages and data comparability, including a list of shortages and an early warning system involving all supply chain stakeholders, about existing and anticipated shortages.

5. Increase transparency through the development of comprehensive databases available to the public to publish information on medicines shortages and encourage the establishment of data sharing mechanisms. These databases should be exclusively governed by national and international authorities (protecting sensitive and commercial data), but in coordination with patients, health professionals and pharmaceutical supply chain stakeholders, such as hospitals, pharmacies, full-service healthcare distributors and other pharmaceutical wholesalers, and the pharmaceutical industry. Patients should be granted the right to report medicines shortages to the appropriate authorities and they should be encouraged to do so.

6. Create policies ensuring the availability of medicines for rare diseases, medicines for children and medicines with low prescription outputs, especially to promote the accessibility to medicines for children by developing national or regional essential medicine lists for children.

7. Implement policies and national laws that balance in an equitable manner patients' needs with the economic, financial and health interests of the state or health system, and the supply chain agents.

8. Implement measures to mitigate the economic impact of medicines shortage on health professionals, supply chain, hospital and community pharmacies and patients.

9. Include in medicines shortages databases information about available alternative medicines that could be dispensed in cases of shortage. The therapeutic alternatives should be decided upon by the pharmacy/drugs and therapeutics committee of each national authority or the equivalent authority.

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10. Include pharmacists in pharmacy/drugs and therapeutic committees, in committees defining essential medicines lists and antibiotic use policies, and in committees promoting responsible use of medicines or proposing guidelines for managing medicines shortages, including lists of alternative medicines when appropriate. Pharmacist expertise should also be sought when developing national drug policy decisions (e.g., cost-containment policies that may affect access to medicines).

11. Authorise pharmacists to dispense an alternative medicine to the prescribed medicine in cases of shortage.

12. Link the medicines shortages database to the (electronic, when available) patient records and prescription systems, giving information about the shortage and the possible available therapeutic alternatives. This should be done in strict observance of personal and commercial data protection regulations.

13. Promote further studies to monitor the effectiveness of measures introduced to address medicines supply shortages.

Recommendations to supply chain stakeholders

FIP specifically recommends that:

1. All supply chain stakeholders (pharmaceutical industry, parallel traders, full-service healthcare distributors and other pharmaceutical wholesalers, hospital and community pharmacies) work together to develop and improve medicines shortages reporting systems in order to share, in a timely manner, information that provides transparent insights on potential unavailability problems.

2. Pharmaceutical manufacturers integrate action plans and measures on how to cascade information to full-service healthcare distributors and other pharmaceutical wholesalers, and hospital and community pharmacies when there are production problems, quality concerns, changes in product formulation, and problems in industrial development capacities.

3. Pharmaceutical manufacturers ensure continued supply of medicines considering a balance between the ethical duty of meeting patients' needs and the economic and financial decisions.

4. Procurers ensure that no action is taken which could exacerbate a medicines shortage, e.g., stockpiling medicines or ordering more stock than required to meet normal demand.

5. Pharmacists increase the use of prospective risk assessments for the mitigation of medicines shortages.

AGAINST THIS BACKGROUND, FIP AND ITS MEMBER ORGANISATIONS COMMIT TO:

1. Promoting the global use of the definition of medicines shortages included in this document (see below) and a set of harmonised criteria to identify and monitor shortages at national, regional and international level. This would promote a better understanding of the problem globally through more accurate, reliable and comparable data.

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2. Advocating for a regulatory and policy framework that allows pharmacists in the pharmaceutical chain to exercise their professional competence and responsibility to mitigate shortages and guarantee timely access to medicines for patients.

3. Developing evidence-based guidelines and competency development programmes targeting pharmacists' roles in mitigating the impact of medicines shortages in hospital and community settings.

4. Promoting collaboration with other health care professionals in mitigating shortages and minimising their impact on patients and health systems.

RATIONALE

Medicine shortages have become a complex global problem. There is evidence (4) (5) (6) (7) (8) (9) (10) (11) that these shortages are worsening with time, creating ever more difficulties for healthcare professionals, and compromising patient safety. Such shortages have also serious implications in terms of additional costs and staff workloads, possibly as much as hundreds of millions of dollars in expenses every year. (12) (13) (14). The unavailability of medicines is on the rise all over the world and it has a tremendous impact on patients and healthcare systems.

