


Health vulnerabilities and the importance of integrating local production of strategic medicines for the SUS


Vulnerabilidades em saúde e a importância da integração da produção local de medicamentos estratégicos para o SUS

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Abstract

A strengthened local supply chain is an essential and highly relevant condition for universal access to health care. This article enables a movement towards a public policy agenda that involve the entire productive health system, including strategic components of the production chain beyond active pharmaceutical ingredients (API), without which universal health access and health sovereignty become unfeasible, leaving the Brazilian Unified Health System (SUS) vulnerable. Within this perspective, qualitative bibliographic research was conducted together with field observation among key informants of the drug production supply chain from Brazil's main Official Pharmaceutical Laboratory. Results showed that in addition to active pharmaceutical ingredients, other strategic health care items in the supply chain also constitute technological bottlenecks. These findings may contribute to expand the debate on health vulnerabilities, relating the productive and economic structure to universal access, thus establishing, nationally and internationally, a theoretical link between the economy, production local and social rights.

Keywords: Health Science and Technology Policy; Health Economic-Industrial Complex; Pharmaceutical Care; Product Production; Supply Chain.

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Resumo

A existência de uma cadeia de suprimentos local fortalecida é condição essencial para o acesso universal à saúde. Esse artigo permite avançar para uma agenda de políticas públicas para envolver todo o sistema produtivo da saúde, incluindo componentes estratégicos da cadeia produtiva para além dos insumos farmacêuticos ativos (IFA), sem os quais, o acesso universal e a soberania em saúde se tornam inviáveis, vulnerabilizando o Sistema Único de Saúde (SUS) brasileiro. Com essa perspectiva, foi realizada uma pesquisa bibliográfica qualitativa, com observação de campo entre informantes-chave da cadeia de suprimentos da produção de medicamentos do principal Laboratório Farmacêutico Oficial do país. O resultado mostrou que, assim como os insumos farmacêuticos ativos, existem outros itens estratégicos para a saúde na cadeia de suprimentos que se configuram em gargalos tecnológicos. Com isso, espera-se ter contribuído para a ampliação do debate sobre as vulnerabilidades em saúde, relacionando a estrutura produtiva e econômica ao acesso universal, contribuindo, em âmbito nacional e internacional, no estabelecimento de um elo teórico entre a economia, a produção local e os direitos sociais.

Palavras-chave: Política de Ciência e Tecnologia em Saúde; Complexo Econômico-Industrial da Saúde; Assistência Farmacêutica; Produção de Produtos; Cadeia de Suprimentos.

Introduction

The productive dimension of globalization has improved the methods of organizing the production process and enabled major technological advances, reorganizing the forms of production and facilitating the interconnection between industries and their supply networks through raw material suppliers and logistics and transport companies, which make it possible to manufacture goods and services with supplies purchased in distant locations (Leão; Vasconcellos, 2015).

At the same time that it proved to be an advance for production processes, the concentration of strategic items for global production chains in a few countries represented a weakness for the developing nations' economies, a situation that was highlighted by the SARS-COV-2 pandemic (COVID-19). Studies on supply chains (Ballou, 2005; Bowersox; Closs, 2004; Tridapalli; Fernandes; Machado, 2011) over the years have emphasized the importance of thinking about the integration of the entire chain, aiming to achieve better results and gains in the competitiveness of companies and nations. But the pandemic has shown that strengthening local supply chains is a strategic condition for developing the economy.

The recent global health crisis resulted in a global public health problem and brought about a debate on the reorganization of forms of production, aiming to reduce foreign dependence and thinking about the sustainable use of natural resources to strengthen local production and neutralize the impacts of this and future pandemics. This topic has been frequently addressed on the international agenda on the global production chains and the environment, looking at the future of countries in a post-pandemic scenario.

The agenda of international organizations, such as the World Health Organization (WHO), the United Nations (UN) and the Organization for Economic Cooperation and Development (OECD), has debated the need for deglobalization as a way to address health and economic weaknesses caused by the pandemic (De Backer, 2016; UN, 2022; WHO, 2021).

