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Semblanza histórica a 120 años del Hospital General de México Dr. Eduardo Liceaga

Servicios – 2a. Parte

HISTORY ARTICLES

HOSPITAL GENERAL de MÉXICO
DR. EDUARDO LICEAGA

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HISTORY ARTICLE

Institutional Pharmacovigilance Center at *Hospital General de México Dr. Eduardo Liceaga*

Octavio Amancio-Chassín

Clinical Pharmacology Service, Hospital General de México Dr. Eduardo Liceaga, Secretaría de Salud, Mexico City, Mexico

The *Hospital General de México Dr. Eduardo Liceaga* (HGM) was 101 years old when, in February 2006, on the instructions of Dr. Francisco Higuera Ramírez, director of our hospital, Dr. Octavio Amancio Chassín was asked to create the Institutional Pharmacovigilance Center, as an institutional need, to obtain the hospital certification granted by the General Health Council, which at that time, it was an essential requirement to guarantee patient safety and provide quality care and thus, belong to the National Program for the Certification of Health Establishments.

To establish the Institutional Pharmacovigilance Center, a series of strategies were programmed, supported by the Official Mexican Standard NOM-220-SSA1-2002, Installation and Operation of Pharmacovigilance[1], published on November 15, 2004, which established the mandatory guidelines in Mexico for the detection, registration, evaluation and prevention of adverse reactions to drugs and vaccines, guaranteeing the safety and efficacy of drugs and vaccines and the Guide for the installation and operation of an Uppsala Monitoring Pharmacovigilance Center[2].

The Institutional Pharmacovigilance Center was established in unit 204, special studies, and according to the guidelines for the facility, it was incorporated into the QFB. Silvia Naranjo Rosales and, later, in August 2006, nurse Petra Ortega Cedillo. At present, the center is located in the clinical pharmacology service, unit 405 E.

The second strategy consisted of establishing an interaction with the National Center for Pharmacovigilance, which at that time was directed by Q. Carmen Becerril Martínez, who served as executive director of pharmacopoeia and pharmacovigilance. From the first contact, Q. Becerril supported the formation of the Institutional Pharmacovigilance Center at the HGM, mainly in the strategy of training health professionals.

The next activity consisted of developing the data collection format to be able to obtain information on adverse drug reactions (ADRs) produced in patients and implementing the tactics to be followed for the identification of ADRs in the different services and units. With the support of NOM 220, the fundamental information to obtain quality notification was established: patient data, suspected adverse reaction, medication, concomitant pharmacotherapy, and medical history (SSA-03-021. Report of possible ADRs).

To identify ADRs in the hospitalization area, it was determined that it was necessary to personally visit the different services or units of our hospital, asking the doctor or nurse responsible about the presence of ADRs in patients, identified during the visit and maintain a permanent telephone line, where the health personnel would report the suspicion of ADRs and immediately the center staff would go to collect the information corresponding.

With the support of the National Pharmacovigilance Center, through Q. Carmen Becerril and her work team: LFs. Yenny Medecigo Hernández, Karla Félix, Mireya Salinas, and the collaboration of the QFB. Juana Leticia Rodríguez and Betancour, Dr. Miguel Gómez, and

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Dr. César Misael Gómez Altamirano, training courses were given (one every 6 months) aimed at doctors and nurses of the HGM. The first was held from 17 to 19 May 2006, with the attendance of 80 health professionals, the second from 15 to 17 November 2006 with 60 participants, and the third in May 2007 with 83 attendees. Subsequently, at least one refresher course was incorporated for undergraduate interns, medical specialist residents, nurses, patients, and patients' relatives. The training courses are theoretical and practical, where clinical cases of patients with ADRs are presented, and the suitability or not of reporting ADRs and their relevance to patient safety are discussed. The importance of obtaining all the information from the antimicrobial resistance (AMR) notification is highlighted, especially about the medicine (generic name, distinctive name, producing laboratory, batch number, expiry date, and reason for prescription).

Always with the objective of sensitizing health personnel to inform about the presence of adverse reactions to drugs, contrast media, biotechnology, and vaccines and to generate the culture of reporting adverse reactions to drugs in health professionals and emphasizing that it is the doctor and nurse of the Institutional Center of the HGM who will collect information from patients who present adverse reactions to drugs to prepare the corresponding notification.

It should be noted that on May 24, 2006, 5 days after the end of the course, the Institutional Pharmacovigilance Center received the first notification of a therapeutic inefficacy of calcium gluconate lactate, 500 mg tablets, in a 36-year-old patient, post-operative: total thyroidectomy, parathyroidectomy, and radical neck dissection for papillary thyroid cancer, which required calcium replacement to prevent hypocalcemia. The second notification was made on 25 May 2006, when the 35-year-old patient developed a generalized rash following intravenous administration of trimethoprim sulfamethoxazole.

From the first notification in May 2006 to December 2025, the Institutional Pharmacovigilance Center has maintained the notification of adverse reactions to drugs, contrast media, biotechnological, and vaccines to the National Pharmacovigilance Center (CNF); so far, a total of 4,700 spontaneous reports or adverse events have been reported and, adding the number of adverse reactions presented by patients, some with two or more symptoms or syndromes, a total of 10,096 adverse reactions are obtained (Table 1). The notification of AMRs was maintained even in the H1N1 (2009) and COVID-19 (2020-2022) flu pandemics, with all the difficulties involved in the sanitary measures that were implemented for each of the services and units of the HGM. In the years in which fewer notifications are observed, it is due to the decrease in health professionals who left the Institutional Center due to retirement, in 2013, the retirement of the QFB. Silvia Naranjo, and in 2017, the nurse Ortega Cedillo. Fortunately, in that period, the MC. Maritza Martínez Venegas was incorporated into the pharmacovigilance activities; in 2018, the nurse Mireya Velázquez Zarco; in 2023, the nurses Ma. Guadalupe Cruz Aguilar and Verónica González Chávez and QFI. Massiel M. Marquez Pulido; and in 2024, the LF. Yazmin N Neri Sánchez and the nurse Ernestina Martínez Mendoza.

Table 1. Number of notifications and adverse reactions sent to the National Pharmacovigilance Center by the Institutional Pharmacovigilance Center of the *Hospital General de México Dr. Eduardo Liceaga*

Year	No. patients	No. adverse reactions
May 24-December 31, 2006	151	307
January-December 2007	366	845
January-December 2008	207	342
January-December 2009	163	298
January-December 2010	338	643
January-December 2011	313	672
January-December 2012	230	495
January-December 2013	180	362
January-December 2014	214	463
January-December 2015	254	552
January-December 2016	288	673
January-December 2017	171	378
January-December 2018	257	467
January-December 2019	258	525
January-December 2020	178	406
January-December 2021	100	208
January-December 2022	134	363
January-December 2023	203	519
January-December 2024	321	716
January-December 2025	374	862
Total notifications	4,700	10,096

Table 2. Group of drugs responsible for adverse reactions reported by the Institutional Pharmacovigilance Center of the *Hospital General de México Dr. Eduardo Liceaga*

Group	Patients		Adverse reactions	
	No.	%	No.	%
Antineoplastics	1,331	28.3	3,813	37.8
Antimicrobials	988	21.0	1878	18.6
Algology	487	10.4	948	9.4
Contrast media	568	12.1	936	9.3
Ophthalmology	319	6.8	649	6.4
Gastroenterology	189	4.0	378	3.7
Cardiology	113	2.4	225	2.2
Endocrinology	119	2.5	218	2.2
Nervous system	89	1.9	146	1.4
Anesthesiology	78	1.7	133	1.3
Urology	73	1.6	118	1.2
Hematology	53	1.1	108	1.1
Vaccinations	36	0.8	101	1.0
Allergology	58	1.2	71	0.7
Corticosteroids	35	0.7	68	0.7
Psychiatry	41	0.9	65	0.6
Nutrition	20	0.4	49	0.5
Pneumology	22	0.5	43	0.4
Obstetrics-gynecology	19	0.4	43	0.4
Rheumatology	19	0.4	41	0.4
Electrolytes	20	0.4	26	0.3
Dermatology	3	0.1	9	0.1
Immunosuppressants	5	0.1	8	0.1
Others	15	0.3	22	0.2
Total	4,700	100.0	10,096	100.0

Table 2 shows the groups of drugs that cause the highest number of adverse reactions; first, antineoplastic drugs, with 1,331 (28.3%) of patients and 3,813 (37.8%) of adverse reactions; Within this group, we find drugs such as paclitaxel (5.7%), 5-fluorouracil (5.6%), cisplatin (2.4%), etoposide (2.1%), oxaliplatin (1.6%), carboplatin (1.6%), doxorubicin (1.0%), L asparaginase (0.7%), ifosfamide (0.9%), and methotrexate (0.9%). In the second place, antimicrobials with 988 (21.0%) of notifications and 1,878 (18.6%) of ADRs, where the following are identified: ciprofloxacin (4.5%), ceftriaxone (4.1%), vancomycin (2.3%), clindamycin (1.2%), and metronidazole (1.1%). Contrast media presented 568 (12.1%) spontaneous reports and 936 (9.3%) adverse reactions, with iopromide (4.3%), iopamidol (2.9%), and iobitridol (2.1%) being the most frequent cases and in the fourth place, the analgesic group with 487 (10.4%) of patients and 948 (9.4%) of notifications, where tramadol (1.6%), lysine clonixinate (1.4%), and paracetamol (1.1%) stand out from this group (Table 3).

Table 3. Drugs with the highest number of adverse reactions and notifications reported to the National Pharmacovigilance Center

Generic name	Patients		Adverse reactions	
	No.	%	No.	%
Paclitaxel	269	5.7	883	8.7
5 fluorouracil	265	5.6	755	7.5
Sodium fluorescein	311	6.6	620	6.1
Ciprofloxacin	212	4.5	458	4.5
Ceftriaxone	191	4.1	363	3.6
Iopromide	204	4.3	329	3.3
Cisplatin	114	2.4	303	3.0
Etoposide	98	2.1	239	2.4
Oxaliplatin	74	1.6	215	2.1
Iopamidol	134	2.9	209	2.1
Carboplatin	76	1.6	207	2.1
Vancomycin	108	2.3	189	1.9
Tramadol	76	1.6	171	1.7
Iobitridol	98	2.1	162	1.6
Doxorubicin	47	1.0	134	1.3
L-Asparaginase	35	0.7	121	1.2
Rituximab	39	0.8	121	1.2
Ifosfamide	43	0.9	108	1.1
Sildenafil	66	1.4	107	1.1
Clindamycin	56	1.2	105	1.0
Lysine clonixinate	68	1.4	105	1.0
Clobenzorex	57	1.2	105	1.0
Methotrexate	40	0.9	102	1.0
Metronidazole	50	1.1	99	1.0
Paracetamol	54	1.1	89	0.9
Others	1,915	40.7	3,797	37.6
Total	4,700	100.0	10,096	100.0

It should be noted that sodium fluorescein, a diagnostic medium used for retinal fluorangiography, occupies the third position among the drugs with 311 (6.6%) reports and 619 (6.1%) of ADRs. In addition, table 3 identifies two drugs that presented adverse events during bioequivalence studies in the clinical pharmacology service: sildenafil with 1.4% and clobenzorex with 1.2% of notifications.

On the other hand, the hospital's Institutional Pharmacovigilance Center participated as a pilot center for the implementation of the 2010 notification system for the capture of adverse reaction notifications implemented by the National Pharmacovigilance Center, which allowed all the notification information to be entered: report data, the patient, the suspected ADR, suspicious drug, concomitant medications, medical history, and assessment

of ADRs (causality, severity, severity of symptoms, quality of information and frequency of adverse reactions) and their subsequent referral to the CNF. The 2010 reporting system generated a database that made it possible to analyze the adverse reactions that occurred in the Institutional Center.

Since January 2020, the Institutional Pharmacovigilance Center of the HGM has been integrated into the Vigiflow Monitoring system of the Uppsala Center through the National Pharmacovigilance Center, where the notification is entered directly into the database, after the evaluation of the suspected adverse reaction and the subsequent review of the CNF. The Vigiflow system uses the MedDRA medical dictionary to code adverse reactions and thus harmonize information internationally. At present, 1310 adverse reactions have entered the Vigiflow system from January 2020 to December 2025. All of them meet the quality standards required for submission to the Uppsala Monitoring Center.

20 years after the formation of the Institutional Pharmacovigilance Center, it has established itself as a center that promotes the detection, identification, quantification, evaluation, and prevention of possible risks derived from the use of drugs, contrast media, biotechnology, and vaccines administered to patients; in addition, to establish the probable causal relationship between the drugs and the adverse reaction. The Institutional Center has regularly and permanently established itself as a unit that notifies the National Pharmacovigilance Center in a timely manner, through the Vigiflow system of the Uppsala Monitoring Center, always maintaining the quality standards of notifications of ADRs.

Funding

The author declares that he has not received funding.

Conflicts of interest

The author declares no conflicts of interest.

Ethical considerations

Protection of human subjects and animals. The author declares that the procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation and with the World Medical Association and the Declaration of Helsinki. The procedures were authorized by the Institutional Ethics Committee.

Confidentiality, informed consent, and ethical approval. This study does not involve personal patient data, medical records, or biological samples and does not require ethical approval. SAGER guidelines do not apply.

Declaration on the use of artificial intelligence. The author declares that no generative artificial intelligence was used in the writing or creation of the content of this manuscript.

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HISTORY ARTICLE

Development of Research Direction at the *Hospital General de México* in the last two decades

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Introduction

From 1905 to 1998, the hospital shared the responsibility of the direction of research and teaching in a single directorate, so the last dual director of Teaching and Research was Dr. María Elena Anzures López. In 1998, Dr. Rubén Burgos Vargas, renowned rheumatologist and researcher emeritus of the National System of Researchers (NSR), would be appointed as director of research. Subsequently, Dr. César Augusto Macías Chapula, a doctor with a specialty in medical information sciences, would take over in 2004. For 2008 and mid-2010, Dr. Francisco Velasco Campos, eminent neurosurgeon and researcher emeritus, would oversee the direction. Then came Dr. David Kershenobich Stalnikowitz, current Secretary of Health in this government, and who also led the direction until 2012. From this date until 2016, Dr. Juan Carlos López Alvarenga, an internist and endocrinologist, served as head of research. Dr. Sergio Agustín Islas Andrade, with a similar training from 2016 to 2018, would take his place. Dr. José Damián Carrillo Ruiz would be the director of the period from 2019 to 2023. Dr. Eustacio Galileo Escobedo González, molecular biologist, is appointed in March 2023 until March 2024. Dr. Gustavo Acosta Altamirano, a physician and specialist in clinical immunology, is the director of research to date.

