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RESEARCH ARTICLE

Promoting eCo-responsibility, eCo-literacy, and eCo-centricity in emergency triAge Regarding climate changE consequences (I-CARE THE 3 Cs): study protocol

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ABSTRACT

Background: Climate change, ambient air pollution, and non-optimal temperatures are recognized as a global health emergency. Many studies have highlighted increases in the number of emergency hospital admissions and hospitalizations for respiratory and cardiovascular diseases associated with non-optimal temperatures, unconventional gas reserves, particulate matter, grounded level O_3, sulphur dioxide, or nitrogen dioxide exposure.

Problem statement: According to the Swiss Health Observatory, 14% of the Swiss population used a hospital emergency department (ED) at least once in 2016, representing 1,7 million admissions or 4,718 admissions per day. In the face of evolving climate-associated reasons for presenting at the ED, the scales used for emergency triage are now proving insufficient for their task. It is becoming critical to introduce and implement more appropriate ED triage tools that incorporate risk factors such as ambient temperature and air pollution. It will also require raising nurses' eco-literacy, eco-responsibility, and eco-centricity, which are currently rated as moderate to low, to ensure adaptation and/or mitigation in the face of this global threat.

Future directions and perspectives for the nursing discipline: The nursing discipline must develop its eco-literacy, eco-responsibility, and eco-centricity to take social and professional responsibility for addressing the health-related impacts of climate change. To do so, the research project's overall aim, which will be achieved in five stages, is to develop, pilot-test, and evaluate the feasibility of a complex nursing intervention named "Education Intervention promoting eCo-literacy, eCo-responsibility, and eCo-centricity in emergency triAge Regarding climate changE consequences (I-CARE the 3 Cs). The *I-CARE the 3 Cs* intervention aims to provide an adequate, effective, efficient, fair, safe, and patient-centered response to patients' and nurses' needs and to develop guidelines for dealing with the health consequences of climate change.

Keywords: Health Literacy; Change; Global Warming; Education; Nurses; Complex Intervention.

1. Introduction

Since 2019, climate change has become a recognized global threat to human health in the same way as non-communicable and cardiovascular diseases[1]. Indeed, human activity led to the "Anthropocene" era[2]. Nine out of ten people in the world breathe poor-quality air, and 4–9 million premature deaths annually are associated with polluting emissions[3,4]. Non-optimal temperatures are now responsible for an increase of 7% since 2015 and 66% since 2000 in excess deaths[5]. Climate change causes many direct (anxiety, heart failure, malnutrition, or dehydration) and indirect (asthma, chronic obstructive pulmonary disease, myocardial infarction, and stroke) adverse health problems for human beings[2,6,7]. The characteristics of the Valais Alps, in Switzerland, make it a particularly high-risk region for its residents. Indeed, it is one of the country's driest regions, with summer precipitation 30%–50% below the expected values in other areas[8]. Air pollution can reach high levels during the coldest winter and hottest summer months[9], and the thickness of its ground-level ozone (O_3) layer varies significantly with the seasons[10].

Many studies have been conducted about health and climate change, including in Switzerland with its SALPADIA cohort[11]. These have highlighted increases in the number of emergency hospital admissions[12,13], and hospitalizations for respiratory and cardiovascular diseases associated with non-optimal temperatures and the development of unconventional gas reserves[2,6,7], premature mortality related to particulate matter (PM_{10}), grounded-level O_3 and non-optimal temperatures[14–17], decreases in lung function or chronic obstructive pulmonary disease linked to sulphur dioxide (SO_2), nitrogen dioxide (NO_2) and PM_{10} exposure[18–20], or exposure to PM_{10} and NO_2 in association with pre-existing diabetes mellitus[21]. According to the Swiss Health Observatory, 14% of the Swiss population used a hospital emergency department (ED) at least once in 2016, representing 1,7 million admissions or 4,718 admissions per day[2]. Pollution levels in Switzerland have nevertheless managed to stay below the World Health Organization's (WHO) target in 13 out of 20 cities. These findings are a warning signal that should immediately raise awareness and cause changes in behavior[22].

