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Implementation and Program Evaluation Pilot Study: Educating Health Care Providers
about Protecting Population Health During Climate Change

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A clinical research project
submitted to the Graduate Faculty of
James Madison University

In

Partial Fulfillment of the Requirements

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Abstract

Recommendations regarding the need to prepare nurses and other health care providers (HCPs) for the health impacts of climate change (CC) have grown ubiquitous in the literature. Timely, efficient and sustainable strategies by the health care industry are necessary. Failure to act is predicted to result in catastrophic and lethal population health consequences. A growing body of research identifies related knowledge gaps and supports HCP competencies and best practice interventions to mitigate adverse population health impacts of CC. A social ecological framework and the PRECEDE-PROCEED approach were employed to develop and evaluate a series of online webinars designed to equip nurses and other HCP's to incorporate strategies to mitigate, adapt and build resilience to the health impacts of climate change into their practice and professional ethic. A pilot Program Evaluation project was undertaken to examine the constructs of awareness, motivation, concern, and engagement in personal and professional climate related behaviors and the impact that the series of educational webinars had on participants. Comparison was made to determine differences between groups and any self-reported changes in the constructs between pre and post webinar participation. Participants were highly aware, motivated, concerned and engaged in personal mitigation and resilience building behaviors. They indicated a sense of knowledge deficit, lack of confidence, and being overwhelmed as barriers to HCP engagement in climate related professional behaviors. Study results indicate that although participants are willing to speak with personal associates about the population health risks associated with climate change, they do not feel prepared, knowledgeable, or confident to

participate in professional behaviors or communicate with colleagues and legislators in order to protect the population from these risks which are predicted to be imminently associated with climate change. The study was limited by small sample size, data collection challenges, and presumable ceiling effect and social desirability bias. This pilot program evaluation study supports the need for immediate development of competency based curricula and practice guidelines to equip, and empower HCP's to meet their professional ethical obligation to protect human health.

Keywords: Health care providers, climate change, environmental sustainability, education

Introduction and Background

An identified health threat such as the late 2019 Coronavirus disease (COVID-19) outbreak sparked mobilization of national and international expertise to develop and disseminate guidelines and best practice recommendations for containment, risk mitigation, and preservation of population health. This is a reasonable response to a global population health threat. Prior to the COVID-19 pandemic of 2020, climate change had been identified as the greatest health challenge of the 21st century (Intergovernmental Panel on Climate Change (IPCC), 2018; World Health Organization (WHO), 2017; Costello, et al., 2009). In a March 2020 briefing, the Director General of the World Health Organization (WHO) implored a global societal and political approach to the issue and that it be founded upon a comprehensive strategy that includes prevention, preparedness, public health and political leadership (Ghebreyesus, 2020). It is expedient that the global health response to COVID-19 that has been promoted by Dr. Ghebreyesus be adopted not only for meeting the challenge of the pandemic, but also the challenge of climate change.

Despite mounting and sufficient evidence on the science of climate change, formal curricular guidelines and practice recommendations have not been generated. Translating the scientific evidence and current knowledge into clinical and educational practice is the purview of evidence-based practice inquiry (Shirey, et al., 2011; Baker, et al., 2014). Consideration and review of the current climate science has been combined with a review of the literature to explore the question: What is the current knowledge and perceived efficacy of HCPs for initiating practice intervention that protects human health

in a changing climate? Results were synthesized to inform development of a series of online educational webinars to guide timely and effective practice change.

Problem Statement

Existing data suggests that without substantial, immediate and concerted efforts from all sectors to reduce greenhouse gas emissions the impact of climate change on public health will be catastrophic at multiple levels (IPCC, 2018; Huffling, 2019).

Professional HCP organizations are increasingly advocating for environmental sustainability (ES) educational competencies and policy (Sheffield et al., 2014).

However, the literature indicates a gap in the knowledge and ability of nursing and other health care professionals to engage in practice based strategies that will protect

population health in this time of changing climate. (McDermott-Levy, et al., 2019;

Walpole et al., 2019; Cook, 2018; Wellbury et al., 2018; Leffers, et al. 2017; Maxwell, et al., 2016; Pearson, et al. 2015; Dunphy, 2014).

Purpose

The purpose of this program evaluation project was to plan, implement and evaluate the impact that a series of online educational webinars had on participants. The webinars were designed to teach and enhance practical skills for HCP's to use to protect population health from risks due to climate change. Comparison was made of two independent groups of participants. Group one; pretest of those waiting to participate; and group two; posttest of those who completed at least one of the online educational webinars. Differences between the two groups were measured for changes in HCP's attitudes, levels of concern and motivation and their personal and professional behaviors related to climate change.

Review of the Literature

Scientists warn that rising sea levels and extreme weather events will result in an increase in water and vector-borne illnesses, loss of biodiversity, heat related morbidity and mortality, wild fires, crop failure and food insecurity, resource scarcity, infrastructure disruption, pollution related asthma and cardiovascular disease, climate refugee migration, civil unrest, and devastating impacts on emotional health and well-being (CDC, 2019; Travers et al., 2019; IPCC, 2018). The health care industry contributes significantly to greenhouse gas emissions that drive climate change (Eckelman & Sherman, 2016). With over 4 million voices (NCSBN, 2018), and consistently rated as the most honest and dependable members of the health care profession, (Gallop, 2017) nurses have an ethical and professional obligation to immediately and robustly engage in preparing for and preventing harm due to climate change (Cook, et al. 2019; Cook, 2018; Leffers, McDermott Levy, Nicholas, & Sweeney, 2017; Schenk, 2019). The World Bank has issued a call to health systems in every nation to act in the interests of population health by leading efforts to mitigate climate change (Bouley et al., 2017). The COVID-19 outbreak has demonstrated that we do have the power to act collectively.