Health moves a broad and diversified supply chain and contributes decisively to economic development, proving to be a valuable field of research to contribute to the debate on local

production and strengthening the economy. By using the production of medicines and vaccines as health technologies, we can empirically relate the supply chain of an Official Pharmaceutical Laboratory (OPL) with previously consolidated concepts of collective health and public health, such as: principles of universal health systems; primary care; financing; access to health services; universal coverage; pharmaceutical care; access to medicines; economy and health; economic and social determinants of health; health technologies; and the health economic-industrial complex (Bermudez, 2021; Bermudez et al., 2018; Bigdeli et al., 2013; Gershman; Santos, 2006; Giovanella et al., 2018; Monteiro et al., 2016).

The promotion, prevention and recovery of health, addressed by Pharmaceutical Assistance (PA), has medicines as a core element. The importance of this product can be observed in all phases of care, from primary to high complexity care, in which it plays a strategic role. Research, production and distribution activities drive a strategic production chain to meet health demands and economic development. The supply chain involved in these dynamics is key for the manufacture of technologies that contribute to comprehensive health care.

The production of medicines and vaccines is an industrial activity included in the productive dynamics of the Health Economic-Industrial Complex (HEIC) (Vargas et al., 2012), which drives the chemical and biotechnology-based subsystem and the other subsystems by using equipment and materials in manufacturing and consumption by hospitals and outpatient clinics during service provision. These dynamics involves a broad chain of suppliers of materials and products of small, medium and high technological complexity, in which the lack of a less complex item can make the production, technology transfer and development of a new medicine unfeasible in the same way as a highly complex input, a situation that demands equal attention from the entire supply chain to neutralize possible weaknesses and contribute to strengthening the Brazilian health system.

Weaknesses and vulnerabilities of national industries (Fernandes; Gadelha; Maldonado, 2021; Hasenclever et al., 2018) can also be observed in the

pharmaceutical sector, in which OPLs are located. However, some situations that contribute to this scenario have been little addressed in studies on the production of health technologies, such as the supply chain involving inputs used in the manufacture of pharmaceuticals and medicines, other than Active Pharmaceutical Ingredients (APIs). Composed, for the most part, of small- and medium-sized companies, this chain holds a great share in economic development, being directly impacted when an event of a global nature causes the disruption of supply, harming local production.

The OPLs, as public producers of medicines, serums, vaccines, diagnostic kits, and generators of technologies for the Brazilian National Health System (SUS) through research and development (R&D), also assist the Brazilian Ministry of Health (MS) in formulating and implementing public policies for health and economy. During the pandemic, the importance of official laboratories became more evident given the need to produce medicines and vaccines to combat the disease and actions that minimize the economic impacts resulting from the interruption of activities due to social isolation (Fernandes; Gadelha; Maldonado, 2022) to contain the community circulation of the virus.

When discussing the development of the HEIC (Gadelha; Temporão, 2018; Temporão, 2022), thinking about encouraging, promoting and improving the internationalization of the production of strategic items and the population's access to health technologies with the strengthening of the Brazilian Unified Health System (SUS), it is necessary to consider all actors in the industrial sector, as is the case with supply chain, also called the production chain, involved in the productive dynamics of health (Leão; Vasconcellos, 2015).

The shortage of strategic items in the sector, which was demonstrated during the health crisis and the current context of global geopolitical conflict with Russia's war with Ukraine, highlighted the weaknesses of the national production base, heightened by foreign dependence, bringing difficulties for the SUS in the provision of essential health services, reinforcing the need to expand the debate on strengthening local production chains and deglobalization (Cassiolato; Falcón; Szapiro, 2021; EP, 2021; WHO, 2021).

Studies on OPL (Magalhães; Antunes; Boechat, 2011; Oliveira; Labra; Bermudez, 2006) have contributed to the debate with an important issue for the development of the HEIC: the public production of medicines. The focus of this study is on the supply chain of strategic materials, beyond APIs, in the production of essential medicines by an OPL.

This article aims to analyze this chain to expand the debate beyond final products for specific health use, bringing other elements of the production support chain that have been little addressed in the literature. It is a supply chain made up of companies and industries that, like pharminochemicals and pharmaceuticals, rely on the import of inputs for the production and supply of items used in the production of medicines.

