Artículo Original

# Biomedical research in Ecuador 2016 – 2024: a scoping review of trends, gaps and policy implications

# Investigación biomédica en Ecuador (2016-2024): una revisión de enfoque sobre las tendencias, deficiencias e implicaciones para las políticas públicas en salud

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**Recibido:** 17 de noviembre 2025
**Aprobado para revisión:** 22 de enero 2026
**Aceptado para publicación:** 14 de mayo 2026

**DOI:** *https://doi.org/10.29166/rfcmq.v51i2.9215*

Rev. de la Fac. de Cienc. Médicas (Quito)
Volumen 51, Número 2, Año 2026
e-ISSN: 2737-6141
Periodicidad trianual

## Abstract

**Introduction:** Biomedical research is essential for advancing global health; however, disparities persist between high-income countries and low- and middle-income countries regarding scientific production and innovation. In this context, Ecuador faces limitations such as insufficient funding, limited specialized infrastructure, and weak alignment between research and national health priorities. Although some progress and international collaborations exist, biomedical production remains limited in addressing infectious and chronic diseases. This scoping review analyzes translational biomedical research conducted in Ecuador between 2016 and 2024, identifying gaps and challenges to strengthen innovation and support public health decision-making.
**Objectives:** To map and analyze translational biomedical research published in Ecuador between 2016 and 2024 and identify knowledge gaps and challenges affecting its national applicability.
**Methods:** A scoping review was conducted following PRISMA-ScR guidelines. Searches were performed in PubMed, Scielo, LILACS, ClinicalTrials.gov, and Cochrane Library using terms related to biomedical research in Ecuador. Studies published in English or Spanish between 2016 and 2024 were included. Three independent reviewers assessed the studies, and a thematic analysis was performed.
**Results:** Nineteen studies were included. Infectious diseases represented the main research focus (n=9), particularly in post-pandemic contexts. Gastroenterology was another relevant field (n=6), emphasizing minimally invasive innovative interventions. Additional areas included nutrition, traumatology, microbiology, and oncology. Fifteen clinical trials were identified; although nine were completed, only four reported published results, limiting efficacy assessment and evidence availability.
**Conclusions:** Biomedical research in Ecuador remains fragmented and underrepresented globally. Strengthening research capacity, increasing funding, and promoting the publication of clinical trial results are essential to enhance the country's scientific and public health impact.
**Keywords:** translational Biomedical Research; biomedical research; Ecuador; scoping review; health policy.

## Resumen

**Introducción:** La investigación biomédica es clave para el avance de la salud global; sin embargo, persisten desigualdades entre países de altos ingresos y países de ingresos bajos y medios en producción científica e innovación. En este contexto, Ecuador enfrenta limitaciones como financiamiento insuficiente, escasa infraestructura especializada y débil alineación entre investigación y prioridades sanitarias. Aunque existen avances y colaboraciones internacionales, la producción biomédica sigue siendo limitada frente a enfermedades infecciosas y crónicas. Esta revisión exploratoria analiza la investigación biomédica traslacional realizada en Ecuador entre 2016 y 2024, identificando vacíos y desafíos para fortalecer la innovación y apoyar la toma de decisiones en salud pública.
**Objetivos:** Mapear y analizar la investigación biomédica traslacional publicada en Ecuador entre 2016 y 2024, e identificar brechas de conocimiento y desafíos que condicionan su aplicabilidad nacional.
**Métodos:** Se realizó una revisión de alcance siguiendo PRISMA-ScR. La búsqueda incluyó PubMed, Scielo, LILACS, ClinicalTrials.gov y Cochrane Library, utilizando términos relacionados con investigación biomédica en Ecuador. Se incluyeron estudios en español o inglés publicados entre 2016 y 2024. Tres revisores independientes evaluaron los estudios y se efectuó un análisis temático.
**Resultados:** Se incluyeron 19 estudios. Las enfermedades infecciosas fueron el principal foco de investigación (n=9), especialmente en contextos pospandémicos. La gastroenterología representó otra línea relevante (n=6), centrada en intervenciones mínimamente invasivas. También se identificaron estudios en nutrición, traumatología, microbiología y oncología. Se registraron 15 ensayos clínicos; aunque nueve fueron completados, solo cuatro publicaron resultados, limitando la evaluación de eficacia y la disponibilidad de evidencia.
**Conclusiones:** La investigación biomédica en Ecuador continúa fragmentada y con baja representación global. Es necesario fortalecer la capacidad investigativa, ampliar el financiamiento y promover la publicación de resultados para incrementar el impacto científico y sanitario del país
**Palabras clave:** investigación biomédica traslacional; investigación biomédica; Ecuador; revisión de alcance; política de salud.

