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

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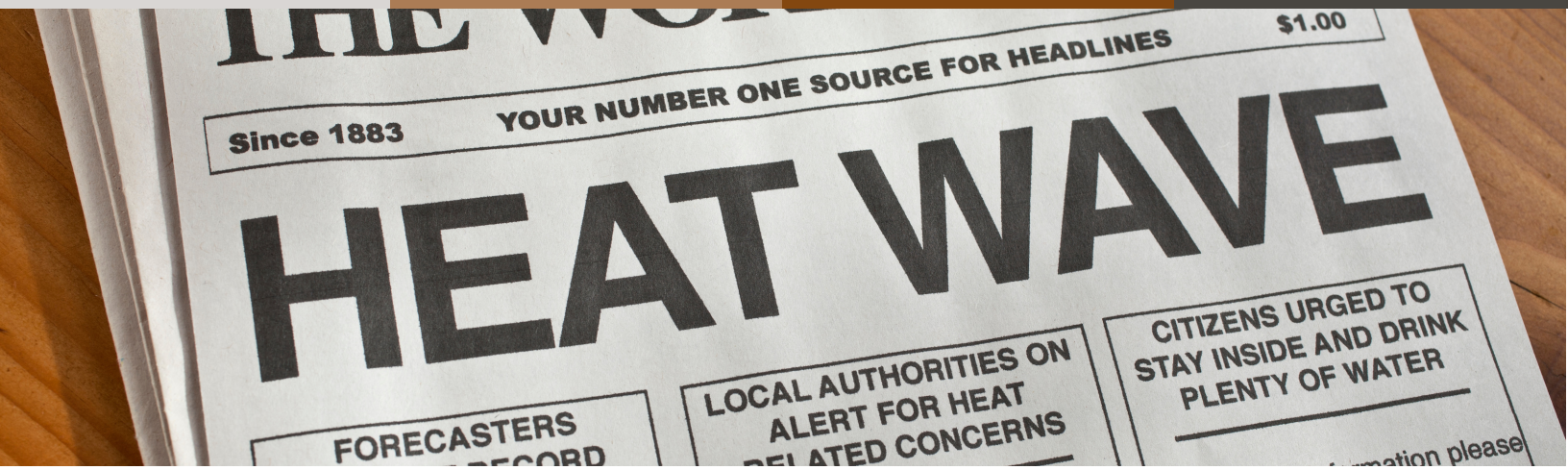


NEWS AND NOTEWORTHY

NEW STUDIES FROM THE HEPRU ARE UNCOVERING HOW AGING CHANGES OUR ABILITY TO STAY COOL AND WHAT WE CAN DO ABOUT IT.

A series of exciting new studies from the HEPRU is helping to uncover how our ability to stay cool during hot weather and heat waves changes as we get older and how we can protect the most vulnerable.

In the first of these studies, Postdoctoral fellows Drs. Robert Meade and Jeremy McCormick compared physiological responses, from heat loss and body temperature at the whole-body level down to the body's individual cells, between young and older adults exposed to a daylong simulated heat wave (9 hours in extreme, dry heat conditions; 40°C, approx. 10% relative humidity). The findings of this work, recently published in the Journal of Applied Physiology, showed that older adults experience greater increases in internal temperature and that these effects were exacerbated in participants with health conditions commonly associated with heat vulnerability (type 2 diabetes and hypertension)(Link). It was also observed that these age-related increases in hyperthermia were paralleled by declines in the ability of our body's cells to protect themselves (Link). These studies provide important new information on how heat vulnerability changes as we age.

But how can we protect ourselves, particularly when we don't have an air conditioner at home?

(see page 3 to learn more)

THE SUMMER EDITION

TABLE OF CONTENTS

A MESSAGE FROM THE DIRECTOR

As we make our way through summer, extreme heat is having catastrophic effects worldwide as record temperatures threaten the lives of millions. As summer heat waves are expected to intensify, immediate action must be taken to protect the most vulnerable. This includes protecting our workforce from extreme heat. Extreme heat is a 'silent' killer because it is not a visible threat. It causes some of the highest death tolls among all-natural weather hazards, dramatically increasing short-term mortality in vulnerable populations (e.g., children, women, the elderly, the physically challenged, and individuals with chronic health conditions). Heat-exposed workers are also at an elevated risk, experiencing impaired work performance and cognitive function, leading to a greater risk of work-related injuries, including severe heat-related health complications (e.g., heat stroke, adverse cardiovascular events).

