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Front Pages

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The *Athens Journal of Health and Medical Sciences* (AJHMS) is an Open Access quarterly double-blind peer reviewed journal and considers papers from all areas of medicine (including health studies and nursing research). Many of the papers published in this journal have been presented at the various conferences sponsored by the Health & Medical Sciences Division of the Athens Institute for Education and Research (ATINER). All papers are subject to ATINER's Publication Ethical Policy and Statement.

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Athens Journal of Health and Medical Sciences

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The current issue is the third of the thirteenth volume of the *Athens Journal of Health and Medical Sciences (AJHMS)*, published by the Health & Medical Sciences Division of ATINER.

Gregory T. Papanikos
President
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- **Dr. Vickie Hughes**, Director, Health & Medical Sciences Division, Athens Institute & Assistant Professor, School of Nursing, Johns Hopkins University, USA.

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- Abstract Submission: **24 November 2026**
- Acceptance of Abstract: 4 Weeks after Submission
- Submission of Paper: **24 May 2027**

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- **Dr. Vickie Hughes**, Director, Health & Medical Sciences Research Division, Athens Institute & Assistant Professor, School of Nursing, Johns Hopkins University, USA.
- **Dr. Carol Anne Chamley**, Head, Nursing Research Unit & Associate Professor, School of Health and Social Care, London South Bank University UK.
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Organizing Green Nature-Based Solutions in Cities for Older Adults and Populations with Chronic Conditions: A Microclimatic Bioenergetic Assessment

By Letizia Cremonini[*] & Teodoro Georgiadis[±]

Urban heatwaves exacerbated by climate change represent an urgent threat to public health in modern cities, disproportionately affecting vulnerable populations with compromised thermoregulatory capacity. Despite general European climate adaptation frameworks, urban planning frequently fails to integrate the microclimatic needs of vulnerable citizens into everyday spatial design. The aim of this study is to assess the urban organization of Green Nature-Based Solutions (GNBS) designed to safeguard older adults and individuals with chronic conditions during severe heatwave events. Grounded in human bioenergetics, the methodology adapts a clinical protocol - the 6-Minute Walk Test (6MWT) - by introducing pathology-specific adjustment coefficients ($\beta_{pathology}$) and environmental heat-stress factors (αheat) to simulate localized pedestrian mobility across four clinical cohorts: healthy elderly, cardiovascular disease, chronic respiratory disease, and type 2 diabetes with autonomic neuropathy. Microclimatic simulations based on high-resolution reanalyses in Bologna, Italy, were integrated with network analysis to evaluate pedestrian accessibility to essential services under extreme thermal stress. The baseline results indicate severe mobility contractions ranging from 28.5% to 58% across cohorts, with 74% of cardiovascular pedestrians exceeding critical core body temperature thresholds ($T_{core} \geq 38.5°C$) before completing the 6-minute window. Simulated GNBS retrofits (a 35% tree canopy expansion) reduced Mean Radiant Temperature (T_{mrt}) by up to 18.5°C, lowering heat storage rates by approximately 70% and successfully restoring 6-minute walking distances to within 76%–92% of clinical baselines. These findings demonstrate that targeted urban greening functions as a vital thermoregulatory infrastructure, expanding spatial autonomy and advancing spatial justice in climate-resilient cities.

Keywords: *urban microclimate, fragile populations, heat wave, green nature-based solutions, human bioenergetics, spatial justice, pedestrian mobility*

Introduction

In an era defined by accelerating climate change, extreme weather events have increased in both frequency and intensity, transforming heatwaves from occasional seasonal anomalies into one of the most lethal environmental hazards of the twenty-first century (Changnon et al. 1996, IPCC 2022, Ballester et al. 2023). This crisis is profoundly amplified in contemporary cities by the Urban Heat Island (UHI) phenomenon, a microclimatic modification in which dense configurations of dark asphalt and concrete, coupled with anthropogenic heat

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emissions, trap shortwave solar radiation and prevent nocturnal cooling (Georgiadis 2017, Nardino et al. 2022). As a result, urban centers experience significantly higher temperatures than their rural surroundings, turning metropolitan areas into epicenters of climate risk (McMichael 2000, Masselot et al. 2024). Crucially, the impacts of these elevated thermal regimes are not distributed uniformly across the urban fabric (Meerow and Mitchell 2017, Tschakert et al. 2025). Instead, extreme heat acts as a powerful threat multiplier, exposing deep-seated socioeconomic, physical, and demographic fractures by disproportionately impacting society's most vulnerable populations, with the elderly and disabled at the forefront of this crisis (Davies and Harwood 2023, Chakraborty 2025).

The acute vulnerability of older adults and fragile cohorts to thermal stress is rooted in a complex intersection of biological degradation and social precarity (Cremonini and Georgiadis 2025, Prina et al. 2024). From a physiological perspective, aging inherently diminishes the human body's capacity for thermoregulation and alters thirst perception, rendering older individuals highly susceptible to dehydration, heat exhaustion, and fatal heat stroke (Koppe et al. 2004, De Gea Grela et al. 2024). These age-related vulnerabilities are further compounded by a high prevalence of pre-existing chronic conditions - such as cardiovascular, respiratory, and metabolic diseases - as well as the use of medications that interfere with normal sweat production (Sisodiya et al. 2024). However, biological susceptibility represents only one facet of the problem; it is heavily exacerbated by social determinants of health and deep-seated inequities (European Commission 2023, Holland et al. 2024). Marginalized urban residents, particularly isolated seniors, often inhabit substandard housing characterized by poor insulation and lack of mechanical ventilation (Poumadère et al. 2005). Financial constraints further lead to energy poverty, forcing vulnerable individuals to ration or entirely forgo air conditioning due to the prohibitive cost of electricity (Lund et al. 2010). This combination of physical frailty and socioeconomic deprivation creates a dangerous synergy, effectively trapping fragile populations in indoor or localized outdoor environments that offer no respite from soaring outdoor temperatures (Conti et al. 2005, Ballester et al. 2023).

As global demographic trends point toward an increasingly urbanized and rapidly aging world population, the convergence of intense urban heat, physiological degradation, and heightened psychological stress presents a critical challenge for public health, equity, and municipal governance (WHO 2021, WHO 2024, Baecker et al. 2025). Beyond immediate physical trauma, exposure to prolonged heat stresses mental well-being, disrupting sleep, altering neurological pathways, and intensifying eco-anxiety and social isolation among frail populations (Cianconi et al. 2020, Pihkala 2022). Historically, mitigating indoor heat stress has relied heavily on mechanical, energy-intensive cooling technologies, an approach that remains fundamentally unsustainable (WHO 2022). The widespread adoption of traditional air conditioning units drives electricity demands, intensifies anthropogenic heat rejection into the immediate urban surroundings, and fuels a vicious cycle of greenhouse gas emissions (Georgiadis 2018). Addressing this public health emergency therefore demands a paradigm shift away from reactive, individualized cooling strategies and toward proactive, systemic interventions that modify the urban microclimate itself (Cremonini et al. 2022).

To ensure long-term resilience and spatial justice for the most exposed citizens, modern urban planning must prioritize sustainable, inclusive design frameworks that align with global development guidelines (About the 2030 Agenda on Sustainable Development 2015, Legislative Decree 62/2024, Italian Republic). In climate adaptation planning, spatial justice refers to the equitable geographic distribution of microclimatic protection and green infrastructure, ensuring that socially and physiologically vulnerable populations are not geographically marginalized or disproportionately exposed to thermal hazards (Meerow and Mitchell 2017). Within this context, Green Nature-Based Solutions (GNBS) represent a strategic infrastructure capable of mitigating the urban heat island effect, restoring ecological balance, and safeguarding both the physical and mental health of vulnerable urban populations (Xu et al. 2025, Repke et al. 2018). The primary objective of this study is to establish a quantitative, spatially explicit bioenergetic framework that evaluates the functional walking capacity and thermal strain of distinct fragile population cohorts during an extreme heatwave. By linking clinical exercise testing with microclimatic modeling and network analysis, this research aims to quantify the extent to which targeted GNBS interventions can mitigate physiological heat stress, restore pedestrian spatial autonomy, and inform inclusive urban planning policies.

Methodology

The primary objective of this methodological framework is to establish a quantifiable, spatially explicit model that evaluates the physiological vulnerability of fragile urban populations, specifically the elderly and individuals with pre-existing chronic conditions, when subjected to extreme heat stress during routine outdoor mobility (Foshag et al. 2024). To achieve this, the methodology bridges urban microclimate simulation and human bioenergetics, using the 6-Minute Walk Test (6MWT) as a standardized metric for physical exertion (Sánchez-González and Osorio-Arjona 2025). Rather than treating the urban population as a homogeneous entity, this approach introduces a series of calibrated physiological adjustment coefficients ($\beta_{pathology}$) that scale the metabolic cost, thermoregulatory capacity, and cardiovascular strain according to specific pathologies, age-related degradation, and functional limits (Cremonini et al. 2025a).

Model Conceptualization and Bioenergetic Equations

In a standard clinical setting, the 6MWT measures the maximum distance an individual can walk at a self-selected pace on a flat, hard surface within a six-minute timeframe ($6MWD_{base}$), converted to an average baseline walking velocity (v_{base} = $6MWD_{base}$/360 s). However, when transposed to an outdoor urban space experiencing a heatwave, this baseline performance is dynamically adjusted (Håkansson et al. 2023). Outdoor thermal stressors - namely elevated air temperature, relative humidity, low wind speed, and intense Mean Radiant Temperature (T_{mrt}) - increase physiological cost (Nardino et al. 2022). Consequently, actual walking velocity (v_{actual}) is formulated as:

$$v_{actual} = v_{base} \cdot \alpha_{heat} \cdot \beta_{pathology}$$

where αheat represents a non-linear environmental heat-strain reduction factor derived from climate-ergonomic data (Kalkstein et al. 2011), activated when the Universal Thermal Climate Index (UTCI) exceeds 32°C:

$$\alpha_{heat} = 1 - k \cdot \max(0, UTCI - 32)^{\wedge}1.5$$

where k = 0.025 °C^-1.5 is an empirical heat-deceleration coefficient.

Pathology-Specific Coefficients ($\beta_{pathology}$)

The model categorizes the vulnerable urban demographic into four distinct cohorts, governed by specific coefficient matrices altering sweat evaporation efficiency (η_{sweat}), maximum cardiac output allocation for skin blood flow (Q_{skin}), and metabolic efficiency exponent (γ):

1. Healthy Elderly Cohort ($\beta_{elderly}$): Accounts for senescent decline in autonomic thermoregulation (20–30% reduced vascular compliance) (Prina et al. 2024).
2. Cardiovascular Cohort (β_{cardio}): Restricts Q_{skin} due to compromised stroke volume, preventing dual oxygen delivery to working limbs and cutaneous cooling, triggering early T_{core} elevation (Semenza et al. 1999, Guolo et al. 2022).
3. Respiratory Cohort (β_{respir}): Adjusts metabolic overhead of breathing in hot, humid air, reducing net kinetic energy available for forward locomotion (Gronlund et al. 2019).
4. Type 2 Diabetes Cohort ($\beta_{diabetes}$): Scales down sweat evaporation efficiency (η_{sweat}) by 40% due to autonomic neuropathy and microvascular damage (Kang et al. 2024, Park et al. 2025).

Human Heat Balance and Core Temperature Dynamics

These physiological profiles are integrated into a dynamic heat balance equation:

$$S = M - W - R - C - E,$$

where S is heat storage rate, M is metabolic heat generation, W is mechanical work, and R, C, E are radiant, convective, and evaporative exchanges. Cumulative heat storage (∫S dt) drives core body temperature escalation:

$$T_{core}(t) = T_{core}(0) + (1 / (m \cdot c_p)) \int S(t') A_{body} dt' ,$$

where A_{body} represents the body surface area in square meters.

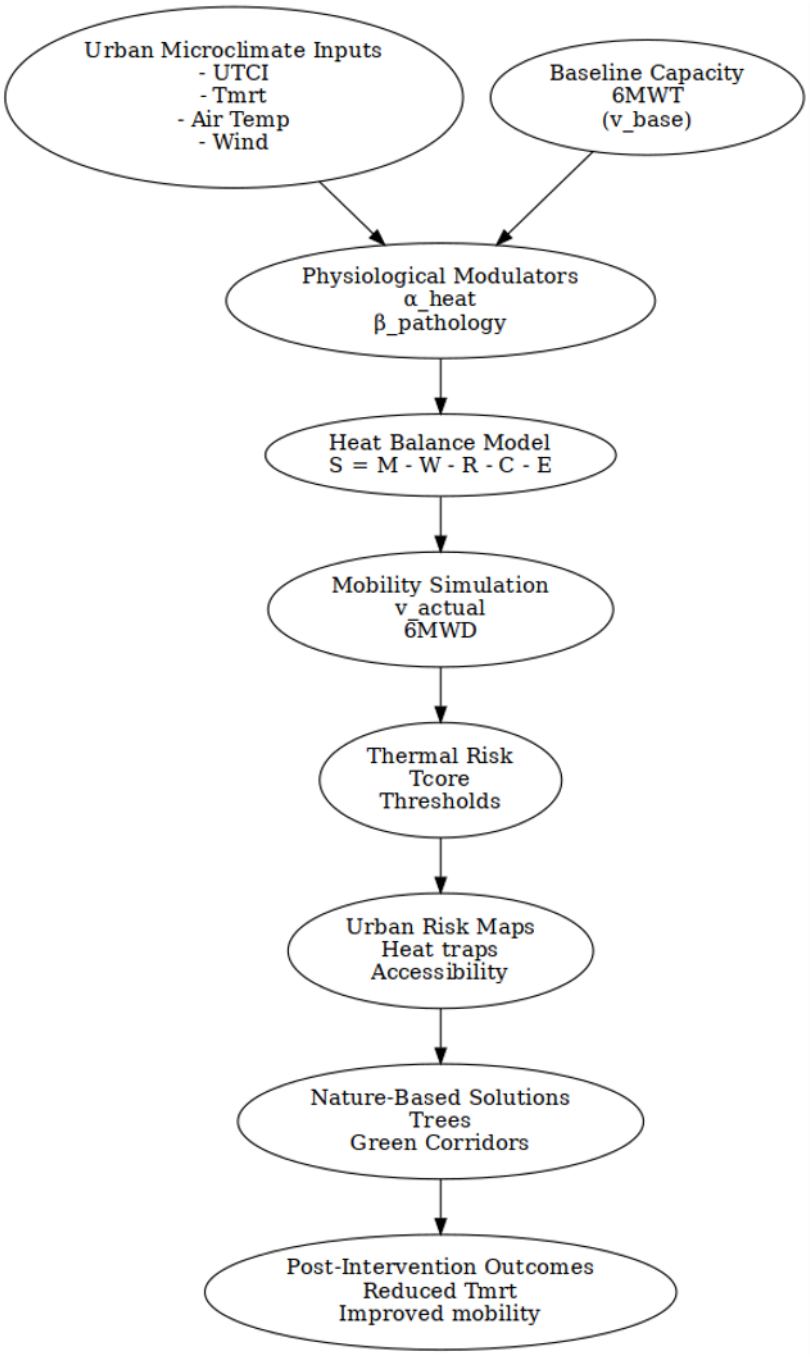
The simulation logs spatial coordinates where T_{core} reaches critical safety thresholds (38.6°C) (Dardin 2024).