Background

The management of the Research Directorate (RD) of the *Hospital General de México Dr. Eduardo Liceaga* (HGM), between 2011 and 2016, was developed in the context of greater globalization. It was hoped that regional economies, societies, and cultures would be integrated through communication, transportation, and trade. Interdisciplinary research was seen as essential to maintaining global competitiveness, and the need to reform education to respond to the demands of the digitally native generations was recognized.

Main achievements organized by areas

Institutional and structural development

A SWOT analysis was conducted, identifying strengths such as the experienced staff of the RD and the close collaboration with the *Universidad Nacional Autónoma de México* (UNAM), and addressing weaknesses such as limited computational resources and low scientific productivity. With the analysis of the positioning of the HGM in relation to Research, we decided on a competitive strategy of alliances with other institutions (Fig. 1). This analysis was a guide for the activities of the RD that responded to the dynamics of the

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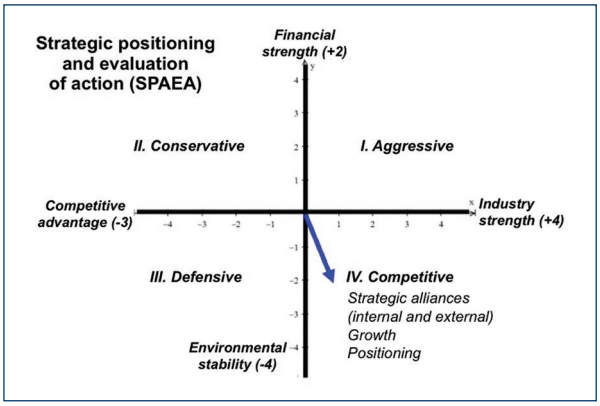

Figure 1. Strategic positioning in 2012.

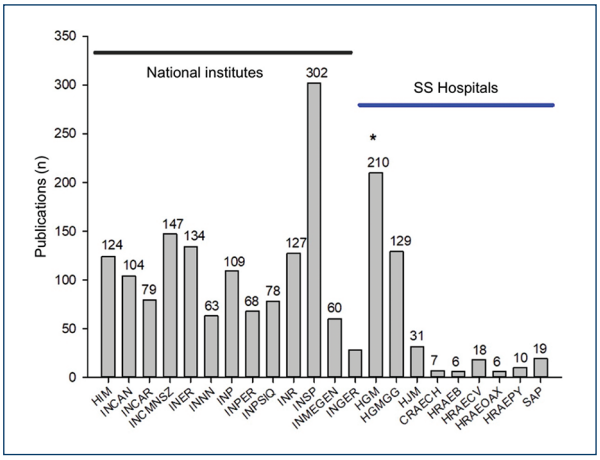

Figure 2. Publications reported by Coordinating Commission of the National Institutes of Health and High Specialty Hospitals 2013. Note that the *Hospital General de México Dr. Eduardo Liceaga* reached a production only surpassed by the Institute of Public Health. The publications reached 280 in 2015.

hospital. The extensive experience of the RD staff was decisive for the success of the management.

One of the first modifications in the RD was the transition of delivery of projects on paper to digital format, improving administrative efficiency, shortening the review time of research projects. The reorganization of office spaces to support the work of RD staff and add mathematical and physical researchers fostered a collaborative environment. The open-door policy of the RD allowed for approaches with a diversity of HGM personnel (Fig. 2). In this way, the RD space was supported for master's and doctoral classes. The creation of the Research and Technological Development Unit (UIDT), in collaboration with *Centro de Ciencias Aplicadas y Desarrollo Tecnológico* (CECADET), promoted interdisciplinary research. Dr. Rosa Quispe was the first coordinator of the UIDT, and together with Dr. Argelia Pérez, they promoted interdisciplinary research.

Collaborations and networks

The strengthening of local alliances with UNAM and *Instituto Politécnico Nacional* in 2012 allowed the solid development of the Master's and Doctoral programs by the RD with the slogan of "Researchers teaching to research." The expansion of close collaboration with the National Institutes of Health allowed for academic exchange that mainly involved the Cancer Institute, the National Institute of Genomics, Institute of Perinatology, among others. In addition, we maintained international collaborations in 2014 with the Cleveland Clinic, Mayo Clinic, and Southwest Foundation for Biomedical Research, results limited to writing articles and presenting posters at scientific events.

Human resource development

We expanded the recruitment of key researchers for the teaching of Master's and Doctorate Degrees (Dr. Arturo Reding) and for the coordination of Research, such as in the Nephrology Service (Dr. Monserrat Pérez). The development of the master's and doctoral programs was directed by Dr. Fiacro Jiménez and Dr. Gloria Queipo, promoting rigorous training of members, residents, and technicians for basic and clinical research. In those years, there were federal resources that increased every year and allowed the support of the research projects of the master's students. It should be noted that many of the physicians who received training in these programs later became heads of hospital services and promoted research with their members and residents.

To solve the problem of research production, scientific writing workshops and English competence were implemented. There were regular English practice sessions with Dr. Adolfo Pérez in which anyone interested could participate openly. The greatest expansion and influence of the RD was achieved with the assignment of research coordinators in each of the medical services, which contributed to improving communication to achieve interdisciplinary projects. In addition, because several of the coordinators had been students of the master's and doctoral program, there was a boost to collaborative research at the HGM.

Scientific productivity

An increase in scientific production was achieved, going from 80 publications in 2010 to 210 in 2013, and then to 280 in 2015, with an increase in collaborative articles from 25.8% to 42.6%. Among the innovative research projects is the implementation of hyperinsulinemic-euglycemic clamps (to directly measure insulin resistance) in the pediatric age in projects by Dr. Nayeli Garibay. The Nursing Sub-Directorate widely supported the training of nurses (Lics. Mireya León and Fabiola Serrato) in this technique; it remains in the history of medicine as a novelty that we were pioneers in the use of this technique in Mexican children. Among other innovative aspects was the encapsulation of beta cells from placental epithelium, demonstrating the safety of the capsules to avoid rejection of immune reactions. With Dr. Adolfo Martínez-Tovar, the beta cells were obtained, and the polymer capsule was developed by the hospital's UIDT.

Clinical research was promoted as a practical tool to improve medical care and contribute to scientific advancement. Internal collaboration projects between hospital services and with external institutions increased, for example, the collaboration of the Maxillofacial Service with UIDT and CECADET allowed the development of prostheses of different materials for patients who had lost skull bones secondary to severe trauma. Another aspect was the use of infrared light cameras to detect thermal changes in diabetic foot lesions, thanks to the collaboration of the Endocrinology Service (led by Dr. Valentín Sánchez). It allowed us to explore new options for early diagnosis.

Financial and resource management

There was a 188.6% increase in resources in 2015, exceeding 5 million pesos through sponsorships and mixed financing. This made it possible to finance projects of researchers, Master's and PhD students, and to publish studies in journals (several journals of international impact required publication payment). For the transparent review of the use of resources, quarterly meetings of the Financial Technical Committee were implemented with our RD financial team to audit the use of resources and ensure transparency.

Achievements in numbers

Increase in active research projects (non-cumulative): From 350 in 2013 to 395/year in 2015. Research positions: INCREASE from 38 to 41 authorized research positions. Scientific output: PUBLICATIONS increased from 80/year (2010) to 280 (2015).

Since the beginning of its foundation, the HGM has been considered as a hospital that stands out in its clinical and teaching procedure, but no less important, contemplated by its creator, Dr. Eduardo Liceaga, as a hospital in which research is also developed from its beginning. The following lines describe the work carried out in the period where the pandemic occurred in Mexico and in the world.

Research during the COVID-19 pandemic period

The pandemic that lasted intensely for the period of 2020-2023 was a time of chiaroscuro where patients and health personnel were affected, some moderately and others who died unfortunately. Immediately, the HGM joined the efforts of the SS. It was named after the *Instituto Nacional de Enfermedades Respiratorias* as a COVID hospital. From here, a series of guidelines was issued in conjunction with the Coordinating Commission of the National Institutes of Health and High Specialty Hospitals (CCINSHAE) and the General Directorate of Health Research Policies (DGPIS), joining the federal efforts of both the clinical and administrative aspects. The following achievements stand out:

- Recruitment of COVID-19 projects. A total of 117 scientific projects dedicated exclusively to this purpose were registered. No other hospital had such a large enrollment with different approaches: epidemiological, basic, clinical, prevention, and transition studies. An adaptation had to be made in conjunction with the Research, Research Ethics, and Biosafety committees so that they could analyze the projects expeditiously given the health emergency. These projects were monitored, and in the end, more than 50 protocols were actively maintained.
- The team of the Genomic Medicine Service with Drs. Eira Valeria Barrón Palma and Ana Laura Sánchez Sandoval, as researchers, facilitated the timely arrest of cases by molecular biology, when the technique was being standardized, their contribution being timely and very valuable for the people of Mexico. On December 24, 2020, the vaccine against COVID-19 would be applied, with the HGM being the first place to do so, with the authorities and the undersecretary of health, Dr. Hugo López Gatell.
- Weekly meetings were held both staff, with the rest of the directors of the hospital, and the extraordinary

meetings with the authorities of the secretariat to resolve the onslaught of the peaks of the pandemic. Scientific sessions were implemented every friday on the most relevant articles in very high-impact journals, to help regulate criteria for diagnosis and treatment with the most used drugs; as well as epidemiology or health policies, as well as research with pathological and immunological data that would serve to establish concrete measures.

- The continuity of the hospital committees already mentioned was carried out, but a quality committee was created with the presidents of each of the committees to be able to carry out the projects in a harmonious way during the pandemic, and later it was continued for the resolution of other research projects or the same direction. This committee was innovative and extremely useful to be able to align the impulses during the pandemic and learn more about some hospital problems.
- Various indexed publications were obtained from the COVID projects, which to this day continue to be forged in articles in journals of an adequate level, either alone by the hospital's researchers or in conjunction with collaborations with other national or foreign institutions.
- The participation in the National Research Colloquium by the DGPIS and the CCINSHAE held annually in Acapulco (headquarters of the SS) during these years, continued with the research carried out mainly on COVID-19.
- During this period, the number of researchers in the National System of Researchers also increased, and for the 1st time in the history of the hospital, there were two appointments of emeritus researchers for Dr. Francisco Velasco Campos and Dr. Rubén Burgos for their excellent career (Tables 1 and 2).
- During this time, two important changes occurred in publications: on the one hand, the number of publications in general increased significantly, placing the hospital as the first place in federal hospitals and within the first three in conjunction with institutes and hospitals of high specialty and reference. On the other hand, a transformation from being part of the publications at the most basic levels to becoming accepted publications at much higher levels**.**
- Highlight the teamwork between the researchers, the administrators, and the secretariat, mainly Mrs. Marcela Ivonne Rodríguez Mendoza, Natividad García Gómez, Carolina Hernández Siles, and Fabiola Valencia Luna.

Institutional program

It is worth noting that the institutional program of the HGM is attached to the National Development Plan 2019-2024, which stipulates that clinical care is based on validated scientific knowledge and that the treatment granted considers the patient as a human being. Thus, in its second objective, it establishes that: scientific research around the patient will be promoted. Three points that have been the focus of these years stand out: (1) Generate knowledge that improves patient care when treated at HGM (2) Disseminate this knowledge in high-impact scientific journals. (3) Research will generate evidence of an equitable care system. (4) Research can help promote and generate health. (5) Establish alliances and agreements with the public and private sectors, mainly the use of drug projects. (6) Strengthen the Research and Research Ethics Committees.

The HGM has a great tradition of 120 years of history in Mexican Medicine. Healthcare and educational activities have been a great rock, but research has also played a leading role in the development of new knowledge and comprehensive patient treatment. During the period 2019-2023, the most important event was to fully support new projects that improved patients during the COVID-19 pandemic, being the hospital in which the most projects were submitted (n = 117) and long-term follow-up (n = 50) in accordance with hospital policies and the HGM being the center with the most beds to care for patients with COVID-19. However, the number of research positions by the DGPIS was also increased, as was the number of national researchers, including two emeritus researchers by the NSR, and importantly, the number of publications was on the rise, both in quantity and in the quality of the level of publication.

Table 1 shows that the HGM has until 2023: 45 level II researchers, and 7 level III researchers, which it had never had; in addition to two emeritus researchers, which is a great achievement. From 2013 to 2023, the HGM increased the number of NSR investigators from 40 to 64 in just 10 years. Table 2 shows the number of high-impact publications from 2015 to 2023. We highlight the period 2019-2023, where the percentage of publications increased significantly from 37.8% in 2019 to 71.7% in 2023.

Consolidating research at the HGM. Identifying opportunities

The clinical, basic, and translational research carried out at the HGM is, today, one of the most prolific among

Table 1. Number of researchers appointed by the NSR, with respect to their level: from candidates to emeritus

NSR level	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Emeritus	0	0	0	0	0	0	0	1	2	2	2
Level III	3	3	4	3	3	5	6	5	5	5	7
Level II	11	12	10	8	9	10	9	9	7	6	45
Level I	20	23	23	30	31	30	24	28	31	40	6
Candidate	6	6	6	4	5	6	4	6	8	10	6
Total	**40**	44	43	45	48	51	43	49	53	63	**64**

Bold numbers highlight the comparison between 2013 and 2023.
NSR: National System of Researchers.

Table 2. Number of high-impact publications from 2015 to 2023

Year	Levels 4-7	Levels 3-7	%
2015	7	28	25
2016	12	35	34.3
2017	28	64	43.8
2018	28	83	33.7
2019	**31**	**82**	**37.8**
2020	42	122	34.4
2021	50	137	36.5
2022	97	139	69.8
2023	**99**	**138**	**71.7**

Bold numbers highlight the comparison between 2019 and 2023.

the health institutions that make up the CCINSHAE. According to the DGPIS of the Ministry of Health, at the HGM, 30% of the researchers have appointments as Researchers in Medical Sciences (RMS) at levels A or B, 62% have appointments in the ICMC or ICMD categories, and 8% have an appointment at the ICME or ICMF levels. On the part of the NSR, we have six National Researchers Level 2, forty-five National Researchers Level 1, and seven National Researchers Level Candidate. In addition, currently more than 55% of the hospital's publications are made in high-impact journals of groups III-VII.