Shortages have been reported in countries of all income levels. They occur across all healthcare settings and involve essential life-saving medicines, very commonly used medicines and both high- and low-price medicines.

The reasons for shortages are complex and multifactorial. Regulation, manufacturing and quality issues, supply, public procurement rules and demand, political and economic factors and health emergencies and disasters are among the causes of shortages. (15) (16)

Simultaneously, adding to the complexity of the problem, there is an ever-growing demand for medicines, due to ageing communities and the availability of more effective treatments in a global context of health budget constraints. When combined with disruptions in the pharmaceutical chain related to the multifactorial reasons mentioned above the frequent result is an inability to supply medicines where and when they are needed.

As the causes of shortages are several, multidimensional and sometimes unpredictable, in the context of a complex global supply chain and a globalised market there is a growing concern among all stakeholders — patients, healthcare professionals, governmental organisations, community and hospital pharmacies, full-service healthcare distributors and other pharmaceutical wholesalers and the pharmaceutical industry — about the future of medicines supplies worldwide.

There is insufficient information to assess the magnitude of the problem at an international level. Similarly, the characteristics of medicines shortages vary greatly from country to country, and the lack of reliable information at a global level limits the capability for establishing a global coordinated action. However, at a few national and regional levels, data have been collected, providing some crucial evidence for the estimation of the extent and depth of the problem of medicine shortages.

Medicine shortages can result in delayed or unavailable treatments, a change to an alternative medicine or to importation of medicines at different prices, and there are effectiveness and safety implications to consider. For example, the effectiveness, safety and cost-effectiveness of alternative medicines may be less ideal than the medicines in shortage (the first choice medicines), which may sometimes negatively influence the

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treatment outcomes of patients (17), wherever they are based – hospital, community or nursing homes, to name but a few.

Some circumstances may require medical doctors to prioritise which patients to treat and which may need their treatment to be delayed or cancelled. Medicine shortages can result in anxiety and/or lower quality of life for patients, conditions worsening or requiring hospitalisation, and even death. Some patients or healthcare systems may not be able to afford the more costly alternative options available, resulting in interruption of treatment. (18)

Shortages may result in additional costs for healthcare systems, as the cost of the alternative medicines could be higher as the purchasing is usually made off-contract for hospitals, or the alternative medicine is less cost-effective than the first choice. Shortages are accompanied by increased indirect costs associated with additional time spent procuring, preparing, administering and monitoring alternative medicines or dosage forms, because patients need to be closely monitored after switching.

Medicines shortages have financial and resource impacts on patients, mainly due to increases in out-of-pocket payments (13) and costs related to the need for a new medical appointment to change therapy. (14)

To limit the impact of medicines shortages as much as possible, healthcare professionals spend substantial amounts of their time trying to find solutions. Recent data showed that pharmacy staff spend 6.6 hours per week dealing with shortages at European level. (19) This also means that medicine shortages divert healthcare providers from direct patient care activities. In a survey undertaken in Canada in 2018, two thirds of pharmacists (67%) deal with drug shortages daily or several times a day. Pharmacists estimate that managing drug shortages can occupy up to 20% of their shift. (20)

In 2019, European hospital pharmacists stated that the impact that medicines shortages had on patients include delays in care (42%), suboptimal treatment (38%), cancellation of care (27%) and increased length of stay (18%). (11)

International organisations, such as the World Health Organization (WHO), (4) established forums to promote discussion between governments, pharmaceutical supply chain stakeholders and patients to identify causes of and find solutions to the problem of medicines unavailability.

Access to medicines for all is one of the targets of the United Nations Sustainable Development Goals, which constitute a political framework that highlights the urgent need for finding solutions to reach this target. Tackling medicines shortages is one of the areas of greatest concern worldwide.

Considering this growing concern, FIP is issuing this statement of policy that looks into the causes, impacts and required actions to the global problem of medicine shortages through a multi-stakeholder approach involving representatives from various sectors.

