Technical Note

THE IMPACT OF PDPS ON THE PRICE OF MEDICATION FOR THE UNIFIED HEALTH SYSTEM

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1 INTRODUCTION[1,2]

Productive Development Partnerships (Parcerias para o Desenvolvimento Produtivo – PDPs) are an innovation incentive policy in which the Ministry of Health (Ministério da Saúde – MoH), through the Unified Health System (Sistema Único de Saúde – SUS), is the end user of a purchase. As an innovation promotion tool, PDPs seek to promote the dissemination and absorption of technology (i.e., medication, vaccines, blood products, and health products) already available in the national and international markets, possibly leading to incremental innovation (Pimentel, 2018), stimulating the development of the Health Industrial Complex through a systemic effort (Gadelha and Temporão, 2018).[3]

From an institutional perspective, PDPs were created in 2008 through a slow process, including different editions of the MoH ordinances. Still, it was only in 2012 that its Regulatory Framework was published (Brasil, 2009). The gaps that have been found resulted in the issue of a new ordinance in 2014 (Brasil, 2014), which still is the main regulatory mechanism.

From a political perspective, PDPs have encouraged debates. Because it is a complex tool that comprises different organizations (public laboratories, national and international private companies, besides the Brazilian Development Bank,[4] the Project and Research Financing Agency,[5] the Brazilian Health Regulatory Agency,[6] and the ministerial offices that are part of evaluation committees and commissions) and includes an increasing allocation of public resources (from R$ 1.32 billion in 2011, a spike of R$ 4.8 billion in 2014, and R$ 2.20 billion in 2020),[7] academia has gradually shown interest in the topic, analyzing and evaluating PDPs in a segmented and interdisciplinary way.

The goal of this technical note is to present a summary of contributions of academic works whose focus was on evaluating PDPs regarding their objective of protecting the interests of public administration by seeking economic viability and advantages regarding the price of SUS's strategic products.[8]

Systematic searches[9] of articles published in scientific journals indexed in Web of Science, Scopus, and Scielo databases were conducted to identify those studies. Master's theses and Ph.D. dissertations were also traced by using the Theses and Dissertations Catalog of the Coordination for the Improvement of Higher Education Personnel (Coordenação de Aperfeiçoamento de Pessoal de Nível Superior – CAPES) and the Brazilian Digital Library of Theses and Dissertations of the Brazilian Institute of Information in Science and Technology (Instituto Brasileiro de Informação em Ciência e Tecnologia – IBICT), which also include information about the final papers of graduate degrees in the country's higher education and research

1. The authors thank Fernanda de Negri and Pedro Miranda for the careful readings and whose recommendations and suggestions were not only accepted, but a source of reflection and inspiration for the most substantial reformulations of this document. This technical note was firstly published in Portuguese, identified as *O Impacto das PDP nos Preços de Medicamentos para o SUS: uma revisão semissistemática da literatura* (Nota Técnica Diset, n. 111/2023).

2. This work was funded by the Brazilian Ministry of Health (TED No. 06/2022).

3. For an overview on PDPs' evolution see, e.g., Rezende (2013; 2022), Varrichio (2017), Pimentel (2018), and Pimentel, Paranhos and Chiarini (2022).

4. Banco Nacional de Desenvolvimento Econômico e Social (BNDES).

5. Financiadora de Estudos e Projetos (Finep).

6. Agência Nacional de Vigilância Sanitária (Anvisa).

7. Rezende (2022) systematized the nominal values according to the data available at the Brazilian Federal Register and deflated them based on the General Market Price Index (Índice Geral de Preços Mercado – IGP-M), base year 2020, available at Ipeadata.

8. Art. 3 of MoH Ordinance No. 2.531 of 2014 establishes PDPs' objectives. Objective number IV is "to protect the interests of public administration and society by seeking economic viability and advantages, considering prices, quality, technology and social benefits" (Brasil, 2014).

9. The search was conducted on August 3rd, 2022.

institutions. The systematic research revealed 51 documents related to PDPs. However, only seven were about economic viability and advantages.

This technical note is structured as follows: section 2 presents the protocol for selecting the documents to be considered in the semi-systematic literature review. Section 3 offers the contributions of each of those seven studies that were focused on the evaluation of PDPs regarding their objective of protecting the interest of public administration by seeking economic viability and advantages. The last section discusses the final remarks.

2 METHODOLOGICAL PROCEDURES

The literature review proposed in this technical note adopts the "semi-systematic review approach." It is the method of literature review used to identify and critically evaluate relevant research about a specific topic. It was designed for topics conceptualized in different ways and studied by many groups of researchers within different fields of knowledge, making difficult a complete and pure systemat ic review process (Snyder, 2019).

> However, while covering broad topics and different types of studies, this approach holds that the research process should be transparent and should have a developed research strategy that enables readers to assess whether the arguments for the judgments made were reasonable, both for the chosen topic and from a methodological perspective (Snyder, 2019, p. 335).

Therefore, a semi-systematic review identifies the empirical evidence that fits in the inclusion criteria preset to answer a particular research question (Snyder, 2019).

