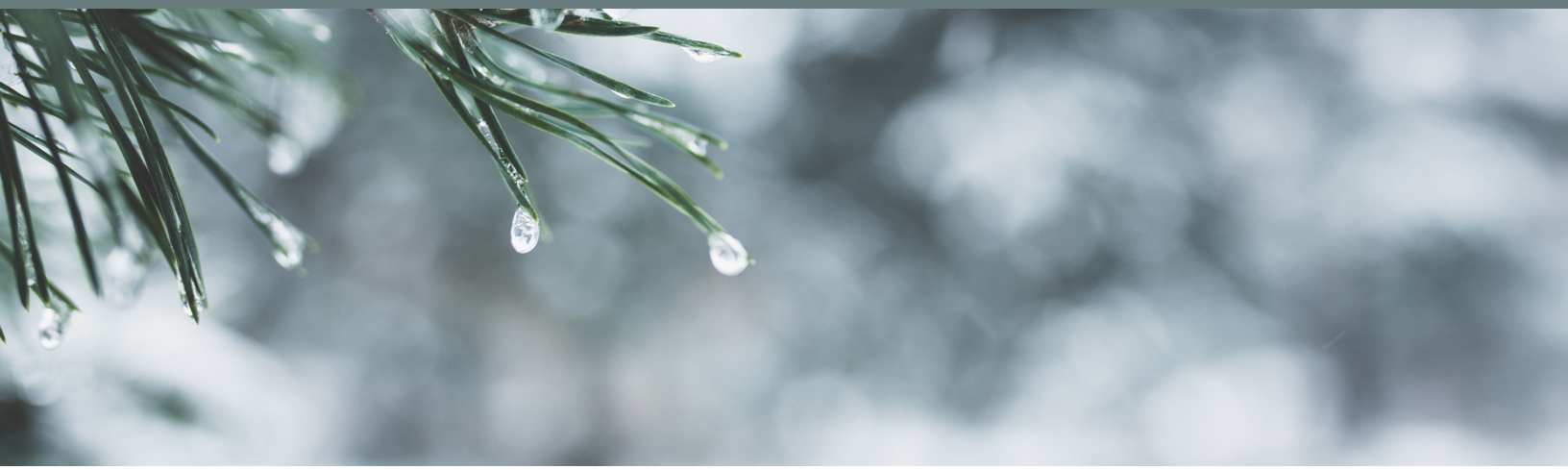
HUMAN & ENVIRONMENTAL PHYSIOLOGY RESEARCH UNIT

NEWSLETTER

HOME OF OPERATION HEAT SHIELD CANADA

Generating the science to help Canadians adapt and prepare to rising temperature extremes

JANUARY 2024 • VOLUME 3 • ISSUE 1



NEWS AND NOTEWORTHY

SIMPLE AND COST-EFFECTIVE WAYS TO BEAT THE HEAT: WHAT DOES THE SCIENCE SAY ON FOOT IMMERSION AND NECK COOLING?

We all know that air-conditioning is an effective way to beat the heat. Unfortunately, owning and operating home units can be hard on the wallet and even harder on the environment. For this reason, our team has been exploring whether low-cost, easily accessible, and sustainable cooling strategies are effective for protecting the health of the most vulnerable during hot weather and heat waves.

In a recent study led by Master student Emma McCourt and Postdoctoral Fellow Robert Meade, we evaluated the physiological effects of immersing the feet in cold water and applying cold, wet towels to the neck. These strategies have often been recommended by researchers and health agencies since they are inexpensive and easy to use by almost anyone.

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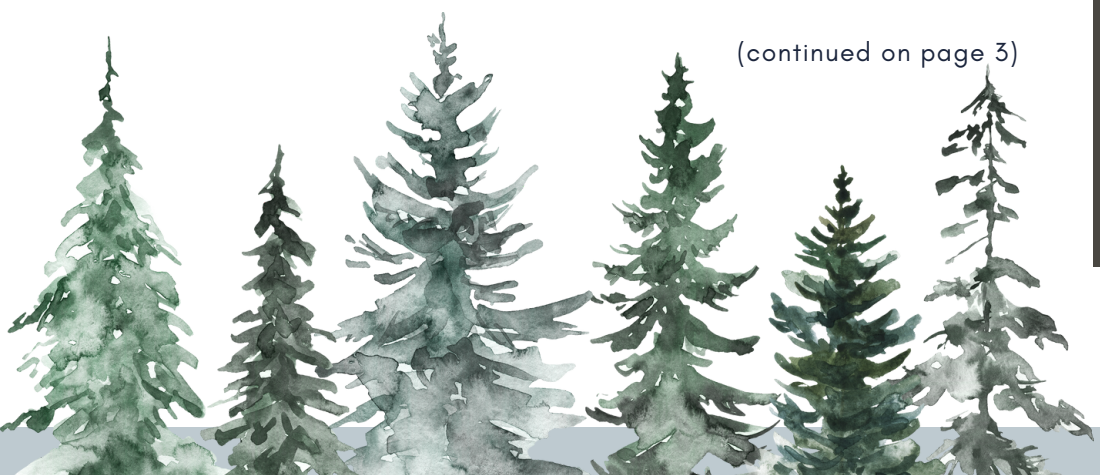

