IOSR Journal of Nursing and Health Science (IOSR-JNHS)
e-ISSN: 2320–1959.p- ISSN: 2320–1940 Volume 13, Issue 5 Ser.6 (Sept. – Oct. 2024), PP 65-76
www.iosrjournals.org

Educational Intervention Impact On Nurses' Emotional Intelligence And Leadership Models: A Longitudinal Randomized Trial

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Abstract:
Background: *Emotional intelligence plays a critical role in nursing leadership, influencing organizational dynamics and patient care. However, there is limited understanding of the impact of emotional intelligence on leadership in Primary Health Care within the Greek context.*
Materials and Methods*: A longitudinal experimental design was used to assess the effects of an educational intervention on emotional intelligence and leadership among Greek Primary Health Care nurses. Questionnaires, including the Wong and Law Emotional Intelligence Scale and the Multifactor Leadership Questionnaire, were administered pre- and post-intervention.*
Results*: The results of the study revealed that, during the second measurement, the intervention group exhibited significant improvements in emotional intelligence, whilst adopting a more transformational style of leadership, compared to the control group. However, between the two measurements, no significant changes were observed in the transformational and transactional leadership models, with the exception of Management by Exception (Passive) and Laissez-Faire Leadership. However, in between the two measurements, no substantial changes in measurements were observed regarding the implementation of transformational or transactional models of leadership in neither of the groups. The only exception was the adoption of a Management by Exception (Passive) approach and that of a Laissez-Faire style of leadership. The tables highlighted nuanced changes in leadership dynamics, post-intervention.*
Conclusion: *The empirical study supports that initiatives in education effectively enhance the emotional intelligence of nurses, while they also influence leadership styles. This suggests and highlights the need for tailored professional development programs in nursing education, in order to develop both the emotional intelligence and the leadership skills of those involved. Trial registration: Iranian Registry of Clinical Trials, registration reference: IRCT 20240126060816N1.*
Keywords: *Emotional intelligence; nursing leadership; primary health care; educational intervention; Greece*

Date of submission: 19-10-2024 Date of acceptance: 29-10-2024

I. Introduction

Emotional intelligence (EI) stands as a cornerstone in the domain of nursing leadership, exerting a profound influence on organizational dynamics, team cohesion, and ultimately, the delivery of superior patient care [1]. Over time, there has been increasing acknowledgment of the indispensable role EI plays in shaping effective leadership paradigms within healthcare contexts. The contemporary healthcare environment necessitates the engagement of leaders who not only possess clinical acumen but also exhibit a heightened sense of emotional intelligence. Nurses, serving at the forefront of healthcare delivery, uniquely manage to balance technical proficiency with compassionate, patient-centric care [2, 3]. Therefore, understanding the intricacies of emotional intelligence is of paramount importance in nurturing adept nursing leadership.

The Problem

Despite the widely recognized significance of emotional intelligence, a notable gap persists in our understanding of its precise impact on nursing leadership dynamics, particularly within the domain of Primary Health Care (PHC). This gap in the literature underscores the need for further exploration into how emotional intelligence intersects with leadership models specifically tailored to PHC nurses.

Fundamental questions remain regarding the extent to which emotional intelligence shapes effective leadership practices in PHC settings. Likewise, its correlation with critical outcomes, such as team cohesion, job satisfaction, and patient well-being, still needs further investigation.

Purpose of the Study

The aim of this study was to record, investigate, and evaluate the EI of PHC nurses and the leadership models adopted in PHC units in Greece, after educational intervention and without any. The specific objectives of the research were to assess and evaluate the scores of these variables, along with their changes between the two measurements. These in turn were depended on whether or not the nurses participated in the educational intervention. Another final aim of the research project was to evaluate the effectiveness of the intervention. Considering the purpose of the study and specific objectives, the following research question was posed: What is the effect of the educational intervention on EI and leadership models in nurses who participated in the intervention compared to those who did not?

Research Cases

Hypothesis 1 (H_1):

Nurses undergoing the educational intervention will demonstrate a significant increase in emotional intelligence scores, compared to those in the control group.

Hypothesis Null (H_0):

Nurses undergoing the educational intervention will be expected to have similar emotional intelligence scores, compared to those in the control group.

Hypothesis 2 (H_2):

The intervention group will show a greater level of adoption of transformational leadership styles after the educational intervention, compared to the control group.

Hypothesis Null (H_0):

The intervention group will show the same degree of adoption of transformational leadership styles after the educational intervention, compared to the control group.

II. Material And Methods

Trial Design

This study employed a randomized, parallel, and longitudinal experimental design with two groups (intervention and control). Individuals in the intervention group received an educational intervention, while those in the control group received no intervention. The study was conducted in two phases, from May 2022 to December 2022.

The research study used a questionnaire composed of three parts. The first part collected demographic, social, and job characteristics, while it contained questions related to job satisfaction as well. The second part included the Wong and Law Emotional Intelligence Scale (WLEIS) [4], which was licensed by Prof. Kafetsios Konstantinos, who translated and validated it into Greek. The third part featured the Multifactor Leadership Questionnaire (Form-5x) (MLQ) [5, 6], for which a license to use and reproduce both the leader and rater forms was granted by Mind Garden. The survey questionnaire was distributed to nurses in both the intervention and control groups. Nurses in the former completed the questionnaire before and after the educational intervention within a week. In contrast, nurses in the latter completed the questionnaire twice, with no intervention, within the period of one month.