The research protocol is presented to ensure the reproducibility of the literature review in this technical note. In the pre-analysis stage, the documents that discuss PDPs were identified in the databases indicated in table 1. Its exhaustive search strategy considered the terms and Boolean operators described in the same table.[10]

10. The Boolean operators AND, OR, and NOT are useful for helping in searches. By using the operator AND (or "E"), it is possible to find articles that contain all the keywords searched, i.e., through an intersection. On the other hand, the operator OR (or "OU") presents a union of sets, showing the articles containing at least one of the keywords. For last, the term NOT (or "NÃO") includes the first term of the search and excludes the second, allowing to refine even more the results.

TABLE 1
Search terms

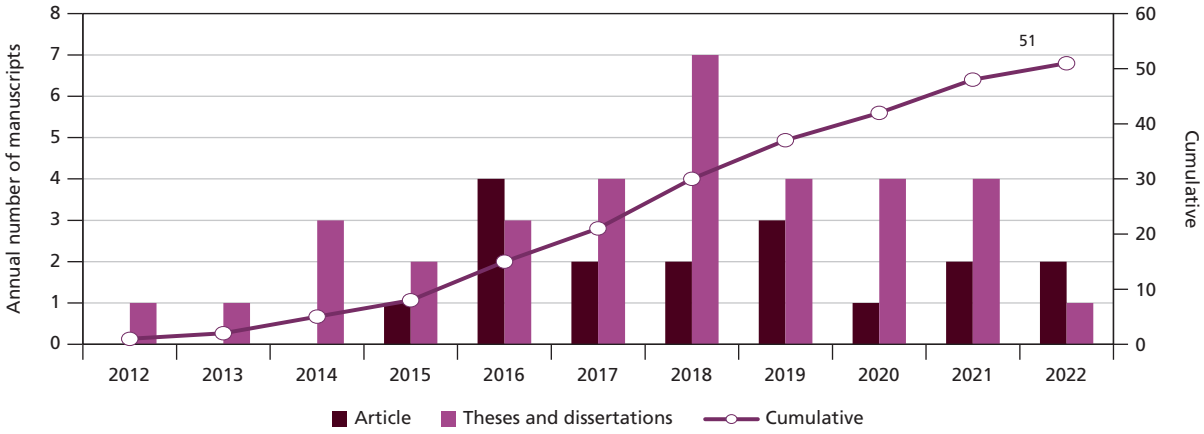
Type of document	Database	Search date	Search terms and Boolean operators
Theses and dissertations	CAPES[1]	Aug. 3rd, 2022	(("parceria para o desenvolvimento produtivo") OR ("parcerias para o desenvolvimento produtivo") OR ("parceria de desenvolvimento produtivo") OR ("parcerias de desenvolvimento produtivo"))
	IBICT	Aug. 3rd, 2022	((TITLE: "parceria para o desenvolvimento produtivo" E ABSTRACT: "parceria para o desenvolvimento produtivo") OR (Title: "parcerias para o desenvolvimento produtivo" E Abstract: "parcerias para o desenvolvimento produtivo") OR (TITLE: "parceria de desenvolvimento produtivo" E Abstract: "parceria de desenvolvimento produtivo") OR (TITLE: "parcerias de desenvolvimento produtivo" E ABSTRACT: "parcerias de desenvolvimento produtivo"))
Indexed articles	Web of Science	Aug. 3rd, 2022	"productive development partnership*" (Title) OR "partnership* for productive development" (Title) OR "productive development partnership*" (Abstract) OR "partnership* for productive development" (Abstract) OR "parceria* para o desenvolvimento produtivo" (Title) OR "parceria* de desenvolvimento produtivo" (Title) OR " parceria* para o desenvolvimento produtivo" (Abstract) OR "parceria* de desenvolvimento produtivo " (Abstract) AND (LIMIT-TO (DOCTYPE,"ar"))
	Scopus	Aug. 3rd, 2022	(TITLE-ABS-KEY("parcerias para o desenvolvimento produtivo") OR TITLE-ABS-KEY("parceria* de desenvolvimento produtivo") OR TITLE-ABS-KEY("productive development partnership*") OR TITLE-ABS-KEY("partnership* for productive development")) AND (LIMIT-TO (DOCTYPE,"ar"))
	Scielo	Aug. 3rd, 2022	((ti:(parceria para o desenvolvimento produtivo)) OR (ti:(parcerias para o desenvolvimento produtivo)) OR (ti:(parceria de desenvolvimento produtivo)) OR (ti:(parcerias de desenvolvimento produtivo)) OR (ti:(productive development partnership)) OR (ti:(productive development partnerships)) OR (ti:(partnership for productive development)) OR (ti:(partnerships for productive development))) OR (ab:(parceria para o desenvolvimento produtivo)) OR (ab:(parcerias para o desenvolvimento produtivo)) OR (ab:(parceria de desenvolvimento produtivo)) OR (ab:(parcerias de desenvolvimento produtivo)) OR (ab:(productive development partnership)) OR (ab:(productive development partnerships)) OR (ab:(partnership for productive development)) OR (ab:(partnerships for productive development)) AND (LIMIT-TO (DOCTYPE,"ar"))

Authors' elaboration.
Note: [1] Search carried out in all fields. CAPES' catalog of theses and dissertations has no filter options.
Obs.: The term "PDP" was excluded because it was associated with works that address other topics, e.g., Productive Development Policies (Política de Desenvolvimento Produtivo – PDP), Product Development Process (Processo de Desenvolvimento de Produtos – PDP), Deep Pain Perception (Percepção de Dor Profunda – PDP), Planned Home Birth (Parto Domiciliar Planejado – PDP), No-Till Farming (Plantio Direto Permanente – PDP), Parallel Distributed Processing (PDP) etc.