THE WINTER EDITION

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A MESSAGE FROM THE DIRECTOR

2023 is officially the hottest year ever recorded and temperatures are expected to keep rising. That difference between pre-industrial times and today puts the world dangerously close to crossing the 1.5 degrees Celsius global warming threshold scientists have warned about for years. The continued warming means extreme weather events, which have already worsened, will become even more frequent and intense across Canada, placing the public and workforce at greater risk of heat-related injuries and death.

With your help, we have led the charge to reshape the contemporary understanding of how humans respond to heat and the factors limiting human heat resiliency. This includes defining new approaches to heat prevention, with the knowledge transformed into policy measures to guide decision-makers in protecting the public and workers.

Our research has challenged long-standing heat-mitigation policies adopted by agencies worldwide. We showed that the one-size-fits-all current heat management guidelines promoted by public health and occupational health and safety agencies are inherently flawed, driving health inequities and ignoring large segments of the public and workforce. Based on this, our team has led the development and implementation of innovative interventions, such as the introduction of safe initial work times before heat-mitigation controls should be employed (e.g., rest breaks, cooling) by workers performing their duties in hot environments along with targeted solutions for heat vulnerable workers (e.g., women, older adults, and individuals with chronic disease) disproportionately impacted by occupational heat stress.

Using our cutting-edge heat wave simulation research, we have evaluated the efficacy of commonly recommended cooling interventions. We have generated new evidence-based heat protection guidelines by assessing whether interventions effectively reduce physiological indicators linked with adverse health outcomes during heat exposure under controlled laboratory conditions. These include i) the introduction of new indoor temperature limits for heat-vulnerable older adults, which were incorporated by Dr. Theresa Tam, Chief Public Health Officer of Canada, in her recently released report on Mobilizing Public Health Action on Climate Change in Canada, and ii) new guidance reshaping long-standing recommendations on the use of cooling centers, body cooling and fans to protect the vulnerable during hot weather. Our internationally recognized work is also uncovering the cellular mechanisms underpinning heat-related vulnerabilities and driving the development of lifestyle interventions and therapeutic strategies to enhance heat resiliency.

Our work, however, would not have been possible without the unparalleled support you and others have provided as volunteers for our studies. With the recent completion of renovations to our research unit and the addition of new tools and instruments funded by a Canada Foundation for Innovation grant ($5M), we are ready to accelerate our work to prepare Canada and the world better to respond to the greatest emerging threat to human survival - extreme heat. We hope that you will join us in addressing this important challenge.

If you are interested in participating in any of our studies, please reach out to me at gkenny@uottawa.ca.

Dr. Glen P. Kenny

Director
Human and Environmental Physiology Research Unit

NEWS AND NOTEWORTHY (CONTINUED)

SIMPLE AND COST-EFFECTIVE WAYS TO BEAT THE HEAT: WHAT DOES THE SCIENCE SAY ON FOOT IMMERSION AND NECK COOLING?

Before our study, however, there was no data supporting their effectiveness for older individuals, many of whom exhibit declines in the ability to regulate body temperature placing them at increased risk of adverse health events during heat waves.

The first article from this work, "Body Core Temperature After Foot Immersion and Neck Cooling in Older Adults Exposed to Extreme Heat" was recently published in the Journal of the American Medical Association, one of the most worlds most prestigious medical journals. We found that foot immersion with or without neck cooling did not prevent increases in core temperature in adults aged 65-81 years exposed for 6 hours to conditions experienced indoors during the 2021 Pacific Northwest Heat Dome (38°C, 35% relative humidity). While we did see some beneficial effects on cardiovascular responses, these effects were small when considering how hot participants felt and how much they had to drink to prevent dehydration. For example, combined foot immersion and neck cooling only prevented approximately ½ cup of fluid loss through sweat, which participants could easily replace by drinking a little more.

