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BUILDING A LEADERSHIP CULTURE FOR ENVIRONMENTAL HEALTH IN A NURSE-LED CLINIC

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Abstract

Climate change is the biggest global health threat of the 21st century (Costello et al., 2009). Temperature shifts caused by greenhouse gases have negative health impacts such as worsening of chronic diseases and increases in vector-borne diseases (American Public Health Association, 2016), which nurses are ethically responsible to address (American Nurses Association, 2015). At an interdisciplinary nurse-led clinic, staff were not prepared to assist patients in building resiliency related to the health impacts of climate change or to implement environmental sustainability in their workplace. Based on principles of partnership-based healthcare (Eisler & Potter, 2014), this project included *Climate Conversations* - sharing stories, values, and knowledge about climate change – (Minnesota Interfaith Power & Light, 2010) and evidence-based transformational leadership. The Nurses' Environmental Awareness Tool (Schenk et al., 2015) was used to survey staff before and after they participated in behavioral interventions to incorporate environmental sustainability at their workplace. Compared to baseline, staffs' knowledge of environmental sustainability increased significantly ($p<0.05$), and staff planned and participated in more environmental behaviors ($p<0.05$). The post-intervention mean scores for beliefs about the relatedness of sustainability to health and ease of performing environmental behaviors in the workplace also increased compared to baseline. One-hundred percent of staff who participated in each activity reported intention to sustain the interventions after the end of the project. Educating and empowering health professionals about environmental sustainability needs further evaluation in larger interdisciplinary settings; however, these methodologies show promise in building a culture of health leadership in taking meaningful action on climate change.

Keywords: Leadership, partnership, nurse-led, environmental sustainability, climate change

BACKGROUND

The effects of climate change on human health are well documented. The direct and indirect impacts of the buildup of carbon dioxide and other greenhouse gases in the earth's atmosphere cause temperature shifts which lead to numerous negative health effects, and the concentration of these greenhouse gases in the earth's atmosphere is only expected to get worse (U.S. Global Change Research Program [USGCRP], 2016). Indeed, in a compelling international report compiled by *The Lancet* and the University College London Institute for Global Health Commission, Costello, Abbas, Allen, Ball, Bell, and colleagues posit that the health effects of climate change "will affect most populations in the next decades and put the lives and wellbeing of *billions* [emphasis added] of people at increased risk" (2009, p. 1693). In fact, they claim that "climate change is the biggest global health threat of the 21st century" (p. 1693).

Unpredictable greenhouse gas-induced temperature extremes contribute to worsening of chronic illnesses such as cardiovascular disease, asthma, and chronic obstructive pulmonary disease (COPD) (American Public Health Association [APHA], 2016; Centers for Disease Control [CDC], 2015; U.S. Global Change Research Program, 2016; World Health Organization, 2015). Higher temperatures and unpredictable precipitation also contribute to droughts, which are factors in agricultural devastation and famine (APHA, 2016; CDC, 2015; USGCRP, 2016; WHO, 2015). The increase in severity and irregularity of weather patterns such as thunderstorms and hurricanes leads to drowning, non-fatal injuries, allergies from mildew, and displacement from homes (APHA, 2016; CDC, 2015; USGCRP, 2016; WHO, 2015). Temperature shifts caused by climate change lead to plant, animal, bacterial, and viral species migration. These temperature shifts are implicated in longer allergy seasons, tick-borne diseases such as Lyme Disease, and mosquito borne-diseases such as Zika virus, West Nile virus, and malaria (APA, 2016; CDC, 2015; USGCRP, 2016; WHO, 2015). Furthermore, the mental health implications of the aforementioned health issues are yet to be quantified.