Emergency triage systems are set up to ensure efficient, high-quality care and patient safety. The scales used to do this are based on classifying the reasons for the patient's consultation or admission and estimating their vital parameters and pain. However, on one hand, a systematic review conducted by Farrohknia et al.[23], the level of emergency nurses triage is estimated as low to moderate. On the other hand, in the face of evolving climate-associated reasons for presenting at the ED, the current triage tools are now proving insufficient for their task. It is becoming critical to introduce and implement more appropriate ED triage tools that incorporate risk factors such as ambient temperature and air pollution[2]. It will also require raising nurses' awareness, skills, and knowledge about these new climate-induced parameters. However, different studies have shown that nurses' knowledge about the health-related impacts of climate change—their *eco-literacy*—is low. Moreover, nurses only showed moderate awareness of climate

change's impacts on the population and planetary health[24–26]. Eco-literacy incorporates behaviors, attitudes, practices, and knowledge about ecosystem maintenance and protection, and all the external conditions affecting human health[22]. *Eco-responsibility* is described as a central component of eco-literacy. It is a person's aptitude to consider the principle of showing long-term respect for their overall physical, social, and economic environment[27]. Finally, the accepted environmental metaparadigm has led nurses to have an *egocentric* and *endemic blindness* to climate change. Therefore, a more *eco-centric* perspective should be adopted[28,29]. The nursing profession must develop its eco-literacy, eco-responsibility, and eco-centricity to take social and professional responsibility for addressing the health-related impacts of climate change.

2. Research method

Responding to the needs arising from the consequences of climate change suggests that a complex intervention would be most appropriate. The present project's overall aim is to develop, pilot-test, and evaluate the feasibility of a complex nursing intervention able to promote eco-literacy, eco-responsibility, and eco-centricity among ED nurses performing emergency triage in the Valais Hospital's EDs (in Sion and Martigny) (Appendices 1). The project's research hypotheses are: a) Introducing and implementing a triage tool that takes into account the health-related consequences of climate change can be associated with the development of a high level of eco-literacy, eco-responsibility, and eco-centricity among ED nurses, as measured using a validated instrument (immediate outcomes); and b) A high level of eco-literacy, eco-responsibility, and eco-centricity among ED nurses can be associated with a reduction in consultations /hospitalizations, more effective prevention of the health consequences of climate change, increases in patients' levels of eco-literacy an eco-responsibility, more efficient care tailored to the population's needs, and improved quality of care and patient safety, as measured using adult ED admission data, focus groups, ED nurses' and patients' levels of satisfaction, and patients' trust in nurses and feelings of safety (ultimate outcomes).

A global problem such as climate change requires a broader vision. The theoretical framework chosen for this research project is *The Conceptual Model of Enhancing Equity and Quality: Population Health and Health Policy*[30]. This model has a quadruple focus (equity, quality, population health, and health policy) and consists of seven multidimensional concepts (environment, population factors, population health concerns, health policy, population-centered, nursology activities, population quality of life, and stakeholders)[30]. The concepts of Implementation science will be used to ensure an effective, efficient implementation process for our complex intervention[31].

2.1 AIM, RESEARCH QUESTIONS, AND DESIGN – STAGE 1: UNDERSTANDING THE CURRENT SITUATION AND THE PROBLEM

Stage one is made up of two different studies. The first is a longitudinal, descriptive, multicentre, mixed-methods study. Adult ED admission data will be assessed for cardiovascular and pulmonary disorders and their associated comorbidities and then

evaluated against weather conditions. This study's three aims are: a) To determine if there are any fluctuations in the numbers of ED consultations for adult cardiovascular and pulmonary diseases/ disorders/ mortality across the four seasons (autumn, winter, spring, and summer). Data collection will occur over 4 weeks in each season. The *Research Randomizer* website (https://www.randomizer.org) will be used to randomly choose 4 weeks from the 12 in the season; b) To identify the profile of the population consulting EDs for adult cardiovascular and pulmonary diseases/ disorders/mortality and any associations with temperature changes and variations in air quality; and c) To explore the perceptions, experiences, expertise, and feelings of the populations at risk. The different hypotheses linked to the study will test whether there are associations between ED consultations for adult cardiovascular and pulmonary diseases/ disorders/ mortality and maximum and minimum temperatures (T_{max}, T_{min}), NO_2, PM_{10}, SO_2, and O_3 concentrations in central Valais' microclimate during the four weeks selected each season. The hypotheses for the second and third objectives will test whether there are associations between the perceptions, experiences, expertise, and feelings of the populations at risk and their sociodemographic variables, as well as between the social determinants of health (SDOH) and wellness, illness, and disease conditions. This third aim will be addressed through focus groups using hermeneutic interpretative phenomenology.

The second study is a descriptive study based on a systematic review aimed at identifying the existing validated instruments able to measure nurses' knowledge and awareness of climate change and climate-associated diseases, i.e., to measure their eco-responsibility, eco-literacy, and eco-centricity . Once the tool has been chosen, a validation process in French will be carried out, as well as exploratory factor analysis. We will investigate whether Valais ED nurses' knowledge, awareness, motivations, attitudes, behaviour, beliefs, skills, and competencies related to climate change and climate-associated diseases differ from those of Canadian ED nurses and US public health nurses.

