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IMPACT OF SPECIALIZED CLINICAL RESEARCH TRAINING IN STRENGTHENING THE SUS: A STUDY WITH PROADI-SUS ALUMNI

IMPACTO DA FORMAÇÃO ESPECIALIZADA EM PESQUISA CLÍNICA NO FORTALECIMENTO DO SUS: ESTUDO COM EGRESSOS DO PROADI-SUS

IMPACTO DE LA FORMACIÓN ESPECIALIZADA EN INVESTIGACIÓN CLÍNICA EN EL FORTALECIMIENTO DEL SISTEMA ÚNICO DE SALUD (SUS) BRASILEÑO: UN ESTUDIO CON EGRESADOS DEL PROGRAMA PROADI-SUS

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ABSTRACT

Objectives: This study assessed the perceived impact of specialized clinical research training funded by PROADI-SUS (2018–2023) and offered by Hospital Alemão Oswaldo Cruz (HAOC), analyzing its contributions to the Brazilian Unified Health System (SUS) across four sectors: universities, research centers, Contract Research Organizations and Academic Research Organizations (CROs/AROs), and the healthcare industry. Methods: A convergent mixed-methods study was conducted with alumni of the specialization program. Data were collected using a structured questionnaire comprising closed-ended items (5-point Likert scale) and open-ended questions. Quantitative analyses included descriptive statistics and exploratory non-parametric/regression models, while qualitative data underwent thematic content analysis. Results: The study included 88 alumni (64.7% response rate), of whom 82% work in clinical research and 67% were currently working in the public sector/SUS. Quantitative results showed consistently high scores in professional confidence, career advancement, and perceived contribution to public health. No statistically significant differences were found in the perceived impact among the different sectors in exploratory analyses ($p > 0.784$), indicating a consistent perception across sectors on the program's benefits. Qualitative analysis identified that the specialization promoted technical maturity, process qualification, and the expansion of a national research ecosystem. Conclusion: The findings suggest that specialized capacity building is perceived by alumni as an important contributor to advancing clinical research and strengthening the SUS. Continuing this investment is supported, alongside future evaluations focusing on objective outcomes, regional equity, and institutional capacity.

KEYWORDS: Clinical Research. PROADI-SUS. Professional Training. Impact Assessment. Unified Health System.

RESUMO

Objetivos: Este estudo avaliou a percepção de impacto da formação especializada em pesquisa clínica financiada pelo PROADI-SUS (2018–2023) e ofertada pelo Hospital Alemão Oswaldo Cruz (HAOC), analisando suas contribuições percebidas para o Sistema Único de Saúde (SUS) em quatro setores: universidades, centros de pesquisa, Organizações de Pesquisa Clínica/Acadêmica (CROs/AROs) e a indústria da saúde. Métodos: Foi realizado um estudo de métodos mistos convergente com egressos do programa de especialização. Os dados foram coletados por meio de questionário estruturado com questões fechadas (escala Likert de 1 a 5) e abertas. Resultados: Participaram 88 egressos (taxa de resposta de 64,7%), dos quais 82% atuavam em pesquisa clínica e 67% trabalhavam no setor público ou diretamente no SUS. Os resultados quantitativos mostraram pontuações elevadas em segurança profissional, progressão na carreira e percepção de contribuição para a saúde pública. Não foram observadas diferenças estatisticamente significativas entre os

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setores nas análises exploratórias (p > 0,784), refletindo percepções de benefício consistentes entre os grupos. A análise qualitativa indicou que a especialização pode contribuir para maior autonomia técnica, qualificação de processos e expansão do ecossistema de pesquisa, embora enfrente barreiras estruturais e burocráticas. Conclusão: Os achados sugerem que a capacitação especializada é percebida pelos egressos como um elemento relevante para o fortalecimento da pesquisa clínica e a qualificação dos serviços no SUS. Recomenda-se a continuidade e o aprimoramento dos investimentos, acompanhados de avaliações longitudinais com indicadores objetivos de impacto.

PALAVRAS-CHAVE: Pesquisa Clínica. PROADI-SUS. Capacitação Profissional. Avaliação de Impacto. Sistema Único de Saúde.

RESUMEN
Objetivos: Este estudio evaluó la percepción de impacto de la capacitación especializada en investigación clínica financiada por el PROADI-SUS (2018–2023) e impartida por el Hospital Alemão Oswaldo Cruz (HAOC), analizando sus contribuciones al Sistema Único de Salud (SUS) en cuatro sectores: universidades, centros de investigación, Organizaciones de Investigación por Contrato u Organizaciones Académicas de Investigación (CROs/AROs) e industria de la salud. Métodos: Se realizó un estudio de métodos mixtos convergente con egresados del programa de especialización. Resultados: El estudio incluyó a 88 egresados (tasa de respuesta del 64,7%), de los cuales el 82% trabaja en investigación clínica y el 67% estaba empleado en el sector público/SUS. Los resultados cuantitativos mostraron puntuaciones consistentemente altas en confianza profesional, crecimiento de carrera y percepción de contribución a la salud pública. No se encontraron diferencias estadísticamente significativas entre los sectores en los análisis exploratorios (p > 0,784), lo que indica una percepción consistente sobre los beneficios del programa. Conclusión: Los hallazgos sugieren que la capacitación especializada es percibida por los egresados como un factor importante para el avance de la investigación clínica y el fortalecimiento del SUS.