Study Area, Network Analysis, and GNBS Interventions

The methodology was applied to an urban case study in Bologna, Italy, characterized by high-density historical street canyons and exposed commercial thoroughfares under peak summer heatwave conditions (air temperature 38.5°C, UTCI > 41°C) (Nardino et al. 2021, 2022). Pedestrian paths were modeled using GIS network analysis tools (Dijkstra's shortest-path graph algorithms), in which edge impedance was dynamically weighted by localized thermal strain rather than by physical distance alone (Foshag et al. 2024). Baseline simulations were compared with retrofitted scenarios incorporating Green Nature-Based Solutions (GNBS), specifically, a 35% expansion of tree canopy cover along primary pedestrian corridors (Xu et al. 2025). Model calibration was performed against empirical weather station datasets in Bologna, and sensitivity analysis confirmed Tmrt and cutaneous vascular capacity as dominant sensitivity parameters.

The following figure illustrates the integrated modeling framework developed in this study. Urban microclimatic variables (e.g., UTCI, mean radiant temperature, air temperature and wind conditions) are combined with baseline human mobility derived from the 6MWT. Physiological responses are adjusted using a heat stress factor (α_{heat}) and pathology-specific coefficients ($\beta_{pathology}$). These parameters drive a dynamic human heat balance model ($S = M - W - R - C - E$), enabling the simulation of walking performance and thermal strain. The framework produces spatially explicit outputs including mobility reduction, thermal risk thresholds, and urban accessibility patterns. Nature-Based Solutions (NBS) are then introduced to modify microclimate conditions, allowing for a comparative assessment of their effectiveness in reducing heat stress and improving mobility among vulnerable populations.

Figure 1. *Integrated Modelling Framework Linking Urban Microclimate, Physiological Response, and Pedestrian Mobility under Heat Stress Pre- and Post-Intervention Scenarios*



Variables: UTCI = Universal Thermal Climate Index; T_{mrt} = Mean Radiant Temperature; Air Temp = ambient temperature; Wind = wind velocity; v_{base} = baseline walking speed; α_{heat} = heat stress factor; $\beta_{pathology}$ = pathology coefficient; S = heat storage rate; M = metabolic heat generation as a function of speed and body mass; W = mechanical work; R = radiant heat exchange; C = convective exchange; E = evaporative cooling; v_{actual} = simulated speed; 6MWD = 6-minute walk distance; T_{core} = core body temperature).

Results

The integration of the path-specific bioenergetic model with high-resolution urban microclimate data yielded highly heterogeneous patterns of thermal strain and mobility degradation across the simulated vulnerable cohorts. The baseline simulation (Table 1) during peak heatwave conditions in Bologna (air temperature 38.5°C, UTCI > 41°C, unshaded pavement T_{mrt} peaking at 64.2°C) revealed severe spatial mobility contractions across all vulnerable cohorts relative to clinical baselines (Nardino et al. 2022, Sánchez-González and Osorio-Arjona 2025).

Table 1. *Simulated Comparative Performance of Clinical Cohorts Pre- and Post-GNBS Intervention under Extreme Heatwave Conditions in Bologna, Italy*

Cohort / Scenario	Air Temp (°C)	T_{mrt} (°C)	Heat Storage S (W/m²)	Core Temp T_{core} (°C)	Walking Speed (m/s)	6MWD Reduction (%)
Healthy Elderly (Pre-GNBS)	38.5	64.2	+88	38.1	0.98	-28.5%
Healthy Elderly (Post-GNBS)	36.8	45.7	+28	37.5	1.26	-8.0%
Cardiovascular (Pre-GNBS)	38.5	64.2	+145	38.6	0.72	-58.0%
Cardiovascular (Post-GNBS)	36.8	45.7	+42	37.8	1.08	-11.0%
Respiratory COPD (Pre-GNBS)	38.5	64.2	+92	38.2	0.57	-46.2%
Respiratory COPD (Post-GNBS)	36.8	45.7	+31	37.6	0.81	-23.2%
Diabetic / Neuropathy (Pre-GNBS)	38.5	64.2	+118	38.4	0.82	-39.1%
Diabetic / Neuropathy (Post-GNBS)	36.8	45.7	+36	37.7	1.15	-13.7%

The healthy elderly cohort exhibited a mean reduction in walking distance of 28.5%, driven primarily by the universal heat-strain reduction factor (α_{heat}) which forced a behavioral and physiological deceleration to prevent excessive metabolic heat production. However, when the pathology-dependent coefficients ($\beta_{pathology}$) were applied, the degradation of mobility and the acceleration of thermal stress became drastically more pronounced, highlighting the inadequacy of treating the elderly as a monolithic group. The simulation of the cardiovascular cohort under baseline heatwave conditions produced the most critical public health indicators. Due to the physiological restriction on maximum cardiac output allocation for skin blood flow (Q_{skin}) governed by βcardio, these individuals were unable to effectively dissipate heat via convective and radiant pathways. Consequently, their rate of heat storage (S) escalated rapidly, averaging a positive accumulation of 145 W/m². The data revealed that 74% of cardiovascular pedestrians failed to complete the 6-minute mobility window because they reached critical safety thresholds

(T_{core} = 38.5°C) on average after 3 minutes and 42 seconds. Spatially, these physiological failures were tightly clustered along wide, unshaded commercial avenues and open transit plazas, where the cumulative radiant heat gain (R) overwhelmed the compromised stroke volume of the cohort, forcing an immediate cessation of mobility to avoid simulated cardiovascular collapse. A distinct set of limitations was observed within the respiratory cohort, where the application of β_{respir} modeled the elevated metabolic cost of hyperventilation in hot, humid environments. For these individuals, the mechanical work of breathing consumed a disproportionate fraction of total metabolic energy (M), leaving insufficient kinetic energy for forward locomotion. Their walking speed plummeted by 46.2%, reducing the 6-minute walk distance (6MWD) from a clinical baseline of approximately 380 meters down to a meager 204 meters. This extreme deceleration meant that this demographic experienced acute spatial paralysis, which was particularly severe in narrow street canyons with low wind velocities, where stagnant air and high ambient humidity trapped vehicle emissions and intensified the perceived thermal oppression. The diabetic and disabled cohorts displayed a unique spatial vulnerability that correlated directly with their reduced sweat evaporation efficiency (η_{sweat}). Because the simulated diabetic pedestrians suffered from impaired sudomotor function, their ability to utilize evaporative cooling (E) was suppressed by 40%. The results showed a catastrophic surge in heat storage when traversing areas dominated by low-albedo artificial surfaces, causing their cumulative thermal strain to track closely with the mean radiant temperature of the pavement. As a result, the diabetic cohort reached borderline heat exhaustion thresholds in 62% of the simulated routes, exhibiting a total 6MWD reduction of 39.1%. The introduction of simulated GNBS retrofits (a 35% increase in tree canopy cover) radically altered the microclimatic profile of the study area and, consequently, the physiological performance of all vulnerable cohorts. High-resolution post-intervention data showed that while ambient air temperatures were only modestly reduced, the Mean Radiant Temperature (T_{mrt}) beneath the simulated tree canopies plummeted by an unprecedented 18.5°C (from 64.2°C to 45.7°C). This massive reduction in radiative heat flux fundamentally altered the human body heat balance equation, dropping cardiovascular heat storage from +145 W/m² to a sustainable +42 W/m² and allowing 89% of these individuals to successfully complete the full 6-minute walk safely. For the respiratory cohort, the cooler, shaded green corridors reduced the thermal hyperventilation response, extending their average 6-minute radius by nearly 70 meters. For the diabetic cohort, continuous tree shade compensated for their lack of sweat-driven evaporative cooling, preventing dangerous spikes in cumulative thermal strain and reducing their rate of simulated heat exhaustion to less than 8%. These results provide empirical, spatially explicit proof that targeted GNBS function as a critical biomimetic intervention that directly restores physical autonomy.

Summarizing the results: due to restricted skin blood flow (Q_{skin}) governed by βcardio, 74% of cardiovascular pedestrians failed to complete the 6-minute walk because they reached critical safety thresholds (T_{core} = 38.5°C) on average after 3 minutes 42 seconds (Guolo et al. 2022, Dardin 2024). For the respiratory cohort, walking speed plummeted by 46.2%, reducing 6MWD from 380 m to 204 m

(Gronlund et al. 2019, Foshag et al. 2024). For the diabetic cohort, reduced sweat evaporation (η_{sweat}) caused heat storage to track pavement radiant temperature, reaching heat exhaustion in 62% of simulated routes (Kang et al. 2024, Park et al. 2025). Simulated GNBS retrofits (35% tree canopy expansion) reduced Mean Radiant Temperature (T_{mrt}) beneath canopies by 18.5°C (from 64.2°C to 45.7°C) (Nardino et al. 2021, Middel et al. 2021). Consequently, cardiovascular heat storage dropped from +145 W/m² to +42 W/m², allowing 89% to complete the walk safely. Respiratory speed increased by 42%, and diabetic heat exhaustion rates fell below 8%, providing model-derived evidence that targeted Green Nature-Based Solutions function as a vital thermoregulatory intervention (Cremonini et al. 2025b).

Discussion

The findings validate the hypothesis that urban thermal stress is not merely a generalized environmental challenge but an acute, highly stratified public health crisis. By coupling the empirical framework of the 6MWT with pathology-specific adjustment coefficients, the results prove that vulnerable urban populations experience highly disparate levels of thermal strain depending on their underlying physiological conditions. The severe degradation of mobility observed in the baseline simulation underscores a profound spatial injustice embedded within contemporary urban fabrics. When unshaded artificial surfaces generate mean radiant temperatures exceeding 64°C, the city effectively strips fragile citizens of their autonomy, transforming routine activities - such as walking to a local pharmacy or transit hub - into high-risk events capable of triggering acute cardiovascular or respiratory failure. Furthermore, our simulated mobility reductions (28.5%–46.2%) align closely with observational field studies documenting senior activity declines during European heatwaves.

The findings validate the hypothesis that urban thermal stress is highly stratified by underlying physiological conditions (Cremonini and Georgiadis 2025, Ballester et al. 2023). Our simulated mobility reductions (28.5%–46.2%) align closely with observational field studies documenting senior activity declines during European heatwaves (Sánchez-González and Osorio-Arjona 2025, Foshag et al. 2024). Furthermore, the 18.5°C drop in T_{mrt} achieved by tree canopies is consistent with empirical urban forestry trials reporting canopy radiant cooling effects between 15°C and 22°C during peak solar hours (Middel et al. 2021, Bowler et al. 2010, Khalvandi and Karimimoshaver 2025).

The stark contrast in performance between the cardiovascular, respiratory, and diabetic cohorts under identical environmental conditions offers crucial insights for future public health strategies and climate adaptation policies. The finding that nearly three-quarters of the cardiovascular cohort failed to complete a basic 6-minute walk highlights the immediate lethality of the Urban Heat Island (UHI) effect on individuals with compromised circulatory systems, as their inability to allocate sufficient cardiac output to cutaneous blood flow means that radiant heat gain is rapidly converted into internal heat storage. Conversely, the drastic deceleration observed in the respiratory cohort underscores a different form of vulnerability where the metabolic overhead of breathing hot, stagnant air

induces early-onset physical exhaustion. By identifying these distinct pathological failure modes, this methodology proves that municipal heat warning systems must evolve from broad, city-wide temperature alerts into highly targeted, hyper-local risk advisories that account for the physiological diversity of the population.

In this context, the quantified success of the simulated GNBS provides a powerful, empirical justification for a paradigm shift in urban planning. The 18.5°C drop in T_{mrt} achieved by tree canopies is consistent with empirical urban forestry trials reporting canopy radiant cooling effects. By intercepting shortwave solar radiation and preventing it from being stored and re-radiated by urban materials, the engineered green corridors directly altered the human body heat balance equation. For the diabetic cohorts, continuous canopy shade functioned as an external thermoregulatory aid, while for the cardiovascular cohort, the reduction in net radiant heat exchange lowered heat storage rates to sustainable levels. These outcomes suggest that urban greening should no longer be viewed as an aesthetic luxury or a generalized ecological goal, but as a targeted health intervention capable of expanding the physiological safety margins of vulnerable populations.

Ultimately, this study demonstrates that bridging the gap between clinical health metrics and environmental simulation is an essential step toward designing climate-resilient cities. Systematically distributing continuous shaded tree canopies along essential urban routes - specifically within the typical 6-minute (or 300-to-400-meter) walking radius of vulnerable populations - ensures safe, equitable access to healthcare, pharmacies, and daily services under extreme heat conditions.

Several limitations must be acknowledged: (1) Algorithmic simulations assume constant self-selected walking pace, whereas real-world pedestrians exhibit complex behavioral adaptations such as resting or hydration stops (Meadows et al. 2024); (2) Pathology coefficients simplify multimorbidity, where concurrent cardiovascular, metabolic, and respiratory conditions interact non-linearly (Davies and Harwood, 2023); (3) Microclimate models do not capture transient anthropogenic heat bursts from traffic or air conditioning exhaust (Nardino et al. 2022); (4) The bioenergetic curves are model projections requiring future empirical validation using wearable sensors.

Municipalities must transition from broad city-wide heat alerts toward hyper-local, shaded mobility networks. Systematically distributing continuous shaded tree canopies along essential urban routes - specifically within the typical 300-to-400-meter walking radius of vulnerable populations - ensures safe, equitable access to healthcare, pharmacies, and daily services under extreme heat (Legislative Decree 62/2024, Italian Republic).

Conclusions and Future Research

This study established a novel, multi-disciplinary bioenergetic framework bridging clinical exercise testing and urban climatology. Baseline simulations confirmed that extreme heat inflicts severe, pathology-differentiated mobility penalties on fragile urban demographics. GNBS interventions (35% canopy expansion) depressed Mean Radiant Temperature (T_{mrt}) by 18.5°C, preventing core temperature threshold exceedance and restoring walking autonomy across all clinical cohorts.

Future lines of research should focus on: (1) Conducting in-situ empirical validation using wearable biometric sensors (smartwatches, core temperature patches) on volunteer cohorts; (2) Developing multi-pathology decision matrices for multimorbid individuals; (3) Optimizing tree species selection and structural canopy geometry in historical city centers to maximize microclimatic cooling per square meter.