These indicators represent, without a doubt, a series of very outstanding achievements at the research level for an institution such as the HGM, whose main task is to provide health services to the population with the highest possible quality. These and other achievements are summarized below as the ten most important of the RD during the 2023-2024 administration.

The first area of opportunity that the 2023-2024 administration detected was to correct the scarce link of new researchers with less experience to consolidated research groups to strengthen the research staff. To this end, the RD promoted a program to link consolidated research groups led by RMS of levels D and F with RMS levels A, B, and C, also linking researchers from the clinical area who are members of the NSR with RMS, mainly from levels A, B, and C. In addition, the RD promoted a Research Seminar every Thursday of each month at 9:30 a.m., where researchers with consolidated careers establish collaborations with young researchers. Compared to the preceding period, the number of RMS level D researchers increased to 10, while the number of RMS level F is now 3. In addition, the number of researchers at transitional levels B and C increased to 7 and 14, respectively. For the 1st time, we have 45 researchers in level 1 of the NSR, as well as 6 in level 2 and 6 in level 3.

The RD began the efforts to form a Research Pre-Committee that will advise researchers, as well as health personnel, in the writing and design of research protocols, data analysis, and the preparation of scientific research articles to be published in journals of Groups III-VII. In addition, the RD is designing a course entitled "Bases for the Effective Development of Research Protocols" that will be taught in person and virtually to all hospital staff interested in developing research activities. As a result, the number of current projects has gradually increased compared to the immediately preceding period. In addition, the course "Bases for the Effective Development of Research Protocols" began to be taught in October 2023 in person and online.

The third line of action included improving the publication of research articles in high-impact journals in Groups III-VII. The RD promoted a plan to link researchers in the basic and statistical areas with researchers in the clinical area, with the aim of combining strengths, reducing the time it takes to write and prepare manuscripts, and developing publications with greater clinical impact, with solid methodological bases. Compared to the preceding period, which reached a maximum peak of 152 publications in 2018, the number of articles published has been gradually increasing, 164 in 2019, 172 in 2020, 201 in 2021, 236 in 2022, and 128 so far in 2023. This upward trend was achieved thanks to the strategy of linking the clinical, basic, and statistical areas, ordered by the General Directorate and implemented by the RD.

The fourth area of opportunity detected consisted of improving the lack of high-level research projects that analyze the conditions, problems, and characteristics of the Mexican population to guarantee better results in health care and a public, equitable, and free health system. The RD, in coordination with the General Directorate, the Directorate of Medical Coordination, and the Directorate of Health Education and Training, promoted the development of a study protocol to understand and address the root causes that determine that non-entitled patients who come to the hospital for consultation and treatment, fill their prescriptions at the free pharmacy. To guarantee that the entire population that comes to this hospital center enjoys a quality, public and free health system, with processes and interventions corresponding to a tertiary level of care hospital. As a result of the studies carried out, areas of opportunity were identified to improve the service that patients receive in the hospital, signage was improved to direct patients to the free pharmacy, the requirement for medical personnel to issue prescriptions on the AAMATES platform was intensified, and the treatment of patients by pharmacy staff was improved. Locating printed information that patient can view to receive specific information about the process of obtaining medications and treatment in the hospital.

The fifth point we addressed was to increase the number of alliances and agreements in the field of research with the public and private sectors, as well as to increase work schemes that guarantee the fight against corruption, transparency, and traceability. In this sense, the RD promoted two strategies to address this lag. First, it was established that the pharmaceutical industry's first contact would be with the RD and not with the responsible researchers. Finally, the Clinical Pharmacology Unit was remodeled to receive and attend to the patients participating in the protocols, as well as to process and store all the samples and information derived from the research protocols. In an unprecedented way, the Research Directorate promoted the subscription of with the pharmaceutical industry, guaranteeing that economic resources were properly managed. In addition, the RD made a collaboration agreement with the *Instituto Nacional de Geriatría* and worked on the development of other agreements with the Faculty of Medicine (FacMed) and the Institute of Cellular Physiology of the UNAM.

With respect to the sixth line of action, we increased collaboration in research with the Experimental Medicine Unit (UME) of the UNAM, the RD promoted a research collaboration agreement with the FacMed, directly with Dr. Paz María Salazar Schettino, who then served as the Head of the Research Division of the FacMed. The research collaboration agreement focused on promoting collaborative projects between the UME and the hospital's researchers. As a result of this, we prepared a research agreement between the UNAM School of Medicine and the HGM.

The seventh area of attention involved improving the review and approval of own and sponsored research protocols. To achieve this, the RD restructured the Research Ethics Committee and the Research Committee, as well as their procedures and guidelines to ensure that the hospital's scientific work is in accordance with current regulations and can be carried out expeditiously. Thus, the RD carried out the renewal of the Research Committee and the Research Ethics Committee, from their presidencies to their members, as well as an update of the guidelines and guidelines for the presentation of projects, which are under review by both COFEPRIS and CONBIOÉTICA for approval and subsequent publication on the hospital's website. In accordance with the General Health Law and the guidelines of good clinical practices aimed at protecting the mental and physical integrity of the participating patients, throughout the research.

The eighth point of improvement was to increase the applicable legal framework for the collection of financial resources from third parties, mainly from the pharmaceutical industry, to attract more resources for the Hospital. In this sense, the RD, together with the General Directorate, implemented a plan for the former, through the Clinical Pharmacology Unit, to regulate all sponsored research carried out in the hospital. The penultimate point of improvement included the optimization of

the processes of use and execution of third-party resources in a transparent and accountable manner.

Finally, the tenth area of opportunity detected consisted of increasing basic and clinical research to face the COVID-19 pandemic and increase patient survival. As a result of the pandemic, research work was carried out on COVID-19 and post-COVID-19. Among the most relevant achievements, a prognostic mortality scale for patients with SARS-CoV-2 infection was published. It should be noted that the COVID-19 pandemic was an unprecedented health emergency in this century. Since the beginning of the pandemic, the guideline set by the General Directorate was to care for patients with COVID-19 and, at the same time, investigate their pathophysiology and the nature of the infection, focusing efforts on developing prognostic scales of severity and mortality to increase patient survival and optimize hospital resources for pandemic care. For this reason, almost a hundred projects on COVID-19 were developed, some of which are still in force. It is important to mention that these projects resulted in a 25-35% increase in the number of total publications between 2020 and 2022; specifically, a prognostic scale was published that considers the total number of blood lymphocytes among the total number of blood neutrophils (LNR), as a scale for predicting mortality from COVID-19, which allowed multiplying efforts in those patients whose risk of mortality was high, from hospital admission. The LNR prognostic scale is still in use in COVID-19 patients who have not received a complete SARS-CoV-2 vaccination schedule.

The future of research at the HGM 120 years after its foundation

Since its foundation in 1905, the HGM has been a pillar of public health and well-being in our country. Her story reflects the spirit of resilience that characterizes Mexico. This institution has bravely faced historic challenges, from its heroic response to the 1985 earthquake to its leadership in health care during the COVID-19 pandemic.

Under the direction of Dr. Gustavo Acosta Altamirano, we understand that chronic diseases such as obesity, diabetes, and cardiovascular diseases require an innovative approach to research, including the validation of more effective and accessible therapies for Mexicans. For this reason, it is essential to advance in preventive medicine, integrating findings from basic and clinical science to develop diagnostic tools that allow interventions to be carried out before diseases progress, and for this, it is necessary to use the new tools that we now have.

Artificial intelligence (AI): a new character on stage

An emerging field of particular interest is the use of AI in clinical practice, from the interpretation of diagnostic images to the design of personalized therapeutic schemes. HGM has the potential to pioneer these types of technologies. En este contexto, la RD realizó el primer curso de AI en las instalaciones del hospital. This course demonstrated that AI is significantly transforming medical practice and research in medicine. Its ability to process and analyze large volumes of data in a short time makes it a tool capable of analyzing medical images, such as X-rays or magnetic resonance imagings, to detect anomalies with accuracy comparable to or even superior to that of expert doctors.

At present, the creation of the AI area is being planned, which will be a space for the development of research for diagnosis and care. Machine learning models can analyze millions of chemical compounds to identify those with the greatest therapeutic potential. For example, during the COVID-19 pandemic, AI algorithms were used to analyze databases of existing drugs and propose candidates for repurposing.

Patient management and hospital systems have also benefited greatly from AI. For example, chatbots and virtual assistants are improving patient experience by answering common questions, scheduling appointments, and providing reminders for medical follow-up. In addition, predictive algorithms are helping to optimize hospital resources, forecasting the demand for intensive care beds or staffing needs. A practical example is the work of Dr. Adolfo García and collaborators, who are developing algorithms that reduce the burden of care in the cardiology and anesthesiology service, helping to discriminate those patients at risk of postoperative complications.

Genetics and genomics: driving translational medicine

In recent years, HGM has begun to position itself as a key player in basic research. In a country where diseases such as diabetes, cancer, and hypertension significantly affect the population, it is crucial to explore their genetic and molecular bases. Genomic medicine is a central axis in projects that analyze the genetic diversity of Mexicans, which has made it possible to

identify variants associated with susceptibility to diseases and be used as biomarkers for early diagnosis and personalized therapies. This is especially relevant in a country as diverse as Mexico, where genetic background has a significant impact on health. Currently, the first studies we are carrying out, using next-generation technology, are led by Dr. Luz María González, who has focused on analyzing gene variants in patients with breast cancer. To promote these same analyses, the RD is promoting the creation of the Sequencing Unit, focused on using next-generation sequencing equipment using platforms such as Ion Torrent (Thermo Fisher) and Oxford Nanopore sequencing Nanopore.

By analyzing genomic, transcriptomic, and proteomic data, algorithms can identify patterns associated with specific diseases and propose personalized treatments. For example, in oncology, tools such as IBM's Watson for Oncology help select targeted therapies based on the molecular characteristics of a patient's tumor. This improves the effectiveness of treatment but also reduces side effects by avoiding generic therapies that might be unnecessary. In this way, AI acts as a bridge between genomic research and daily clinical practice.

The sequencing unit will also be able to provide care services to strengthen the diagnosis of complex diseases, as well as participate in the development of various types of research from microbiology to virology. The lessons of the COVID-19 pandemic have underscored the importance of strengthening our capacity to anticipate and respond to epidemiological outbreaks with innovative scientific solutions.

Histocompatibility: the challenge of transplantation

The HGM has been a pioneer in the performance of transplants, establishing itself as the number one in liver transplantation in Mexico. This hospital has also implemented advanced programs in kidney and heart transplantation, developing specialized protocols that guarantee the safety of the donor and the recipient, optimizing long-term results. As a challenge for the general management, the RD has been entrusted with the creation of the Histocompatibility Laboratory, which will provide care to hospital patients who are candidates for some type of transplant. These tests stand out as a reliable option thanks to their combination of precision, technological innovation, and adaptability to the needs of our institution; in this way, the RD will be a pioneer in the implementation of molecular tools with a high impact on improving patient survival.

Strengthening inter-institutional research and private industry

Collaboration between hospitals, universities, and private industry represents an invaluable opportunity to address current health challenges. The hospitals and institutes that make up the CCINSHAE contribute their clinical knowledge and access to patients; universities, their scientific capacity; and private industry, financial resources, and innovative medicines.

The RD has continued to draw up agreements to promote inter-institutional collaboration to develop research projects. An example of these interactions has been the approach with the UME of the UNAM, where we have the collaboration of researchers from this unit, with whom we intend to carry out innovation projects focused on the health of the Mexican population through a multidisciplinary approach. Likewise, the approaches to various institutions such as *Instituto Nacional de Medicina Genómica* (INMEGEN), the *Hospital Juárez* in Mexico, the *Hospital Infantil de México*, the *Hospital Regional de Alta Especialidad de Ixtapaluca* and universities such as the *Benemérita de Puebla*, the *Autónoma de Aguascalientes* and the *Universidad Autónoma de la Ciudad de México* have generated the possibility of carrying out research agreements with a focus on translational medicine that would have a high impact on our population.

Finally, through the pharmacology service, the RD continues to promote collaboration with private industry. This has made it possible to centralize processes and generate a space that provides facilities for the pharmaceutical industry to develop its projects. The HGM achieved significant advances in clinical, basic, and translational research, strengthening its impact in the field of health in Mexico. The administrations of recent decades have promoted strategies to consolidate scientific development by integrating young researchers into consolidated groups, training for the creation of protocols and scientific articles, and the implementation of plans to improve the quality and quantity of publications in high-impact journals. In addition, strategic alliances with national and international institutions continue, strengthening transparency in the management of financial resources. The hospital's response to the COVID-19 pandemic exemplifies the institution's commitment to healthcare innovation, developing prognostic tools that continue to benefit high-risk patients. These achievements reflect a solid

commitment to raise the quality of health services and promote research as a fundamental pillar in highly specialized medical care in Mexico within the framework of the 120th anniversary of its foundation.

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Conflicts of interest

The authors declare no conflicts of interest.

Ethical considerations

Protection of human subjects and animals. The authors declare that no experiments on humans or animals were performed for this research.

Confidentiality, informed consent, and ethical approval. This study does not involve personal patient data, medical records, or biological samples, and does not require ethical approval. SAGER guidelines do not apply.

Declaration on the use of artificial intelligence. The authors declare that no generative artificial intelligence was used in the writing or creation of the content of this manuscript.

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HISTORY ARTICLE

The Central Laboratory of the *Hospital General de México*. Advances in diagnostic technology

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Introduction

Medicine, as a product of science, is based on the knowledge that has been generated through observation, experimentation, and deduction. However, science, in addition to generating knowledge, has also been able to generate technology and this, in turn, has served to generate knowledge and grow at the same time, feeding each other. Anton Van Leeuwenhoek, with a microscope, which he himself invented and elaborated, described blood cells in 1674 while current optics and histology allow us to see and differentiate the elements that make up it, for example. This inseparable duo (knowledge and technology) has contributed, historically, to the generation and improvement of equipment that allows the analysis and quantification of morphological and functional elements of almost any organ of a human being, which provides information on an individual, which is why it has become one of the fundamental tools that the doctor uses to diagnose, evaluate a treatment or predict the course of the disease; laboratory studies. Tertiary level hospitals, such as our *Hospital General de México* (HGM) *Dr. Eduardo Liceaga*, are highly complex institutions designed and equipped to attend to and solve the health problems of our country.[1] In this sense, we have trained personnel, as well as advanced and specialized technology that allows us to diagnose diseases and provide treatments. However, we do not only treat patients from our hospital, but we also provide care to patients referred from other institutions who do not have the necessary human and technological resources for their diagnosis and treatment. In such a way, the robotization of the Central Laboratory that began in 2007 has been of vital importance for medical care. In addition, its constant technological renewal has maintained the balance between care, science and teaching thanks to the digitalization processes that we now have and, by virtue of its avant-garde healthcare spirit, we will implement as a result of the technology in turn.

