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Article

Madrid Nurses' Experiences and Expectations of Resilience Training Through Extended Reality: A Grounded Theory Study

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Highlights

What are the main findings?

- Resilience was understood by nurses as a relational and emotional competency developed through experience, reflection, and teamwork.
- XR was perceived as a valuable opportunity to strengthen emotional coping skills in safe and clinically relevant environments.

What are the implications of the main findings?

- Resilience training should move beyond stress management approaches and incorporate emotional, situational, and relational dimensions of nursing practice.
- Successful implementation of XR requires organizational commitment, protected learning spaces, and supportive leadership.

Abstract

Background: Nurses routinely navigate high emotional demands and heavy workloads. Resilience is a critical competency for sustaining professional well-being and ensuring safe, person-centered care. Immersive technologies such as extended reality (XR) offer new possibilities for developing emotional and cognitive competencies within simulated, controllable, and clinically authentic

environments. **Objectives:** To explore the experiences, needs, and expectations of nurses in Madrid regarding XR-based resilience training within the European XR2ESILIENCE project, with the aim of training mental health skills in virtual scenarios relevant to real-world practice. **Methods:** We conducted a qualitative study using a hybrid analytic approach. Four focus groups were held between February and March 2025 across three level-II hospitals and one out-of-hospital emergency service in Madrid, Spain. Twenty-six nurses were recruited through theoretical sampling. Data were analyzed through open and axial coding to identify emergent categories and their interrelationships. Standards for Reporting Qualitative Research (SRQR) guidelines were followed. **Results:** Three overarching categories were identified: (1) expectations surrounding XR, including the need for realistic and customizable training scenarios; (2) perceived barriers, such as workload pressures and digital skill gaps; and (3) facilitators and opportunities, including professional motivation and openness to innovation. The relational analysis showed how organizational conditions shaped nurses’ receptivity to XR and their capacity to cultivate resilience. **Conclusions:** Nurses viewed XR as a promising resource for strengthening resilience and managing work-related stress. Implementation will require participatory planning, adequate resources, and protected training time. These findings provide direction for developing XR-based educational programs.

Keywords: resilience; extended reality; nursing; work-related stress; emotional training; grounded theory

1. Introduction

Nursing professionals work in environments marked by high emotional demands, increasing clinical complexity, and constant exposure to suffering, psychosocial risks, uncertainty, and critical decision-making. The COVID-19 pandemic and its aftermath have profoundly intensified these conditions, exacerbating workload pressures, emotional strain, and exposure to ethically and clinically challenging situations. As a result, the risk of chronic stress, compassion fatigue, and burnout among nurses has increased significantly, with persistent effects on professional well-being beyond the acute phase of the pandemic [1,2]. Inadequate staffing levels and excessive workloads, further amplified during the pandemic, have been associated with poorer patient outcomes and increased healthcare costs, highlighting the structural pressures under which nursing professionals deliver care [3]. Burnout among nurses has also been consistently linked to adverse patient outcomes, reduced quality of care, and negative organizational consequences [4].

In this context, and in response to the sustained emotional and organizational challenges intensified by the COVID-19 pandemic, resilience is recognized as an essential competency that enables healthcare professionals to adapt positively to adversity, sustain emotional balance, and maintain effectiveness in clinical practice [5,6].

International research has consistently shown that strengthening resilience is associated with lower levels of burnout, improved care outcomes, and greater job satisfaction [7,8]. However, traditional training strategies aimed at developing resilience often focus on cognitive learning or individual stress management, placing less emphasis on the experiential and emotional dimensions of professional practice. Consequently, there is a growing need for training methods that integrate emotional, situational, and relational components capable of simulating the real context of nursing work [7,9]. Extended Reality (XR), encompassing virtual, augmented, and mixed reality, has become a promising tool in healthcare education [8,10]. Its capacity to create immersive, controlled, and safe environments allows the recreation of complex clinical situations and offers unique opportunities for developing emotional skills, communication abilities, and strategies for coping with stress [11–13].

Complementarily, innovations based on artificial intelligence (AI) expand these possibilities by optimizing learning processes, personalizing training experiences, and enhancing healthcare workers’ well-being [14]. Moreover, the integration of AI-based innovations now makes it possible to improve the well-being and quality of life of healthcare professionals, further strengthening the

impact of immersive technologies on workplace and emotional outcomes [15]. Recent studies have reported meaningful results in the use of XR to enhance empathy, reduce stress, and support the acquisition of interpersonal competencies among healthcare workers [7,10,16,17]. Nonetheless, its potential for resilience training in nursing professionals remains an emerging and underexplored field, particularly within qualitative research [8,18,19]. Against this backdrop, the European XR2ESILIENCE project is developing an XR-based emotional training program designed to expose professionals to high emotional load situations within a controlled and safe environment [15,18].

