Climate Change Vulnerability and Opportunities for Adaptive Capacity in Patients with Heart Failure in an Ambulatory Setting

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ABSTRACT

Introduction: Climate change, a global crisis, affects health through changes such as more intense and longer lasting heatwaves. Some populations are more vulnerable to such events, including those with certain medical conditions, like heart failure. This study aimed to improve understanding of heat-related vulnerabilities and opportunities to enhance adaptive capacity of patients within an ambulatory heart failure clinic.

Methods: Heart failure clinic patients at the Clement J. Zablocki VA Medical Center in Milwaukee, Wisconsin, voluntarily completed a 25-question multiple-choice survey. We present descriptive statistics of the survey responses with count and percentage for categorical responses.

Results: We found that out of 60 survey respondents, 46.55% agreed or strongly agreed they would benefit from discussing heat illness risks with their physician, and 31.58% were not aware their heat illness risk is higher on days hotter than 90 °F (32.2 °C). Several vulnerability factors were common: 70.69% follow a prescribed fluid restriction, 33.33% live alone, 20.34% lack a car with air conditioning, and 20.00% worry about their ability to pay electric bills. Notable knowledge gaps included 65% do not check forecasted temperatures, 60% do not plan activities for the coolest times of day, 43.10% lacked awareness of cooling centers, 33.33% were unsure of heat illness symptoms, and 27.12% lacked awareness of Wisconsin's Focus on Energy program.

Conclusions: A sizable portion of survey respondents indicated they would benefit from discussing their heat illness risk with their clinicians, and many underestimated their personal risk of heat illness. Additionally, multiple vulnerability factors were highly prevalent and knowledge gaps were demonstrated in this population. Our findings support adaptive capacity opportunities through heat illness education, anticipatory guidance, and increased resource awareness for patients with heart failure in an ambulatory setting.

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INTRODUCTION

Climate change is a global crisis affecting human health. Extreme heat events are projected to continue to increase in severity, frequency, and duration.[1] Increases in extreme temperature events are accompanied by rising heat-associated morbidity and mortality.[2] Heat waves have been shown to have a negative impact on cardiovascular health, particularly in vulnerable populations.[2-4] Patients with heart failure are more susceptible to these events due to their decreased ability to thermoregulate, in part due to medications they may be prescribed to treat their disease, such as diuretics.[5]

Prior studies have focused on heart failure patients' knowledge of their disease or patients' awareness of their cardiovascular disease risk.[6] Other studies have assessed patient views on climate change and health.[7,8] However, there is a lack of knowledge regarding heart failure patients' awareness of their elevated risk of climate change-related heat events and their ability to adapt and prevent harm.

Patients are receptive to learning more about how their health is affected by climate change.[8] In addition, a majority of physicians believe climate change is impacting their patients' health.[7] Yet, both patients and physicians report rarely discussing climate and health during patient visits.[7,9] Some studies describe ways that patients may adapt to protect their health during elevated temperatures. Patients taking certain cardiac-related medications, such as diuretics, may need closer monitoring—especially during heat events,[2] which are defined as high humidity and temperatures

greater than 90 °F for at least 2 to 3 days.

In general, health risk awareness and adaptation may reduce morbidity and mortality. Patients with heart failure are more susceptible to illness related to extreme heat exposure. Patient-clinician dialogue and plan building can minimize the risk of heat-related illness in patients living with heart failure. Therefore, we found it important to improve our understanding of the opportunities for education and resources that can aid in awareness of and adaptation to heat illness. The objectives of this study were to identify the current level of heat-risk awareness in patients with heart failure, assess the prevalence of heat-risk vulnerabilities within this population, and understand their current resource awareness with the goal of identifying potential opportunities to build adaptive capacity.

Table. Demographic Characteristics of Survey Participants

Characteristic	n (%)
Age	
47-75	25 (41.67)
75+	35 (58.33)
Race	
White	40 (66.67)
Other	20 (33.33)
Education	
High school degree or less	15 (26.32)
Some college, no degree	25 (43.86)
Associate degree or higher	17 (29.82)
Area	
Urban	36 (62.07)
Rural	22 (37.93)

METHODS

Study Population

Study participants were recruited from the heart failure clinic at Clement J. Zablocki VA Medical Center in Milwaukee, Wisconsin, during January through March 2023. Participants had to be 18 years of age or older. Those without medical decision-making capacity were excluded from the study. Patients are typically referred to the heart failure clinic for multiple hospital admissions related to heart failure, difficulty managing volume status, and/or medication titration. Clinic providers include a nurse practitioner and 2 cardiologists. Collectively, the providers complete about 30 patient visits per week.