Who are we?

The Central Laboratory of the HGM is a service that is located in unit 205 of this hospital and provides care to patients who require our service 24 h a day, 365 days a year, providing quality, warmth and performing clinical laboratory analyses in an efficient and

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timely manner, to contribute to the diagnosis in the medical care of patients who attend the HGM. We are also a laboratory certified by the ISO 9001:2015 standard with a well-established Quality Management System in all processes. We process around 4,000,000 laboratory studies and treat approximately 500,000 patients per year, thanks to the constant support of the General Directorate, the Medical Coordination Directorate and the Diagnostic and Treatment Support Directorate. In addition, we support the different committees of the institution in carrying out the research projects of the different services of both the federal budget and the pharmaceutical industry, such as: antimicrobials, detection and control of nosocomial infections, institutional control and performance, among others. We also actively participate in medical education since there are inter-institutional agreements with the different universities serving around 300 medical students a year.

Central Laboratory structure

The Central Laboratory is made up of 10 sections: (1) Sampling, in charge of the QFBT. Javier Sánchez Mejia and Biol. Rodolfo Sandoval Guzmán, who provide personalized care to adult and pediatric outpatients who come to the laboratory. Through a digital system with barcodes which allows the correct identification and compliance with international patient safety goals; (2) Parasitology, by TEQAC. Beatriz Álvarez Lara, where the studies of the stool and coproparasitoscopic examination of feces are carried out. Recently, the immunological fecal occult blood test was performed, favoring specificity in the determination of the test; (3) Clinical Biochemistry, in charge of the M en C. Leonardo Fermín Acevedo Olvera where about 30 different analytes are performed per patient, glucose tolerance curves, gynecological screening and recently the addition of the glycated hemoglobin test by high-performance liquid chromatography; (4) Bacteriology, in charge of the QBP. Miguel Ángel Morales Gil, where the identification of bacteria and yeasts is carried out using sophisticated techniques such as mass spectrometry; as well as bacterial susceptibility tests to different drugs; (5) Immunology-Virology, by the QFBT. Oscar Iván Acuña Herrera, performs tests of Virology, Tumor Markers, Hormones, Autoimmunity and recently Flow Cytometry and polymerase chain reaction in real time for HIV and SARS CoV2; (6) Hematology-Coagulation in charge of the QBP. Diana Becerril González where Blood Cytometry, Coagulation Times, LE Cells and search for Hematozoa in Blood are performed; (7) Uroanalysis; by Biol. Emilia Evelia Mendoza Figueroa, is in charge of the analysis of more than 10 chemical parameters of urine and the reading of the urinary sediment in real time with the help of an automated state-of-the-art analyzer; (8) Quality Control, in charge of the MAH and SP. Mariblanca Solís Elías is in charge of monitoring compliance with the procedures and activities necessary for compliance with the internal and external quality control of the aforementioned sections; (9) Serum electrolytes; in charge of the QBP Laura Eréndira López Zaragoza where tests are carried out such as the determination of sodium, potassium, chlorine and calcium in urine, purification of endogenous creatinine and proteins in urine for 24 h; and (10) Emergencies, in charge of the QFB. Dr. Sharone Garduño González performs rapid response tests for hospitalized patients who require our service. The independent automated analyzers in this area give priority in the event of an emergency in the Transplant Unit; as well as the rapid response codes of our hospital: stroke, infarction, mater, red, sepsis, among others.

As a leadership strategy, each section leader has been appointed based on their academic background and professional experience within the service, which ensures that each section provides its service with humanism, efficiency and punctuality. In addition, the staff in his charge is highly qualified to provide the professional and quality service that the medical staff requires and our patients deserve, uninterruptedly. It is important to note that the delivery times of results do not exceed 24 h, 365 days a year. It is essential to comment that the central laboratory has been able to face the challenges of being up to the HGM, and an important challenge we faced was the COVID-19 pandemic and free of charge, where we had the need to replace manual techniques with others of greater sensitivity and specificity, and the prompt and timely implementation of high-performance automated equipment.

Human resources assigned to the Central Laboratory

The foundation of any hospital is made up of the people, caregivers, and support staff directly responsible for patient outcomes and satisfaction levels. In the Central Laboratory, a positive and compassionate work culture is always encouraged, working as a team has allowed us to always issue reliable and timely results to contribute to the diagnosis in the medical care of the patients who come to our beloved hospital. Currently,

our staff consists of 177 people (1 head of service, 33 chemists, 2 biologists, 19 laboratory technicians, 78 laboratory technicians, 1 general practitioner, 24 administrative staff, and 19 workers).

Patient care

Appointment scheduling

To perform laboratory studies on outpatients, quickly and effectively (Fig. 1). The adult patient and/or companion presents' himself at the reception of the Central Laboratory from 8:30 a.m. to 2:00 p.m. from Monday to Friday and in the case of pediatric patients from 10:00 a.m. to 1:00 p.m. from Monday to Friday. The reception staff asks the applicant on the day of the appointment with the doctor, to schedule the date of studies, minimum 15 days before the medical appointment and maximum 30 days, or it will adjust to the dates available in the calendar of the computer system. The staff offers a date to the applicant to find out if the patient can attend the study appointment, if not, another date is proposed. Once the date is agreed, it is captured in the computer system and the patient is provided with their proof of appointment.

Figure 1. Patient care in the Central Laboratory. Outpatient and medical staff reception area (left), outpatient sample waiting room (right).

Sampling

This process is the one with the greatest contact with our patients and we provide them with human warmth and security by having new and sterile material for their procedure. First, the surveillance staff asks the patient and/or companion to go to the reception for the printing of barcode labels for studies requested by the doctor and then to line up for the collection of a sample, which can be blood, parasitological and/or bacteriological. The Central Laboratory professional starts the session through an electronic tablet that is located in each cubicle, entering their username and password and that also registers with barcodes the type of patient, shift, productivity of each phlebotomist, internal folio, the patient's full name, age and sex, thus complying with institutional identifiers and international patient safety goals. Finally, the staff proceeds to take the patient's samples, register them with barcodes and distribute them to the different process areas (Fig. 2).

Figure 2. Blood samples are taken at the Central Laboratory. Barcode identification of biological samples (left), care process in cubicles (right).

Central Laboratory automation

The first step toward optimizing resources and improving efficiency was the centralization of samples in a single Central Laboratory. To this end, a pneumatic sample transport system was implemented, which allows samples to be sent from the different areas of the hospital to the Central Laboratory. This centralization has allowed all samples to be processed in one location, which has facilitated excellent quality control and standardization of procedures. In April 2007, a robotic system for transporting and handling samples known as Power Proccesor was installed for the areas of Biochemistry and Immunology, which has eliminated up to 80% of manual processes, considerably reducing processing times and biological risk for equipment operators. It is important to mention that in the past 4 years, more than 35 high-performance automated analyzers have entered all sections of the Central Laboratory, maintaining the constant commitment to technological

Figure 3. Automation and modernization of the Central Laboratory. Users of the operational area of the different sections (hematology, immunology and bacteriology), respectively.

Figure 4. Advances in diagnostic technology. Bacteriology section of the Central Laboratory where you can see some of the high-performance automated equipment to provide a better service.

innovation and the elimination of obsolete equipment (Figs. 3 and 4). To mention a few, BC Robo 900 equipment with greater capacity in the automatic labeling of tubes was introduced in the sampling area, which minimizes the risk of errors in the identification of patient samples, a critical factor in medical diagnosis. In addition, in the bacteriology section, a comprehensive system has been installed with an automated plate seeder, the highest range of bacterial identification and detection of sensitivity to antibiotics, an instrument with the greatest capacity on the market in the detection of bacterial growth and another more recent in mass spectrometry, generating greater support for timely diagnosis. In recent days, a robotic belt with a greater capacity for the transport and handling of samples known as DXA 5000 fit is in the process of being installed, being the Central Laboratory of our hospital the spearhead of a select group of laboratories in Latin America that can count on this technology.

Future scenario of the service

Definitely, today, there is a constant trend toward innovation and modernization in all work environments. This causes great expectations in all areas since having state-of-the-art technology is key to having better results, whatever the field of work. Laboratories do not escape this trend and in order to be "the laboratory of the future" in addition to the equipment, knowledge and experience of the staff, it is necessary to have adequate spaces, not only in size but also in design and other characteristics. Currently, the direction of personalized medicine allows us to approach the treatment and prevention of diseases based on their genetic and environmental variability and the lifestyle of each person. The implementation of the processes associated with Personalized Medicine and the demand of the population increasingly implies that the professionals of the Central and Peripheral Laboratory of the HGM, face great challenges with increasingly sophisticated automated technologies that are very useful to obtain laboratory results quickly.[2] Accurate and reliable. All this will strengthen the national health system and provide better care to patients from all corners of

our country, prioritizing vulnerable groups. Similarly, the transformation of health systems toward a digital world will have an impact on the way health services are delivered, cost savings and improved efficiency.

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Conflicts of interest

The authors declare no conflicts of interest.

Ethical considerations

Protection of human subjects and animals. The authors declare that the procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation and with the World Medical Association and the Declaration of Helsinki. The procedures were authorized by the Institutional Ethics Committee.

Confidentiality, informed consent, and ethical approval. This study does not involve personal patient data, medical records, or biological samples, and does not require ethical approval. SAGER guidelines do not apply.

Declaration on the use of artificial intelligence. The authors declare that no generative artificial intelligence was used in the writing or creation of the content of this manuscript.

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HISTORY ARTICLE

Clinical Nutrition Service at the *Hospital General de México Dr. Eduardo Liceaga*

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Throughout human history, medicine has undergone significant advances, especially in the past five decades. Among the recently developed disciplines is Clinical Nutrition (CN). It deals with the prevention, diagnosis, and treatment of nutritional and metabolic changes related to acute or chronic diseases and conditions caused by excess or deficit of energy. It is important to emphasize that NC not only has a curative approach but also a preventive one[1].

History of the formation of the CN service

The *Hospital General de México Dr. Eduardo Liceaga* (HGM) was inaugurated on February 5, 1905, by President Porfirio Díaz, with the presence of Dr. Liceaga and its first director, Dr. Fernando López. Since then, food was provided to patients during their hospital stay, with the aim of satisfying "hunger," since the hospital was conceived as the "hospital of the poor[2]."

In 1943, the first courses for the training of dietitians began in Mexico, which addressed both the clinical and social aspects of food, promoting the emergence of formal education in Nutrition. In 1950, the hospital´s Nutrition Service was established. Initially, it was in charge of cooks, laborers, and treasurers, who focused on the operational preparation of food for hospitalized patients[3]. Over the decades, dietitians, nutrition technicians, and nutrition graduates joined the service after the creation of the first bachelor's degrees in this area in the country, graduating from various public and private institutions.

In 2000, some of the staff who were in the food service took the initiative to form a nutrition service focused on the clinic and outpatient consultation with a dieto-therapeutic approach. The concern then arose to separate the functions, location, and structure of the food service area or central kitchen to create a new CN service. However, it was not until 2013 that this division was carried out thanks to the dietitians headed by Alejandra Ruíz Barranco, RD in Nutrition, and with the support of the General Director, chaired at that time by Dr. Francisco P. Navarro Reynoso and Dr. Jesús Miguel Chávez Mayol, Director of Diagnostic and Treatment Support who was in charge of the development of the new CN service, at that time, was temporarily located in the basement of unit 204 of the HMG.

At the same time, in 2001, Dr. Vanessa Fuchs Tarlovsky began a series of research projects focused on the nutritional assessment and treatment of cancer patients, being a pioneer in this area in Mexico. Subsequently, in 2005, at the request of Dr. Eduardo Arana Rivera and Dr. Raquel Gerson Cwillich, a service focused on the nutritional care of hospitalized patients at the oncology service who required enteral or parenteral nutritional support was initiated.

In 2013, the areas that had emerged in parallel were merged, and Dr. Vanessa Fuchs Tarlovsky MD, PhD, RD and specialized in Clinical Nutrition, was appointed head of the first oficial Clinical Nutrition Service, who continues to date in office and who is algo an internationally known researcher in clinical nutrition and has contributed with many impoirtant papers regarding

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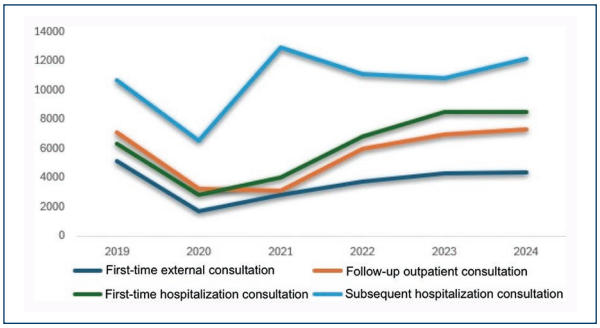

Figure 1. Type of hospital consultation from 2019 to 2024. *2024: period from January to November.

practice of clinical nutrition. In that year, the workforce was made up of six graduates in nutrition and four technical dietitians. In 2018, with the support of Dr. César Ahité Gutiérrez, general director in turn, the coordination of the unit was changed to the Medical Direction, even if it algo contribute to the surgical and pediatrics areas, and the unification of the CN service was promoted through the physical relocation of the newly formed service at the Unit 308 which is where it is located today. At present, the service has eight offices, a management area, a research coordination, and a space for academic sessions for patients, assigned staff, and students.

In the past 10 years (2013-2023), the CN service has potentially grown by 383% compared to its beginning s (Fig. 1). Professionals with specialty, master's, and doctoral degrees in nutritional sciences have been incorporated, to high quality care to the population.

During this period, a total of 191,948 consultations were provided, of which 42.4% were outpatient consultations, providing nutritional guidance to patients with highly prevalent conditions in the country, such as malnutrition, obesity, dyslipidemia, and diabetes. 57.5% of consultations were provided to patients during their hospital stay, mainly those with malnutrition or who required nutritional support.

Comparing with year 2020, when hospital occupancy was mainly of patients affected by the COVID-19 pandemic, with the current year (2024), in which all clinical areas are operating normally, an increase of 55.8% has been observed both inpatient and outpatient nutritional.