PALABRAS CLAVE: Investigación Clínica. PROADI-SUS. Capacitación Profesional. Evaluación de Impacto. Sistema Único de Salud.

1. INTRODUCTION

Clinical research is a crucial area in medical science, involving studies with human beings to investigate the efficacy and safety of innovative treatments, thus serving as the foundation for the development of new medicines, therapies, and medical technologies. Brazil has seen a significant expansion in this field, largely driven by public incentive policies from the Ministry of Health (Brasil, 2020a; Brasil, 2025). As of June 2024, the country ranks 13th globally with approximately 10,000 registered clinical trials, according to ClinicalTrials.gov search data. Nevertheless, Brazil still lags behind global leaders such as the United States, which has over 130,000 registered studies, highlighting the need for increased capacity (Sverdloff et al., 2024; U.S., 2025).

However, gross counts of trial registrations should not be interpreted in isolation as a direct measure of scientific capability or competitiveness, as they do not account for study complexity, local principal investigator leadership, or technological value creation. To enhance international competitiveness and scientific autonomy, Brazil must transition from primarily executing pre-defined protocols to developing original and innovative research, which requires a highly qualified workforce.

To strengthen the research base within the public health system (SUS), the Ministry of Health of Brazil (MOH) has substantially increased its investments, reaching R$350 million in 2023 (Brasil,

2024). A key mechanism for this indirect investment is the Institutional Development Support Program of the Unified Health System (PROADI-SUS), which strategically prioritizes education and research to promote the technical and scientific qualification of health professionals. This forms a virtuous circle: the MOH invests in specialized professional training, and these graduates — who work across universities, research centers, Clinical Research Organizations and Academic Research Organizations (CROs/AROs), and the pharmaceutical industry — return knowledge, innovation, and quality research directly or indirectly to the SUS, ensuring a sustainable process of scientific development (Brasil, 2020b; Brasil, 2011; Santos et al., 2023).

In evaluating such educational policies, established frameworks (e.g., Kirkpatrick's model of reaction, learning, behavior/transfer, and organizational results) emphasize distinguishing between individual professional perceptions, institutional capacity gains, and broader health system impacts. Given the strategic importance of this circle, evaluating the concrete impact of this training on knowledge production and its alignment with the complex needs of the SUS is imperative. Despite the clear policy framework, robust empirical evidence is required to validate the effectiveness of this investment-training-return circle as a sustainable public policy. Addressing this critical gap, this study's main objective is to evaluate how a PROADI-SUS Specialization Program in Clinical Research contributes to the advancement of clinical research and the strengthening of the SUS, analyzing its direct and indirect perceived impact in the different spheres of action: universities, CROs/AROs, pharmaceutical industries, and research centers.

2. METHODS

2.1. Design, Procedures, and Study Population

This is a convergent mixed-methods design (Creswell; Clark, 2007) involving an online survey. An invitation letter was emailed to all alumni of the Hospital Alemão Oswaldo Cruz (HAOC) clinical research specialization funded by PROADI-SUS (2018–2023).

The target population consists of all graduates (alumni) from the four HAOC specialization cohorts offered between 2018 and 2023. Eligibility criteria included course completion, voluntary consent via an electronic Free and Informed Consent Form, and integral response to the questionnaire within the established period.

2.2. Data Collection

All 136 alumni of the course were approached via email and WhatsApp. Data were collected from July 2025 to August 2025 using a structured online questionnaire composed of 20 questions (17 closed and 3 open-ended questions). The questionnaire was developed by the authors and revised with contributions from a panel of clinical research experts for content validation. The closed-ended questions utilized a 5-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree).

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The questionnaire was divided into two parts: sociodemographic/general trajectory data, and specific domain-based questions for those currently working in clinical research across four key spheres (University, Research Center, CRO/ARO, or Pharmaceutical Industry). The five domains evaluated were:

In the second part, questions were directed only to those who responded that they currently work in clinical research. If their answer was 'no,' the questionnaire was terminated. If their answer was 'yes,' new questions were unlocked, specific to the sphere the participant currently belongs to (University, Research Center, CRO/ARO, or Pharmaceutical industry). These four key spheres of clinical research were included on the basis of their direct (public institutions) or indirect (private companies) contribution to SUS. For this second part, the questionnaire is structured around five pre-defined domains. The choice of these domains was based on the need to evaluate the outcomes of the HAOC clinical research specialization program across dimensions critical to the development of clinical research and alignment with the demands of SUS. Therefore, the questions were adapted for each specific sphere, but their domain remained the same; that is, the essence of the question was consistent and intended to address a specific context, as detailed below.