The review of the literature identifies recommendations for curricular development in academia and continuing education (Alvarez-Nieto et al. 2018; Cruz, et al., 2018; Richardson, et al., 2017; Schenk et al, 2016; Richardson, et al., 2016). These recommendations include basing efforts on an ecological perspective that incorporates educating HCP's about the effects of climate change, educating all HCP's about personal and professional strategies for climate mitigation, adaptation and community resilience building, (with "community" being local, organizational, national, international, global

and planetary spheres of influence), and educating, and motivating HCP engagement in advocacy for environmentally sustainable policy and practices (McDermott-Levy, et al., 2019; Neal-Boylan, et al., 2019; Leffers, et al. 2017). Additionally, the health care sector's actual contribution to environmental pollution and environmental resource stewardship should be incorporated into HCP education, and in budget creation and purchasing habits (Sheffield, et al., 2014; Schenk, 2019; Whitmee et al., 2015). There have been a limited number of research studies measuring health care provider attitudes, perceptions, and ES behaviors in practice (Anaker, et al., 2015; Barraclough et al., 2019; Cruz, et al., 2018; Dunphy, 2014; Lyne et al., 2020; Polivka, et al., 2012; Potteiger, et al., 2017; Richardson, et al., 2017; Richardson et al, 2015; Schenk et al., 2020; Schenk et al., 2016). (See Appendix A: Summary of Evidence from the Literature Review).

Fidelity to the public health framework of mitigation (primary prevention) adaptation (secondary prevention), and resilience building (tertiary prevention) and the United Nations sustainable development goals has been recommended for enhancing HCP's knowledge and climate related practice behaviors (Nicholas, et al., 2020; Leffers, et al., 2017; Whitmee et al., 2015).

Theoretical Model

McLeroy and colleagues' Social Ecological Model of Health Behavior (SEM) was fundamental to guiding identification and development of the educational components of the program's series of online webinars (McLeroy, et al., 1988). This model begins with the individual and embeds that individual at the core of widening spheres of bi-directional influences (influence directed towards or upon the individual, and influence that the individual may have on the widening spheres). The SEM highlights

the interdependent interactions between individual, interpersonal, institutional and environmental contexts and the overarching influence and importance of public policy.

(See Appendix B: Social Ecological Model).

Project and Study Design

The aim of this project is to synthesize current evidence to deliver a series of online educational webinars that will teach health care providers how to :

1. Explore the relationship and unique health challenges between climate change and COVID-19.
2. Recognize and correlate the impact of climate change on human health.
3. Articulate the impact of weather extremes, weather-related disasters, changing air quality, changing water quality, and changes in the occurrence of vector-borne illnesses on selected health conditions.
4. Describe challenges associated with weather-related disaster preparedness for vulnerable individuals, communities, and populations.
5. Reduce health care's contribution to climate change by identifying resources available and best practices for mitigating adverse effects of weather and climate impacts on health conditions.
6. Identify ways to become involved in promoting policies that help address the underpinnings of the changing climate challenge.

Because the overarching objective is the application of knowledge to action to protect human health in a changing climate, a successful program was designed to meet educational objectives and to also result in measure-able and sustained changes in the pre and post participation constructs of program participants awareness, concern, motivation,

and engagement in personal and professional climate change mitigation, adaptation and resilience building strategies for protecting human health. Ambitious goals were established intending that participation in the series of web based seminars would lead to participant demonstration of:

1. A 15% increase in scores on the construct of awareness.
2. A 25% increase in scores on the construct of concern.
3. A 25% increase in scores on the construct of motivation.
4. A 25% increase in scores on the construct of home behavior.
5. A 25% increase in scores on the construct of work behavior.

Political science research and data suggest that engagement and active participation by 3.5% of a population facilitates successful change. (Robson, 2019). An endeavor to educate and actively engage HCP's that achieves these construct outcomes in at least 3.5% of the participants will convey to HCP contribution to successfully protecting population health.

The PRECEDE-PROCEED model is widely utilized to promote population health because it facilitates generation of clear and targeted objectives and provides a compass for intervention implementation and evaluation criteria that are useful to problem solving (Green & Kreuter, 2005; Geilen, McDonald, & Bone, 2008). The 8 phases of this model provided the developmental structure for the project which was then guided and informed by the SEM theoretical framework to translate the current evidence into recommended knowledge and practice activities for addressing the health impacts of climate change (See Appendix C for the Program Evaluation Project Plan).

Phase I Social Assessment

A need for a conference to educate HCP's about mitigating, adapting and building resilience to population health risks due to climate change was identified by review of the literature, key informant input including nursing faculty and continuing education project developers, members of the Massachusetts General Hospital Institute (MGHI) of Health Professions School of Nursing Center for Climate Change, Climate Justice and Health's Steering Committee, the Alliance of Nurses for Healthy Environments, and Clinicians for Climate Action experts and affiliates. Social reconnaissance to further explore current knowledge and knowledge gaps, community resources and activities regarding the health impacts of climate change has included key individual and organizational informant interviews, and data gathered through practicing nurses, nursing students and nursing faculty participation in the Climate Health and Nursing Tool (CHANT). Dr. Elizabeth Shenk who participated in the design, piloting, refinement, and psychometric testing of the tool, continues to gather national data through the Nurses Climate Challenge (NursesClimateChallenge.org, 2019). The CHANT is a newly developed and nationally piloted survey that is designed to measure the awareness, concerns, motivations, and personal and professional behaviors of nurses regarding climate change. (Cook et al, 2019, Schenk, et al., 2020). See Program Evaluation Methods, Measures and Instruments below for a thorough discussion of the psychometrics of this tool.