According to Dr. James Hansen of the National Aeronautics and Space Administration [NASA], "if humanity wishes to preserve a planet similar to that on which civilization developed and to which life on earth is developed... carbon dioxide will need to be reduced from [current levels of 400ppm] to at most 350ppm" (350.org, 2016). If humanity is not able to adapt to climate change and mitigate future effects, it is possible that the amount of carbon dioxide in earth's atmosphere may not be conducive to human life (350.org, 2016). Climate scientists fear for the literal future of humanity (350.org, 2016). New technologies and practices to reduce fossil fuel-related energy consumption and waste are emerging, but the shifts have not yet become widespread across industries such as health care (Institute of Medicine [IOM], 2007), which is the second most energy-consumptive building industry in the U.S. based on energy usage per square foot (Health Care Without Harm, 2016).

All professions need to evaluate their cultures and practices for opportunities to improve their environmental sustainability – particularly when the discipline involves caring for human health that is harmed by climate change. In fact, the Code of Ethics for Nurses charges nurses to "identify conditions and circumstances that contribute to illness, injury, disease; foster healthy lifestyles; and participate in institutional and legislative efforts to protect and promote health" (American Nurses Association [ANA], 2015, p. 32). Thus, nurses are ethically responsible to address the health impacts of climate change. While climate change is a global issue, small actions at every level can effect positive change. In the context of health, leaders in care settings can address climate change internally by reducing their energy expenditure and waste production (Anderko, Chalupka, & Gray, 2013; Johnson, 2012; Munoz, 2012). On an external level, health care professionals can lead action by informing patients and the public of the health impacts of climate change (Health Care Without Harm, 2015; Sayre, Rhazi, Carpenter, & Hughes, 2010).

The work of inspiring and urging health professionals to take action on climate change is possible, and illuminating best practices is critical (Anderko et al., 2013; Health Care Without Harm, 2015; Johnson, 2012; Munoz, 2012; Sayre, Rhazi, & Carptenter, 2010).

The aim of this project was to test the use of transformational leadership and partnership-based health care (Eisler & Potter, 2014) to shift techniques in guiding staff to incorporate environmentalism as a human health focus. The proposed outcomes included achieving an increase in staff's self-reported knowledge of environmental sustainability in health care and in self-reported behavior related to environmentalism in the workplace. The setting for the project was a nurse practitioner clinic in the inner city of a large metropolitan area. The ultimate project goal was for the clinic to become an exemplar of positive climate change action for other clinics and other organizations.

LITERATURE REVIEW

Although only a small percentage of Americans are alarmed about climate change, an even smaller percentage understands and appreciates the related negative health impacts (Roser-Renouf, Maibach, Leiserowitz, Feinberg, Rosenthal, et al., 2014). Researchers claim, "Even the segments most concerned about global warming have little understanding of its human health consequences" (Roser-Renouf et al., 2014, p. 3). According to Roser-Renouf and colleagues (2014), for the small percentage of people who have an understanding of the health impacts of climate change, the illnesses most recognized as being related to climate change include lung diseases such as asthma and COPD. In fact, fewer than 10% of Americans can correctly identify heat-related illnesses, vector-borne diseases, allergies, injuries or deaths that occur during extreme weather events, or mental illness as related to climate change (Roser-Renouf et al., 2014). Furthermore, many perceive climate change to harm others more than themselves or their local communities (Roser-Renouf et al., 2014; Scannell & Gifford, 2011). When care providers fail to recognize the health impacts of climate change, treatment plans may be inadequate.

Given the relatively small proportion of Americans who are alarmed by climate change *and* believe it to be harmful to human health, messaging techniques for activation are imperative. It is especially important for health providers to share information using appropriate messaging techniques, because research has demonstrated that people

listen to climate change warnings when the warnings are linked to health (Scannell & Gifford, 2011).

According to research on individuals in health fields (ecoAmerica et al., 2015), health providers respond most strongly to framing that addresses climate change as a moral responsibility for the collective future and focuses on families and children, highlights health, and projects positivity, among others. Scannell and Gifford (2011) and Roser-Renouf and colleagues (2014) also found locality to be paramount in messaging. When individuals learn that events happening geographically near to them are related to climate change, they are more likely to feel personally at risk; therefore, using stories about climate change 'close to home' is an effective messaging technique (Scannell & Gifford, 2011; Roser-Renouf et al., 2014). Perhaps above all is the importance of framing climate change activation in terms of hope rather than despair (Myers, Nisbet, Maibach, & Leiserowitz, 2012; Roser-Renouf et al., 2014).