Domain 1 - Impact on Professional Practice and Innovation

(1) Impact on Professional Practice and Innovation - the objective was to assess how the training influenced the professional practice of the alumni within their respective spheres, including: changes in routine practices; adoption of new methodologies; development of innovative projects; and resolution of challenges in clinical research

Domain 2 - Contribution to Clinical Research Quality and Efficiency

(2) Contribution to Clinical Research Quality and Efficiency - the goal was to measure whether the training elevated the quality and efficiency of clinical studies conducted by the alumni, considering: scientific rigor and good clinical practices; effective data management; compliance with ethical and sanitary regulations; and process optimization for greater speed and reliability;

Domain 3 - Alignment with SUS Needs and Public Health

(3) Alignment with SUS Needs and Public Health - the assessment focused on whether the training prepared the alumni to identify and conduct research aligned with SUS priorities, develop technologies and treatments for prevalent diseases in Brazil, and propose solutions applicable to the public health system;

Domain 4 - Public Health, Collaboration, and Networking

(4) Public Health, Collaboration, and Networking - we assessed whether the training promoted strategic networks among alumni, institutions, and SUS, collaborative skills for translational research, and/or multisectoral partnerships that accelerate public health benefits;

Domain 5 - Impact on Knowledge Formation and Dissemination

(5) Impact on Knowledge Formation and Dissemination - the assessment focused on how the training transformed the alumni into multiplier agents, ensuring the sustainability of clinical research in Brazil, training of new professionals (teaching, mentoring), agile dissemination of good practices and results to society and the scientific community.

2.3. Data Analysis

Quantitative and qualitative data were analyzed separately. For quantitative data, continuous variables were expressed as means and standard deviations (SD), whereas categorical variables were presented using absolute (n) and relative percentages (%).

Each domain received a mean score (1–5). Given the ordinal nature of Likert data and the small sample size in certain subgroups (e.g., industry, n = 2), exploratory statistical comparisons were performed using non-parametric methods/robust generalized models suitable for bounded ordinal scores. A significance level of $p < 0.05$ was adopted. Absence of statistical significance in low-powered subgroups does not demonstrate equivalence or consensus across spheres, and comparisons remain strictly exploratory.

The qualitative data gathered from open-ended questions were subjected to thematic content analysis (Bardin, 1977; Santos, 2012). A total of 72 responses were analyzed qualitatively; among them, 7 (9.7%) were excluded from sphere-specific thematic categorization because the respondents did not currently work within one of the four defined research spheres, leaving 65 responses for deep thematic coding. To ensure analytical trustworthiness, coding was reviewed iteratively by the research team.

2.4. Ethical Aspects of Research

The study was approved by the Research Ethics Committee of Hospital Alemão Oswaldo Cruz in July 2025 (CAAE n. 90121425.3.0000.0070; Approval n. 7.701.454). Generative AI tools were used solely for English grammar and editing checks.

3. RESULTS

3.1. Study Population Characteristics and Quantitative Data

Among the 136 alumni approached, 88 (64.7%) participated in the research. Of the total participants, 80% were female, with a mean age of 41.3 (± 7.5) years. 41% originated from the Southeast region and 34% from the Northeast region of Brazil. About 58% held a stricto sensu degree (master's or PhD degree), and 67% were currently working directly for the SUS / public institutions (Table 1).

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Among these respondents, 82% (n = 72) currently work in clinical research, with 60% belonging to the 'research center' sphere, 19% to 'universities', 18% to 'CRO/ARO', and 3% (n = 2) to 'industry'. General sociodemographic characteristics are presented in Table 1.

Table 1: Profile of the 88 Study Participants, Separated by Sphere of Activity.

Variable	University (n=14)	Research Center (n=43)	CRO/ARO (n=13)	Industry (n=2)	No Clinical Research Role (n=16)
Age - mean (SD)	41.4 (7.6)	41.4 (7.6)	41.5 (7.7)	40.8 (7.1)	41.4 (7.5)
Female sex - n (%)	9 (64.3%)	36 (83.7%)	11 (84.6%)	2 (100.0%)	12 (75.0%)
Southeast region - n (%)	7 (50.0%)	21 (48.8%)	8 (61.5%)	1 (50.0%)	4 (25.0%)
South region - n (%)	1 (7.1%)	3 (7.0%)	2 (15.4%)	1 (50.0%)	2 (12.5%)
North region - n (%)	0 (0.0%)	3 (7.0%)	0 (0.0%)	0 (0.0%)	1 (6.25%)
Northeast region - n (%)	4 (28.6%)	16 (37.2%)	3 (23.1%)	0 (0.0%)	0 (0.0%)
Central West region - n (%)	1 (7.1%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (6.25%)
Public sector - n (%)	14 (100.0%)	29 (67.4%)	4 (30.8%)	0 (0.0%)	11 (68.7%)
Coordinator - n (%)	6 (42.9%)	23 (53.5%)	1 (7.7%)	0 (0.0%)	-
Researcher / Professor - n (%)	8 (57.1%)	2 (4.6%)	0 (0.0%)	0 (0.0%)	-
CRA - n (%)	0 (0.0%)	3 (7.0%)	7 (53.8%)	1 (50.0%)	-

Legend: CRO/ARO - Contract / Academic Research Organization; CRA - Clinical Research Associate.