In formulating recommendations to address all or any one of the causes of medicine shortages, FIP assumes the following:

A. Medicines should not be considered as ordinary commodities of trade.
B. Patients' and health systems' needs must be the main factor driving national pharmaceutical policies.
C. Pharmacists' role in mitigating the impact of medicines shortages should be enhanced.
D. There are both short-term solutions (addressing current shortages) and long-term strategies (preventing future shortages) for this problem.

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Medicines shortages definition

There is no harmonised, international definition of medicines shortages. It differs from country to country.

The WHO provides a list with a compilation of definitions for medicines shortages. (21) A WHO panel of experts proposed the following two definitions from two different perspectives:

On the supply side: A "shortage" occurs when the supply of medicines, health products and vaccines identified as essential by the health system is considered to be insufficient to meet public health and patient needs. This definition refers only to products that have already been approved and marketed, in order to avoid conflicts with research and development agendas.

On the demand side: A "shortage" occurs when demand exceeds supply at any point in the supply chain and may ultimately create a "stockout" at the point of appropriate service delivery to the patient if the cause of the shortage cannot be resolved in a timely manner relative to the clinical needs of the patient.

The Pharmaceutical Group of the European Union defines a medicines shortage as "every (temporally) inability for a community or hospital pharmacy to supply patients with the medicinal product requested as a result of factors beyond their control, requiring the dispensing of an alternative agent or even discontinuation of an ongoing medical therapy". (22)

In 2019, the European Medicines Agency and Heads of Medicines Agencies defined shortages in the following terms: "A shortage of a medicinal product for human or veterinary use occurs when supply does not meet demand at a national level." (23)

For the purpose of this statement, FIP adopts a broad definition to address the impact on the availability of medicines from the patient's perspective, namely:

A medicines shortage is a mismatch between supply and demand that results in changes, delays or discontinuity of patient care or reduced adherence.

CAUSES OF AND CONTRIBUTING FACTORS TO MEDICINES SHORTAGES

Medicines shortages are caused by a wide number of factors and complex causes that affect the adequate supply of medicines to meet the needs of health systems and patients.

The reasons and contributing factors have been classified into different groups but for the purpose of this statement a global approach is used, based on available literature and pharmaceutical chain stakeholders' perspectives. (7) (15) (22) (16) (24)

A. **Regulatory and political factors**

Regulatory factors related to different regulatory systems around the world and different obligations and requirements according to regions or countries may lead to delays in approval of marketing authorisations and, potentially, to national shortages.

At policy level, there are several factors that may lead to an increase in demand with consequent impacts on the normal supply or barriers to access, resulting in medicines shortages or unavailability for patients. Some examples include decisions related to

public health policy, such as new clinical practices (e.g., the introduction of new vaccines in a national health plan), contingency measures related to stockpiling and safety reserves at national level, or diplomatic or military conflicts involving sanctions. (5) (7) (25) (26)

Regulatory agencies, including the United States' Food and Drug Administration (FDA) and the European network of Heads of Medicines Agencies (HMA), have introduced guidance or legislation requiring the reporting and monitoring of medicines shortages. Such approaches are a critical element of the surveillance of the market and for regulators to intervene to mitigate shortages on the supply side, for example, by requesting alternative suppliers to increase production if possible, or by expediting reviews of facilities and equipment in order to resume production as quickly as possible. Nevertheless, it is not always clear whether these measures are entirely effective in addressing and resolving shortages. There are limitations on the ability of regulatory authorities to override the rights of marketing authorisation holders, although in the event of shortages alternative suppliers may be authorised through appropriate procedures. In some cases, product labelling requirements (e.g., language) may be exempted to allow importation of substitute products.

Regulatory requirements for approval are generally based on fixed procedures that may take significant time to make it possible for alternative manufacturers to gain timely approval. A report by the FDA (24) suggests that there may be approaches to enabling manufacturers with mature quality systems to be recognised. Also, China recently amended legislation to facilitate the prioritised evaluation and approval of medicines in shortage which are in urgent need for clinical practice. (27)

B. **Manufacturing and quality factors**

At manufacturing level there are many reasons that may lead to production problems that can potentially contribute to shortages.

Mergers and a small number of geographically concentrated manufacturing sites may increase the risk of disruptions in the supply of certain medicinal products or APIs in case of problems in production facilities and limited production capacity.