This set of characteristics provides a valuable object of study to understand the production of medicines beyond the debate on the structural deficiencies of the national pharmaceutical industry, allowing us to move towards a public policy agenda involving the health production system as a whole, contributing to an expanded view of foreign dependence that makes SUS vulnerable.

Methodology

This is a qualitative bibliographical research study, involving a literature review and field observation carried out through the application of a semi-structured questionnaire among key informants from Brazil's main official pharmaceutical laboratory. Key informants are people with certain knowledge acquired as a result of their professional training, leadership responsibility or specific experience. They participated in the medicine manufacturing supply chain by providing inputs, materials and products in 2020 and 2021, a period in which the productive sectors were impacted the most by the pandemic.

The classification of main official laboratory is due to it being a health science and technology institution, operating in the areas of education, research, innovation, technological development and medicine manufacturing. The laboratory operates in nine lines of research; holding technology transfer agreements with India, the United States and some European and African countries; it has an installed

production capacity of more than 2.5 billion units of medicines per year, has approximately 33 different types of registered medicines, and manufactures: antibiotics; anti-inflammatories; anti-infectives; antiulcers; analgesics for endemic diseases such as malaria and tuberculosis; antiretrovirals for the treatment of AIDS and viral hepatitis; in addition to manufacturing medicines for the cardiovascular system and the central nervous system. This profile requires a highly qualified supply chain to meet the production needs and demands of the SUS.

In total, 30 participants from the pharmaceutical production and research and development (R&D) supply chain of the laboratory studied were invited to participate. Of these, 18 participated in the survey by answering a questionnaire with semi-structured questions, designed and administered through Redcap, which is a secure platform for creating and managing databases and research in online environments, enabling a diversified data collection and analysis strategy.

The study began with a conceptual approach to the productive base of health, its weaknesses, the problems caused by the pandemic and the foreign dependence on strategic inputs for the production of technologies. Emphasis was placed on health and the economic-industrial complex, highlighting the production of medicines by official laboratories and the importance of manufacturing this technology for Brazilian public health and economic development.

The scientific databases Virtual Health Library (VHL), Scientific Electronic Library Online (SciELO) and Latin American and Caribbean Literature in Health Sciences (LILACS) were consulted, using the keywords: science, technology and innovation; health science and technology policy; pharmaceutical care; health economic-industrial complex, production of products, access to medicines, vaccines, pharmaceutical industry, public health, collective health. These thematic cores were used based on their relation to the productive field of health.

Other non-health-specific databases were also searched, aiming to access references that relate to health but are not found in health-specific databases, such as: supply chain management; economic development; pharmaceutical logistics; production systems; globalization. In total, 425 references

were found among papers, books, book chapters, theses, dissertations, technical notes, websites, and regulations. Of these, 28 were selected as they contained themes related to the study objective.

The empirical part of the study involved field research, with data collection and analysis among key informants. Although the collected data are not subject to quantitative statistical analysis, they provide elements to identify the profile of the supply chain of the official laboratory studied, which sought, with the field survey, to move away from the issue of APIs and pharminochemical industries, since the pandemic has shown that the depletion of several components of the production chain, such as vials, packaging, masks, filters, disposable materials, among others, are also impediments to universal access and the right to health due to the ability to disrupt the production of technologies.

Finally, discussions were held on the findings and, thus, conclusions. The research's ethical issues were previously submitted to the Research Ethics Committee (CEP), which issued a substantiated opinion.

Results and discussion

The literature surveyed in this study shows that the debate on foreign dependence, despite having advanced, has focused more on the issue of APIs and medicines, and the pharminochemical and pharmaceutical industries, highlighting the weaknesses of the chemical and biotechnological-based subsystem of the HEIC.

Despite not being capable of quantitative statistical analysis, field research provides important elements for understanding existing weaknesses in the drug manufacturing supply chain of Brazil's main public pharmaceutical laboratory. The result shows a supply chain composed mostly of small- and medium-sized companies, which supply medium- and low-complexity items for the manufacturing of high-level technologies.