The first five questions / affirmative sentences of the questionnaire addressed the impact of the specialization in clinical research on professional careers, regarding: (Q1) increased security and confidence after completing the course, (Q2) the opportunity for career growth and progression, (Q3) proactivity and professional performance, (Q4) the belief in one's professional self-contribution to clinical research in Brazil, and (Q5) the self-perception of cooperation towards population health. All responses were similar among the spheres and those who are not currently working in clinical research, where the mean responses ranged from 4.8 to 4.1 points ($p>0.970$, data not shown). The frequency of the satisfaction level of alumni regarding the postgraduate course in clinical research is demonstrated in Figure 1.

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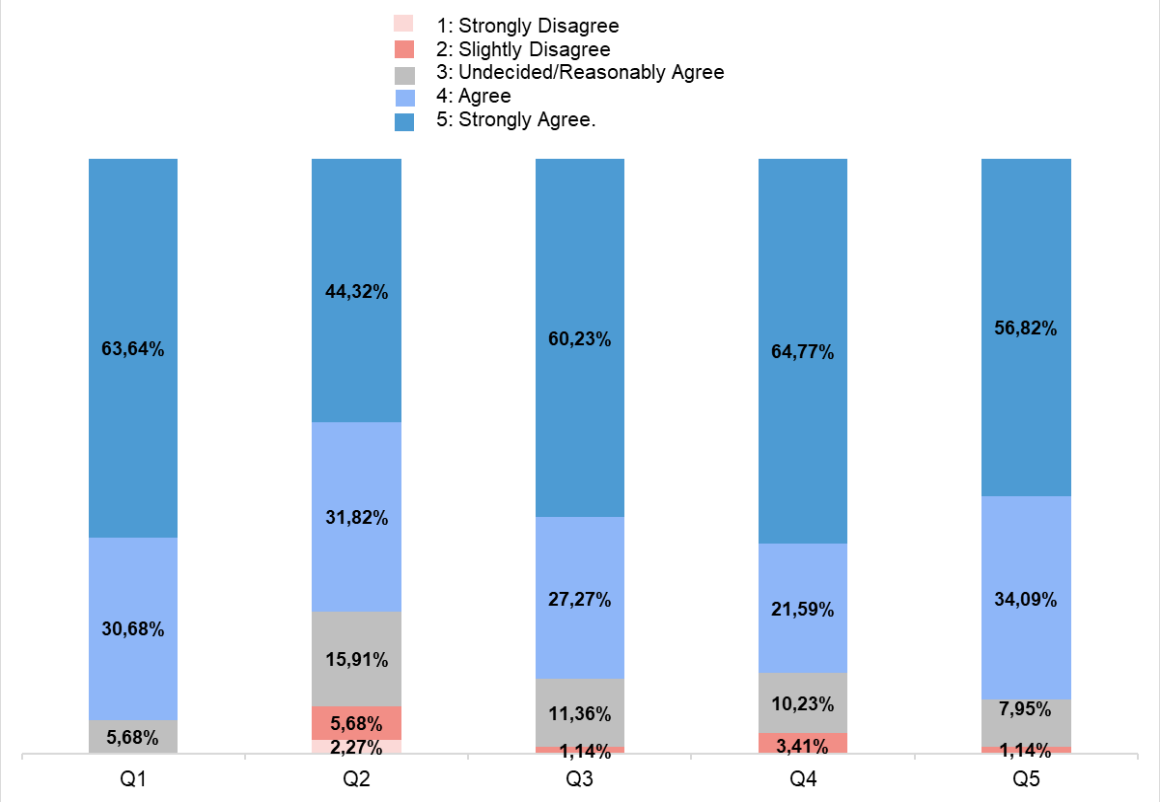


Figure 1: General Answers of 88 Study Participants, Regarding the Degree of Contribution of the Clinical Research Specialization/Postgraduate Program to Their Professional Development. *Q - Question (Affirmative Sentence); Q1 - After completing the postgraduate program, I noticed greater security and confidence in my professional practice; Q2 - The postgraduate training enhanced my opportunities for career growth and advancement; Q3 - The postgraduate training enhanced my proactivity in identifying problems and proposing solutions in my workplace; Q4 - I believe my professional performance, enhanced by the postgraduate training, contributes to the advancement of clinical research in Brazil; Q5 - I believe my work, since completing the postgraduate program, has the potential to positively impact population health.

In the domain scores across spheres (Figure 2), mean scores remained elevated (ranging from 3.5 to 4.9). Exploratory statistical tests showed no statistically significant differences across spheres ($p > 0.784$). However, this lack of statistical significance primarily reflects low statistical power due to small subgroup sizes (especially industry, $n = 2$) rather than proven equality or uniform consensus across sectors.