With your support over the past few years, we have led the charge to assess and develop effective heat mitigation strategies and advice to protect the most vulnerable. This has included developing guidance on indoor temperature limits during hot weather. Keeping your home at or below 26°C will ensure you do not experience undue physiological strain. If you live in a dwelling where indoor overheating is a risk, plan to spend 1-3 hours in a cooler environment such as a shopping mall, community centre or other facilities. Spending a full day in an overheated home can pose a risk to your health, especially if indoor temperatures climb above 30°C (notably, indoor temperatures in some homes in British Columbia reached 40°C during the 2021 heat wave). If you visit a cooled location, avoid overexerting yourself upon returning home, as your body temperature will rapidly increase upon re-entry to the heat. This is especially important given that you may not sense the heat the same way, as spending time in a cooler environment can make you feel better, giving you a false sense of security when you transition back to your overheated dwelling. Whenever possible, stay within 'cooler' areas of your home and close off (shut door(s)) of hotter areas (e.g., rooms with large windows with sun exposure). Stay hydrated and find ways to stay cool for the rest of the day.

Many of you may be tempted to use fans. While fans can make you feel better, they do not reduce your body temperature during exposure to very hot conditions. If you feel unwell and overly fatigued from exposure to the heat, the best and most effective way to protect yourself during an extreme heat event is to cool your dwelling. Keeping your home at or below 26°C will ensure you and your loved ones remain safe.

As noted above, extreme heat can have severe consequences on the health and safety of workers. Despite this, workers are given limited guidance on how to protect themselves during hot days. What limited guidance that is available has been primarily developed for young male workers, leaving women and older individuals under-protected. Our team is leading the charge to address this problem. While we are in the early stages of our work, it is clear that sex- and age-specific safe exposure limits for work in the heat are required to ensure all workers are protected. We will provide updates as we continue this work over the next two years.

We must continue our important work as we face the unyielding threat of rising global temperatures. The success of our work hinges on the unparalleled support you and others have provided as volunteers for our studies. Later this fall, we will commence a large study assessing the effects of fans on individuals confined to their beds (e.g., those individuals in hospitals, long-term care facilities, and others). We are also continuing our work developing safe exposure limits for women and older adults who must perform their duties in hot conditions and researching the general effects of heat on the health and well-being of women. If you are interested in participating in our studies, please contact me at gkenny@uottawa.ca. We are looking for men and women up to 85 years of age with and without diabetes or hypertension. All eligible participants will receive a full fitness assessment.

Dr. Glen P. Kenny

Director
Human and Environmental Physiology Research Unit

Continued from Page 1

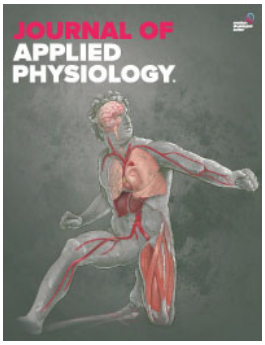
In such a situation, health agencies, including Health Canada and the World Health Organization widely recommend spending a few hours per day in an air-conditioned location like a cooling center, a friend's house, a shopping mall etc. While it is common sense that moving to a cool place helps us cool off, it was not known how effective this strategy is or how long the cooling effects last when we return to a hot environment. So, in a recent paper published in Environmental Health Perspectives (Link), the team simulated the effects of visiting a cooling center during a day-long heat wave. While we observed a robust reduction in internal body temperature in older adults briefly exposed to air-conditioning (compared to those who weren't), these effects were transient - body temperature quickly increased upon return to a hot environment. These findings provide important evidence to support the use of cooling centers during heat waves but also highlight that the cooling effects are temporary, a factor that should be considered in future guidance issued by health agencies.

This is just a snapshot of some of the exciting work being conducted at the HEPRU aimed at improving guidance on using strategies for protecting vulnerable individuals during hot weather and heat waves!