Field research was completed by 60% of the respondents, who participate in the laboratory's supply chain with items that are used in the manufacture of medicines, such as: packaging materials (7); reagents, solvents, and other laboratory supplies (5); transport and distribution of medicines (2); raw material (1); three respondents did not

comment on which items they provided. Regarding how they operate in the supply chain, 11 companies declared that they are only suppliers of materials and products, three are both manufacturers and suppliers, two are only manufacturers, and two did not respond.

Among key informants, eight declared the companies they represent as small sized, six as medium, three as large, and one did not comment their company's size. There is a supply chain made up, mostly, of small- and medium-sized companies (78%), with small ones representing 44.4%, medium-sized 33.3%, and large ones 16.6%.

These data reflect the reality of the Brazilian industrial scenario, in which Micro and Small Companies (MSC) represent more than 90% of the country's companies, accounting for 30% of the Gross Domestic Product (GDP) and more than 50% of all jobs (ABDI/FGV, 2021). As in other segments of the economy, the participation of MSCs in the health sector, through the medicine manufacturing supply chain, is also significant, according to the research results. This demonstrates the attention that must be given to these manufacturers and suppliers, which have an important role to play in public health policies and pharmaceutical assistance in the SUS.

From the main perspective of the HEIC approach, which deals with the health production system, the analysis also allows for the identification of interconnections among different subsystems, illustrating the impact caused on the distribution chain of materials different from those studied by the HEIC. The interdependence among the different systems and the dynamics of the drug and medicine production chain reinforces the extent to which the industry supplying non-final materials interacts with the other subsystems of the complex and needs to be studied, given that debates about the weaknesses and bottlenecks of the health production base (Vargas et al., 2012) have not been expanded to the same extent as the other industries and companies, leaving a gap that this article sought to fill.

Field research among suppliers of Brazil's main official laboratory shows that other actors in the supply chain also face the same problems as those in the chemical and biotechnology base, affecting other bases. In this sense, the HEIC idea of health vulnerabilities is expanded, which focuses more on

the foreign dependence for API as the main reason for weaknesses (Fernandes; Gadelha; Maldonado, 2021; Hasenclever et al., 2018; Vargas et al., 2012), causing articulation with the supply chain of each subsystem, a situation that opens up a future agenda to be better explored in new studies that deepen the

dialogue between the industrial complex and its own bases and expand its scope.

Table 1 summarizes the results of the field research and the profile of the companies that are part of the supply chain studied in the production of essential medicines.

Table 1 – Summary of field research: profile of the supply chain researched, 2022

SUPPLY CHAIN PROFILE			
General Sample	Participants – 30	Respondents – 18	Completion – 60%
Companies size	Small – 44.4%	Medium – 33.3%	Large – 16.6%
Technological complexity of items	High – 27.7%	Medium – 55.5%	Low – 16.6%
Participation in the production chain	Supplier – 61.1%	Manufacturer – 11.1%	Manufacturer and Supplier – 16.1%
Foreign dependence	Yes – 72.2%	No – 22.2%	No Answer – 1
Items provided	Packaging materials – 7		
	Reagents and solvents – 5		
	Active Pharmaceutical Ingredient – 1		
	Transport and distribution – 2		
	Did not respond – 3		
Pandemic impact	Only one participant reported not having been impacted by the pandemic		

The public production of essential medicines for pharmaceutical assistance is addressed in the literature as an important strategy that contributes to the principle of integrality of the SUS (Bermudez et al., 2018) and to strengthen the national pharmaceutical industry, with official pharmaceutical laboratories (OPL) as a strategic resource of the State to boost public production and regulate drug prices in Brazil (Fernandes; Gadelha and Maldonado, 2022; Magalhães; Antunes; Boechat, 2011).

OPLs need to improve their production capacity to supply the SUS with essential medicines and meet pharmaceutical assistance (PA) strategies.

This modernization also involves the supply chain involved in the manufacture of medicines that play an important role in OPL's activities. Studies that address this production chain and provide insight into the factors that cause weaknesses are equally important in contributing to PA strategies.