2.2 AIM, RESEARCH QUESTIONS, AND DESIGN – STAGE 2: DEVELOPMENT

Once the situation has been assessed, it will be necessary to respond to the needs identified. To do so, two different studies will constitute the Development stage. The first will be a pre-implementation, sequential, descriptive, explanatory, transversal, multicentre, mixed-methods study that will describe the facilitating and constraining factors that may influence the implementation of an educational intervention, i.e., complex intervention. The three specific objectives are a) to measure and explore ED nurses' perceptions and feelings about implementing innovation and changes to their practices,b) to evaluate their openness to change, and c) to evaluate ED's culture concerning innovations. The research hypothesis will be that there are associations between the sociodemographic variables of *Age*, *Years of professional experience,* and *Place of work* and nurses' scores for openness to, readiness for, and adoption of change. These findings will enable us to construct an implementation process tailored to the characteristics of ED professionals and their clinical field.

For the study's quantitative component, change and some of its processes will be measured using three self-administered questionnaires: the Organizational Change Questionnaire–Climate of Change, Processes, and Readiness (OCQ–CPR)[32], the Organizational Readiness for Change (ORC) assessment instrument[33] and Prochaska's stages of change[34]. For the qualitative component, homogenous focus groups will be conducted based on Redmond and Côté-Arsenault recommendations[35,36] and the questions proposed by Damschroder *et al.*[37]. Coding of the verbatim transcriptions will be done using deductive essentialist/realist thematic analysis. Each theme will be evaluated using the Consolidated Framework for Implementation Research (CFIR) Rating Rules coding grid, by investigators individually and then to form a consensus, using N-Vivo® 12 software[37].

The second study will aim to build the *I-CARE the 3 Cs* intervention by developing the protocol and manual intervention (construct validity). To do so, a normative, two-part Delphi design study will be constructed. A comprehensive list encompassing all items covered by the instruments evaluated in the systematic review (Stage 1) will be compiled and presented to experts. An international, multidisciplinary panel of experts will be selected based on the study's objectives and research questions and by outreach using several strategies: contacting international professional associations, universities, and hospitals, a search of the relevant literature, LinkedIn contacts, personal recommendations, the Intergovernmental Panel on Climate Change (IPCC) and any study materials available in English, French, Portuguese, or German[38]. Between-participant anonymity will be ensured, and feedback will be controlled, with statistical summaries (median/means and range of group responses) about the average response, changes between rounds, or any modifications of the survey instruments will be guaranteed. The chosen data collection method is e-mail, and experts will be given three weeks to respond to each round, and up to three reminders will be sent per round. In the first round, experts will have to answer the following question: *Which items from the tools selected in the systematic review are most relevant when triaging emergency department patients whose presentation may be climate-associated?* Experts' ratings will be categorized as low scores (ratings 1–2), medium scores (rating 3), and high scores (ratings 4–5) for each item's clarity, relevance, and applicability or appropriateness. A cut-off point for dropping items will also be established[39,40]. For the second round, experts will have to answer the question: *If necessary, considering your experience, would you add an item that has not yet been considered?* An inductive content analysis of the experts' responses will be performed on emerging themes[38]. The final list of items will be pre-tested to help identify ambiguities and improve the administration process. Finally, a consensus will have to be reached on which items to include. The degree of agreement that the experts should reach by the end of the study, i.e. a limited number of rounds or a consensus threshold[39,40] will be specified. The Guidance on Conducting and Reporting Delphi Studies (CREDES)[41] will be followed. Once the study is completed, modeling the *I-CARE the 3 Cs* intervention will be guided by the CReDECI 2 criteria list[42]. With regards to

our intervention delivery methods and pedagogical strategies, the systematic review conducted by Portela *et al.*[43] suggested using different educational strategies combining multiple learning pathways and techniques with regular follow-up and feedback from mentors and leaders.