FRESH OFF THE PRESS

Physiological responses to 9 hours of heat exposure in young and older adults: Part I - Body temperature and hemodynamic regulation

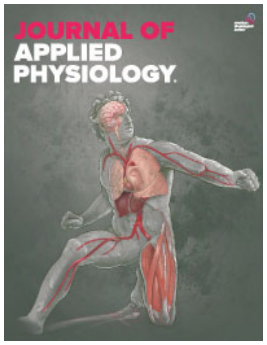
Robert D. Meade, Sean R. Notley, Ashley P. Akerman, Gregory W. McGarr, Brodie J. Richards, Emma R. McCourt, Kelli E. King, James J. McCormick, Pierre Boulay, Ronald J. Sigal, and Glen P. Kenny



CLICK HERE TO READ MORE!

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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Efficacy of Cooling Centers for Mitigating Physiological Strain in Older Adults during Daylong Heat Exposure: A Laboratory-Based Heat Wave Simulation

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

CLICK HERE TO READ MORE!

HEPRU TEAM HIGHLIGHT

MEET CAROLINE LI-MALONEY

Caroline began as a doctoral student in September 2022. She completed her undergraduate education at the University of Toronto and her master's degree at the University of Ottawa in the Careau lab, specializing in evolutionary physiology.

She made the switch from rodents to humans and is interested in how heat stress affects women's health. Caroline's thesis is focused on whether hot flashes are a factor in how vulnerable menopausal women are to heat illness.

Since starting, Caroline has taken the lead on projects using laser-doppler flowmetry to study the effect of heat on skin-blood flow. She is currently investigating how menopause can affect skin blood-flow responses across the body.

Click here to read more about Caroline.

MEET NICHOLAS GOULET

Nicholas is a second-year master's student who volunteers at the Human and Environmental Physiology Research Unit (HEPRU). He joined the laboratory in June 2021 after completing his undergraduate degree in human kinetics and participating in studies at the HEPRU.

In addition to his volunteer work at the HEPRU, Nicholas is completing his master's thesis at the Behavioural and Metabolic Research Unit (BMRU) under the supervision of Dr. Pascal Imbeault at the University of Ottawa, where he is studying how sleep apnea impacts lipid metabolism differently between men and women.

His involvement in both laboratories has strengthened his human- and cell-based research abilities. This year, Nicholas is starting his doctoral studies under the co-supervision of Dr. Imbeault and Dr. Kenny hopes to characterize heat vulnerabilities in individuals with respiratory conditions such as asthma, chronic obstructive pulmonary disease, and sleep apnea. Nicholas is motivated by an ambitious desire to drive discovery and advancing knowledge related to age- and disease-associated vulnerabilities, with the ultimate goal of protecting the health of Canada's most vulnerable populations.

Click here to read more about Nicholas.

RECRUITMENT CORNER

PROTECTING WORKERS PERFORMING THEIR DUTIES IN THE HEAT

Occupational heat stress directly threatens workers' ability to live healthy and productive lives. Heat exposed workers are at an elevated risk of experiencing impaired work performance and cognitive function leading to a greater risk of work-related injuries, which includes traumatic injury (e.g., fractures) and heat-related illnesses (e.g., heat stroke, acute kidney injury, adverse cardiovascular events).

To mitigate this risk, safety organizations recommend upper limits for heat stress, typically defined by the level of effort and ambient conditions. Yet, heat stress continues to compromise worker health and safety. This can in part be attributed to the fact that employers underestimate the risks associated with heat stress and are given relatively limited guidance in how best to implement heat mitigation strategies.

Perhaps the strongest contributing factor is the fact that current occupational heat stress management guidelines assume a one size fits all approach and do not consider individual variability in physiological tolerance to heat stress, leaving many heat-vulnerable workers, such as women and older individuals under protected.

With climate change fueling an increase in the occurrence of hot weather, the risk of heat-related injury and disease is expected to rise dramatically in both prevalence and severity over the next decades.

To address the shortcomings of current heat management guidelines, we are conducting a study to generate safe work times to protect all workers, regardless of age or sex, that must perform their jobs in hot environments.