The new coronavirus pandemic has shown that the problem is not restricted to API. The entire world was left without supplies of various materials to combat the disease, leaving health systems on the verge of collapse due to a lack of materials and other less complex inputs, a situation that drew attention to other components of the supply

chain that can disrupt local production of essential medicines and vaccines, compromising health care.

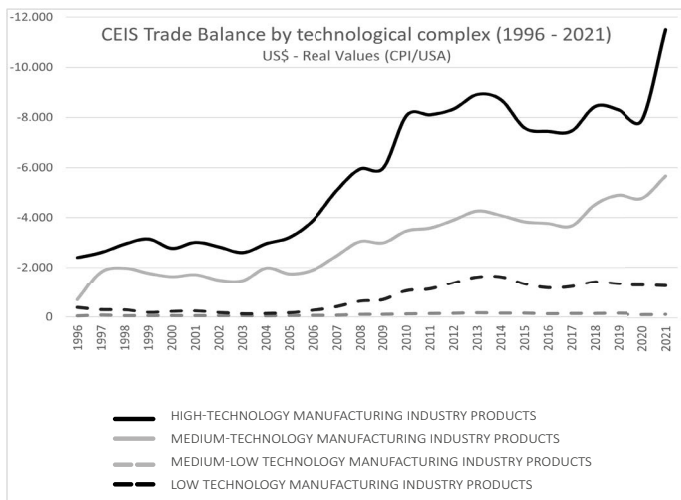
This discussion, which has been occurring over time focusing on the biotechnological basis, gained more space with the need to strengthen local production chains due to the pandemic, and advances in what the debate calls “making the way back,” or deglobalization (De Backer, 2016; WHO, 2021).

The need therefore arises to broaden the debate on the theme of this study, drawing attention to another factor that leads to weaknesses and vulnerabilities in health: the supply chain of non-final components, which are equally strategic for health and have not been considered in literature, public policies and recent approaches in due proportion, because they also constitute technological bottlenecks generated by foreign dependence.

The deficit of the health-specific trade balance shows that low- and medium- technological items also play a role in the trade balance formation. The import of these items, and others, occurs due to the absence of public policies and government incentives that strengthen the expansion of manufacturing facilities proportionally to the growing demands of health. Despite the low technology involved, the short supply of these items creates technological bottlenecks for national production. The manufacturing of medicines and vaccines, which involves a high degree of complexity, is also dependent on less complex materials and inputs.

The trade balance deficit for products from manufacturing industries, including pharmaceuticals, shows the foreign dependence for less technologically complex materials (Figure 1).

Figure 1 – Health trade balance: evolution of the deficit by technological complexity of manufacturing industries, 2022



Source: Gadelha, 2022

The field research highlights that 72.2% of respondents companies rely on imported items to carry out their activities, compared to 22.2% who reported not relying on imports, and one respondent who did not comment on this issue. Considering that only one respondent stated that they were both producer and supplier of raw materials (API), the data indicate that the debate on the need to reduce foreign dependence, and thereby strengthen the pharmaceutical industry and the health production

base, is not restricted to this supply and needs to be extended to the entire supply chain for the production of medicines and vaccines.

The need to import supplies is not exclusive to those with greater technological complexity. More than half (55.5%) of the companies that participated in the field research provide materials and products of medium technological complexity, followed by 27.7% that provide highly complex items, and 16.6% low complexity items. These data reinforce

that studies on the productive base of health must give equal attention to all components, some due to the high values that involve high technological complexity, others due to the strategic importance in manufacturing technologies, despite the low technological complexity.

With the problem of global production chains aggravated by the pandemic, which had major negative impacts on the economies of all countries, especially developing ones, the damage to public health was enormous, highlighting the need for debate on the dangers of globalization and strengthening local production.

Table 2 shows that the need to strengthen local production of strategic items for health systems is already part of the agenda of international organizations, aiming at improving access to health technologies, notably essential medicines and vaccines.

Table 3 provides a non-exhaustive list of the main items used in the manufacture of essential medicines that gain strategic characteristics due to the ability to configure technological bottlenecks in the event of shortages that disrupt the flow of the supply chain.