The initial search resulted in 42 articles and 57 theses and dissertations. After eliminating the duplicated entries and excluding the non-relevant terms (works that did not address PDPs but were found by the search system), 17 indexed articles and 41 theses and dissertations were achieved. After reading those documents, seven papers were not considered because, although they mentioned PDPs, the focus was not on analyzing them since they were marginally presented.

The set of manuscripts addressing distinct aspects of PDPs has been growing over time, according to figure 1, and the number of theses and dissertations is much higher than the indexed articles. The topics addressed range from studies evaluating the management capacity of public laboratories to the ones analyzing the regulatory alignment between Anvisa and MoH to promote PDPs.

FIGURE 1
Annual and cumulative number of academic about PDPs (2012-2022)



Source: CAPES, IBICT, Scielo, Scopus, and Web of Science.
Authors' elaboration.

One of the less discussed topics is related to the effort of evaluating the gap in the price of medication seeking economic viability in favor of the Federal Government. Seven manuscripts were identified after reading the 51 previously selected documents.[11]

3 AFTER ALL, DO PDPs GENERATE ECONOMIC VIABILITY?

Economic viability aims at minimizing costs without affecting quality.[12] Therefore, it is observed that not always the lowest price will be the one that best serves the interest of public administration since the technical features shall also be taken into account.

The seven works found were gathered in table 2. Although it was observed that there were works including analyses of PDPs regarding their distinct aspects since 2012 (Pimentel, 2012), Andrade's (2014) work was the first study identified that makes a temporal analysis of physical and financial numbers of drug procurement carried out in a centralized way by the MoH. The author aims to analyze PDPs considering the local component of pharmaceutical care and its significance in serving the Brazilian market.

The study of Andrade (2014) showed that from the 46 drugs of PDPs approved between 2009 and 2012, only five were delivered to the MoH until 2012 – tacrolimus (1 mg), rivastigmine (3 mg, 4.5 mg, and 6 mg), quetiapine (25 mg, 100 mg, and 200 mg), clozapine (25 mg and 100 mg), and tenofovir (300 mg) – and were analyzed by the author. After adjusting the prices for inflation according to the Extended National Consumer Price Index – IPCA (keeping the 2013 prices as the base year) and by comparing the unit values of the national public laboratories to the last value charged by private pharmaceutical companies or to the value of reimbursement of the Authorization for High Complexity Procedures, Andrade (2014) noted that the procurement of eight (80%) of those drugs was more economical to MoH after carrying out PDPs, while the procurement of two (20%) was more expensive. According to the author, in the drug procurement with PDPs, more than R$ 114 million were saved in a year (2013 current prices).

11. One thesis (Albareda, 2020) was not considered. Although it addresses PDPs' economic viability analysis, it was published in a shorter version, as an article (Albareda and Torres, 2021) with the same title. We preferred to keep only the indexed article.

12. Available at: https://www.congressonacional.leg.br/legislacao-e-publicacoes/glossario-orcamentario/-/orcamentario/termo/principio_da_economicidade.

Chaves et al. (2015) analyzed the government's strategies for reducing MoH's prices in procuring antiretroviral medicines for human immunodeficiency virus (HIV). They studied the public expenditure related to those drugs from 2005 to 2013, comparing it to international prices. The authors studied the procurement of atazanavir (200 mg and 300 mg) through the records in the Integrated System for the Administration of General Services (Sistema Integrado de Administração de Serviços Gerais – SIASG) and, after comparing the prices paid in Brazil to the lowest price charged by Bristol-Myers Squibb – BMS (discount price) and the price of the generic version, they revealed that the prices charged in Brazil were the highest. Furthermore, they identified a price reduction after the PDP agreement was signed. In the year immediately before signing the PDP, atazanavir 200 mg was purchased at a unit value of R$ 3.89 and, in 2013, by R$ 3.40 (2011 prices). In turn, the 300 mg version dropped from R$ 6.12 to R$ 5.58 in the same period.

Moraes, Osorio-de-Castro, and Caetano (2016) investigated the federal procurement of the antineoplastic drugs imatinib mesylate (in 100 mg and 400 mg tablets versions), trastuzumab (440 mg vial) and L-asparaginase (10.000 UI vial), whose time series comprises from 2004 to 2013. The data was collected from SIASG, and the average weighted prices of each drug were calculated based on the volumes acquired and the unit prices charged at the procurement for each year of the series. Moreover, using the simple linear regression (method of ordinary least squares), a progressive reduction in the average weighted prices of the antineoplastic drugs for the period was found. The largest reductions were registered in procurements before the PDPs' approval. L-asparaginase was the exception, whose procurement associated with PDPs increased above 100% of its average price.