Due to the increase in interconsultations in the hospitalization area, the demand for supplies to nourish the population of patients with special requirements has increased, including standard and specialized polymeric enteral formulas in addition to having a pharmacy center within the hospital to guarantee the prescription of parenteral nutrition with individualized calculations. Placing the hospital as one of the most complete public hospitals in the entire country to guarantee nutritional support.

At present, the service is made up of 28 workers: a head of service, a research coordinator, two administrative staff, 22 nutritionists, as well as two nutrition technitians. Of the nutrition staff, 65.2% work in the morning shift, providing care to the 1130 hospitalization beds in the areas of adult care and outpatient consultation. 13.6% are dedicated to the care of hospitalized pediatric patients, including the recent Child Welfare Clinic. 18% focus exclusively on adult outpatient consultation in Unit 308 during the evening shift and on weekends, while 4.5% of the staff attends in the Obesity and Diabetes Clinic for adults.

The CN service is distinguished not only for its patient care but also as a benchmark in the training of generations of students of the Bachelor's Degree in Nutrition, postgraduate programs in specialties and master's degrees in CN and health sciences from various national and international institutions, as well as medical doctors who study their high specialty in CN. This fact has also led to an annual number of publications in indexed journals at the national and international level, allowing the CN service to expand its presence in other countries by publicizing its current practices through scientific publications and its participation in national and international conferences.

CN is a human right linked to the right to health and food that it is imperative to promote in the clinical setting to guarantee access to nutritional care for hospitalized patients, regardless of their stage of life[4]. Because of all the work that has been done and the success that the CN servicie has develop since it's creation, we thank all the staff who work and have worked in the NC service, and especially the patients, who have allowed us to grow as professionals in our work of nurturing.

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Conflicts of interest

The authors declare no conflicts of interest.

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HISTORY ARTICLE

Ophthalmology: the search for visual health

Emma V. Ramírez-Sánchez, Karla P. García-Carmona, and Ma. Estela Arroyo-Yllanes*

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Introduction

Thinking about the history of the *Hospital General de México Dr. Eduardo Liceaga* (HGM) throughout these first 120 years, fills us with pride and satisfaction to be part of this history. Since its inception, the Ophthalmology Service has been represented by outstanding ophthalmologists who made important contributions to the world of ophthalmology both nationally and internationally; hence, it has evolved both in the knowledge of eye diseases, in clinical diagnosis and that carried out by diagnostic assistants, as well as the medical and surgical treatments which have been developed in this noble institution.

In such a changing world, which the HGM has witnessed from its beginnings in 1905 to the present, scientific and technological advances in the different areas of medicine, ophthalmology has not been the exception. The evolution of cataract surgery that began with the intracapsular technique to the present day with cataract phacoemulsification procedures or cataract surgery with femtosecond laser, the different refractive surgery techniques that we have available today. Treatments for cases of diabetic retinopathy, such as laser, vitrectomy surgery, and in some cases, treatment with antiangiogenic drugs and dexamethasone implants for the treatment of associated macular edema, have become very relevant in recent years. In diagnostic aids, ultrasound, interferometers, Scheimpflug cameras, and optical coherence tomographs have also undergone an evolution that in recent years has been at great speed, providing more accurate results and images that provide great information for the diagnosis and monitoring of eye diseases.

Visual health for those of us who make up the ophthalmology service is a passion and an ongoing challenge to care for, restore, or preserve our patients' vision. The change in life expectancy, maternal and child health, the diagnosis and control of chronic-degenerative diseases, and the timely detection of oncological diseases, among others, are factors that have given a different expression to eye diseases. Hence, the need for continuous updating and daily learning arises.

Head of the Ophthalmology Service 2010-2017

When Dr. María Estela Arroyo Yllanes took over the management, many challenges were encountered that had to be focused on and measures taken to carry out the various projects. One of the important problems was the occupation of the beds of the service by patients from other services, which caused frequent suspension of surgical procedures, so it was decided to start the ambulatory surgery program in August 2010. For the outpatient surgery program, 8 non-census beds, 6 adult beds, and 2 cribs were used. In this first period, 365 surgeries were performed. In 2016, 1139 were performed, which represented 38% of the Service's surgeries.

Another challenge to be solved was the clinical file, so it was decided to restructure it, the first step was the

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printing of folders of different colors per year, which allowed to keep both the ophthalmological file, the administrative file and all the studies in one place, An important decision was the change in the way of the purification of the clinical records, manually one by one, discarding the dead file only those with more than 5 years of absence and updating the others to a new number; This task was carried out by medical personnel in order to be able to properly evaluate the cases that should be updated.

In the administrative area, a job profile was made per person, emphasizing how to cover activities during vacation or disability periods. The operating room was remodeled to comply with the standard, including the exterior corridor for the correct flow in and out, as well as the recovery area. Two clinics were formed: Diabetic Retinopathy Patient Care Clinic and Retinopathy of Prematurity Patient Care Clinic, both important visual health problems. In one of the areas in which special emphasis was placed was on teaching, 2 fixed vacation periods were assigned for residents in June and December. This implementation allowed for more efficient planning of the academic program, clinical sessions, and examinations without extemporaneousness.

It was possible to enter the specialization course in ophthalmology to the High-Quality program of *Consejo Nacional de Humanidades, Ciencias y Tecnologías* (CONACYT), with this program, the residents were able, among other things, to opt for a 4-week rotation abroad financed by CONACYT. The endorsement of the *Universidad Nacional Autónoma de México* was achieved for the high specialty courses in retina, directed by Dr. Daniel Moreno Páramo, and glaucoma by Dr. Sergio Herrero Herrera, with this the service had 5 high specialty courses: strabismus, cornea, anterior segment surgery, retina, and vitreous and glaucoma. During the administration, all the graduates who took the certification exam of the Mexican Council of Ophthalmology were approved, and most of them took a high specialty course.

The Ophthalmology Service was named after Dr. Magin Puig Solanes, who began specialty courses in Mexico, with university recognition, with the Specialization Course in ophthalmology taught in the Ophthalmology Service of the HGM being the first in the country. There were many achievements and many others that were not carried out or were left at the beginning or unfinished, representing the ophthalmologists of the HGM. It was a great honor, and what was done was largely due to the collaboration, help, and willingness of each of them.

Head of the Ophthalmology Service 2017-2023

During the management, as head of the Ophthalmology Service of the HGM, of Dr. Karla Paola García Carmona, which lasted from March 2017 to August 2023, strategies were implemented to improve the quality and productivity of surgical activity. This made it possible to achieve a 37% increase in the main cause of ophthalmological surgery, cataract phacoemulsification, benefiting one of the main needs of the country's most vulnerable population. Another achievement was obtaining the certification of the Ophthalmology Service for *Seguro Popular* in 2018, later *Instituto de Salud para el Bienestar*, to operate on senile cataract, congenital cataract, corneal transplant, pterygium, glaucoma, strabismus, and retinopathy of prematurity. It is important to note that, throughout the global contingency due to COVID-19, the ophthalmology service remained open, attending to medical and surgical emergencies, resulting in being the only option at that time for the care of these, since the Ophthalmological Institutes and other services remained closed in the first wave of infections. In terms of research, 8 articles and 2 books were published, written, and developed by the basic physicians of the service.

Ophthalmology was the service of the HGM that performed short-stay procedures, with 5,733 interventions under this concept, which represented 40% of the total surgical interventions performed in this period, which made it the greatest reference in experience for its administration and management, a process that has eventually been replicated by the other services of the hospital.

During November 2021, the opinion of reaccreditation for Medical Care was obtained, for 5 more years, in the Universal Catalog of Health Services as an Establishment for Ophthalmological Care, in which this service participates with the main intervention indicated in it, Cataract Surgery, highlighting that, during this period, a total of 7,547 interventions were performed. The project for the acquisition of ophthalmological equipment was presented: visual field, manual tonometer, YAG laser, specular microscope for patients, and specular microscope for the eye bank. In terms of transplants, 164 corneal transplants were performed, thanks to the fact that in 2018 and 2023 the service achieved the accreditation opinion on capacity, quality, and safety for medical care for transplants in pediatric and/or adult patients in corneal transplantation (Table 1).

In teaching, the Specialty in Ophthalmology Program was maintained in the National Quality Graduate Program of CONACYT, despite the contingency period due to COVID-19, and an average graduation rate of 78% was achieved in this period.

Head of the Ophthalmology Service 2023 to date

At present, the service is in charge of Dr. Emma Verónica Ramírez Sánchez from August 15, 2023 to date; this service is made up of 25 affiliated doctors, 10 doctors in high specialty courses (4 retina, 3 anterior segment, 2 glaucoma and 1 strabismus); 22 resident doctors (eight 1st year, seven 2nd year and seven 3rd year), 3 social service interns, 3 CENATRA (*Centro Nacional de Trasplantes*) social service interns and 10 optometry interns. We also have 2 optometrists, 34 nurses, 16 administrative staff, 11 caregivers, 2 stretcher-bearers, and 2 social work graduates. Each and every one of us contributes to the assigned tasks, with a sense of responsibility and working as a team to provide care for the patients who are our main engine.

From January to October 2024, 6799 first-time patients have been treated, and 19747 subsequent consultations have been granted. Likewise, 2061 surgeries have been performed, in addition to different diagnostic and therapeutic procedures that, in total add up to 5835 procedures (Table 2).

In June of this year, after a project of several years with Patrimony of Public Charity, the arrival of different equipment was achieved, including: campimeter, yag laser, and specular microscopes, as well as a non-contact tonometer. In July 2024, recognition was received from Rotary Mexico City for the professional and committed work of the members of this service, and in November 2024, recognition from the Mexican Council of Ophthalmology for the outstanding participation as the venue for the certification examination.

Work is being done to consolidate the eye bank, as well as to strengthen the corneal transplant program within this Unit. Likewise, comprehensive patient management has continued, with joint work between general ophthalmology doctors and highly specialized ophthalmology doctors in order to establish optimal diagnoses and treatments according to each case. In collaboration with the pharmaceutical industry, a campaign is being carried out to diagnose macular diseases with a mobile unit equipped with an optical coherence tomograph from October to December of this year. And it could possibly continue through 2025.

Table 1. Number of transplants and number of corneal procurements per year

Year	Transplant	Procurement
2008	17	29
2009	30	33
2010	42	62
2011	38	46
2012	44	44
2013	54	60
2014	44	45
2015	27	32
2016	38	39
2017	43	66
2018	37	58
2019	24	30
2020	4	4
2021	10	20
2022	25	35
2023	34	43
2024	19	30

Table 2. Main diagnoses and surgical procedures

Diagnostics	Procedures surgical
Cataract	Cataract phacoemulsification with intraocular lens implant
Diabetic retinopathy	Posterior vitrectomy
Glaucoma	Glaucoma surgery
Strabismus	Corneal transplantation
Uveitis	Surgery of the orbit, eyelids, or tear duct
Corneal diseases	Strabismus surgery

Likewise, since the end of 2023, the process for the accreditation of the *Modelo Único de Evaluación de la Calidad* (MUEC) began, and in conjunction with the hospital authorities, work is being carried out for the surgical tower B project, where this service will be incorporated in the coming years. Steps were taken to restructure the hospitalization beds, as well as the short-stay, in order to optimize the operation of the operating room and hospitalization, to meet the demand of the different ophthalmological surgical procedures.

On the part of the doctors of the service, they have participated in different presentations, in book chapters, as well as in the publication of scientific articles. In teaching, the program of the Specialty in Ophthalmology is continued within the National Program of Quality Graduate Studies of CONACYT.

In the future, the ophthalmology service will continue to work for and for the visual health of the patients of this institution, seeking to provide more equipment, continue the hard work of programs such as transplantation and cataract surgery; care of pediatric patients with eye diseases, corneal diseases, retinal and vitreous diseases, glaucoma, strabismus, inflammatory eye diseases, eyelid and orbital problems, neuro-ophthalmological conditions, among others; developing the different surgical techniques as well as their innovation.

Strengthen the teaching of the specialty course, as well as that of the different High Specialty courses that we have based on academic excellence, ethical and humanistic principles, together with the development of research in each of the areas. To do this, to continue contributing to the greatness that, during these 120 years, the HGM has achieved, and the Ophthalmology Service will continue the search for visual health.

Conclusion

Since its inception, the Ophthalmology Service has contributed to the care of patients with eye diseases. Over the years, it has overcome various challenges but has worked and will continue to work for the benefit of patients and in pursuit of visual health.

Funding

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Conflicts of interest

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Protection of human subjects and animals. The authors declare that the procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation and with the World Medical Association and the Declaration of Helsinki. The procedures were authorized by the Institutional Ethics Committee.

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HISTORY ARTICLE

The Otorhinolaryngology Service at the *Hospital General de México Dr. Eduardo Liceaga*, 2010-2024

*Jorge F. Moisés-Hernández[1,2], Alma D. Anaya-González[2], and Natalia Rivera-Espinosa de los Monteros[2]**

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The specialty of otorhinolaryngology has been present at *Hospital General de México Dr. Eduardo Liceaga* (HGM) since its foundation in 1905; however, it was initially integrated with the ophthalmology service, and both shared pavilions 9 and 19 for the care of "diseases of the eyes, throat, nose, and ears." Later, in 1909, the separation into two sections was carried out, leaving Dr. Ricardo Tapia y Fernández in charge of the otorhinolaryngology section, which was later succeeded by several distinguished physicians whose various contributions helped lay the foundations and shape the service as it exists today. In 1962, it was decided to change the physical structure of the hospital, and the staff of the otorhinolaryngology service did not suspend their work in the 13th oncology pavilion until 1964, when they returned to their rehabilitated pavilion, it changed its name to Section 101.

In 1985, the hospital was heavily damaged, and thanks to the efforts of the then head of service, Dr. Ney Chavolla, and the rest of the doctors assigned to the otorhinolaryngology service, it was possible to rebuild the service, acquiring new instruments, including a CO_2 laser and the flexible laryngoscope. However, the service suffered the loss of three resident doctors in the earthquake who are still remembered: Dr. Javier Cara García R-III, Dr. Armando Carrillo R-II, and Dr. Felipe Ramírez Salas R-I.

