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Attention to Gaps and their Incidence in the Imaging Service in Patients of a Hospital in La Libertad 2025

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ABSTRACT: Timely and equitable access to diagnostic imaging services is a strategic component for the effectiveness of public health systems, particularly in regional contexts characterized by structural inequalities. This article analyzes the incidence of gap care in the performance of the imaging service in a public hospital in the La Libertad region during the year 2025. The research was developed under a quantitative approach, with a non-experimental, cross-sectional and correlational-causal design, working with a sample of 365 patients. Logistic ordinal regression models and structural equation models (SEM) were applied to estimate causal relationships between variables. The results show a direct, positive and statistically significant influence of gap care on the imaging service ($p < 0.05$), with a relevant explanatory capacity (Nagelkerke's $R^2 = 46.4\%$). The most determining dimension was geographical accessibility, followed by human resources and infrastructure. From a public management perspective, the findings reveal that structural and organizational constraints have a direct impact on diagnostic equity, timeliness, and effectiveness, posing substantive challenges for regional governance and evidence-based health planning.

INTRODUCTION

The efficient provision of health services is one of the essential functions of the modern State and a key indicator of its capacity to generate public value. In the hospital setting, the diagnostic imaging service represents a critical link in the chain of care, since it conditions diagnostic accuracy, therapeutic opportunity and, ultimately, the clinical outcomes of patients. However, in regions with structural limitations, the provision of this service is crossed by persistent gaps linked to insufficient infrastructure, deficit of specialized human resources, and territorial restrictions of access.

In the La Libertad region, these gaps are manifested in prolonged delays, geographical accessibility difficulties, and limitations in the resolution capacity of the hospital system. In this context, the original research aimed to explain to what extent gap care affects the imaging service in patients of a public hospital during the year 2025. However, beyond the statistical verification of causal relationships, it is necessary to delve into the institutional and governance implications that these results reveal.

This article reformulates and expands the findings of the thesis, articulating them with contemporary debates on public management, modernization of the State, and reduction of inequalities in essential services. The analysis is aimed not only at describing the relationship between variables, but also at problematizing the structural conditions that configure the performance of the service from a public policy perspective.

In the United States, accessibility to health care in rural settings, especially imaging services, represents one of the greatest challenges of the health system. These facilities are taking a tendency to shrink, forcing the population to move to urban areas to get care. The consequences of this behavior are evidenced by the fact that 80% of women who should have an annual mammogram exam do not do so due to the inaccessibility of imaging services (Loria, 2020).

In Latin America, barriers have been identified that influence the scope of care in radiology services, such as high costs in procedures, low health insurance capacity, the distribution of medical infrastructure, as well as access to transportation to rural areas (Pantoja et al., 2024).

Social Security, EsSalud in Peru, is one of the most important health systems and, according to the profile of the insured population, during the first quarter of 2023 the number of insured people was 12 million 675 thousand 670 people (Central Management of Planning and Budget, 2023). EsSalud's National Telemedicine Center (CENATE, 2024) was created as the first sustainable care network and as a solution to remote patient care in areas far from the capital, shortening care gaps in areas where specialist doctors are not located.

In the Ancash region, it was shown that the actions of the main managers of the imaging service provider units, hospitals, health networks and the planning and budget units of the Regional Government of Ancash are needed to strengthen the acquisition of radiology equipment (X-rays, tomographs, magnetic resonators), it is urgent to modernize health centers according to their complexity (Castro, 2023).

In the La Libertad region, the number of insured persons amounts to 757,088 for the first quarter of 2023, considering that this region is made up of 12 provinces and has 1 Level III-E Hospital, which offers the only Magnetic Resonance Imaging service, has a Multislice Tomography equipment, 2 mammography equipment, 1 static X-ray machine, 3 C-arms in different diagnostic and treatment support rooms (operating room, brachytherapy, retrograde cholangiopancreatography), a C-arm for invasive procedures such as pacemaker implantation, interventional neuroradiology, interventional cardiology, X-ray C-arm for lithotrippy procedures, a gamma camera for nuclear medicine procedures, and 2 portable X-ray machines to take X-rays when the patient cannot be transferred in the cases of patients who are immobilized in emergency, hospitalization and all intensive care units (adults, intermediate care unit, pediatric ICU, ucineonatal, among others), (Central Management of Planning and Budget, Management of Information Management, Deputy Management of Analysis and Studies, 2023).