Chaves, Hasenclever, and Oliveira (2018) assessed the public procurement of tenofovir 300 mg, an antiretroviral drug used to control HIV infection. The authors noticed a reduction in the drug unit price (adjusted according to IPCA) during the legal effect of the PDP (2011 to 2013) between Ezequiel Dias Foundation (Fundação Ezequiel Dias – Funed), Nortec Química, and Blanver. However, the prices were higher than Cipla's generic version. The authors pointed out a difference of about ten times between the price of the product resulting from the PDP and the price of the generic drug offered by the Indian company. However, the company did not have sanitary registration for the medication in the country until 2012. Although the MoH could not acquire the medicines at the prices charged by Cipla, Chaves, Hasenclever, and Oliveira (2018, p. 15) confirm that:

> the fact that Cipla has systematically reduced the price of the product through the year shall serve as a reference for the prices charged nationally and also in the context of industrial policy, especially when the product in question reflects a considerable increase in the volume acquired and the MoH expenditure, as it was the case of tenofovir during the period analyzed.

Also, by analyzing the data on the public procurement of antiretroviral drugs for controlling HIV infection, Prata (2018) evaluated the impact of PDPs (in different stages) on the final price of those medicines. The author started by calculating the annual average unit prices from 2008 to 2015, applying the IPCA deflator (base year 2015). Considering the direct procurement of medications in the scope of PDPs in stage 2 and stage 3 – although the medicines of stage 2 are not acquired within PDP agreements because they are still in the product development stage with pending registration requested at Anvisa –, Prata (2018) demonstrated that the average price values presented a small reduction for the period, while there was an increase in the number of the pharmaceutical units.

Therefore, Prata (2018) – by using linear regression to verify if the government intervention would have allowed a reduction of the average prices with a subsequent increase of the pharmaceutical units acquired – showed that there is an antagonistic tendency between these two studied variables, with an increasing tendency for the quantity and a decreasing for the price, which may, imply the assumption that there was: an impact of politics on the price of medication, a natural adjustment of the price by the economy of scale, or an interaction effect of those two factors. Prata (2018) divided the average unit price curve into three periods: i) before the intervention (until 2019); ii) from the beginning of the intervention until 2011; and iii) post-2011.

The author created two groups for analysis: i) the control group (non-PDP), which he considers the historical profile of the average unit price of drugs that were not included in PDP's scope; and ii) the treatment group (PDP), which comprises the historical profile of the average unit price of drugs that were included within the PDP's scope at any studied stage and period.

Between 2008 and 2009, Prata (2018) demonstrated a reduction in the average unit price of drugs included in the treatment group (PDP), revealing a strong tendency for a price decrease. On the other hand, the medicine included in the control group (non-PDP) showed a price increase. From 2009 to 2011, there was a reduction in the average unit price for both groups analyzed. Between 2011 and 2015, Prata (2018) highlighted a negative tendency for the treatment group and a positive for the other group. To present a more solid analysis, the author used the econometric method of difference-in-difference with fixed effects (diff-in-diff) to isolate the effect in question by comparing the groups. With the models, the author showed that the causal relationship of politics is statistically true, i.e., the quantity does not influence the effect of the intervention in the price reduction in the model.

Santana (2018) estimated the budget impact of incorporating the biosimilar infliximab in treating rheumatoid arthritis in SUS. To this end, the author used the claims data-based model, which estimates the number of users based on the usage history of a determined technology, to project the impact between 2017 and 2021. In other words, the author used the SUS Outpatient Information System database to estimate the use of the medication by patients diagnosed with the disease (ICD-10: M050, M053, M058, M060, M068, M080) who were prescribed infliximab.

For the estimates, Santana (2018) considered as a reference scenario the use of infliximab for all the cases of rheumatoid arthritis and, as alternative scenarios, she ran the following simulations: i) only the new cases of rheumatoid arthritis that received the innovative infliximab (Remicade) would use the biosimilar infliximab (Remsima) – or the PDP infliximab, considered by the author as a "non-comparable biologics" –; and ii) both the new cases and 50% of those already using the innovative infliximab used the biosimilar infliximab (or the PDP infliximab) in increasing proportions.

For estimating the costs for each scenario, were considered: the number of vials per treatment session for a 70 kg patient, the quantity of 100 mg per vial, and the dose determined by the Clinical Protocols and Therapeutic Guidelines – PCDT (3 mg/kg). Furthermore, one-way sensitivity analyses were carried out to evaluate the degree of uncertainty of the estimates used in the study and to test the strength of the results, considering a progressive diffusion of the two products and with the worst and the best-case scenarios. Those scenarios were analyzed with the simultaneous variation of the relevant parameters as the price of biosimilars, the cost of the reference medication, the population estimates, the patient's weight, and the "market quota" for biosimilars to obtain a combination of estimates less or more favorable, respectively, to the incorporation of new biosimilar drug and the PDP product. A third sensitivity analysis was carried out to evaluate the impacts of the variations in the diffusion rate of new technologies, varying the proportion of cases that will use the biosimilar and the PDP product in each scenario.

The estimates found by Santana (2018) show that if the population with rheumatoid arthritis in SUS with a prescription for infliximab treatment continued using the innovative medication (Remicade), that would represent a total expenditure of R$ 1.5 billion in five years. Prescribing the biosimilar infliximab (Remsima) to 100% of the new patients would reduce the spending to R$ 1.2 billion, meaning savings of R$ 284 million in five years. Incorporating the PDP's infliximab for 100% of the new patients would mean savings of R$ 366 million for the same period.