Phase II Epidemiological, Behavioral, and Environmental Assessment

Epidemiologic data on current morbidity, mortality and other functional and mental health impacts of climate change was collected via key organizational informants; interviews, web sites, Issue Briefs, and other salient local, state and national resources

such as the World Health Organization (WHO), the National Institutes of Health (NIH), National Resources Defense Council (NRDC), Departments of Health, the Georgetown Climate Center, and others. Webinar objectives were developed, expanded and refined according to the epidemiologic and social assessment data collected. Consideration and priority were given to vulnerable population, morbidity and mortality, healthcare, and infrastructure impact. In addition to greatest impact effect; national, state and local policy initiative opportunities were prioritized.

In the behavioral and environmental components of this phase, informal surveying of nurses, key informant individuals and organizations and the literature describing personal (proximal determinants) and health care organizational behaviors and activities (distal determinant) that are either negatively contributing to the health impacts of climate change or positively contributing via mitigation, adaptation or related resilience building practices was undertaken.

Phase III Educational & Ecological Assessment

The literature and key individual and organizational informant interviews were used to develop and refine educational objectives in an ongoing process until information saturation was agreed upon by members of the conference planning team. General conference objectives were identified based on a review of the literature and knowledge identified in phases one and two of the PRECEDE portion of the PRECEDE-PROCEED model. Together these predisposing and reinforcing factors supported the need for educational programming that engages HCP's in awareness, concern, motivation, and personal and practice behaviors to mitigate, adapt and build community resilience to health risks associated with climate change and the need for environment-protective

changes in the organization and delivery of health care services. Facilitating and engaging these concepts in webinar participants was the objective of this project.

Phase IV Administrative and Policy Assessment/Intervention Alignment

Resources for implementation of the project have included the MGH Institute (MGHI) School of Nursing (SON) Center for Climate Change, Climate Justice and Health (CCCCJH) and their technology resources, their office of enrollment and marketing resources and the Alliance of Nurses for Healthy environment's (ANHE) marketing and web based educational resources, the expertise of the planning committee and a commitment to fidelity to current best practice recommendations from the literature.

The planning committee was formed by a network of individuals and organizations whose missions aligned with the project and program objectives. It was made up of members of the MGH Institute's CCCCJH steering committee and the climate and health program manager from ANHE. Each of the members of the planning team brought resources capable of making the program of educational webinars a reality. MGH Institutes, CCCCJH, ANHE, and this writer bring experience in planning and conducting educational conferences for HCP's. Each member of the planning committee donated their time in the interests of meeting individual and collective institutional and organizational missions and objectives. Speakers with expertise in the health impacts of climate change were identified and their commitment to voluntary and donated participation was secured for the program. MGH Institutes CCCCJH and ANHE's combined technology, and marketing resources were also donated for implementation of the webinars as part of their organizational mission and objectives.

The planning committee developed the webinar series content and objectives, speakers list, registration materials and marketing materials. Electronic registration for a pilot webinar opened in April of 2020, and the first webinar in the program evaluation series opened in early May of 2020.

Phase V Implementation

Setting and Resources

A series of educational webinar offerings for HCP's on meeting population health challenges in a changing climate was organized in collaboration with the MGHI 's CCCCJH and the ANHE. A panel of experts convened as the planning committee. Specific educational webinar content areas were determined based on panel expertise and the Educational and Ecological assessment component of the project's PRECEDE-PROCEED model. The content areas included population health impacts of climate change, health and nurse advocacy and leadership, and the intersection of climate change and COVID-19. Speakers identified mitigation, adaptation, and community resilience building strategies and best practices, as well as challenges and interventions for climate impact disaster preparedness. Guest speakers were identified and invited by the planning committee based on their expertise in the identified webinar program content. Content regarding the inequitable impact and burden of climate change on vulnerable populations was included throughout the series of webinars. HCP's were introduced to opportunities for becoming involved in participating and promoting strategies and policies that support the protection of human health in a changing climate.

Technology was capable of supporting 500 participants per webinar. Invitations to participate in the educational offerings were sent to universities, and health care and professional organizations across the United States.

Methods

A descriptive and quasi experimental pre-test, intervention, and 8 week post-test electronic survey design was developed to evaluate the online educational program. Ultimately, the program endeavored to facilitate a modest increase in application of best practice recommendations for protecting population health. The Climate Health and Nursing Tool (CHANT), a psychometrically validated instrument for measuring nurse's awareness, concern, motivation and engagement in personal and professional practice strategies was utilized both to inform educational program offerings and to survey webinar participants. The CHANT survey is a newly developed and nationally piloted 22-item Likert scale instrument that measures the constructs of climate related awareness, concern, motivation, personal and practice behaviors. The instrument was developed by a panel of 12 content experts including nurses, a physician and a psychometrician (Schenk, et al., 2020). Psychometrics of the tool include: exploratory factor analysis, retaining 5-factor model demonstrated comparative fit index (CFI) = .95, root mean square errors of approximation (RMSEA) =.04, and standardized root mean square residual (RMSR) =.09, and demonstration of subscale internal consistency with Cronbach's alpha >.70 (Schenk, et al., 2020 p. 97). This author worked with one of the generators of the CHANT to specifically modify it by expanding demographic data variables beyond nursing for this project. This was undertaken to render it useful in this program

evaluation study designed to promote interdisciplinary collaboration, education, and practice among HCP's.