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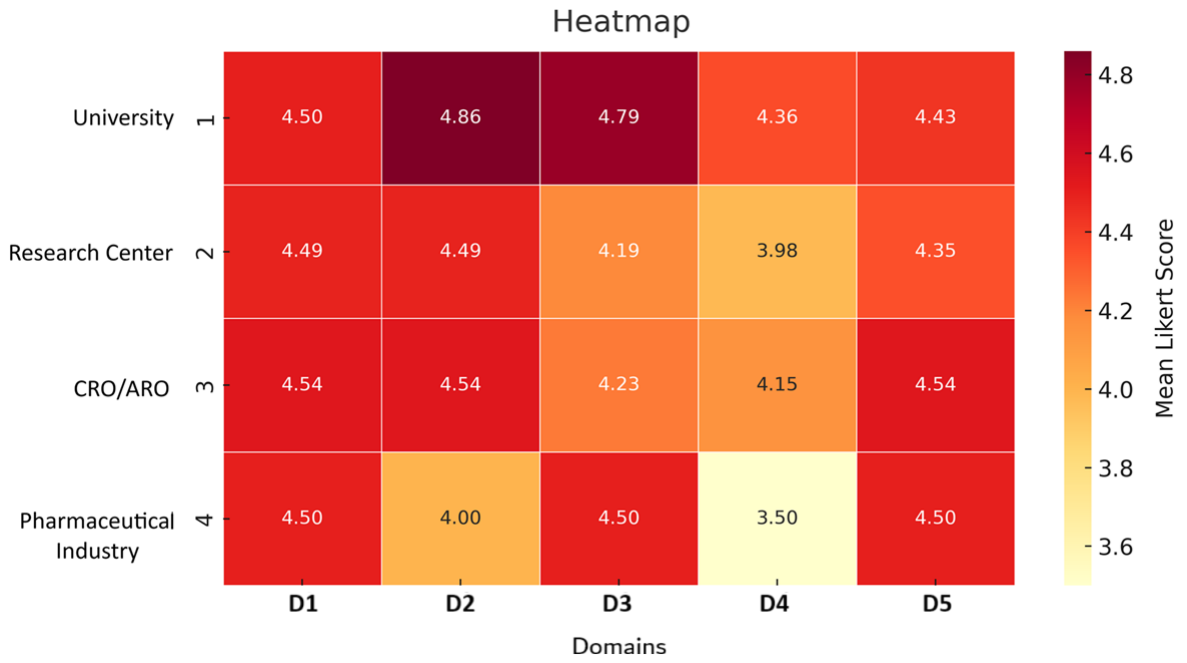


Figure 2: Heatmap showing the mean scores of the five study domains, separated by analyzed spheres, based on the responses of 72 clinical research participants. Legend: CRO/ARO - Clinical / Academic Research Organization. D - based on each approached “Domain” (D1- Impact on Professional Practice and Innovation; D2- Contribution to Clinical Research Quality and Efficiency; D3- Alignment with SUS Needs and Public Health; D4- Public Health, Collaboration, and Networking; D5- Impact on Knowledge Formation and Dissemination). Poisson distribution, all p> 0.826. University, n=14; Research Center, n=43; CRO/ARO, n=13; Pharma Industry, n=2.

Pertaining to Domain 4 (D4), the “Public Health, Collaboration, and Networking”, we assessed whether the training promoted strategic networks among alumni, institutions, and SUS, collaborative skills for translational research, and/or multisectoral partnerships that accelerate public health benefits. The means, in descending order, were 4.4±1.1 for ‘university’, 4.1±1.2 for ‘CRO/ARO’, 4.0±0.9 for ‘research centers’, and 3.5±0.7 for the ‘pharmaceutical industry’ (p=0.906). Finally, in Domain 5 (D5) on the “Impact on Knowledge Formation and Dissemination”, the responses were also very similar, ranging between 4.3±0.8 to 4.5±1.0 (p=0.993).

Regarding the final score, we observed that all spheres demonstrated the same high, undifferentiated consensus on program contribution when the domain means were summed (p=0,784, Figure 3).