Upon request, the research was approved by the Research Ethics Committee of the University of West Attica in Greece (Prot. No.: 12758-16/02/2022) and by the scientific councils of all Health Regions of Greece. In addition to obtaining ethical approval and informed consent, the study was registered in a public registry that complies with WHO criteria. The trial details, including the registration reference IRCT 20240126060816N1, are accessible in the IRCT registry, ensuring transparency and adherence to ethical standards.

Participants

Participants were nurses selected through convenience sampling who had signed informed consent for their participation in this study. The study included 101 nurses from various primary health care (PHC) facilities across Greece, representing all seven Regional Health Authorities. Specifically, the nurses were from facilities located in the prefectures of Attica, Thessaloniki, Achaia, Heraklion, Larissa, Aetolia-Acarnania, Evia,

Magnesia, the Dodecanese, Ioannina, Chania, Evros, Pella, Kavala, Trikala, Pieria, Karditsa, the Cyclades, Rodopi, Lesvos, Halkidiki, Drama, Arcadia, Xanthi, Laconia, Arta, Preveza, and Florina.

Each participant received an information leaflet prior to participating in the study. This leaflet outlined the purpose and significance of the study, the conditions and procedures for participation, the security and protection of personal data, potential benefits or risks involved, availability of funding, and information on how to raise complaints or grievances. Participants had the opportunity to ask questions either directly or later, and the researchers were available to provide clarification. If they agreed to participate in the study, informed consent was obtained from all participants before their involvement. The confidentiality of participant data was rigorously upheld throughout all stages of the research process, ensuring compliance with ethical standards and safeguarding participant privacy and rights.

Eligible participants were active nursing practitioners working in PHC settings, fluent in Greek, with a tertiary education degree in nursing, and who provided voluntary consent to participate. Exclusion criteria included nursing paramedical staff, nursing assistants with less than four years of training, individuals employed in secondary or tertiary health institutions, and those unwilling to participate, ensuring the homogeneity of the sample and an alignment with the study's objectives.

Interventions

The educational intervention delivered to the intervention group aimed to enhance participants' understanding of emotional intelligence (EI) and its implications for leadership in healthcare settings. The intervention covered topics such as the importance of EI in both personal and professional contexts, various leadership models, and the correlation between EI and effective leadership. Case studies were presented to facilitate reflection and discussion among participants.

The intervention included a one-hour session covering EI, its advantages, typical leadership styles, and the established link between EI and leadership based on existing research.

Sample Size

The study included 101 nurses, divided into two groups: 50 in the intervention group and 51 in the control group. According to the power analysis, the estimated sample size for this survey design was at least 100 participants (50 per group). This sample size provides 90% power with an effect size of 0.30 for the between-group comparison, 95% power with an effect size of 0.18 for the comparison between two time points, and 95% power with an effect size of 0.18 for the control for the interaction term.

Randomization

Participants were randomly assigned by the researchers to either the control or intervention group with a 1:1 allocation using a computerized random number generator.

Blinding

The study was a single-blind one, because only the researchers knew which participants were receiving intervention and which ones were not.

Statistical Methods

The statistical analysis was performed using SPSS (version 26.0, Statistical Package for the Social Sciences). Descriptive statistics, such as means, standard deviations, frequencies, and percentages, were utilized to summarize participant characteristics and questionnaire responses. Inferential statistics, including t-tests and correlation analyses, examined differences between groups and relationships between variables. Statistical significance was set at $p < 0.05$. Missing data and outliers were addressed using appropriate techniques to ensure the integrity of the analysis. Additionally, multivariate analyses were conducted to comprehensively explore the interplay of multiple variables within the dataset, enhancing the depth of the statistical examination.

Quantitative variables were expressed as mean values (SD), while qualitative variables were expressed as absolute and relative frequencies. For the comparison of proportions, chi-square and Fisher's exact tests were used. Independent sample Student's t-tests were employed for comparing mean values between the two groups. Repeated measures analysis of variance (ANOVA) was used to evaluate changes in MLQ and EI scores between the control and intervention groups over the follow-up period, as well as between employees and supervisors within the intervention group.

III. Results

Participants' Flow

The CONSORT flowchart illustrates the progression of study participants through the phases of the randomized trial, from the assessment of eligibility to analysis. The chart details exclusions, allocations to intervention/control groups, follow-up, and final analysis numbers (Figure 1).