Survey Design and Implementation

A 25-item survey was designed based on a content expert literature review. Questions were reviewed by all study personnel and a survey design expert to ensure clarity for a basic literacy level. The study team further refined questions through cognitive interviewing of 6 individuals without a background in health care. The study process was piloted with 5 patients without any major flaws.

Six survey questions requested basic demographic data, with the option of "prefer not to answer" for most (Appendix). The remaining survey questions assessed participants' understanding of the link between heat exposure and their health, vulnerabilities to heat illness, understanding and access to adaptation strategies, and awareness of and interest in related resources.

Participants were recruited by study personnel—a clinic nurse practitioner—to voluntarily complete a survey in the clinic after their scheduled appointment. The study personnel provided a short, scripted description of the study to the participant and was available for any questions. In addition to the paper survey, participants were provided with an informational handout. Informed consent was not needed. Surveys were returned to the study personnel upon completion. (The survey and handout are included in the Appendix.)

The Clement J. Zablocki VA Institutional Review Board determined this study to be exempt on December 15, 2022.

Statistical Analyses

All analyses were done in R version 4.0.3 (R Core Team). A P value <0.05 was considered statistically significant. Summary characteristics were reported with count and percentage. Comparisons of variables were made by age (<75 vs 75+), race (White vs other), area (rural vs urban), and rating on the perceived benefit of discussing heat exhaustion with a physician (strongly agree/agree vs strongly disagree/disagree/neutral). Chi-square tests were used for these comparisons. Variables with cell sizes less than 10 were not included to maintain the VA policy regarding nonidentifiable data. Study author AT had full access to all study data and takes responsibility for its integrity and the data analysis.

RESULTS

Demographics

Of the 60 survey respondents, 58.33% were 75 years or older, and a majority reported their race as White (66.67%). Most participants indicated they live in an urban area (62.07%) and have some post-high school education (74.68%) (Table).

Prevalence of Heat Illness-related Risk Factors

Most survey respondents indicated that they follow a prescribed fluid restriction (70.69%). A third (33.33%) reported living alone, and nearly a fifth (18.97%) did not feel comfortable asking a neighbor for help. Many did not have a car with working air conditioning (20.34%) and worried about paying their electric bill during the past summer (20.00%).

Awareness of Heat Illness-Related Risk Factors

When asked if being outside on a very hot (>90 °F or 32.2 °C) or humid day puts their health at risk, 31.58% of survey respondents failed to recognize their health is at risk. The most identified heat illness symptom was dizziness (58.33%), followed by confusion (48.33%); nausea or vomiting (45.00%); heavy sweating (45.00%); cold, pale, clammy skin (40.00%); headache (38.33%);

fainting (38.33%); muscle cramps (35.00%); and decreased urination (18.33%). A third (33.33%) of respondents indicated they were unsure of heat illness symptoms.

Awareness of Strategies, Programs, and Resources for Adaptive Capacity

Participants were asked about their awareness of several community resources: 27.12% of respondents were unaware of the state's energy efficiency program, Wisconsin's Focus on Energy,[10] and 43.10% were unaware of their communities' cooling and charging centers.

When asked what steps they take to protect themselves during very hot or humid weather, the majority of respondents reported they stay indoors (81.67%) and/or turn on the air conditioner (70.00%); less than half increase water intake (45.00%) and/or plan outdoor activities for the coolest times of day (40.00%). In particular, respondents aged 75 years or older were less likely than those younger than 75 to plan outdoor activities for the coolest times of the day ($P=0.03$). Most respondents (65%) reported not checking the forecasted temperature.

Receptiveness to Heat Illness Risk Education

Respondents were asked if they felt they would benefit from discussing their risk of heat illness with their physicians: 46.55% agreed or strongly agreed, 36.21% were neutral, and 17.24% disagreed or strongly disagreed.

About 25% of patients invited to participate in the study declined. Their reasons included visual impairment with lack of usual visual aids, ie, glasses, concern about time before another visit, and lack of interest.

DISCUSSION

Vulnerability to heat events varies among different populations. Understanding how specific populations—such as those with heart failure—are vulnerable may inform strategies to preserve health during prolonged or excessive heat exposure. Wilhelmi and Hayden's framework for extreme heat vulnerability consisted of 3 components: exposure, sensitivity, and adaptive capacity.[11] They stressed the value of evaluating the knowledge and access to resources for coping with extreme heat events in order to understand the adaptive capacity of a specific population. To our knowledge, our study is the first to evaluate heat exposure knowledge, perspectives, and resource access of patients within an ambulatory heart failure clinic. We found several common vulnerabilities and knowledge gaps, which may elucidate opportunities to build adaptive capacity.