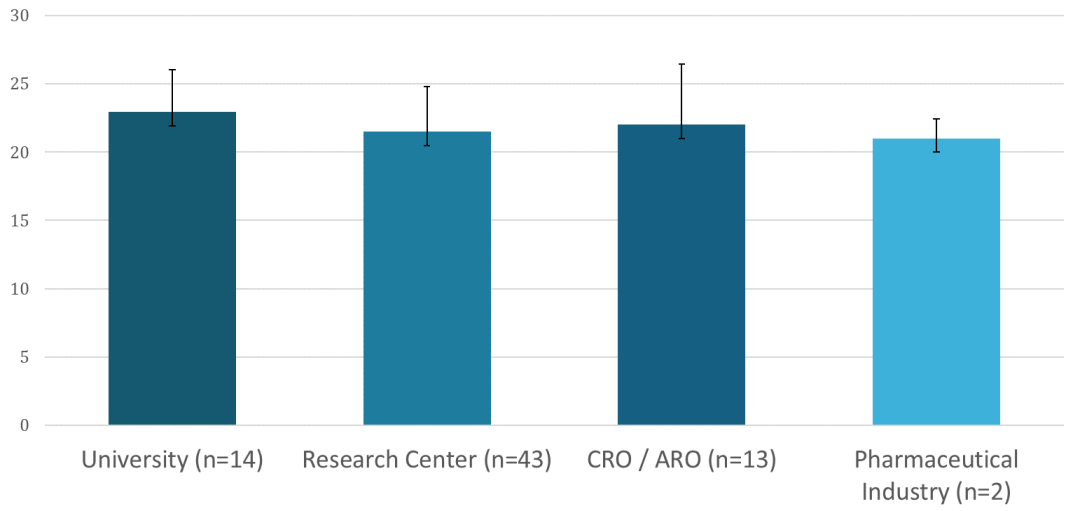


Figure 3: Overall Score (Sum of All Domain Means) from 72 Clinical Research Participants in the Four Analyzed Spheres. Legend: CRO/ARO - Clinical / Academic Research Organization. Poisson distribution, p= 0.7837.

3.2. Qualitative Data

A total of 72 answers were submitted. Among them, seven (9.7%) were excluded from sphere-specific analysis because the respondents were not working with clinical research under one of the four established spheres.

Based on the answers, our analysis identified six core thematic areas of impact and challenge: Structural and Bureaucratic Barriers, Process Improvement and Qualification, Program Enhancement Needs, Alignment with SUS Reality, Impact on Research and Academic Culture and Networking and Connection with the SUS. The key thematic findings and representative quotes are summarized in Table 2.

Professional Sphere	Theme	Quote
University	Alignment with SUS Reality	"I work in SUS hospitals, so we can actively contribute to the care of this population." (Female, 34 years old) "The specialization provided a solid foundation, generating quality data that can subsidize decisions within the scope of the SUS." (Male, 48 years old)
University	Impact on Research and Academic Culture	"There was a maturation of the research group, with improved project management and better research, teaching, and extension practices." (Male, 47 years old) "I was able to start a research center at a federal public university." (Male, 48 years old)

Research Center (site)	Structural and Bureaucratic Barriers	"One of the biggest challenges was adapting theoretical knowledge to the reality of public service, which often has limitations in structure, team, and time." (Female, 32 years old) "The public sector often presents structural and bureaucratic limitations that make the implementation of more innovative practices difficult." (Female, 37 years old)
Research Center (site)	Process Improvement and Qualification	"Contributed to agility and process improvements" (Female, 41 years old) "expanding the understanding of the regulatory, ethical, and methodological processes that guide clinical research, ensuring greater quality and compliance in conducting studies." (Female, 39 years old)
Research Center (site)	Program Enhancement Needs	"include more practical content on applied research in the SUS, focusing on real service problems." (Male, 37 years old) "maintain an active channel of communication between alumni and the specialization for clarification of doubts." (Female, 39 years old)
CRO/ARO	Networking and Connection with SUS	"Conversing and exchanging experiences with colleagues from other regions and areas (especially the North and Northeast) helped me better understand the challenges of the SUS in more remote areas." (Female, 40 years old) "Expanding the view of the SUS in Brazil, as a whole, prevents me from restricting myself only to my local experience." (Female, 39 years old)

Table 2: Thematic Analysis of Qualitative Results by Professional Sphere (n= 72).
Legend: CRO/ARO - Clinical / Academic Research Organization; SUS: public health system

Within Research Centers, the central themes were the persistent challenge of structural and bureaucratic barriers alongside the program's positive contribution to professional and institutional maturity. Professionals frequently cited institutional rigidity, slow processes, and lack of resources (human and financial) as major obstacles to innovation and implementing new practices. Despite these hurdles, the specialization was credited with contributing to process improvement and qualification by enhancing technical maturity, ensuring greater quality and compliance with regulatory, ethical, and methodological standards, and ultimately strengthening the centers. Feedback also included suggestions for program enhancement, focusing on the need for more practical activities, internships, and a greater focus on networking and in-person exchange to foster a community of practice.

In the University sphere, the primary focus was the vital relationship between academic knowledge and public health practice, seeking alignment with the SUS reality. Professionals emphasized the constant preoccupation with applying knowledge to the public system, reporting that the specialization provided a solid basis for generating quality data that can subsidize decisions within the SUS. Furthermore, the training was seen as fundamental for impact on research and academic culture, leading to the maturation of research groups, improved project management, and fostering greater institutional acceptance of new, evidence-based methodologies.

For CRO/ARO professionals, the impact was defined by networking and connection with the SUS. Within Research Centers, key themes included structural and bureaucratic barriers alongside process qualification.

For ORPC/ARO professionals, the impact was largely defined by the implementation of knowledge in a corporate environment and networking. The main challenge reported was the acceptance and implementation of new methodologies within established corporate structures. However, the program's greatest value was the opportunity for networking and connection with the SUS. This connection was vital for exchanging experiences and gaining a broader vision of the SUS nationally, which facilitates the dissemination of knowledge and clarifies how these organizations can collaborate effectively with the public health research network.