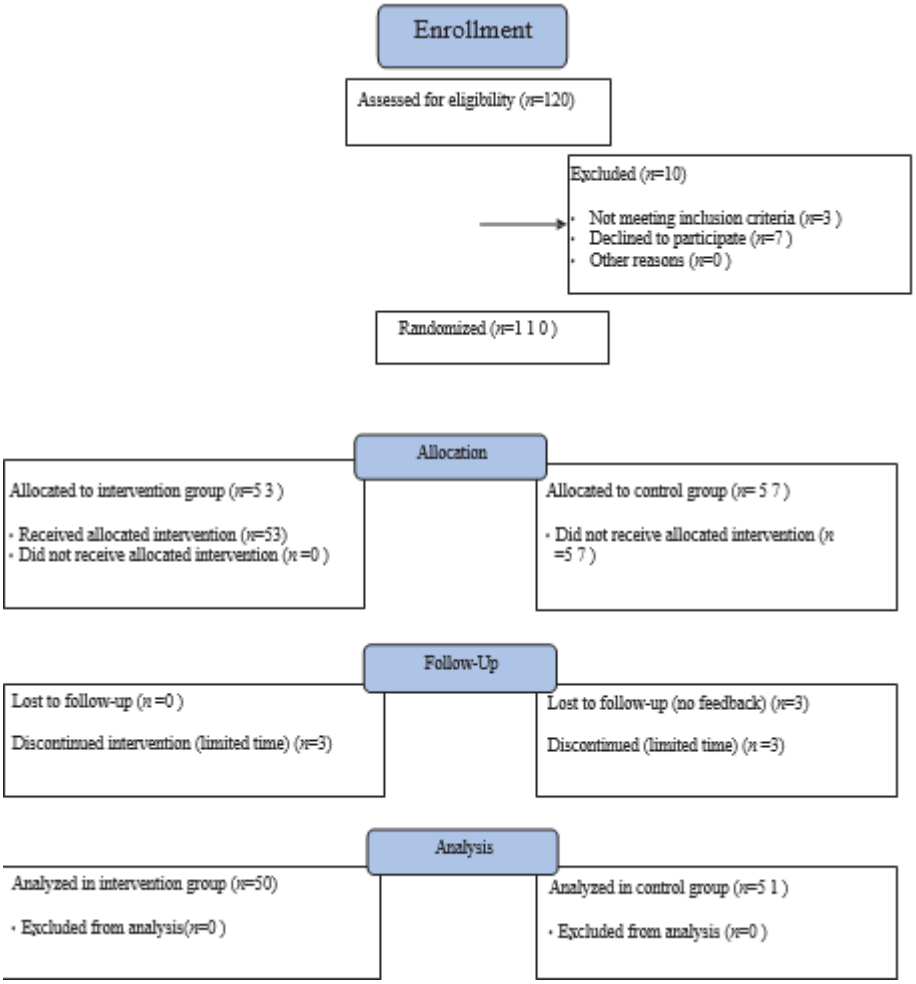

Figure 1. The CONSORT 2010 flowchart.

Outcomes

The results section contains five tables summarizing the findings of the study. Table 1 provides demographic and job-related characteristics of the study participants, divided into control and intervention groups. The study included 101 participants (50 in the intervention group and 51 in the control group). This table includes data on gender, age, family status, educational level, specialty, working position, type of primary care facility, employment status, working shift, years of nursing experience, and job satisfaction levels.

Table 1. Sample characteristics, by group.

		Group		P
		Control (N=51; 50.5%)	Intervention (N=50; 49.5%)	
		N (%)	N (%)	
Gender				
	Men	4 (7.8)	7 (14.0)	0.321+
	Women	47 (92.2)	43 (86.0)	
Age, mean (SD)		41.2 (9.3)	40.1 (6.4)	0.478‡
Family status				
	Unmarried	16 (31.4)	9 (18.0)	0.313++
	Married	33 (64.7)	37 (74.0)	
	Divorced	1 (2.0)	3 (6.0)	
	Widowed	1 (2.0)	1 (2.0)	

Educational level				
	Technological university	23 (45.1)	22 (44.0)	0.939+
	University	6 (11.8)	5 (10.0)	
	MSc	22 (43.1)	23 (46.0)	
Specialty		4 (7.8)	6 (12.0)	0.525++
Working position				
	Employee	41 (80.4)	42 (84.0)	0.636+
	Supervisors	10 (19.6)	8 (16.0)	
Primary care facility				
	Health center	41 (80.4)	42 (84.0)	0.715++
	ToMY (=Local Health Units)	8 (15.7)	5 (10.0)	
	Other	2 (3.9)	3 (6.0)	
Working status:				
	Permanent employee	31 (60.8)	35 (70.0)	0.331+
	Contract employee	20 (39.2)	15 (30.0)	
Working shift				
	Morning	13 (25.5)	10 (20.0)	0.063+
	Morning and afternoon	17 (33.3)	28 (56.0)	
	24h	21 (41.2)	12 (24.0)	
Years of working experience as a nurse				
	1-10	19 (37.3)	12 (24.0)	0.082++
	11-20	16 (31.4)	28 (56.0)	
	21-30	11 (21.6)	8 (16.0)	
	31+	5 (9.8)	2 (4.0)	
Job satisfaction				
	None	2 (3.9)	1 (2.0)	0.383++
	A little	2 (3.9)	7 (14.0)	
	Moderate	22 (43.1)	11 (22.0)	
	Much	18 (35.3)	21 (42.0)	
	Very much	7 (13.7)	10 (20.0)	

[1.] +Pearson's chi-square test;++Fisher's exact test; ‡Student's t-test

The majority of participants in both groups were women. The mean age of subjects in the control group was 41.2 years, while in the intervention group it was 40.1 years. Most participants in both groups were married. In the control group, 45.1% of participants were graduates of a Technological University, and 46% of participants in the intervention group held a master's degree. Supervisors comprised 19.6% of the control group and 16% of the intervention group. The majority of individuals in both groups worked in a health center and held a permanent position. In the control group, 41.2% had 24-hour shifts, while 56% of the intervention group had morning and afternoon shifts. Additionally, 37.3% of the control group had up to 10 years of total service, compared to 56.0% of the intervention group, with 11-20 years of total service. Overall, both groups were similarly satisfied with their work. No significant differences were found between the two groups concerning their characteristics.