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Understanding the Health Challenges among East African Women in the U.S. with a History of Female Genital Mutilation

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Women's reproductive health, long recognized as a fundamental priority, continues to face increasing and evolving risks. Female genital mutilation (FGM) is a harmful cultural practice and a sensitive topic of significant public health importance. According to the World Health Organization, FGM affects an estimated 230 million women and girls worldwide. Published studies on lived experiences and health complications of East African women and girls in Southern California are lacking. This pilot study was conducted to understand the lived experiences and associated health challenges or complications, and barriers to healthcare for women and girls with a history of FGM. We recruited six participants and conducted semi-structured interviews with them who met the inclusion criteria. Our data analysis resulted in the development of four themes: Attitudes, Cultural Beliefs, Practices, and Myths; Health Consequences; Barriers to Healthcare Access; and Education. The participants described their lived experiences that included physical and psychological health complications, sexual dissatisfaction, excessive bleeding, painful intercourse, difficult menstruation, and reduced sexual dysfunction, including desire or libido, arousal, excitement, and orgasm. Other self-reported lived-experiences were mental health complications, including depression, anxiety, and post-traumatic stress disorder. Our results support previously published studies on self-reported health challenges and complications experienced by women with FGM. Education is key to understanding FGM, prevention, and improving healthcare access and outcomes among ethnically diverse and at-risk girls and women. This calls for essential healthcare services, with sustained evaluation of the underlying factors, cultural beliefs and practices, and their policy implications. The role of the healthcare professionals as agents of social change and servant leaders in providing high-quality care to women and girls affected by these cultural practices cannot be overemphasized. Health is considered a fundamental human right. Concerted efforts are needed to protect, support, and be culturally responsive in advocating for the eradication of FGM and related procedures to become an international priority. We recommend targeted education for at-risk populations, actionable data for localized public health intervention, as well as the enforcement of existing laws to combat or eradicate FGM and other inhumane and traumatic cultural practices.

Keywords: *female genital mutilation, FGM, genital cutting, East African women, reproductive health, culturally responsive healthcare education*

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Background

Female genital mutilation (FGM) or genital cutting, or circumcision, involves partial or total removal of external female genitalia for non-medical and non-therapeutic reasons, and often for the purpose of limiting sexual pleasure or controlling sexuality, and without the individual's consent (Agboli et al. 2020, Johnsdotter et al. 2025, UNICEF 2024). The procedure is part of global social norms and cultural practices estimated to affect over 230 million women and girls in 30 countries, primarily in the Horn of Africa (e.g., Djibouti, Eritrea, Ethiopia, and Somalia), the Middle East (e.g., Iraq and Yemen), and Asian e.g., Indonesia) have undergone the procedure (UNICEF 2024). Of the total 230 million FGM women and girls, Africa accounts for 144 million, Asia has 80 million, the Middle East has 6 million, while migrants from countries where the practice occurs, living in other countries, including Australia, Europe, Canada, and the United States of America, account for 1-2 million. It is estimated that 4 million girls remain at risk of FGM yearly. According to UNICEF (2024), the FGM prevalence rate is estimated at 90 percent or higher in some African countries, including Djibouti, Somalia, and Guinea. In the United States, over 513,000 women and girls have experienced or are at risk of FGM (Goldberg et al. 2016).

There are four major types of FGM, classified based on the degree of genital tissue removed during the circumcision (UNICEF 2024, Pallitto et al. 2025). Type I or clitoridectomy, the most common procedure, consists of partial or total removal of the clitoris and/or the prepuce; Type II or excision, involves partial or total removal of the clitoris and labia minora with or without excision of the labia majora; Type III or infibulation, involves tightening or narrowing the vaginal opening by cutting or sewing the labia together to create a seal with or without clitoral glans excision; and Type IV includes all other harmful procedures inflicted on female genitalia for non-medical reasons (i.e., piercing, pricking, incising, scraping, and cauterization or burning).

Historically, FGM is an ancient cultural practice that is shrouded in secrecy, with reported estimates considered to be gross underestimations of the actual number of affected women and girls (Agboli et al. 2020). The practice has continued due to the belief that female circumcision will prevent masturbation, decrease libido, and ultimately preserve a woman’s sexuality and virginity until marriage (WHO 2025). Although FGM is prevalent in both Muslim and Christian communities throughout Africa, it has not been directly associated with religious beliefs and appears nowhere in the Bible or the Quran. In countries where FGM is practiced, women and girls must be circumcised to gain acceptance in their communities and be married, and dissenters are often stigmatized (Utz-Billing & Kentenich 2008). Older women would routinely perform the procedure using unsterilized and barbaric instruments without anesthetics or antibiotics (Odukogbe et al. 2017). In addition, several migrants from affected countries who live in North America, Australia, and Western Europe continue to practice FGM by sending daughters back to their family homeland for the procedure.

Female circumcision has no known health benefits, is considered a cultural norm, and a rite of passage for women and girls (Johnson-Agbakwu & Abdulcadir

2020). Several sexual, gynecological, obstetric, urological, and mental health complications have been reported (Goldberg et al. 2016, Pallitto et al., 2025).

The practice has been associated with various health effects and complications, including physical and psychological harms, lifelong health complications (Kaplan et al. 2011, WHO 2025). The short-term complications include severe pain, infections, bleeding, shock, urine retention, and death, whereas long-term complications include hemorrhages, scarification, genital infections, increased risks of childbirth complications, and newborn deaths (Kaplan et al. 2011, Reisel & Creighton 2015, Odukogbe et al. 2017). It is estimated that 90% of affected women expressed feelings of intense fear, helplessness, horror, and severe pain during the cutting stage (Mulongo et al. 2014, Behrendt & Moritz 2005). Although comprehensive data on mortality rates is lacking due to the stigma associated with the cultural practices, excessive bleeding due to improper wound closure has been reported as a major cause of death (Kaplan et al. 2011). However, the World Health Organization (WHO 2025) has reported that the practice significantly affects women's mental health, including increases in depression, anxiety, and post-traumatic stress disorder. Also, the affected women often faced post-traumatic stress disorder and other mental health problems as they were routinely reminded of their trauma when seeking medical treatments (Smith & Stein 2017).

A growing population of women from diverse cultures and traditions, particularly migrants from the Horn of Africa, who have experienced widespread genital cutting and have not received medical treatment, and were generally unsatisfied with their healthcare provider's level of knowledge (Utz-Billing & Kentenich 2008). Although some healthcare providers are knowledgeable of the health complications of FGM and applicable regulations, there remains a paucity of knowledge regarding the long-term significance, cultural implications, and enforcement of laws to protect at-risk women and girls.

In the United States and most developed countries, FGM is considered a violation of fundamental human rights, and in 2020, the US Congress enacted the STOP FGM Act (OWH 2025, H.R.6100-116th Congress 2021). This law created a statutory definition of genital cutting and provided detailed information on its health implications for interstate commerce. Additionally, the law broadened the scope of prohibited FGM-related conduct on minors, including attempts or conspiracy to perform the procedure; facilitating or consenting as a parent, guardian, or caretaker; and transportation of a minor for the procedure. Also, Public Law No. 116-309, enacted on January 5, 2021, specifically prohibits FGM-related conduct and mandates a maximum prison term of 10 years for any offender. According to UNICEF (2024), many countries and communities worldwide have made significant progress towards abandoning or eradicating the practice.

The main objective of this study was to understand the lived experiences of East African diaspora women who have undergone FGM and currently live in a large city in southern California, with a view to improving future healthcare access and delivery. In addition, this study will contribute to the existing literature on the risks of health complications and advocate for culturally competent healthcare access and services for those affected, with the goal of the total eradication of the practice for at-risk women and girls.

Methods

Design and Recruitment of Participants

This qualitative study is based on semi-structured interviews with FGM participants at a community clinic in a city in southern California, to understand knowledge and garner information regarding their FGM experiences, health challenges, and complications. The study was conducted as part of the requirements for a capstone project by graduate public health students, and Institutional Review Board approval was granted by the university prior to the study. Considering the sensitive nature of FGM and the stigma associated with it, extensive efforts were made to recruit eligible participants by word of mouth, networking with community members, and distributing flyers in high-traffic areas within community clinics, health centers, and faith-based organizations. The inclusion criteria were: East African women 18 years or older; had undergone FGM; and had FGM-lived experiences. The study protocol and consent form were provided to each participant before the interviews. consents. Those who agreed to participate voluntarily completed and signed the written informed consent form. No incentives were provided to the participants.

Six FGM participants who met all the eligibility requirements completed the in-depth structured interviews at a community clinic or health center. The interview questions on FGM-lived experiences were adapted from Creswell & Poth's (2018) previously published qualitative research methods and are summarized in Figure 1. This qualitative study included open-ended questions that solicited participants to describe their FGM-lived experiences, health complications, access to healthcare services, and recommendations for social changes to reduce future complications and improve healthcare services. In addition, the questions were specifically structured to assess participants' FGM norms, cultural and religious beliefs, and experiences. Each interview was audio-taped to document the discussions confidentially. Follow-up questions were developed to prompt participants to reveal further details about their experiences.

All interviews were conducted in private rooms at a community clinic for approximately 30 minutes each. To maintain confidentiality, a unique identifier was assigned to each participant’s responses, which were audiotaped, saved in a password-protected file, and subsequently transcribed verbatim using ATLAS.ti™ software for coding and data analysis.

Figure 1. *Interview Questions for FGM Participants*

Instructions: Please answer the following survey questions to the best of your knowledge.
Note: All responses to the questions will be treated anonymously and confidentially.

1. Have you undergone FGM? Yes ☐ No ☐ Don't know
2. Why was the FGM procedure performed on you?
3. How common is FGM in your community?
4. Does circumcision or FGM affect your willingness to see a doctor for health issues?
5. Are you comfortable talking to your healthcare provider about FGM?
6. What do you want healthcare providers to know and discuss with you about FGM?
7. What can healthcare providers do to make it easier for you to receive medical care?
8. Do you think FGM can cause health problems (please choose all that apply)?
   ☐ Menstrual problems ☐ Sexual intercourse problems ☐ Fertility problems
   ☐ Problems with labor during pregnancy ☐ None of the above
9. Do you think FGM will your chances of marriage (please choose one):
   ☐ Increase ☐ Reduce ☐ Don't know
10. What other concerns about FGM would you like your healthcare provider to address?
11. Do you think the practice of FGM should continue? ☐ Yes ☐ No ☐ Don't know
    Why? Please explain:
12. Would you have FGM performed on your daughter? Yes ☐ No ☐ Don't know
    Why? Please explain:

Data Analysis

The transcripts were reviewed line by line for significant statements and words, then categorized into common themes or subthemes. To find common themes, qualitative methods were employed to identify health barriers for FGM participants' experiences and their knowledge of healthcare professionals regarding complications of FGM. Before coding, the interview notes were integrated into the transcripts to clarify each participant's responses and provide additional information about verbal and nonverbal responses. We extracted codes from the interview transcripts using an inductive reasoning approach. Additionally, we developed four themes with evidence from statements made by participants that included (1) Attitudes, Cultural Beliefs, and Myths about FGM; (2) Health Consequences of FGM; (3) Barriers to Healthcare Access; and (4) Education about FGM.

Results

The six participants included in the study had their FGM performed in their respective East African countries before immigrating to the United States. The results of the FGM participants' interviews, including the categories and descriptions of the themes and select quotes, are summarized in Tables 1 and 2. Four themes emerged from the analysis of the interview questions: Attitudes, Cultural Beliefs, Practices and Myths; Health Consequences; Barriers to Healthcare Access; and Education. The FGM participants described their lived experiences, strong opposition to the

practice, and advocacy for demystification, education, and total eradication. These results, along with the exemplification of each theme, are described below.

Table 1. *Qualitative Interview Coding Themes Used for the Research Study*

S/N	Category of Theme
1	Attitudes & Beliefs
2	Cultural Beliefs
3	Religious Beliefs
4	Health Consequences
5	Psychological Consequences
6	Barriers to Healthcare
7	Laws Regarding FGM
8	Education

Table 2. *Categories of Common Themes from the Interviews with FGM Participants*

Theme	Explanation	Participants' Quotes (Selected)
Attitudes, Cultural Beliefs, and Myths about FGM	Provides a description of the attitude, cultural, religious, and other beliefs regarding FGM.	• "FGM procedure is rooted in misogyny, and it's rooted in pleasing (a) man and not pleasing women. It doesn't benefit women in any way." (FGM Participant #3) • "Some people try to promote this as a religious thing, which is not true." (FGM Participant #1) • "Actually, they didn't have an explanation, it's a cultural issue and they feel like if they circumcise their daughters, they will stay out of reach of men and they will be pure women and they will be applied and not need a man until she gets married." (FGM Participant #1)
Health Consequences of FGM	Describes the psychological effects of FGM, including mental or emotional trauma, post-traumatic stress disorder (PTSD), anxiety, depression, etc.	• "There's no anesthesia, so you feel every single little thing that's happening to you." (FGM Participant #5) • "So, it's very, very traumatic, it's a very visual memory that you have in your memory that you feel and experience everything, … some kind of PTSD." (FGM Participant #6) • "Yes, yes, more cramping, more blood flows, and kidney problems, and I feel pain in my kidney like I cannot walk that much, so it affects my walking ability, and then you get a lot of headaches." (FGM Participant #3) • *"It's a very traumatic experience. I remember it like yesterday, like I will never forget it. I remember the lady's face, and I remember what happened to me, the room, the place, my recovery, everything." (FGM Participant #5)*
Barriers to Healthcare Access	Describes the barriers to accessing available healthcare and receiving needed support from their healthcare providers.	• "I would like to know ahead of time, what's going to happen to me and how they're going to deal with my situation." (FGM Participant #4) • "It was not comfortable to explain what they (doctors) can do for you." (FGM Participant #2)
Education about FGM	Describes the knowledge and experiences of the participants regarding FGM.	• "Educate the people, this is not any religion or anything, this is the culture, and that's not a good thing to do for women." (FGM Participant #4)

Categories of Themes

1. Attitudes, Cultural Beliefs, and Myths

All six participants independently reported that they underwent the procedure due to cultural beliefs that framed the procedure as a way to preserve purity, maintain virginity, make women and girls remain virgins until marriage, and discourage promiscuity. Participants also stated that this was not questioned in their countries of origin because the prevailing social norms required the procedure. Questioning parental decisions was viewed as challenging the culture itself because the practice remains deeply rooted in social norms, primarily driven by historical and cultural beliefs on gender identity in their societies. The participants further explained that women and girls were often unable to voice individual opinions about the practice while still living in their countries of birth.

> "Actually, they didn't have an explanation, it is a cultural issue, and they feel that if they circumcise their daughters, they will stay out of reach of men, and they will be pure women, and they will be applied and not need a man until she gets married." (FGM Participant #1)

Participants' attitudes and beliefs about FGM were examined and analyzed to understand their current views, concerns, and feelings about allowing their daughters to undergo the procedure. Overall, the participants were generally opposed to having their daughters undergo FGM. One participant described her struggles and deep anger for years to forgive her parents for subjecting her to the procedure, explaining that the experience not only caused deep anger, but it also affected her emotional and mental well-being. Although she eventually forgave them because they are her parents but has continued to suffer both emotional and mental health complications. She also emphasized the importance of maintaining a healthy lifestyle for herself and her daughter. Participants' concerns and opposition to their daughters undergoing the procedure are reflected in the following statements:

> "Because I do not want them to have what I had. The problems I came here with, there is no benefit as I said."