Once the service was rebuilt in this administration, the concept of multidisciplinary medicine was favored with various services of the HGM, and promotion was given to neck surgery, skull base, tracheal laryngeal reconstruction, and laryngeal microsurgery, among others. Dr. Rogelio Chavolla Magaña took possession of the head of the service from 2000 to 2010. During his management, the attention of tumor pathology, in particular juvenile nasopharyngeal angiofibroma was highlighted, and endoscopic sinonasal and laryngeal surgery was significantly promoted, in addition to carrying out the corresponding procedures to change the name to "Otorhinolaryngology and Head and Neck Surgery Service," as the specialty is currently recognized. In addition, the remodeling of all areas of the service is being carried out, with changes that lasted until 2024 (Tables 1 and 2).

In 2010, Dr. Enrique La Madrid Bautista began his tenure as head of service, and as of November 2014, Dr. Jorge Francisco Moisés Hernández was appointed head of service, who made several improvements by restructuring the Outpatient Clinic to improve reception times and volume of consultations, acquiring new equipment for the area of diagnostic and therapeutic endoscopy. Through a Public-Private Partnership scheme, surgical microdebridement equipment for endoscopic sinonasal surgery and a diode LASER system for laryngeal surgery were acquired. In addition, outpatient consultations were adapted by incorporating new equipment purchased with the service's own resources, enabling the implementation of digital formats for the service's documentation and optimizing patient care times (Fig. 1).

Research lines and databases were formed to give impetus to research, which had the greatest boom

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Table 1. Main diagnosis in hospitalization 2010-2024

Diagnosis	ICD-10 Code
Acquired deformity of the nose	M950
Deep neck abscess	L0281
Deviation of nasal septum	J342
Tonsil hypertrophy	J351
Fracture of the lower jaw	S026
Nasal cavity polyp	J330
Chronic tonsillitis	D106
Tumor of uncertain behavior	D487
Chronic pansinusitis	J3424
Nasal turbinate hypertrophy	J343

Table 2. Main diagnosis in outpatient consultation 2010-2024

Diagnosis	CIE-10 Code
Deviation of the nasal septum	J342
Acquired deformity of the nose	M950
Chronic tonsillitis	J350
Nasal turbinate hypertrophy	J343
Chronic otitis media	H653
Papillomavirus	B977
Dysphonia	R490
Benign paroxysmal vertigo	H611
Mixed hearing loss	H906
Sensorineural hearing loss	H903

between 2000 and 2010 and again from 2014 to date; with participations in courses and congresses, obtaining second place in the contest of the National Academy of Surgery in 2015 and first place in the presentation of free work during the National Congress of the Mexican Society of Otorhinolaryngology in 2024. Annual refresher courses are held in otorhinolaryngology, a course-workshop on LASER in otorhinolaryngology, the otology week, a course-workshop on the use of lasers in oral and maxillofacial surgery, in conjunction with Dr. Paredes from the Stomatology/maxillofacial Surgery Service.

Figure 1. Otorhinolaryngology outpatient consultation and office view for patient examination.

It should be noted that the service has participated in several National Cochlear Implant Campaigns in conjunction with the DIF, implanting children throughout the Republic, and in 2017, it received a visit and recognition from the Presidency of the Republic; and during that same year, the documentary The Cochlear Implant in Mexico was made. Moreover, we are accredited as a certified site for the placement of cochlear implants for 5 more years valid on March 24, 2028, in addition to being recognized by the citizen observer Rotary Mexico City, for professional and committed work.

In the face of the COVID-19 pandemic, work teams were formed to support the COVID areas, performing procedures of the specialty, including tracheostomies to hospitalized patients, as well as support for polymerase chain reaction sampling for the detection of severe acute respiratory syndrome (SARS)-CoV-2. In July 2020, due to the prevalence of the SARS-CoV-2 pandemic, the hyperbaric upper airway inhalation therapy area disappeared, and under the management of Dr. Moisés Hernández, the furniture was reconditioned, and the reception area of the head of service was completely remodeled.

Over the years, the outpatient clinical equipment has also been modified, modernized, as well as hospitalization beds, stretchers, and wheelchairs, strengthening institutional programs of quality and safety in patient care. In July 2024, the service was relocated from Pavilion 101, which had housed it for more than a decade, to allow for its demolition and the subsequent construction of Surgical Tower II. As a result of this transition, the number of attending physicians assigned to the service was reduced from 18 to the current 9 physicians, who now provide outpatient consultation and surgical care with coverage in both the morning and afternoon shifts. Who provides consultation and surgery care with

coverage in the morning and afternoon. Likewise, the number of census beds was reduced from 25 to 11 and the number of offices from 10 to 5, since we are currently temporarily housed within the Cardioneumology Tower. During all this time, the doctors of the otorhinolaryngology and head and neck surgery service are committed to providing the population with timely care with quality and warmth, optimizing resources through state-of-the-art technology to provide third-level service and care.

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Conflicts of interest

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Ethical considerations

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HISTORY ARTICLE

Pathological Anatomy Service at the *Hospital General de México Dr. Eduardo Liceaga*, 2010-2024

Jorge Pérez-Espinosa

Pathology Service, Hospital General de México Dr. Eduardo Liceaga, Secretaría de Salud, Mexico City, Mexico

The Pathological Anatomy Service was created 71 years ago; it is a specialized service to support the diagnosis and treatment of patients. This service is nationally recognized for the high quality of the work it does and the specialized human resources it trains, which in addition to the skills and abilities with which it is endowed, take with them the institutional values that accompany them throughout their lives and their professional actions. It offers patients who require it comprehensive medical care with quality and safety, applying new technologies that allow timely and reliable diagnosis and individualized and accurate treatment (Fig. 1).

The Pathological Anatomy Service performs an average of 45,000 studies annually; it is made up of the surgical, post-mortem and cytopathology units, which each have their respective laboratory, together with an administrative unit, block and slide files, slides and digitized photos, in addition to the museum which is a center of knowledge for scholars of health sciences, unique in the world. The pathology museum has more than 1,000 anatomical specimens on display.

Advances in medical, architectural, administrative, and technological knowledge made evident the need to verticalize the physical infrastructure of the hospital, derived from this need the construction of the tower of pathology, genetics, genomics, and center for the improvement of medical-technical skills began in 2013, in an area of 10,720 m^2 with an investment of 347 million pesos. It was inaugurated in mid-2017, its medical-architectural design is specific to the needs of the pathology, genetics, genomic medicine services that are located there (Fig. 2).

The different areas of the pathology service were disintegrated, for years, they were located in different spaces. The surgical pathology area was reorganized to optimize the result of its indicators; the correct reception of specimens and the timely delivery of results, traceability of organs and tissues through the monitoring of processes. In January 2011, a great change began in the history of the pathology service as the building it had occupied for many years was demolished. For this reason, a process of relocation of each of the areas was initiated. This relocation process, in which there was a need to build and enable numerous areas, began in February and ended in October of that year (Fig. 3).

In February 2012, Dr. Marco Antonio Duran Padilla was assigned to the head of the pathology service, at which time all the pathology staff and facilities were already relocated and shared with the different services of the hospital, a situation that did not affect the care or teaching activity to exercise the function of support for diagnosis and treatment.

At that time, the adapted facilities had little space to work; despite this, the work in support of patient care did not impact the work of the service. In the administrative area, it was organized so that the personnel will perform their specific functions according to their code.

The courses of neuropathology, hematopathology, and oncological pathology were incorporated (with the support of the Directorate of Education and Training of

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Figure 1. The tower of pathology, genetics, genomics, and center for the improvement of medical-technical skills.

Figure 2. Its medical-architectural design is specific to the needs of the Pathology, Genetics, and Genomic Medicine Services.

the *Hospital General de México*), in addition to the other two subspecialties of cytopathology and neuropathology. The demand for renal and hemato-oncological biopsies studies at the hospital and external consultation cases increased. In 2013, it was celebrated with the 60th anniversary of the foundation of the pathology service. In this commemoration, a pathology course was inaugurated, with the presence of the secretary of health Dr. Mercedes Juan, Dr. Ruy Pérez Tamayo, and the General Director Dr. Cesar Athie Gutiérrez, numerous pathologists graduated from the service were invited.

In October 2020, Dr. Jorge Pérez Espinosa became head of the service, the quality coordination of the pathological anatomy service was consolidated, making the units of the service more efficient from the reception of samples to the delivery of results, achieving

Figure 3. The Pathology Service, as the building it had occupied for many years, was demolished.

recertification in different processes, optimizing the use of medium and high technology equipment; efficiently using inputs, avoiding misuse and waste.

During the current administration, the museum was integrated into the national catalog of museums, having national and international visits, with a constant visit by groups of health personnel in training from different states of the Mexican Republic, considerably increasing the influx of visitors.

The care work, which is the priority and core objective of the service, has been evolving over the years since the pathology laboratory of the *Hospital General de México Dr. Eduardo Liceaga* is the largest in Latin America and one of the largest and most important worldwide; it is a logistical and administrative challenge. Therefore, innovative models have had to be structured and implemented for the proper management of the biological material received, material resources, and human resources, with the aim of providing first-class care to its users while making the resources available to the hospital more efficient, finally doing an efficient and effective job in an adequate work environment.

Our vision is to be a replicable management model, which achieves compliance with institutional and national health care objectives and standards, using state-of-the-art technology, with timely, efficient, certified processes, which effectively and accurately support the diagnosis and treatment of the people who are cared for in the institution. To train specialized human resources, with high levels of medical competencies and skills that can contribute to medical care with quality and safety in any area of health systems.

Funding

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Conflicts of interest

The author declares no conflicts of interest.

Ethical considerations

Protection of human subjects and animals. The author declares that the procedures followed complied with the ethical standards of the responsible human experimentation committee and adhered to the World Medical Association and the Declaration of Helsinki. The procedures were approved by the Institutional Ethics Committee.

Confidentiality, informed consent, and ethical approval. This study does not involve personal patient data, medical records, or biological samples, and does not require ethical approval. SAGER guidelines do not apply.

Declaration on the use of artificial intelligence. The author declares that no generative artificial intelligence was used in the writing or creation of the content of this manuscript.

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HISTORY ARTICLE

The Radiology and Imaging Service at the *Hospital General de México Dr. Eduardo Liceaga,* 120 years of history

Linda M. Silva-Lira and Juan González-de la Cruz*

Radiology and Imaging Service, Hospital General de México Dr. Eduardo Liceaga, Secretaría de Salud, Mexico City, Mexico

Nowadays, it is difficult to conceive of the idea of making a medical diagnosis without the support of radiological studies, so that radiology has become a fundamental part of the multidisciplinary team for the comprehensive care of the patient, not only for its participation in the diagnosis but also for the treatment of minimal invasion.

A few years after Röentgen discovered X-rays, a radiology cabinet was already included in a marked effort to provide the hospital with the most advanced equipment, so the Hydrotherapy, Mechanotherapy, and Electrotherapy (Radiology) Service of the *Hospital General de México* had the first Mexican radiologist, Dr. Roberto Jofré. Radiology Service began properly in 1934 when the first X-ray machine was installed under the command of the Head of Service, Dr. Carlos Cogui, however the boom of radiology at that time occurred in 1952 when technician manual development devices from the Westinghouse company arrived. It is at this time when the Rehabilitation and X-ray Services were separated. Around the 70s, the first ultrasound arrived in Hall 10. In 1990, a computed tomography (CT) scanner was integrated into the Service, and in 1993, the structural modification of the Nuclear Medicine and Tomography Service began. In 1994, the structural modification of Interventional Radiology Room 1 began for the installation of two angiographs. In 1995, a 0.2 T Siemens open resonator was added to the service (Fig. 1).

Technological development has radically transformed the practice of all fields of medicine, medical diagnostic imaging constitutes a paradigm of needs for any computer system, so in May 2006, the system of digitization of images in central X-rays was inaugurated, however still under the modality of development and printing of radiographic film and by June 2010, it was replaced by a Radiology Information System (RIS) and one of Communication and Image Archive (PACS) in the short, medium and long term that achieves the total digitization of radiological studies (Fig. 2).

In 2023, more than 144,353 patients were treated, of which the most requested are conventional X-rays, with a total of 73,402 studies performed, with a prevalence of chest X-rays, 53,642 ultrasounds, and 36,187 CT scans. At present, there are 6 “C” arches, 16 portable digital X-ray equipment, 2 tomographs of 128 slices, 1 magnetic resonance of 1.5 Tesla, 5 general ultrasound rooms, 2 mamographs with tomosynthesis and stereotactics as well as 3 ultrasound rooms for the care of breast studies, 3 conventional radiology rooms, and 1 fluoroscopy room. A second 1.5 T magnetic resonance equipment donated by the Public Welfare is in the process of being installed to speed up diagnosis and treatment, especially in patients with neurological conditions. The Department of Nuclear Medicine has a Gamma camera, and the acquisition of positron emission tomography/CT equipment for the care of cancer patients is in the process of being invested.

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Figure 1. Radiology Service *(personal archive TR. Ivette Martínez de los Ríos)*.

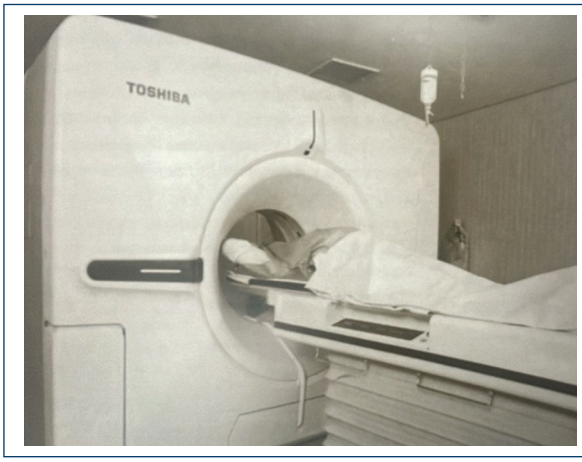

Figure 2. Tomography Service, taken from "History of the General Hospital of Mexico 1905-2010."

It is worth highlighting the work carried out by the Interventional Radiology Service, whose vision of radiology aimed at treatment is based on the use of "C" arches and the hybrid operating room that has a state-of-the-art Angiograph in which minimally invasive treatments and highly complex surgeries are performed.

Technological progress has allowed diagnostic studies to be carried out today using techniques such as spectroscopy in Magnetic Resonance Imaging, which provide us with biochemical aspects of the lesions and therapeutic aspects with a minimum invasion of the patient in the field of Interventional Radiology. As radiology intervenes in all medical specialties, it is necessary to train specialists in this branch who contribute to the multidisciplinary and highly qualified medical care of the patient. Before Dr. Ceballos, the teaching was totally tutelary; the residency in Radiology began around 1967-1969. At present, it has the endorsement by the *Universidad Nacional Autónoma de México* of the Medical Specialization Course in Diagnostic and Therapeutic Imaging, as well as the Postgraduate Courses of High Specialty in Medicine in Vascular and Interventional Radiology. Whole Body Tomography, Breast Imaging, and Head and Neck Intervention and Imaging, which supports the training of new radiologists who work throughout the country and in the rest of Latin America.