International studies are considered, such as that of the researcher Grabowska et al. (2023) from the University of Silesia who from Poland carried out a work that aims to demonstrate the current achievements in the application of protocols that reduce the time of magnetic resonance imaging in 10 selected neoplastic diseases, applying various protocols in pelvic neoplasms, adrenal masses, renal masses, malignant neoplasms in the lung, breast, pancreas and prostate, acute pancreatitis, hepatocarcinoma, liver metastasis. As a result, it is obtained that in some pathologies it is possible to optimize the speed of image acquisition, such as liver metastasis, pancreatic neoplasms and female pelvic cancer. The authors conclude that these protocols can help expand patient access by meeting increasing clinical demands. This contribution of information is useful as it demonstrates that access to imaging services can be improved through the implementation of protocols allowing the increase of magnetic resonance imaging.

In the United Arab Emirates, authors Abuzaid et al. (2023) from Sharjah Sharjah University, investigate patient satisfaction in a radiology service, which evaluates care, comfort, service, and, finally, accessibility to imaging services, in a cross-sectional descriptive study, surveying a total of 444 patients. Their results showed that 70.4% of the population has ease in making an appointment, 54.9% indicated that the waiting time was adequate, and 56.1% were satisfied with the waiting time for the report. They concluded that health providers should prioritize appointment scheduling by reducing waiting times and encouraging positive interactions between the staff who provide care and patients. This study has a significant contribution, as it contributes to considering waiting times and the perception of quality care in the imaging service.

The following review study carried out in India by Chandramohan et al. (2023), had as its main objective to consolidate the literature on technological instruments that have access to imaging care in the primary area of health, as secondary objectives to identify the barriers and facilities to adopt technological solutions and improve access to imaging care. 95 studies that met the criteria for this research were reviewed. The data were taken from 10 states in India, of which 9 are rural areas. The results of the articles were: connectivity through teleradiology, digital images through cell phones, artificial intelligence, data security and web technology, public-private collaboration, cost, concordance, evaluation and implementation. They concluded that the use of digital imaging systems such as DICOM visualizers can interconnect different specialized medical centers with others of

lower level to access medical images. Regarding teleradiology, its use dates back to 1996 and it was found that medical images can be reported from anywhere in the world, thus creating many companies that offer teleradiology services. They also conclude that response times for emergency imaging reports of 30 minutes and a time of 6 hours for non-emergency patient reports are beneficial. This denotes the viability of teleradiology in a remote region of the country with scarce resources to allow access to diagnosis and health care in a timely manner. This article provides important information for research, as it involves teleradiology and the use of computer technologies to access imaging services.

In Baja California Sur, Mexico, researchers Carrillo et al. (2022) set out to quantify the waiting time of patients to receive their final diagnosis. An observational, descriptive survey was carried out on patients insured with BIRADS 4 and 5, and 36 records of women between 40-69 years of age were analyzed, using descriptive statistics. They measured demographic variables and waiting time from the generation of the study request to the issuance of the final result, resulting in a waiting time for their final diagnosis of 125.05 + 66.23 days, only in 13.9% was it possible to complete the diagnostic procedure on time, however, in 86.1% it took more than 30 days to complete the diagnostic protocol. They concluded that it is necessary to generate management strategies to achieve the goal of the times regulated by the flowcharts of the different levels of care to promote improvements in the diagnosis and treatment of patients with breast cancer. The significant contribution of this article lies in the fact that it is important to consider the times considered in the official normative documents of any institution and/or national regulations.

