

A transformative experience in Luxembourg: Reflections on a predoctoral research stay and its impact on professional development.

Una experiencia transformadora en Luxemburgo: Reflexiones sobre una estancia de investigación predoctoral y su impacto en el desarrollo profesional.

Sandra Leon-Herrera ¹, Marta Sanchez-Castro ² and Raquel Gomez-Bravo ^{3,4 *}

¹ Department of Psychology and Sociology, University of Zaragoza, Zaragoza, Spain; sleon@unizar.es, 0000-0002-1200-5904

² Department of Life Sciences and Medicine, University of Luxembourg, 6, avenue du Swing, L-4367 Belvaux, Luxembourg; marta.sanchez@uni.lu, 0000-0002-0310-0360

³ Rehaklinik, Center Hospitalier Neuro-psychiatrique (CHNP), Ettelbruck, Luxembourg.

⁴ Research Group Self-Regulation and Health. Institute for Health and Behavior, Department of Behavioral and Cognitive Sciences. Faculty of Humanities, Education, and Social Sciences, Luxembourg University, Luxembourg. raquelgomezbravo@gmail.com, 0000-0002-3786-8626

* Correspondence: raquelgomezbravo@gmail.com

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Abstract: International predoctoral stays play a crucial role in the academic training of PhD students, especially in areas related to health and biomedicine. This article aims to assess the impact of a predoctoral stay in Luxembourg on the development of scientific, intercultural and professional competences in the field of health. The paper addresses the question of how international experiences can prepare future professionals to face the challenges of the global health system. The stay was carried out at the Neuro-Psychiatric Hospital of Ettelbruck and the Luxembourg Centre for Systems Biomedicine (LCSB), within the framework of a research project on Long COVID. During this experience, key skills such as project management, teamwork, intercultural communication and autonomous decision-making were developed. Furthermore, participation in innovative projects and access to advanced research methodologies allowed an enriching approach to novel approaches in global public health. The results indicate that international predoctoral stays significantly strengthen the preparation of PhD students to address global challenges. These experiences promote international collaboration, emotional resilience and the ability to adapt to diverse work environments. This type of training is essential to ensure competent and committed professional practice in the health field.

Keywords: Predoctoral stay; international collaboration; cultural adaptation; professional development; interdisciplinary research.

Resumen: Las estancias predoctorales internacionales desempeñan un papel crucial en la formación académica de los estudiantes de doctorado, especialmente en áreas relacionadas con la salud y la biomedicina. Este artículo tiene como objetivo evaluar el impacto de una estancia predoctoral en Luxemburgo en el desarrollo de competencias científicas, interculturales y profesionales en el ámbito de la salud. El trabajo aborda la pregunta de cómo las experiencias internacionales pueden preparar a los futuros profesionales para enfrentar los desafíos del sistema de salud global. La estancia se llevó a cabo en el Hospital Neuro-Psiquiátrico de Ettelbruck y el Luxembourg Centre for Systems Biomedicine (LCSB), en el marco de un proyecto de investigación sobre el Long COVID. Durante esta experiencia, se desarrollaron habilidades clave como la gestión de proyectos, trabajo en equipo, comunicación intercultural y toma de decisiones autónoma. Además, la participación en proyectos innovadores y el acceso a metodologías avanzadas de investigación permitieron una aproximación enriquecedora a enfoques novedosos en salud pública global. Los resultados indican que las estancias predoctorales internacionales fortalecen significativamente la preparación de los estudiantes de doctorado para abordar desafíos globales. Estas experiencias promueven la colaboración

internacional, la resiliencia emocional y la capacidad de adaptación en entornos de trabajo diversos. Este tipo de formación es fundamental para garantizar una práctica profesional competente y comprometida en el ámbito de la salud.

Palabras clave: Estancia predoctoral; colaboración internacional; adaptación cultural; desarrollo profesional; investigación interdisciplinaria.

1. Introduction

Predocctoral stays play a key role in the academic training of doctoral students, especially in disciplines related to health and biomedicine. These programs provide students with the opportunity to gain practical experience in various research environments, often international, which offers them a broader perspective on public health problems and innovative solutions in development (1).

The problem addressed by this work lies in the need to identify how international predoctoral stays contribute to the development of key competencies, such as learning multidisciplinary and intercultural approaches, essential elements in the comprehensive training of medical students and related areas, allowing them to face global challenges in complex and interconnected health systems (2-3).

