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Article

Environmental Competencies in Nurses and Undergraduate Nursing Students Related to the Effects of Climate Change on Older People's Health

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Abstract

Introduction: Climate change is increasingly affecting the health of older people. This study aimed to determine the knowledge, skills, and attitudes of nurses and undergraduate nursing students regarding the effects of climate change on older people's health. **Material and Methods:** A descriptive cross-sectional study was conducted between January and April 2024 with 708 participants (210 nurses and 498 undergraduate nursing students). The Nursing Competencies Questionnaire on Environmental Health of Older People (NCQ-OPEH) was used to assess environmental competencies. Descriptive values were calculated and interrelationships between knowledge, attitudes, and skills were analysed. **Results:** A total of 115 nurses (54.75%) and 185 students (37.15%) demonstrated good-excellent knowledge. Similarly, a higher percentage of nurses (50.77%) reported better perceived skills than students (42.52%). However, the majority of both samples (98.97% and 87.85%, respectively) had good to excellent attitudes. These differences were significant for knowledge ($p < .001$) and attitudes ($p = .013$), but not for skills ($p = .054$). Furthermore, a significant relationship was found between prior education on climate change and health and greater knowledge ($p = .019$) and skills ($p = .027$) among nurses and better skills and attitudes ($p < .001$ in both) among nursing students. **Conclusion:** Nurses have better environmental competencies than undergraduate nursing students. Therefore, it is important to include education on climate change and older people's health to be included in the academic curriculum of university nursing degrees. Nurses also need to reinforce these competencies through specific educational programmes. This new tool will evaluate educational and formation sessions on climate change and the health of older adults.

Keywords: environmental competencies; knowledge; skills; attitude; climate change; older people; nurses; undergraduate nursing students

Introduction

Nowadays, there is growing concern about understanding how climate change and global warming will affect the ageing population [1]. The physiological changes associated with the ageing process increase the vulnerability to harmful stimuli, especially in cases of comorbidity, chronicity, and/or polypharmacy. As a result, this collective is particularly vulnerable to the effects of climate change [2]. There is also a relationship between climate change and the mental health of the older population, potentially inducing new or aggravating existing mental health conditions or aggravating existing ones [3].

The Sustainable Development Goals (SDGs) represent a global action plan to address the challenges that climate change presents for the health of older people. Nurses contribute to improving

the health and well-being of older people at risk from climate change (SDG 3) and enable climate action (SDG 13) through sustainable, quality nursing care that strengthens resilience and adaptability to the dangers associated with climate change [4]. Nursing professionals must be able to establish adaptation, mitigation, and resilience strategies to this end. It should also be taken into account that the healthcare sector contributes to climate change through its consumption of energy and resources and the generation of waste. In fact, its climate footprint accounts for 4.4% of global net emissions [5]. Healthcare professionals, particularly nurses, are on the front line when it comes to facing the health impacts of climate change on older people, whether direct (disasters such as floods) or indirect (increased demand for emergency services and hospitalisations). As climate change accelerates, the need to treat climate-related illnesses in this population group will also increase [6]. Nurses hold a position of trust in the community and can therefore play an influential role by providing information on the health effects of climate change. They can help communities through education on prevention and adaptation to the impacts, as well as understanding the potential risks [7]. Therefore, it is essential that university students receive education for sustainable development (ESD) through the incorporation of skills to promote planetary health. It is necessary to provide and instruct nurses and nursing students in the knowledge, skills, and attitudes required to develop actions aimed at finding solutions to climate change [6–8]. In short, it is up to the nursing profession to make significant changes to improve society's response to climate change and drive the transformation needed to achieve a healthy future [9].

Although there is growing evidence of the interconnection between climate change and the health of older people, a considerable gap exists in the knowledge, skills, and attitudes of nurses and nursing students to address these issues. Many healthcare professionals have no formal training in climate-related health and care provision; therefore, they are unprepared and only perform half of the tasks involved in environmental measures [10]. Few nurses understand why extreme weather events are linked to climate change and how they affect the health of older people. Consequently, they are unaware of strategies or interventions to reduce the impact on this population [11]. Furthermore, there are currently no clear guidelines for the development of curricula that integrate climate change into university nursing education, despite the fact that the SDGs clearly highlight the need for education for sustainable development (ESD) that aims to maintain planetary health [12]. However, nursing students are generally not adequately trained in the impacts of climate change on health and the appropriate response of the nursing profession [7]. Therefore, this study aimed to determine the knowledge, skills, and attitudes of nurses and undergraduate nursing students regarding the effects of climate change on the health of older adults. In addition, this study aims to determine these competencies based on various sociodemographic variables. The hypothesis was established that nurses have greater competencies regarding the environmental health of older people than nursing students.

Materials and Methods

Study Design

This research is a descriptive cross-sectional study. The STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) statement for cross-sectional studies was used to prepare the report [13] (Supplementary material 1).

Participants

The convenience sample consisted of 708 participants (210 nurses and 498 undergraduate nursing students).

Data Collection

Various strategies were employed for data collection between January and April 2024, ranging from dissemination of the instrument via social media to emails from hospitals to nursing staff. Students were recruited in their practical classes from the four years of the nursing degree at three Spanish universities. The link to the questionnaire hosted on the SurveyMonkey® online platform was provided in both samples.