THEORETICAL FRAMEWORK

The theoretical framework that guided this doctoral project is *cultural transformation theory* developed by Riane Eisler (Eisler & Potter, 2014). Eisler posits that caring, accountability, and mutual respect are essential for the future of life as we know it. She claims that there are "unprecedented economic, environmental, and social challenges" that need to be addressed immediately via an entire cultural fundamental paradigm shift (Eisler & Potter, 2014, p. 50). Cultural transformation theory is built on the premise that shifting our cultural paradigm involves a "shift in basic beliefs, assumptions, behaviors, and social structures," which is necessary for humankind to address the broader issues of human culture and relationships as they stand (Eisler & Potter, 2014, p. 50).

A major concept in cultural transformation theory is relationships structured around partnership, which involves relationships based on mutual respect, versus relationships structured around domination or hierarchy (Eisler & Potter, 2014). In this project, the

leader and the staff practiced partnership techniques to gain a deeper understanding of the relationships within the workplace and the roles that each person could serve in contributing to the project. Culture change happens continuously – and shaping culture change using partnership rather than domination results in better outcomes (Eisler & Potter, 2014). Cultural transformation theory suggests that "mutual respect, accountability, and caring" are greater when a project is co-developed and co-owned (Eisler & Potter, 2014, p. 50). Therefore, the project leader and the staff approached the project as equals rather than using more traditional hierarches of domination.

Additionally, creating a culture that supports environmental sustainability in an outpatient clinic required a systems approach to planning and interventions. Systems elements including health, economic, environmental, and social factors (Eisler & Potter, 2014) were addressed.

METHODS

Sample and Setting

Context. The nurse practitioner clinic was already recognized as a leader based on the innovative interdisciplinary nurse-led care model. The clinic provides primary and family care to individuals across the life span. Of note, the clinic shares a building with a residence for formerly homeless or incarcerated individuals, as well individuals who formerly struggled with substance abuse – many of these residents seek care at the clinic. The director, who also served as a nurse practitioner, emphasized the importance of including her staff in all decision making in order to improve employee engagement. As an affiliate of a larger health system, the clinic was able to collaborate with the environmental sustainability committee of its partner health organization (which had not occurred prior to this project).

The team. The core project team included the project lead and the entire staff of six clinic employees. Clinic staff included the director-nurse practitioner, an additional nurse practitioner, a clinical pharmacist, two certified medical assistants, and a patient

representative. Additional ancillary team members included a representative from environmental services and a recycling liaison from the clinic's county.

Implementation Strategy

The project lead educated staff members, provided opportunities for change or action, and facilitated the teamwork required to incorporate environmental sustainability in the clinic. From the beginning, the project lead held the goal of fostering shared ownership and personal connection to the project process and outcomes. This open and flexible approach allowed for the staff at the clinic to actively engage in the planning and implementation of the project. Thus, project goals and strategies were constantly evolving as the staff at the clinic discovered and committed to new and emerging environmental behavioral changes for their workplace.

Transformational leadership techniques such as inspirational motivation, intellectual stimulation, and individualized attention were used first to develop a cohesive team by changing organizational culture along with staffs' perceptions, aspirations, and values (Cox, 2010). The team then held a Climate Conversation (Minnesota Interfaith Power and Light [MNIPL], 2010) at the start of the project, which included four exercises: a) describing stories of connection, b) drawing values out of elements from individuals' stories, c) discussing group members' feelings and knowledge about climate change, and d) discussing ways to engage health professionals in taking action on climate change. The transformational leadership and partnership techniques were also used throughout the project in all communications with staff. Listening to each individual's stories and striving to connect workplace changes to personal values helped to holistically tie beliefs to actions (ecoAmerica et al., 2015; Marshall, 2011).