In the second strategy, the savings generated would result in R$ 419 million for the biosimilar (Remsima) and R$ 539 million for the PDP product. In the sensitivity analysis by progressive diffusion, it was also observed savings considering the different strategies. The best-case scenario analysis showed savings of R$ 1.011 million and R$ 1.222 million for the biosimilar (Remsima) and the PDP product, respectively. On

the other hand, in the worst-case scenario, the estimates indicate that introducing the analyzed technologies would burden SUS with R$ 8.5 million and R$ 5.3 million for the biosimilar and the PDP product, respectively.

For last, Albareda and Torres (2021) studied the economic viability by comparing the medication acquired through the waiver of competitive bidding (through PDP) and regular competitive bidding using the variables of quantity, unit price, and total amount per procurement. The authors analyzed the procurement through PDPs for 51 products (33 drugs) in stages 3 and 4. The authors identified 186 purchases made through PDPs between 2009 and 2018 and compared them with the procurement made outside PDPs. They noticed a considerable reduction in the average unit price paid for the medication within PDPs.

> Trastuzumab showed a price reduction between 20% and 30%. Tacrolimus 1 mg also revealed a drop in the average price of around 30% to 40%. For four drugs (atazanavir 300 mg, NPH insulin, thermostable ritonavir, and sevelamer), a decrease between 40% and 50% was observed. For the other 32 drugs, the reduction in the average acquisition price was greater than 50% (Albareda and Torres, 2021, p. 7).

However, tacrolimus 5 mg showed an increase of 10.92% in the average unit price, and clozapine 25 mg recorded an increase of 3.49%.

TABLE 2

Studies that evaluate PDPs concerning their objective of protecting the public administration interest, considering the prices of strategic products for SUS

Authors	Title	Evaluation method	Medication studied	Period	Main results
Andrade (2014)	Contribution of the national public laboratories in the MoH procurement of drug policy.[1]	Temporal analysis of physical and financial numbers of medication procurement carried out centralized by the MoH.	Tacrolimus 1 mg	2009-2012	Although there are no counterfactual analyses, the study shows that the procurement of 80% of these drugs was more economical for the MoH after the PDPs, and the procurement of 20% was more expensive (clozapine 25 mg and 100 mg).
			Rivastigmine 3 mg, 4 mg, 5 mg, and 6 mg		
			Quetiapine 25 mg, 100 mg, and 200 mg		
			Clozapine 25 mg and 100 mg		
			Tenofovir 300 mg		
Chaves et al. (2015)	Strategies for price reduction of HIV medicines under a monopoly situation in Brazil.	Temporal analysis of physical and financial numbers of procurement of antiretroviral drugs for acquired immunodeficiency syndrome (AIDS) carried out in a centralized way by the MoH.	Atazanavir 150 mg, 200 mg, and 300 mg	2011-2013	The drug procurement prices showed a reduction in the unit value comparing the year immediately prior to the signing of the PDP to the two subsequent years. However, the study lacks counterfactual analysis and hypothesis testing.
Moraes, Osorio-de--Castro and Caetano (2016)	Federal procurement of antineoplastic drugs in Brazil: analysis of imatinib mesylate, trastuzumab and L-asparaginase, 2004-2013.	Temporal analysis of physical and financial numbers of medication procurement carried out centralized by the MoH.	Imatinib 100 mg and 400 mg	2004-2013	Although the article brings no causal analysis, the study suggests that the inclusion in PDP and the procurement centralization by the MoH seem to justify the price reductions for imatinib and trastuzumab. Still, L-asparaginase showed an increase of more than 100% in its average price.
			Trastuzumab 400 mg		
			L-asparaginase		
Chaves, Hasenclever and Oliveira (2018)	Price reduction of monopoly medicine in the SUS: the case of Tenofovir.	Temporal analysis of physical and financial numbers of medication procurement carried out centralized by the MoH.	Tenofovir 300 mg	2003-2013	Reduction in the unit price of the drug during the PDP term (2011 to 2013), but the study lacks analyses with control groups.
Prata (2018)	The role of SUS in innovation: a study on technology transfer in Brazil.[1]	Econometric analysis using linear regression method of difference-in-difference (diff-in-diff).	Lamivudine 10 mg	2008-2015	The study compared drugs included and not included in the program with results that show a reduction in the purchase price, providing wider access to these drugs.
			Tenofovir 10 mg		
			Darunavir, 75 mg and 150 mg		
			Etravirine 100 mg		
			Maraviroc 150 mg and 300 mg		
			Raltegravir 400 mg		
			Tipranavir 100 mg and 250 mg		

(Continues)

(Continued)

Authors	Title	Evaluation method	Medication studied	Period	Main results
Santana (2018)	Budgetary impact of the incorporation of biosimilar infliximab in the treatment of rheumatoid arthritis from the perspective of the Brazilian Public Health System.	Claims data-based model.	Infliximab	2017-2021	Incorporation of the PDP drug for the treatment of rheumatoid arthritis offers a reduction in SUS's expenses, considering the contrafactual (procurement of Remicade). However, the one-way sensitivity analyses, considering a progressive diffusion of the two products (Remsima and infliximab from the PDPs) and with the worst and the best-case scenarios, showed a burden when considering the worst-case scenario.
Albareda and Torres (2021)	Assessment of the economic savings and advantages of PDPs.	Temporal analysis of physical and financial numbers of medication procurement carried out centralized by the MoH.	33 drugs	2009-2018	There was a reduction in the drug procurement cost after the PDPs (prices charged at competitive bidding) in most of the studied drugs. Still, tacrolimus 5 mg and clozapine 25 mg registered an increase in their average unit prices.

