

# “MIPRES grew like a snowball and took us with it”: Evolution of a health information infrastructure.

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**Abstract.** This paper explores how the Colombian MIPRES system emerged as a nationwide ePrescription solution and, how it evolved into a backbone for the country's Information Infrastructure. Our empirical qualitative study is based on the analysis of interviews conducted in the Ministry of Health, hospitals, insurance companies and patients' organizations. In addition, documents and notes from ethnographic observations were analyzed. Information Infrastructure theoretical insights were employed to analyze the contextual conditions that shaped this evolution. Initially, MIPRES was conceived as a simple reporting system. Through its non-threatening strategy and alliances, it gained momentum like a snowball and, grew to become a central component of the Colombian health information infrastructure. Considered a “successful” implementation, MIPRES triggered a new network of relationships that exists in the background, it is invisible, and frequently taken for granted; thus we conclude that MIPRES wove around it the health information infrastructure of Colombia.

## Introduction

Due to the epidemiological and demographic challenges in contemporary societies, national governments are struggling with the increasing demands for biomedical technologies (Bloom et al, 2015; Fan & Savedoff, 2014). These technologies, such as medicines, devices and special treatments are crucial components of health systems and essential requirements to guarantee the right to health (World Health Organization, 2013). However, because of their innovative nature they are often very expensive, forcing governments to struggle to control health expenditure without sacrificing population needs. (Rumbold et al., 2017; Rovira, De Barcelona, & De Catalunya, 2001) To face this pressure, governments are looking for strategies to control the prescription of expensive biomedical technologies while protecting the public interest and guaranteeing the sustainability of health systems. To this end, they usually deploy information systems to monitor and quantify what happens with these technologies (Oortwijn, Mathijssen, & Banta, 2010).

In the global south, the landscape is not very different (Gaviria, 2014). A Latin American country has been a pioneer in introducing information technology for addressing these challenges (Prada et al, 2018; Gaviria, Vaca, Gómez, & Morales, 2016). In this paper, we present the case of the MIPRES system (Colombia, Ministry of Health and Social Protection, 2016) which is a web application created by the Colombian Government as a centralized ePrescription system for high-cost and high-tech medicines. Its purpose is to guarantee patients' access to medicines while controlling health expenditure (Congress of the Republic of Colombia, 2015). Before MIPRES, health insurers granted access to high-cost and high-tech medicines via cumbersome processes based on paper prescriptions and authorizations (Mejía et al, 2002). These processes frequently resulted to delays and/or medicine refusals while at the same time allowed space for system abuse through unnecessary prescriptions. Overall, before the introduction of MIPRES it was very difficult to control the costs related to special medicines (Abadia & Oviedo, 2009; Bernal & Barbosa, 2015). Addressing this problem required a solution that respects the different actors' interests (Congress of the Republic of Colombia, 2015). Thereby, through a process that included disputes and consultations the MIPRES web application emerged as a viable solution to fulfil all the expectations (Colombia, Ministry of Health and Social Protection, 2016). After a rapid design and implementation process, MIPRES began to operate compulsorily on April 2017 throughout the country. According to the Ministry of Health, MIPRES was a straightforward case of successfully adopting a web application. In this context, all the informational and institutional changes stimulated by it were downplayed, giving to the artefact and its role in the health system a marginal relevance.

These characteristics make MIPRES a relevant case for studying the emergence and evolution of information infrastructures, which are usually populated by examples of failure and implementation challenges (Greenhalgh, 2018). Because MIPRES appeared to be implemented in a straightforward way, this case can be interesting to discuss and compare with others which have been less fortunate. Meanwhile, MIPRES is there, as part of an infrastructure that exists in the background, invisible and, frequently taken for granted (Star & Ruhleder, 1996). Besides, “in such a marginalized state its consequences become difficult to trace and politics are easily buried in technical encodings” (Hanseth, Monteiro, & Hatling, 1996; Monteiro & Hanseth, 1997). Based on this background, we aim to answer the following research question: What contextual conditions make possible the evolution of an information technology towards acquiring a central role in an information infrastructure?