4. DISCUSSION

Training health and clinical research professionals is essential to generate returns for society and the public system. Our findings reveal that the PROADI-SUS specialization reached professionals outside major central hubs, with 34% of alumni originating from the Northeast region, fostering regionalization and equity (Pierantoni et al., 2019; Rodrigues, 2025).

While 58% of alumni hold a Master's or Doctoral degree, formal academic degrees alone do not fully address the specific regulatory and operational demands of clinical trials (Paschoale et al., 2010). Specialized training acts as a strategic catalyst to bridge this gap (Guimarães, 2011).

However, it is critical to acknowledge that this study measured self-reported perceptions of alumni. We did not collect objective performance indicators (e.g., pre/post-course publication counts, number of initiated trials, regulatory approval times, or funding amounts). Therefore, claims that training or has should be replaced with proportional statements indicating that capacity building is perceived by alumni as an important contributor to professional confidence and process qualification (Knapke et al., 2025; Peralta; Sánchez-Santiago, 2024; Sancheti et al., 2023).

Furthermore, the inclusion of the industry sphere with only two participants constitutes a major limitation. Subgroup comparisons involving this group are strictly exploratory and cannot be generalized.

Our initial findings demonstrate a heterogeneous profile of alumni in terms of their current working region in Brazil. In general, policies for access, admission, and retention employed by Higher

Education Institutions for example, are critical for strengthening Health Regions, as they drive regionalization, technological development, and labor market expansion, particularly in underserved áreas (Pierantoni et al., 2019). The same can be considered for postgraduate education, which is equally important and still reaches only a minority of health professionals. This is vital, given that the heterogeneous distribution of investments in training and clinical research reflects significant regional socioeconomic disparities (Pierantoni et al., 2019). In this sense, the present study demonstrates that the Southeast region was not the sole area targeted for this training program, with 34% of alumni originating from the Northeast region. The inclusion of all Brazilian regions in this enhancement program indicates that PROADI-SUS has the potential to reach minority areas and actively contribute to regional development. This was facilitated by the hybrid format of the clinical research training offered by the program. Future actions to sustain and improve the SUS must prioritize increased public funding, the integration of digital technologies, and stronger social participation, alongside efforts to tackle persistent regional inequalities and reinforce Brazil's global health leadership (Rodrigues, 2025). Since its inception, the SUS remains a fundamental pillar for social inclusion and the reduction of disparities, proving that health is an essential investment for achieving equity and improving population well-being (Rodrigues, 2025).

In the present study, approximately half of participants had a background in nursing or pharmacy. However, other areas were also featured, and this training proposal of PROADI-SUS/HAOC benefited a multidisciplinary team, including biologists, biomedical scientists, physicians, physical therapists, and other specialties. It is important to emphasize the need for comprehensive multiprofessional representation in clinical research training programs across the country. This concern aligns with the findings of Rahman et al., (2017), who highlighted the necessity of creating formal collaborative structures to increase the participation and involvement of various health professionals. They noted that certain groups, such as community health agents, are often less incentivized, exhibit greater distrust or lack of mastery regarding the research process, and demonstrate lower participation in substantive research stages.

There is a scarcity of literature on the impact of postgraduate clinical research within the SUS. We were able to demonstrate in this study that the perceived societal contribution of alumni was satisfactory, with the majority (67%) currently holding direct roles in the SUS, due to their public institutional background. Postgraduate training in clinical research acts as a strategic catalyst, linking human resource development directly to the maturation of the national health innovation system. By strengthening professional expertise, these programs ensure training is solidly aligned with the service and research priorities of the SUS. This alignment is crucial for fostering technological and social productivity, supporting the healthy growth of institutional research models in Brazil (such as institutes and research centers), and ultimately expanding the SUS’s capacity to address complex epidemiological and social challenges (Guimarães, 2011).

Our findings reveal that participants highly valued the specialization, demonstrated by consistently high scores across all assessed items. The study showed that the training elevated the alumni's perception across all assessed items - security, growth opportunity, improved performance, and a greater sense of making a difference in clinical research and population health - regardless of their current sphere of activity. While our study utilizes a simple, self-report-based design, the importance of professional training is broadly supported in the literature. Other studies across different areas have shown that the presence of trained professionals results in improved health indicators. For example, in the maternal-infant context, training resulted in increased coverage of prenatal care, exclusive breastfeeding, and childhood vaccination, as well as advances in cervical cancer screening and early diagnosis of congenital syphilis (Nascimento et al., 2020). Integration initiatives between primary care teams and hospitals, focused on updating and communication, have also demonstrated the potential to reduce readmissions and improve clinical outcomes, reinforcing the role of training in care quality (Branco et al., 2016). Additionally, training through specialization courses and distance education has been associated with a reduction in hospitalizations for conditions sensitive to primary care and an improvement in the monitoring of chronic diseases, such as diabetes and hypertension (Moraes et al., 2019). These findings sustain that the training of health professionals, especially those working within the SUS, generates relevant benefits for the quality of patient care and contributes to reduced hospital overload and better longitudinal follow-up.