You can help protect our workers by participating in this important study. We are looking for healthy older (55-69 years) men and women who are habitually active but not engaged in endurance training activities. If you feel like you can contribute, reach out to Dr. Glen Kenny at gkenny@uottawa.ca to participate.

Learn more about our occupational heat stress research at www.hepru.ca

Heat tolerance and the validity of occupational heat exposure limits in women during moderate-intensity work.

Initial stay times for uncompensable occupational heat stress in young and older men: a preliminary assessment.

Heat Tolerance and Occupational Heat Exposure Limits in Older Men with and without Type 2 Diabetes or Hypertension.

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

RECRUITMENT CORNER

DOES MENOPAUSE AFFECT THE BODY'S ABILITY TO COOL DOWN?

For women, menopause is a normal part of the aging process, however, there are often undesirable symptoms, such as hot flashes. Hot flashes are known to severely impact quality of life through consequences such as sleep deprivation, heat intolerance, and physical and general malaise. Moreover, hot flashes are associated with increased risk for cardiovascular disease and related deaths. Despite the impact that hot flashes have on up to 80% of menopausal women, there has been no comprehensive research assessing whether women who experience hot flashes have impairments in heat loss during a heat stress, and therefore a higher risk of heat-related illness.

Our team is initiating a series of studies aimed at understanding the effects of menopause on skin blood-flow, which is integral for dissipating heat to the environment.

Our key focus is on women who may be the most vulnerable to heat-related illness: women with severe hot flashes and women with chronic health conditions. If you are in menopause, please consider participating in our study.

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

- Women 40-65 years of age
- Post-menopausal (>1 year since last menstrual cycle)
- With and without severe hot flashes
- May be physically active but not engaged in intense exercise training programs
- With and without type II diabetes
- 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

DO COMMON CHRONIC DISEASES AFFECT HOW IMMUNE CELLS RESPOND TO EXERCISE?

Autophagy is a crucial process that takes place in almost all cells in the human body, which serves to protect normal cellular function when faced with physical stressors like exercise or high temperatures. If the stressor is too severe for the cell to handle, cell death mechanisms (apoptosis) are activated to eliminate the cell and prevent harm to surrounding cells or tissues.

To gain insight into these vital cellular mechanisms in humans, we are studying immune cell responses in numerous populations before and up to six hours after engaging in 30 minutes of semi-recumbent cycling exercise in temperate (25°C) and hot (40°C) environments.

Our findings thus far show that during exercise in a temperate environment, cellular survival mechanisms (autophagy) are activated, but when exercise is performed in the heat, there is a shift toward cellular death mechanisms (apoptosis).

We are currently looking for participants with hypertension and type II diabetes to continue investigating these responses across the lifespan. This research is critical to better understand how cells are affected during exercise- and heat-induced stress and to ultimately protect human health.