According to the Brazilian Association of Fine Chemical, Biotechnology and Specialty Industries

(Abifina, 2021), APIs represent the beginning of the pharmaceutical industry’s production chain, but until the end of this chain there is a range of items that can disrupt it in case of supply shortages and quality problems, which impacts the manufacturing and availability of products, making access difficult and harming public health policies.

The pandemic showed that entire production systems can come to a halt if supply chains are disrupted, forcing us to rethink the ways production chains are organized, making it clear that the concentration of strategic items for production in a few countries is harmful to local production systems.

The field research brings other important components about the pandemic’s impact on supply chain activities. When asked about this aspect, only one respondent reported not having been affected by the pandemic, despite saying that they rely on imported material to carry out their activities. Of the others, 76.5% were negatively affected, the main reason being the lack of supplies, followed by workforce absence due to virus contamination and prices increase. Furthermore, 23.5% of companies were positively impacted by the pandemic due to increased demands, which resulted in an increase in business and job creation.

Table 2 – Topics discussed in the sessions of the global forum for local production

WORLD LOCAL PRODUCTION FORUM	
SESSION	KEY MESSAGES
1 – Building the business eco-system for local production	“Long-term government commitment and support for local production are critical to ensure sustained human capital development, financing, regulatory system strengthening and compliance with international quality standards, among others.”
	“With public health as the driver, policies among different ministries should be coherent with shared goals to promote local production and benefit public health needs.”
	“A concerted effort based on multi-stakeholder collaboration, with government support, is critical for market information to be available and accessible for sustainable local production.”
2 – Getting regulatory systems for a pandemic ready	“A strong regulatory system is an important component of the business ecosystem of local production.”
	“Local production and local regulatory capacity should be concomitantly strengthened, as local production without quality assurance does not deliver public health benefits.”
	“Regulatory harmonization and reliance through collaboration and cooperation can help regulatory authorities use limited resources effectively and reduce duplicative regulatory processes.”
	“Communication, information sharing and strengthening of networks are critical to agile regulatory systems and pandemic preparedness.”

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Table 2 – Continuation.

WORLD LOCAL PRODUCTION FORUM	
SESSION	KEY MESSAGES
3 – Unlocking global manufacturing potential through licensing and technology transfer	“Sharing of intellectual property, know-how, trade secrets, etc. and voluntary licensing and effective technology transfer are essential to facilitate rapid scale-up of production capacity.”
	“An enabling environment for technology transfer includes good governance, skilled workforce, access to market information, and viable national/regional markets, among others.”
	“The capacity to receive and absorb the transferred technology should be assessed to produce quality-assured products and to support a sound business plan.”
4 – Expanding access to affordable capital	“Governments need to elevate the importance of the public health agenda and public health security to enable supportive policies to promote a conducive financial environment.”
	“Strong, viable and bankable business cases, which offer long-term commercial sustainability and address local/regional health needs, are crucial to attract financing and investment.”
	“Cooperation and coordination among development banks, donors and other finance providers are essential to share risks.”
5 – Building capacity to enhance access to vaccines and biologic products for COVID-19 and beyond	“Technology, product and location diversification is important for pandemic scenario readiness and sustainability; the hub and spoke model could deliver high impact to the diversification with efficiency and address manufacturers’ training needs and skills development.”
	“Development of skilled human capital is a vital component. Skills and capacity building for manufacturers and regulators are needed to ensure quality and timely market entry. Training in particular areas includes technology transfer, GMP, process development, etc.”
	“Innovative technologies could potentially reduce the time and cost for establishing vaccine manufacturing. It could also generate production flexibility across vaccines and biologics and support long-term commercial viability and sustained capacity.”
6 – Leveraging innovation, AI and the digital revolution in the health products industry	“Innovation can take place in technology, product development, manufacturing processes and business models.”
	“Lower-middle-income countries can leverage on innovation and the digital revolution to strengthen capacity and deliver significant impacts on the production and distribution of health products.”
	“Innovations in artificial intelligence and the digital revolution can address specific challenges faced by lower-middle-income countries related to improving quality, reducing the risk and cost of drug development, data management, analysis and sharing, production, supply chains.”