2.3 *AIM, RESEARCH QUESTIONS, AND DESIGN – STAGE 3: TESTING*

The third stage aims to use a quasi-experimental, interrupted time series study to evaluate the feasibility, appropriateness, fidelity, acceptability, and effectiveness of implementing the *I-CARE the 3 Cs* intervention (internal and external validity)[44]. The study will take place around the *I-CARE the 3 Cs* intervention's implementation, using the same methodology and data collection as in stages one and two. Five outcomes will be measured and explored: a) ED nurses' perceptions of and feelings about the implementation of innovations and changes in practices, and how they evaluate their openness to change and the ED's culture about innovations, to be measured using the same instruments as in Stage 2; b) ED nurses' knowledge, awareness, motivation, attitudes, behaviors, beliefs, skills and competencies regarding climate change and climate-associated diseases, to be measured using a selected validated instrument (Stage 1); c) Nurses satisfaction with the intervention; d) The perceptions, experiences, expertise, and feelings of the populations at risk before, during and after the implementation; and e) Patient-related experience outcomes by evaluating their trust in nurses using the validated French language version of the Trust in Nurses Scale[45] and their feelings of safety through focus groups (PROMs and PREMs). Feasibility, reliability, appropriateness, and acceptability have fundamental roles in implementation research and serve as indicators of the implementation process's effects. The intervention's feasibility will be explored using a focus group and the Feasibility Intervention Measure (FIM)[46]. The intervention's reliability will be measured using the Intervention Capacity Assessment (ICA). The Acceptability of Intervention Measure (AIM) and the Intervention Appropriateness Measure (IAM) will also be administered[47]. Finally, monthly case conferences will be held with ED nurses to ensure quality, consistency, and adherence to the intervention's guidelines. Specific cases will be discussed, and nurses will be able to share their experiences and reflect on the cases presented[46]. We hypothesize that ED nurses' perceptions and feelings about the implementation of innovation and changes in practices, and how they evaluate their openness to change and the ED's culture regarding innovations in per-implementation are better than in pre-implementation, as are their knowledge, awareness, motivation, attitudes, behaviors, beliefs, skills and competencies regarding climate change and climate-associated diseases. We hypothesize that they will be satisfied with the delivery methods and pedagogical strategies used to implement the *I-CARE the 3 Cs* intervention. Regarding patients, we hypothesize that their perceptions, experiences, expertise, and feelings will be more positive in per-implementation, compared to pre-implementation, and that they will trust nurses and feel safer regarding their ED care following the *I-CARE the 3 Cs* intervention.

4. Discussion

With the scientific reality of climate change now accepted, the focus of action must spread from the scientific realm to the policy realm. At a more meta-level, this type of study should impact public health policy and help guide political decision-making in matters of healthcare and the revision of existing ED guidelines (14). The *I-CARE the 3 Cs intervention* aims to provide an adequate, effective, efficient, fair, safe, and patient-centered response to patients' and nurses' needs, and to develop guidelines for dealing with the health consequences of climate change (clinical utility). Nurses must adapt their practices to this reality if they are to become agents of change.

5. Conclusion

In 1995 already, the Institute of Medicine suggested that nurses were inadequately prepared for and educated about climate change and its health consequences[48]. The first step to addressing this issue is investing in undergraduate and continuing education to include more information about environmental health and climate-conscious care. Nurses need to have a comprehensive knowledge of environmental health issues to perform their individual and professional duties to the best of their ability. Indeed, nursing's challenge is not only to be more aware and knowledgeable about the climate's impact on health but also to maintain and adapt their expertise by implementing changes in practice. To fulfil their missions, they need to develop and transmit their competencies, skills, behaviors, awareness, and attitudes regarding climate change and climate-associated, that is eco-responsibility, eco-literacy, and eco-centrism. Once these crucial competencies to reduce the direct and indirect negative effects of climate change are evaluated, it is necessary to promote them.

For the nursing discipline to achieve its paradigm shift, the implementation of complex nursing interventions is the best strategy. To guarantee the appropriateness and added value of the innovation, it is necessary to conduct an implementation process, in pre-, per-, and post-implementation. Indeed, recommendations from the implementation sciences suggest that variables, such as sociodemographic variables, ED nurses' perceptions, and feelings about the implementation of innovations and changes in practices, ED's openness to change, or ED's culture about innovations, must be assessed to guarantee the specific characteristics and needs of the stakeholders and the clinical field. Respecting this process offers a tailor-made implementation process.

Conflict of Interest:

The authors declare no conflict of interest.

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Ethics considerations

This project's research protocol will be presented to its different partners. It is subject to Switzerland's Human Research Legislation, and an authorization request will be presented to Swiss Ethics. The support of the University of Applied Sciences and Arts Western Switzerland's (HES-SO) Applied Ethics Department, headed by Mr Jean-Gabriel Piguet, has been ensured. Study participants will sign an informed consent form. All study materials will be kept as long as required on a secure server at the HES-SO, Valais–Wallis.

Authors contribution

OPS, HV, and PJPA contributed to the study.