We explore the emergence of a health digital artefact, MIPRES, and its evolution into an Information Infrastructure (Hanseth, Monteiro, & Hatling, 1996; Monteiro & Hanseth, 1996) by shedding light on the contextual conditions of this process. We aim to contribute to the literature in Information Infrastructures (II) evolution in highly politicized contexts, such as those of the current Colombian health system and analyse the contextual conditions that allowed the success of this implementation and the emergence of this specific II backbone.

## Research approach

Between January 2017 and January 2019, a qualitative case study was conducted to follow the introduction of MIPRES in Colombia’s health system across different organizations. To examine how contextual conditions, make possible the evolution of an information technology as a central component of an II in the Colombian context, we draw on three sources. First, 40 semi-structured interviews about MIPRES design and implementation were carried out. The interviewees included government officials (managers and engineers), hospital staff (technicians, doctors and managers of hospitals) and insurers (managers and technicians) as well as patients. All interviews, which lasted two hours on average using individual interview guides, were recorded and transcribed verbatim after permission from the participants. Second, 110 MIPRES related documents were consulted (policy regulations, technical reports and media news). Third, we draw on a secondary analysis of data collected in an earlier ethnographic work. We conducted 63 hours of clinical and managerial MIPRES related information processes through non-participatory observations. The analysis of data provides an account of infrastructural emergence and interaction, rather than individual agents’ accounts.

The analysis of empirical material was performed via an iterative approach facilitated by NVivo 12. The project was approved by the Research Ethics Committee at the University of the first researcher and the Research Committee of the hospital where the observation was conducted.

## Findings

### Emergence and evolution of MIPRES

In early 2016, MIPRES was born as an idea in the office of the Minister of Health of Colombia, where it was envisioned as a reporting system on the supply of high-cost medicines. Until that moment, the reports in flat files from hospitals and insurers to the Government were the main sources used to build the health information infrastructure in the country. However, in subsequent meetings, the initial idea began to change. Motivated by discussions with advisers and officials about the possible scope of this tool, the Minister of Health said: “Let's make of this a social experiment” (Interview, Ministry staff, Physician, 2018).

The Ministry wanted to develop the reporting system, and the Minister' office invited the IT Department to be part of this development. Several actors involved agreed that this was a special moment because “before, technology did not allow us to do some things, political will was not there, but, all the stars lined up for this to happen” (Interview, Ministry staff, Physician, 2018). The IT Department strengthened its capacity to develop applications and created several digital citizen-centred services such as [miseguridadsocial.com.co](http://miseguridadsocial.com.co) or [MiVox-pópuli](http://MiVox-pópuli) in previous years. Based on these experiences, the IT department began to develop an online report of high-cost medications and named it Miprescription, i.e. MIPRES. The initial development was based on agile methodologies and soon the scope of the system began to change during the presentations to the Ministry officials.

“So, let's say. At the beginning, the scope of this was only as a reporting system where doctors were going to enter the medical prescriptions of high-cost technologies not included in the health benefit plan, and that's how it started. But, suddenly, this began to evolve and evolve...” (Interview, Ministry staff, Engineer, 2018).

### IT strategy in the making

The negotiation process between the different units of the Ministry was complex, because many needs and opportunities were expressed. In turn, the IT department identified that MIPRES was different from previous developments, because it responded to real clinical and pharmacological practice. So, the requirements elicitation could not be conducted only based on the administrative knowledge of

the Ministry officials, they also needed clinical doctors and medical knowledge. The Ministry started to convene with medical societies as guilds of recognized knowledge and scientific authority among doctors.

The Ministry identified that “it was always an advantage to have scientific societies in our side. In fact, this was publicly presented as an initiative by them, as a scientific society solution for medical autonomy.” (Interview, Ministry staff, Physician, 2018). Patients also participated, although initially not by invitation from the Ministry, but because they heard about the development in progress and demanded inclusion in the process. The leaders of the national patients’ association said:

“We realized that there was a first draft of MIPRES that was ready to be signed by the Minister, and the Ministry had not consulted us. Then, we presented a right of petition, with a copy to the attorney general’s office, requesting to stop the process until the proper consultation with us was done”. (Interview, Spokesman, National Association of Patients, 2018).