Participants completed the NCQ-OPEH (Nursing Competencies questionnaire on Older People's Environmental Health). This psychometrically validated tool is designed to assess the knowledge, skills, and attitudes of both nurses and undergraduate nursing students regarding the effects of climate change on older people's health. The instrument consists of a knowledge questionnaire, KQ-OPEH (11 items with true/false/don't know response options), a skills scale, SS-OPEH (13 items with response options ranging from 1 to 5 on a Likert scale), and an attitudes scale, AS-OPEH (11 items with response options ranging from 1 to 5 on a Likert scale), and shows strong internal consistency in each of its parts (Cronbach's α values of .68, .91, and .93, respectively).

Sociodemographic variables were collected from participants, such as age, gender, previous education on climate change and health, workplace, course taken, and completion of healthcare internships, to study whether there are differences in competencies based on these variables.

Data Analysis

To compare the difference in scores between nurses and students and between those who had previous education on climate change and those who did not, the non-parametric Mann-Whitney U statistic was used, since the Kolmogorov-Smirnov test indicated that the data deviated from a normal distribution. To assess whether there were significant differences between the mean scores for different sociodemographic variables (gender, workplace, and course enrolled), the Kruskal-Wallis test were used as the data did not meet the assumption of homogeneity of variances through Levene's test. In cases where a statistically significant relationship was found, Dunn's post hoc test was performed by applying the Bonferroni adjustment to the p-values. The analysis was completed by examining Spearman's rho to assess the correlation between knowledge, skills, and attitudes, as well as age, in each population group.

The free software JASP Version 0.95.4 was used for both descriptive statistics and hypothesis testing.

Results

Demographic Data

Among the nurses' sample, respondents were from primary care, nursing homes, and hospital care. Undergraduate nursing students from the four years of the Nursing Degree programme were also surveyed. The majority of the total sample were women (80.93%) and had no previous education on climate change and health (66.81%), with the latter percentage being much higher in nurses (90.95%).

Table 1. Participants' sociodemographic characteristics.

Characteristic	Nurses	Nursing students
n (%)	210 (29.66)	498 (70.34)
Mean age, years (SD)	43.81 (10.90)	22.94 (7.02)
Gender, n (%):		
Male	38 (18.10)	90 (18.07)
Female	170 (80.95)	403 (80.92)
Others	2 (.94)	5 (.80)
Education in climate change and health, n (%):		

Characteristic	Nurses	Nursing students
No	191 (90.52)	279 (56.02)
Yes	19 (9.05)	219 (43.98)
Nurses' workplace, n (%):		
Primary Care	54 (25.71)	NA
Nursing Homes	8 (3.81)	NA
Hospital Care	115 (54.76)	NA
Other	33 (15.71)	NA
Highest course enrolled, n (%):		
First	NA	162 (32.53)
Second	NA	184 (36.95)
Third	NA	133 (26.71)
Fourth	NA	19 (3.82)
Assistance practices, n (%):		
No	NA	338 (67.87)
Yes	NA	160 (32.13)

SD: Standard deviation; NA: not applicable.

Knowledge on Climate Change and the Health of Older People

A total of 708 participants (210 nurses and 498 students) completed the knowledge questionnaire. With regard to knowledge, less than half of the complete sample (42.37%) demonstrated good to excellent knowledge, 54.75% of nurses and 37.15% of undergraduate nursing students (Table 2).

Table 2. Level of knowledge of the participants.

Knowledge	Total sample		Nurses		Students	
	n	%	n	%	n	%
Excellent (11 pts)	1	.14	1	.47	0	0
Very Good (9-10 pts)	75	10.59	28	13.33	47	9.44
Good (7-8 pts)	224	31.64	86	40.95	138	27.71
Not Enough (4-6 pts)	344	48.59	86	40.95	258	51.80
Poor (0-3 pts)	64	9.04	9	4.28	55	11.04

The item with the highest number of correct answers was K2 (*‘Socioeconomic factors affect older people’s ability to adapt to climate change risk’*), with 92.38% of nurses and 88.55% of nursing students. In contrast, item K5 (*‘Extreme heat is the climate change effect that most affects older people’s health’*) was the most mistaken, with 518 (73.16%), 184 (87.62%) nurses, and 334 (67.07%) students choosing the wrong option. Finally, the least known item was K3 (*‘Climate change consequences affect older women’s health more than that of same-age men’*) (413, 58.33%), with 112 (53.33%) nurses and 301 (60.44%) students.

The mean score obtained in the knowledge questionnaire was 6.04 (SD = 1.93) out of a maximum total of 11, with 6.58 (SD = 1.79) for nurses and 5.82 (SD = 1.95) for nursing students. The difference of 0.73 points more on average in the knowledge questionnaire for nurses than for university students was significant ($p < 0.001$) (Table 3).

Nurses with prior training on climate change and health had greater knowledge than those who did not (0.88 points higher on average, $p = 0.041$). In contrast, no significant differences were found between university students based on whether or not they had received such training (Table 3).