Once the groundwork for a cohesive team was developed via the Climate Conversation, it was necessary to evaluate staff's baseline knowledge and beliefs regarding the relationship between health care and environmentalism. Based on the knowledge gaps identified in a survey, the project lead developed and shared an educational PowerPoint presentation with a voiceover. Having background knowledge empowered

staff to make the transition from their current practices to their desired state (Disch, 2012).

The presentation laid a foundation for the introduction of opportunities for improvement at the clinic site. In order for the staff to collectively develop a plan for action, it was imperative that they learned about changes they could make. As an introduction, the project lead created a virtual team on the Minnesota (MN) Energy Challenge website (2009). The Energy Challenge is a public space for the staff to track and virtually visualize the sustainable actions they were already taking at the clinic; it also provided comparisons to other Minnesotans (MN Energy Challenge, 2009). This activity promoted staff engagement and made staff aware of options for improvement in workplace sustainability.

Next, the team met to discuss goals and plans to achieve them. The project leader encouraged and facilitated self-driven behavior change using a bottom-up approach. According to Kuipers, Higgs, Kickert, and colleagues (2014); Levasseur (2001); and Pascal, Sternin, and Sternin (2010), successful change rarely comes from the top down, and employees are more likely to be engaged and willing to sustain a project if they claim ownership. Throughout the project, the group held bi-monthly face-to-face meetings with at least one staff member on site, and there were nearly weekly email communications with the entire staff. This regular communication provided space for team development and ongoing assessment of the project's successes, challenges, and costs.

Sustainability Projects
Based on collective team decision-making, the final projects included:

- Transition to 100% wind energy (Xcel Energy, 2016)
- Initiate and participate in recycling via a county grant
- Install and monitor 30 electricity timers
- Create patient education about climate and health

- "These Come From Trees" stickers for paper towel reduction (Kazanjy, 2016)

- Transition to reusable promotional materials (grocery bags and drinkware)

- Create a self-written vision for the clinic to be environmental stewards in the interest of a healthy climate

Measures

To evaluate the staff's baseline and post-intervention knowledge and behaviors of environmentalism in the workplace, the project leader used the Nurses' Environmental Awareness Tool [NEAT] (Schenk, Butterfield, & Postma, et al., 2015). This tool was adapted for the electronic Qualtrics platform (Qualtrics, 2016) (see Figure 1 for examples of questions). The NEAT consists of three sections: the Nurse Awareness Scale (knowledge), the Nurse Professional Ecological Behaviors Scale (behavior in the workplace), and the Personal Ecological Behaviors Scale (behavior at home) (Schenk et al., 2015). For the purpose of this project, the Personal Ecological Behaviors Scale section was not included in the pre- or post-intervention surveys.

Figure 1
Examples of questions from the Nurses' Environmental Awareness Tool

Prompt	Possible Answers	Scale Category
"Hospitals use 2.5 times as much energy per square foot as typical office buildings"	Have you heard of this information before? 1 No, I have never heard of this before 2 I don't think I've heard of this before 3 I'm not sure 4 I think I've heard of this before 5 Yes, I have definitely heard of this	Nurse Awareness
	How related to health impacts do you think this is? 1 Never related 2 Rarely related 3 Sometimes related 4 Often related 5 Always related	Nurse Awareness of [/Belief about] Relatedness to Health Care

| "At work, I lead recycling efforts" | How often do you do this behavior?
1 Never or almost never
2 Rarely
3 Sometimes
4 Frequently
5 Always or almost always | Nurse Professional Ecological Behaviors |
| | How easy or difficult is this behavior to do?
1 Very difficult
2 Somewhat difficult
3 Neither easy nor difficult
4 Somewhat easy
5 Very easy | Nurse Professional Ecological Behavior Difficulty |

Note. Adapted with permission from the Nurses' Environmental Awareness Tool [NEAT] Schenk, E., Butterfield, P., Postma, J., Barbosa-Leiker, C., & Corbett, C. (2015). Creating the Nurses' Environmental Awareness Tool (NEAT). *Workplace Health and Safety, 63*(9), 381-391.