The Ministry responded to these requests by including the patients in the discussion meetings of MIPRES and making some modifications as a result of the negotiations with their representatives. This gave legitimacy to the Ministry because now leaders of patients and doctors associations had been part of the technology development. Of course, other interest groups also presented their complaints and concerns. The pharmaceutical industry, for example, was one of the most interested actors in this technological artefact and used different forms of relationship with the Ministry (political pressure, supporting medical training sessions and didactical materials).

Thus, technological development was negotiated among diverse interest groups, resistances and concessions, producing a technology that embedded multiple purposes. The Ministry itself was surprised by what MIPRES has allowed: “one of the things that seemed most interesting, is that MIPRES became the excuse, for the Ministry to do many things that for a long time we didn’t.” (Interview, Ministry staff -Physician, 2018). MIPRES was launched to serve a multiplicity of purposes implicit in its design and code: guarantee medical autonomy with self-regulation; protect right to health for citizens and, have access to transparent and real-time information (Colombia, Ministry of Health and Social Protection, 2016). Nevertheless, Ministry officials and engineers made the decision to not emphasize MIPRES potential capacities and uses: “We do not call it an information system but a tool, just an application” (Interview, Ministry staff -Engineer, 2018).

Introducing MIPRES in all the hospitals took less than a year, this happened mainly during 2017. Limited resources were invested, but the initiative had significant political backing. The Colombian health system has historically been fragmented due to its free market logic being based on competition among multiple

organizations. Traditionally, health care actors and organizations viewed information as a strategic asset, making it difficult to access. For the first time, MIPRES triggered the connection of multiple interests, organizations and data sources that were previously separated. Unintentionally, MIPRES acquired a central role and became Colombia's most influential health information artefact. Within less than two years of its introduction, it attained the role of the backbone in Colombia's health information infrastructure.

After two years of operation and with more than 11 million prescriptions of high cost technologies through it, MIPRES use is established among professionals and institutions, although resistance and some unintentional uses persist. MIPRES in the official discourse remains just an application. But, MIPRES is far from being just another app in the Colombian health information landscape. In fact, Ministry officials recognized that “MIPRES has been growing like a big snowball, it grew like this and it took us” (Interview, Ministry Executive commanding MIPRES ideation and implementation).

The snowball phenomenon metaphor reflects the significance of the application for the healthcare system. The MIPRES introduction stimulated a cascade phenomenon (a snowball effect) in the previously fragmented Information Infrastructure (II). By enabling real-time connections between institutions, MIPRES led to the creation of new data registers and data flows. Because it got linked to and required data from, the introduction of MIPRES triggered the reordering of existing sources (Figure 1. MIPRES connections) such as the National Register of all the Hospitals and Health Providers and the Colombian National Register for Rare Diseases. Also, the Colombian Register of Victims and the National Register of People living with Disabilities, both were connected to MIPRES. All these registers previously existed only on paper or were outdated and fragmented throughout many institutions. Additionally, the insurance companies also got access to rich data contained in MIPRES flat files that are available for them to download daily. Also, a new mandatory web register was created for all the health professionals: RETHUS (Register of Human Talent).

Furthermore, MIPRES introduction required updating all databases containing catalogues of health products (medicines, devices, nutritional products, etc.) with prices, international denominations, registers of sanitary authorization about safety and efficacy and standardized codification. In that sense, MIPRES reassembled and connected all these various systems and reports into a new Information Infrastructure in the country, becoming the Colombian healthcare system's II backbone (Figure 1. MIPRES connections). Most of these sources had been created many years ago but due to low response and low data from health sector institutions, the databases were almost empty or not useable. Also, there was no

mechanism or incentive to update these systems. However, MIPRES triggered a comprehensive upgrading and revitalization of the Colombian health information infrastructure.