One participant stated that FGM should be eliminated from her culture. The other participants' responses agreed with this suggestion.

> "FGM procedure is rooted in misogyny, and it is rooted in pleasing (a) man and not pleasing women. It does not benefit women in any way." (FGM Participant #3)

Religious belief emerged as another subtheme. Participants were asked whether religion played a role in the acceptance of FGM in their countries of origin. All participants agreed that FGM was not rooted in religion but was a cultural belief and practice.

> "FGM has nothing to do with religion; it was simply a cultural thing." (FGM Participant #2)

2. Health Consequences

Participants were asked if they believed that undergoing FGM caused any health problems. Follow-up questions encouraged them to elaborate on whatever FGM-related health problems they may have experienced. Self-reported physical and psychological health consequences were sexual dissatisfaction, excessive bleeding, painful intercourse, and menstruation, reduced sexual excitement, desire, arousal, orgasm, and post-traumatic stress disorders. Four of the six participants believed that their abnormally severe menstrual cycles and excessive bleeding were due to mutilation of their vaginas. They explained that their menstrual periods caused more severe cramps, back pains, bleeding, and headaches. In addition, one of the participants noted that she experienced infections due to the blood (during menstruation) not having a large enough passageway. Three participants stated that they experienced increased difficulties during labor due to the smaller sizes of their vaginal openings when compared to the sizes of their babies. Another physical consequence that the participants reported was pain or numbness that they felt during sexual intercourse with their partners. One participant compared sexual intercourse with her husband to being raped, while another stated that she felt no pleasure during sexual intercourse.

Although no physical examinations were conducted on any of the participants, their sentiments and beliefs on the physical consequences attributed to the FGM procedure were clearly self-reported. All participants expressed feelings and experienced various physical health conditions associated with FGM. For example, one participant exclaimed as follows:

> "Yes, yes, more cramping, more blood flows, and kidney problems, and I feel pain in my kidney like I cannot walk that much, so it affects my walking ability, and then you get a lot of headaches." (FGM Participant #3)

Reported psychological consequences included various types of mental or emotional trauma that participants attributed to FGM. Some participants said they could remember the face, room, and people who were there when the FGM took place. Other participants noted that they felt shame and embarrassment when going to see the doctor because of their mutilated vaginal area, and they did not know what to say to the doctor. Another participant stated that she did not want to consult with the doctor because she was afraid of reliving the entire experience and facing the embarrassment associated with FGM. One of the participants compared relieving her FGM experience to post-traumatic stress disorder (PTSD) because she had flashbacks and remembered each second of undergoing the FGM procedure vividly. This was corroborated by four other participants who mentioned "some kind of PTSD" that they felt from the memory of having FGM performed at a young age.

> "There is no anesthesia, so you feel every single little thing that's happening to you. So, it's very, very traumatic; it's a very visual memory that you have in your memory that you feel and experience everything." (FGM Participant #6).

Also, two of the participants expressed the excruciating pain, trauma, and post-traumatic stress disorders that they experienced during the procedure, as detailed below.

> "It's a very traumatic experience. I remember it like yesterday, like I will never forget it. I remember the lady's face, and I remember what happened to me, the room, the place, my recovery, everything." (FGM Participant #5)
> "So, it's very, very traumatic, it's a very visual memory that you have in your memory that you feel and experience everything, … some kind of PTSD." (FGM Participant #6)

3. Barriers to Healthcare Access

Barriers to accessing healthcare were another important theme that all the participants identified and related to. All the participants stated that they were uncomfortable with discussing FGM with their healthcare providers in any clinical setting. This barrier arose multiple times during the interviews in the private room. When participants reflected deeply on their struggles and experiences during their initial visits or prenatal care with health professionals, they stated that the fear of personal judgment and shame was a major barrier to accessing healthcare. Some participants shared stories that involved health professionals being completely insensitive and directly asking them what had happened to their genitals. In contrast, others merely stared in disbelief without regard to the patient's feelings. In one instance, a participant shared that after seeing the doctor's reaction to her vaginal circumcision, she wanted to run away because she was so ashamed and embarrassed. Additionally, participants reported the importance of having access to health professionals who can provide solutions to their health challenges and educate them about available options.

Several participants mentioned language barriers to accessing healthcare. For example, when asked, "What do you want healthcare providers to know and discuss with you about FGM?" The participants generally agreed that it would be best to have an interpreter to help them understand medical terms, processes, and explanations of treatment plans, rather than a simple check-up with no guidance. One of the participants summed it up as follows:

> "It was not comfortable to explain what they can do for you, and I would like to know ahead of time what is going to happen to me, and how they are going to deal with my situation." (FGM Participant #2)

4. Education

Participants were asked what they knew about FGM based on their personal life experiences, and not necessarily the education obtained at school. The issue that stood out the most and was most important to participants was the consensus that FGM is a long-standing tradition and a deeply ingrained cultural belief, not a religious issue.

> "Some people try to promote this as a religious thing, which it is not." (FGM Participant #1)

Participants felt that the FGM procedure was unnecessary and did not benefit women in any way, so they were adamant about increasing awareness about the subject to aid in the reduction of the number of girls who undergo this practice.

Participants were aware of the health consequences they faced from undergoing FGM, including excessive cramps, headaches, infections, problems with labor and delivery, reduced sensitivity, emotional trauma, and PTSD.

Additionally, they reported that other women they were close to, such as relatives, experienced various difficulties in their marriages, including reduced sexual pleasure due to FGM. Although participants' medical histories or current health conditions were not evaluated, it was important to draw on their firsthand experiences and knowledge of this subject to create an informative booklet and guide that will help address their individual concerns and those of women in their community. Most participants expressed the need for education and awareness about the practice.

> "Educate the people, this is not any religion or anything, this is the culture, and that is not a good thing to do for women." (FGM Participant #4)

Lastly, the participants generally suggested that health professionals should educate the community about FGM practices and health consequences, with the hope of preventing future generations of girls from having to undergo the procedure.

> "Because they do not understand, like they do not know what is going on. Like, in America, they do not practice that (FGM), so I do not think they have anything to offer me." (FGM Participant #3)

Discussion

There has been an increasing public health interest in issues related to FGM during the past few decades due mainly to the continuous influx of immigrants to the United States from countries where FGM is practiced. However, data on FGM experiences among diaspora communities in the United States is scanty. FGM involves the cutting, piercing, sewing, or removing parts of or all external genitals in women and girls, usually for no medical reason or health benefits, and is in violation of human rights (Hussein 2010). According to the WHO (2025), "FGM comprises all procedures that involve partial or total removal of the female external genitalia and/or injury to the female genital organs for cultural or any other non-therapeutic reasons." In addition, 140 million women and girls and over 513,000 females in the U.S. have experienced FGM, and an estimated 3 million girls worldwide are at risk of undergoing genital cutting every year (OWH 2025).

FGM remains a common traditional practice in 30 African countries, primarily in the southern Sahara, including parts of northern, eastern, and central Africa, as well as some Asian and Middle Eastern countries (Hussein 2010, UNICEF 2024, Odukogbe et al. 2017). The procedure is often performed with unsterilized instruments or cutting tools, without anesthesia or antibiotics, by elderly women who are non-medical practitioners (Odukogbe et al. 2017, OWH 2025). This observation agreed with our finding that the women reported a lack of anesthesia, as stated in the following quote: "There is no anesthesia, so you feel every single little thing that's happening to you." It has been reported that in African communities, FGM is considered an important part of their culture and gender identity and that the practice

virtually cuts across all religions in the continent, including Muslims, Christians, Ethiopians, Jews, and other traditional African religions (Hussein 2010). All the participants reported the issue of gender identity and religious belief or connection.

> "Some people try to promote this as a religious thing, which is not true."

Several other studies have documented physical, psychological, and long-term health consequences among FGM women and girls, including infections, problems with urinating, painful menstrual periods and bleeding, problems during and after childbirth, anxiety and depression, and post-traumatic stress disorder. These health consequences were reported by all the women interviewed during this study, as documented in the following quote from one of the participants:

> "So, it is very, very traumatic, it is a very visual memory that you have in your memory that you feel and experience everything, … some kind of PTSD."

FGM participants stated that they were less likely to talk openly about their FGM experiences because in most African cultures where FGM is performed, sex before marriage is taboo. This cultural taboo made it harder for the FGM participants to be comfortable in having conversations with healthcare professionals who have limited knowledge and experience about FGM practice. Finally, our findings revealed a communication disconnect between the FGM participants and their healthcare providers. Subsequently, healthcare professionals may not know how to lead discussions in providing care to FGM patients; hence, we advocate for culturally competent healthcare delivery.

Our results have significant implications and call on healthcare professionals to recognize that FGM patients may be unfamiliar with existing laws, including Public Law No. 116-309 in the United States. To this end, there is a need for healthcare professionals to receive culturally competent training that will position them to work with affected communities and to educate them to end FGM. At the national level, many countries, including the United States, have outlawed the practice by promulgating various legislations against the cultural practice of FGM among women and girls. The United Nations (UN) recognizes FGM as a violation of fundamental human rights, and the General Assembly has adopted a milestone resolution to intensify international communities' efforts to eradicate FGM practices by 2030 (UNICEF 2024). Additionally, both the UN resolution and the SDG framework called on the international community and national partners to work cooperatively on accelerated action to ensure the total elimination of FGM across all continents. As stated in the (UNICEF 2024), several international and regional treaties apply either directly or indirectly to FGM: The Convention on the Elimination of all forms of Discrimination against Women; the Convention on the Rights of the Child (CRC); and the Convention against Torture and Other Cruel, Inhuman or Degrading Treatment or Punishment. Existing laws at regional and national levels include: The European Convention for the Protection of Human Rights and Fundamental Freedoms; The Covenant on Civil and Political Rights; The African Charter on Human and Peoples' Rights (the Banjul Charter) and its Protocol on the Rights of Women (The Maputo Protocol); and The African Charter on the Rights and Welfare of the Child.

A previous study among Somali women noted that women were ashamed to discuss their experiences due to FGM stigmatization and the acceptance that the practice is normal and cannot be questioned (Hussein 2010). This agrees with our findings with the East African migrants, in which the participants reported that FGM is rooted in misogyny, does not benefit women, and that social norms and health beliefs often play a key role in perpetuating the procedure. In Egypt, where circumcision of daughters has declined due to improved socioeconomic status, education, and the empowerment of women, as well as targeted social media messages (Modrek & Liu 2013, Ministry of Health and Population [Egypt] 2014). Additionally, a demographic and health survey conducted in Egypt showed a reduction of circumcision rate from 90% in 2005 to 28% and 18% in 2014 amongst girls aged 0-13 years and 0–17 years, respectively. This finding agrees with our participants' consensus never to have their daughters circumcised.

A study by Achia (2014) reported that approximately 10% of women interviewed in Kenya advocated for the continuation of FGM. This contrasts with the findings of our study, in which all six participants advocated total eradication of FGM and the need to enforce existing laws. However, the Kenyan study is a driving force for FGM. It is supported by a UNICEF (2024) report that documented a decline in FGM prevalence over the last three decades. However, the pace of decline was uneven, especially in African countries, where little progress was made amid increased population growth. UNICEF noted that if current trends persist, the number of girls and women undergoing FGM will rise significantly over the next 15 years (UNICEF 2024). In a recent study on female genital mutilation in the UK, 146 FGM cases, including 103 confirmed cases of FGM, were reported. Fewer children under 16 years presented with FGM, and there was only one prosecution in two years (Hodes et al. 2021). The authors reported consistency in attitude changes in communities where FGM is still practiced and recommended culturally competent national policies to protect and support at-risk children.

Our results showed that health communication between FGM participants and their healthcare providers was in-effective and sometimes detrimental to their FGM experiences. To assist healthcare professionals in providing better care to FGM patients, the WHO (2025) has developed comprehensive FGM guidelines and fact sheets. It is anticipated that the WHO guidelines would improve care for millions of women and girls who have experienced FGM and serve to bridge the gap between them and their healthcare providers. To prevent FGM practice among future generations, there is an urgent need for effective education and targeted communications to adequately address cultural norms, beliefs, and attitudes towards FGM in existing communities. It is important and strongly recommended that the healthcare provider educate and communicate in a culturally appropriate manner with the women and girls who have undergone the procedure, as well as encourage them to talk to other members of their community or religious leaders for help or support about FGM. In addition, women and girls in many countries who have undergone the procedure, as well as men and boys who live in the same households, have expressed strong opposition to the practice, an indication that communities favor the eradication of FGM (UNICEF 2024).

Conclusion

Women's reproductive health remains a sensitive topic of significant public health importance, and several studies have documented severe physical, psychological, and mental health effects of FGM, an entirely preventable practice. However, studies on the FGM-lived experiences of East African women and girls in Southern California diaspora communities are lacking.

Our study adds to the literature on how understanding FGM and improving healthcare outcomes require increased knowledge of the underlying factors and cultural beliefs surrounding the practices. The role of healthcare professionals as agents of social change in FGM eradication and legislation enforcement cannot be overemphasized. It is recommended that future efforts should focus on eradicating FGM practices worldwide through culturally-tailored education of women and girls, and for healthcare providers to be adequately trained to respond to existing health complications of FGM. In consideration of the unique socio-cultural context of FGM practices and to develop evidence-based guidelines, validated measures of sexual function and health are warranted to ensure culturally-appropriate education of healthcare providers and community outreach programs for the FGM at-risk populations.

FGM involves non-medical procedures that require the removal of external female genitals for non-therapeutic reasons, often without the individual's consent. In this study, we developed four categories of themes, including Attitudes, Cultural Beliefs, and Myths about FGM; Health Consequences of FGM; Barriers to Healthcare Access; and Education about FGM. The results of this pilot study indicated that cultural competency and knowledge regarding FGM are lacking and are needed to better serve the ever-increasing population of immigrants currently living in San Diego, a large city in southern California. The culturally competent guide for FGM developed from this study includes summary information on background, cultural myths, health consequences, legislation, and policy implications. It is anticipated that the guide will benefit women and girls who have undergone FGM and assist healthcare professionals in improving their cultural competency while providing better care to FGM patients, especially in neighborhoods with high refugee and immigrant populations. The benefits of the guide include understanding FGM practice, physical and psychological health effects, and how healthcare professionals can provide needed support to affected women and girls in a more culturally competent and less uncomfortable manner. This is with a view to reducing stigmatization and health disparities surrounding FGM and improving the overall health and well-being of the affected populations.

The importance of increasing trust and sensitivity for FGM patients cannot be overemphasized, as this is vital to preventing future generations of girls from having the disastrous health consequences and complications of FGM. It is recommended that health professionals who work in communities with refugee and immigrant populations must understand the severity of FGM, the cultural beliefs, and the differences that exist. By doing so, healthcare professionals would increase their knowledge of FGM, thus allowing them to communicate effectively and provide better and improved quality of care to those who have undergone FGM.