Authors' elaboration.
Note: [1] For this article, the titles of these two works were translated into English, and their original ones are listed in the references in Portuguese.

4 FINAL REMARKS

Based on what was presented in this technical note, it was possible to verify that the studies addressing PDPs have been growing over time, covering different topics. Despite this growing interest, the economic viability evaluation is still incipient.

Seven studies that evaluate PDPs regarding their objective of protecting the public administration interest by seeking economic viability and advantages considering the price of strategic products for SUS were found. All those works show that the analytical methods presented are heterogeneous for most analyzed drugs. Some works show a reduction in the price of PDP products (like Andrade, 2014); there is one work that compared the price of PDPs drugs with the prices charged at competitive biddings (Albareda and Torres, 2021), and a study that analyzed the impact of the price of PDPs drugs based on the estimate of the number of individuals who use a specific drug (Santana, 2018).

Although the contributions to understanding PDPs, it is worth mentioning that only the most recent works present contrafactual analyses (Prata, 2018; Santana, 2018; Albareda and Torres, 2021) using different methodologies and control groups. For last, it is noteworthy that only one work (Prata, 2018) presented a more robust statistical method by verifying if the observed decrease in price was a result of the drug pricing policy or if it was a natural adjustment of prices by the economy of scale, since, as the studies presented in table 2 show, the SUS procurement increased in terms of quantity of medication.

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APPENDIX A

MAIN TOPIC OF THE DOCUMENTS ANALYZED

TABLE A.1
List of articles, dissertations and theses pertinent to this work

Source	Authors	Titles	Main topic identified
CAPES[1]	Santana, Pamela Karla Guimaraes	Impacto orçamentário para o Sistema Único de Saúde da incorporação do infliximabe biossimilar no tratamento de artrite reumatoide	-
IBICT[2]	Andrade, Wenderson Walla	Contribuição dos laboratórios farmacêuticos públicos na política de aquisição de medicamentos do Ministério da Saúde	Evaluation of medicine procurement
Scielo	Chaves, Gabriela Costa, Hasenclever, Lia, Osorio-De-Castro, Claudia Garcia Serpa, Oliveira, Maria Auxiliadora	Estratégias de redução de preços de medicamentos para aids em situação de monopólio no Brasil	Evaluation of the price development of atazanavir
Scielo	Moraes, Elaine Lazzaroni, Osorio-De-Castro, Claudia Garcia Serpa, Caetano, Rosangela	Compras federais de antineoplásicos no Brasil: análise do mesilato de imatinibe, trastuzumabe e L-asparaginase, 2004-2013	Analysis of the profile of purchases made
Scielo	Chaves, Gabriela Costa, Hasenclever, Lia, Oliveira, Maria Auxiliadora	Redução de preço de medicamento em situação de monopólio no Sistema Único de Saúde: o caso do Tenofovir	Evaluation of the evolution of tenofovir prices
IBICT/CAPES	Prata, Wallace Mateus	O papel do Sistema Único de Saúde (SUS) na inovação: um estudo sobre transferência de tecnologia no Brasil	Evaluation of Productive Development Partnerships (Parcerias para o Desenvolvimento Produtivo – PDPs) in the final price of medicines
IBICT/CAPES	Albareda, Alexandra Patricia	Avaliação da economicidade e vantajosidade da política pública das parcerias para o desenvolvimento produtivo	Economic viability evaluation
Scielo	Albareda, Alexandra, Torres, Ricardo Lobato	Avaliação da economicidade e da vantajosidade nas Parcerias para o Desenvolvimento Produtivo	Economic viability evaluation
IBICT	Oliveira, Nilceu José	Assistência farmacêutica no Brasil: uma análise bioética no interesse do melhor acesso	Mapping of policies aimed at medicine production and distribution benefits technological independence
CAPES	Scopel, Carolinne Thays	Modelo de análise das Parcerias para o Desenvolvimento Produtivo de medicamentos na perspectiva da saúde pública	Proposal of methodology to evaluate PDPs from the perspective of access to medicines
Scielo	Figueiredo, Tatiana Aragão, Schramm, Joyce Mendes de Andrade, Pepe, Vera Lúcia Edais	A produção pública de medicamentos frente à Política Nacional de Medicamentos e à carga de doenças no Brasil	Analysis of the list of strategic products
Scielo	Fernandes, Daniela Rangel Affonso, Gadelha, Carlos Augusto Grabois, Maldonado, Jose Manuel Santos de Varge	O papel dos produtores públicos de medicamentos e ações estratégicas na pandemia da covid-19	Evaluation of activities during the pandemic
CAPES	Costa, Silvia Moreira Taketsuma	A indústria de biossimilares no Brasil: desafios e oportunidades	Evaluation of the challenges faced by companies for the local production of biosimilars
IBICT	Miranda, Pedro Henrique Marques Villardi	Saúde pública, patentes farmacêuticas e acesso a medicamentos: arranjos para a produção de medicamentos essenciais no Brasil (1960-2012)	Analysis of how the Brazilian government deals with the monopolies created by pharmaceutical patents, namely the TRIPS and the Industrial Property Law (LPI) safeguard, aiming to protect Public Health.