The Nurse Awareness Scale

The Nurse Awareness Scale consisted of 17 prompts, each of which had two follow up questions: 1) "Have you heard of this information before?" and 2) "How related to health impacts do you think it is?" (Schenk et al., 2015). Participants ranked their level of knowledge using a one-to-five Likert scale such that 1 = "No, I have never heard of this before" and 5 = "Yes, I have definitely heard of this" (Schenk et al., 2015). They then ranked their beliefs about the prompt's relatedness to health impacts using the following one-to-five Likert scale: 1 = "never related;" and 5 = "always related" (Schenk et al., 2015).

The Modified Nurse Professional Ecological Behaviors Scale

The modified Nurse Professional Ecological Behaviors Scale consisted of 14 prompts followed by two follow-up questions: 1) "How often do you do this behavior?" and 2) "How easy or difficult is this behavior to do?" (Schenk et al., 2015). Participants ranked their frequency of ecological behaviors at work using a one-to-five Likert scale as follows: 1 = "Never or almost never;" and 5 = "Always or almost always" (Schenk et al.,

2015). Additionally, they ranked their beliefs about the ease of the behavior with a one-to-five Likert scale: 1 = "very difficult;" 5 = "very easy" (Schenk et al., 2015).

Analysis

Data analysis involved using one-sided t-tests to compare the differences in means for pre-intervention and post-intervention survey answers for the following four categories of questions within the NEAT (Schenk et al., 2015): a) Have you heard of this information before? b) How related to health impacts do you think it is? c) How often do you do this behavior? and d) How easy or difficult is this behavior to do? The project team tested for statistically significant changes in means from the pre-intervention survey to the post-intervention survey using 95% confidence intervals, as well as for each individual survey question to examine differences between the four categories.

The post-implementation survey also included two unique process questions that were not on the pre-implementation survey. These questions were designed to evaluate the number of interventions launched at the clinic that each staff member participated in and whether she intended to sustain each environmental behavior initiated by the team. Open-ended qualitative questions at the end of the final survey addressed the perceived value of the project and personal impacts the project had on each member. These qualitative questions were analyzed by two separate baccalaureate-prepared individuals to draw out themes.

Ethical considerations. This project was not required to undergo Institutional Review Board review. Throughout the project, the lead emphasized verbally and in written form the staff's independence and respect for individual choice in project commitments and decisions. All data from the project was de-identified and stored on a password-protected computer.

RESULTS

Process Measures and Outcomes

See Figure 2 for data pertaining to interventions, staff participation, and staff intention to sustain interventions.

Figure 2
Participation and Intention to Sustain Staff-Identified Interventions

Staff-identified intervention	# of staff who participated (n=6)	# of staff who intended to sustain intervention (n=6)
Transition to 100% wind energy (Xcel Energy, 2016)	6	6
Initiate and participate in recycling via a county grant	6	6
Install and monitor 30 electricity timers	6	6
Create patient education about climate and health	4	4
Utilize "These Come From Trees" stickers to reduce paper towel usage (Kazanjy, 2016)	6	6
Transition to sustainable promotional materials (reusable grocery bags and drinkware)	6	6
Incorporate environmental sustainability into clinic's values	6	6

Note. Staff-identified interventions launched in the nurse practitioner clinic and number of staff who participated in the intervention

Contextual Elements

Several important contextual elements impacted the intervention implementation. First, the clinic is a patient care site, and the patient care schedule affected when and for how long the full project team could hold meetings. Second, obtaining permission

from the clinic's partners (both at a corporate level and physical building level) to initiate change provided challenges for many of the team's sustainability efforts.