A deeper understanding of FGM and the impact migration plays in the practice of genital mutilation of girls and young women will require concerted local, national, and global policies and lasting measures to support research in countries known for widespread FGM practices and a lack of enforcement of international laws.

Study Limitations

The results of this pilot study should be interpreted with caution due to several limitations. The participants constituted a small sample size of migrant women of East African descent. The results cannot be generalized because the sample size was small, and because the results were self-reported based on participants' lived experiences and perceptions of FGM. In addition, the study was limited to English-proficient participants who had mutual trust with the researchers, who were of the same race/ ethnicity, and lived in the same neighborhoods. In addition, the results of the study could be skewed since the researchers neither had medical confirmations that the women interviewed had truly undergone FGM nor did participants provide any clarification regarding the types of FGM they had undergone. Therefore, the findings of this pilot study may differ from the diverse experiences of the general FGM population of women and girls in the United States.

Implications for Policy and Practice

In the United States, FGM practice is illegal and is treated as a federal crime with prescribed and severe penalties, a type of child abuse and gender-based violence, including the 1996 Illegal Immigration Reform and Immigrant Responsibility Act (IIRAIRA). Among others, the Act requires that at or before entry into the United States, visa recipients from 28 high-risk countries must be informed of the legal and health repercussions of FGM. In addition, the US Department of Health and Human Services, as mandated by Congress, must provide medical students with information on FGM treatment and prevention. Also, the US Department of State defines FGM and cutting (FGM/C) "as all procedures involving partial or total removal of the external female genitalia, or other injury to the female genital organs for non-medical reasons." Any violation of the FGM law is punishable by up to 10 years in prison, fines, or both. There is no exception for performing FGM/C because of religion, custom, ritual, tradition, or standard practice. As of August 2023, 41 states have outlawed FGM through the passage of strict laws that specifically criminalize the practice. As stated by Dr. Pascale Allotey, Director of Sexual and Reproductive Health and Research at WHO, "there is a critical need to ensure timely, high-quality health care for survivors, to engage communities for prevention and ensure families are aware of FGM's harmful effects, alongside serious political commitment to stop the practice and educate and empower women and girls." Achia (2014) recommended using advanced statistical and spatial mapping tools to identify at-risk individuals or communities in geographic hot spots where FGM practices prevailed across different regions in Kenya. The study's implications

are relevant to epidemiological research that supports policymakers and non-governmental organizations in providing actionable data for targeted and localized interventions to combat FGM.

Our study highlights several implications for public health policy and practice, as well as social change for communities affected by FGM. The study adds to existing literature by providing a deeper understanding of FGM practices based on participants' self-reported and lived experiences, including physical, emotional, and psychological health consequences. Additionally, the study provides information on the importance of culturally competent training for healthcare professionals who provide targeted care to women and girls affected by FGM in communities with high refugee and immigrant populations. Finally, this study recommends that healthcare professionals should support patients who often lack familiarity with existing FGM laws. To eradicate FGM, UNICEF calls for "leaders and communities to redouble their efforts to end gender discrimination and inequality; urgently invest in services for girls; promote girls' agency and assets; prioritize girls' rights in laws and policies; and better track the prevalence of the practice through quality data."

Recommendations for Future Research

Future research and prevention efforts are recommended to provide better insight and understanding of the prevalence of FGM with a view to addressing a larger at-risk population, its varying degrees of severity, health consequences, barriers to accessing quality healthcare, and the need for culturally competent care for FGM patients. Global efforts and research in countries with widespread FGM practice and non-enforcement of laws would provide a better understanding of its public health significance. To present a more reliable and complete picture of the prevalence and practices of FGM among refugees and immigrants in the United States, qualitative and quantitative research is urgently needed. In addition, nationally representative surveys would provide updated prevalence, experiences, perceptions, and statistical data in the United States and beyond, with a view to measuring progress towards achieving the UN General Assembly's milestone.

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Registered Nurses' Experiences with Family Members of Patients Receiving End-of-Life Care in Health Centre Wards: A Descriptive Qualitative Study

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Aims and objectives: *To describe registered nurses' experiences of interactions with family members of patients receiving end-of-life care in health centre wards.* ***Methods:*** *A descriptive qualitative study following the Consolidated Criteria for Reporting Qualitative Studies (COREQ) checklist to ensure proper reporting. Data were collected using individual semi structured interviews with registered nurses (n = 20) working in health centre wards and analysed using inductive content analysis.* ***Results:*** *Registered nurses' experiences with family members were described as providing comprehensive support to family members, including emotional and informational support for families and understanding the importance of a registered nurse's expertise in this support. Additionally, experiences were described as facilitating family involvement in patient care by supporting both family participation in the patient's daily care and family involvement in care decisions.* ***Conclusions:*** *Healthcare systems should support family-centred end-of-life care by promoting education, clinical support, mentorship, and access to experienced nursing expertise, while addressing organisational barriers that may limit family involvement. Clear guidelines are needed to support communication and decision-making in situations involving disagreements regarding care or conflicts between patients' wishes and family members' needs.*

Keywords: *nursing, qualitative research, end-of-life care, palliative care, family-centred care, inpatients, primary care*

Introduction

Palliative and end-of-life care are essential for enhancing the quality of life of patients with serious, life-limiting illnesses. End-of-life care, as the final stage of palliative care, is family-centred and aims to improve the overall quality of life for both the patient and their family by addressing physical, psychosocial, and spiritual needs (Bökberg et al. 2019, Ullrich et al. 2021). Therefore, supporting both the patient and their family is an integral part of comprehensive care (Hasson et al. 2020, Chambers et al. 2019), particularly in the end-of-life context (Yıldız et al. 2024, Kennedy et al. 2025).

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End-of-life care can be distressing for family members due to the diverse symptoms and evolving needs of the patient, which become more complicated as their condition deteriorates (Pun et al. 2023). Family members often experience fear, anxiety, stress, guilt, and a sense of unpreparedness for various situations (Çatıker et al. 2023). Despite this, few studies have been conducted concerning family-centred care, especially in the context of end-of-life care in health centres (Hasson et al. 2020). Recent evidence also highlights that communication challenges between healthcare professionals and family members may contribute to emotional distress and difficulties in end-of-life decision-making (Korsah et al. 2026, Peerboom et al. 2025, Setyawan et al. 2026).

Although the importance of family-centred end-of-life care is well recognized, recent studies continue to report challenges related to communication with family members, family involvement in care, and the emotional demands placed on nurses, indicating a need for further research in different care settings (Korsah et al. 2026, Aschale et al. 2025). Therefore, this study aimed to describe registered nurses' (RNs') experiences of interacting with family members of patients receiving end-of-life care in health centre wards. The study focused on nurses' experiences of providing informational and emotional support to family members and facilitating their participation in patient care.

This paper first outlines the background of family-centred end-of-life care and the role of RNs in supporting family members. It then describes the qualitative study conducted to explore RNs' experiences of interactions with family members in health centre wards. Finally, the paper presents the experiences described by RNs and discusses their implications for end-of-life care practice.

Literature Review

Family members are important resources in end-of-life care, and their involvement and presence enhance the patient's well-being (Ahmadi and Shahboulaghi 2025). With the patient's consent, they can participate in treatment planning and be involved in end-of-life care (Saarinen et al. 2023a, Lemetti et al. 2020). Families also serve as a crucial link between the patient and healthcare staff, particularly in facilitating discussions and planning for care during the final stages of life (Peerboom et al. 2025, Kennedy et al. 2025). Family-centred care recognizes patients and their family members as the unit of care and emphasizes partnership, information sharing, participation, and shared decision-making between families and healthcare professionals (Kokorelias et al. 2019). In palliative and end-of-life care, it seeks to address the physical, psychosocial, spiritual, and practical needs of both patients and their families throughout the illness trajectory and during bereavement (Kokorelias et al. 2019, Kim and Kim 2024).

Providing adequate, clear, and timely information, as well as support to family members regarding the patient's symptoms and treatment progression, can reduce their distress and facilitate their involvement in end-of-life care (Yıldız et al. 2024, Walker et al. 2023, Setyawan et al. 2026). Families often need practical guidance both during and after the patient's end-of-life phase (Saarinen et al. 2023a, 2023b, Zhu et al. 2023, Setyawan et al. 2026). However, in such situations, many family members experience considerable emotional strain (Walker et al. 2023), such as feeling upset and uneasy

about the patient's condition, experiencing fear of loss, and feeling unprepared and uncertain about the future (Cheng et al. 2022, Peerboom et al. 2025). Family members do not always receive sufficient support during the end-of-life care phase and feel forced to make significant decisions with incomplete information (Walker et al. 2023, Cheng et al. 2022). Moreover, in many cases, information about the patient's care or condition is not readily offered and needs to be explicitly requested from the healthcare staff (Zhu et al. 2023, Soikkeli-Jalonen et al. 2022, 2025).

Adequately supporting the families of patients both during and after their end-of-life care period at health centre wards requires healthcare staff, particularly nurses, to genuinely engage with and support the family (Walker et al. 2023). In the context of end-of-life care, a nurse's role is multifaceted, with high demands for knowledge and skills competence (Soikkeli-Jalonen et al. 2020, Setyawan et al. 2026, Korsah et al. 2026). Nurses need to be capable of comprehensive care management and interaction with families, working in a multidisciplinary team (Kesonen et al. 2024, Hökkä et al. 2020), and simultaneously addressing the evolving needs of both patients and family members (Melender et al. 2022).

Although nurses' experiences of providing end-of-life care have been examined in home settings (Walker et al. 2026) and intensive care settings (Setyawan et al. 2026), less is known about nurses' experiences of interacting with family members in health centre wards.

Given the crucial role nurses play in supporting families during end-of-life care, the current study explored their experiences supporting families in health centre wards, where a significant amount of end-of-life care is provided.

Methods

Study Design

This descriptive qualitative study was conducted using individual semi-structured interviews with RNs. The study followed the Consolidated Criteria for Reporting Qualitative Studies (COREQ) checklist to ensure all essential research stages and factors affecting reliability and objectivity were covered (Tong et al. 2007).

Setting

This study was conducted in five health centre wards in a university hospital district in *country blinded for review*. In *country blinded for review*, a three-tiered organisational model based on the complexity of patient needs and the required healthcare staff competence is followed for palliative care and end-of-life care services: basic, special, and demanding special levels. Basic-level units, such as wards at community health centres and hospitals, integrate end-of-life care with general healthcare services as part of their routine operations (Finnish Institute for Health and Welfare 2023).

Participants

The participants were 20 purposively selected RNs providing end-of-life care with ≥6 months of work experience in end-of-life care.

Data Collection

Each unit had a designated contact person responsible for recruiting interviewees and providing written information about the research objectives, the interviewers' role, and the importance of informed consent. RNs had 2 weeks to sign up for interviews by filling out a paper form on background information. A written informed consent was obtained prior to the interviews.

Interview times were coordinated with the ward manager to accommodate the RNs' work schedules. Virtual interview links were provided to designated contact persons who forwarded them to the interviewees. Data were collected through individual semi-structured interviews conducted remotely using a remote access application (Microsoft Teams) between September and November 2021. The interviews were conducted by a master level female health sciences student, who also was a registered nurse but had no professional relationship with the interviewees. Only the interviewer and the interviewee were present, and all interviews were audio-recorded with the participants' permission. The semi-structured interview guide used was based on the following themes from previous research on end-of-life care and family interactions: 1) providing informational support to family members (Anderson et al. 2019, Karbasi et al. 2018), 2) providing emotional support (Soikkeli-Jalonen et al. 2020, Haavisto et al. 2022, Wang et al. 2018), and 3) family participation in the care (Saarinen et al. 2021, Mackie et al. 2019). Follow-up questions were asked to allow participants to share their experiences freely. Interviews lasted 45–60 min. Data collection continued until saturation was reached, confirmed by two additional interviews that revealed no new information.

Data Analysis

The data were analysed using inductive content analysis by two researchers, followed by comments from the research group. The interviews were transcribed verbatim, resulting in a 45-page transcript, which was thoroughly reviewed multiple times to identify original expressions relevant to the research aim (Elo and Kyngäs 2008). These expressions were then condensed while preserving their original meanings. Numeric codes were assigned to the condensed expressions for traceability. A total of 355 original expressions were identified, which were further simplified. These simplifications were then organised into subcategories describing similar themes, which were then combined to form broader categories, ultimately forming the main themes.

Ethical Considerations

The study adhered to established best practices recognised by the scientific community (The World Medical Association 2018). Each participating organisation's relevant protocols were followed to obtain the necessary permissions for conducting the research. According to *country blinded for review* law and ethical guidelines, a separate ethical review is not necessary if a study involves only healthcare staff who are not considered to be in a vulnerable position (Finnish National Board on Research Integrity TENK 2023); our study met these criteria.

During recruitment, it was emphasised that study participation was entirely voluntary and that any information disclosed during the interview would remain confidential. Participant anonymity was maintained throughout the study, ensuring that they could not be identified from the research data, results, or reports; moreover, the specific health centre where each respondent worked was not revealed. The participants also received detailed explanations of how the data would be used, stored, and published.

Results

Participant Characteristics

Twenty RNs participated in the study (average career length: 14.1 years), with 12 having received specialised training in end-of-life care.

RNs' Experiences with Family Members of Patients Receiving End-of-Life Care

The RNs' experiences with family members were categorised into two main themes: *providing comprehensive support to family member*s and *facilitating family involvement in patient care* (Table 1).

Table 1. *Registered Nurses' Experiences with Family Members of Patients Receiving End-of-life Care*

Subcategory	Category	Main category
Discussions with family members	Emotional support to family members	Providing comprehensive support to family members
Considering family well-being		
Empathetic approach to family members		
Information related to the patient's condition	Informational support to family members	
Meeting specific informational needs related to end-of-life care		
Registered nurses' ability to support family members in challenging end-of-life care situations	Importance of a registered nurse's expertise in supporting family members	

A registered nurses management of their own emotions when interacting with family members		
Enabling family presence in the care unit	Supporting family participation in the patient's daily care	Facilitating family involvement in patient care
Supporting family members' choices to participate in patient care		
Guiding family members in patient care		
Supporting family participation in decision-making	Family involvement in care decisions	
Considering family members' wishes in patient care decisions		

Providing Comprehensive Support to Family Members

The main category of *providing comprehensive support to family members* included the following themes: *emotional support to family members, informational support to family members,* and *importance of a nurse's expertise in supporting family members* (Table 1).

Emotional support to family members involved having *discussions with family members* during the end-of-life care period, ensuring information exchange. The RNs felt a great deal of conflict when the ward's hectic pace prevented them from attending adequately to the family's needs or creating a supportive care environment. Nevertheless, they actively asked about family members' desires to discuss any concerns and tried to find time for these conversations.