Ethics Protection of and Human Subjects

Institutional review board (IRB) approval was sought and obtained from the James Madison University (JMU) institutional review board (IRB) committee. Participant consent to use of their anonymous survey responses to inform future online educational program activities, and development of competencies and curricular guidelines for educating future HCP's was obtained.

Participants were asked to self-assign a confidential identifier and they were notified that their online progression to survey participation constituted their voluntary consent to participate. Demographic and descriptive data that were requested on the survey included professional licensure and role, or student status, years in practice or school, practice environment, current practice setting, and participant zip code.

Participants were notified that their pre-program survey will be utilized to inform future continuing education and curricular development on the impacts of climate change and that it will contribute to data collection about regional HCP knowledge, attitudes and personal and professional climate change mitigation, adaptation and resilience building behaviors. They were advised that minimal if any risks were anticipated due to participation in the study. They were advised that those minimal risks may include inconvenience, and possible performance anxiety. Participants were notified that potential benefits to participating in the survey include increased knowledge of webinar program content; perception of improved self-efficacy implementing practice related climate change; mitigation, adaptation and resilience building strategies. Opportunity

exists for further study to identify participant benefit such as contribution to mitigation, adaptation and resilience building strategies for HCP's and communities; improved quality of life due to reduction in moral distress associated with discrepancy between personal, professional, and health care organization climate change; mitigation, adaptation and resilience building strategies; networking; increased commitment to action, acquisition of new ideas, re-focused attention to topic; restoration of hopefulness and commitment to professional practice ethics.

Additionally, participants were notified that the primary investigator and research advisor will have electronic access to anonymous pre and post program survey responses. They were provided the information that their responses may be utilized in future manuscript publication regarding knowledge, attitudes and personal and professional climate change mitigation, adaptation and resilience building behaviors of HCP's and that they may request notification of publication. Notification was provided to participants about how their data will be stored and disposed of in the future.

Data Collection

At the time of their registration, and just prior to each webinar, participants were asked by MGH Institute Faculty to click on a link and complete a survey that was being conducted to gather information to help inform development of future educational offerings. The link took them to information about the survey episode code, the survey itself, how to create an anonymous and unique personal identifier code, and a consent to participate in research. See Appendix D: Consent to Participate in Research.

Study Population Sample

The population of interest included English speaking adult (> age 18) nursing and interprofessional (HCP) communities from across the U.S. who participated in at least one of the 40 minute educational webinars on the health impacts of climate change. HCP or Health Science or Administration students were also invited to participate.

Program Description

The project was designed as a pre-post two group quantitative design using convenience sampling to measure the impact and effectiveness of the online educational programs to increase awareness, concern, motivation, and engagement in personal and professional climate change mitigation, adaptation and resilience building behaviors. Participant cohort follow up occurred 8 weeks post webinar participation to allow for measurement of self-reported behavior changes. The comparison group (n= 31) were participants who were waiting for the educational intervention who took the pretest. The intervention group (n= 36) those participants who completed at least one of the educational web-based programs and took the post test at eight weeks post intervention. A target minimum of 25 survey participants both pre and 8 weeks post webinar participation was established and met.

Phase VI Process Evaluation

Over 500 participants registered for and attended the webinars. Technical difficulties were experienced during the April pilot session due to higher numbers in attendance than anticipated, and more than the technology platform could successfully handle. This un-anticipated conference day challenge was swiftly and expertly managed

with minimal inconvenience to participants, validated the value of pilot or trial runs, and confirmed that there would be a responsive interest in participation in a webinar on the topic of climate change.

The May, June and July webinars were switched to an alternate platform and included pre-registration. Technology resources were adequate and the process ran very smoothly. The webinars were successfully implemented and very well-attended despite administrative decision to refrain from obtaining authorization and charging for continuing education units (CEUs) for attendees during this pilot initiative.

A limitation in the data collection process was identified. Although a working link and careful written instructions were provided; either participants had difficulty creating a unique personal identifier for matching pre and post participation CHANT survey data collection, or there was a glitch in the process of data collection, capture and conveyance to this researcher. This will be useful for informing future program evaluation research patterned after this study.

Phase VII Impact Evaluation

Program Evaluation Project Methods

As noted, the CHANT tool was chosen both to inform current and future educational program offerings and to ascertain the impact of attendance on webinar participants. Pre and post webinar program attitudes, concern, motivation and personal and professional practice activities related to the health impacts of climate change and demographic data was collected anonymously and electronically utilizing voluntary participant completion of the CHANT survey. Outcome analysis will be discussed below in the Phase VIII Outcome Evaluation section of the paper.

This pilot program evaluation study has resulted in modification of the CHANT tool for use with all HCP's in a newly formed collaboration between Washington State University (WSU) and the ANHE and Health Care without Harm professional organizations. As a direct result of collaborative effort for this program evaluation study, the CHANT more readily lends itself for use with interprofessional collaboration and education. Additionally, it is now available through Washington State University (WSU) for ongoing data collection about HCP awareness, motivation, concern and personal and professional climate related behaviors. At the WSU online site, researchers will be provided a link so that responses are available in real time for their data collection and analysis (Washington State University n.d). These outcomes may be useful to inform future interprofessional curricular development and the genesis of professional competencies and guidelines to enhance health care providers motivation, skills and behaviors for protecting population health in a changing climate.