Associations between Interventions and Outcomes

In evaluating the project data across all NEAT categories, all questions, and all participants as a whole, there was a statistically significant mean increase in aggregate NEAT scores between pre- and post-intervention surveys of 16.6%, or 0.83 points ($p<0.005$). The breakdown of results of each NEAT category is as follows:

Have you heard of this information [related to environmental sustainability in health care] before? Of the 17 questions in this category, 12 had statistically significant positive changes as compared to baseline across all participants ($p \leq 0.05$). Across staff members, the mean pre-intervention survey results for all 17 questions in the prior knowledge category was 3.1 out of a possible 5.0 on the NEAT (3 = "I'm not sure") (See Figure 3). The mean post-intervention score in that category was 4.5 on the NEAT (4 = "I think I've heard of this;" 5 = "yes, I have definitely heard of this") (See Figure 3). This category had the highest mean increase in scores over time of 1.4, or 28%.

How related to health impacts do you think this [information related to environmental sustainability in health care] is? This category also included 17 questions, three of which showed statistically significant positive changes as compared to baseline across all participants ($p \leq 0.05$). For all 17 questions in the category of "how related to health impacts do you think this is," the average pre-intervention score was 4.3 on the NEAT (4 = "often related") (See Figure 4). The average post-intervention rating across all participants was 4.7 on the NEAT (5 = "always related") (See Figure 3). There was a mean of a 0.4-point (8%) increase over time for the questions in this category, but the change was not statistically significant for 14 of the 17 questions.
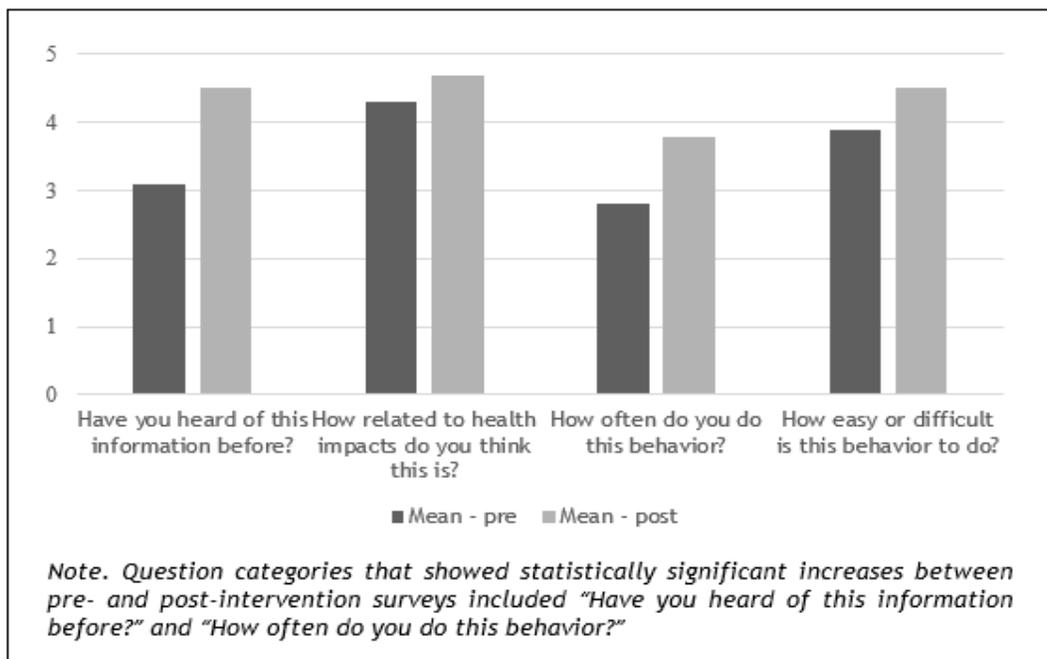
How often do you do this [workplace environmentally sustainable] behavior? Of the 14 total questions in the behavioral frequency category, seven had statistically significant positive changes between the pre-intervention survey and the post-

intervention survey, of which the mean was greater than 20% across all participants ($p \leq 0.05$). The mean pre-intervention survey value was 2.8 (3 = "sometimes") on the NEAT, and the mean post-intervention survey value was 3.8 (4 = "frequently") on the NEAT across all participants (See Figure 4). For seven of the 14 questions in this category, this mean increase of 1.0 was not statistically significant.