Although differences in knowledge were found based on gender, these differences were not significant in either nurses or students (.279 and .077 respectively). This was not the case with regard to age, as a correlation with knowledge was observed in both populations, but in the opposite

direction. Among nurses, the older they were, the less knowledge they had ($p = .019$), whereas among university students, the older they were, the greater their knowledge ($p = .004$) (Table 3).

Knowledge of nurses also varied depending on the workplace ($p = .009$) (Table 3). Dunn’s post hoc comparisons showed that nurses working in other types of care or education centres scored 2.76 points higher on the knowledge questionnaire than those working in primary care ($p = 0.006$) and 2.07 points higher than hospital nurses ($p = 0.039$). Similarly, nurses at nursing homes obtained an average of 2.43 points more than those in primary care ($p = .015$) and 1.97 more than those working in hospitals ($p = .049$). However, after applying the Bonferroni correction, only the first difference in the knowledge questionnaire score was significant ($p = .035$).

Finally, among undergraduate nursing students, a significant correlation was found between having completed assistance practice in health care centre or hospital ($p < .001$) and being in a more advanced academic year ($p = .010$) with a higher knowledge about climate change and the health of older people (Table 3). In general, the higher the course level, the more the knowledge, although only the difference between the first and third courses was significant in Dunn’s post hoc analysis (3.24 points more, $p = .007$).

Table 3. Statistical tests for the KQ-OPEH.

	NURSES	STUDENTS
NURSES-STUDENTS	64084 (< .001)	
Mann Whitney U test (p value)		
PRIOR EDUCATION		
Mann Whitney U test (p value)	2330 (.019)	31063 (.242)
GENDER		
Mann Whitney U test (p value)	3424.50 (.279)	19861 (.077)
AGE		
Spearman rho (p value)	- .17 (.019)	.13 (.004)
WORKPLACE		
Kruskal Wallis (p value)	11.51 (.009)	NA
ASSISTANCE PRACTICES		
Mann Whitney U test (p value)	NA	21832 (< .001)
COURSE ENROLLED		
Kruskal Wallis (p value)	NA	11.26 (.010)

In bold, significant p-values; NA: not applicable.

Skills on Climate Change and the Health Of Older People

A total of 672 participants (197 nurses and 475 students) completed the skills scale. Slightly less than half of the sample (44.94%) perceived that they had good to excellent skills in caring for older adults at climate risk. The group of nurses reported 50.77% good to excellent perceived skills, whereas the nursing students reported 42.52% (Table 4).

Table 4. Level of skills of the participants.

Skills	Total sample		Nurses		Students	
	n	%	n	%	n	%
Excellent (59-65 pts)	33	4.91	6	3.05	27	5.69
Very Good (52-58 pts)	75	11.16	26	13.20	51	10.74
Good (46-51 pts)	194	28.87	68	34.52	124	26.11
Not Enough (33-45 pts)	310	46.13	81	41.12	229	48.21
Poor (13-32 pts)	60	8.93	16	8.12	44	9.26

For both populations, the item with the highest perceived skill was S7 (*‘I am able to assess the housing conditions that pose a risk to older people in case of extreme temperatures’*) (3.80, SD = .87), while the

item with the lowest perceived skill was S5 (*‘I am able to identify the climate change effects that may affect the mental health of older people’*) (2.90, SD = 1.08).

The mean score for the skills scale was 46.81 (SD = 6.41) on a maximum of 65 points, with the main for nurses being 44.86 (SD = 7.97) and students being 43.99 (SD = 9.02). However, this difference in mean scores between the two populations was not statistically significant according to the Mann Whitney U test ($p = .054$) (Table 5).

Prior education on climate change and health resulted in nurses ($p = .027$) and nursing students ($p < .001$) reporting greater perceived skills in caring for older people at climate risk, with higher mean scores of 4.08 ($p = .027$) and 3.65 ($p < .001$) on the SS-OPEH, respectively (Table 5).

As with knowledge, the statistics revealed no significant differences between gender-based skills in either population (nurse and university students, $p = .174$ and $.256$, respectively). Being older and possessing better skills are not related among nurses ($p = .509$), whereas older university students have greater skills ($p < .001$) (Table 5).

The Kruskal-Wallis test showed statistical differences in nurses’ skills based on their workplace ($p = .007$) (Table 5). In particular, Primary Care nurses have higher perceived skills than hospital care nurses, with an average of 1.98 points more on AS-OPEH ($p = .004$). Primary care nurses obtained higher scores than the rest, although the Bonferroni corrections resulted in non-significant values.

In addition, nursing students reported a correlation between completed assistance practice in health centres or hospitals and academic year with perceived environmental skills ($p < 0.001$ in both) (Table 5). Those students who have completed internships have more perceived skills (5.31 higher score, $p < .001$). Third-year students report higher perceived skills than first-year students (an additional average of 5.86 points, $p < .001$) and second-year students (an additional average of 4.46 points, $p < .001$).

Table 5. Statistical tests for the SS-OPEH.