Suárez et al. (2022), from the University of Medical Sciences of Pinar, in Cuba, conducted a study whose objective was to describe the costs of care for external users in intensive care units (ICUs). The population was 455 patients with a sample of 155 by simple random sampling. The records were obtained from hospital data. They determined that expenses in radiology were the ones with the highest charges, around 23069.88 Cuban pesos, at the exchange rate of $966.32, where X-rays are the diagnostic means of highest value (76 CUP= $3.17), since they are very frequently indicated for the same patient for control of complications, which generates a higher expense, followed by CT scans. They concluded that imaging and laboratory studies are necessary to diagnose and subsequently monitor the patient's recovery and represent the highest cost. This study provides important information since it shows that the costs of medical imaging are high and very necessary to diagnose, generate a treatment scheme and maintain control of the diseases of critical patients.

Frija et al. (2021), from the University of Paris, conducted a study with the aim of analyzing the essential and growing role of imaging units in health care, to propose possible solutions and initiatives to overcome the gaps and barriers that contribute to the failure to develop the sustainable implementation of these services in those countries with low- or middle-income economies. They state that there is a shortage of imaging equipment and professionals in developing countries and describes a plan to improve access to imaging in the global health agenda through a holistic approach. The authors present a generic model for the organization of imaging services in countries with emerging economies through reference organizations or institutions within each region, they also highlight that computer science and artificial intelligence play development roles, however, it proposes to establish an international medical imaging commission to promote the collaboration of other organizations to improve practices. This article provides information such as the use of the model to describe the management of imaging services.

In national background, we have Castro (2023), from the César Vallejo University, whose objective was to describe access to medical imaging care to reference patients from the first level of care. The author selected 8 level II-2 health facilities and analyzed the requirements, documents of insistence on the need for the acquisition of X-ray equipment, tomographs and magnetic resonators. As a result, he presents the relationship of priorities with persistence of the need for acquire medical imaging equipment with the executive directors of hospitals, health networks, the planning and budget unit of the Health Directorate of the Ancash region. It concludes that it finds non-compliance in the hours of care for patients, equipment without the necessary maintenance, as well as a deficit of human resources; likewise, it proposes to apply strategies to expand coverage in rural posts with a system of counter-referral to specialized diagnoses to contribute to patient access. This research provides knowledge to highlight imaging equipment and the respective procedures such as preventive maintenance, equipment implementation, human resources and their influence on the care of gaps.

Figueroa et al. (2021), from the San Martin de Porres University, investigated how quality assurance applied to an in-house and outsourced tomograph in institutions providing services to the Comprehensive Health System, affects the quality of service. The study was of a non-experimental design of a descriptive-comparative nature and correlational level. 111 patients and 30 radiology medical technologists from two hospitals in Lima were surveyed. From the results, it was obtained that 1% of patients with self-use tomograph indicate that there is poor performance in the imaging equipment, 8% work regularly and in 91% that

the equipment is operational. Of the physicians, they indicated that 20% of outsourced tomograph complies with quality assurance and 80% that it sometimes complies. The authors conclude that they find no relationship between quality assurance between an outsourced tomograph and their own CT scanner using Pearson's correlation, which showed a result of -0.27. This study provides relevance to the importance of verifying the quality of radiological equipment and its importance in patient care, ensuring quality and adequate dose for care.

Arellano et al. (2021), from the Universidad Continental, developed a thesis with the purpose of improving the management of radiology services, which is why it carries out multiple strategies of continuous training. The authors used 4 methods or analysis: Internal, environment, SADCI methodology, MACTOR methodology, and concluded that one year of training requires an investment of 11770 soles for 29 identified workers, despite an institutional deficit, social viability and human resources, allowing the activities to be executed; likewise, it was evidenced that there is inadequate management due to management factors, inadequate infrastructure and patient dissatisfaction. However, it proposes a plan of daily activities, highlighting the appropriate working hours and the effect of work overload on health personnel; a program on the importance of training and compliance with standards, a program of attention to good practices for patient care, a monitoring plan to reduce the waiting period for results for outpatient patients and a continuous training plan. This research provides significant information about the training of radiology human resources to improve patient services.