**Cómo citar este artículo:** Alcocer-Veintimilla SM, Pillajo-Gangotena VA, Gutiérrez-Bravo MF. Biomedical research in Ecuador (2016 – 2024): a scoping review of trends, gaps and policy implications. Rev Fac Cien Med [Internet]. 2026may [cited]; 51(2):28-44. Available from: https://doi.org/10.29166/rfcmq.v51i2.9215

## Introduction

Biomedical research plays a crucial role in global health advancement, enabling the discovery of innovative solutions for disease prevention, early diagnosis, and effective treatment[1]. In the last decade, the field has experienced unprecedented growth, driven by advancements in molecular biology, genomics, and biotechnological tools. However, the distribution of research efforts and resources has been highly uneven, with high-income countries contributing significantly more to biomedical innovation than low- and middle-income countries (LMICs)[2]. This disparity has far-reaching implications for global health equity and the accessibility of modern healthcare interventions[3,4]

Ecuador, classified as an upper middle-income country by the World Bank, represents a unique case for understanding the challenges and opportunities of biomedical research in LMICs. Its healthcare system has undergone significant reforms in the past two decades, improving access to primary care and essential services[5]. Yet, the country remains underrepresented in global biomedical research networks, raising questions about the sufficiency and impact of its scientific contributions to public health. The country faces a dual burden of disease, with both infectious diseases, such as dengue, and non-infectious or non-communicable diseases (NCDs), including diabetes and cardiovascular conditions[6].

In Ecuador, the biomedical research landscape is influenced by structural, economic, and cultural factors. Despite some progress in its health research output, particularly in collaboration with international institutions, Ecuador's overall scientific productivity in biomedicine remains limited[7]. The specific problem that Ecuador´s biomedical research faces is the lack of sufficient funding, specialized infrastructure, and alignment with the national health priorities, which hinders the generation of actionable knowledge for policymakers and healthcare providers[8]

Applied and translational biomedical research plays an important role in advancing therapeutic strategies and improving patient care. Biomedical research centered on treatments, for example through clinical trials, interventional studies or translational applications, could generate the evidence needed to validate the efficacy, safety and scalability of these innovative treatments or therapies. In LMICs, such as Ecuador, the investment in treatment research is essential to bridge the gap between international biomedical innovation and local patient needs. This scoping review aims to map and analyze biomedical translational research conducted in Ecuador between 2016 and 2024, while identifying knowledge gaps and challenges that influence its applicability in the country.

This study aspires to contribute to a deeper understanding of Ecuador's scientific landscape, offering insights that could inform national policies and stimulate investments in research and innovation.

## Methods

No protocol was registered for this scoping review, as PROSPERO explicitly states that this type of review is not eligible for registration under its current criteria.

Eligible studies included original articles with clinical-observational, interventional, or clinical-experimental designs. To be considered, studies had to be conceptualized or conducted in Ecuador, with or without external institutions sponsorship, or include Ecuadorian participants. Additionally, studies were required to involve human participants, address questions within the scope of translational biomedicine and have potential application in, or report findings applied to human health. Studies in Spanish and English, published between January 2016 and December 2024 were included. Excluded studies comprised systematic reviews, meta-analyses, narrative reviews, editor communications, and commentary articles. Studies where Ecuador was listed as part of an International

Consortium were not included if the inclusion criteria were not met. Observational-qualitative studies and non-clinical observational studies were not included as well. Institutional Board Review approval was not required.

The following databases were used: PubMed, Scielo, Lilacs, Cochrane Library and ClinicalTrials.gov. The search strategies were drafted and further refined through team discussion. The final search strategy for the digital repositories and databases is detailed below. The most recent search was performed on August 5, 2025, for PubMed, Scielo, Lilacs and ClinicalTrials.gov, and updated on April 1, 2026, to include and complement with the Cochrane Library search, following revisions.
An exhaustive literature search, restricted to English and Spanish literature, was performed in the PubMed, Scielo, LILACS, Clinical Trials and Cochrane Library databases, with a timeframe restriction from January 01, 2016, to December 31, 2024.

The following search algorithms were used for each database: Pubmed: (Ecuador[Title/Abstract]) AND (biomedicine); (Ecuador[Title/Abstract]) AND (precision medicine); (Ecuador[Title/Abstract]) AND (clinical trial) + criteria=pilotANDexperimental;((Ecuador[Title/Abstract]) OR (Ecuador[Text Word])) AND ((biomedical research[MeSH Terms]) OR (medical translational research[MeSH Terms])); Scielo: ((ti:(Ecuador))) OR (ab:(Ecuador)) AND (estudio piloto); (((ti:(Ecuador))) OR (ab:(Ecuador)) AND (pilot) ) AND (experimental); LILACS: (ti:(Ecuador)) OR (ab:(Ecuador)) AND (Biomedicine); (ti:(Ecuador)) OR (ab:(Ecuador)) AND (precision medicine); (ti:(Ecuador)) OR (ab:(Ecuador)) AND (ti:(pilot study)) OR (ab:(pilot study)) AND (ab:(experimental)); ClinicalTrials.gov: Location: Ecuador; Study status: all studies; Study type: interventional, observational; Study start: January 01, 2016; Study completion: December 31, 2024.; Cochrane Library: searches were conducted in Search Manager using title, abstract, and keyword fields, combining terms related to Ecuador, translational biomedicine, therapies, interventions, and study design. Results were limited to records published between 2016 and 2024 in English or Spanish.