> "Unfortunately, there's just too little time. When the wards are always full and it's busy, the lack of time is really unfortunate because you can't always have as many conversations as you'd like." (ID8)

The RNs pointed out that family members could also seek support through discussions with other healthcare professionals, such as doctors, especially given that many family members often feel the need to discuss the patient's condition with a doctor. Additionally, multidisciplinary collaboration expanded access to support; for example, the RNs could contact hospital chaplains and deacon workers for conversational support.

> "Our work is multidisciplinary, so you can get help from the hospital chaplain or the deacon worker. If I can't or don't have time to talk, there are other resources available." (ID4)

Emotional support also included *considering family well-being*. The RNs considered not only the overall situation of family members and their level of exhaustion but also tried to ensure that they were coping and reminded them to take care of themselves.

> "It's also part of our job to make sure that the family member is coping." (ID11)

An *empathetic approach to family members* was expressed by the RNs as an essential part of their support, leading the family members through difficult

circumstances by being genuinely present with them, showing understanding, gently touching them, and remaining calm in any situation. Furthermore, the RNs felt it crucial to remain respectful and patient, even when family members exhibited difficult emotions or behaviours.

> "You can be compassionate and offer words of comfort and be empathetic in the situation, but you still need to be the one who is calm and composed, who maintains the order in that situation." (ID5)

Informational support to family members included informational support concerning the patient's condition, such as symptoms and changes in their health status, which could deteriorate rapidly. The RNs felt that family members sought detailed information and frequent updates about the patient's condition, and as a result, they made efforts to communicate proactively whenever major changes occurred.

> "We quickly contact the family member if there are any changes in the patient's condition or other important information to share, so we keep the family well-informed." (ID20)

In particular, family members sought information about pain management. The RNs explained how pain medications helped and justified their use for the patient's benefit. In general, family members understood the importance of effective pain management in the final stages of life, but some believed painkillers negatively affected their interactions with the patient or caused drowsiness. This resistance made it challenging for the RNs to address the patient's pain management needs.

> "(We ask) if they (family members) have any preferences about it (pain medication). We reach a pretty good understanding, even when they are strongly against the pain medication. We discuss it quite openly and directly with them." (ID10)

The end-of-life care situation requires *meeting specific informational needs related to end-of-life care,* that the RNs felt they must address. The RNs found it easy to communicate with family members, but establishing good communication required time, and they had to consider the sensitivity of the topics. Family members sought detailed information about what end-of-life care entailed, including the prognosis, timeline, and expected changes in the patient's condition over the coming weeks or days. The RNs described this aspect of care as particularly demanding, mentally burdensome, and time consuming. They described devoting a significant portion of their workday to these discussions but still feeling unable to spend enough time with families because of other duties. Additionally, family members were not always emotionally prepared to accept information about the approaching death, and their distress prevented them from absorb and process what they were told.

> "We need to explain how things have been going, how the patient has been doing, and what might happen in the coming days. But if you notice that the family member is having a hard time letting go and hasn't fully processed everything, it can be quite demanding for the nurse." (ID12)

Importance of an RN's expertise in supporting family members emerged as an aspect of *providing comprehensive support to family members*. The RNs highlighted the importance of an *RN's ability to support family members in challenging end-of-life care situations*—particularly, the skills and capability to understand and empathise with their feelings as well as to interpret and respond to their needs. These skills were described as developing over time through experience in end-of-life care, which gave the RNs the confidence to engage in difficult conversations and to offer empathetic support to families.

> "As a newly graduated nurse, I definitely wasn't ready to have those kinds of conversations. But maybe life experience, work experience, and doing various tasks have, in a way, given me the tools to have those discussions." (ID7)

The RNs emphasised the importance of a *nurse's management of their own emotions when interacting with family members*. They sometimes found these interactions with family members, especially those dealing with their grief and anxiety, to be painful and challenging—even more so than the interactions with the patients themselves. Confronting the impending death could also be uncomfortable for the RNs. Family members might vent their distress to the RN or feel frustrated with the RN due to the late detection of the serious illness's progression. In such challenging situations, the RNs relied on the help of their colleagues to manage their emotions. They also tried not to take the harsh comments from family members personally, recognising that family members react differently in the context of end-of-life care.

> "You have to be quite flexible and patient when you see the family member's emotions, situation, and emotional turmoil." (ID10)

Facilitating Family Involvement in Patient Care

The second main category was *facilitating family involvement in patient care*, which included the following themes: *supporting family participation in the patient's daily care* and *family involvement in care decisions* (Table 1).

Supporting family participation in the patient's daily care was considered important by the RNs. They deemed it essential to *enable family presence in the care unit* and encouraged family members to be part of the patient's daily end-of-life care as much as possible, as it was beneficial for not only patients but also family members and RNs. Family members' presence from the beginning of end-of-life care was perceived as helping family members cope with the approaching death. From the RNs' perspective, family members also provided support to the patient and practical help to the nursing staff. The RNs appreciated having family members close by, as it was good for the patient's care, and therefore, family

members' desires to be present were supported as much as possible. According to the RNs, family members also had the opportunity to be by the patient's side around the clock, even overnight.

> "It's actually a great relief for us if a family member is present with the patient because then the patient doesn't need to call a nurse for small things. Having their loved one there is a big help sometimes." (ID11)

> "The possibility of being there around the clock during the final moments is important. Once the decision for end-of-life care is made, family members are given the opportunity to stay overnight and be close as death approaches." (ID2)

The RNs considered it important to *support family members' choice to participate in patient care*, allowing them to decide whether and in which tasks they wanted to be involved. Although some family members actively participated in all care activities, others found it difficult to engage in basic care or were hesitant to touch the patient. The RNs respected and supported both behaviours. They did not encourage family members to participate in intimate hygiene care, which they viewed as their own responsibility and a matter of the patient's privacy.

> "Some (family members) participate very intensively, while others are really scared (to participate). Then there are those who don't participate at all, or maybe just call to check in but don't get involved in any other way." (ID15)

The RNs *guided family members in patient care* that they felt was appropriate, such as maintaining the patient's hygiene, ensuring the patient's nutrition, or changing the patient's position in bed.

> "They participate in feeding, giving something to drink, even things like applying lotion to the feet—basic tasks like these. But they might not be involved much beyond that in care. Some may help with changing the patient's position." (ID12)

Additionally, the RNs supported the family's participation in preparing the deceased immediately after death and guided them on what tasks they could perform and how they could take care of the patient in the health centre setting.

Family involvement in care decisions was also described as an essential part of their relationship with their patients' families. The RNs supported family participation in care decisions by engaging in discussions and clearly explaining the factors influencing such decisions. Major care decisions were made in the family's presence, but it was not uncommon for family members to find it difficult to accept the transition to end-of-life care; the finality of such decisions was often hard for them to process. The RNs also noted that the absence of family members during decision-making could pose challenges later, such as misunderstandings and resistance, particularly if the patient's condition worsened. To mitigate this, family participation in decision-making was strongly encouraged.

> "It is sometimes difficult to determine the line when someone else decides for the patient. It is not always clear, and it can be a problem. There may be decisions made about limiting treatments and not providing intensive care or intravenous fluids, and the next day, a relative comes and insists on overturning everything." (ID3)

The RNs also *considered family member's wishes in patient care decisions* and end-of-life care decisions. However, some felt that the patient's preferences should take precedence. The RNs described situations in which family members were making demands regarding care and questioned whether all treatment options had been explored, the right choices had been made, and if everything possible had been done to prevent death. In such situations, the RNs tried to consider the family members' wishes as much as possible, and care decisions were justified to family members as being in the patient's best interest.

> "If it is not recommended to provide any intravenous hydration (to the patient), but often it causes a lot of anxiety for the family members. So, we decided that, okay, we will provide a small amount of intravenous hydration for a couple of days and observe the response. If there is no response, it will stop. These are the kinds of concessions we can make to consider both the family members and the patient as much as we can." (ID2)

Discussion

In this study RNs experiences of interactions with family members of patients receiving end-of-life care in health centre wards were described as encompassing two main roles: *providing comprehensive support to family members* and *facilitating their involvement in patient care*. The importance of providing comprehensive emotional and informational support to family members and the importance of the RNs' expertise in these interactions were consistently emphasised. The facilitation of family involvement in patient care was implemented through their participation in daily care and in care-related decision-making. Few previous studies have examined family-centred care during the end-of-life phase of patients in health centre settings (Hasson et al. 2020). This study provides a novel insight into registered nurses' perspectives on their work in health centre wards, where end-of-life care is commonly provided (Finnish Institute for Health and Welfare 2023).

The RNs reported the need for skills in providing emotional and informational support and empathy to family members. As noted in other studies, adequate quality and quantity of encounters, guidance, and communication about the patient's care support family members' ability to cope in difficult situations (Yıldız et al. 2024, Walker et al. 2023, Peerboom et al. 2025). However, while the RNs' in the current study were aware of family members' needs for communication and support and of the ways to meet these needs, they cited limited resources and lack of time as the primary barriers to providing sufficient support. End-of-life care is demanding for RNs, requiring them to simultaneously address the evolving needs of both patients and family members (Melender et al. 2022). The findings of the current study suggest that systemic limitations, particularly insufficient resources, can significantly hinder RNs from delivering the level of care they aspire to provide. Healthcare systems should

address these structural issues by allocating adequate resources and time to support RNs in their multifaceted roles, thereby enhancing the quality of care and support provided to patients receiving end-of-life care and their families.

The RNs in this study also emphasised the importance of their professional competence in identifying, understanding, and responding to the families' emotions and needs while managing their own. They underscored the value of work experience, which provided them with the confidence to interact with families and guided their behaviour in emotionally complex situations in the end-of-life context. Previous studies have consistently indicated that RNs require a broad range of competencies in navigating end-of-life care necessitates (Soikkeli-Jalonen et al. 2020, Setyawan et al. 2026). The results of the current study suggest that the development of these competencies is a gradual process cultivated primarily through practice. RNs are expected to be highly competent not only in managing symptoms but also in collaborating with patients, families, and other team members (Kesonen et al. 2024, Hökkä et al. 2020). To ensure sufficient support and high-quality interactions, it may be beneficial to place greater emphasis on valuing the work experience of RNs. Recognising and appreciating the experiential knowledge that RNs bring to their roles could enhance the overall quality of care provided to patients and their families.

Supporting family involvement in patient care emerged as a crucial aspect of the RNs experiences with the families of patients receiving end-of-life care. Family members were actively encouraged to be present in the care unit and to participate in the patient's daily care. They were viewed not only as valuable resources in patient care but also as sources of emotional support for the patient. This finding is strongly supported by earlier literature reviews, which have highlighted that family presence is meaningful for healthcare staff in patient care and provides significant mental support to patients (Saarinen et al. 2023a, Kennedy et al. 2025). This study and others provide evidence that RNs see family members as valuable contributors to patient care, offering significant emotional support; this benefits the patient and strengthens the connection between healthcare staff and patients, fostering a more holistic and supportive care environment.

The RNs emphasised their efforts to support family participation and respect for their wishes in decision-making, even though the views of patients and healthcare staff on care planning and goals often differed from those of family members. Notably, family presence during the decision-making process often prevented confrontations with families later. As a result, the RNs encouraged family participation to ensure that they understood and agreed with the decisions made. Studies have confirmed the relevance of considering family members' perspectives in end-of-life care–related decision-making (Saarinen et al. 2023a, Zhu et al. 2023, Kennedy et al. 2025). Consistently, RNs in the present study recognised family participation in decision-making as essential and highlighted the importance of considering the family's perspective, even when it did not align with the views of healthcare staff or the patient. They also noted that in such situations, it is crucial to balance family members' well-being with the patient's best interests. Ultimately, the patient has the right to make decisions as long as they are capable, even if these decisions contradict the family's wishes.

Strengths and Limitations

This study's trustworthiness was evaluated using the criteria established by Graneheim and Lundman (2004). Credibility was ensured through a robust methodology involving interviews with participants with the most relevant experience in the subject. The researchers' diverse backgrounds were considered to mitigate personal biases and subjective insights. Rich data and ample participant quotes were gathered to ensure accurate representation of the phenomenon, and interviews included open-ended questions to ensure the participants' opinions were fully expressed. Data collection continued until saturation indicated that sufficient data had been gathered (Hennink et al. 2017). Transferability of the findings was defined by noting the study's context in *country blinded for review* health centre wards: The findings may be relevant to similar healthcare settings providing end-of-life care. Dependability was ensured by careful planning of data collection and the use of a semi structured interview guide for consistency. Table 1 presents the detailed analytical framework, with the research group reviewing and discussing the analysis to further strengthen dependability.

Cultural, organisational, and resource-specific factors should be considered when applying the results to other settings and contexts. For the busy situation at the wards and anonymity of the data collection, the transcripts of the interviews were not returned to participants for comments.

Conclusions

The findings suggest that RNs require adequate organisational support, training, and resources to effectively meet families' informational and emotional needs and to facilitate meaningful participation in patient care. Education and clinical support should particularly address communication during the transition to end-of-life care, emotionally demanding situations, disagreements regarding care, and the conflict, criticism, and ethical challenges that may arise in interactions with family members.

The findings highlight the importance of experienced RNs in supporting family members during end-of-life care. Incorporating their clinical expertise into staff education, mentoring, care planning, and the development of end-of-life care practices may strengthen the quality of family-centred care. Given the emotional and clinical complexity of end-of-life care, healthcare organisations should ensure that nurses have access to experienced colleagues and sufficient support when providing family-centred end-of-life care.

Because families are vital to patient support and the care process, healthcare systems should establish policies that enable family involvement. They should also address organisational barriers, such as lack of time and resources that prevent RNs from providing family-centred care. RNs are often required to balance family members' needs with patients' wishes and best interests, which can create anxiety and conflict. Care guidelines should emphasise this balance and provide clear procedures for handling conflicting situations, thus facilitating decision-making and offering justification to both families and patients.

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AI-Supported Interview Training for Young People with Disabilities: The ELVIR Virtual Trainer

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Young people with disabilities often face barriers when preparing for job interviews, particularly due to limited opportunities for repeated practice and individualized guidance. Recent advances in generative artificial intelligence and large language models offer new possibilities for creating conversational training environments that complement traditional employability programs. This paper presents ELVIR (Virtual Job Interview Trainer), an artificial intelligence-based platform designed to support interview preparation for young people participating in employment inclusion programs. The system was developed in collaboration with specialists from Teletón Chile and integrates conversational AI, virtual avatars, configurable interview scenarios, and session recording capabilities to provide simulated job interview experiences. Users can select different occupational profiles and interview difficulty levels, allowing the platform to support a variety of training needs and preparation contexts. The contribution of this work is the design and implementation of a virtual interview training platform specifically oriented toward employment inclusion. The paper describes the motivation for the system, its architecture, implementation, and current deployment within a pilot program conducted with participants from Teletón Chile. In addition, the paper discusses the opportunities and challenges associated with the use of conversational AI to support interview training in disability inclusion contexts.