Silva (2021), from the Technological University of Peru, aims to implement a medical image management framework that allows optimizing telediagnosis in a level III hospital in Lima. A prototype was implemented that allowed the deposit of images with the use of a powerful PACS server DCM4CHEE as open source. A significant decrease in the times used in the delivery of the final radiological result was obtained, as well as an optimization of processes related to patient care. The author considers fulfilling 5 phases for the implementation of the project: Project management, diagnosis, network architecture design (PACS), implementation and closure of the project and as a result presents the application of open source tools such as PACS DMACHEE, caGrid platform for dicom images. A minimization of waiting periods for radiological results was obtained, optimizing the processes related to queues, appointments, analysis and patient results using digital solutions. It concludes that the implementation of modern computer systems to handle giant amounts of images are efficient solutions that impact procedures, processes and protocols for the benefit of patients. This study provides information on the use of technologies such as teleradiology.

The notion of "gap" in public services refers to the difference between the available supply and the actual or potential demand for a service, as well as to the territorial and social inequalities that condition its access. In the field of health, these gaps can take on multiple dimensions: insufficient physical infrastructure, obsolete equipment, lack of specialists, inefficient administrative processes, or geographical barriers that hinder timely access.

From the perspective of public management, addressing gaps is a strategic instrument for planning and allocating resources. It is not only a matter of closing material deficits, but also of guaranteeing equity in access and effectiveness in results. In this sense, the performance of the imaging service can be analyzed under the results-based management approach, where waiting time, the opportunity for appointments, the quality of human resources, and the availability of equipment act as indicators of institutional performance.

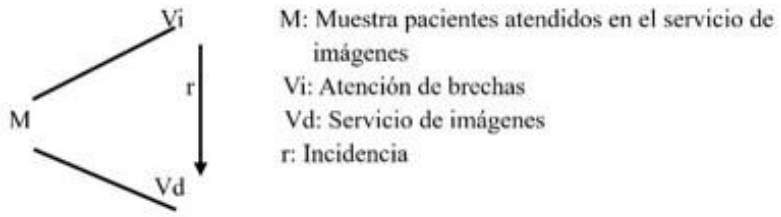
The conceptual framework of the study considered as an independent variable the attention to gaps, operationalized in dimensions such as geographical accessibility, opportunity of access, equity, human resources, infrastructure and waiting time. The dependent variable, image service, was evaluated based on the user's perception of the quality, timeliness and efficiency of the service received.

This approach allows us to understand the hospital service not only as a technical service, but as an institutional product conditioned by budgetary decisions, management capacity and intergovernmental articulation.

METHODOLOGY

The present research was applied. It had a quantitative approach, a non-experimental cross-sectional design and causal correlation. (Hernández et al., 2014).

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The study population was all patients who met the eligibility criteria: They belong to the hospital in La Libertad where the study was carried out, they are in the waiting room. The exclusion criteria were: those patients who do not belong to the patients cited, patients who cannot provide reliable information, emergency patients and hospitalization. The total population was calculated as the patients cited during one month in the various areas of diagnostic imaging, reaching 7 320 patients. The sample was calculated based on the formula of finite populations, obtaining 365 patients. This research made use of the survey technique and the instrument in relation was the questionnaire for the variables.

RESULTS

The results show that gap care has a direct, positive and statistically significant impact on the imaging service ($p < 0.05$). The logistic ordinal regression model showed a Nagelkerke R^2 of 46.4%, which indicates that about half of the variability in service performance is explained by the analyzed dimensions of gap care.

In the structural analysis, geographic accessibility emerged as the most determining dimension, explaining 53% of the variability of the service. This finding suggests that territorial proximity and ease of travel are critical factors for hospital performance. The human resources dimension presented a causal coefficient of 0.75, while infrastructure and equipment reached a coefficient of 0.72, confirming their relevance in institutional resolution capacity.