	NURSES	STUDENTS
NURSES-STUDENTS		
Mann Whitney U test (p value)	50477 (.054)	
PRIOR EDUCATION		
Mann Whitney U test (p value)	2147.50 (.027)	34461 (< .001)
GENDER		
Mann Whitney U test (p value)	2950 (.174)	17562 (.256)
AGE		
Spearman rho (p value)	.05 (.509)	.16 (< .001)
WORKPLACE		
Kruskal Wallis (p value)	12.03 (.007)	NA
ASSISTANCE PRACTICES		
Mann Whitney U test (p value)	NA	33450 (< .001)
COURSE ENROLLED		
Kruskal Wallis (p value)	NA	37.52 (< .001)

In bold, significant p-values; NA: not applicable.

Attitudes on Climate Change and the Health of Older People

In total, 648 participants (195 nurses and 453 students) completed the attitude scale. The vast majority of participants (91.18%) had a good to excellent attitude towards the effects of climate change on the health of older adults. In nurses, the proportion in these categories was 98.97%, whereas among students, it was 87.85% (Table 6).

Table 6. Level of participants’ attitudes.

Attitude	Total sample		Nurses		Students	
	N	%	N	%	N	%
Excellent (50-55 pts)	240	37.03	76	38.97	164	36.20
Very Good (44-49 pts)	252	38.88	89	45.64	164	36.20
Good (39-43 pts)	99	15.27	28	14.36	70	15.45
Not Enough (28-38 pts)	52	8.02	1	.51	51	11.26
Poor (11-27 pts)	5	.77	1	.51	4	.88

In both populations, the participants showed a more positive attitude towards item A6 (*‘It is important that health professionals are aware of the consequences of the effects of climate change on the health of older people’*) (4.41, SD = .71), while the greatest disagreement was shown towards item A8 (*‘Health professionals have the responsibility to address climate change impacts on the health of the older population’*) (4.06, SD = .82).

The attitude scale obtained an average score of 46.81 (SD = 6.41) out of a maximum total of 55 points, with significantly higher scores for nurses (47.02, SD = 4.99) than for nursing students (46.33, SD = 6.89) ($p = .013$) (Table 7).

Only a significant relationship was found between prior education on climate change and health and better attitudes among nursing students, 2.62 points higher in AS-OPEH ($p < .001$) (Table 7).

On this occasion, no relationship was found between gender and age and having better attitudes towards caring for older people at risk from climate change in either of the two populations, as the differences were not significant (Table 7).

Similarly, no significant relationship was reported between the attitude level and the nurses’ workplace ($p = .310$) (Table 7).

On the other hand, among university nursing students, a relationship was found between having external practices ($p = 0.03$) and the academic year completed ($p = .032$) with better environmental attitudes (Table 7). More specifically, 1.73 higher score ($p = .012$) than those who have not practices yet. Attitudes also increase as the year of study progresses ($p = .032$), with a significant difference between the third and first years in terms of the AS-OPEH score (2.76 points higher on average, $p = .035$)

Table 7. Statistical tests for the AS-OPEH.

	NURSES	STUDENTS
NURSES-STUDENTS	48999 (.013)	
Mann Whitney U test (p value)		
PRIOR EDUCATION		
Mann Whitney U test (p value)	1763.50 (.348)	30014.50 (< .001)
GENDER		
Mann Whitney U test (p value)	2009.50 (.985)	16337.50 (.140)
AGE		
Spearman rho (p value)	.05 (.498)	.03 (.518)
WORKPLACE		
Kruskal Wallis (p value)	13.50 (.321)	NA
ASSISTANCE PRACTICES		
Mann Whitney U test (p value)	NA	25763 (.003)
COURSE ENROLLED		
Kruskal Wallis (p value)	NA	9.00 (.029)

In bold, significant p-values; NA: not applicable.

Overall Environmental Competencies

Statistically, knowledge and skills are positively correlated in nurses (weak correlation; $p = .001$), meaning that the more knowledge they have about the effects of climate change on the health of older people, the greater their perceived skills in caring for them. However, no significant relationship was found between knowledge and attitudes ($p = .084$) or between skills and attitudes ($p = .080$) (Table 8).

Knowledge, skills, and attitudes are positively correlated in undergraduate nursing students: the greater the knowledge, the more skills ($p < .001$) and better the attitudes ($p = .009$) the students have. Furthermore, the more perceived skills they have, the better their attitudes are towards the role of nursing in the effects of climate change and the environmental health of older people ($p < .001$) (Table 8).

Table 8. Knowledge-Skills-Attitude correlation.

	Spearman rho (p value)	
	Nurses	Students
KNOWLEDGE-SKILLS	.23 (.001)	.04 (< .001)
KNOWLEDGE-ATTITUDE	.13 (.084)	.12 (.009)
SKILLS-ATTITUDE	.13 (.080)	.13 (< .001)

In bold, significant p-values.

Discussion

The results of our study partially support the main hypothesis, since although nurses have greater environmental competencies in older people’s environmental health than undergraduate nursing students, this is statistically significant in terms of knowledge and attitudes, but not for skills. In general, nurses have moderate knowledge and perceived skills, whereas students have insufficient or poor skills. In contrast, both groups have very high attitudes towards the effect of climate change on the health of older people.