In the context of medical education, research has become a key tool to enrich the theoretical knowledge acquired during university training, offering students the opportunity to apply the scientific content learned in a practical way (4-5). Research in public health, biomedicine and other related branches not only facilitates a deeper understanding of the biological and social processes that affect populations, but also fosters critical thinking, the ability to analyze complex problems and the ability to generate innovative solutions (6-7).

Teamwork and effective communication are essential skills in the medical field, where professionals often interact with multidisciplinary teams to address complex health problems (8-9). International predoctoral fellowships are an excellent opportunity for medical and other health students to hone these skills (3). In multicultural environments, students learn to manage diversity, communicate their ideas clearly and precisely, and work collaboratively with professionals from different disciplines and cultures (10). This type of experience not only fosters a more holistic and cooperative approach to health care, but also enhances students' ability to adapt to changing and dynamic environments, such as those that characterize global health systems (1).

Furthermore, predoctoral stays abroad allow students to participate in cutting-edge research projects, providing them with a privileged view of the latest scientific innovations (11). The opportunity to work in research teams addressing emerging problems not only broadens their perspective on globally relevant health issues, but also allows them to apply new methodologies, technologies and therapeutic approaches (12-13). This exposure to cutting-edge research is invaluable for future health professionals, who must be prepared to face contemporary public health challenges, many of which require an innovative and multidisciplinary approach (14).

In the field of biomedicine and public health, international stays also contribute to the development of interpersonal and professional skills that are crucial for students' future careers (3). As global health systems become interconnected and globalized, healthcare professionals must be equipped with the ability to work in international teams, manage complex projects and adapt to new working methodologies (15). Predocctoral stays allow students to strengthen these skills, preparing them to play an active role in improving health systems in their respective countries, as well as to collaborate on solutions at an international level (3).

This article aims to analyse the contribution of a predoctoral stay in Luxembourg to the development of scientific, intercultural and professional skills in the field of health, as a training strategy to face global public health challenges.

The experience took place at two key institutions: the Hospital Center Neuro-Psychiatrique in Ettelbruck and the Luxembourg Centre for Systems Biomedicine (LCSB), and focused on a study on

Long COVID. Throughout this stay, the student involved developed important skills in areas such as project management, teamwork, intercultural communication and autonomous decision-making, which highlights the importance of these stays for the comprehensive development of medical students and other health areas.

2. Methods

The article adopts a descriptive approach, based on the experience of a predoctoral researcher during a stay in Luxembourg. The activities undertaken, the challenges faced and the skills acquired were systematically documented. In addition, the results of the projects in which she participated were analysed, including interdisciplinary collaborations and methodological innovations. The information was contextualised with relevant literature to establish comparisons and support the conclusions.

3. Results

Preparation and planning of the stay

The organisation of a predoctoral stay involves detailed planning, covering both the administrative management and the logistical aspects necessary to ensure the success of the experience (16). In this case, preparations began with obtaining mobility grants, a fundamental step to finance the stay. Invitation letters were issued by the host institutions, the Hospital Centre Neuro-psychiatrique and the Luxembourg Centre for Systems Biomedicine (LCSB). These letters allowed the application for two specific supports: a scholarship for short and long-term stays within the framework of the Erasmus+ Project, managed by the Campus Iberus consortium, and the "Support Action for the Figure of the Predoctoral Researcher", granted by the intramural call for the promotion of health research in Aragon 2023. The planning process also included the management of bureaucratic procedures and the organisation of the trip, with the support of the home university and the collaborating institutions. These steps ensured that the logistical aspects were fully covered. English was the main language used during the stay. To strengthen language skills, additional preparation was provided through a C1 level course, which allowed for optimizing fluency and confidence in communication within a multicultural environment. The planning of the stay had as main objectives the learning of advanced academic skills, the strengthening of project management skills and integration into a multicultural context. These elements highlight the relevance of international predoctoral stays in the training of future professionals in the health field.

Experience during the stay

First impression and culture shock

Adapting to a different cultural and linguistic environment is one of the main challenges faced by students during international stays (17). In the case of Luxembourg, its marked cultural diversity and multilingual character represented an enriching setting for the development of international and adaptation skills. Luxembourg is a country where several official languages converge, such as French, Luxembourgish, German and English, which creates a unique multicultural context. During the stay, English was the predominant language in the work environment, although daily contact with different languages in daily life offered an additional formative experience. This multilingual environment fostered the development of greater intercultural sensitivity and strengthened quick adaptation skills, essential elements for success in international environments. The immersion process in this context allowed not only an effective integration in the professional field, but also the acquisition of relevant skills for intercultural communication and collaboration in multicultural teams, fundamental aspects in globalized health systems.