At present, it is inconceivable to think that a digital hospital does not have technologies that allow health personnel and users to have a more efficient and faster flow of care, so this year, the RIS/PACS System was renewed and the digital information of the studies carried out in the service of the last 5 years is being migrated according to current regulations with 50 interpretation stations that speed up radiological interpretation, which aims to reduce the long delivery times of results.

Teaching and research are areas that have benefited from digital radiological archives, since it is possible to immediately access the image files of patients where there is no loss in image quality, and they are available to medical personnel and residents of the different clinical areas. Surgical, diagnostic, and treatment assistants, so that study reviews, bibliographic sessions, research protocols, courses, and publications can be carried out more quickly.

Within the service, there are 36 specialists in nuclear medicine and radiology and imaging with various courses of high specialty, 99 radiology technicians trained in the different imaging modalities, 15 nurses, 28 administrative people, 14 cleaning people, and 2 stretcher bearers, who together provide care to patients, from the granting of appointments for procedures, the performance of imaging studies and their interpretation, all with the aim of providing professional and timely care with quality and warmth to the patient.

The future of the Radiology and Imaging Service is aimed at continuing with the use of state-of-the-art technologies, seeking the incorporation of artificial intelligence, and continuing with teaching guided by teachers with decades of experience, contributing to research but above all, to direct all efforts to the multidisciplinary care that our patients require (Fig. 3).

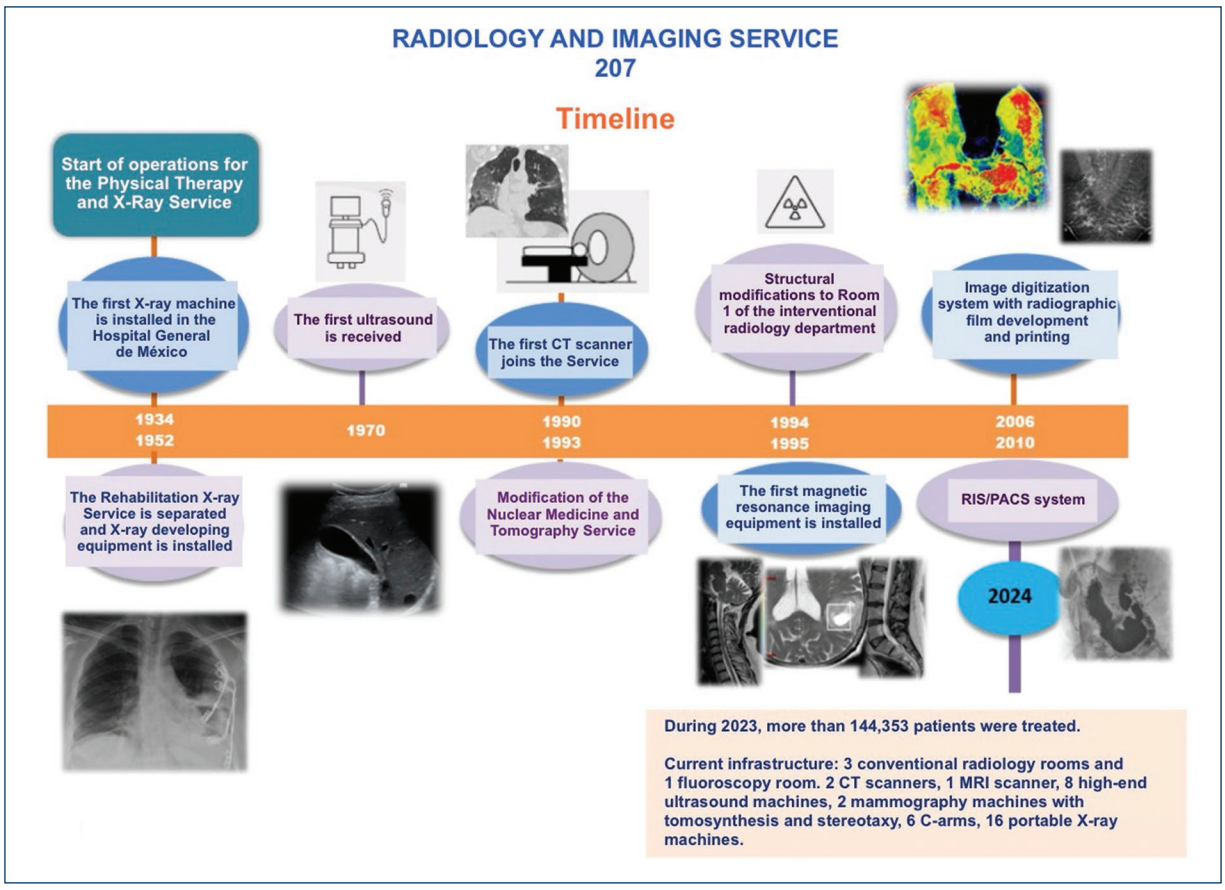

Figure 3. Timeline, Radiology and Imaging Service, *Hospital General de México*.

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Conflicts of interest

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Ethical considerations

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HISTORY ARTICLE

The Rheumatology Service, a milestone within the *Hospital General de México Dr. Eduardo Liceaga*

Gabriel Medrano-Ramírez, Janitzia Vázquez-Mellado Cervantes, and Rubén Burgos-Vargas*

Department of Rheumatology, Unit 404-A, Hospital General de México Dr. Eduardo Liceaga, Secretaría de Salud, Mexico City, Mexico

The history of Rheumatology at the *Hospital General de México* (HGM) dates to the end of the 60s, with the arrival of the Hungarian doctor Gabor Katona, who received the invitation of Dr. Fernando Martínez Cortés, then director of the HGM, to work in this Institution and join pavilion 29. He worked hard to establish a service for patient care, teaching rheumatology and clinical pharmacology studies.

In 1975, Gabor Katona and a group of eminent rheumatologists in the country, achieved the recognition of Rheumatology as a medical specialty with the endorsement of the postgraduate division of the *Universidad Nacional Autónoma de México* in the Rheumatology services of the National Institute of Nutrition (Donato Alarcón Segovia); National Medical Center of the Instituto Mexicano del Seguro Social (Gregorio Mintz Spiro), National Institute of Cardiology (Javier Robles Gil), *Hospital General de La Raza* (Antonio Fraga Mouret), and *Hospital 20 de Noviembre* of the *Instituto de Seguridad y Servicios Sociales de los Trabajadores del Estado* (Jorge Badia Flores). Part of the same group and others founded the Mexican Council of Rheumatology. In this way, the recognition of the rheumatologists graduated from the programs by the General Directorate of Professions and the Mexican Council of Rheumatology was achieved as of 1975.

The rheumatology service has three linked lines of work: medical care, teaching, and research attached to a vision, mission, and values that have led it to national and international recognition.

Teaching

The first rheumatologists trained by Gabor Katona at the HGM finished the Rheumatology course in 1975, since then, two to six students have joined the postgraduate course in Rheumatology per year, therefore, 132 residents have graduated until 2023, including foreigners, additionally we are a venue for rotations of various specialties in the country and abroad (Bulgaria, Spain, Italy, Austria, Argentina, Colombia, Venezuela, Peru, Bolivia and Ecuador), likewise over the years more professors have been added to the staff of the specialty, now having more adjuncts and assistants (10) who actively participate in the training of residents and undergraduate students from different universities.

Currently, there is a program that is modified around every five years, and that frequently includes rotation to other services and institutions such as the rehabilitation service within the HGM, pulmonology at the Instituto Nacional de Enfermedades Respiratorias Ismael Cosío Villegas, pediatric rheumatology within the *Hospital Infantil de México Federico Gómez* and neurology within the *Instituto Nacional de Neurología Manuel Velasco Suárez*.

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Health care

While at the beginning we had six beds and two offices, as the years went by, we now have 12 beds and 5 offices divided into two. The medical care provided has been organized by disease clinics, which have helped teaching and research. Due to the rapid growth of the population and pathologies treated, in 1995 the doctors assigned to the service decided to organize medical care in specialized clinics that over time have been modified according to the needs of the service, to date it is organized in order of importance, (1) Outpatient consultation: filter consultation (where the patient is evaluated and classified for the first time and then channeled to the corresponding clinics), the specialized clinics are: Rheumatoid arthritis, Systemic lupus erythematosus, Spondyloarthritis, Psoriatic arthritis, Gout, Connective tissue diseases (inflammatory myopathies, systemic sclerosis, human adjuvant disease, vasculitis, and other low-frequency autoimmune pathologies), Fibromyalgia and Arthritis of recent onset.

Healthcare activities underwent important changes as a result of the 1985 earthquake and the COVID-19 epidemic. In the first, the disappearance of the hospital was proposed, and in the second, the major modifications for patient safety. During the last administrative management of the service, more certified rheumatologists were hired, which provided the opportunity to open the evening consultation and a reproductive health clinic in pregnancy in patients with autoimmune diseases.

Over the years, an increase in the indicators of first-time and subsequent consultations, as well as hospital discharges, has been observed, with around 15,000 medical visits and 190 hospital discharges per year. The two main causes of subsequent care are rheumatoid arthritis (42.9%) and, in second place, systemic lupus erythematosus (23.5%). The first place in hospitalization is occupied by systemic lupus erythematosus. The rheumatology service is made up of 13 physicians, 100% of the rheumatologists are currently certified (Table 1).

Table 1. Rheumatology service physicians

Dr. Gabriel Medrano Ramírez Head of Service	
Doctors assigned to the morning shift	
Dr. Everardo Álvarez Hernández Dr. Julio César Casasola Vargas Dra. Gabriela Huerta Sil	Dra. Graciela Meza López y Olguín Dra. Leticia Lino Pérez Dr. José Francisco Moctezuma Rios
Doctors assigned to the afternoon shift	
Dra. Karina I. Arias Callejas Dra. Adriana C. Lobato Belmonte Dr. David A. Vargas Gutiérrez	
Research area	
Dr. Ruben Burgos Vargas Dra. N. Janitzia Vázquez-Mellado C. Dra. Ingris Peláez-Ballestas	

Research

Despite being considered a non-priority activity, especially in the units dedicated to medical care, our service has played an important role in national and international research.

In 1983 he began the field of clinical and basic research in the rheumatology service with Dr. Rubén Burgos Vargas (who had a stay in England to train additionally in pediatric rheumatology), on his return he developed projects in different areas of rheumatology (adults and pediatrics), to later and to date form one of the great pillars of the service and of international reference. Spondyloarthritis In 1990, Dr. Janitzia Vázquez-Mellado Cervantes, at the end of her residency, completed a master's and doctorate in medical sciences at the *Instituto Nacional de Nutrición Salvador Zubirán*, returning in 1995 to form and develop the gout clinic, another of the pillars and international reference of the service. Dr. Ingris Peláez Ballestas, with a doctorate in epidemiology, has largely developed epidemiological research in rheumatology with national and international projects. Currently, there is an emeritus SNI 3 level F, an SNI 3 level D, and an SNI 3 level E. The other rheumatologists in the service have also joined this group, generating remarkable productivity. Productivity indicators, such as publications, presentations at conferences, and participation in multiple international teams and working groups to edit a multitude of works of international application, such as participation in the development of diagnostic guidelines and therapeutic recommendations, efficacy and safety studies, cohort studies of various diseases and epidemiological studies in collaboration with multiple institutions have been received from various national and international awards (Table 2).

Funding

The authors declare that they have not received funding.

Table 2. Academic productivity of the Rheumatology Service

Year	2015	2016	2017	2018	2019	2020	2021	2022	2023
Publications in journals	34	21	10	18	25	23	28	25	52
Papers at national and international conferences	7	19	22	23	1	20	6	0	8
Distinctions and awards	0	1	2	3	1	1	0	1	1

Conflicts of interest

The authors declare no conflicts of interest.

Ethical considerations

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HISTORY ARTICLE

Current situation of the Surgical Therapeutics Unit

Sandra C. López-Romero and Mariel González-Calatayud*

Coordination of Surgical Therapeutics, Surgical Tower, Unit 310, Hospital General de México Dr. Eduardo Liceaga, Secretaría de Salud, Mexico City, Mexico

From the beginning of the operation of the *Hospital General Hospital de México* (HGM), on February 5, 1905, it was determined as a clinical-surgical educational hospital which began with a large semicircular amphitheater and on the sides two regular rooms, for laparotomies, craniotomies, and operations in general. In 1911, 894 operations carried out in this amphitheater were quantified. Great figures have emerged from the HGM who have contributed to the development of Medicine in Mexico, specialists such as Dr. Aquilino Villanueva, Dr. Gregorio Salas, Dr. Darío Fernández, Dr. Fernando Quiroz, Dr. Ignacio Chávez, Dr. Salvador Zubirán, Dr. Abraham Ayala González, and Dr. Fernando Ortiz Monasterio, among others, who toured different surgical areas.

The central operating rooms (U.203) were designed in the early sixties, with Dr. Clemente Robles as general director, which had 10 surgical rooms, a central equipment and sterilization (CEyE), and seven laparoscopic surgery towers, among other equipment. Since 2010, there have been more than 10,000 procedures per year, trying to have the latest technology to perform safer and more effective procedures. Since its foundation, the Central Operating Theatre Service has been directed by several distinguished surgeons: Dr. Manuel Alcaraz G., Dr. Óscar Dávila Flores, Dr. José Garreta, Dr. Nuncio Piccolo Ciriello (1989-1999), Dr. Jorge M. López López (2000-2009), Dr. Mario Guzmán Gutiérrez (2009 to 2019), Dr. Mariel González Calatayud (2019-2022) and, currently, Dr. Sandra C. López Romero (May 2022 to date).

In 2016, when the development of the U. 310 Surgical Tower was completed, with the medical director Dr. César Athié Gutiérrez at the helm, the Surgical Therapeutics Service was established, which included the 10 rooms of "central operating rooms," as well as two operating rooms for outpatient procedures, two operating rooms for transplants and a hybrid operating room with the latest technology for highly complex and demanding procedures.