No previous research analysing nurses' environmental competencies regarding the health of older people [14]. Nevertheless, most studies on nurses suggest that their knowledge about climate change and health is moderate, as shown in our research [15,16]. Other researchers, however, found that health professionals had insufficient knowledge about the scientific aspects of climate change [17–19] or more specific aspects of it [20,21]. A study showed that although nurses had good knowledge about climate change and health, more than half were unable to recognise the older population as a group that is particularly vulnerable to its effects [22]. Regarding undergraduate nursing students, our report indicated less knowledge than nurses about the environmental health of older people and the climate risks to which they are exposed. This is consistent with studies that have measured knowledge about climate change and health among nursing students, finding high percentages of insufficient knowledge [23–27]. This lack of knowledge may be due to the fact that the most common sources of information on the consequences of climate change were not official, as various studies point out, nor were they through social media [14,17,23]. We only found greater knowledge in higher-level courses at universities where they had already received some training on the subject, as Aronsson reported [28]. As in our research, some studies found a positive correlation between students’ knowledge and attitudes. This means that greater knowledge leads to better attitudes towards climate change and sustainable practices [26]. Some research has found a relationship between female gender and knowledge [24,25,29], although this was not the finding in our study as in the case of researcher Çetin [27]. As in our results, studies have shown that prior education on climate change and health is associated with greater knowledge and attitudes [27].

Our research showed that skills for caring for older people affected by climate change were greater among nurses, especially those working in primary care. However, this difference was not statistically significant. Although we have not found any articles on this vulnerable population, there is research that reveals the limited skills of nurses [19,30] and nursing students in relation to

environmental health in general [23]. A positive correlation between knowledge and skills has been demonstrated [19]. This could explain the lack of skills due to a deficit of knowledge about climate change and its effects on health [27]. As with knowledge, this study found no significant differences in skills in terms of gender, either among nurses or nursing students. In contrast, research such as that by Álvarez-García and Levine found greater perceived skills among male students [23,31].

The two populations studied in this research demonstrated that the vast majority had excellent attitudes towards how climate change affects the health of older people. This result is repeated in practically all the studies found on environmental attitudes [18,19,22,23,32–36]. Although both demonstrated excellent attitudes towards climate change and the important role of nursing in preventing and mitigating its effects [28], most disagreed with the responsibility of healthcare professionals to address these effects through sustainable care. We found discrepancies between studies in which most nurses recognised that health systems contribute to climate change [22,33] and others in which only a minority were aware of the contribution of the health sector [21,30,37,38]. Although motivated, the participants admitted that they needed more knowledge and skills to respond appropriately [33,37]. Furthermore, several studies have suggested that, in general, there is a disconnect between nurses' awareness of climate change and the implementation of sustainable practices. The main reason reported is the heavy workload they typically face on a daily basis [29,33,39]. Others emphasised meeting patients' immediate needs rather than carrying out environmentally responsible practices [38,40]. Although both nurses and nursing students agreed on the need for healthcare professionals to be aware of the effects of climate change on the health of older people, the majority of participants in both groups in this study had not previously participated in training courses on climate change and health, with this figure being much higher among nurses, as reported by Abdelaziz et al [19]. This reveals a significant challenge, as nurses require ongoing education about climate change, its impact on health, and the role of nursing in addressing the issue [30].

Limitations

The authors identified some aspects that could limit the results to a certain extent. First, as this was a convenience sample, particularly in the case of nursing students, some inherent error may have occurred due to the non-random nature of the sample. An attempt was made to minimise this by using a large sample of participants from different locations throughout the country to achieve the greatest possible representativeness. Second, participation in the study was voluntary, which could mean that the participants were those most interested in environmental issues and, therefore, compromise the generalisation of our results, particularly in the case of attitudes that scored very highly in both study groups. Finally, the possible social desirability bias must be pointed out, as concern for climate change and sustainability is a socially established issue with a high positive value. This bias was reduced by the participants' complete anonymity and the fact that it was a self-administered instrument (which also controls for researcher bias).

Future research

The approach for future projects focuses on creating materials and implementing educational interventions to increase the environmental competencies of nurses and nursing students for the care of older people at climate risk, as the results of this study and the literature suggest that basic nursing training or professional development does not adequately address climate change [16]. Training nursing professionals in climate-related issues is a key step towards modernising the profession. By including this focus in university curricula and research, clinical practice and health policies can be ensured to be aligned with the current planetary reality [41]. We found several actions undertaken in this regard in the literature, including strengthening the content of university degree programmes [42,43], creating online materials and modules for professionals [44], developing educational video games [45], simulation [46], and augmented reality [36].

Conclusion

Although more research is needed, our findings showed that nurses have better environmental competencies than undergraduate nursing students. On the one hand, the greatest differences are found in knowledge and skills. Therefore, it is important for education on climate change and health to be included across the board in the academic curriculum of nursing degrees. At the same time, nurses also need to reinforce these competencies through specific educational programmes. Likewise, prior education on climate change and health increases environmental competencies, such that greater knowledge leads to greater skills and better attitudes towards its effect on the health of older people. On the other hand, attitudes were excellent in both groups, reflecting the fact that they are aware of the vulnerability of this population and the need for health professionals to actively address this issue. The application of this new tool, designed to measure the environmental competencies of older people's health, provides an opportunity to evaluate the transition from 'knowing' to 'doing' and 'wanting to do', leading to a real impact on clinical practice in healthcare for this vulnerable group.