The software Rayyan.ai[9]and no single method fulfills the principal requirements of speed with accuracy. Automation of systematic reviews is driven by a necessity to expedite the availability of current best evidence for policy and clinical decision-making. We developed Rayyan (http://rayyan.qcri.org was used to eliminate duplicates, and a blinded screening method was applied. The initial screening and selection of studies were conducted independently by three reviewers to ensure objectivity and reduce selection bias. Titles, abstracts and full texts were assessed based on the eligibility criteria. In cases of disagreement, the reviewers engaged in discussion to reach a consensus. If consensus could not be achieved, a fourth researcher was consulted to provide an independent evaluation and resolve the conflict. The full process is outlined in Figure 1.

From included articles, the following data was extracted: title, DOI, year of publication, period (pre-pandemic: defined between 2016 to 2019, or post-pandemic: defined between 2020 to 2024), type of disease discriminated against 5 groups: chronic non-transmissible, infectious, zoonotic, acute non-infectious, others; and database. From ClinicalTrials registries, the following data was extracted: title, ClinicalTrial identifier number, period (pre-pandemic or post-pandemic), study type, study status, results (yes or no), date of first submission, date of last update, and implementation (internal or external).

We abstracted data on the type of implementation (internal or external), primary purpose (treatment or experimental biomedicine research), contextual factors (e.g., study record dates between 2016-2024), barriers and facilitators to engagement (e.g., definition of biomedicine), and results of any formal assessment of engagement (e.g., available or non-available results from Clinical Trials registries, clear or unclear participation of Ecuadorian population or researchers).

Critical appraisal of the included studies was performed following the Oxford Centre for Evidence-Based Medicine: Levels of Evidence[10]. This framework was used as a descriptive hierarchy of study design for published sources with available results. Two independent researchers reviewed each study and assigned a level of evidence (Table 1). Registered clinical trials without posted or published results were not assigned a rating, as their records do not provide outcome data sufficient for formal appraisal. Therefore, these records were described separately by status (Table 2).

Overall themes across multiple studies and/or registries were recognized and described. A narrative method was used following a thematic analysis. The tool ChatGPT V. GPT-5, was used to support tasks such as language refinement, assistance in structuring sections and summarizing the text to meet the word count.

## Results

### *Selection of sources and characteristics of included studies*

In total, 187 studies were identified during the literature search. After removal of duplicates and screening of titles and abstracts, potentially eligible records were assessed in full text according to the inclusion and exclusion criteria. A total of 19 studies were included in the final stage for conducting the scoping review. The study selection process is summarized in figure 1.

The included sources comprised both published original articles and registered clinical trials addressing translational biomedical research conducted in Ecuador. The final sample included sources corresponding to individual cohort studies, clinical-observational, interventional, ecological and randomized controlled trials study designs. In thematic terms, the included studies were concentrated in a limited number of areas: infectious diseases represented the predominant focus of research (n=9), followed by gastroenterology (n=6). Additional topics included nutrition (n=1), traumatology (n=1), microbiology (n=1), and oncology (n=2).

Of the 19 studies included sources, 15 corresponded to clinical trial registries. Of these, 6 were registered during the pre-pandemic period, whereas 9 were registered in the post-pandemic period. Among all the registries, 12 were classified as interventional studies and 3 as observational. As for trial status, 9 were marked as completed, 5 had an unknown status, and 1 was still recruiting at the time of writing. Notably, 13 out of 15 registered trials had no published results. In terms of research leadership, 9 of the clinical trials were conducted by national institutions, whereas 6 were led by international collaborators.

Based on the Oxford Centre for Evidence-Based Medicine Levels of Evidence, from the 4 published articles in databases, 2 studies were cataloged as 1b evidence level, 1 study as 1c, and 1 study as 2c. Table 1 presents the information from published articles in databases, while Table 2 presents information extracted from Clinical Trials Registries.