Measures implemented by companies to increase efficiency and reduce waste may lead to problems of inadequate supply to the volume demanded. On the other side, tenders and other centralised purchase systems may differ from production plans (28) leading to manufacturing lag times. Surges in demand related to changes in prescription patterns or inaccurate forecasting may have the same result. (16)

Quality-related problems may arise related to Good Manufacturing Practice (GMP) requirements that may lead to a need for implementing corrective measures and even plant closures, with a consequent impact on production capacity. The availability of alternative suppliers who can meet demands in a timely manner and with appropriate quality may be limited by both financial and regulatory requirements.

Production has times that cannot be avoided, reduced or eliminated; on the other hand, some products are produced by campaign only. These constraints can hinder a rapid response to mitigate the increase in market demands.

Production capacity may also be affected by natural disasters causing unforeseen disruptions in the supply.

Another possible constraint in production capacity are the shortages of raw materials and APIs, due to the limited availability of alternative suppliers considering both API market concentration and challenges in licensing alternative sources of raw material.

Consolidation of manufacturing to specific regions or countries may increase the risk of shortages in the event of a pandemic or natural disaster, as evidenced by the problems experienced during the COVID-19 pandemic (exports bans, transport disruptions, stockpiling).

C. Demand and supply

Medicines supply chains involve several economic agents interacting with each other through a global framework of economic and commercial agreements. Demographic, economic and social contexts at national level have implications not only for the organisation of the supply chain but also for the demand and needs of national markets.

On the demand side, there are different reasons that may have an impact on medicines availability, namely, peaks in demand related to public mindset and understanding of options available, and public health emergencies and natural disasters that originate shifts in demand and needs of health care systems and the public. One example of this is the hoarding seen in the initial phase of the COVID-19 pandemic following news in the press about potential treatments/preventive medicines and vaccines. On the opposite side, products with low-market demand, such as emergency medicines, medicines for children, legacy technologies of lower price and/or lower volume, and orphan drugs may be at major risk of shortages. (29) (30)

Changes in a country's population due to migration and refugee flows may introduce significant changes in demand and lead to shortages of certain medicines overall or in certain population groups.

On the supply side, there are also important reasons that may lead to medicines shortages. For instance, some regional shortages may be caused by limited distribution of products in certain areas, low interest in the delivery to remote areas, and insufficient delivery capacity. (31) (32)

Consideration needs to be given also to the impact of grey or unregulated markets and counterfeit products that highlight the need to maintain protection balanced against access.

The structure of the network or supply chain in a country, within a global market, may also result in shortages due to the discrepancy between the volume manufacturers release to a given market and actual patients' needs. Trade and market regulations (e.g., parallel trade) and commercial agreements between pharmaceutical chain agents (e.g., quotas) may also result in shortages. (16) (33)

Pharmaceutical manufacturers must quickly ensure that stock reports are accurate and up to date. Pharmaceutical manufacturers and wholesalers have a joint obligation to ensure appropriate and continued supply of medicinal products so that the needs of patients nationally are covered, and pharmacists should be given greater opportunities to directly address medicines shortages.

Any uncoordinated increases in demand can create supply problems (e.g., hoarding, stockpiling or panic-buying behaviours).

D. Economic factors

The economic context and budget constraints faced by different governments at global level result in different measures to address health systems' challenges and increasing health expenditure.

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Limited financial resources impact the sustainability of the pharmaceutical chain in low-, middle- and high-income countries.

Pricing mechanisms that impact on prices and margins may affect the viability and sustainability of agents in the pharmaceutical supply chain and, consequently, the availability of medicines. These mechanisms may include reference pricing, administrative price reviews, discounts or clawbacks, tendering and procurement, payback policies and other cost-containment policies. They may also lead to commercial withdrawals of certain products from national markets and a reduction in the number of suppliers. Additionally, in many countries, there are delays in payments to suppliers, which combined with low prices policies, market size and structure, may result in lack of attractiveness to marketing authorisation holders. (16) (28)

Affordability, associated with fragmentation and suboptimal implementation of regulations, may cause shortages in low- and middle-income countries due to a lack of national production and high prices of imported medicines. For these reasons, in many countries, especially African countries, many people do not have access to essential medicines not only due to unavailability but also to frequent stock-outs. (34) (35)