Author Contributions: Conceptualization, EMMR, LPA, IMLM and DPF; Methodology, EMMR, LPA and IMLM; Software, EMMR, LPA and IMLM; Validation, LPA and IMLM; Formal analysis, EMMR, LPA and IMLM; Investigation, EMMR, LPA, IMLM and DPF; Resources, EMMR and DPF; Data curation, EMMR; Writing—original draft preparation, EMMR, LPA and IMLM.; Writing—review and editing, EMMR, LPA, IMLM and DPF; Visualization, EMMR; Supervision, EMMR, LPA and IMLM; Project Administration, LPA and IMLM; Funding Acquisition, EMMR. All authors have read and agreed to the published version of the manuscript.

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Institutional Review Board Statement: The study was conducted in accordance with the Declaration of Helsinki, and approved by the Andalusian Biomedical Research Ethics Committee (PEIBA) (code: Tesis-CCECCSM-2019/0902-N-21 dated: 10/28/2021).

Informed Consent Statement: Informed consent for participation was obtained from all subjects involved in the study.

Public Involvement Statement: Nurses and nursing students were involved in this research through responding to the survey. This study was carried out in accordance with the principles outlined in the Declaration of Helsinki. The research was approved by the Andalusian Biomedical Research Ethics Committee (PEIBA) (code: Tesis-CCECCSM-2019/0902-N-21 dated: 10/28/2021):.

Guidelines and Standards Statement: This manuscript was prepared following the procedures outlined in Strengthening the Reporting of Observational Studies (STROBE) (Supplementary Material 1). A complete list of reporting guidelines can be accessed via the equator network: <https://www.equator-network.org/>.

Use of Artificial Intelligence: AI or AI-assisted tools were not used in drafting any aspect of this manuscript.

Data Availability Statement: The original data presented in the study are openly available in RUJA at <https://hdl.handle.net/10953/6471>. The instrument Nursing Competencies Questionnaire on Older People's Environmental Health (NCQ-OPEH) can be consulted at <https://hdl.handle.net/10953/7389>

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References

1. 1.González DS, Alvarado RC. Envejecimiento de la población y cambio climático. Granada:Comares;2019

2. 2.Casado J M R, editor. Cambio climático, salud y persona mayor. *An RANM*.2023; 140(01):59–64. <http://dx.doi.org/10.32440/ar.2023.140.01.rev06>
3. 3.Ayalon L, Keating N, Pillemer K, Rabheru K. Climate change and mental health of older persons: A human rights imperative. *Am J Geriatr Psychiatry*.2021;29(10):1038-1040. <https://doi.org/10.1016/j.jagp.2021.06.015>
4. 4.Fields L, Perkiss S, Dean BA, Moroney T. Nursing and the sustainable development goals: a scoping review. *J Nurs Scholarsh*. 2021 Sep;53(5):568-577. <https://doi.org/10.1111/jnu.12675>
5. 5.Ortiz AF. Salud planetaria. *FMC*.2023;30(5):213–217. <https://doi.org/10.1016/j.fmc.2022.10.010>
6. 6.Álvarez-García C, López-Medina IM, Sanz-Martos S, Álvarez-Nieto C. Salud planetaria: educación para una atención sanitaria sostenible. *Educación Médica* 2021;22(6):352–357. <https://doi.org/10.1016/j.edumed.2021.08.001>
7. 7.López-Medina I.M., Álvarez-Nieto C, Grose J, Elsbernd A, Huss N, Huynen M, et al. Competencies on environmental health and pedagogical approaches in the nursing curriculum: A systematic review of the literature. *Nurse Educ Pract*. 2019 May;37:1-8. <https://doi.org/10.1016/j.nepr.2019.04.004>
8. 8.Sayre L, Rhazi N, Carpenter H, Hughes NL. Climate change and human health: the role of nurses in confronting the issue. *Nurs Adm Q* 2010;34(4):334–342. <https://doi.org/10.1097/NAQ.0b013e3181f60df9>
9. 9.Anderko L, Schenk E, Huffling K, Chalupka S. Climate change, health, and nursing: A call to action. Published online 2016. Available from: <https://envirn.org/wp-content/uploads/2017/04/Climate-change-health-and-nursing-1-11-17.pdf>
10. 10.Middleton L, Howard AA, Dohrn J, Von Zinkernagel D, Parham Hopson D, Aranda-Naranjo B, et al. The Nursing Education Partnership Initiative (NEPI) innovations in nursing and midwifery education. *Academic medicine*.2014;89:S24–S28. <https://doi.org/10.1097/ACM.0000000000000342>
11. 11.McDermott-Levy R, Kolanowski AM, Fick DM, Mann ME. Addressing the health risks of climate change in older adults. *J Gerontol Nurs* 2019;45(11):21–29. <https://doi.org/10.3928/00989134-20191011-04>
12. 12.Shaw E, Walpole S, McLean M, Alvarez-Nieto C, Barna S, Bazin K, et al. AMEE Consensus Statement: Planetary health and education for sustainable healthcare. *Med Teach* 2021;43(3):272–286. <https://doi.org/10.1080/0142159X.2020.1860207>
13. 13.Von Elm E, Altman DG, Egger M, Pocock SJ, Gøtzsche P.C., Vandenbroucke JP, et al. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) Statement: guidelines for reporting observational studies. *Int J Surg* 2014;12(12):1495–1499. <https://doi.org/10.1016/j.ijsu.2014.07.014>
14. 14.Portela Dos Santos O, Perruchoud É, Pereira F, Alves P, Verloo H. Measuring nurses' knowledge and awareness of climate change and climate-associated diseases: Systematic review of existing instruments. *Nurs. Rep.* 2024, 14, 2850-2876. <https://doi.org/10.3390/nursrep14040209>
15. 15.Subiza-Pérez M, Vrotsou K, Esnal H, Kortajarena M, Mujika A, Marinelarena E, et al. Environmental health knowledge and competences in Basque health workers. A comparison of different professional profiles. *Environ Res* 2024;243:117789. <https://doi.org/10.1016/j.envres.2023.117789>
16. 16.Iira T, Ruth M, Hannele T, Jouni J, Lauri K, editors. Finnish nurses' perceptions of the health impacts of climate change and their preparation to address those impacts. *Nurs Forum*. 2021 Apr;56(2):365-371. <https://doi.org/10.1111/nuf.12540>
17. 17.Barimah AJ, Abdul-Ganiyu M, Dumba J, Commey RD, Osei-Tutu A, Nketiah YB, et al. Investigating health professionals' understanding and risk perception of the effect of climate change on health. A cross-sectional study at three hospitals in Sunyani, Ghana. *J Public Health Res*. 2025;14(4):22799036251388592. <https://doi.org/10.1177/22799036251388592>
18. 18.Nsengiyumva R, Mukarubayiza MR, Murekatete C, Meharry P. Climate change associated with neonatal health risks: Rwandan nurses and midwives' awareness and perceptions. *Rwanda Journal of Medicine and Health Sciences* 2020;3(2):261–272. <https://doi.org/10.4314/rjmhs.v3i2.15>
19. 19.Abdelaziz FS, Elzeiny A, Fouda NM, Shahin MAH, Alabed HH, Loutfy A. Nurses' Knowledge, Skills, and Attitudes Regarding Climate Change and Its Impact on Children's Health in Egyptian Hospitals: A Comparative Study. *Salud, Ciencia y Tecnología* [Internet]. 2024;25.4.:908. <https://doi.org/10.56294/saludcyt2024.1361>