References:

1. Braitberg G. Climate change can be seen through a disaster medicine lens. *Med J Aust*. 2022;217(9):464-465. doi:10.5694/MJA2.51730

2. Filippini M, Masiero G, Steinbach S. The impact of ambient air pollution on hospital admissions. *European Journal of Health Economics*. 2019;20(6):919-931. doi:10.1007/S10198-019-01049-Y/TABLES/5

3. Costa S, Leitão MJ;, Taylor M, et al. Climate Change Prevention through Community Actions and Empowerment: A Scoping Review. *International Journal of Environmental Research and Public Health 2022, Vol 19, Page 14645*. 2022;19(22):14645. doi:10.3390/IJERPH192214645

4. Khomenko S, Pisoni E, Thunis P, et al. Spatial and sector-specific contributions of emissions to ambient air pollution and mortality in European cities: a health impact assessment. *Lancet Public Health*. 2023;8(7):e546-e558. doi:10.1016/s2468-2667(23)00106-8

5. de Schrijver E, Bundo M, Ragettli MS, et al. Nationwide Analysis of the Heat- and Cold-Related Mortality Trends in Switzerland between 1969 and 2017: The Role of Population Aging. *Environ Health Perspect*. 2022;130(3). doi:10.1289/EHP9835

6. Trickey KS, Chen Z, Sanghavi P. Hospitalisations for cardiovascular and respiratory disease among older adults living near unconventional natural gas development: a difference-in-differences analysis. *Lancet Planet Health*. 2023;7(3):e187-e196. doi:10.1016/S2542-5196(23)00009-8

7. Vicedo-Cabrera AM, Chen K. Living in a highly polluted and warmer environment: Challenges for cardiovascular prevention. *Eur J Prev Cardiol*. 2020;27(5):511-512. doi:10.1177/2047487319871708

8. Climat des Alpes - Bulletin du semestre d'été 2022 - MétéoSuisse. Accessed February 15, 2023. https://www.meteosuisse.admin.ch/services-et-publications/publications/rapports-et-bulletins/2022/climat-des-alpes-bulletin-du-semestre-d-ete-2022.html

9. Peters A, Schneider A. Cardiovascular risks of climate change. *Nat Rev Cardiol*. 2021;18(1). doi:10.1038/S41569-020-00473-5

10. Rust D;, Katharopoulos I;, Vollmer MK;, et al. Rights / license: Creative Commons Attribution 4.0 International Swiss halocarbon emissions for 2019 to 2020 assessed from regional atmospheric observations. *Atmos Chem Phys*. 2022;22(4):2447-2466. doi:10.3929/ethz-b-000536610

11. SAPALDIA_fr. Accessed June 19, 2023. https://www.swisstph.ch/fr/topics/non-communicable-diseases/human-biomonitoring/sapaldia-fr

12. Ragettli MS, Vicedo-Cabrera AM, Flückiger B, Röösli M. Impact of the warm summer 2015 on emergency hospital admissions in Switzerland. *Environ Health*. 2019;18(1):1-10. doi:10.1186/S12940-019-0507-1/FIGURES/3

13. Cicci KR, Maltby A, Clemens KK, et al. High Temperatures and Cardiovascular-Related Morbidity: A Scoping Review. *Int J Environ Res Public Health*. 2022;19(18). doi:10.3390/IJERPH191811243

14. van Daalen KR, Romanello M, Rocklöv J, et al. The 2022 Europe report of the Lancet Countdown on health and climate change: towards a climate resilient future. *Lancet*

Public Health. 2022;7(11):e942-e965. doi:10.1016/S2468-2667(22)00197-9

15. Vicedo-Cabrera AM, Sera F, Liu C, et al. Short term association between ozone and mortality: global two stage time series study in 406 locations in 20 countries. *BMJ*. 2020;368. doi:10.1136/BMJ.M108

16. Sera F, Armstrong B, Tobias A, et al. How urban characteristics affect vulnerability to heat and cold: a multi-country analysis. *Int J Epidemiol*. 2019;48(4):1101-1112. doi:10.1093/IJE/DYZ008

17. Eze IC, Schaffner E, Foraster M, et al. Long-Term Exposure to Ambient Air Pollution and Metabolic Syndrome in Adults. *PLoS One*. 2015;10(6). doi:10.1371/JOURNAL.PONE.0130337

18. Ackermann-Liebrich U, Leuenberger P, Schwartz J, et al. Lung function and long term exposure to air pollutants in Switzerland. Study on Air Pollution and Lung Diseases in Adults (SAPALDIA) Team. *Am J Respir Crit Care Med*. 1997;155(1):122-129. doi:10.1164/AJRCCM.155.1.9001300

19. Bayer-Oglesby L, Schindler C, Hazenkamp-Von Arx ME, et al. Living near main streets and respiratory symptoms in adults: the Swiss Cohort Study on Air Pollution and Lung Diseases in Adults. *Am J Epidemiol*. 2006;164(12):1190-1198. doi:10.1093/AJE/KWJ338