Review of project methods for this pilot program evaluation study highlighted a need to design and include post webinar participant feedback and evaluation of technology, content, speakers and overall webinar satisfaction when planning and conducting future evaluation research studies. Additionally, program evaluation project method review reveals opportunity for modifications or revisions to the CHANT tool to enhance clarity and greater detail for capturing and identifying demographic information and professional role, setting and years in practice information.

See study limitations below for additional evaluative and discussion information about project methods.

Phase VIII Outcome Evaluation

Data analysis

Descriptive statistics and independent t-test statistical analysis was conducted utilizing SPSS version 27, to explore the impact that HCP participation in a series of online educational webinars had on each of the five construct variables; awareness, concern, motivation and participation in personal and professional ecological behaviors related to climate change. HCP participation in communication about climate change with friends and personal associates, colleagues and clients and elected officials or community leaders has been explored. The reasons that participants were motivated and barriers to addressing climate change were analyzed. Finally, HCP participant motivation to engage in mitigation, adaptation and resilience behaviors was identified based on identification of participant responses of how true on a 5 point Likert scale from very untrue to very true for me, each of the three statements beginning with the statement "I want to".

A total of 67 participants in two groups; Comparison group (n= 31) and an Intervention group (n= 36) completed surveys for this study. Two of the 67 (3%) did not provide demographic information about their profession. A comparison of participant self-reported demographics is presented in Appendix E.

There were three participants who were not from the United States; one from Canada, one from Poland and one from the United Arab Emeritus. Nearly 40% of participants were from Massachusetts. Seventeen U.S. States were represented in the

survey population. Most participants identified living in the northeastern part of the country but participants logged in from the western state of Oregon, northern states as Montana and New York, and from as far south as Florida.

All completed surveys were analyzed based on subscale scores and means were calculated for each group. A significance level of .05 was set a priori to the data collection. Independent t-tests comparing the intervention vs comparison groups did not demonstrate any significant difference in mean scores on the constructs of awareness, concern, motivation, personal behaviors and professional behaviors. Detail of group statistics and independent samples test are provided in Appendix F.

Data shows us that most attendees were moderately to extremely familiar with the reality of planetary warming and human cause due to GHG's. While nursing was somewhat familiar with health care delivery's responsibility for 10% of the GHG emissions in the U.S. the medical and "other" attendees were only slightly or not at all familiar. Also, noteworthy is that nursing, occupational therapy and other attendees were moderately to extremely familiar with the amplified effect climate change will have on vulnerable populations. However, medical provider attendees were only somewhat familiar with this reality. Data indicates that over 90% of all participants are noticing climate-related weather events in their geographic areas.

One participant identified an expectation that they will be dealing with climate related trauma in the workplace but that their employer provides no avenue for addressing climate change and in fact actively dismisses their attempts to champion the use of recyclables in the work setting. Another participant recommended federal policy which includes climate resolutions, targets and policy modeled on the approach taken in

Scandinavian countries and the need for a 5 year action plan, active listening and small daily changes. Comments and data clearly indicate that these webinars were largely attended by participants who are educated about and actively engaged in addressing climate change. One participant alone mentioned training and a committee role with the National NAACP Environmental Climate Justice program and participation in a faith based organization that is engaged in environmental awareness and advocacy. These responses corroborate the possibility that results may have been skewed due to the “ceiling effect” of a large number of highly knowledgeable and personally engaged HCP's and social desirability bias. These two possibilities will be further discussed below in the section on study limitations.

Participants more readily engage in personal behaviors for mitigation and resilience building than in professional or community wide behaviors. They communicate with personal associates more often than they do professional associates or political leaders. Appendix G; Factors that Motivate or Act as Barriers to CC Behaviors; illustrates how participants responded when asked to select “all that apply” to identify what motivates them to address climate change and all applicable barriers to addressing climate change to the extent that they would like. The most identified barriers to addressing climate change by HCP participants included a sense of being overwhelmed, lacking knowledge and confidence to act on climate awareness, and a sense that the issue is too complex, or that they are too busy to act. These identified barriers substantiate the need for actionable next steps towards the development of educational interventions that will motivate and empower HCP's to engage in population protective climate change behaviors.

Over 90% of group participants demonstrate a desire to change practice, over 88% a desire to teach patients, colleagues and the community about GHG and the impact of climate change on health, and over 95% of participants desire to prepare for the health impacts of climate change in their work-places. A review of participant level of optimism and belief that humans will adequately prepare for the impacts of climate change, and/or prevent further climate change reveals that just over 85% of HCP participants are either not at all, slightly or only somewhat optimistic that humans will adequately prepare for the impacts of climate change. This leaves only 14-15% of the HCP webinar participants who are well aware, concerned and motivated to engage in personal and professional mitigation, adaptation and resilience building behaviors actually believing that humans will adequately prepare for impacts or prevent further climate change.