Table 2 focuses on changes in subscales of emotional intelligence measured before and after the intervention, and comparing them within the control and intervention groups. It evaluates four key areas: self-emotion appraisal, emotion appraisal of others, use of emotion, and regulation of emotion. For each subscale, the table presents mean scores before and after the intervention, the observed changes, and p-values indicating the significance of these changes. This table demonstrates that the intervention group demonstrated statistically significant improvements in their emotional intelligence capabilities, compared to the control group.

Table 2. Changes in emotional intelligence subscales, by group [7] .

	Group	**Pre**	**Post**	**Change**	**P^2**	**P^3**
		Mean (SD)	**Mean (SD)**	**Mean (SD)**		
Self emotion appraisal	Control	5.49 (0.95)	5.54 (0.87)	0.05 (0.6)	0.640	0.049
	Intervention	5.59 (0.91)	5.97 (0.67)	0.38 (1.00)	0.001	
	P^1	0.588	0.007			
Emotion appraisal of others	Control	5.54 (0.94)	5.39 (0.92)	-0.15 (0.63)	0.161	0.005
	Intervention	5.63 (0.88)	5.9 (0.67)	0.27 (0.84)	0.011	
	P^1	0.631	0.002			
Use of emotion	Control	5.38 (1.14)	5.33 (1.11)	0.03 (0.67)	0.679	0.022
	Intervention	5.39 (1.02)	5.74 (0.88)	0.26 (1.01)	0.005	
	P^1	0.944	0.044			
Regulation of emotion	Control	4.85 (1.24)	4.78 (1.22)	-0.06 (0.83)	0.637	0.026
	Intervention	4.88 (1.15)	5.25 (0.96)	0.37 (1.08)	0.008	
	P^1	0.886	0.035			

p^1=value for group effect p^2=value for time effect p^3=value for repeated measures ANOVA. Differences in change from one measure to another between groups.

Before the intervention, there were no significant differences between the two groups. After the intervention, participants in the intervention group had significantly higher scores on all four dimensions of emotional intelligence, compared to the scores participants achieved in the control group. Over time, scores in all EI subscales increased significantly only in the intervention group, while in the control group there were no significant changes. Due to the significant increases detected in the intervention group only, the degree of change in all EI scores was also significant, when compared between the two groups.

Table 3 examines changes in leadership styles and outcomes using the Multifactor Leadership Questionnaire (MLQ) framework. It analyzes transformational and transactional leadership styles, management by exception, passive and laissez-faire leadership, extra effort, effectiveness, and satisfaction with leadership. The table reports pre- and post-intervention mean scores, the changes between these two points, and p-values indicating the significance of these changes. This table highlights the impact of the educational intervention on leadership behaviors and perceptions among the nurses.

Table 3. Changes in MLQ Leadership Styles and Outcomes, by group.

	Group	**Pre**	**Post**	**Change**	**P[2]**	**P[3]**
		Mean (SD)	**Mean (SD)**	**Mean (SD)**		
Transformational	Control	3.39 (0.95)	3.42 (0.98)	0.03 (0.55)	0.667	0.483
	Intervention	3.7 (0.91)	3.66 (0.94)	-0.04 (0.56)	0.575	
	P[1]	0.095	0.222			
Transactional	Control	3.27 (0.81)	3.38 (0.79)	0.11 (0.56)	0.151	0.498
	Intervention	3.49 (0.74)	3.53 (0.64)	0.04 (0.55)	0.636	
	P[1]	0.147	0.298			
Management by exception (Passive) & Laissez-Faire Leadership	Control	2.37 (0.92)	2.38 (0.94)	0.01 (0.61)	0.849	0.009
	Intervention	2.38 (0.88)	2.74 (0.83)	0.36 (0.67)	<0.001	
	P[1]	0.923	0.046			
Extra effort	Control	3.3 (1.29)	3.34 (1.32)	0.04 (0.74)	0.702	0.397
	Intervention	3.81 (1.27)	3.73 (1.31)	-0.08 (0.72)	0.415	
	P[1]	0.048	0.142			
Effectiveness	Control	3.48 (1.2)	3.52 (1.17)	0.04 (0.6)	0.621	0.244
	Intervention	3.92 (1.15)	3.82 (1.23)	-0.1 (0.67)	0.249	
	P[1]	0.058	0.211			
Satisfaction with the leadership	Control	3.5 (1.22)	3.5 (1.23)	0 (0.66)	>0.999	0.731
	Intervention	3.97 (1.13)	3.93 (1.17)	-0.04 (0.64)	0.628	
	P[1]	0.045	0.076			

p[1]=value for group effect p[2]=value for time effect p[3]=value for repeated measures ANOVA. Differences in change from one measure to another between groups.