20. Mehta AJ, Miedinger D, Keidel D, et al. Occupational exposure to dusts, gases, and fumes and incidence of chronic obstructive pulmonary disease in the Swiss Cohort Study on Air Pollution and Lung and Heart Diseases in Adults. *Am J Respir Crit Care Med*. 2012;185(12):1292-1300. doi:10.1164/RCCM.201110-1917OC

21. Eze IC, Schaffner E, Fischer E, et al. Long-term air pollution exposure and diabetes in a population-based Swiss cohort. *Environ Int*. 2014;70:95-105. doi:10.1016/J.ENVINT.2014.05.014

22. Spínola H. Entre a literacia e a cultura ambiental. *Literacia científica: ensino, aprendizagem e quotidiano*. Published online 2021:27-40. doi:10.34640/UNIVERSIDADEMADEIRA2021SPINOLA

23. Farrohknia N, Castrén M, Ehrenberg A, et al. Emergency Department Triage Scales and Their Components: A Systematic Review of the Scientific Evidence. *Scand J Trauma Resusc Emerg Med*. 2011;19(1):1-13. doi:10.1186/1757-7241-19-42/TABLES/8

24. Polivka BJ, Chaudry R V., Mac Crawford J. Public health nurses' knowledge and attitudes regarding climate change. *Environ Health Perspect*. 2012;120(3):321-325. doi:10.1289/EHP.1104025

25. 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. doi:10.1111/JOCN.15519

26. Schenk EC, Cook C, Demorest S, Burduli E. Climate, Health, and Nursing Tool (CHANT): Initial survey results. *Public Health Nurs*. 2021;38(2):152-159. doi:10.1111/PHN.12864

27. McBeth W, Volk T. The National Environmental Literacy Project: A Baseline Study of Middle Grade Students in the United States. *http://dx.doi.org/101080/00958960903210031* . 2010;41(1):55-67. doi:10.1080/00958960903210031

28. Griggs C, Fernandez A, Callanan M. Nursing and the barriers to sustainable health care: a literature review. https://doi.org/1012968/bjon201726221230. 2017;26(22):1230-1237. doi:10.12968/BJON.2017.26.22.1230

29. Portela Dos Santos O, Melly P, Joost S, Verloo H. Climate Change, Environmental Health, and Challenges for Nursing Discipline. *Int J Environ Res Public Health*. 2023;20(9). doi:10.3390/IJERPH20095682

30. Moss MP, Phillips JM, Trent-Adams S, et al. Health Equity and Nursing. *Health Equity and Nursing: Achieving Equity Through Policy, Population Health, and Interprofessional Collaboration*. Published online January 13, 2021:1-341. doi:10.1891/9780826195074

31. Albers B, Schulthes MT, Brauchli P, Naef R, Von Wyl V, Clack L. Implementation science in Switzerland: It's time to seize the opportunity. *Swiss Med Wkly*. 2022;152(4950):40021-40021. doi:10.57187/SMW.2022.40021

32. Bouckenooghe D, Devos G, Van Den Broeck H. Organizational Change Questionnaire–Climate of Change, Processes, and Readiness: Development of a New Instrument. http://dx.doi.org/101080/00223980903218216. 2010;143(6):559-599. doi:10.1080/00223980903218216

33. Holt DT, Armenakis AA, Feild HS, Harris SG. Readiness for organizational change: The systematic development of a scale. *Journal of Applied Behavioral Science*. 2007;43(2):232-255. doi:10.1177/0021886306295295

34. Prochask JO, Norcross JC. Stages of change. *Psychotherapy*. 2001;38(4):443-448. doi:10.1037/0033-3204.38.4.443

35. Redmond R, Curtis E. Focus groups: principles and process. *Nurse Res*. 2009;16(3):57-69. doi:10.7748/NR2009.04.16.3.57.C6946

36. Côté-Arsenault D, Morrison-Beedy D. Maintaining your focus in focus groups: avoiding common mistakes. *Res Nurs Health*. 2005;28(2):172-179. doi:10.1002/NUR.20063

37. Damschroder LJ, Aron DC, Keith RE, Kirsh SR, Alexander JA, Lowery JC. Fostering implementation of health services research findings into practice: A consolidated framework for advancing implementation science. *Implementation Science*. 2009;4(1):1-15. doi:10.1186/1748-5908-4-50/TABLES/1

38. Massaroli A, Martini JG, Lino MM, Spenassato D, Massaroli R. Método Delphi como referencial metodológico para a pesquisa em Enfermagem. *Texto & contexto enferm*. 2017;26(4):e1110017-e1110017. doi:10.1590/0104-07072017001110017