Many shortages have been reported to be associated with low-price products and there is a lack of any economic imperative to provide alternatives. The lack of a profit incentive and relatively long approval times, even for established medicines, provide limited motivation for a new manufacturer to enter a market. (24)

Whatever the causes and impact of medicine shortages, it is in the best interest of the global community, governments, healthcare professionals, patients and all pharmaceutical supply chain stakeholders, such as hospitals, pharmacies, full-service healthcare distributors and other pharmaceutical wholesalers, and the pharmaceutical industry, to work together in collaboration, transparency and understanding of the factors influencing the issue, in order to prevent or mitigate the worsening of the longstanding global trend of medicine shortages.

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References

1. Wickware C. GPs vote for pharmacists to have power to substitute medicines during shortages. Pharmaceutical Journal. 2019; 303(7932).
2. Canadian Pharmacists' Association. Pharmacists' Expanded Scope of Practice. [Online]. [cited 2020 May 7. Available from: https://www.pharmacists.ca/pharmacy-in-canada/scope-of-practice-canada/.
3. International Pharmaceutical Federation — FIP. Pharmacy: A Global Overview — Workforce, medicines distribution, practice, regulation and remuneration. 2015-2017. The Hague :; 2017.
4. World Health Organization. Medicines Shortages: Global approaches to addressing shortages of essential medicines in health systems. WHO Drug Information. 2016; 30(2): p. 180-185.
5. Acosta A, Vanegas E, Rovira J, Godman B, Bochenek T. Medicine Shortages: Gaps Between Countries and Global Perspectives. Frontiers in Pharmacology. 2019; 10: p. 763.
6. Gray A, Manasse HJ. Shortages of medicines: a complex global challenge. Bull World Health Organ. 2012; 90(3): p. 158-158A.
7. International Pharmaceutical Federation. Report of the International Summit on Medicines Shortage. The Hague:; 2013.