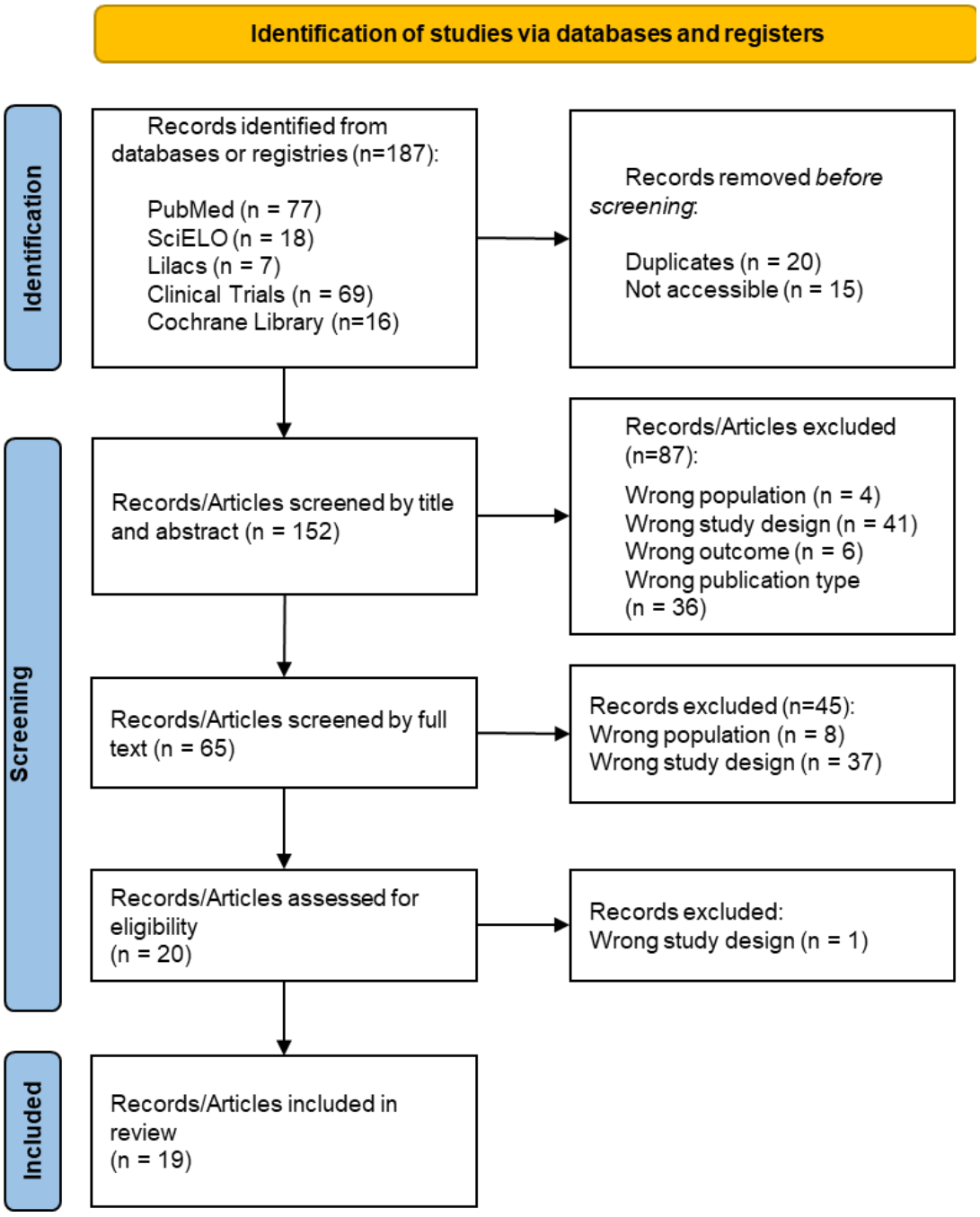


**Figure 1.** Flow diagram illustrating the selection process of studies evaluating the status and trends of experimental and applied biomedical research in Ecuador between 2016 and 2024. This diagram follows the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines and outlines the inclusion and exclusion criteria applied during the study selection process for this scoping review.

**Table 1**. Operationalization of variables extracted from articles retrieved from databases.

| N | Article Title | DOI | Year of publication | Period* | Topic | Topic detail | Database | Evidence level** |
|---|---|---|---|---|---|---|---|---|
| 1 | Molecular epidemiology and phylogenetic analysis of human papillomavirus infection in women with cervical lesions and cancer from the coastal region of Ecuador | 10.1016/j.ram.2017.06.004 | 2018 | Pre-pandemic | Infectious | Infectious agent: Human Papilloma Virus (HPV) | PubMed | 1b |
| 2 | Receiver operating characteristic (ROC) to determine cut-off points of clinical and biomolecular markers to discriminate mortality in severe COVID-19 living at high altitude | 10.1186/s12890-023-02691-2 | 2023 | Post-pandemic | Infectious | Infectious agent: severe acute respiratory syndrome coronavirus 2 (SARS-CoV2) | PubMed | 1c |
| 3 | Photodynamic therapy: Progress toward a scientific and clinical network in Latin America | 10.1016/j.pdpdt.2015.08.004 | 2016 | Pre-pandemic | Chronic Non-Communicable | Disease: Cancer | PubMed | 1b |
| 4 | Screening of Antibacterial Activity of Some Resupinate Fungi, Reveal Gloeocystidiellum lojanense sp. nov. (Russulales) against E. coli from Ecuador | 10.3390/jof9010054 | 2022 | Post-pandemic | Infectious | Infectious agent: Escherichia coli | PubMed | 2c |