The present study forms part of the qualitative work conducted within the XR2ESILIENCE project and aims to explore the experiences, needs, and expectations of nursing professionals in the Madrid region regarding resilience training through Extended Reality (XR) environments. By examining nurses’ perceptions of the usefulness, barriers, and opportunities associated with XR, this study seeks to inform the development of realistic and clinically relevant training scenarios. The findings suggest that nurses consider XR a promising approach to strengthening resilience and emotional coping skills; however, its successful implementation requires institutional support, protected training time, and training experiences that reflect the realities of clinical practice.

2. Materials and Methods

2.1. Study Design

A hybrid qualitative approach was used. Open and axial coding, following the principles of Glaser and Strauss’ Grounded Theory [20], supported the development of preliminary categories through constant comparison, while reflexive thematic analysis was employed to organize patterns of meaning and deepen the interpretive process. These approaches were integrated in a complementary manner, maintaining an inductive orientation as the primary driver of analytic decision-making. This design enabled an exploration of nurses’ experiences, perceptions, and expectations regarding resilience training through Extended Reality (XR), allowing emergent categories to be generated directly from participants’ accounts without imposing prior hypotheses.

Standards for Reporting Qualitative Research (SRQR) guidelines were followed to ensure trustworthiness in reporting the findings [21].

2.2. Context and Participants

The study was conducted between February and March 2025 across four healthcare institutions in the Madrid region: three level-II hospitals and one out-of-hospital emergency service. A total of 26 bedside nurses participated, distributed across four focus groups (see Table 1).

Table 1. Study Sites and Participants.

Center	Focus Groups	Participants
Hospital 1	1	6
Hospital 2	1	7
Hospital 3	1	7
Emergency Service	1	6

Inclusion criteria required participants to be actively employed as bedside nursing professionals, to belong to one of the institutions participating in the European XR2ESILIENCE project, and to express a willingness to share experiences related to emotional management and professional resilience. Efforts were made to ensure heterogeneity in age, years of professional experience, gender, and sociocultural background. Theoretical saturation was considered reached when the addition of new participants no longer contributed substantial new insights to the categories already identified.

2.3. Data Collection

Focus groups (FG) were used as the primary data collection technique, following the methodological recommendations of Krueger and Casey [22]. Sessions were facilitated by a moderator experienced in qualitative research and accompanied by an observer who recorded nonverbal interactions and contextual notes. Each focus group lasted approximately 90 minutes. Discussions were audio- and video-recorded with explicit consent and subsequently transcribed verbatim and anonymized.

The discussion guide included the following thematic axes: (1) experiences of stress and emotional coping; (2) perceptions of resilience as a professional competency; (3) expectations and concerns regarding the use of XR in healthcare training; and (4) organizational and personal conditions that might facilitate or hinder its implementation.

2.4. Data Analysis

Data were analyzed through an inductive and constant comparative process, beginning with open coding and followed by axial coding, in alignment with Grounded Theory [20]. A reflexive thematic analysis was then conducted following Braun and Clarke's approach [23], enabling the identification of patterns of meaning and their organization into main categories and emergent subcategories. Additionally, sentiment coding (positive, negative, and neutral) was applied, along with co-occurrence matrices examining relationships among codes, categories, and sentiments.

2.5. Methodological Rigor

The quality of the study was ensured by applying the criteria of credibility, transferability, dependability, and confirmability. A detailed record of analytic decisions was maintained through a methodological log, and peer debriefing was carried out to validate internal coherence between categories and supporting textual excerpts.

2.6. Ethical Considerations

The study was approved by the Ethics Committee for Research with Medicinal Products (CEIm) of Hospital Universitario de Getafe on 30 January 2025 (CEIm24/125) and conducted in accordance with the Declaration of Helsinki (2013). All participants provided written informed consent. Data were anonymized and securely stored in compliance with Regulation (EU) 2016/679 and the Spanish Organic Law 3/2018 of December 5 on Personal Data Protection and the guarantee of digital rights. No conflicts of interest were identified, and no financial incentives were provided for participation.

2.7. Use of Generative Artificial Intelligence

During the preparation of this manuscript, the authors used Claude AI (Anthropic), ChatGPT (OpenAI), and Microsoft Copilot (Microsoft Corporation) for text drafting, language refinement, and editorial support. The authors critically reviewed and edited all outputs and take full responsibility for the final content of the manuscript.