The Surgical Therapeutics Service is located within the U.310 Surgical Tower and consists of 10 operating rooms, two operating rooms for outpatient surgery, two Transplant operating rooms, and a hybrid operating room, as well as two CEyE on the first and second floors, 14 preoperative beds, and 16 recovery beds. There is an average annual surgical productivity of 7,617 surgeries/year in the past 3 years, which is equivalent to just over a quarter of the surgical procedures performed in the entire hospital.

The central operating room area consists of 10 equipped and functional rooms, 7 complete laparoscopy towers to provide the minimally invasive surgery service for scheduled and emergency procedures and a microscope that is used for microsurgery procedures of the Plastic Surgery and Urology Service, mainly. The users of these operating theatres are the General Surgery, Plastic and Reconstructive Surgery services, Urology, Orthopedics, Oncology, Vascular Surgery, and Coloproctology. It consists of 8 stretchers for the preoperative stay of patients and 10 stretchers for monitoring the immediate postoperative recovery of patients operated

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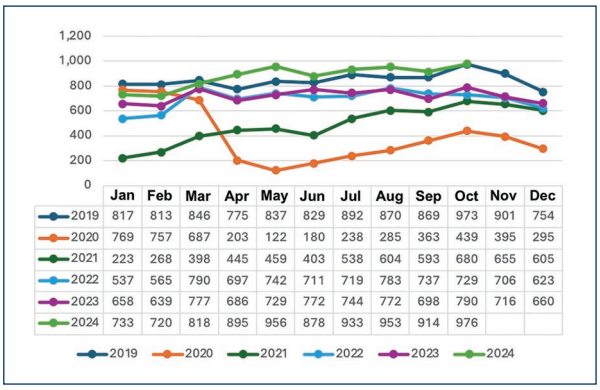
Table 1. The procedures that have been performed in the Surgical Therapeutics Service

Year	2016	2017	2018	2019	2020	2021	2022	2023	2024
Procedures performed	10 512	10 884	10 454	10 176	4 733	5 871	8 339	8 641	8 776

on in the area, equipped with vital signs and cardiac activity monitors.

The Hybrid Operating Room is a space with technological and functional capabilities unique in Latin America, which has hemodynamics equipment (angiography), state-of-the-art surgical microscope, monitors with high image resolution, cameras for remote links and a robotic surgical table linked to the hemodynamics equipment, which allows the safe execution of highly complex surgical procedures such as wide tumor resections with prior embolization of the supply Immediate neurosurgical interventions, high-precision neurosurgical interventions, endovascular procedures with fluoroscopy support, angioembolization, cesarean section and hysterectomy for severe placental problems in pregnant women (*Código Mater*), cardiac catheterization and angioplasties or stent placement (Infarction Code), etc. Establishing a multidisciplinary management for the well-being of patients, merging specialties and subspecialties such as advanced minimally invasive surgery, oncological surgery, orthopedic surgery, urology, vascular surgery, neurosurgery, otolaryngology, plastic and reconstructive surgery, cardiology and interventional radiology, and pediatric surgery, together with the intervention of specialist anesthesiologists with the capacity to care for complex surgical entities and nurses trained for highly complex interventions. It has a recovery area with 4 stretchers for monitoring the postoperative period of the patients treated.

The Outpatient Operating Room is a space consisting of two fully equipped operating rooms to perform minor and major outpatient procedures. It has designated spaces for the dressing room for patients, doctors, and nursing staff, as well as preoperative, recovery, doctors' work area, and nursing and anesthesiology warehouse. The procedures considered major outpatient surgery are those that do not require special or prolonged postoperative care and the patient can be discharged within a period of no more than 8 h. In our Institution, it is currently used to perform outpatient procedures by the General Surgery, Coloproctology, and Orthopedics services who perform an average of 60 procedures/month of diverse origin. It has a preoperative area with 4 stretchers where patients undergoing



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2019	817	813	846	775	837	829	892	870	869	973	901	754
2020	769	757	687	203	122	180	238	285	363	439	395	295
2021	223	268	398	445	459	403	538	604	593	680	655	605
2022	537	565	790	697	742	711	719	783	737	729	706	623
2023	658	639	777	686	729	772	744	772	698	790	716	660
2024	733	720	818	895	956	878	933	953	914	976		

Figure 1. Surgical productivity of the Surgical Therapeutics Service by month 2019-2024.

outpatient procedures are changed and prepared and 4 stretchers for postoperative recovery until the patient is discharged. The two rooms of Transplant Operating Rooms are used by the Plastic Surgery service to carry out minor and short-stay procedures on an outpatient basis, both reconstructive and aesthetic.

According to the figures counted, and despite the pandemic of COVID infections that ravaged the world between 2020 and 2021, the procedures that have been performed in recent years in the Surgical Therapeutics Service are shown in table 1.

Productivity 2024

Surgical productivity in 2024 increased by 23% compared to 2023, with 2 months left in the year (Fig. 1). There is evidence of an increase in the number of scheduled surgeries, such as emergency surgeries, compared to 2023, and it was possible to exceed the productivity reported before the COVID pandemic (in 2019) and, although there has been an increase in high-specialty and laparoscopic procedures that consume more surgical appointments, it began in April of this year, the scheduled elective surgery in 3 surgical rooms on weekends and holidays, which favored the final increase in procedures.

Being a third-level hospital and having highly specialized surgery clinics, there are many surgical

Table 2. Most frequently performed high specialty procedures in 2024

No.	Procedures	Total
1	Total thyroidectomy	98
2	Laparoscopic total nephrectomy	62
3	Laparoscopic fundoplication	50
4	Gastric bypass with laparoscopic Y-in-analyzed gastrojejunum	48
5	Gastric sleeve or laparoscopic restrictive gastroplasty	46
6	Prostatectomy + laparoscopic pelvic lymphadenectomy	42
7	Hemithyroidectomy	39
8	Liver transplant	37
9	Microsurgical graft or flap placement or advancement	33
10	Open hepatojejunumanastomosis	26
11	Interbody spinal fusion device insertion	25
12	Sigmoidectomy + laparoscopic colorrectoanastomosis	25
13	Ventral rectopexy with laparoscopic mesh	21

procedures that take an entire shift, even up to two shifts (pancreatectomies, hepatectomies, reconstructive surgeries, intestinal restitutions, spine surgeries, liver transplantation, etc.). Table 2 details the most frequently performed high-specialty procedures in the first three quarters of 2024. The Surgical Therapeutics unit offers a highly efficient service. We coordinate the passage of surgical patients from different specialties, both elective and urgent, to achieve timely care for the high demand of patients with surgical resolution pathologies.

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Conflicts of interest

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Ethical considerations

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HISTORY ARTICLE

The history of the Urology Service at the *Hospital General de México*. Current situation

Jesús E. Rosas-Nava, Hugo A. Manzanilla-García, Jorge Jaspersen-Gastelum, and Mateo L. Garduño-Arteaga*

Urology Service, Hospital General de México Dr. Eduardo Liceaga, Secretaría de Salud, Mexico City, Mexico

The Urology Service of the *Hospital General de México* (HGM) was inaugurated by Aquilino Villanueva Arreola on October 30, 1930, seeking as goals the training of human resources of excellence, the care and timely management of urinary tract diseases to the neediest sector of society, as well as to promote research so scarce in this area; without forgetting one of the fundamental principles of the HGM and that has characterized it over time, the humanistic vision of medicine and the treatment of our patients with these principles.

Our service is traditionally characterized by a high demand for care by the low-income population of the country, who do not have the protection of any social security service, providing around 30 thousand consultations a year, being the diseases with the highest frequency of attention: obstructive prostate growth, urinary tract lithiasis and oncological conditions of the organs of the genitourinary system. which implies the performance of about 3000 surgeries per year.

During these 95 years of life, pavilion 105-A has been directed by great urologists and excellent teachers, Dr. Aquilino Villanueva Arreola (1930-1960), Dr. Javier Longoria Porras (1960-1970), Dr. Raúl López Engelking (1970-1976), Dr. Jaime Woolrich Domínguez (1976-1982), Dr. David Jiménez Velasco (1982-1988), Dr. Carlos García Irigoyen (1988-1997), Dr. Francisco Antonio Gutiérrez Godínez (1997-2005), Dr. Hugo Arturo Manzanilla García (2005-2015). Dr. Mateo Leopoldo Garduño Arteaga (2015-2018), and Dr. Jorge Jaspersen Gastélum (2019-2024), always seeking to transmit the sense of belonging to our service and our general hospital of Mexico. Currently, the Urology Service has been directed since November 01, 2024, by Dr. Jesús Emmanuel Rosas Nava, who graduated from unit 105-A and has dedicated himself to teaching laparoscopic and robotic surgery in Mexico; he completed a master's degree in medical sciences and a doctorate in senior management, and also has extensive experience in the academic, healthcare and organizational field of medical societies of great relevance in Mexico.

With the aim of providing an excellent service for our patients, the group of affiliated doctors work by highly specialized sections, thus having experts in each area; divided into care of uro-oncological conditions, currently in charge of Drs. Hugo Arturo Manzanilla García, Dr. Eduardo Montiel Delgado, and Dr. Edson David Rodríguez Valle, where tumors of the kidney, adrenal, ureter, bladder, prostate, penis, and testicle are managed. The second section is aimed at the care of lithiasis of the urinary tract, in charge of Drs. Mario Silvino Almanza González, Dr. Juan Carlos Moreno Cabrera, and Dr. Anuar Daniel Berber Deseusa, where they perform open and endourological procedures for the resolution of these conditions. A third section aimed at the care of urogynecological conditions, pelvic floor alterations, and reconstructive surgery of the urinary tract is currently in charge of Drs. Guillermo René Soria Fernández, Dr. Miguel Ángel Reyes Gutiérrez, and Dr. Hugo Rivera Astorga, in which open and endoscopic procedures are performed for the resolution of

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these diseases. As well as a section that is dedicated to minimally invasive surgery, this one includes Dr. Jorge Jaspersen Gastelum, Dr. José Francisco Virgen Gutiérrez, and Dr. Eduardo Jimenez Cisneros.

Due to the fact that the care and academic activities are full-time, in the afternoons, care is offered to patients with prostate problems with the use of state-of-the-art laser technology by Dr. Daniel Arias López, as well as care for urogynecological conditions by Dr. Jennifer Estefania Reyes Alcaraz. The management options for urological diseases are diverse; however, the impact of technological improvements and the acquisition of them in pavilion 105-A, has made it possible to optimize hospital stay times, minimize complications, and thus positively impact the quality of life of the population in question. Thus, endoscopic procedures are performed with the use of laser energy and fluoroscopy, as well as minimally invasive surgeries with laparoscopic approaches for benign and oncological diseases.

The Urology Service (Fig. 1) is the headquarters of the specialty of urology of the unique program of medical specialties of the faculty of medicine of the *Universidad Nacional Autónoma de México* (UNAM), having an average of six resident doctors for each generation that is made up of Mexican doctors and doctors from Central and South America, who are eager to acquire the theoretical and practical knowledge found in each of the patients we attend from the consultation external and accompanying them throughout the process until they reach a surgical procedure and its follow-up, thus being a fundamental part of how large and relevant Unit 105-A is.

Continuing with the mystique and tradition that has characterized the Urology Service of the HGM since its creation, pavilion 105-A is one of the few urologist training centers that seek specific training in laparoscopy in urology, being the high specialty course in laparoscopy and robotics in urology with endorsement by the faculty of medicine of the UNAM oldest nationwide, a course taught by Dr. Victor Enrique Corona Montes and Dr. Jesús Emmanuel Rosas Nava, which since its inception has achieved the development of competent urologists for the benefit of patients with urinary tract pathologies in various parts of Mexico and the American continent.

The doctors assigned to the service and professors of the university course encourage in the resident doctors, in addition to the field of care, the importance of the development of research protocols on a constant basis, and in order to lead by example, 60% of the doctors assigned have postgraduate master's degrees and/or doctorates in medical sciences,

Figure 1. External wall of the Urology Service 105-A.

hospital administration or senior management. In addition, they are part of various academic organizations such as the Mexican Academy of Surgery, Mexican Society of Urology, Mexican National Council of Urology, and International Associations.

During the last 15 years, there has been an exponential growth in the technological field to favor the management of patients in the Urology Service, including improvements in the physical structure of the unit (remodeling in the hospitalization rooms, the urology auditorium, the meeting room or high performance, and the urology operating rooms), as well as having high-tech equipment, initially with ureteroscopy equipment (semi-rigid and flexible), percutaneous tracts for the treatment of lithiasis, bipolar resection equipment, ultrasound and equipment to perform prostate biopsies, more recently the arrival of urodynamics equipment, holmium laser for enucleation of the prostate, testicular prostheses for young people with testicular cancer, as well as a laparoscopy tower for the management of urological patients. The future of urology in pavilion 105-A of the HGM is linked to technological advances, as history marks, it is our obligation to continue with the implementation of a first-world medical practice in a hospital traditionally characterized by humanism.

Pavilion 105-A was, is and will be a hotbed of professional men and women in charge of seeking the construction of a better tomorrow, a titanic task that has resonated since its foundation, it is our duty to maintain the relief, comfort and health of the most vulnerable Mexican population who blindly surrender to the knowledge, skills and abilities that all the members of the work team develop. From doctors, nurses, administrators, and social workers work hard day by day within

Figure 2. Graduates of the Urology Service of the *Hospital General de México Dr. Eduardo Liceaga*, during the tribute to the career of Dr. Carlos García Irigoyen. From left to right, Dr. Francisco Barrios, Dr. Hugo Manzanilla, Dr. Emmanuel Rosas, Dr. Carlos García Irigoyen, Dr. Miguel Ángel Reyes, Dr. Miguel Hernández, Dr. Guillermo Soria, and Dr. Alfonso de Silva.

Figure 3. Graduates of the Urology Service, *Hospital General de México Dr. Eduardo Liceaga*, during the 75th National Congress of the Mexican Society of Urology. Cancun, Q. Roo, November 2024.

the walls of pavilion 105-A to achieve the best results (Figs. 2 and 3). It is important to remember that the way to predict the future is to work hard and continuously to create it, without forgetting the essence and sense of belonging that the invaluable pavilion 105-A and the HGM have always instilled in each and every one of us who have been academically and humanly trained in them.

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Conflicts of interest

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Ethical considerations

Protection of human subjects and animals. The authors declare that the procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation and with the World Medical Association and the Declaration of Helsinki. The procedures were authorized by the Institutional Ethics Committee.

Confidentiality, informed consent, and ethical approval. This study does not involve personal patient data, medical records, or biological samples, and does not require ethical approval. SAGER guidelines do not apply.

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