* Period is defined as pre-pandemic: between 2016 and 2019, or post-pandemic: between 2020 and 2024

** Critical appraisal was performed following The Oxford Centre for Evidence-Based Medicine: Levels of Evidence, defined by study design.

**Table 2.** Operationalization of variables extracted from Clinical Trials Registries.

| N | Clinical trial Title | Clinical trial identifier number | Period* | Study type | Study Status | Published results | Type of implementation | Topic |
|---|---|---|---|---|---|---|---|---|
| 1 | Efficacy and Safety of Phototherapy in the Treatment of Loss of Smell Post Acute Infection of Coronavirus 19 | NCT05177445 | Post-pandemic | INTERVENTIONAL | UNKNOWN | NO | NATIONAL | Infectology |
| 2 | Hyaluronic Acid in Patients With Gastroesophageal Reflux Disease | NCT05561179 | Post-pandemic | INTERVENTIONAL | UNKNOWN | NO | NATIONAL | Gastroenterology |
| 3 | Treatment of Gastric Varices Using EUS Guided Techniques | NCT03155256 | Pre-pandemic | INTERVENTIONAL | COMPLETED | NO | NATIONAL | Gastroenterology |
| 4 | LULUN PROJECT II - Cohort Follow-up Study | NCT03902145 | Pre-pandemic | OBSERVATIONAL | COMPLETED | NO | INTERNATIONAL | Nutrition |
| 5 | Safety and Efficacy of Viusid and Asbrip in Hospitalized Patients Infected by SARS-Cov-2 With COVID-19 | NCT04407182 | Post-pandemic | OBSERVATIONAL | COMPLETED | NO | INTERNATIONAL | Infectology |
| 6 | Bone Marrow Versus Adipose Autologous Mesenchymal Stem Cells for the Treatment of Knee Osteoarthritis | NCT04351932 | Post-pandemic | INTERVENTIONAL | UNKNOWN | NO | NATIONAL | Traumatology |
| 7 | A Retrospective Medical Record Review of First-Line Sunitinib Administration Schedules and Outcomes Among Patients With mRCC in Latin America (LA) | NCT04115189 | Post-pandemic | OBSERVATIONAL | COMPLETED | YES | INTERNATIONAL | Oncology |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 8 | EUS-guided Combined Therapy Versus Beta Blocker Therapy in Primary Prophylaxis o GOV II and IGV I | NCT04075760 | Pre-pandemic | INTERVENTIONAL | UNKNOWN | NO | NATIONAL | Gastroenterology |
| 9 | Isoprinosine in HIV Patients With Viral Load > 50 y < 200 Copies/mL | NCT03883334 | Pre-pandemic | INTERVENTIONAL | UNKNOWN | NO | NATIONAL | Infectology |
| 10 | Primary EUS-GBD in Patients With Unresectable Malignant Biliary Obstruction and Cystic Duct Orifice Involvement. | NCT03729882 | Pre-pandemic | INTERVENTIONAL | COMPLETED | NO | NATIONAL | Gastroenterology |
| 11 | Effect of High Doses of Vitamin C on the Tissular Reparation (Healing) in Patients Under Surgery in the "Hospital de Los Valles". | NCT04896359 | Post-pandemic | INTERVENTIONAL | COMPLETED | NO | NATIONAL | Tissue damage and recovery |
| 12 | A Double-blind Placebo Controlled, Randomized, Phase II Study to Assess the Safety, Tolerability, Pharmacokinetics and Efficacy of Twice Daily Topical Applications of AP611074 5% Gel for up to 16 Weeks in Condyloma Patients | NCT02724254 | Pre-pandemic | INTERVENTIONAL | COMPLETED | NO | INTERNATIONAL | Infectology |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 13 | A Phase 2, Randomized, Double-blind, Placebo-controlled, Dose-ranging Trial to Evaluate Pharmacokinetics, Pharmacodynamics, and Safety of AT-752 in Patients With Dengue Infection | NCT05466240 | Post-pandemic | INTERVENTIONAL | COMPLETED | YES | INTERNATIONAL | Infectology |
| 14 | Feasibility, Safety, and Efficacy of EUS-guided Thermal Radiofrequency Ablation in the Treatment of Gastrointestinal Stromal Tumors | NCT05453292 | Post-pandemic | INTERVENTIONAL | RECRUITING | NO | NATIONAL | Gastroenterology |
| 15 | Anti-Coronavirus Therapies to Prevent Progression of COVID-19, a Randomized Trial | NCT04324463 | Post-pandemic | INTERVENTIONAL | COMPLETED | NO | INTERNATIONAL | Infectology |