At baseline, no significant differences were found between the two groups. However, at follow-up, the intervention group had a significantly greater score in Management by Exception (Passive) and Laissez-Faire Leadership, compared to that of the control group. Additionally, there was a significant increase in the Management by Exception (Passive) and Laissez-Faire Leadership style score in the intervention group from baseline to follow-up. The degree of change was similar for Transformational and Transactional styles, but it differed significantly for the Management by Exception (Passive) and Laissez-Faire Leadership styles between the two groups.

Initially, extra effort and satisfaction with leadership scores were significantly higher in the intervention group, but at follow-up, no significant differences were found between the two groups. No significant time-related differences were observed in leadership outcomes, nor were there significant differences in the degree of change.

Table 4 delves into specific elements of leadership measured by the MLQ, including idealized influence (attributed and behavioral), inspirational motivation, intellectual stimulation, individual consideration, contingent reward leadership, and management by exception (active and passive). Similar to the previous tables, it compares pre- and post-intervention scores and changes for both groups, providing insights into the nuanced ways in which the intervention influenced various aspects of leadership.

Table 4. Changes in MLQ leadership elements, by group.

	Group	Pre	Post	Change	P^2	P^3
		Mean (SD)	Mean (SD)	Mean (SD)		
Idealized Influence (Attributed)	Control	3.5 (1.29)	3.52 (1.21)	0.02 (0.53)	0.777	0.609
	Intervention	3.86 (1.17)	3.82 (1.2)	-0.04 (0.7)	0.660	
	P^1	0.141	0.214			
Idealized Influence (Behavior)	Control	3.49 (0.84)	3.47 (0.94)	-0.02 (0.8)	0.811	0.739
	Intervention	3.61 (0.82)	3.64 (0.91)	0.02 (0.65)	0.816	
	P^1	0.468	0.360			
Inspirational Motivation	Control	3.36 (1.1)	3.46 (1.13)	0.1 (0.67)	0.321	0.337
	Intervention	3.8 (1)	3.77 (1.01)	-0.04 (0.74)	0.713	
	P^1	0.037	0.151			
Intellectual Stimulation	Control	3.4 (1.14)	3.44 (1.11)	0.04 (0.72)	0.684	0.401
	Intervention	3.73 (1.11)	3.65 (1.1)	-0.08 (0.66)	0.435	
	P^1	0.144	0.334			
Individual Consideration	Control	3.21 (0.91)	3.24 (0.96)	0.03 (0.8)	0.777	0.410
	Intervention	3.52 (0.89)	3.43 (0.89)	-0.09 (0.67)	0.380	
	P^1	0.091	0.318			
Contingent Reward Leadership	Control	3.55 (1.07)	3.56 (1.02)	0.01 (0.66)	0.873	0.452
	Intervention	3.86 (0.98)	3.78 (0.93)	-0.08 (0.66)	0.368	
	P^1	0.133	0.280			
Management – by exception (Active)	Control	2.99 (0.87)	3.2 (0.84)	0.21 (0.87)	0.060	0.742
	Intervention	3.13 (0.86)	3.29 (0.77)	0.16 (0.7)	0.158	
	P^1	0.415	0.582			
Management – by exception (Passive)	Control	2.73 (0.92)	2.70 (0.94)	0.03 (0.67)	0.797	0.031
	Intervention	2.59 (0.90)	2.90 (0.86)	0.31 (0.86)	0.006	
	P^1	0.445	0.283			
Laissez-Faire Leadership	Control	2.2 (1.06)	2.26 (1.09)	0.07 (0.71)	0.552	0.016
	Intervention	1.98 (1.01)	2.44 (1.16)	0.46 (0.92)	<0.001	
	P^1	0.290	0.423			

p^1=value for group effect p^2=value for time effect p^3=value for repeated measures ANOVA. Differences in change from one measure to another between groups.

At baseline, the intervention group had a significantly greater score in Inspirational Motivation compared to the control group, while all other scores were similar between the two groups. At follow-up, no significant differences were found between the two groups. When scores were compared over time, it was found that only the Management by Exception (Passive) and the Laissez-Faire Leadership scores increased at follow-up, and this increase was observed essentially in the intervention group.

Focusing exclusively on the intervention group, Table 5 analyzes changes in emotional intelligence and leadership styles based on the participants' working positions (employees vs. supervisors). It covers Management by Exception (Passive), Laissez-Faire Leadership, and a combined score for these two styles, in addition to Self-Emotion Appraisal, Emotion Appraisal of Others, Use of Emotion, and Regulation of Emotion. The table presents mean scores before and after the intervention, the observed changes, and p-values to evaluate the differential impact of the intervention on employees and supervisors alike.

Table 5. Changes in subscales of the intervention group, by working position.