Overall, our study does not support foot immersion and neck cooling as effective cooling strategies for heat-vulnerable older adults. However, they highlight the need for more research to identify effective and sustainable cooling strategies for use by the most vulnerable Canadians.

In 2024, we are excited to share with you follow-up papers from this work as well as our other exciting studies and programs aimed at protecting the most vulnerable from the growing threat of extreme heat and climate change!

CLICK HERE TO READ MORE!

Body Core Temperature After Foot Immersion and Neck Cooling in Older Adults Exposed to Extreme Heat

Dr. Robert D. Meade, Emma R. McCourt, Dr. James J. McCormick, Dr. Pierre Boulay, Dr. Ronald J. Sigal, Dr. Glen P. Kenny

JAMA. Published online December 21, 2023. doi:10.1001/jama.2023.24417

FRESH OFF THE PRESS

Hot Topic: A Systematic Review and Content Analysis of Heat-Related Messages During the 2021 Heat Dome in Canada

Emily J. Tetzlaff, Nicholas Goulet, Melissa Gorman, Gregory R.A. Richardson, Paddy M. Enright, Robert D. Meade, Glen P. Kenny

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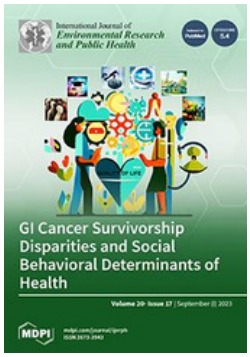
The intersection of the COVID-19 pandemic and the 2021 Heat Dome in Canadian digital news media: A content analysis

Emily J. Tetzlaff, Nicholas Goulet, Melissa Gorman, Gregory R.A. Richardson, Glen P. Kenny



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Working Under the 2021 Heat Dome: A Content Analysis of Occupational Impacts Mentioned in the Canadian Media

Emily J. Tetzlaff, Nicholas Goulet, Melissa Gorman, Leonidas Ioannou, Glen P. Kenny

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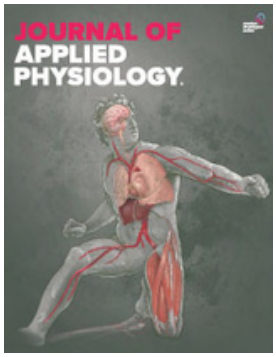
Brief ambient cooling preserves autophagy in peripheral blood mononuclear cells from older adults during 9 h of heat exposure

James J. McCormick, Robert D. Meade, Kelli E. King, Sean R. Notley, Ashley P. Akerman, Ronald J. Sigal, Glen P. Kenny



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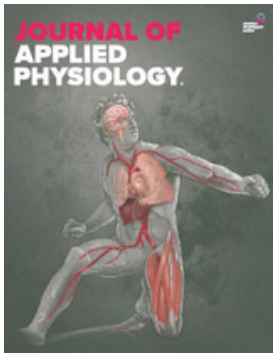
Physiological responses to 9 hours of heat exposure in young and older adults. Part II: Autophagy and the acute cellular stress response

James J. McCormick, Robert D. Meade, Kelli E. King, Sean R. Notley, Ashley P. Akerman, Gregory W. McGarr, Brodie J. Richards, Emma R. McCourt, Pierre Boulay, Ronald J. Sigal, and Glen P. Kenny



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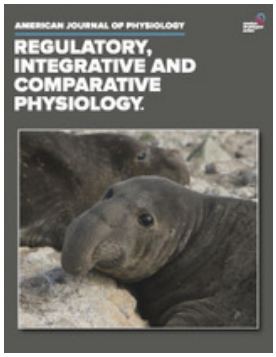
The intensity-dependent effects of exercise and superimposing environmental heat stress on autophagy in peripheral blood mononuclear cells from older men

James J. McCormick, Morgan K. McManus, Kelli E. King, Nicholas Goulet, and Glen P. Kenny



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HEPRU TEAM HIGHLIGHT

MEET FARAH MOURAD

Farah is a third-year undergraduate student completing her Honors Bachelor's of Health Sciences with a special option in Bioscience. Since joining the lab in her second-year, Farah has been assisting with a multitude of studies in understanding the impact of heat stress on cellular responses in our body, especially amongst vulnerable populations. Some of these studies include working directly with WSIB's health and safety program to develop worker heat-health safety policies, and as well as Health Canada with improving the outreach of heat-health messaging services and alerts. She is eager to continue developing her research skills and examine these relationships through various experimentation techniques, as she believes that these studies become important for developing public policies that protect and aid those vulnerable to heat injury.