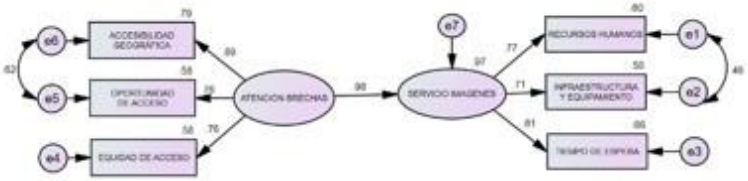
Likewise, it was identified that the waiting time and the opportunity to access registered predominantly low levels in the perception of users, which shows organizational and operational restrictions that affect the efficiency of the service.

Taken together, the results confirm that structural gaps are not marginal variables, but substantive determinants of institutional performance.

Figure 1 Diagram of the influence of gap care on the imaging service in patients of a hospital in La Libertad 2025.

Figura 1

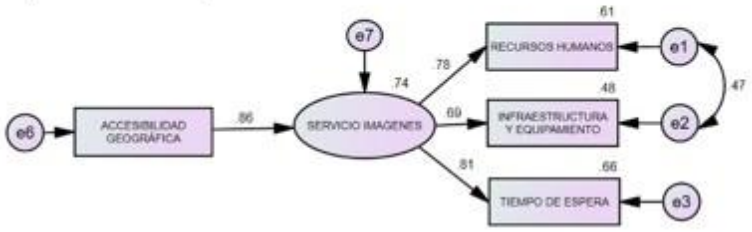
Diagrama de la influencia de la atención de brecha sobre el servicio de imágenes en pacientes de un hospital de La Libertad 2025.



Interpretation: For this first structural model, the fit indices that evaluate the influence of gap care on the imaging service report an X^2/gl ratio of 3.083, an RMSEA of 0.076 and a CFI of 0.991. These values indicate an acceptable fit of the model, according to the criteria commonly established in the literature ($X^2/gl < 5$, RMSEA $\leq .08$, CFI $\geq .90$). Together, the indices strengthen the validity of the model proposed to explain the influence of gap care on the imaging service, with a causal relationship of 0.98 (very high) and where the imaging service is explained with 97% of the gap attention.

Figura 2

Diagrama de la influencia de la accesibilidad geográfica sobre el servicio de imágenes en pacientes de un hospital de La Libertad 2025.



Interpretation: For this first structural model, the fit indices that evaluate the influence of geographic accessibility on the image service report an X^2/gl ratio of 0.520, an RMSEA of 0.000 and a CFI of 1.000. These values indicate an acceptable fit of the model, according to the criteria commonly established in the literature ($X^2/gl < 5$, RMSEA $\leq .08$, CFI $\geq .90$). Finally, the indices support the validity of the proposed model to explain the influence of geographic accessibility on the image service, with a causal relationship of 0.86 (very high) and where the image service is explained with 74% of geographic accessibility.

DISCUSSION

The findings support that the attention to gaps is a structural factor that conditions the quality and effectiveness of the diagnostic imaging service. The high incidence of geographical accessibility reveals a territorial dimension of inequality that transcends the hospital environment and is linked to regional planning and the ordering of the health system.

From a governance perspective, the persistence of gaps indicates limitations in the articulation between strategic planning, public investment, and operational management. Empirical evidence suggests that the allocation of resources does not always respond to comprehensive territorial diagnoses, which reproduces inequities in access.

The significant impact of human resources and infrastructure reinforces the need for comprehensive policies that combine investment in equipment with the strengthening of specialized human capital. The mere acquisition of technology without adequate management of human talent can generate underutilization of resources and loss of efficiency.

In terms of public management, the results support the importance of incorporating gap indicators in multi-year programming instruments and in institutional performance evaluation systems.

CONCLUSIONS

The study confirms that the attention to gaps has a significant impact on the performance of the diagnostic imaging service in the hospital analyzed. Geographical accessibility, human resources, and infrastructure are determining factors of institutional performance. The explanatory capacity of the model shows that almost half of the variability of the service can be attributed to the structural gaps identified.

From the perspective of public management, the research provides empirical evidence that supports the need for comprehensive policies to reduce gaps as a mechanism to strengthen the equity and efficiency of the regional health system.

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