Limitations

This pilot program evaluation study originally intended a one-way ANOVA to evaluate any sustained changes in webinar program participant's awareness, concern, motivation and engagement in personal and professional climate related behaviors at three time points. Modifications due to the COVID-19 pandemic led to a plan to utilize a matched t-test to identify changes in the five constructs pre and 8 weeks post participation in a series of online educational webinars. Error in participant understanding and capacity to generate and utilize an anonymous personal identifier, cumbersome directions, and low visibility and access to survey participation invitation due to the invitation being embedded in with other announcements all acted as limitations to data collection for the modified study as planned. Sample sizes were

small and underpowered. In addition to the aforementioned contributing limitations, the poor response rate may have been related to overload in participants who were all exposed to and likely experiencing significant social and environmental unrest and the extreme challenges of the COVID-19 pandemic at the time of this study. (See survey fatigue below). Technical failure in data collection or conveyance occurred and also prevented measurement of the same variables in the same person twice under the same condition. Therefore data was analyzed utilizing the independent t-test for statistical differences between two different and independent groups whose similar condition was their participation in the MGHI webinars for engaging in mitigation, adaptation and resilience building to impact health risks associated with climate change. Non-significance in mean scores between the groups may be due to participant familiarity and engagement with the issues, i.e. the “preaching to the choir” or ceiling effect or the possibility that the instrument may not be sensitive enough to capture the information sought for identifying relevant changes (Chyung, et al., 2020). Additionally, social desirability self-report, particularly in the virtual presence of a presumed peer group may have undermined data validity (Cerri, et al., 2018).

Survey fatigue is a phenomenon described as reduced participation and data quality due to boredom and impatience with requests for survey completion and/or the length of a survey once a respondent has begun the survey process (Ben-Nun, 2008). A limited number of respondents, unanswered questions and missing data during the study may be attributed to webinar and survey participant experience of survey fatigue during the 10-12 minute survey. Additionally, the survey tool was chosen for its ability to provide useful information about HCP motivation to address climate change, and barriers

to addressing climate change, however error in the process of data collection methodology, data capture or data conveyance to this author occurred. This resulted in the complete absence of data about motivation or barriers to HCP's addressing climate change for the pre webinar participation group. Process analysis and change that enables researchers to directly access survey data will eliminate this limitation in the future.

Implications

Research

Descriptive and inferential relationships between demographic variables and the five constructs and associated item variables should be explored. Identification of relationship or correlation between demographics such as years in practice, practice role and setting, and awareness, concern, motivation, and personal and professional ecological behaviors related to climate change and population health, and reasons for and blocks to motivation for addressing climate change will be helpful for developing future programs. Careful consideration, development and deployment of techniques that will broaden the pool of program and thus survey participants in order to minimize the ceiling effect threat to content validity should be undertaken. Interventional methods such as inclusion of social desirability scales should be included to reduce data compromise caused by social desirability bias (Van de Mortel, 2008). Further interdisciplinary research should be conducted in collaboration with the behavioral sciences towards development of tools for validating measurable engagement and improvement in nursing and other HCP's capacity, motivation and willingness to engage in professional climate mitigation and community resilience building behaviors. Careful development and pilot of clear instructions should be undertaken for assignment or participant creation of

anonymous personal identifiers for matched cohort analyses. Opportunity exists for further exploration of participant benefits including diminished moral distress associated with discrepancy between personal and professional or health care organization climate change behaviors. Exploration of potential benefit including development or restoration of hopefulness and optimism, acquisition of new ideas, re-focused attention to the topic, and engagement as an avenue for actionable commitment to professional practice ethics should be undertaken.

Timely engagement in this salient research will help to establish much needed quantifiable interventions and outcomes and the opportunity is fertile with possibility.

Practice

HCP's across all practice settings must be at the forefront of protecting population health from hazards that have been identified as the biggest global health threat of the 21st century. This study illustrates the need for the development of best practice guidelines and competencies for communicating about climate change and for interdisciplinary work in the practice arena to mitigate and build resiliency to its effects. This study demonstrates the need to develop competency and leadership across all HCP roles to meet the population health challenge associated with climate change. This study models opportunity for successful HCP collaboration and contribution to the development of public health campaign education and policy advocacy through engagement with professional practice organizations. HCP's have the opportunity to request and hold their professional organizations accountable to the development and adoption of resolutions for the incorporation of environmental health into practice standards. Consideration should be given to specialty HCP credentialing in order to

develop and embed expertise and leadership towards socially and environmentally just responsiveness to climate related population health risks.

Education

Given the results among this group of aware, concerned, knowledgeable and motivated participants, this pilot program evaluation study supports the need for expedient development of academic and continuing education guidelines and curricula that build pragmatic understanding, preparation, and tools for HCP's to engage in climate risk reducing behaviors. Consideration should be given to reaching a wider, and as yet un-informed audience to provide this educational information to in order to create and ascertain greater impact. In addition to education and guidelines, the study reveals that further exploration and intervention to build hopefulness and optimistic expectation that HCP engagement in behaviors to protect population health in a changing climate will lead to positive outcomes is needed.

Policy

A Social Ecological approach should inform academic and professional development and adoption of best practice guidelines and interventions. This framework will equip HCPs to meet their ethical professional responsibilities to engage in advocacy for social, and environmental justice as part of pre and post licensure education. The social ecological approach will lead to HCP advocacy for population health protective policy at professional, organizational, local, state, national and global levels (McDermott-Levy, et al., 2019; Neal-Boylan, et al., 2019).