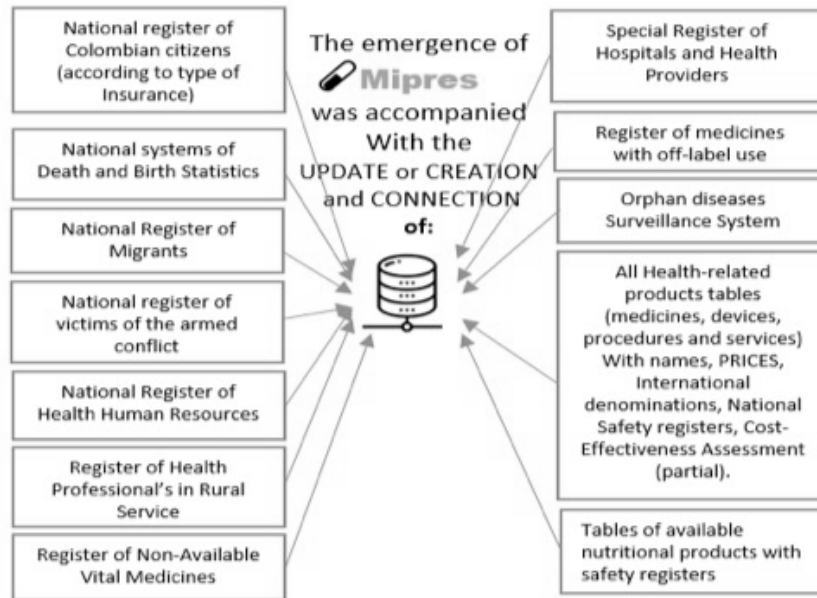


Figure 1. MIPRES connecting multiple pre-existing and new data sources and triggering updates.

## Conclusion & Discussion

This paper explores the contextual conditions that allowed an information technology to expand in a way that transformed the entire information infrastructure of a country, turning it into an informational backbone. In the MIPRES case, the application was born humbly, but with the particular political and historical conditions given, it became more complex than the initial scope indicated. MIPRES also triggered a cascade effect of upgrading the rest of the II.

We identified three main elements in the MIPRES expansion strategy that can be analysed and serve as a reference to other national initiatives:

- MIPRES was born as a simple artefact, “just an app”. Although it has been growing and becoming more complex, its low profile has been continually maintained, avoiding producing more resistance.
- MIPRES achieved legitimacy through consultative and deliberative processes with key actors (doctors and patients) for its production and use.
- MIPRES became important for others in the healthcare system since it began to connect multiple data sources. Thus, different actors and processes started updating information to or for MIPRES use. MIPRES awakened an interest

for increasing information quantity and quality, which led to an information reengineering exercise across information processes of the Ministry and many other organizations in the health system.

Although the particular trajectory of MIPRES is context-dependent and historically situated, the strategic elements that have been identified have a universal character and can shape technological developments in different contexts. We suggest that the insights from the MIPRES case analysis are relevant for making sense of the dynamics of infrastructural expansion, stabilization and use contributing to the literature on II in highly politicized contexts.

Prior II literature has pointed to the role of tactics for introducing new infrastructural component including the tactic of staying under the radar (Grisot, Thorseng, & Hanseth, 2013), furthermore prior literature has identified the importance of legitimisation (Vassilakopoulou & Marmaras, 2015). Additionally, with the MIPRES case, we gain insights about the catalytic role of creating real-time connections. MIPRES created links with multiple other systems and data sources that were previously stand alone. This way, the addition of a single component to the existing infrastructure, radically changed the overall infrastructure topology. Despite being in a marginalized state, MIPRES became a central node in the overall network of systems. Our study aims to go beyond the static focus on technology itself investigating infrastructural dynamics. The findings of the MIPRES case study remind us that infrastructures are complex adaptive systems and the creation of new connections significantly affects their overall behaviour and also the various newly connected components.

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## References

- Abadia, C. and Oviedo, D. (2009). Bureaucratic itineraries in Colombia. A theoretical and methodological tool to assess managed-care health care systems. *Social Science & Medicine*, vol. 68, no.6, pp.1153-1160.
- Bernal, O. and Barbosa, S. (2015). La nueva reforma a la salud en Colombia: el derecho, el aseguramiento y el sistema de salud. *Salud Pública de México*, 57, pp. 433-440.
- Bloom, D., Chatterji, S., Kowal, P., Lloyd-Sherlock, P., McKee, M., Rechel, B. and Smith, J. (2015). Macroeconomic implications of population ageing and selected policy responses. *The Lancet*, vol. 385, no. 9968, pp. 649-657.