Overcoming barriers

Adapting to a new work and cultural environment during a predoctoral stay represents one of the main challenges faced by international students. In the case of the professional environment in Luxembourg, significant differences were identified with respect to the usual work dynamics in the home country. One of the main characteristics of the Luxembourg work environment is its focus on more collaborative and less hierarchical teamwork. Unlike the more formal and supervisor-dependent structures observed in other contexts, the Luxembourg system encourages horizontality and interaction between team members. A representative example of this dynamic is the practice of holding weekly team meetings, as well as using lunchtime as a space to share progress and challenges. These meetings not only facilitate the exchange of ideas, but also promote an environment of continuous support, where it is possible to discuss ongoing projects and request guidance on specific issues. This collaborative approach proved to be a valuable tool for problem-solving and innovation, highlighting the importance of having spaces for the exchange of diverse perspectives. The experience allowed us to develop confidence to raise questions and propose ideas, promoting both professional and personal growth.

From a linguistic perspective, working in an environment where English was the predominant language presented challenges, especially when dealing with technical terminology and complex concepts in the biomedical field. To overcome these difficulties, support from colleagues with experience in the context was essential, facilitating continuous learning. Likewise, the need to be more proactive in seeking clarification contributed to the development of more accurate and effective communication skills.

On a personal level, distance from the usual support network posed emotional challenges. Learning to manage these situations strengthened resilience, allowing difficult moments to be faced with greater autonomy. In particular, unexpected events at a time of emotional exhaustion illustrated the importance of adapting to new and challenging circumstances in an unfamiliar environment. These types of experiences highlighted the need to develop practical and emotional skills to cope with adversity, which resulted in significant personal growth.

Clinical and educational experience

The predoctoral stay allowed to participate in innovative projects, apply multidisciplinary approaches and take advantage of an advanced technological infrastructure that favored learning. These experiences resulted in the development of critical skills and a broader understanding of research processes in the biomedical field. During the stay, we contributed to research related to Long COVID, including those focused on the feasibility of innovative treatments, such as caloric restriction for patients with this condition, through the "FastCov-P" project. Additionally, we participated in the preparation of a scoping review on this same topic, which allowed us to deepen our management of scientific information and acquire a more complete perspective on this emerging phenomenon. The work was developed in two main institutions: the Hospital Center Neuro-Psychiatrique and the Luxembourg Centre for Systems Biomedicine. In both institutions, collaborative and multidisciplinary approaches were implemented, bringing together researchers from various specialties. This experience not only enriched scientific knowledge, but also highlighted the importance of interdisciplinary interaction as a fundamental tool to advance biomedical research. Another highlight was the advanced technological infrastructure of the host institutions. These tools facilitated more efficient learning and performance. For example, the possibility of working with multiple screens connected to the laptop significantly improved the ability to manage large volumes of data and perform tasks that required comparing multiple sources of information simultaneously. This experience underlined how an appropriate infrastructure can make a noticeable difference in productivity and the organization of daily work. Together, these opportunities contributed not only to the development of technical skills, but also to a better understanding of the differences between international and national research environments, reinforcing the importance of international mobility in the training of future professionals.

Professional and personal development. Skills acquired

During the pre-doctoral stay, a number of key skills were developed, covering international collaboration, time management, intercultural communication, autonomy and leadership, as well as improving language skills in English and French. The main skills acquired are described below:

- **International collaboration and teamwork:** The experience allowed participation in an interdisciplinary and multicultural team, made up of professionals from various disciplines, such as general medicine, genetics, psychology, nursing, sexology and occupational therapy. The interaction with these areas, different from one's own, enriched professional understanding and fostered the ability to manage team dynamics in an international context. This learning highlighted the importance of diversity in problem solving and in implementing complementary approaches. In addition, working in a multicultural environment improved the ability to adapt and communicate in diverse teams.
- **Time management and organization:** Simultaneous participation in multiple projects required a high level of organization and efficiency in time management. Skills were acquired to balance responsibilities, prioritize tasks and maintain consistent performance, skills that will be valuable in future professional development.
- **Intercultural communication and sensitivity:** Daily interaction in a culturally diverse environment facilitated the development of intercultural communication skills and increased sensitivity to different work and social approaches. In the early days, living with multiple languages (English, French, German and Luxembourgish) represented a significant challenge, but gradually this linguistic diversity was managed. This experience strengthened adaptability and attention to international environments, highlighting the importance of cultural flexibility in a globalized context.
- **Autonomy and decision-making:** During the placement, the student assumed responsibility for leading projects and making decisions autonomously, even in situations that required acting without constant supervision from the mentors. For example, the leadership of a scope review project was assigned from the beginning of the placement, which involved developing guidelines and coordinating the team. This process allowed the development of leadership skills, self-management, and confidence in the ability to make decisions in an unfamiliar professional environment.
- **Improved English and French language skills:** Interactions in English in the workplace increased confidence to participate in academic discussions and presentations. Private French lessons also contributed to better integration into the local environment and facilitated the creation of interpersonal relationships. Initially, language limitations made it difficult to understand everyday conversations, but towards the end of the stay, significant progress was made, such as the ability to follow conversations and respond in French, which reinforced the motivation to continue developing these language skills.

Together, these skills acquired during the predoctoral stay not only strengthened professional development, but also promoted comprehensive personal growth, highlighting the importance of international mobility in the training of future researchers.

Overcoming challenges

The predoctoral stay in an international environment presented various challenges that required a process of adaptation and constant learning. The main challenges faced and the strategies developed to overcome them are described below:

- Adapting to an international work environment: The experience of working in an international context revealed significant differences in approaches to work. In Luxembourg, the work environment is characterised by a less urgent pace and a more relaxed management of priorities. For example, it was observed that teams tended to respond to emails less immediately and to complete tasks close to deadlines. This contrast with the more agile and structured work style to which they were accustomed initially generated a feeling of stress. However, this experience allowed them to reflect on the importance of being flexible and adaptable in diverse work environments. They also learned to value different forms of organisation and time management, which contributed to the development of a greater capacity for adaptation and the acceptance of new work perspectives.
- Managing distance and self-sufficiency: Being away from one's home country and familiar surroundings posed emotional and social challenges. This distance, while difficult at times, facilitated the development of self-sufficiency and resilience skills. The ability to maintain continuous contact with family and friends through communication technologies, such as video calls, was critical to mitigating the impact of physical distance. This learning not only strengthened the connection with personal support networks, but also helped to value independence and take advantage of time abroad as an opportunity for personal and professional growth.

Impact on research

The predoctoral stay had a notable impact on the student's doctoral research, as well as on her general vision of the field of public health. During this period, she participated in innovative projects and worked with various methodologies related to Long COVID, which allowed for broadening approaches and perspectives on this complex and multifaceted phenomenon. For example, the collaboration on the "FastCov-P" project promoted the exploration of the potential of dietary interventions, such as fasting, in the context of innovative treatments for Long COVID, an aspect that had not previously been considered in her line of research. In addition, the process of receiving feedback from the teams at the host institutions was essential to refine hypotheses and incorporate novel perspectives into ongoing projects. This exchange not only improved the quality of research work, but also highlighted the importance of interdisciplinary collaboration and constant feedback in the academic field.

In the long term, this experience significantly influenced the student's professional aspirations. It sparked an interest in further researching topics related to Long COVID and other aspects of public health, with a particular focus on the application of practical interventions aimed at improving the quality of life of patients. It also reinforced the conviction that working in collaborative and multicultural environments not only enriches the research process, but also enhances the implementation of effective solutions in the field of health. The creation of a network of professional contacts during the stay was also highlighted as one of the most important achievements. Meeting experts from various disciplines offered valuable opportunities to establish collaborations and maintain continuous learning. These relationships have continued to be a source of professional support, with the potential to influence future research projects. In summary, the skills and knowledge acquired during this experience will be fundamental for the student's future development as a researcher. Furthermore, they will contribute significantly to comprehensively addressing the challenges of public health, promoting an innovative and collaborative approach in this field.