20. Vandenberg SY, Oosterbroek T, Chircop A, Kellett P. Registered Nurses' Knowledge, Attitudes, and Practices Toward Climate-Sensitive Vector-Borne Diseases: Findings from a Cross-Sectional Survey. *Public Health Nurs* 2025. <https://doi.org/10.1111/phn.70035>

21. Xiao J, Fan W, Deng Y, Li S, Yan P. Nurses' knowledge and attitudes regarding potential impacts of climate change on public health in central of China. *Int. J. Nurs. Sci.*2016;3(2):158–161. <https://doi.org/10.1016/j.ijnss.2016.04.002>

22. Yilma AN, West KP, Sauve HE, Sznajder KK, Hwang G, Baatiema L, et al. Frontline knowledge, attitudes, and practices on climate change and its link to zoonotic diseases: a mixed-methods study of healthcare workers in Ada East, Ghana. 2025. <https://doi.org/10.21203/rs.3.rs-8282544/v1>

23. Álvarez-García C, Álvarez-Nieto C, Sanz-Martos S, Puente-Fernández D, López-Leiva I, Gutiérrez-Puertas L, et al. Undergraduate nursing students' attitudes, knowledge, and skills related to children's environmental health. *J Nurs Educ* 2019;58(7):401–408. <https://doi.org/10.3928/01484834-20190614-04>

24. Elsharkawy SA, Elsheikh AA, Refaat LAR. Knowledge, perception, and practices regarding climate change among students of Al-Azhar University for Girls in Cairo, Egypt. *J Public Health* 2024;32(7):1251–1260. <https://doi.org/10.1007/s10389-023-01901-9>

25. Ali AZ, Hassan AK, Abd Elzaher OM. Knowledge and Reported Practices of Nursing Students Regarding Health Effects of Climate Change in Sohag City. *Assiut Scientific Nursing Journal* 2024;12(42):90–100. <https://doi.org/10.21608/asnj.2024.269676.1789>

26. Yang L, Liao W, Liu C, Zhang N, Zhong S, Huang C. Associations between Knowledge of the Causes and Perceived Impacts of Climate Change: A Cross-Sectional Survey of Medical, Public Health and Nursing Students in Universities in China. *Int J Environ Res Public Health* 2018 Nov 26;15(12). <https://doi.org/10.3390/ijerph15122650>

27. Çetin AÖ, Özdemir ST. Climate Change Related Health Problems and Awareness of Nursing Students: A Cross-Sectional Study. *Nurs Health Sci* 2025;27(3):e70211. <https://doi.org/10.1111/nhs.70211>