		Pre	Post	Change	P^2	P^3
	Working position	Mean (SD)	Mean (SD)	Mean (SD)		
Management – by exception (Passive)	Employee	2.77 (0.86)	2.98 (0.85)	0.21 (0.83)	0.104	0.086
	Supervisors	1.66 (0.35)	2.44 (0.81)	0.78 (0.91)	0.011	
	P^1	0.001	0.102			
Laissez-Faire Leadership	Employee	2.04 (1.07)	2.55 (1.22)	0.50 (0.98)	0.001	0.538
	Supervisors	1.63 (0.61)	1.91 (0.63)	0.28 (0.59)	0.397	
	P^1	0.289	0.154			
Management by exception (Passive) & Laissez-Faire Leadership	Employee	2.56 (0.85)	2.91 (0.77)	0.36 (0.71)	0.001	0.960
	Supervisors	1.47 (0.25)	1.81 (0.38)	0.34 (0.44)	0.160	
	P^1	0.001	<0.001			
Self emotion appraisal	Employee	5.52 (0.93)	5.95 (0.67)	0.42 (1.04)	0.009	0.497
	Supervisors	5.94 (0.78)	6.09 (0.69)	0.16 (0.79)	0.662	
	P^1	0.243	0.573			
Emotion appraisal of others	Employee	5.57 (0.89)	5.89 (0.62)	0.31 (0.85)	0.020	0.446
	Supervisors	5.91 (0.82)	5.97 (0.92)	0.06 (0.85)	0.836	
	P^1	0.330	0.754			
Use of emotion	Employee	5.34 (0.97)	5.7 (0.85)	0.36 (1.09)	0.026	0.781
	Supervisors	5.69 (1.28)	5.94 (1.09)	0.25 (0.42)	0.491	
	P^1	0.379	0.484			

Regulation of emotion	Employee	4.91 (1.09)	5.2 (0.9)	0.29 (1.13)	0.082	0.277
	Supervisors	4.75 (1.51)	5.5 (1.25)	0.75 (0.61)	0.054	
	P^1	0.727	0.426			

Note. Only scales that changed significantly during follow-up in the intervention group were analyzed. p^1=value for group effect, p^2=value for time effect p^3=value for repeated measures ANOVA. Differences in change from one measure to another between groups.

The score in Management by Exception (Passive) increased significantly at follow-up only for participants who were supervisors. In contrast, scores in Laissez-Faire Leadership and almost all EI subscales (except for Regulation of Emotion) increased significantly at follow-up only for participants who were not supervisors. The score in Management by Exception (Passive) and Laissez-Faire Leadership style was similar between the two measurements. At baseline, supervisors had significantly lower scores in Management by Exception (Passive). Additionally, supervisors had significantly lower scores in the Management by Exception (Passive) and Laissez-Faire Leadership style at both measurements.

No serious adverse events related to the study were identified in either group of participants.

In summary, Hypothesis 1 was verified, as the participants who underwent the intervention showed significant improvements in EI. Hypothesis Null was not confirmed.

In contrast, Hypothesis 2 was not verified, as there was no increase in the score regarding transformational leadership or a shift towards more transformational leadership styles. Hypothesis Null was confirmed.

IV. Discussion

The discussion of the findings of our study, particularly those elucidated in Tables 2 and 3, reveals not only intriguing parallels but also deviations from existing literature on emotional intelligence (EI) and leadership styles in nursing. The educational intervention aimed at enhancing EI and leadership styles among Greek Primary Health Care nurses yielded significant improvements, particularly in the intervention group, after compared to the control group. This study, utilizing a longitudinal experimental design, employed the Wong and Law Emotional Intelligence Scale (WLEIS) and the Multifactor Leadership Questionnaire (MLQ) to measure changes pre- and post-intervention. Table 2 highlighted significant improvements in all four subscales of emotional intelligence for the intervention group. These enhancements in self-emotion appraisal, emotion appraisal of others, use of emotion, and regulation of emotion demonstrate the effectiveness of the intervention in bolstering the emotional competencies of nurses, which are critical for patient care and team dynamics. Our analysis indicates a significant increase in emotional intelligence subscales,including self-emotion appraisal and emotion regulation, for the intervention group. This aligns with research by Brackett et al. [8], who emphasize the malleability of EI through targeted educational programs. Their findings support our observation that structured interventions can enhance crucial EI components among healthcare professionals, reinforcing the hypothesis that EI is not an innate trait but one that can be developed through specific educational efforts. However, the shift towards more passive and laissez-faire leadership styles post-intervention describes a complex scenario. While traditional literature posits transformational leadership as the gold standard for nursing leadership due to its association with positive patient outcomes and workplace environments, our study suggests an unintended effect of the intervention, as there was no increase in scores with regard to a swift to more transformational leadership styles. This is somewhat reflected in the work of Skogstad et al. [9], who explored the negative impact of laissez-faire leadership on job satisfaction and employee health, underscoring the potential challenges these leadership styles pose to effective nursing practice.

Interestingly, the increase in Management by Exception and Laissez-Faire Leadership contrasts with findings from Cummings et al. [10], who advocate for transformational leadership to enhance patient care and nursing work environments. Our study's divergence from this established narrative invites further exploration into the nature of the educational intervention and its potential biases towards fostering less proactive leadership behaviors. The consistency in emotional intelligence improvement yet variability in leadership style outcomes raises questions about the direct translation of EI gains into leadership practices. This discrepancy suggests that, while EI can be enhanced, translating these improvements into desired leadership behaviors may require a more nuanced approach or additional components within educational interventions. This observation is supported by Mayer et al. [11], who argue that the application of EI in leadership extends beyond mere capability enhancement to include the strategic deployment of these skills in leadership practices.