3. Results

Analysis of the four focus groups, which included 26 frontline nursing professionals from various hospital and emergency care settings across the Community of Madrid, led to the identification of three main categories that articulated participants' experiences and expectations regarding resilience training through XR environments: (1) Expectations about XR; (2) Perceived barriers; and (3) Facilitators and opportunities. Open and axial coding enabled theoretical saturation and demonstrated strong consistency across centers. Sentiment coding revealed a predominance of conditional positive perceptions and reflective neutral sentiments, with occasional instances of strong

negative feelings. (Descriptive statistical complements are provided in Appendix A: Supplementary Tables: T1, T2, T3, T4, T5).

3.1. Expectations Regarding Extended Reality (XR)

Nursing professionals expressed an open and expectant attitude toward the possibility of using XR as a training tool. They perceived immersive environments as capable of providing practical and emotionally realistic experiences, supporting the development of coping skills and stress-management strategies in a safe setting.

The most frequently mentioned expectations included scenario authenticity, the opportunity to rehearse emotional responses to real-life crises, and the transferability of virtual experiences to everyday clinical practice.

"I would like the scenarios to be as realistic as possible, so we can prepare for common situations, like when a patient deteriorates or a family reacts badly." (FG2-P5)

"I think it could help us notice how we respond under pressure, without having to wait to experience it during a real shift." (FG3-P2)

"In a virtual environment you can make mistakes, get emotional or freeze, but then you reflect and learn; at work that's not always possible." (FG1-P4)

3.2. Perceived Barriers

Despite the general interest, participants identified several structural and personal barriers that might limit the implementation of XR as a training tool. Heavy workload, limited time for professional development, and lack of familiarity with immersive technologies were the most frequently cited obstacles, generating feelings of frustration and moderate skepticism.

"We are very eager to try it, but sometimes there's barely time to breathe during a shift." (FG1-P5)

"We would like to receive this training, but if it requires a lot of time or complicated equipment, it will be difficult to sustain." (FG4-P3)

"We already have many digital tools and they don't always work; sometimes technology makes things more complicated." (FG2-P6)

3.3. Facilitators and Opportunities

Participants identified several factors that could support the adoption and success of XR-based resilience training. Among these, intrinsic motivation to improve emotional coping, institutional support, and collaboration between nursing staff and educators were particularly relevant.

"We really need this type of training, because many times we don't have space to talk about how we feel." (FG3-P7)

"If management supports it and it can be integrated into working hours, it would be very positive." (FG4-P2)

"It would be important for us to help design the scenarios ourselves, so they resemble what we experience every day." (FG1-P2)

Axial analysis showed that expectations were shaped by perceived barriers, particularly those related to workload, whereas facilitators acted as compensatory elements that strengthened participants' readiness for change.

3.4. Central Phenomenon and Emerging Conceptual Model

The constant comparative analysis enabled the identification of a central phenomenon that synthesizes and integrates the study's main categories: a conditioned openness toward Extended Reality (XR) as a tool for emotional training, shaped by a work context characterized by high structural pressure.

This phenomenon illustrates that acceptance of XR does not depend solely on the technical or pedagogical qualities of the tool, but rather on the dynamic balance between perceived usefulness, organizational barriers, and facilitators linked to institutional support and professional development.

3.4.1. Causal Conditions

Nurses describe high emotional demands and a substantial workload burden as the starting point from which they recognize the need to strengthen their resilience. The high care demand and the clinical pressures inherent to high-intensity settings further intensify these experiences, shaping their capacity to cope with stress, uncertainty, and the inherent challenges of their professional roles.

3.4.2. Phenomenon: Conditioned Openness Toward XR

XR is perceived as an innovative training tool capable of recreating emotionally intense scenarios in a safe environment. However, this positive disposition is modulated by structural factors that influence its feasibility: available time, ease of use of the devices, and the existence of protected time for training.

3.4.3. Context: Structural Work Pressure

Workload pressure, limited resources, and restricted access to training spaces shape the implementation of XR. This context does not diminish its potential but imposes clear boundaries on its adoption and sustainability, creating the challenge of realistically adapting immersive scenarios to the constraints of everyday clinical practice.

3.4.4. Action Strategies

Participants identified several strategies that could facilitate the integration of XR: co-design of training scenarios, embedding the training within working hours, the presence of empathetic leadership, and access to technical and emotional support.