All of our study participants had 1 or more causes for impaired thermoregulation: a diagnosis of heart failure; prescription treatments, including diuretics and fluid restrictions; and/or age 65 or older. While many survey respondents were aware they were at increased risk for heat illness and were interested in discussing their risk with their physicians, nearly a third did not understand their risk and/or saw no potential benefit in discussing this topic with their physician. This knowledge gap is particularly striking considering that about 75% of the respondents had some post-high school education and could be considered a relatively educated patient population. This finding aligns with prior research showing that within a generalized population among people aged 65 or older, 35% believed heat waves pose no potential for personal harm.[12] The mismatch between perceived and actual risk related to heat exposure supports the need for effective patient education. Such education may aim to help patients with heart failure understand that their medical condition, along with its treatment, makes them more susceptible to heat illness and the precautionary measures they may take.

Our findings suggest knowledge gaps in multiple precautionary measures. While many respondents reported staying indoors and using air conditioning, a majority of participants reported not checking the temperature forecast or planning activities for the cooler times of day, including those older than 75 years. With this age group being less informed, focused education on planning outdoor activities may be more important—particularly as these individuals are also at higher risk due to less ability to physiologically compensate upon heat exposure.[5]

Helping patients identify symptoms of heat illness may be another opportunity for patient education. One-third of the study participants were unsure of these symptoms. Being aware of heat illness symptoms may allow patients to recognize the need for medical care promptly and take precautionary measures. Heart failure patients are already educated on monitoring for signs of poorly controlled heart failure, such as increasing home weights and difficulty breathing. Education regarding these and similar topics through disease management programs and patient navigator programs have been shown to improve self-care behaviors and decrease hospital readmissions in heart failure patients.[13-17] Expanding this education to include signs of heat illness may similarly reduce health care use.

In terms of demographics, a majority of survey respondents lived in an urban setting. Heat distribution in urban areas with decreased natural ground cover results in urban heat islands and increased exposure to heat.[11] A majority of respondents reported protecting themselves from excessive heat exposure by air conditioning their home. However, a fifth of respondents reported worrying about being able to pay their electric bill in the past summer. This is similar to the American Council for an Energy-Efficient Economy (ACEEE) finding that 25% of all US households experience a high energy burden, paying more than 6% of their income on energy bills.[18] Unfortunately, over 25% of our respondents were not aware of Wisconsin's Focus on Energy program, which can provide assistance with paying energy bills. Connecting more patients to energy efficiency and financial assistance programs may help preserve health.

Cooling centers are another strategy for reducing excessive heat exposure, particularly for those living in urban areas. Yet, 43% of survey respondents reported not being aware of cooling centers within their community. Hayden et al found a similarly low awareness of cooling centers in their study of household-level adaptive capacity among residents of Houston, Texas.[19] In addition to poor public awareness, access to centers is a challenge. Kim et al compared cooling centers across 25 US cities and found that only 10.3% were within walking distance from their home.[20] Our study showed that about 20% of participants lacked a car with working air conditioning. Health care professionals may improve the utilization of cooling centers by raising public awareness through patient education and providing resources for air-conditioned transportation services on high-heat days.

Despite most respondents living in an urban setting close to neighbors, a third reported living alone and nearly a fifth noted feeling uncomfortable asking a neighbor for help when not feeling well. Living alone was found to be a significant risk factor for heat-related death in the Chicago 1995 heatwave, while social contacts were protective.[21] Targeted patient outreach during high-heat days may be a solution for reducing the risk of heat-related death. Patients may also be counseled on contacting a support person for help during a heat event.

Next steps include developing and studying interventions aimed at reducing risk and preserving the health of patients with heart failure. Such interventions may include educating patients on precautionary measures and signs and symptoms of dehydration and connecting patients to available resources, including energy efficiency programs. This study also may serve as a model for future studies of other patient populations with increased vulnerability to climate change, such as those with chronic obstructive pulmonary disease or asthma.

Limitations

Our study was limited by a small sample size and a single institution. Our findings may not generalize to other VA clinics or the general public. Of note, the VA population includes a higher proportion of male patients, which may skew results. Despite these limitations, our approach may be leveraged in other clinical settings to identify and prioritize population-specific interventions.

CONCLUSIONS

Many knowledge gaps were observed in this population, including identifying signs and symptoms of heat illness, strategies to protect oneself during hot and humid days, and resources and programs available for assistance on hot days. These knowledge gaps not only support patient education and anticipatory guidance about heat illness for patients with heart failure in the ambulatory setting but also identify areas where patient knowledge is lacking and can be a focus for physicians.

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Appendix: Available at www.wmjonline.org

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