Source: Authors’ preparation based on the World Health Organization report of the first world local production forum (WHO, 2021)

Of the companies that were negatively impacted, all depend on imported items to carry out their activities, and of those that were positively impacted, all reported not having this dependence. This data highlights how harmful foreign dependence is for internal production and the development of local economies.

When it comes to items used in the production of health technologies, the problem becomes even more serious, because it affects the population’s social demands. In universal health systems, such as the SUS, which have integral health care among

their principles, problems such as the lack of medicines and vaccines compromise the system’s goal, affecting the most disadvantaged sections of the population.

A strong regulatory system contributes to strengthening local production, as it guarantees the quality of medicines with benefits for public health. In this regard, 72.2% of companies reported that they control the quality of the materials and products they supply through management actions, and 22.2% do not. One respondent did not report on this issue.

They also said that they extend their controls to their suppliers, expanding quality actions to other members of the chain.

These percentages are not related to company size, as of the 13 respondents who reported carrying out this control, five are small-sized, five are medium-sized and three are large-sized companies. This is a positive factor in the laboratory's supply chain, because, according to the National Health

Surveillance Agency (Anvisa), in its Board Resolution No. 31/2019, which governs good manufacturing practices (GMP), the pharmaceutical quality system extends from the product development stage to manufacturing activities, in which suppliers are involved, ensuring the correct supply and use of raw materials and packaging materials and the conformity of each receipt, involving the entire supply chain (Brazil, 2019).

Table 3 – Strategic items in the drug production supply chain, 2022

Items used in the production of medicines					
Chemical and biotechnology-based subsystem		Mechanical, electronic and material-based subsystem			
Active pharmaceutical ingredient (API)	Chemical reagents and solvents	Excipients	Packaging materials	Prints	Medical-hospital and consumer materials
Active ingredients used in manufacturing.	Materials used in production quality control, in R&D laboratories and in cleaning production areas and equipment.	Non-active, non-therapeutic substances, used in manufacturing, such as: preservatives, colorings, flavorings, sweeteners, among others.	Primary, secondary and tertiary packaging, such as: cardboard boxes, flasks, caps, tubes and blisters.	Labels and package inserts.	Consumable materials used to support manufacturing, such as: filters, personal protective materials – gloves, lab coats, caps, shoe covers, masks, among others.

According to respondents, opportunities for improvements to tackle the challenges include public policies to reduce dependence on imports, bureaucracy tape, tax burden, operating costs, and regulatory burdens and to improve national infrastructure. Actions to promote innovation, qualify the workforce, and encourage the continuous improvement of processes and the participation of experts in policy-making for the sector were also mentioned as opportunities for improvements to face challenges in the national supply chain and the logistics involved.

Worryingly, it is noteworthy that only one company expressed the need to take care of the environment and use renewable sources in the health production chain as a change for the future, contrary to the debate promoted by the UN environment assembly, on sustainable consumption and

production, considering a post-COVID-19 global scenario of the environmental dimension of production (UN, 2022).

Final considerations

Based on the data in this study, it is concluded that foreign dependence in the HEIC trade balance does not only affect the pharminochemical and pharmaceutical industries in the production of active pharmaceutical ingredients and medicines and more complex supplies. Despite the greater attention to APIs in the literature, this problem extends to the entire medicine production supply chain, encompassing other consumer items of lesser technological complexity, weakening the healthcare production base.

The pandemic, which unfolds into the post-pandemic context, has highlighted the strategic importance of local production as a determining factor in promoting universal access and sovereignty in health, by mitigating the technological bottlenecks caused by foreign dependence.

The fragility of the local production chain is a factor that impacts the sustainability of the SUS, highlighting the need for a more comprehensive view of all the productive components of the Health Economic-Industrial Complex that support the SUS, seeking to expand the scope of the existing literature, restricted to active pharmaceutical ingredients, medicines and vaccines, failing to consider other critical items without which local production is not viable.

With this, we hope to have contributed to expanding the current debate on healthcare vulnerabilities, relating the productive and economic structure to universal access, and establishing a theoretical link between the economy, local production and social rights (ELAC, 2021; WHO, 2021).

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Authors' contribution

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