28. Aronsson J, Elf M, Warwick P, LoMartire R, Anåker A. The relevance of climate change and sustainability in nursing education: a cross-sectional study of students' perspectives. *BMC nursing* 2025;24:834. <https://doi.org/10.1186/s12912-025-03285-5>

29. Ryan EC, Dubrow R, Sherman JD. Medical, nursing, and physician assistant student knowledge and attitudes toward climate change, pollution, and resource conservation in health care. *BMC Med Educ* 2020 Jun 23;20(1):200. <https://doi.org/10.1186/s12909-020-02099-0>

30. Kalogirou MR, Dahlke S, Davidson S, Yamamoto S. Nurses' perspectives on climate change, health and nursing practice. *J Clin Nurs* 2020;29(23-24):4759–4768. <https://doi.org/10.1111/jocn.15519>

31. Levine DS, Strube MJ. Environmental attitudes, knowledge, intentions and behaviors among college students. *J Soc Psychol* 2012;152(3):308–326. <https://doi.org/10.1080/00224545.2011.604363>

32. Byron L, Akerlof KL. Climate and health concerns of Montana's public and environmental health professionals: a cross-sectional study. *BMC Public Health* 2021;21(1):1778. <https://doi.org/10.1186/s12889-021-11737-1>

33. Polivka BJ, Chaudry RV, Mac Crawford J. Public health nurses' knowledge and attitudes regarding climate change. *Environ Health Perspect* 2011;120(3):321. <https://doi.org/10.1289/ehp.1104025>

34. May K, Noel D. School nurses and climate change. *Annu Rev Nurs Res* 2019;38:275–286. <https://doi.org/10.1891/0739-6686.38.275>

35. Kallio H, Pietilä A, Kangasniemi M. Environmental responsibility in nursing in hospitals: A modified Delphi study of nurses' views. *J Clin Nurs* 2020;29(21-22):4045–4056. <https://doi.org/10.1111/jocn.15429>

36. Álvarez-Nieto C, Álvarez-García C, Parra-Anguila L, Sanz-Martos S, López-Medina I.M. Effectiveness of scenario-based learning and augmented reality for nursing students' attitudes and awareness toward climate change and sustainability. *BMC nursing* 2022;21(1):245. <https://doi.org/10.1186/s12912-022-01023-9>

37. Wilson R, Stanifer SR, Wiggins AT, Walton AL. Oncology Nurses' Awareness, Concern, Motivations, and Behaviors Related to Climate Change and Health. *Clin J Oncol Nurs* 2025;29(6). <https://doi.org/10.1188/25.CJON.474-483>

38. Anåker A, Nilsson M, Holmner Å, Elf M. Nurses' perceptions of climate and environmental issues: A qualitative study. *J Adv Nurs* 2015;71(8):1883–1891. <https://doi.org/10.1111/jan.12655>

39. Ozdemir C, Sahan S, Baykan N. The effect of environmental awareness on climate change worry and waste management in nurses: A cross-sectional study. *J. Public Heal.* 2026;1–8. <https://doi.org/10.1007/s10389-025-02635-6>.
40. Kalogirou MR, Dahlke S, Davidson S, Yamamoto S. How the hospital context influences nurses' environmentally responsible practice: a focused ethnography. *J Adv Nurs* 2021;77(9):3806–3819. <https://doi.org/10.1111/jan.14936>
41. Leffers J, Levy RM, Nicholas PK, Sweeney CF. Mandate for the nursing profession to address climate change through nursing education. *J Nurs Scholarsh* 2017;49(6):679–687. <https://doi.org/10.1111/jnu.12331>
42. Beitz J, de Castro AB. Integrating environmental health into nurse practitioner training-childhood pesticide exposure risk assessment, prevention, and management. *AAOHN J* 2010 -08;58(8):349–355. <https://doi.org/10.1177/216507991005800806>
43. Kligler B, Pinto Zipp G, Rocchetti C, Secic M, Ihde ES. The impact of integrating environmental health into medical school curricula: a survey-based study. *BMC Med Educ* 2021 -01-08;21(1):40. <https://doi.org/10.1186/s12909-020-02458-x>
44. Wong KH, Allen A, Durrani TS. Evaluating Effectiveness of Online Learning Modules in Pediatric Environmental Health Education. *J Med Toxicol* 2020 -07;16(3):269–275. <https://doi.org/10.1007/s13181-019-00746-7>
45. Kihal Talantikite W, Renou D, Magdelaine A, Harang W, Zmirou-Navier D, Deguen S. Development of Serious Games (Equit'Game) to Address Health and Environmental Inequalities: Protocol for an App-Delivered Program to Perform a Territorial Diagnosis. *JMIR Res Protoc* 2020 -1-7;9(1):e11786. <https://doi.org/10.2196/11786>
46. İlaslan N, Orak NŞ. Sustainable healthcare education using cooperative simulation in developing nursing students' knowledge, attitude and skills: A randomized controlled study. *Nurse Educ Today* 2025;151:106706. <https://doi.org/10.1016/j.nedt.2025.106706>

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