Conclusion

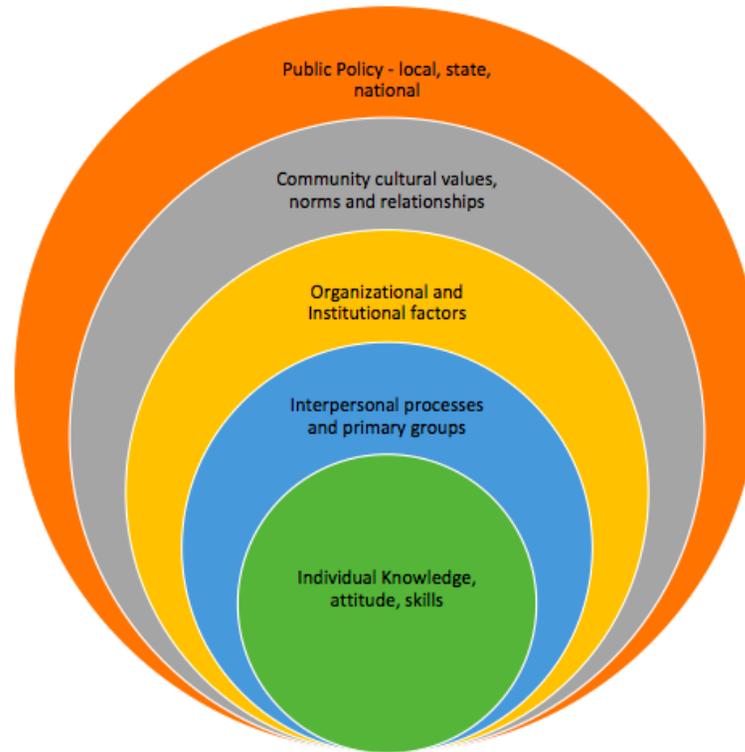
The need for actionable awareness, concern and motivation to engage in personal and professional behaviors to “flatten the curve” in the growing population health threat posed by climate change has been identified in the literature. Experts are recommending practice guidelines, competencies, and curricular development to prepare future and current HCP's. The opportunity to make a difference has never been greater, and the time to act is now. Health care providers and health care organizations have a professional, ethical responsibility to act. This pilot program evaluation of a series of educational webinars demonstrates the need to equip HCP with professional strategies and activities for prevention, adaptation and resilience building within their individual, community, national, global and planetary spheres of practice influence. It provides a useful tool for collecting information for generating associated competencies, practice guidelines, and curricular development. It provides a systems approach to equipping HCP's from a framework that highlights interrelatedness and their roles and responsibilities in their spheres of influence and an approach that is based on the public health paradigm of prevention (mitigation), adaptation and resiliency building to protect human health.

This pilot program evaluation study contributes to enlightening, inspiring, and engaging health care providers, who are pivotally positioned to advocate for and practice sustainable solutions that reduce health care's contribution to carbon emissions, and to engage in authentic health promotion that mitigates and builds equitable communities and population health that is resilient to the risks associated with climate change.

Appendix A: Summary of Evidence from the Literature Review

https://drive.google.com/file/d/161uo92jtXL1uMezrw3_BBvgLZQiyIUA/view?usp=sharing

Appendix B: Social Ecological Model



Adapted from McLeroy, K. Steckler, A., & Bieau, D. (Eds.) (1988). An ecological perspective on health promotion programs. *Health Education Quarterly* 15 (4) , 351-377. https://www.cceb.med.upenn.edu/sites/default/files/uploads/chbr/1988-McLeroy-An_Ecological_Perspective_on_Health_Promotion_Programs.pdf

Appendix C: Logic Model: Protecting Human Health in a Changing Climate Program

Goal: Increase HCP knowledge and engagement in personal and practice strategies to protect health in a changing climate						
Priorities	Inputs	Outputs		Outcomes		Impact Long Term
		Strategies/Activities	Participation	Short Term	Medium Term	
To protect human health in a changing climate.	<p>Educational program needs analysis</p> <p>Organizational sponsorship</p> <p>Money for continuing education, program setting, program materials and marketing</p> <p>Program planning committee</p> <p>Facilities & technology</p>	<p>Content needs analysis</p> <p>Bi-monthly, then weekly planning committee web-based meetings.</p> <p>Conference dates, objectives, content, speaker identification.</p> <p>Continuing education & program sponsorship exploration.</p> <p>Educational program evaluation instrument chosen & developed. (CHANT)</p> <p>Personal identifier strategy and episode codes determined.</p> <p>Project IRB approval.</p> <p>Registration process developed and deployed.</p>	<p>Planning Committee</p> <p>Planning Committee</p> <p>Planning Committee</p> <p>DNP candidate, nurse expert</p> <p>DNP candidate,</p> <p>Planning Committee</p>	<p>Educational program successfully implemented, well-attended and positively evaluated.</p> <p>Pre and post participation surveys completed by each individual participating in the program.</p> <p>Educational program meets identified program objectives</p> <p>AEB continuing education program evals.</p> <p>Educational program results in score increases on constructs of awareness, concern, motivation and personal and professional climate mitigations, adaptation and resilience building behaviors.</p> <p>Analysis of continuing education program evaluation data and SPSS CHANT program impact data.</p>	<p>4 week post program participation CHANT survey completed by 75% of program participants.</p> <p>Analysis of SPSS CHANT survey pre-, immediate post and 4 week post program impact data.</p>	<p>Improved HCP engagement in personal and professional CC mitigation behaviors.</p> <p>Reduced personal and professional contribution to GHG emissions.</p> <p>Increased population decrease in contribution to GHG emissions.</p> <p>Increased CC disaster planning & adaptation.</p> <p>Increased community resilience to impacts of CC on human health.</p> <p>Establishment and application of best practice recommendations.</p>

Appendix D: IRB Consent to Participate in Research

Consent to Participate in Research**Identification of Investigators and Purpose of Study:**

You are being asked to participate in this program evaluation study conducted by Christine Fasching Maphis under supervision of project advisor, Dr. Linda Hulton from James Madison University. The purpose of this study is to identify educational needs of health care providers about population health risks associated with climate change, and personal and professional practice behaviors to mitigate, adapt and build community resilience to these risks, thereby protecting human health. This project study will contribute to Christine Fasching Maphis' completion of her Doctor of Nursing Practice project, and will contribute to ongoing national and global analysis. This data may be utilized in the development of mitigation, adaptation and community resilience building education and practice guidelines for health care providers.