3.4.5. Consequences

When facilitators are activated and structural barriers are reduced, XR evolves from being perceived merely as a technological innovation to becoming a tool for emotional growth, improved coping, and strengthened individual and collective resilience. Taken together, this central phenomenon offers a conceptual framework that articulates how nurses experience, evaluate, and envision the use of XR in their professional practice, guiding the design of training interventions that are sensitive to the real conditions of the clinical environment.

4. Discussion

The findings of this study show that nursing professionals in the Community of Madrid generally hold a positive view of XR as a tool for resilience training, although this is tempered by structural barriers and organizational constraints. This ambivalence, oscillating between enthusiasm and uncertainty, reflects the coexistence of a transformative expectation and a pragmatic form of resistance.

4.1. Internal Convergences

Across the four contexts analyzed, participants consistently recognized the importance of strengthening resilience as a professional competency to cope with stress, emotional demands, and the complexity of care. XR was described as an opportunity for experiential learning capable of simulating emotionally challenging situations within controlled environments, thus fostering self-reflection, emotional awareness, and the safe practice of coping strategies. This perception of

immersive environments as emotionally engaging aligns with previous research highlighting the influence of virtual reality on users' subjective emotional experience and sense of presence [7,8,10].

4.2. Internal Divergences

Differences were observed between hospital and emergency settings. In hospitals, participants prioritized the curricular and technical integration of XR; in the out-of-hospital emergency service, the emphasis was placed on its practical applicability in critical situations and its potential for rapid adaptive responses. Differences also emerged according to professional seniority, with greater openness among younger nurses and more caution among those with longer experience, an observation aligned with the literature on technological acceptance in healthcare [8,10].

4.3. Convergences with the Literature

The findings are consistent with studies documenting the effectiveness of resilience-based interventions in improving mental health and performance among nursing professionals [7,9], as well as with research demonstrating that virtual reality can reduce perceived stress and enhance emotional self-regulation in healthcare workers [8,24]. Participants' preference for realistic scenarios also aligns with advanced clinical simulation literature, where immersion and contextual authenticity are recognized as essential elements for meaningful learning [10,16].

4.4. Divergences from the Literature

While some studies report high levels of technological acceptance [7,10], the present work revealed an ambivalent perception shaped by limited time and high clinical workload. These differences may be explained by the fact that many previous studies were conducted in academic or volunteer contexts, whereas this research was situated in real clinical units with structural constraints. Additionally, although the literature highlights the positive impact of XR on motivation and well-being [16,24], participants emphasized the need for institutional support and long-term sustainability, introducing the nuance that effectiveness depends not only on pedagogical design but also on systemic integration within the organization.

4.5. Interpretive Synthesis

From a Grounded Theory perspective, the emerging categories form a dynamic conceptual model in which expectations, barriers, and facilitators interact to shape openness to innovation. Professional resilience emerges as a relational process sustained by personal, interpersonal, and organizational factors. XR appears not only as a technical training tool but also as an opportunity for emotional growth and professional self-care.

4.6. Common Elements in the Understanding of Knowledge Structures

4.6.1. Professional Resilience and Emotional Coping

"Sometimes you have to be strong for everyone else, even when you feel broken inside." (FG1-P3)

"You learn to stay calm when things get difficult." (FG2-P6)

Key points:

A predominantly neutral-reflective and conditionally positive tone emerges.

Resilience is constructed through shared experience and emotional self-regulation.

Nurses perceive resilience as something learned through lived experience rather than as a formally taught competency.

4.6.2. Experiential Learning and Reflection in Practice

"Every mistake teaches you something if you're able to talk about it." (FG1-P5)

"After a difficult shift, reflecting as a group helps you avoid repeating mistakes." (FG2-P2)

Key points:

Collective reflection appears as a central axis of professional development.

XR is seen as an environment that facilitates emotional learning and safe simulation.

XR is associated with training in calmness, communication, and decision-making.

4.6.3. Culture of Support and Organizational Leadership

"When you have a team that listens to you, everything feels lighter." (FG2-P1)

"Close, supportive leadership helps you get through critical moments." (FG1-P4)

Key points:

Collective resilience depends on empathetic leadership and spaces for emotional support.

Participants recognize the need for protective institutional structures: time for training, a climate of safety, and humanized leadership.

XR is perceived as a tool that can contribute to organizational culture if it promotes collaborative learning.

4.6.4. Understanding of the Theoretical Concept

A reflective perspective predominates, focused on improvement and meaning at work.

Positive emotions are linked to pride and growth, while negative emotions relate to fatigue and lack of recognition.

4.6.5. Final Qualitative Synthesis

Nursing resilience is a relational and emotional competency, learned through doing and sharing.