Comparison with the country of origin

The experience in Luxembourg allowed the student to observe and participate in a collaborative and multidisciplinary work model, markedly different from the more hierarchical approach present in her home country. During her stay, these cultural and organizational differences in the workplace significantly influenced her view of teamwork, professional dedication, and international work dynamics. Firstly, immersion in an international and diverse work environment fostered the

development of key skills such as project management, teamwork in multicultural contexts, effective communication, and autonomous decision-making. These skills not only enriched her professional profile, but also redefined her future goals. On the other hand, exposure to a collaborative and multicultural approach in Luxembourg reaffirmed her interest in participating in global teams and working on projects with an impact that transcends borders. This experience allowed her to recognize the advantages of a less hierarchical work model, where cooperation and equal participation between professionals from various disciplines are essential for success. In conclusion, the stay was not only an opportunity to apply previous knowledge, but also a catalyst for the development of essential professional skills in a globalized world. This learning will be decisive in future professional decisions, with an emphasis on international research and interdisciplinary work.

Recommendations based on experience

Based on her stay, the student shares a series of recommendations for PhD students or healthcare professionals who wish to undertake similar international stays or rotations. These suggestions emphasize the importance of adequate preparation and an open attitude towards learning and adaptation:

- **Language preparation:** It is essential to take time to improve your language skills before starting your stay. Effective communication not only makes daily work easier, but also fosters the creation of meaningful professional and personal relationships.
- **Cultural Adaptation:** It is crucial to keep an open mind towards new ways of working and perspectives. Cultural adaptability improves collaboration in diverse teams and fosters a more enriching work environment.
- **Define clear goals:** Before starting the stay or rotation, it is essential to establish specific and achievable objectives. This allows you to direct your efforts and measure progress at the end of the experience.
- **Taking advantage of learning opportunities:** Actively participating in discussions, workshops, social activities, and other networking opportunities is key to maximizing learning. These interactions can enrich the experience and facilitate the creation of valuable professional relationships.
- **Preparedness to receive feedback:** Being open to constructive criticism and willing to implement suggestions is crucial to professional development. Feedback from colleagues and supervisors can provide new perspectives that contribute to personal growth and project improvement.
- **Exploring new methodologies:** Adopting a receptive attitude towards innovative research methodologies or practices can be highly beneficial. Exposure to different approaches fosters creativity and can inspire improvements in one's own projects.
- **Proactivity:** Taking the initiative to get involved in projects, even if they are not directly related to areas of personal interest, is essential. Each experience offers learning opportunities and can strengthen one's professional profile.

4. Discussion

The experience of completing a predoctoral research stay in an international environment has a significant impact on both the academic training and the professional development of students, especially those in the health field. Beyond the acquisition of scientific knowledge, these stays allow the strengthening of skills that not only enrich research, but also improve the ability of future doctors to face the challenges of the global health system (1, 3).

One of the student's key learnings was the development of intercultural and multidisciplinary collaboration skills. In her experience, working with professionals from various disciplines and nationalities enriched her perspective and improved her communication skills, especially in integrating diverse perspectives. This type of collaboration, in which perspectives from different fields of knowledge are integrated, is essential in the training of physicians who must address complex public health problems. The ability to work effectively in multidisciplinary teams is an increasingly valued skill in the healthcare field (18, 19).

In the research field, the student's participation in the "FastCov-P" project on Long COVID allowed her to explore innovative approaches, such as dietary interventions through support, a topic she had not previously considered in her work. This finding is consistent with what has been proposed in previous research, which highlights how international stays allow students to experience innovative research approaches (20). Furthermore, these experiences allow students to not only improve their research skills, but also generate new ideas and approaches to address health problems affecting global populations (3, 21).

In terms of personal and professional development, the experience in Luxembourg allowed the student to strengthen her autonomy and decision-making capacity, fundamental aspects in the training of health leaders. The literature mentions that autonomous project management and exposure to collaborative environments are essential skills to face the challenges of the global health system (22).

Finally, emotional resilience was another aspect that the student highlighted as a result of her international stay. Rehaag Tobey's study already documented in 2008 that exposure to international environments and distancing from the usual environment contribute to the development of greater self-sufficiency and adaptability, essential characteristics for health professionals who face demanding and high-pressure contexts (23). These findings complement the conclusions of Caro Alonso & Rodriguez Martin, who highlight resilience as a crucial attribute for doctors and other health professionals, who must constantly adapt to these challenging environments (24).

5. Conclusions

- Predoctoral research stays, such as the one described in this article, not only contribute to the development of scientific and technical skills, but also to the strengthening of interpersonal skills such as collaboration, resilience and autonomous decision-making.
- These experiences provide comprehensive training that prepares students to face the challenges of the global health system, allowing them to contribute significantly to the solution of complex problems in the field of medicine and public health.

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