Research Procedures

This study consists of an online Qualtrics survey. You will be asked to answer a series of questions about your knowledge, concern and engagement in personal and professional climate related ecological behaviors.

Time Required

Participation in this study will require 10-15 minutes of your time completing the survey after your registration for the online educational webinar; 10-15 minutes of your time completing the survey after your participation in the online educational webinar; and then 10 – 15 minutes of your time completing the survey 4 weeks after your participation in the online educational webinar. Overall it is estimated that you will spend 30 minutes responding to survey questions associated with this study.

Risks

The investigator does not perceive more than minimal risks from your involvement in this study (that is, no risks beyond the risks associated with everyday life).

Benefits

Potential benefits from participating in this study include increased self- awareness and knowledge of climate change related population health risks and ability to engage in personal and professional practice behaviors that will contribute to risk mitigation, adaptation and community resilience building. Your participation in the study will contribute to ongoing national and global analysis of health care provider needs for climate related education and practice guidelines.

Confidentiality

No personal identifying information will be collected or shared about you. Your responses will be anonymously obtained and recorded online through Qualtrics. Data is kept in the strictest confidence. The results of this study will be presented at Population Health topic meetings, professional conferences and in professional publications. The researcher retains the right to use and publish non-identifiable data. Data will represent

averages and generalizations about survey responses as a whole. All data will be stored in a secure location accessible only to the researchers. Upon completion of the study, all information and answers of the participants will be destroyed. Final aggregate results will be made available to participants upon request.

Participation and Withdrawal

Your participation is entirely voluntary. You are free to choose not to participate and should you choose to participate, you may withdraw at any time without consequences of any kind. However, once your responses have been submitted and anonymously recorded you will not be able to withdraw from the study.

Questions about the Study

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Questions about your Rights as a Research Subject

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Giving of Consent

I have been given the opportunity to ask questions about this study. I have read this consent and I understand what is being requested of me as a participant in this study. I certify that I am at least 18 years of age. By clicking on the link below, and completing and submitting this anonymous survey, I am consenting to participate in this research.

Insert hyperlink here, if appropriate.

Christine Fasching Maphis
Name of Researcher (Printed)

5/1/20
Date

This study has been approved by the IRB, protocol # 20-1745.

Appendix E: Participant Self-Reported Demographics

Participant Self-Reported Demographics

Group	Gender	Mean Age (SD)	Ethnicity	Professional Role
Comparison Group (n=31)	Male: 5	43.04 (13.17)	Asian 9.7%	Direct Care 41.4%
	Female: 24		Black 0%	Faculty/Research/Other 41.3%
			Caucasian 80.6%	Student/Retired 17.2%
Intervention Group (n=36)	Male: 2	53.54 (14.73)	Asian 5.4%	Direct Care 36.1%
	Female: 33		Black 5.4%	Faculty/Research/Other 44.5%
			Caucasian 81.1%	Student/Retired 19.4%

Appendix F: Independent Sample t Test for Participant Groups on Construct Variables

Independent Sample t Test for Participant Groups on Construct Variables

Construct	Group	N	Mean (SD)	t value (df)
Awareness	Comparison Group	29	20.9 (3.5)	-1.15 (62)
	Intervention Group	35	22.0 (4.0)	-1.16 (61.8)
Concern	Comparison Group	23	22.3 (2.7)	-1.33 (55)
	Intervention Group	34	23.2 (2.60)	-1.32 (46.6)
Motivation	Comparison Group	23	13.3 (1.9)	-1.5 (53)
	Intervention Group	32	14.0 (1.5)	-1.44 (41)
Personal Behaviors	Comparison Group	29	22.4 (2.9)	-1.31 (63)
	Intervention Group	36	23.6 (4.0)	-1.36 (62.4)
Professional Behaviors	Comparison Group	23	12.7 (2.9)	-.557 (48)
	Intervention Group	27	13.2 (2.7)	-.554 (45.5)
Communication	Comparison Group	28	8.8 (3.1)	-.921 (61)
	Intervention Group	35	9.5 (3.3)	-.928 (59.5)

Appendix G: Factors that Motivate or Act as Barriers to Climate Change Behaviors

Motivating	Barriers
Reasons I engage in personal CC behaviors	Reasons I don't engage in CC behaviors in my professional setting
Protecting the Planet	I am overwhelmed
Clean Air & H2O	I don't know what to do
Health Impacts	N/A I do address CC to the extent that I would like
Concerns for the Future	I'm not confident to act
Increasing Weather Severity	It is too complex
Infectious Disease Risk	I am too busy
Creating Healthy Communities	I don't know enough about CC
Minimizing Ecological Footprint	I choose to spend time on other important issues

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