** Period is defined as pre-pandemic: between 2016 and 2019, or post-pandemic: between 2020 and 2024*

The body of evidence identified in this review shows that translational biomedical research in Ecuador between 2016 and 2024 is limited in volume, and concentrated mainly in a small number of clinical fields. Overall, the retrieved studies reflected a predominance of treatment-oriented research, particularly in infectious diseases and gastroenterology, with fewer contributions in oncology, microbiology, nutrition and traumatology.

Infectious diseases emerged as the main research focus, especially during the post-pandemic period. Gastroenterology represented the second most prominent thematic area, with studies emphasizing minimally invasive and endoscopic ultrasound-guided interventions, although they appear to be concentrated in specialized centers with limited broader applicability across the national health system.

Other biomedical areas were represented by isolated studies; for example, nutrition research addressed early-life interventions with potential developmental benefits, while traumatology incorporated regenerative approaches such as mesenchymal stem cell-based therapies. Microbiology studies explored the antimicrobial potential of natural bioactive compounds, and oncology-related research included both therapeutic and molecular epidemiological approaches.

A notable finding was the high proportion of clinical trial registries relative to published results. While 15 clinical trial registries were identified, only a minority of completed trials

had publicly available results. This uneven reporting reduced the amount of evaluable evidence and limited the possibility of fully characterizing the contribution of ongoing or completed interventional research.

## Discussion

Biomedicine is an ambiguous concept. It has been defined as the link between biology and physiology with clinical medicine[11] and according to the United States' Cancer Institute is a synonym for conventional medicine as it involves drugs, radiation, or surgery[12]. For this review, we defined biomedicine as the application of principles of molecular and cellular biology, biochemistry and genetics to the development of new treatments and diagnostics, as well as technologies and tools to guide medical research or practice[13]. This definition narrowed the scope of the results and reduced the number of publications or registries included. During the screening process, various articles were discarded under the "wrong study design" category based on this definition, for example, articles related to mental health qualitative studies or existent diagnostic tools comparison.

In Ecuador, experimental and applied biomedical research have been conducted under two strategies: internal, led by Ecuadorian researchers and involving Ecuadorian participants; and external, where Ecuadorian participants are recruited, but the execution is done by foreign institutions. Based on this classification, 9 studies were identified as internal research while 6 were external. Notably, the Ecuadorian Institute of Digestive Diseases (IECED) played a prominent role, hosting most clinical trials on the gastroenterology category[14–17], as internal studies. In contrast, the external studies had primary execution and coordination handled by international academic[18] or pharmaceutical institutions[19]. Interestingly, only one of these trials included a local university affiliation[18] and mirrors a similar study published earlier[20], suggesting that the Ecuadorian study replicated an existing research model rather than a novel approach, adapted to the local context. Another study by Catalysis SL[19] shows Ecuador´s contribution in patient recruitment (n=60) at Hospital de Especialidades Dr. Teodoro Maldonado Carbó in Guayaquil, but no Ecuadorian researchers were listed as co-authors, and the clinical trial was sponsored[21] and coordinated by the Spanish pharmaceutical company. A similar pattern is observed in a study on sunitinib administration schedules and outcomes among patients with metastatic renal cell carcinoma in Latin America[22].

Ecuadorian-led biomedical studies often build upon established international methodologies or previously reported findings, adapted to address local health challenges rather than introducing entirely novel concepts. For example, a study on unresectable malignant biliary obstruction in Ecuador[17] exhibits similar aspects with a previously conducted international study[23]. While the Ecuadorian study emphasized on a prophylactic approach, the international one adopted a therapeutic perspective. This trend reflects a strategic effort to improve medical practices and technologies within the national context while contributing to the broader field of modern medicine. Within this process, universities have emerged as key drivers of national biomedical research capacity. Through 1995 and 2021, Ecuador experienced an exponential increase in biomedical research output, with 98.82% of all publications from the las century concentrated in this timeframe[24]. Both public and private universities played a central role in this growth. For example, cohort studies and randomized clinical trials were conducted more frequently at private universities (19.55%) than their public counterparts (5.54%)[24], although research is still limited.