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Source	Authors	Titles	Main topic identified
Scielo	Costa, Laís Silveira, Metten, Antoine, Delgado, Ignácio José Godinho	As Parcerias para o Desenvolvimento Produtivo em saúde na nova agenda de desenvolvimento nacional	Assessment of political and institutional elements
Scopus	Gomes E.B.P., Rosseto R., Pinheiro L., Hasenclever L., Paranhos J.	Desenvolvimento de biossimilares no Brasil	Analysis of the biosimilars industry in Brazil
WoS	Silva, Gabriela de Oliveira; Rezende, Kellen Santos	Parcerias para o desenvolvimento produtivo: a constituição de redes sociotécnicas no Complexo Econômico-Industrial da Saúde	Evaluation of networks among the main actors of the PDPs
Scielo	Gadelha, Carlos Augusto Grabois, Temporão, José Gomes	Desenvolvimento, Inovação e Saúde: a perspectiva teórica e política do Complexo Econômico-Industrial da Saúde	Analysis of the main ideas of the Health Economic and Industrial Complex approach
Scielo	Rezende, Kellen Santos, Silva, Gabriela de Oliveira, Albuquerque, Flávia Caixeta	Parcerias para o Desenvolvimento Produtivo: um ensaio sobre a construção das listas de produtos estratégicos	Analysis of the list of strategic products
IBICT/CAPES	Oliveira, Gabriela Rocha Rodrigues de	Políticas industriais no contexto do Complexo Econômico-Industrial da Saúde: um olhar sobre o caso das Parcerias para o Desenvolvimento Produtivo	Mapping of industrial policies carried out in health-related sectors
CAPES	Alvares, Lais Botelho Oliveira	Desenvolvimento e o complexo econômico-industrial da saúde: estudo de caso da política pública das parcerias para o desenvolvimento produtivo	Evaluation of policy logic
CAPES	Espindola, Michele Vieira	Proposta de uma Parceria de Desenvolvimento Produtivo como fortalecimento da relação SUL-SUL	PDP proposal involving a South American company (Uruguayan – Megalabs) with National Public Laboratories (LFOs)
IBICT/CAPES	Luzia, Alisson Bruno	Transferência de tecnologia e parceria para o desenvolvimento produtivo no setor de biotecnologia: um estudo de caso na Fundação Ezequiel Dias	Evaluation of technology transfer
IBICT	Silva Junior, Edison Nunes da	Requisitos da qualidade no projeto de transferência de tecnologia aplicados em uma empresa de produtos biológicos	Assessment of quality requirements
IBICT/CAPES	Santos, Gregório Bittencourt Ferreira	O PES aplicado à análise estratégica das parcerias de desenvolvimento produtivo	Assessment of gaps in strategic planning
IBICT	Alves, Simone Basile	Como os acordos de parceria podem melhorar o desempenho das atividades de PD&I na área de fármacos e medicamentos	Analysis of routine and practice of PDP management that can lead to better results in research, development and innovation (RD&I) activities
CAPES	Silva, Gabriela de Oliveira	Parcerias para o Desenvolvimento Produtivo e a produção pública de medicamentos: uma proposta de monitoramento estratégico	Proposal of methodology for strategic assessment of PDPs
Scielo	Costa, Nilson do Rosário, Lago, Regina Ferro do, Sousa, Ana Cristina Augusto de, Raupp, Augusto da Cunha, Jatobá, Alessandro	Complexo Econômico-Industrial da Saúde e a produção local de medicamentos: estudo de caso sobre sustentabilidade organizacional	Assessment of organizational sustainability condition
IBICT/CAPES	Fernandes, Daniela Rangel Affonso	Fatores críticos de sucesso em Parceria para o Desenvolvimento Produtivo – PDP – Estudo de caso em um laboratório farmacêutico público (Farmanguinhos)	Evaluation of critical factors in the management of PDPs from the stakeholders' point of view
Scielo	Silva, Gabriela de Oliveira, Elias, Flávia Tavares Silva	Parcerias para o Desenvolvimento Produtivo: uma proposta de monitoramento estratégico	Proposal of methodology for strategic monitoring
CAPES	Souza, Monica da Silva	Parcerias para o Desenvolvimento Produtivo como estratégia para o desenvolvimento do Complexo Econômico-Industrial da Saúde: desafios para o Sistema Fiocruz	Evaluation of Oswaldo Cruz Foundation's (Fiocruz) Planning System monitoring