39. Diamond IR, Grant RC, Feldman BM, et al. Defining consensus: a systematic review recommends methodologic criteria for reporting of Delphi studies. *J Clin Epidemiol*. 2014;67(4):401-409. doi:10.1016/J.JCLINEPI.2013.12.002

40. Barrios M, Guilera G, Nuño L, Gómez-Benito J. Consensus in the delphi method: What makes a decision change? *Technol Forecast Soc Change*. 2021;163:120484. doi:10.1016/J.TECHFORE.2020.120484

41. Guidance on Conducting and REporting DElphi Studies (CREDES) in palliative care: Recommendations based on a methodological systematic review | EQUATOR Network. Accessed August 15, 2023. https://www.equator-network.org/reporting-guidelines/credes/

42. Möhler R, Köpke S, Meyer G. Criteria for Reporting the Development and Evaluation of Complex Interventions in healthcare: revised guideline (CReDECI 2). *Trials*. 2015;16(1). doi:10.1186/S13063-015-0709-Y

43. Portela Dos Santos O, Melly P, Hilfiker R, et al. Effectiveness of Educational Interventions to Increase Skills in Evidence-Based Practice among Nurses: The EDITcare Systematic Review. *Healthcare 2022, Vol 10, Page 2204*. 2022;10(11):2204. doi:10.3390/HEALTHCARE10112204

44. Bernal JL, Cummins S, Gasparrini A. Interrupted time series regression for the evaluation of public health interventions: a tutorial. *Int J Epidemiol*. 2017;46(1):348. doi:10.1093/IJE/DYW098

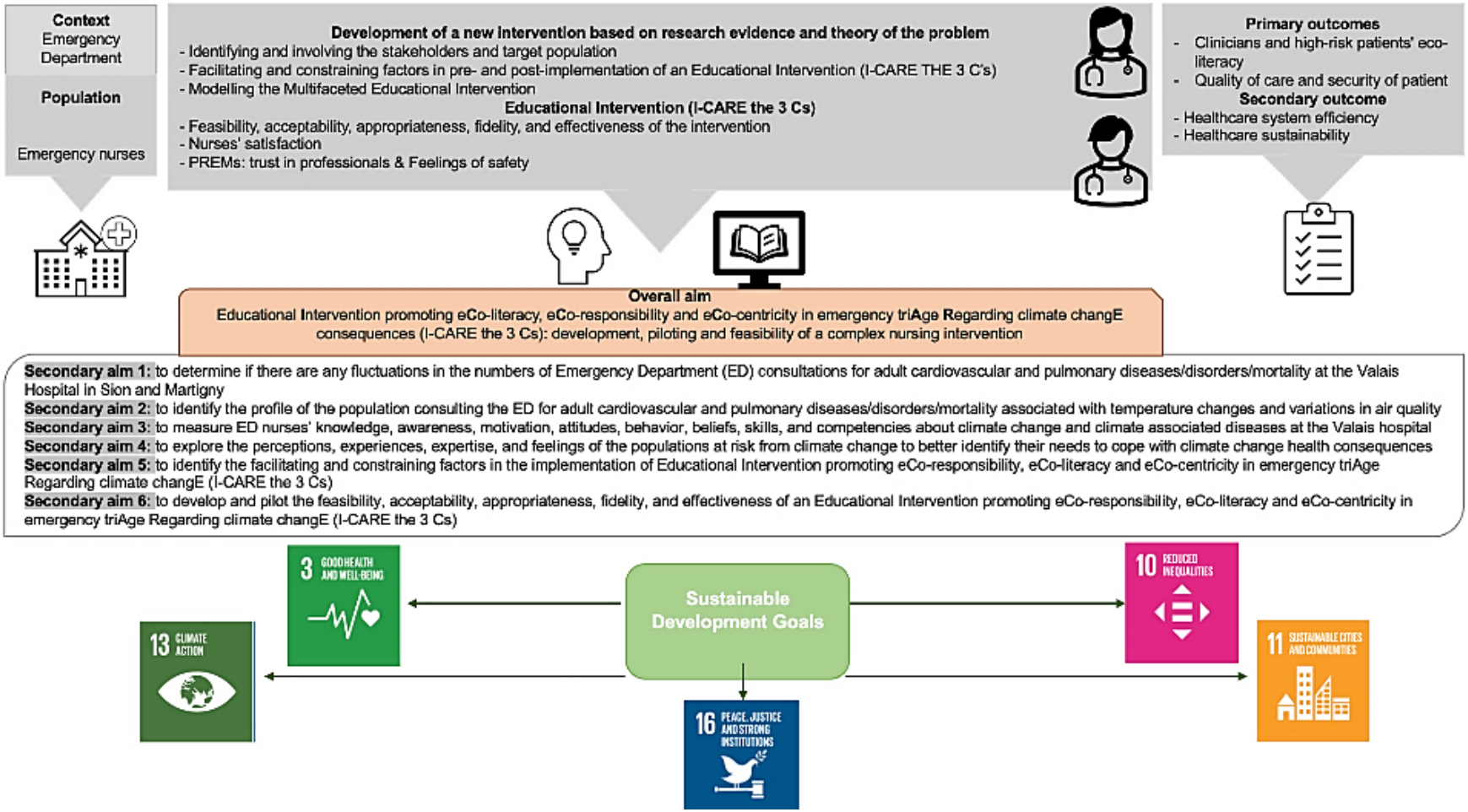
45. Ku E, ak ak, Ku W, et al. Trust in Nurse Scale Developed on the Basis of the Standardized Trust in Physician Scale by Anderson and Dedrick. *Mater Sociomed*. 2019;31(1):57. doi:10.5455/MSM.2019.31.57-61