XR is perceived as a transformative opportunity, provided it is integrated into safe, reflective environments with empathetic leadership.

The study reveals a mature and self-reflective profession that understands resilience as an essential component of care.

5. Conclusions

This qualitative study, conducted through a hybrid approach combining Grounded Theory and reflexive thematic analysis, enabled an in-depth understanding of how nursing professionals in the Community of Madrid experience, evaluate, and envision the use of Extended Reality (XR) as a tool for strengthening professional resilience. The findings indicate that XR is perceived as a technology with strong potential to support emotional learning and stress self-regulation through immersive, safe, and clinically realistic experiences.

The central phenomenon identified, a conditioned openness toward XR within a context of structural work pressure, reveals that positive perceptions of this technology are not unconditional but depend on a balance between perceived usefulness, organizational barriers, and institutional and relational facilitators. Acceptance and sustainability of XR require protected time for training, technical and pedagogical support, operational simplicity, empathetic leadership, and spaces that integrate emotional reflection into everyday practice. Participatory co-design of scenarios emerges as a key strategy to ensure clinical relevance, realism, and professional ownership.

At a practical level, these results inform the development of XR-based training programs that respond to the real needs of nursing professionals, incorporating the emotional, situational, and relational dimensions of care. At an organizational level, they highlight the importance of fostering an institutional culture that prioritizes emotional well-being, enables training time, and recognizes the value of experiential learning.

Future research should examine the longitudinal impact of XR training on resilience, psychological well-being, care quality, and professional retention. It would also be valuable to

explore implementation across diverse healthcare contexts, analyze how XR interacts with team dynamics, and investigate its role in emotionally demanding environments such as emergency care, critical care, and out-of-hospital services.

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Institutional Review Board Statement: The study was conducted in accordance with the Declaration of Helsinki and approved by the Ethics Committee for Research with Medicinal Products (CEIm) of Hospital Universitario de Getafe (CEIm24/125, 30 January 2025).

Informed Consent Statement: Informed consent has been obtained from all participants involved in the study. Written informed consent has been obtained from the participants to publish this paper.

Data Availability Statement: The data presented in this study are not publicly available due to ethical and privacy restrictions. Qualitative data contain information that could compromise participant confidentiality. Anonymized data may be available from the corresponding author upon reasonable request and subject to approval by the relevant Ethics Committee.

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Abbreviations

The following abbreviations are used in this manuscript:

XR2ESILIENCE Extended Reality for Resilience (European Horizon Europe Project)	
SERMAS	Madrid Regional Health Service
SUMMA 112	Medical Emergency Service of Madrid
XR	Extended Reality
SRQR	Standards for Reporting Qualitative Research
AI	Artificial Intelligence
FG	Focus Group
CEIm	Ethics Committee for Research with Medicinal Products

Appendix A

Table A1. Frequency of Sentiments by Study Site.

Center	Positive	Neutral	Negative
Hospital 1	292	791	339
Hospital 2	102	1387	395
Hospital 3	365	3628	445
Emergency Service	250	726	343

Table A2. Extended Sentiment Frequency by Study Site.

Center	Positive Enthusiastic	Positive Conditioned	Neutral Reflective	Neutral Resigned	Negative Mild	Negative Intense
Hospital 1	0	292	791	0	339	0
Hospital 2	0	102	1387	0	395	0
Hospital 3	0	365	3628	0	445	0
Emergency Service	0	250	726	0	343	0

Table A3. Percentage of Sentiments by Study Site.

Center	Positive (%)	Neutral (%)	Negative (%)
Hospital 1	20.5	55.6	23.8
Hospital 2	5.4	73.6	21.0
Hospital 3	8.2	81.7	10.0
Emergency Service	19.0	55.0	26.0

Table A4. Extended Sentiment Percentages by Study Site.

Center	Positive Enthusiastic	Positive Conditioned	Neutral Reflective	Neutral Resigned	Negative Mild	Negative Intense
Hospital 1	0.0	20.5	55.6	0.0	23.8	0.0
Hospital 2	0.0	5.4	73.6	0.0	21.0	0.0
Hospital 3	0.0	8.2	81.7	0.0	10.0	0.0
Emergency Service	0.0	19.0	55.0	0.0	26.0	0.0

Table A5. Category Frequency by Study Site.

Category	Hospital 1	Hospital 2	Hospital 3	Emergency Service
Quality and Safety	13	15	21	0
Communication and Coordination	2	11	34	22
Professional/Patient Experience	38	54	137	20
Training and Competencies	11	14	28	8
Organization and Resources	936	1196	2670	900
Technology and Data	5	5	10	4

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