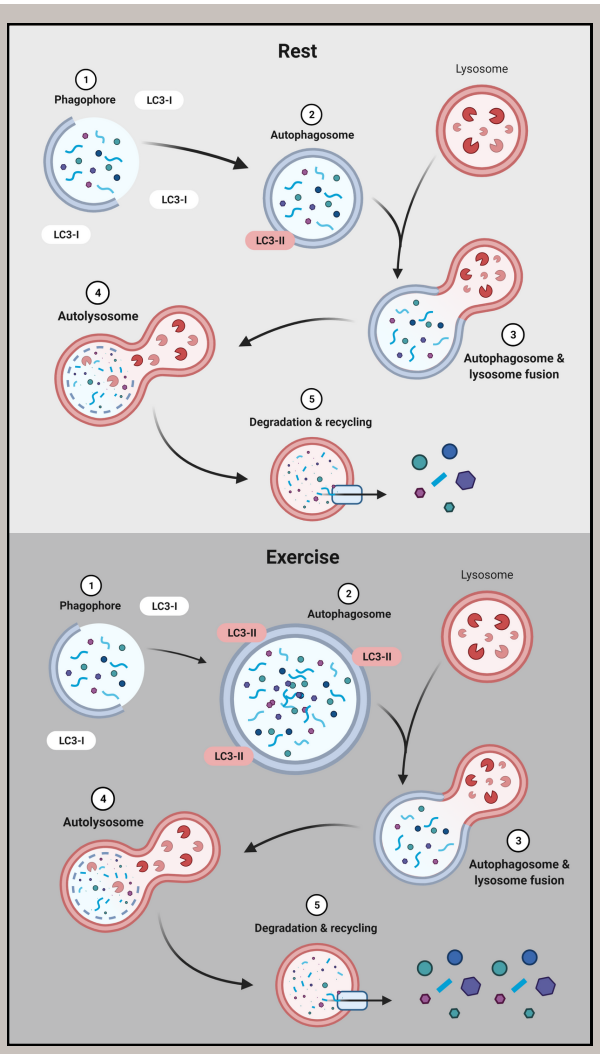

Figure. Summary of the autophagic process at rest (top panel) and during exercise (bottom panel). Increased levels of LC3-II during exercise reflect an increase in autophagosome content (misfolded and damaged proteins).

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

- Males and females 60-80 years of age
- With type 2 diabetes or hypertension
- May be physically active but not engaged in intense exercise training programs

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

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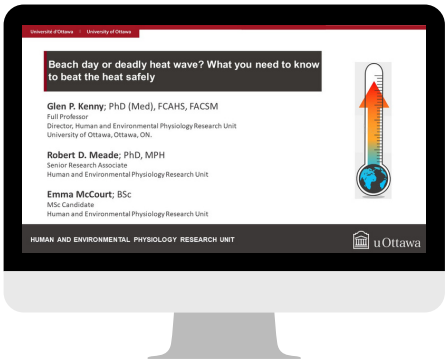
NEW IN THE NEWS

Over the course of the 2023 spring, 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!**

Conference Engagement: American College of Sports Medicine 2023

From May 30 to June 2, many HEPRU team members travelled to Denver, Colorado, for the American College of Sports Medicine 2023 Annual Meeting and World Congress. HEPRU was well represented at the conference, with five master's students, two doctoral students, and two post-doctoral fellows presenting noteworthy findings from multiple ongoing studies in the laboratory. The presented topics included our innovative work on the effectiveness of cooling strategies (e.g., fan use, limb cooling) during day-long exposures to extreme heat, and how sleep deprivation or ice-cold drinks affect the body's capacity to thermoregulate during exercise in the heat, as well as cellular responses to heat-, cold-, and exercise-related stress, and also how aging influences our blood vessels' ability to vasodilate during passive whole-body heating.

HEPRU student Emma McCourt was also awarded the 1st Place Master's Student Research Award by the ACSM Exercise and Occupational Physiology Interest Group, Emergency Responder Human Performance Lab, for her work on the "*Efficacy Of Limb And Neck Cooling For Limiting Heat-related Cardiac Autonomic Disfunction In Older Adults.*"



Webinar: Ottawa Branch of the National Association of Federal Retirees

In mid-May 2023, Dr. Glen Kenny and his team gave a presentation to members of the National Association of Federal Retirees on heat mitigation strategies and tips to keep healthy and well during hot summer days. In partnership with Health Canada, Dr. Kenny's team at the Human and Environmental Physiology Research Unit (HEPRU) has conducted groundbreaking research in this area. The results of HEPRU's most recent studies were shared, including work on the development of indoor temperature limits and heat exposure guidelines for older adults, as well as novel insight into the effectiveness of cooling strategies such as fan use and limb cooling. This work will form the basis for new recommendations and messages that will be shared with Canada's public health partners and the World Health Organization.

Conference Engagement: Workplace Safety North

This year, Workplace Safety North celebrated 25 years of helping make Ontario mining operations safer. Dr. Glen Kenny and PhD Candidate Emily Tetzlaff had the pleasure of presenting during the annual Mining Health and Safety Conference from April 18 to 20, 2023, in Sudbury, Ontario. Their talk titled *A Hot History, a Hotter Future: Creating a Heat-Resilient Workforce for the Mining Industry in the Face of a Warming Planet* focused on how heat continues to affect worker health and safety within the mining and metallurgical industry, which is concerning given the projected increase in the number of hot weather events due to climate change. Together, Dr. Kenny and Emily offered key solutions and important advice on how to improve and refine existing workplace heat prevention and monitoring programs.

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