At regional level, the limited biomedical output has been attributed to the lack of governmental prioritization reflected in low funding opportunities[25,26] Consequently, most research is done by private universities, health institutions and non-governmental organizations, often supported by external funding sources[24,27]. The "publish or perish" phenomenon, combined with insufficient

resources has constrained both the quantity and quality of research, sometimes resulting in deficient methodological rigor and limited impact[26]. Moreover, high-income countries offer attractive opportunities for investigators: scholarships, adequate laboratories, attractive salaries and job security are strong temptations for researchers, contributing to the brain drain phenomena[25]. Nonetheless, Ecuador has made efforts to reverse this trend. Between 2009 and 2017, Ecuador's Government implemented the "Prometeo-Viejos Sabios" program to attract foreign experts and strengthen local research[7]. By 2019, the Secretaría de Educación Superior, Ciencia, Tecnología e Innovación (SENESCYT) reported 2554 active accredited researchers and 789 inactive ones, showing an increase compared to 2017[28]. These efforts highlight the potential of policy-driven initiatives to expand scientific capacity. However, the greatest challenge remains to establish biomedical research as a clear national priority, with greater investment in infrastructure, equipment and incentives. Addressing these gaps is critical for promoting research that responds to Ecuador´s health needs, particularly in the field of treatment-oriented biomedical research.

In gastroenterology, a group of studies has explored innovative, minimally invasive strategies for managing upper gastrointestinal disorders, mainly evaluating endoscopic ultrasound-guided intervention as therapeutic and prophylactic strategies[14]. These studies show the international trends toward adopting advanced technologies and demonstrate encouraging results in safety and efficacy. However, their concentration in highly equipped centers limits their application in the Ecuadorian healthcare system. Moreover, the lack of studies on feasibility, cost-efectiveness and scalability of these interventions in the Ecuadorian context, limits their translation into clinical practice. As such, while these studies represent an important step forward in the modernization of therapeutic strategies, they also reveal the gaps in translational research and equitable access that must be addressed to ensure that biomedical advancements benefit the wider population.

Chronic non-communicable diseases (NCDs) remain the leading cause of morbidity and mortality in Ecuador. An epidemiological study conducted in 2022 reported high prevalence rates of arterial hypertension (26.53%), Alzheimer's disease (10.20%), cardiovascular diseases (10.20%), and other conditions such as cataracts, blindness, hiatal hernia, hernioplasty, hypoacusis, and pancreatitis, which together account for 26.53% of the total[29]. A 2023 study further reported NCD incidence ranging between 3.9% and 75%, with the highest incidence reported in arterial hypertension (14.3%–63%), followed by Type II Diabetes Mellitus (6.09%–38.5%) and respiratory diseases (6.3%–75%)[30]. Despite this pressing burden, relatively few experimental or interventional studies have targeted NCDs. Instead, biomedical research has predominantly focused on gastroenterology, with three out of the four identified studies in this field being conducted by the same group[14–16].

Infectious diseases constitute another central theme, particularly in the post-pandemic period. Research has evaluated therapeutic options for viral infections, including a study on the use of Isoprinosine as an immunomodulator against HIV replication[31]. The remaining studies focus on COVID-19 and explore various therapeutic strategies to improve clinical outcomes[19,32,33]. Notably, only one study was published during the pandemic itself[19], despite Ecuador´s substantial disease burden, which has reported a total of 864 811 cases as of December 2024[34].

In addition to these dominant fields, Ecuadorian researchers have demonstrated a strong interest in complementary and emerging therapies. In the field of nutrition, one study evaluated the role of egg consumption on improving infant nutrient intake and preventing developmental delays[18]. In traumatology, a non-blinded randomized controlled clinical trial examined the efficacy of intra-articular injections with Mesenchymal Stem Cell (MSC) for knee osteoarthritis[35]. Microbiology research evaluated the antimicrobial potential of resupinate fungi as a source of novel

bioactive compounds against antibiotic-resistant bacteria[36]. In oncology, studies assessed Sunitinib as a first-line treatment for metastatic renal cell carcinoma[22] and explored the molecular epidemiology of human papillomavirus (HPV) and associated risk factors in Ecuadorian women with cervical lesions and cancer[37]. Regarding infectious diseases, phototherapy was tested as an adjuvant treatment for post-COVID anosmia, with no results posted until the writing of this review[33]. Finally, pharmacological repositioning has gained attention, with compounds such as Viusid and Asbrip proposed as adjuvant therapies for mild to moderate COVID-19, demonstrating faster recovery, symptom reduction and shorter hospital stays[19].

These heterogeneous research highlights Ecuador's growing engagement in specialized and high-impact biomedical research domains, while also revealing an under-used potential for integrating it into broader national health policies. Many of these initiatives stem from the expertise acquired by Ecuadorian scientist abroad, which they seek to transfer and adapt to the country, even when facing significant constraints. Although, these studies remark the resilience and creativity or Ecuador´s scientific community, which continues to generate relevant information for the local context as well as innovative contributions to the clinical knowledge, despite the financial and technological challenges that hinders the scalability and implementation of this emerging therapies.