Keywords: *disability inclusion, employment inclusion, artificial intelligence, conversational agents, job interview training*

Introduction

The labor inclusion of people with disabilities remains a global challenge due to its scale and the persistent inequalities affecting access to employment opportunities. According to the World Health Organization (WHO), approximately 16% of the world's population lives with some form of disability (WHO 2022). Several studies have shown that this population experiences lower labor market participation rates and greater difficulties accessing employment opportunities compared to individuals without disabilities (Bishop et al. 2023, Cree et al. 2020). These disparities not only

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limit economic autonomy but also negatively affect well-being, social participation, and quality of life (Milner et al. 2014, Ballo and Alecu 2023).

This situation is also evident in Chile. According to the Third National Study on Disability and Dependency, approximately 17.6% of the adult population lives with some degree of disability. A significant proportion of this group remains excluded from the formal labor market, highlighting the persistence of barriers that hinder access to employment and effective participation in recruitment and selection processes. Although several public policies have been implemented in recent years to promote labor inclusion, people with disabilities continue to face challenges associated with both structural factors and the requirements imposed by recruitment procedures.

Among the different stages of personnel selection, the job interview constitutes one of the most important steps for obtaining employment. However, for many young people with disabilities, this situation can represent a challenging experience due to factors such as anxiety, lack of confidence, difficulties regulating emotions in evaluative contexts, and limited prior experience participating in interviews. As a result, some candidates may encounter difficulties communicating their competencies, knowledge, and capabilities effectively, creating a gap between their interview performance and their actual potential to perform successfully in a work environment.

In Chile, this challenge has been identified by Teletón, an institution that develops rehabilitation and social inclusion programs for children and young people with disabilities. As part of its employability initiatives, professionals work to strengthen the skills required for labor market participation, including preparation for job interviews. One of the strategies commonly employed involves simulated interviews in which specialists assume the role of interviewers and recreate scenarios similar to those encountered in real recruitment processes. These activities allow participants to practice responses, increase confidence, become familiar with different types of questions, and develop communication skills within a controlled environment.

Nevertheless, the implementation of simulated interviews depends on the availability of specialists and the amount of time they can dedicate to each participant. Consequently, opportunities for practice are often limited and difficult to repeat with sufficient frequency to support continuous training, particularly when programs seek to serve an increasing number of young people.

At the same time, recent advances in generative artificial intelligence have enabled the development of large language models capable of maintaining natural and context-aware conversations with users (Kelly et al. 2022, Wang et al. 2024). These systems can formulate questions, interpret responses, adapt dialogue according to the interaction, and provide performance-related feedback (Kyaw et al. 2019). Such capabilities are particularly relevant for recreating conversational learning experiences, including those associated with job interview preparation.

The possibility of employing artificial intelligence as a virtual interviewer creates new opportunities to complement the work performed by specialists. A virtual interviewer can generate training scenarios that are available at any time, represent different interviewer profiles, adjust the level of difficulty of interview questions, and provide individualized feedback aimed at developing employability skills. In this way, training opportunities can be expanded while supporting a

more systematic preparation process before candidates participate in real recruitment procedures.

Although several artificial intelligence–based interview training systems have been reported in the literature, including Conversate and SimInterview, which use large language models to support interview practice through conversational interaction and adaptive feedback (Daryanto et al. 2025, Nguyen et al. 2025), relatively few have been designed specifically to support employment inclusion programs for young people with disabilities. Existing examples include AllyChat, developed for individuals with intellectual disabilities, and Virtual AIVantage, aimed at supporting underrepresented groups through virtual reality–based interview preparation (Garcia-Pi et al. 2023, Ajri et al. 2023). Furthermore, there is limited evidence regarding the integration of conversational artificial intelligence into structured employability training processes conducted by rehabilitation and inclusion organizations, particularly in real-world inclusion programs (Sumi et al. 2025, Garcia-Pi et al. 2023).

To address this need, ELVIR (Virtual Job Interview Trainer) was developed as an artificial intelligence–based platform designed to support job interview preparation for young people with disabilities participating in employment inclusion programs at Teletón. ELVIR allows users to select different occupational scenarios and participate in simulated interviews conducted by virtual interviewers with different interaction styles and difficulty levels. The platform is currently being deployed in a pilot initiative involving participants from Teletón Chile employment inclusion programs.

The objective of this paper is to present the design, architecture, and implementation of ELVIR as an artificial intelligence application intended to support employment inclusion processes. Rather than evaluating employment outcomes, this work focuses on describing the motivation, conceptual design, system architecture, and implementation of the platform, as well as its current deployment in a real-world pilot context. The paper also discusses the opportunities and challenges associated with the use of conversational artificial intelligence for job interview training among young people with disabilities.

The remainder of this paper is organized as follows. Section 2 presents a review of the relevant literature on artificial intelligence–based interview training systems. Section 3 describes the architecture, design decisions, and implementation of ELVIR. Section 4 presents the current results of the platform deployment and the functionalities implemented in the system. Section 5 discusses the implications, opportunities, and limitations of the proposed approach. Finally, Section 6 presents the conclusions and future lines of work.

Literature Review

Recent advances in large language models have driven the development of platforms capable of simulating job interviews through conversational interaction. Current evidence shows that these systems employ artificial intelligence to formulate questions, analyze responses, and generate training experiences adapted to different learning contexts (Daryanto et al. 2025, Nguyen et al. 2025, Gupta 2025).

One of the most common capabilities reported in the literature is the dynamic generation of interview scenarios. Conversate, developed by Daryanto et al. (2025), implements interactive simulations in which the system assumes the role of an interviewer and conducts a conversation focused on interview practice. SimInterview, proposed by Nguyen et al. (2025), uses large language models to generate interviews adapted to different professional and educational contexts. These studies demonstrate that conversational artificial intelligence enables the creation of more flexible training experiences than traditional systems based on predefined question sets.

Another recurring feature is the incorporation of feedback mechanisms. Conversate includes a post-interview stage intended to promote user reflection through conversational interaction (Daryanto et al. 2025). Other systems generate automated evaluations based on the content of user responses and provide recommendations for improvement (Gupta 2025, Suberson et al. 2025). Reported findings suggest that this type of feedback can contribute to the development of communication skills and improve preparation for future interviews.

The literature also shows a transition toward multimodal assessment approaches. In addition to textual analysis, some proposals incorporate information derived from speech, confidence indicators during verbal interaction, and non-verbal signals to complement performance evaluation (Suberson et al. 2025). These approaches seek to provide a more comprehensive assessment of the elements typically considered during real job interviews.

Several studies have also highlighted the value of repeated practice under multiple scenarios. Systems based on large language models can generate interviews with different levels of complexity, interviewer profiles, and occupational contexts, expanding training opportunities without requiring the continuous participation of human specialists (Nguyen et al. 2025, Sumi et al. 2025). This capability is consistently identified as one of the main advantages of conversational artificial intelligence for interview preparation.

Alongside applications designed for the general population, recent work has begun to focus on specific user groups. AllyChat, developed by Garcia-Pi et al. (2023), employs a virtual reality conversational agent to support individuals with intellectual disabilities. Virtual AIVantage, presented by Ajri et al. (2023), focuses on interview preparation for professionals from groups underrepresented in computing disciplines. Similarly, Yarlagadda et al. (2024) describe an artificial intelligence–based interface designed to improve the accessibility of interview training for military veterans. These initiatives illustrate a growing interest in adapting conversational artificial intelligence to contexts where additional barriers to employment exist.

Overall, the reviewed literature suggests that conversational simulation, repeated practice, and personalized feedback represent the principal contributions of artificial intelligence to job interview preparation. However, several limitations remain. These include the potential presence of algorithmic bias, the need to adapt systems to different sociocultural contexts, and the limited evidence regarding their impact on actual employment outcomes (Nofal et al. 2025). Furthermore, applications specifically designed for people with disabilities remain relatively scarce when compared with those developed for students, graduates, or professionals in training.

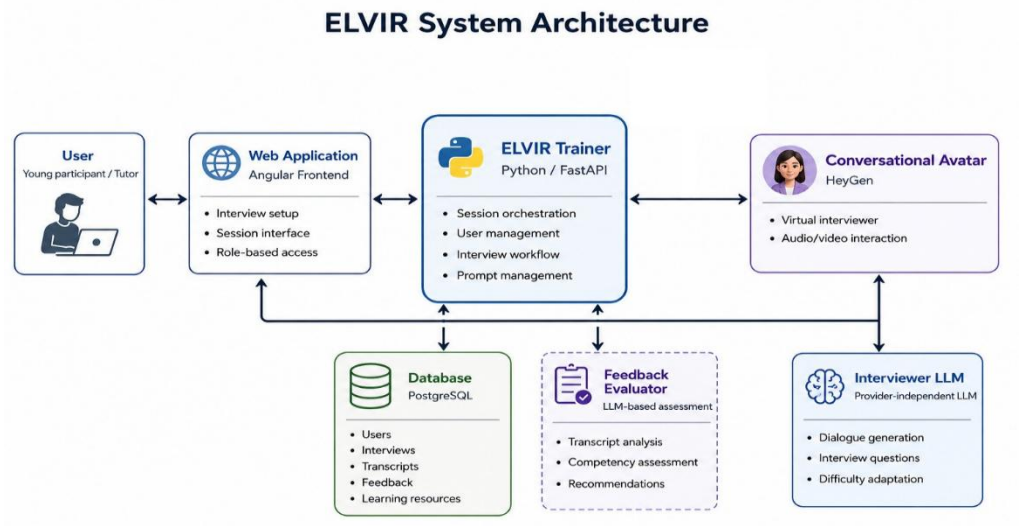
An additional limitation identified in the literature is that most existing systems are designed as standalone interview practice tools and are rarely integrated into structured employment inclusion programs supported by rehabilitation or social inclusion organizations. Consequently, there remains an opportunity to explore how conversational artificial intelligence can be incorporated into employability training environments that complement the work of specialists while providing greater opportunities for practice and preparation.

It is within this context that ELVIR was developed. The platform seeks to support job interview preparation for young people participating in employment inclusion programs at Teletón by combining conversational artificial intelligence, configurable training scenarios, and specialist-supported training processes within a single environment.

System Architecture and Implementation

ELVIR was designed as a conversational artificial intelligence platform intended to support job interview preparation for young people participating in employment inclusion programs. The system architecture comprises components responsible for user interaction, interview management, dialogue generation through large language models, data storage, and performance assessment. Figure 1 presents the overall architecture of the platform and the relationships among its main components.

Figure 1. *ELVIR Architecture Composed of Modules for Interview Management, Avatar-based Interaction, Large Language Model–Driven Dialogue Generation, and Performance Assessment*



User Roles

ELVIR was designed around three user roles: trainees, tutors, and administrators. Trainees correspond to participants enrolled in employment inclusion programs and use the platform to conduct simulated interviews, review previous sessions, and

access supporting materials. Tutors are responsible for monitoring participant progress and reviewing information generated during training sessions. Administrators manage user accounts and platform configurations.

These roles were defined in collaboration with employment inclusion professionals from Teletón to represent the different stakeholders involved in interview preparation processes. This structure enables the separation of training, monitoring, and administrative activities within a single platform.

Web Application

The user interface was implemented using Angular 20 following a Single Page Application architecture. The web application provides access to the functionalities available to trainees, tutors, and administrators, including interview configuration, session review, and access to training resources. Communication with backend services is performed through REST interfaces, allowing the presentation layer to remain independent from the business logic implemented within ELVIR.

ELVIR Trainer

The core component of the platform is ELVIR Trainer, implemented using Python and FastAPI. This module concentrates the business logic of the system and coordinates interview execution, communication with the conversational avatar, database access, and interaction with the large language models used during training sessions. In addition, it is responsible for constructing the parameters that define each interview and managing the information generated during the interaction.

Before an interview begins, ELVIR Trainer requires the configuration of a set of parameters that determine the behavior of the virtual interviewer. In the current version, users select both the occupational profile and the interview difficulty level. These parameters are subsequently incorporated into the instructions sent to the language model responsible for generating the interview dialogue.

The platform currently supports four occupational profiles selected in collaboration with employment inclusion professionals from Teletón. These profiles correspond to operator, customer service representative, administrative assistant, and technical-professional positions. Each profile includes a specific description that is incorporated into the prompt construction process, enabling the virtual interviewer to generate questions aligned with the characteristics of the selected role.

To accommodate different training objectives, four levels of interview difficulty were defined. The first level focuses on emotional regulation and confidence building through supportive and low-pressure interactions. The second level represents a conventional interview similar to those commonly encountered during recruitment processes. The third level is designed for participants who may require additional structure during communication, encouraging concise and focused responses through more specific questioning. The fourth level represents a demanding interview scenario in which the virtual interviewer adopts a less supportive style and introduces challenging or potentially uncomfortable questions that may arise during real recruitment situations.

Interview generation is based on dynamically constructed prompts. These prompts combine information related to the selected occupational profile, the desired difficulty level, and the overall objectives of the training session. The resulting instructions define the role of the interviewer, the occupational context, the expected interaction style, and a set of behavioral constraints intended to preserve conversational consistency throughout the interview.

Once the interview has been configured, ELVIR Trainer generates the corresponding prompt and establishes communication with the external services responsible for dialogue generation and avatar representation. During the session, the module maintains the conversational context, records all interactions, and stores the generated information for subsequent review and analysis. This architecture decouples the training logic from the underlying artificial intelligence services, facilitating the future incorporation of new language models and evaluation mechanisms.

Data Management

ELVIR uses PostgreSQL to store information generated throughout the training process. The database maintains records related to platform users, interview sessions, conversation transcripts, and feedback generated during training activities. These data support the monitoring process conducted by tutors while also providing the foundation for future analytical and evaluation functionalities.

Conversational Avatar

The audiovisual representation of the virtual interviewer is implemented using HeyGen LiveAvatar technology. This component integrates conversational capabilities, speech synthesis, and facial animation to support real-time interaction with users. Within the ELVIR architecture, the avatar receives the interview configuration generated by ELVIR Trainer and manages the audiovisual interaction throughout the session.

Large Language Model–Based Evaluation Module

ELVIR incorporates an evaluation module that is currently under development. The purpose of this component is to analyze interview transcripts and provide automated feedback regarding participant performance. The module employs a large language model together with evaluation prompts designed to assess competencies relevant to job interview situations.

The evaluation process focuses on identifying strengths, areas for improvement, and recommendations derived from participant responses during the interview. The generated assessments are stored within the platform and are intended to support both participant self-reflection and tutor-led follow-up activities.