How easy or difficult is this [workplace environmentally sustainable] behavior to do? The behavior difficulty category also included 14 questions, two of which had statistically significant positive changes of a mean of 12% on the post-intervention survey as compared to the pre-intervention survey ($p \leq 0.05$) (See Figure 4). Across all participants, the mean pre-intervention score on the NEAT was 3.9 (4 = "somewhat easy"), and the mean post-intervention survey score on the NEAT was 4.5 (5 = "very easy") (See Figure 3). While this indicates an increase of a mean of 0.6 points over time across all participants, it was not statistically significant for 12 of the 14 questions.

Figure 3

Pre- and Post-Intervention NEAT Scores by Question Category

Note. Question categories that showed statistically significant increases between pre- and post-intervention surveys included "Have you heard of this information before?" and "How often do you do this behavior?"

Qualitative themes. For a summary of the themes identified by participants in the post-intervention survey *see Figure 4.*

Figure 4
Qualitative Themes Identified in the Post-Implementation Open-Text Survey of Staff

Question	Theme
What did you find most valuable about this experience?	Learning about energy and waste reduction Patient education Teamwork and energized workplace
How has this project impacted you personally?	Increased general awareness of environmental sustainability Increased understanding of personal responsibility Made changes at home and/or educated family members Alternative transportation to work via bicycles or light rail

Unexpected Outcomes

In planning this project, the project lead hoped that the staff would learn about the connectedness between environmental sustainability and health and become engaged in an onsite cultural change project related to environmentalism that they deemed meaningful. One unexpected outcome of the project was a wide variety of activities designed and initiated by the staff (See Figure 2). Empowered to be full partners, the staff's activities far exceeded the project lead's anticipated outcomes. To our knowledge, many of the staff-owned interventions are a first in a Minnesota nurse-led clinic, such as divesting from fossil fuels via Windsource (a wind power purchasing program) (Xcel Energy, 2016), the creation of a patient education brochure about the health impacts of climate change, and the incorporation of environmental sustainability and climate change into the company's values (See Figure 5). Several other institutions have since requested access to the patient education materials, which were created under open access for this project.

Figure 5. *Staff-Developed Environmentally Sustainable Mission*

"We recognize that a healthy climate will promote the wellbeing for all of our patients. We pledge to work together to be good stewards of the environment, and to assist our patients in their environmental efforts as well."

DISCUSSION

Summary

The methodologies that were implemented led to successful outcomes based on the project aim. Staff at the nurse practitioner clinic gained a significant amount of knowledge about environmentally sustainable practices in health care, and they planned and implemented seven distinct environmentally sustainable initiatives via this project. Importantly, the clear majority of participants reported intentions to sustain almost all of the initiatives after project end. Through the use of transformational leadership, partnership, and cultural transformation, the staff at the clinic demonstrated leadership and claimed ownership of the initiatives they developed during this project.

A particular strength of this project included the site; a sample size of six clinic employees was manageable for meeting, decision-making, and project ownership. Each staff member had the opportunity to take part in leadership roles on specific environmentally sustainable interventions. An additional strength included the methodologies for deciding which environmentally sustainable changes to initiate in the clinic. The transformational leadership approach, Climate Conversation, and team development strategies all increased the likelihood of participant engagement and continuation of the project after the official end date with the project leader.

Interpretation

Based on pre-intervention and post-intervention mean scores on the NEAT, the project interventions had an overall positive effect on staffs' knowledge of environmental sustainability, beliefs about relatedness of environmental sustainability to health care, workplace environmental behaviors, and perceived ease of those behaviors. It seems to

follow that the seven environmentally sustainable interventions the staff participated in stemmed from the project's interventions of transformational leadership, partnership, and cultural transformation strategies. Furthermore, in comparison to other limited findings of nursing leadership in addressing environmental sustainability efforts, these results align with results from other nurse-led projects (Health Care Without Harm, 2015; Munoz, 2012; Sayre et al., 2010).