Farah has been continuously working on her skills in hopes of pursuing the path of clinical research. Being able to connect research to advancing patient care has grown to be a goal of hers, especially through her experiences with working as a researcher and assistant in HEPRU. In her free time, Farah is also an avid writer and reader, and hopes to publish a book one day.

MEET KRISTINA-MARIE JANETOS

Kristina-Marie completed her undergraduate degree at Brock University with a Bachelors of Kinesiology in 2018. She began her journey as a master's student at the Human and Environmental Physiology Research Unit (HEPRU) in September 2021, where her thesis aims to understand how a short-term passive warm-water immersion protocol may be used as a heat acclimation strategy to further enhance heat dissipation in heat vulnerable older adults.

In conjunction to her thesis, Kristina-Marie has taken the lead on projects using laser-doppler flowmetry to study the effect whole-body and local heating on skin-blood flow in response to various pharmacological agents.

She has also assisted in comprehensive research dedicated to understanding how humans perform in adverse environments and the impact of that thermal stress on physiological responses and overall cellular function. Along with quantitative research, Kristina-Marie has assisted in qualitative reviews sought to evaluate the language, readability, suitability, and accessibility of heat-health messaging content disseminated by federal, provincial/territorial, and regional public health authorities in Canada, as well as systematic research to determine if there is a relationship between extreme hot weather conditions and tourism.

Looking into the future, Kristina-Marie hopes to continue to blend her expertise in physiology and qualitative research in order to develop evidence-based guidance and policy for protecting vulnerable persons from extreme heat and climate change.

RECRUITMENT CORNER

CAN THE USE OF CEILING FANS PROTECT YOU DURING A HEAT WAVE?

With the increasing regularity and intensity of hot weather and heat waves, there is an urgent need to develop heat-alleviation strategies able to provide targeted protection for heat-vulnerable older adults. While air-conditioning provides the most effective protection from extreme heat, it is inaccessible for many individuals. Air-conditioning is also energy intensive, which can strain the electrical grid and, depending on the source of electricity generation, contribute to greenhouse gas emissions. For these reasons, recent guidance has recommended the use of electric fans as a sustainable cooling alternative. While fans may increase sweat evaporation and heat loss in healthy, young adults, evidence supporting their use in older adults is scarce. Further, studies show that when environmental temperature exceeds skin temperature, fans are not effective and can even exacerbate hyperthermia in older adults. While older adults only account for approx. 13% of the population, they account for approx. 40% off all hospitalizations. In the context of sustainable cooling interventions, this is of particular importance given that many hospitals and long-term care homes do not have air-conditioning and rely on ceiling fans to enhance sweat evaporation while participants are bed-resting. While recent biophysical modelling has suggested that pedestal fans likely provide a clinically meaningful cooling effect (proposed to be $\geqslant$0.3°C) in temperatures below approx. 34°C in older adults, the efficacy of ceiling fans in mitigating heat strain in these conditions is currently unknown.

To address these knowledge gaps, we will evaluate body core temperature, cardiovascular strain, orthostatic intolerance, dehydration, and thermal comfort in adults aged 65-85 years exposed for 8-hours to conditions experienced during indoor overheating occurring during a heat wave in a temperate continental climate (31°C, 45% relative humidity). Each participant will complete two randomized exposures that will differ only in the airflow generated by a ceiling fan: no airflow (control) or standard airflow. Participants will remain in a supine position for the duration of the 8-hour exposure period, except for during hour 7 when they will complete a series of cardiovascular autonomic response tests.

This study is looking for men and women 65-85 years of age. Please contact Dr. Glen Kenny at gkenny@uottawa.ca to participate.

www.hepru.ca gkenny@uottawa.ca Montpetit Hall, University of Ottawa, 125 University Pvt. Ottawa, Ontario K1N 6N5, Canada

RECRUITMENT CORNER

HEAT STRESS & WOMEN'S HEALTH

HEPRU has demonstrated that aging is associated with large reductions in the body's ability to lose heat—which can result in marked elevations in body temperature and a greater strain on the cardiovascular system during a heat stress. Unfortunately, there is a lack of research into how women change in their heat loss responses as we age. At the moment, we are addressing this gap in research into women's heat health with two study series.

In our first series of studies, we seek to better understanding the effects of menopause on heat tolerance during exposure to heat at rest. The studies are currently focused on assessing the separate effects of hot flashes, hormone replacement therapy and diabetes on heat tolerance.