This shift is particularly relevant in healthcare, where leadership styles directly influence patient care quality and team cohesion [12]. For instance, the diversity in age, educational level, and years of experience within the sample can provide insights into how these factors might influence receptiveness to and impact of the educational intervention. Research by Day and Carroll [13] suggests that individual differences can significantly affect the development of EI and leadership capabilities, which might explain the variance in outcomes observed across different participant groups.

There are findings in the present study which align with existing literature on EI and nursing leadership, as highlighted by Jiménez-Rodríguez et al. [14], Fouad et al. [15], and Russ et al. [15]. These studies emphasize the importance of EI training interventions in enhancing EI competencies among nursing professionals. While Jiménez-Rodríguez et al. [15] focused on undergraduate nursing students and the effects of a non-technical skills training program on EI and resilience, Fouad et al. [15] examined the impact of emotional intelligence training on nursing students' EI and empathy levels. Despite differences in methodologies and target populations, these studies collectively underscore the potential benefits of EI development in healthcare settings. Our study enhances EI and leadership styles among Greek Primary Health Care nurses through educational intervention, showing significant EI improvements and a shift towards transformational leadership, aligning with Russ et al. [16]. They highlight Trait EI's critical role in healthcare leadership, emphasizing its development for leadership efficacy. Unlike the broad analysis of Russ et al. [16], our empirical evidence demonstrates the effectiveness of targeted interventions in developing EI and leadership, supporting the notion that EI can be nurtured through specific training programs.

The comparison between our study and the research conducted by Imperato and Strano-Paul [17] reveals insightful parallels and contrasts in the application and effects of educational interventions on emotional intelligence (EI), as measured by the Wong and Law Emotional Intelligence Scale (WLEIS). Both studies utilize the WLEIS, emphasizing its utility in evaluating EI's four dimensions: self-emotion appraisal, others' emotion appraisal, use of emotion, and regulation of emotion. However, the interventions differ significantly in focus and structure. Our study targeted Greek Primary Health Care nurses to enhance both EI and leadership skills, whereas Imperato and Strano-Paul [17] focused on encouraging reflection among medical students to augment empathy and, indirectly, EI. This distinction highlights different impacts of the interventions; while our study observed marked improvements in EI and a shift towards transformational leadership, Imperato and Strano-Paul [17] noted a significant rise in empathy but no change in overall EI scores.

The study by Metwally et al. [18] on transformational leadership within a multinational FMCG company in Egypt provides a context for comparing leadership styles in Greek Primary Health Care settings for our research. Both studies employed the Multifactor Leadership Questionnaire (MLQ). Metwally et al. [18] concentrated on how transformational leadership influences employee satisfaction in a corporate environment, finding that dimensions like Idealized Influence and Inspirational Motivation significantly boost job satisfaction. This finding aligns with Mohammad et al. [19], who similarly highlighted the positive impact of transformational leadership on satisfaction and performance within organizational settings. Metwally et al. [18] emphasize the direct correlation between transformational leadership and job satisfaction, reflecting broader research, which suggests that engaged, visionary leadership can profoundly affect corporate morale and employee retention. In contrast, our research propounds that, while similar interventions can foster positive leadership traits in healthcare, the impact on practical outcomes, like patient care and team dynamics, requires further exploration.

Compared to the study by Alqahtani et al. [20], which examined leadership styles and job satisfaction among healthcare providers in primary health care centers in Saudi Arabia, our research focuses on similar themes but in a different context. Alqahtani et al. [20] utilized a cross-sectional design, employing the MLQ (Form 6-S) along with a job satisfaction survey to evaluate the leadership practices of PHC managers and assess job satisfaction among 300 healthcare providers. Their results highlighted a predominant use of transformational leadership elements like 'idealized influence' and a significant reliance on 'management by exception', whereas laissez-faire leadership was less common. They found varied levels of job satisfaction, with a considerable number of healthcare providers reporting ambivalence towards their jobs.

Research conducted by Tyczkowski et al. [21] and Carragher and Gormley [22] foregrounds the essential role of EI in nursing leadership. These studies collectively emphasize EI's crucial role in developing effective nursing leadership and advocate for the incorporation of EI development into nursing education programs. There is a consensus among these studies that EI is a foundational component of transformational leadership, vital for effectively navigating the complexities of healthcare environments. A distinctive feature of our study is the implementation of a specific educational intervention, designed to enhance EI and investigate its direct impact on leadership styles. While Tyczkowski et al. [21] focused on establishing correlations between existing levels of EI and leadership styles, and Carragher and Gormley [22] explored the theoretical implications of EI for leadership development, our research provides empirical evidence supporting the effectiveness of targeted interventions in simultaneously boosting EI and leadership competencies among nurses.

