

Tracing and measuring the COVID-19 Colombian vaccination network

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Abstract: The COVID-19 vaccination process in Colombia has been a major challenge not only in terms of public health but also in terms of supply chain management and logistics processes. To support the monitoring of these processes and associated decision-making, a dashboard was designed in Google Data Studio focused on analyzing the progress of COVID-19 vaccination and its logistics efficiency. This article describes the design and implementation of the dashboard using a design science approach and discusses the main lessons learned. During its development, four major challenges were identified: the search for and availability of data sources, the definition and standardization of metrics, the extraction of data in different formats; and finally, the validation of the metrics. Despite these challenges, the dashboard became a source of information for different stakeholders in the Colombian COVID-19 vaccination network, facilitating the monitoring of key performance indicators (KPIs), supporting decision-making, and policy evaluation. This reaffirms the importance of having open information to generate knowledge for both public and private entities as well as for the public. The main contribution of this work is the definition and standardization of the KPIs and it is therefore expected that this experience will serve as an insightful input for designing mass vaccination strategies.

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1. INTRODUCTION

The COVID-19 pandemic has had a broad impact, highlighting the inequality in access to health care, especially in developing countries. In Colombia, the National Vaccination Plan (PNV by its name in Spanish) began on February 17th of 2021. It established the goal of fully vaccinating 70% of the population by December 31st of 2021, as the main strategy of the Colombian government not only to prevent COVID-19 deaths but also to enable economic reactivation (Gaus, 2021) and seek timely and equitable distribution of vaccines throughout the country.

To achieve this objective, the availability of vaccines is not the only requirement; it is also necessary to define the logistics process for their allocation and distribution. Thus, the PNV stipulated the macro-logistics along the vaccination network to distribute vaccines throughout the country, defining the design of the cold chain, distribution to the main territorial entities, transportation, and storage at different nodes of the network such as collection centers (Bae et al., 2021). However, it fell short in specifying the micro-logistics in the vaccination network (i.e., the process in which vaccines will be dosed to people). Especially, in aspects related to the recording and collection of information on the vaccines administered and, in general, with open data management, which is especially important during a health emergency such as a pandemic.

The importance of having open information lies in the fact that it promotes transparency, efficiency, and effectiveness of the services offered to the population while allowing working on

decision support models and generating knowledge for both public and private entities (Xue, 2021). On the other hand, actors in the healthcare sector can control quality and cost through the design of key performance indicators (KPIs), for which the implementation of Business Intelligence (BI) tools and data visualization techniques is recommended (Díaz-Piraquive et al., 2021).

The purpose of this research is to design and implement a COVID-19 vaccination dashboard using the design science research (DSR) approach to produce valuable information on the vaccination progress and its logistic efficiency in Colombia, thus supporting public health decision-making. The dashboard uses structured and unstructured data with different update periodicities and the main contribution is the definition and standardization of the key indicators to be implemented. This paper is organized into four sections plus this introduction. The second section presents a brief literature review, followed by the description of the DSR approach defined to design the dashboard in section three. Then, the results are described in section four and finally, section five presents the discussion and conclusions of this paper.

2. LITERATURE REVIEW

COVID-19 vaccination has posed a logistics problem for which different organizations have designed types of monitoring and tracking dashboards that have been published online and in academic articles. For this research, the COVID-19 dashboards were organized and classified into three groups: a) patient tracking dashboards throughout the phases of vaccine development (Shrotri et al., 2021); b) global, regional