A total of 15 clinical trials were identified for this review that followed the inclusion criteria, 6 of which were conducted during the pre-pandemic period[15,16,18,31,38,39], and the remaining 9 were post-pandemic[19,22,33,35,38,40–42]. In the first period, four trials were completed, but none of them have their results reported. Similarly, in the second period, five clinical trials were completed, with only one having published results[22]. In total, nine clinical trials were completed in both periods. More importantly, from all the studies retrieved for this review, only 4 had published results available at scientific online repositories: two in the first period[37,43] and two in the second[32,36].

Most of the clinical trials reported no published results, despite having been completed, making it difficult to assess the effectiveness of each trial and leading to a gap in the information retrieved. The lack of results is relatively common in the early phases of the analyzed clinical trials, however, even some studies in advanced phases remain without results[15], indicating irregularities in monitoring, management, and the effective completion of the research process.

A small proportion of published results (n=4) could be evaluated by a descriptive hierarchy of study design, using the Oxford Centre for Evidence-Based Medicina framework. Studies classified as level 1b evidence, reflect a relatively modest but significant capacity for conducting higher-quality experimental research in Ecuador. Most of the included evidence corresponded to individual cohort studies and randomized controlled trials, indicating that the available literature was primarily centered on patient-oriented and intervention-based research. The presence of RCTs is noteworthy, as they represent a more rigorous standard for evaluating treatment efficacy and safety; however, their limited number highlights the challenges of implementing large-scale, resource-intensive studies within the national context.

According to the World Health Organization (WHO), Ecuador publishes around 355 articles per year, representing only 0.04% of the global scientific output, compared to neighboring countries like Colombia and Peru, which publish 3623 and 3201 articles annually, accounting for 0.40% and 0.35% of the global total, respectively[44]. This trend has persisted over time, with Ecuador contributing only 0.0001% to the global scientific production between 1943 and 2011[24]. Interestingly, the articles published do not consistently address local health needs; only 4.3-7.2% focus on diseases or conditions with high morbidity and mortality in the country[45]. Until 2021, Ecuador´s

medical publications stagnated at 12.7% of the global contribution and was mainly distributed between journals in quartiles 2-4[46]. At the time of writing this review, the percentage of publications from Ecuador contributing to the global total of experimental or applied biomedicine area has yet to be reported.

### Limitations

This scoping review has several limitations. First, several clinical trials identified have not reported results, which makes it difficult to evaluate them in terms of their effectiveness. Therefore, much of the available evidence remains inconclusive, which may affect the bibliometric indicators and limit their contribution to scientific knowledge, reducing their usefulness in guiding future research. Regarding the methodology, Ecuadorian universities repositories were not included in the search strategy, which may contain more publications than those presented in this review, particularly small-scale studies that may not have progressed towards publications in peer-reviewed journals and therefore, represent a missed sourced of potentially relevant data. Finally, the restricted number of included studies in this review may not accurately capture the landscape of experimental and interventional research currently being developed in the country, which originates from the biomedicine definition used in this review.

## Conclusions

This scoping review provides a comprehensive overview of biomedical research in Ecuador between 2016 and 2024, with emphasis on the translational and treatment aspects of the biomedical sciences. The findings reveal that although Ecuador has made notable contributions in specific areas, such as infectious diseases and gastroenterology, the overall landscape remains fragmented and underrepresented in the global biomedical research ecosystem.

The evidence suggests that while Ecuador demonstrates a clear interest in advancing biomedical research, especially through complementary and emerging therapies, and replication of foreign studies in the local context, the limited scope and fragmented nature of the current output limit the impact on the national biomedical development. Addressing these limitations will require the strengthening of local research capacity, foster scientific research funding, and integrating the findings into public health policies. By doing so, Ecuador can transform its emerging scientific expertise into a more cohesive, impactful and relevant contribution to both national and international biomedical knowledge.

## Approval And Informed Consent

This study is a scoping review and did not involve human participants, animals, or the collection of identifiable personal data. Therefore, approval from an ethics committee and informed consent were not required. The review was conducted in accordance with the Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) guidelines, which provide methodological and reporting standards for evidence synthesis.

## Authors contribution

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## Conflict Of Interests

All authors declare that they have no conflicts of interest.

## Aknowledgements

The authors extend their gratitude to Dr. José Ruales, former Minister of Health of Ecuador, for kindly reviewing the manuscript.

## Funding

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

## Ai Disclosure

The authors declare the use of the AI tool ChatGPT V. GPT-5, to support tasks such as language refinement, assistance in structuring sections and summarizing the text to meet the word count; however, all ideas and interpretations presented are responsibility of the authors.

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