Sabbah et al. [23] explored leadership styles and their impact on nurses' well-being in Lebanon, using the MLQ (5x Short Form), similar to our study, which also employed the MLQ to evaluate leadership styles in Greek PHC. Sabbah et al. [23] observed that transformational and transactional leadership styles were prevalent and positively associated with nurses' well-being. These findings echo our results, where transformational leadership significantly enhanced leadership behavior and effectiveness, post-intervention. Similarly,

transactional leadership in both studies showed a positive influence, although the specifics of the impact varied, reflecting contextual differences in setting and healthcare practices. The consistent use of the MLQ across both studies provides a robust framework for comparing the direct impacts of leadership behaviors on healthcare outcomes, emphasizing the universal relevance of effective leadership in enhancing operational efficiency and employee morale in healthcare.

Cope and Murray [24] provided an expansive overview of leadership and leadership styles relevant to nursing, advocating for the significance of effective leadership in enhancing healthcare outcomes. Their discussion on transformational and transactional leadership styles and the necessity for nurses to develop these competencies mirrors the emphasis of our study on the educational development of EI and its impact on leadership behavior. Another distinction in our study is the observation of shifts towards less effective leadership styles (management by exception and laissez-faire) in the absence of targeted interventions. This insight adds depth to the discourse on leadership dynamics in healthcare, highlighting the potential for educational interventions to not only promote effective leadership styles but also mitigate the drift towards less desirable leadership behaviors [25, 26, 27].

Limitations

At this point, it would be useful to elaborate on the limitations faced by our research. **(1)** The survey was conducted amid the Covid-19 pandemic. The given moment may have affected the psychology and overall mood of nurses, stress levels, job satisfaction and working conditions, etc. The pandemic probably also affected the supervisors, who then had to act decisively, facing new and unprecedented circumstances. Therefore, leadership models may have diversified. **(2)** The educational intervention took place only once (duration of approximately 1 hour). A more systematic and comprehensive program of longer duration, aimed at the development of emotional intelligence as well as the development and improvement of nurses' leadership skills, could have been designed. However, due to the Covid-19 pandemic, we faced numerous practical difficulties and obstacles during the study. **(3)** The WLEIS scale, which was used to measure EI, is a self-report psychometric tool, meaning that participants subjectively rated the dimensions of EI according to their own personal beliefs. Also, the MLQ captures the views of nurses regarding the leadership model that they consider to be applied in their workplace. **(4)** A scale related to nurses' job satisfaction could have been included during the research design for further investigation.

V. Conclusions

The outcomes of the research include documenting, investigating, and evaluating the EI of nurses, as well as the leadership models applied in PHC in Greece. It is anticipated that the results will help nurses understand the value of EI, which is directly related to their interpersonal relationships and leadership styles. These findings are expected to contribute to better organization within the health system, specifically in PHC, with the ultimate goal of improving the quality of health services provided. No serious adverse events or harm related to the study were reported in either group of participants.

It was found that the educational intervention had a positive effect on the intervention group, as the levels of EI showed significant changes between the first and second measurements. The emotional intelligence levels of those in the intervention group increased, whereas no significant differences were observed between the two measurements in the control group. Regarding leadership models, both groups showed a preference for transformational leadership, followed by transactional leadership with a small difference in the score, and Passive and Laissez-Faire Leadership was used less frequently in both measurements. However, the degree of change between baseline and follow-up was similar for Transformational and Transactional styles, while it differed significantly for Passive and Laissez-Faire Leadership styles. There was a significant increase in the Passive and Laissez-Faire Leadership style score in the intervention group at follow-up, compared to baseline. The study successfully addressed its main objectives and the research question by demonstrating the effectiveness of educational interventions in enhancing nurses' EI and influencing their leadership styles.

These findings underscore the importance of integrating EI development into nursing education and professional training to foster compassionate care, improve team dynamics, and enhance patient outcomes. The development of EI through education, for both nursing staff and leaders, is considered particularly important and beneficial, as it actively and substantially contributes to changes and improvements in healthcare delivery.

List of Abbreviations

EI = Emotional Intelligence
PHC = Primary Health Care
WLEIS= Wong & Law Emotional Intelligence Scale
IRCT = Iranian Registry of Clinical Trial
SD = Standard Deviations

TE= Technological Education
UE= University Education

Ethics Approval and Consent to Participate: The study was approved by the Research Ethics Committee of the University of West Attica (No. Prot: 12758-16/02/2022) and by the scientific councils of all the health districts of Greece. Additionally, the study was registered in the Iranian Registry of Clinical Trials (IRCT) with registration reference: IRCT 20240126060816N1. Informed consent was obtained from all participants before their involvement in the study. The confidentiality of participant data was rigorously upheld throughout all stages of the research process, ensuring compliance with ethical standards and safeguarding participant privacy and rights.

Human and Animal Rights: No animals were used in this research. All procedures involving human participants were conducted in accordance with the ethical standards of the institutional and/or research committee and with the 1975 Declaration of Helsinki, as revised in 2013.

Availability of Data and Materials: All data are available with the corresponding author on request.

Conflicts of Interest: The authors declared no conflict of interest, financial or otherwise.

Funding: This research received no external funding.

Guidelines and Standards Statement: CONSORT guidelines were followed.

Acknowledgments: We express our gratitude to Prof. Kafetsios Konstantinos for granting permission to use the Wong and Law Emotional Intelligence Scale in Greek. Our appreciation also extends to all participating nurses for their invaluable contribution to the research.

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