It is known that the reality of academic research often differs significantly from that of traditional or sponsored clinical trials in Brazil, creating a clear gap between the academic and corporate worlds. This disparity is partly due to the fact that few institutions include clinical research disciplines or Good Clinical Practice (GCP) training in their undergraduate and postgraduate curricula. Nevertheless, this is a scenario that requires careful attention, making clinical research training extremely valuable, particularly when the University sphere is involved. In the present study, we report that less than 20% of our alumni currently work in the academic sector. Maintaining ethical and regulatory integrity throughout the conduct of a clinical trial is essential. According to Sancheti et al. in 2023, for any academic department to participate in such studies, strict adherence to the applicable national laws is mandatory. Furthermore, the academic department must establish an elevated ethical rigor in its research, whose structure and functioning are typically defined by regulatory requirements. This commitment to ethical rigor, coupled with extensive clinical experience and subject-matter expertise, significantly contributes to the implementation of high-quality research.

However, this partnership must occur while respecting the individual roles, established functions, and pre-agreed counterparts from both parties. Rasmussen et al., (2018), for example, showed that while industry employees and academic authors are often involved in various stages of sponsored clinical trials, data analysis is frequently conducted without academic input. Although academics generally view the collaboration as beneficial, some report a perceived loss of academic

freedom. Training programs have the potential to bridge the involvement of these parties across different stages, while also facilitating mutual cooperation and solid networking.

The inherent complexity and ever-evolving nature of clinical trials necessitate specialized and ongoing training for all professionals involved (Peralta; Sánches-Santiago, 2024). In our study, the vast majority of alumni stated that the training was essential for enhanced job satisfaction and professional motivation. This aligns with other studies that investigated the professional fulfillment of individuals working in clinical research. As highlighted by Peralta and Sánchez-Santiago (2024), addressing the challenges within the clinical trial sector—including enhancing retention and improving trial outcomes—requires clear role delineation and a strong commitment to continuous professional development. Recently, Knapke et al., (2025) aiming to identify challenges potentially associated with the high turnover of professionals in the pharmaceutical industry and clinical research organizations, demonstrated that among the various points related to work engagement and well-being were also opportunities for education and professional development.

This demand for continuous training is not exclusive to Brazil but is also observed internationally. Corroborating the necessity for ongoing capacity building, a recent self-assessment of professional competencies in Portugal revealed that multidisciplinary teams frequently lack adequate training. Bogas et al. in 2025 reported that, on average, participants scored below 60% in knowledge levels across essential clinical research domains, evidencing critical gaps that require intervention. To address this, the authors proposed the development of a national action plan, constructed through a collaborative effort involving research centers, universities, regulatory agencies, and notably, the industry. This joint effort is viewed as crucial for elevating the quality of studies and ensuring compliance with international standards, ultimately benefiting both researchers and patients.

Beyond the alignment of our findings with existing literature, the investment in specialized capacity building shows clear impacts on professional qualification and strategic alignment with the SUS. The HAOC Specialization Program in Clinical Research generated clear demonstrations of capacity development and positive systemic alignment across all reporting spheres. Furthermore, participant feedback offered direct and actionable implications for improving future training policies, particularly regarding the need for more practical content and internships. Despite these important findings, this study is subject to limitations. First, the study is cross-sectional, which prevents the longitudinal evaluation of the training's long-term impact over time. Second, as data collection relies on self-reported questionnaires regarding past events, the findings may be susceptible to recall bias, potentially affecting the accuracy of retrospective reports. Third, the absence of qualitative responses from the Industry sector limits our comprehensive understanding of the program’s complete impact across the entire research ecosystem. Consequently, comparative results among spheres are strictly exploratory, presenting low statistical power and precluding robust inferences specifically for the industrial sphere. Finally, while the qualitative methodology offered in-depth insights, these findings

are context-specific and not directly generalizable to the entire population of program graduates without further extensive quantitative research.

Limitations include the cross-sectional design, which relies on retrospective self-reports and is therefore susceptible to recall and social desirability bias. Additionally, the non-response rate of approximately 35% was not accompanied by a formal non-responder analysis. The industry sector presented a small sample size and an absence of qualitative responses, further limiting the depth of analysis for this sphere. The study also lacked an unexposed control group, and potential institutional evaluation bias should be considered when interpreting the findings.

5. CONCLUSION

In this mixed-methods study, we explored the perceived impact of investing in specialization on clinical research capacity. The findings indicate that the perceived contributions of HAOC alumni support the direct and indirect strengthening of the SUS.

In conclusion, the findings suggest that specialized capacity building is perceived by alumni as an important contributor for developing clinical research in Brazil.

The findings support the continuation and further evaluation of investments in specialized clinical research training, with emphasis on objective outcomes, regional equity, and institutional capacity.

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