8. European Association of Hospital Pharmacists. Medicines shortages in European Hospitals. [Online].; 2013 [cited 2020 April 16. Available from: https://www.eahp.eu/sites/default/files/files/EAHPdeplMedicineHR2f.pdf.
9. European Association of Hospital Pharmacists. Medicines Shortages in European Hospitals. [Online].; 2014 [cited 2020 April 16. Available from: https://www.eahp.eu/sites/default/files/shortages_report05online_0.pdf.
10. European Association of Hospital Pharmacists. EAHP's 2018 Survey on Medicines Shortages to improve patient outcomes. [Online].; 2018 [cited 2020 April 16. Available from: https://www.eahp.eu/sites/default/files/report_medicines_shortages2018.pdf.
11. European Association of Hospital Pharmacists. 2019 EAHP Medicines Shortages Report. [Online].; 2019 [cited 2020 April 2020. Available from: https://www.eahp.eu/sites/default/files/eahp_2019_medicines_shortages_report.pdf.
12. De Weerdt E, Simoens S, Casteels M. Clinical, Economic and Policy Implications of Drug Shortages in the European Union. Appl Health Econ Health Policy. 2017; 15: p. 441-445.
13. Phuong J, Penm J, Chaar B, Oldfield. The impacts of medication shortages on patient outcomes: A scoping review. Plos One. 2019; 14(5).
14. Centre for Health Evaluation and Research (CEFAR). Impact of medicines unavailability in the citizens and in the health system. Lisbon:; 2019.
15. Iyengar S, Hedman L, Forte G. Medicine shortages: a commentary on causes and mitigation strategies. BMC Med. 2016; 14(124).
16. AESGP, EAEPC, EFPIA, GIRP, EIPG, Medicines for Europe, Vaccines Europe. Addressing the root causes of medicines shortages; Supply chain Stakeholders' views on root causes and solutions. [Online].; 2019 [cited 2020 April 16. Available from: https://www.efpia.eu/media/413378/addressing-the-root-causes-of-medicines-shortages-final-051219.pdf.
17. Nonzee NJ, Luu TH. The Drug Shortage Crisis in the United States: Impact on Cancer Pharmaceutical Safety. Cancer Treatment and Research. 2019;(171): p. 75-92.
18. Nascimento RM, et al. Availability of essential medicines in primary health care of the Brazilian Unified Health System. Revista de Saúde Pública. 2017 November 13; 51(2).
19. Pharmaceutical Group of the European Union. PGEU Medicine Shortages Survey 2019. [Online].; 2019 [cited 2020 April 16. Available from: https://www.pgeu.eu/publications/press-release-pgeu-medicine-shortages-survey-2019-results/.
20. Canadian Pharmacists Association. CPhA Drug Shortages and Recalls Survey 2018. [Online].; 2019 [cited 2020 April 16. Available from: https://www.pharmacists.ca/cpha-ca/assets/File/cpha-on-the-issues/CPhADrugShortagesandRecallsSurvey2018.pdf.
21. World Health Organization. Meeting Report: Technical Definitions of Shortages and Stockouts of Medicines and Vaccines. [Online].; 2016 [cited 2020 April 16. Available from: https://www.who.int/medicines/areas/access/Meeting_report_October_Shortages.pdf.
22. Pharmaceutical Group of the European Union. Position Paper on Medicines Shortages. [Online].; 2019 [cited 2020 April 16. Available from: https://www.pgeu.eu/wp-content/uploads/2019/03/2019-PGEU-Position-Paper-on-Medicine-Shortages-1.pdf.
23. European Medicines Agencies/Heads of Medicines Agencies. Guidance on detection and notification of shortages of medicinal products for Marketing Authorisation Holders (MAHs) in the Union (EEA). [Online].; 2019 [cited 2020 April 16. Available from: https://www.ema.europa.eu/en/documents/regulatory-procedural-guideline/guidance-detection-notification-shortages-medicinal-products-marketing-authorisation-holders-mahs_en.pdf.
24. United States Food and Drug Administration. Drug Shortages: Root Causes and Potential Solutions. ; 2019.
25. Setayesh S, Mackey T. Addressing the impact of economic sanctions on Iranian drug shortages in the joint comprehensive plan of action: promoting access to medicines and health diplomacy. Global Health. 2016; 12(31).
26. Polanco A, Urrutia I. Venezuela's chronic shortages give rise to 'medical flea markets'. Reuters. 2017 December 8.
27. People's Republic of China. Drug Administration Law. [Online].; 2019 [cited 2020 May 1. Available from: http://www.gov.cn/xinwen/2019-08/26/content_5424780.htm.

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28. The Economist Intelligence Unit. Addressing medicine shortages in Europe: Taking a concerted approach to drive action on economic, manufacturing and regulatory factors. ; 2017.
29. Yang C, Wu L, Cai W, Zhu W, Shen Q, Li Z. Current Situation, Determinants, and Solutions to Drug Shortages in Shaanxi Province, China: A Qualitative Study. PLoS ONE. 2016; 11(10).
30. Walker J, Chaar B, Vera N, Pillai A, Lim JS, Bero L. Medicine shortages in Fiji: A qualitative exploration of stakeholders' views. PLoS ONE. 2016; 12(6).
31. Fox ER, Birt A, James KB. ASHP Guidelines on Managing Drug Product Shortages. Am J Health Syst Pharm. 2018; 75: p. 1742-50.
32. Li Y, Sheng Y, Zhao M, Hu A. Research on the Causes of Supply Shortage and Supply Guarantee in China from the Perspective of Supply Chain. Health Economics Research. 2017; 6: p. 55-59.
33. Pauwels K, Huys I, Casteels M. Drug shortages in European countries: a trade-off between market attractiveness and cost containment? BMC Health Serv Res. 2014; 14: p. 438.
34. World Health Organization. Access to medicines project wraps up amid progress and hope. [Online].; 2016 [cited 2020 April 16. Available from: https://www.who.int/medicines/areas/coordination/access-medicines-project/en/.
35. Barton I, Avanceña A, Gounden N, Anupindi R. Unintended Consequences and Hidden Obstacles in Medicine Access in Sub-Saharan Africa. Front. Public Health. 2019 November 15; 4.
36. International Pharmaceutical Federation. Pharmacist's authority in pharmaceutical product selection: therapeutic interchange and substitution. [Online].; 2018 [cited 2020 June 26. Available from: https://www.fip.org/file/2086.

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