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Source	Authors	Titles	Main topic identified
IBICT/CAPES	Zanon, Marcus Julius	Riscos na transferência de tecnologia nas Parcerias de Desenvolvimento Produtivo (PDP) na área de saúde	Software proposal for PDPs
Scielo	Fernandes, Daniela Rangel Affonso, Lima, Sheyla Maria Lemos, Chagnon, Roberto Pierre	Contribuições do modelo Fatores Críticos de Sucesso para análise da gestão de Parcerias para o Desenvolvimento Produtivo de um laboratório oficial	Identification of critical PDP success factors
CAPES	Guzzo, Felipe Gilio	Projetos de Parceria de Desenvolvimento Produtivo em um Laboratório Farmacêutico Oficial: análise do processo decisório a partir da Modelagem de Processos	Evaluation of PDP macroprocesses of a lab
CAPES	Jota, Fernando Alves	Parcerias para o Desenvolvimento Produtivo (PDP) da sua origem aos dias atuais – Laboratório Farmacêutico da Marinha: uma visão estratégica	Evaluation of the Brazilian Navy Pharmaceutical Laboratory (LFM) from the learning acquired in the production of medicines within PDPs
IBICT	Pimentel, Vitor de Menezes	Parcerias de desenvolvimento produtivo vinculadas ao complexo industrial da saúde: um estudo sobre os avanços e o papel de cada agente de saúde na inovação e estruturação do Parque Farmacêutico Nacional	Mapping the view and role of each agent in PDPs
IBICT/CAPES	Silveira, Carla Cristina de Freitas da	Saúde pública, direitos de propriedade intelectual e políticas para o acesso a medicamentos: um estudo antirretroviral atazanavir.	Analysis of the proposed policies for the drug atazanavir
Scielo	Viana, Ana Luiza D'Avila; Silva, Hudson Pacifico; Ibanez, Nelson; Iozzi, Fabiola Lana	A política de desenvolvimento produtivo da saúde e a capacitação dos laboratórios públicos nacionais	Evaluation of the capacity of public laboratories
CAPES	Almeida, Aguida Cristina Santos	Análise dos efeitos das parcerias para o desenvolvimento produtivo nos laboratórios farmacêuticos oficiais	Assessment of innovative capacity
IBICT/CAPES	Messias, Jorge Rodrigo Araújo	Compras governamentais como política de incentivo à inovação por demanda: experiência recente com Parcerias para o Desenvolvimento Produtivo – PDP na área da saúde pública	Evaluation of the PDPs (Stages III and IV) from the point of view of the generated innovation capacity
IBICT/CAPES	Moreira, Mario Santos	As parcerias para o desenvolvimento produtivo (PDP) no setor da saúde: o poder de compra do estado como política de indução à inovação e a capacitação tecnológica da Fiocruz no campo das biotecnologias	Assessment of industrial and technological capacity development
IBICT	Pimentel, Vitor Paiva	Parcerias para o Desenvolvimento Produtivo de medicamentos no Brasil sob a ótica das compras públicas para inovação: 2009-2017	Map of the institutional framework
IBICT	Silva, Luiza Pinheiro Alves da	Modelos alternativos de financiamento ao desenvolvimento de produtos no setor farmacêutico	Evaluation of the Pharmaceutical Innovation System
CAPES	Rezende, Kellen Santos	Parcerias para o desenvolvimento produtivo uma estratégia para o desenvolvimento do complexo econômicoindustrial da saúde (CEIS) no país	Evaluation of productive and innovative efforts arising from productive internalization and the technology transfer process.
CAPES	Rezende, Kellen Santos	As parcerias para o desenvolvimento produtivo e estímulo à inovação em instituições farmacêuticas públicas e privadas	Evaluation of PDPs as a Public Health Policy tool
IBICT	Braga, Stefânia Leirias	Análise crítica do abastecimento de insumos farmacêuticos importados sob vigilância sanitária	Evaluation of the import of Active Pharmaceutical Ingredients (API)
CAPES	Goncalves, Marina Ferreira	Parcerias para o Desenvolvimento Produtivo: Análise do alinhamento estratégico entre os marcos normativos da Anvisa e do Ministério da Saúde	Evaluation of the alignment between Anvisa's[3] regulatory framework and the Ministry of Health

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Source	Authors	Titles	Main topic identified
IBICT/CAPES	Moreira, Marcelo Mario Matos	Acompanhamento das parcerias de desenvolvimento produtivo de produtos biológicos: proposta de revisão da resolução – RDC nº 02, de 2 de fevereiro de 2011	Assessment of the resolution of good manufacturing practice certification
IBICT/CAPES	Glassman, Guillermo	O regime jurídico das Parcerias para o Desenvolvimento Produtivo de medicamentos	Evaluation of the PDPs' legal framework
Scielo	Rech, Norberto, Farias, Mareni Rocha	Regulação sanitária e desenvolvimento tecnológico: estratégias inovadoras para o acesso a medicamentos no SUS	Analysis of innovative regulatory practices
Scielo	Lago, Regina Ferro do, Sousa, Ana Cristina Augusto de	A oferta pública de medicamentos para aids e o papel de Farmanguinhos	Analysis of the supply of human immunodeficiency virus (HIV) antiretrovirals

Source: CAPES, IBICT, Web of Science, Scopus and Scielo.
Authors' elaboration.
Notes: [1] Coordination for the Improvement of Higher Education Personnel (Coordenação de Aperfeiçoamento de Pessoal de Nível Superior).
[2] Brazilian Digital Library of Theses and Dissertations of the Brazilian Institute of Information in Science and Technology (Instituto Brasileiro de Informação em Ciência e Tecnologia).
[3] Brazilian Health Regulatory Agency (Agência Nacional de Vigilância Sanitária).
Obs.: TRIPS – Trade Related Intellectual Property Rights.

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