46. Oesch S, Verweij L, Clack L, Finch T, Riguzzi M, Naef R. Implementation of a multicomponent family support intervention in adult intensive care units: study protocol for an embedded mixed-methods multiple case study (FICUS implementation study). *BMJ Open*. 2023;13(8):e074142. doi:10.1136/BMJOPEN-2023-074142

47. Kien C, Schultes MT, Szelag M, Schoberberger R, Gartlehner G. German language questionnaires for assessing implementation constructs and outcomes of psychosocial and health-related interventions: A systematic review. *Implementation Science*. 2018;13(1):1-16. doi:10.1186/S13012-018-0837-3/FIGURES/3

48. Pope, A.M., Snyder, M.A., Mood, L.H. (1995). Nursing, health, & the environment: Strengthening the relationship to improve the public's health. Washington, DC: Institute of Medicine, National Academy Press. *Image: the Journal of Nursing Scholarship*. 1996;28(1):81-81. doi:10.1111/J.1547-5069.1996.TB01184.X

Appendix 1


Context
Emergency Department
Population
Emergency nurses
Development of a new intervention based on research evidence and theory of the problem
- Identifying and involving the stakeholders and target population
- Facilitating and constraining factors in pre- and post-implementation of an Educational Intervention (I-CARE THE 3 C's)
- Modelling the Multifaceted Educational Intervention
Educational Intervention (I-CARE the 3 Cs)
- Feasibility, acceptability, appropriateness, fidelity, and effectiveness of the intervention
- Nurses' satisfaction
- PREMs: trust in professionals & Feelings of safety
Primary outcomes
- Clinicians and high-risk patients' eco-literacy
- Quality of care and security of patient
Secondary outcome
- Healthcare system efficiency
- Healthcare sustainability
Overall aim
Educational Intervention promoting eCo-literacy, eCo-responsibility and eCo-centricity in emergency triAge Regarding climate changE consequences (I-CARE the 3 Cs): development, piloting and feasibility of a complex nursing intervention
Secondary aim 1: to determine if there are any fluctuations in the numbers of Emergency Department (ED) consultations for adult cardiovascular and pulmonary diseases/disorders/mortality at the Valais Hospital in Sion and Martigny
Secondary aim 2: to identify the profile of the population consulting the ED for adult cardiovascular and pulmonary diseases/disorders/mortality associated with temperature changes and variations in air quality
Secondary aim 3: to measure ED nurses' knowledge, awareness, motivation, attitudes, behavior, beliefs, skills, and competencies about climate change and climate associated diseases at the Valais hospital
Secondary aim 4: to explore the perceptions, experiences, expertise, and feelings of the populations at risk from climate change to better identify their needs to cope with climate change health consequences
Secondary aim 5: to identify the facilitating and constraining factors in the implementation of Educational Intervention promoting eCo-responsibility, eCo-literacy and eCo-centricity in emergency triAge Regarding climate changE (I-CARE the 3 Cs)
Secondary aim 6: to develop and pilot the feasibility, acceptability, appropriateness, fidelity, and effectiveness of an Educational Intervention promoting eCo-responsibility, eCo-literacy and eCo-centricity in emergency triAge Regarding climate changE (I-CARE the 3 Cs)
3 GOOD HEALTH AND WELL-BEING
13 CLIMATE ACTION
Sustainable Development Goals
16 PEACE, JUSTICE AND STRONG INSTITUTIONS
10 REDUCED INEQUALITIES
11 SUSTAINABLE CITIES AND COMMUNITIES