In our second series of studies, we are investigating the differences between older and younger women in heat tolerance during heat exposure at rest. We will be examining both local and whole-body responses to heat exposure.

This study is looking for participants that meet the following criteria:

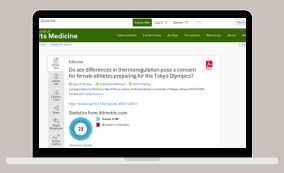
- Women 50-85 years of age
- May have type 2 diabetes and/or hypertension

Additionally, if you are interested in our menopause-related studies we are looking for women that:

- Have no history of premature or surgically induced menopause

Please contact Dr. Glen Kenny at gkenny@uottawa.ca to participate.

Learn more about how age and sex affect thermoregulation at www.hepru.ca



Do sex differences in thermoregulation pose a concern for female athletes preparing for the Tokyo Olympics?

The Relation between Age and Sex on Whole-Body Heat Loss during Exercise-Heat Stress.

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RECRUITMENT CORNER

COLD-WATER IMMERSIONS & WOMEN

Autophagy is a vital protection mechanism that is found in nearly all human cells and increases during physiological stress. Accumulating evidence is alluding to sex-related differences in autophagic activation, indicating a reduced dependence in women attributed to the antioxidant properties of estrogen. Our recently completed research at HEPRU has shown that a moderate cold stress can stimulate autophagy in young males, however, it is unknown how cellular protection mechanisms may differ in women.

In an upcoming study, we seek to understand the influence of estrogen on cellular protective mechanisms, such as autophagy, during the physiological stress of cold exposure. This study will involve three visits to the laboratory including a preliminary session (to assess aerobic capacity and body composition) and two cold-water immersion sessions at different intensities.

This study marks the start of the second series that assesses autophagy and other cellular protection mechanisms during cold-water exposures.

In this first phase of the study, we are looking for participants that meet the following criteria:

- Women 18-30 years of age
- No medications (excluding birth controls)
- Habitually active (150+ min a week of structured exercise)

Please contact Kelli King at kking073@uottawa.ca to participate.

Learn more about how age and sex affect thermoregulation at www.hepru.ca

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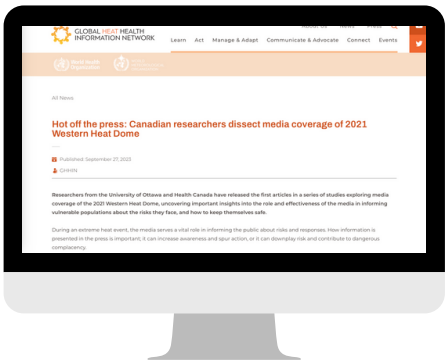
NEW IN THE NEWS

Over the course of the 2023 fall, HEPRU's research was highlighted by various local, provincial and national media outlets showcasing how our practical, action-oriented research is impacting public health in Canada. **Click the links on the screens below to learn more!**



Hot off the press: Canadian researchers dissect media coverage of 2021 Western Heat Dome

Researchers from the University of Ottawa and Health Canada have released the first articles in a series of studies exploring media coverage of the 2021 Western Heat Dome, uncovering important insights into the role and effectiveness of the media in informing vulnerable populations about the risks they face, and how to keep themselves safe.

During an extreme heat event, the media serves a vital role in informing the public about risks and responses. How information is presented in the press is important; it can increase awareness and spur action, or it can downplay risk and contribute to dangerous complacency.

As exposure to extreme heat continues to rise due to climate change, it is becoming increasingly important for the press to strategically cover heat events in order to help protect those at risk.

In order to understand how extreme heat is covered in Canadian press, and the impact of that coverage, a team of researchers from the University of Ottawa's Human and Environmental Physiology Research Unit, together with experts from Health Canada's Climate Change and Innovation Bureau, recently conducted a series of studies exploring media coverage of the most historic and deadly extreme heat event on record in Canada - the 2021 Western Heat Dome.

Global News: What are the Benefits to taking a cold plunge?

Early in November of 2023, Kelli King engaged in an interview with Global News 980 CKNW Mornings with Simi. During this discussion spotlighting the advantages of cold plunges, Kelli noted that the numerous mental health claims associated with cold-water plunges lack robust scientific backing, with various studies yielding conflicting results.

Regardless of whether or not the cold-induced mood enhancement is attributable to a placebo effect, researchers are persisting in their exploration of health benefits linked to cold-water immersions and hope to uncover valuable insights on how cold plunges may be advantageous to humans.

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