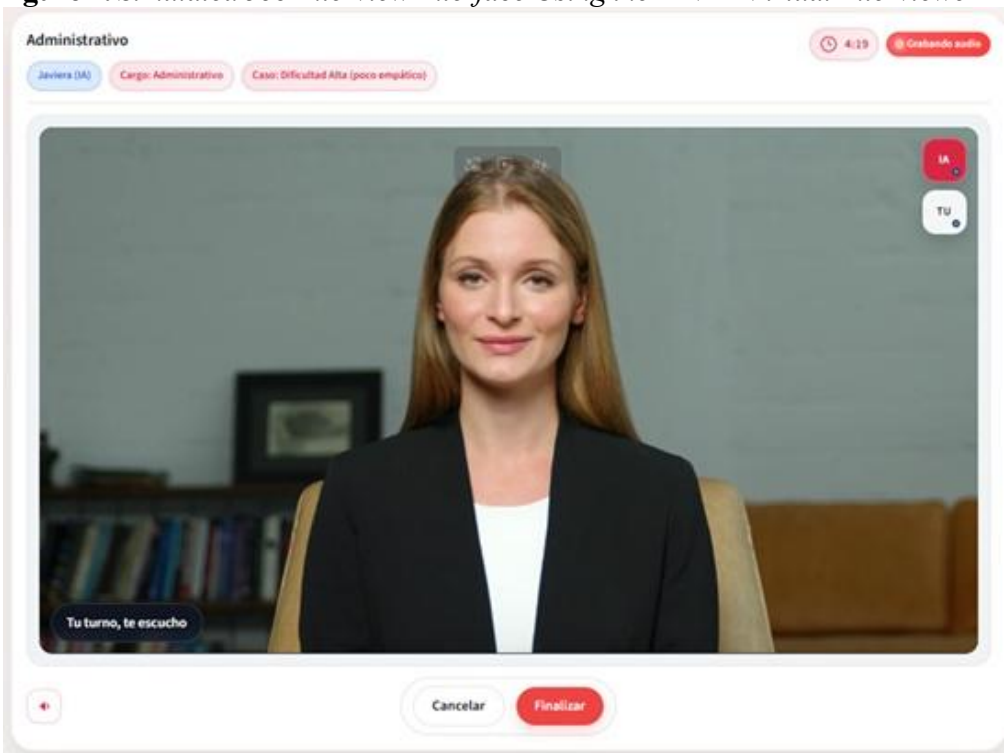
Results

Implementation of the Virtual Interview Environment

One of the main outcomes of this work was the implementation of a virtual interviewer capable of conducting simulated job interviews through real-time conversational interaction. The interface integrates an audiovisual avatar, voice-based communication, and dynamic question generation based on the interview configuration selected for each training session.

Figure 2 presents the interface used during the execution of a simulated interview. During platform testing, the system was able to maintain conversational context, generate questions associated with the selected occupational profile, and formulate follow-up questions based on participant responses. These capabilities allow the interview to evolve dynamically rather than following a predefined sequence of questions.

Figure 2. *Simulated Job Interview Interface Using the ELVIR Virtual Interviewer*



Source: Authors.

To illustrate the conversational behavior of the platform, the following excerpt corresponds to a simulated interview conducted for an administrative position.

> *Interviewer: Tell me about an experience that you consider relevant for this administrative position.*
> *Participant: I completed an internship.*
> *Interviewer: Could you tell me more about that internship? What tasks did you perform and what did you learn from the experience?*
> *Participant: I registered information and helped respond to user inquiries.*

Interviewer: What type of information did you register? Did you use any specific system or software tools?
Participant: I used Excel spreadsheets to enter user information.
Interviewer: I understand. Based on that experience, what skills do you think you could contribute to this position?

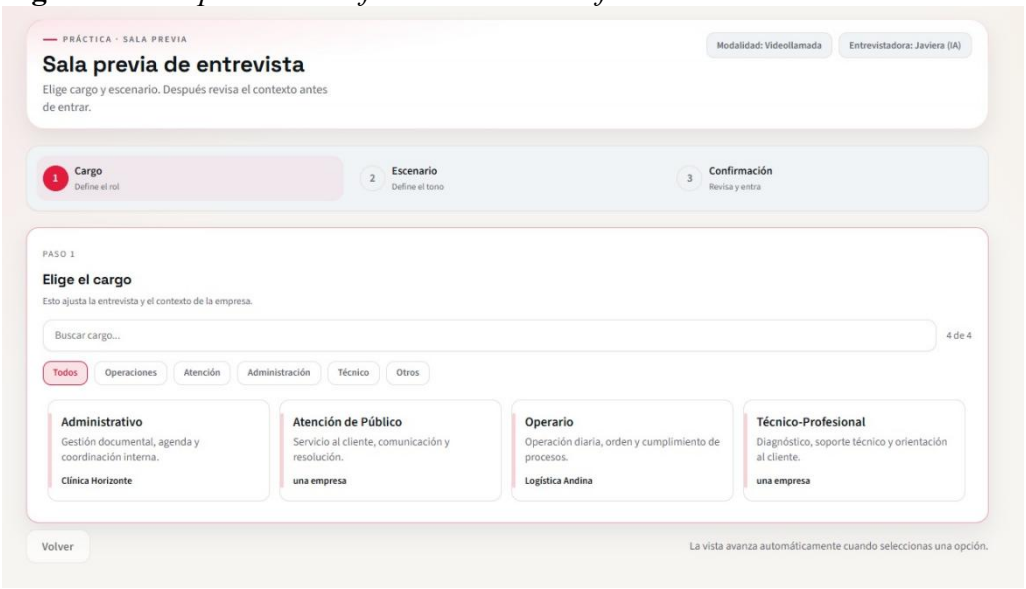
This example illustrates how the system adapts the conversation according to participant responses, requesting additional information when necessary to achieve the objectives of the interview.

Configuration of Training Scenarios

The platform supports the configuration of different training scenarios through the selection of both an occupational profile and an interview difficulty level. The current implementation includes operator, customer service, administrative, and technical-professional profiles, together with four levels of interview difficulty defined in collaboration with employment inclusion specialists.

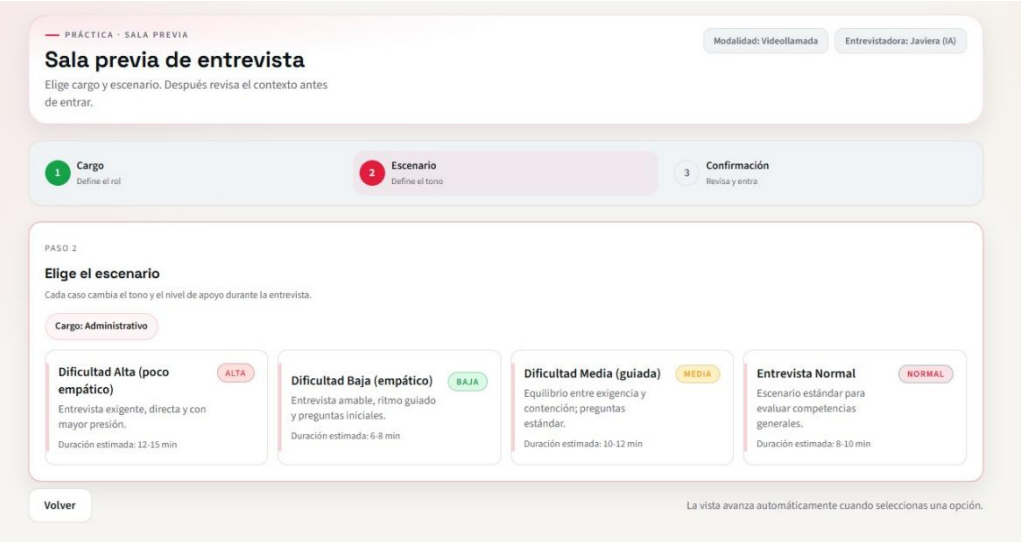
The selected configuration determines the expected behavior of the virtual interviewer and the occupational context within which the interview is conducted.

Figure 3. *Occupational Profile Selection Interface*



Source: Authors.

Figure 4. *Interview Difficulty Level Selection Interface*



Source: Authors.

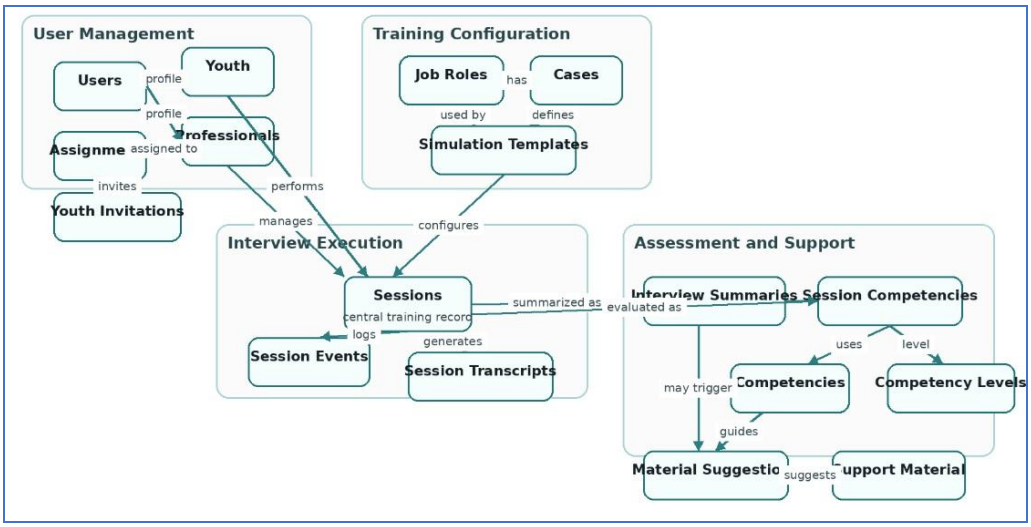
This approach enables the same conversational architecture to support different training objectives and levels of preparation while maintaining a consistent user experience.

Data Model and Information Management

A relevant outcome of the implementation process was the development of a data model capable of supporting the complete interview training lifecycle. Beyond storing user information, the platform was designed to manage interview sessions, conversation transcripts, competency assessments, training materials, and tutor follow-up activities within a unified information structure. The model was also conceived to support future scalability requirements, enabling the incorporation of additional training scenarios, assessment mechanisms, and recommendation services without requiring substantial modifications to the underlying architecture.

Figure 5 presents a simplified view of the main entities and relationships implemented in ELVIR. The model is centered around interview sessions, which act as the primary element connecting participants, professionals, interview configurations, generated transcripts, competency evaluations, and supporting learning resources.

Figure 5. *Simplified ELVIR Data Model*



Source: Authors.

The information model was designed to support both training and monitoring activities. Interview sessions store the conversational exchanges generated during each interaction, while transcript and summary entities maintain records that can be reviewed by participants and tutors. In addition, competency-related entities provide the foundation for future assessment capabilities, allowing interview performance to be associated with predefined competency categories and proficiency levels. This information can facilitate longitudinal monitoring of participant progress and support data-driven decision-making during employability training processes.

The model also incorporates support material and recommendation entities that enable future integration between interview outcomes and personalized learning resources. This structure was included to facilitate the progressive evolution of the platform as additional assessment and recommendation functionalities become available. Furthermore, the separation of training, assessment, and recommendation components contributes to maintaining modularity and flexibility within the overall system design.

Interview Recording and Monitoring

The platform records the information generated during each training session, including interview configurations and conversation transcripts. These records can subsequently be reviewed by both participants and tutors, allowing previous interviews to be revisited and supporting continuity throughout the training process.

The information collected during each session also provides the foundation for future analytical capabilities, including automated evaluation and personalized feedback mechanisms currently under development. By maintaining a complete record of participant interactions, the platform creates a longitudinal training history that may support future monitoring and assessment activities.

Pilot Deployment

The current version of ELVIR has been deployed within a pilot initiative conducted in collaboration with employment inclusion programs at Teletón Chile. The objective of this deployment is to validate the operation of the platform in a real-world environment and to collect information that may guide future functional improvements and user-centered evaluation activities.

The pilot constitutes an important stage in the development of the platform because it enables the observation of how participants interact with conversational artificial intelligence within an employability training context. In addition, it provides opportunities to identify usability issues, refine interview configurations, and improve the overall training experience offered by the system.

At the time of writing, the pilot remains in progress and the large language model–based evaluation module continues to be developed and integrated into the platform. Consequently, this paper focuses on the design and implementation of the system rather than on the assessment of its effectiveness or impact on employment outcomes.

Discussion

Complementing Traditional Employability Training

ELVIR was not designed to replace the work performed by employment inclusion professionals but rather to complement existing training activities by increasing opportunities for practice. The continuous availability of the platform enables participants to engage in simulated interviews with a frequency that is difficult to achieve through face-to-face sessions alone. This capability may facilitate repeated exposure to interview situations and increase familiarity with different occupational contexts and interview styles.

The proposed approach aligns with the growing use of conversational artificial intelligence as a support tool in educational and training environments. Within employment inclusion programs, such technologies may contribute to extending learning opportunities beyond the time constraints typically associated with specialist-led interventions.

Adaptation to Different Training Needs

One of the distinguishing characteristics of ELVIR is the incorporation of interview difficulty levels defined in collaboration with professionals from Teletón. This design allows the behavior of the virtual interviewer to be adapted to different training objectives, ranging from confidence-building and emotional regulation scenarios to more demanding interview situations.

The ability to parameterize interviewer behavior represents an advantage of large language model–based systems when compared with more rigid approaches based on predefined interview scripts. By modifying the interaction style while maintaining the

overall interview objectives, the platform can support a broader range of participant needs and training contexts.

Challenges and Limitations

Despite the capabilities demonstrated during development and initial deployment, several challenges remain. The quality and consistency of the interaction depend on both the underlying language models and the prompts used to guide their behavior. As a result, maintaining stable and predictable interview experiences continues to require careful prompt design and system monitoring.

Another important challenge relates to automated performance assessment. Evaluating interview responses involves subjective dimensions associated with communication skills, self-presentation, contextual appropriateness, and non-verbal behavior. Although large language models offer promising opportunities for automated feedback generation, the validity and reliability of such assessments require further investigation.

A further limitation of the present work is that the pilot deployment remains ongoing. Consequently, it is not yet possible to determine the impact of the platform on interview performance, employability skills, or employment outcomes. The current contribution should therefore be understood as the design and implementation of a conversational artificial intelligence platform rather than as an effectiveness study.

Future Work

Future developments will focus on the completion and validation of the automated evaluation module, the assessment of user experience among participants and tutors, and the study of the platform's role as a support tool within employment inclusion programs. Additional work will also explore the incorporation of new occupational scenarios and the development of personalization mechanisms adapted to individual training needs.

Conclusions

This paper presented ELVIR, a conversational artificial intelligence platform designed to support job interview training for young people participating in employment inclusion programs. The proposed solution integrates a virtual interviewer capable of generating dynamic interactions across multiple occupational scenarios and interview difficulty levels.

The main contribution of this work lies in the design and implementation of a training environment that combines large language models, conversational avatars, configurable interview scenarios, and session management functionalities within a single platform. Through this approach, ELVIR seeks to expand opportunities for interview practice while complementing the work performed by employment inclusion professionals.

At the time of writing, the platform is being deployed within a pilot initiative conducted in collaboration with Teletón Chile. Future work will focus on evaluating the user experience, validating the automated assessment module, and studying the potential contribution of conversational artificial intelligence to employability training and disability inclusion programs.

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