The impacts of this project reach farther than the stated outcomes; they impact both human and planetary health, based on systems theory. Participants identified several personal impacts that resulted from this project (See Figure 4). Additionally, the actions by the staff involved in this project impacted patients through the use of patient education handouts pertaining to the health impacts of climate change. Some participants also reported sharing their experience with their family members and encouraging behavior change at home. Furthermore, several other Midwestern health system leaders have formally and informally learned about the clinic staff and their successes in this project, which has the potential to lead to meaningful partnerships and widespread change in the future. Finally, it is important to note the clinic's divestment from fossil fuels, decrease in energy usage, and decrease in waste production as having an impact on the greater global system. As a result of this project, the nurse practitioner clinic has taken leadership in decreasing its carbon footprint.

However, not all outcomes were statistically significant. While only two categories of questions on the NEAT showed overall statistically significant positive change (awareness and frequency of behavior), it is important to assess the differences in pre- and post-test means for the two categories that did not result in statistically significant change (relatedness to health impacts and ease of behavior). While the difference in pre- and post-intervention survey means for relatedness to health impacts and ease of behavior increased, the pre-intervention means were high in both circumstances, and the sample size was low; this led to mean increases that were not statistically significant.

Limitations

Given the setting, the sample size, and the participants involved in this project, the work is not generalizable. While interdisciplinary, the small nurse-led clinic site does not employ physicians, who are traditionally viewed as leaders in health care settings. Addressing climate change and environmental sustainability will take an interdisciplinary effort across all industries, so launching a project in a physician-exclusive clinic may weaken the aforementioned methodologies for use in future projects. Additionally, the entire clinic comprised female staff members, which decreased diversity.

Threats to internal validity could have included bias, confounding, and imprecision in design. Bias in creating the staff educational material was possible, as the project lead aimed to create the presentation both to inform the staff on the topics presented in the NEAT survey and to provide context on the greater scope of climate change. It is also possible that the staff may have learned about aspects of environmental sustainability in health care outside of the clinic setting between the start and end of the project; thus, results indicating an increase in knowledge over time would not necessarily have reflected the project's educational intervention. In fact, several staff members reported doing personal research about environmental sustainability in the interest of making changes in their own home settings. In reality, the confounding variable of personal research was actually more of a positive benefit in the context of the topic of this project. Imprecision in design such as an unclear timeline and informal evaluations of the interventions implemented by the clinic team may have also threatened the internal validity of the project.

Overall, efforts to minimize and adjust for limitations such as bias and imprecision in design included best practices for interventions such as Climate Conversations (ecoAmerica et al., 2015; Levasseur, 2001; Marshall, 2011; MNIPL, 2010), and educational material (ecoAmerica et al., 2015; Schenk, 2013). It was not possible to control for the confounding variable of knowledge gained externally.

Conclusion

The methodologies in this project were useful for developing teams, building knowledge, encouraging leadership and team work, and creating ownership in regards to environmental sustainability within health care or otherwise. The team dynamics and staff-identified interventions are also sustainable over time, particularly because the efforts took place within the larger context of a health system with an environmental sustainability team. Even without a broader environmental team to join after project end, this project included purchasing infrastructure that remained at the clinic, which facilitates increased likelihood of project sustainability. It is entirely possible for most elements of this project to spread to other contexts including both health care settings and other industries. If similar methodologies are used throughout health care, this project could serve as a model for increasing knowledge about environmental sustainably and climate change within the context of health care, as well as support partnership-based teamwork for implementing environmental behaviors in the workplace. Given the potential for culture change across industries, more research is necessary to evaluate efficacy in larger teams and in other settings.

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