- Colombia, Ministry of Health and Social Protection. (2016). Resolution 003951 de 2016. Por la cual se establece el procedimiento de acceso, reporte de prescripción, suministro, verificación, control, pago y análisis de la información de servicios y tecnologías en salud. Bogotá D.C: The Ministry.
- Congreso de la República de Colombia. (2015). Ley Estatutaria 1751 del 16 de febrero de 2015. Por medio de la cual se regula el derecho fundamental a la salud y se dictan otras disposiciones. Bogotá, D.C: El Congreso.
- Fan, V. and Savedoff, W. (2014). The health financing transition: a conceptual framework and empirical evidence. *Social science & medicine*, vol. 105, pp. 112-121.
- Gaviria, A. (2014). Cost of progress prices of new medicines threaten Colombia's health reform. *Finance and Development*, vol. 5, no. 4.
- Gaviria, A., Vaca, C., Gomez, C. and Morales, A. (2016). The debate on regulating biotechnology drugs: Colombia in the international context. *Revista Panamericana de Salud Publica*, vol. 40, no. 1, pp. 40-48.
- Greenhalgh, P. (2018). How to improve success of technology projects in health and social care. *Public Health Research and Practice*, vol. 28, no.3.
- Grisot, M., Thorseng, A. and Hanseth, O. (2013). Staying Under the Radar: Innovation Strategy In Information Infrastructures For Health. *ECIS 2013 Completed Research*, vol 149.
- Hanseth, O., Monteiro, E. and Hatling, M. (1996). Developing information infrastructure: The tension between standardization and flexibility. *Science, Technology, & Human Values*, vol. 21, no.4, pp. 407-426.
- Mejía, S., Vélez, A., Buriticá, O., Arango, M. and del Río, J. (2002). National pharmaceutical policy and social security reform in Colombia: access and rational use of medicines. *Cadernos de Saúde Pública*, vol.18, no. 4, pp. 1025-1039.
- Monteiro, E. and Hanseth, O. (1996). Social shaping of information infrastructure: on being specific about the technology. En W. Orlikowski, G. Walsham, M. Jones, J. DeGross(eds.):, *Information technology and changes in organizational work*, Springer, Boston, pp.. 325-343.
- Monteiro, E. and Hanseth, O. (1997). Inscribing behaviour in information infrastructure standards. *Science, Technology & Human Values*, vol 21, no 4, pp. 407-426.
- Oortwijn, W., Mathijssen, J. and Banta, D. (2010). The role of health technology assessment on pharmaceutical reimbursement in selected middle-income countries. *Health Policy*, vol. 95, no. 2-3, pp. 174-184.
- Prada, S., Soto, V., Andia, T., Vaca, C., Morales, A., Márquez, S. and Gaviria, A. (2018). Higher pharmaceutical public expenditure after direct price control: improved access or induced demand? *The Colombian case. Cost Effectiveness and Resource Allocation*, vol. 16, no.1.
- Rovira, J., De Barcelona, U. and De Catalunya, G. (2001). The role of prices in drug expenditure analysis. *Eur J Health Econ*, vol. 2, pp.142-9.
- Rumbold, B., Baker, R., Ferraz, O., Hawkes, S., Krubiner, C. and Littlejohns, P. (2017). Universal health coverage, priority setting, and the human right to health. *The Lancet*, no. 390, pp. 712-14.
- Star, S. and Ruhleder, K. (1996). Steps toward an ecology of infrastructure: Design and access for large information spaces. *Information Systems Research*, vol. 7, no. 1, pp. 111-134.
- Vassilakopoulou, P. and Marmaras, N. (2015). Investigating technology-induced transitions in healthcare: work practice adaptations within their overall context. *Health Policy and Technology*, vol. 4, no. 3, pp. 277-285.
- World Health Organization. (2013). *Medical devices and eHealth solutions: Compendium of innovative health technologies for low-resource settings 2011-2012*. Geneva, Switzerland: WHO.