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

APRIL 2024 • VOLUME 3 • ISSUE 2

NEWS AND NOTEWORTHY

ELECTRIC FANS ARE AN INEXPENSIVE WAY TO IMPROVE THERMAL COMFORT BUT WON'T PROTECT YOU DURING A HEAT WAVE

Electric fans are a widely available, inexpensive strategy that can make us feel more comfortable during hot weather. However, health agencies have historically cautioned that electric fans cause the body to gain more heat during heat waves (typically in air temperatures ≥35°C/95°F). Despite this, recently published guidance has suggested that fans can still cool the body in air temperatures up to 40°C by making it easier for sweat to evaporate. By re-analysing the studies used to support this claim, postdoctoral fellow Dr. Robert Meade showed that any improvements in sweat evaporation with fan use are not large enough to keep the body cool when air temperatures reach 33°C or more, especially for individuals with reduced ability to sweat (e.g., older adults). Strategies to cool the inside of the home like air-conditioning or heat pumps are more effective options, but strategies are needed to ensure they are available to everyone and do not cause more damage to the environment.

Robert's work is freely available from the Lancet Planetary Health

THE SPRING EDITION

TABLE OF CONTENTS

A MESSAGE FROM THE DIRECTOR

While winter made a brief comeback in Ontario at the start of April, "Those Lazy-Hazy-Crazy Days of Summer" are coming soon and it is time to get prepared for some those warm summer days. While staying active can help your body handle hot weather by enhancing heat dissipation, engagement in regular physical activity also improves brain health, facilitates weight management, reduces the risk of disease, strengthens bones and muscles and many other health benefits. For this reason, engaging in regular physical activity is important for preserving health as we get older.

Aging is closely associated with progressively increased risk for chronic health conditions and reductions in functional disability. However, it is important to note that even healthy older adults experience decrements in physical function, which can impact one's ability to engage in regular activities of daily living. Studies demonstrate that we experience an average decline of ~5-15% in aerobic fitness (a strong predictor of all-cause mortality) per decade after the age of 30 years, ultimately leading to a decrease in exercise capacity (and therefore functional ability) of up to 60% by the age of 70 years. However, it is important to note that such a loss in performance is more strongly related to an increase in sedentary lifestyle rather than chronological aging. Bottom line, stay active! At a minimum, engagement in regular physical activity can increase the number of years of generally healthy living, free from serious disease or chronic disability.

As in the case of age-associated reduction in fitness, your ability to lose heat decreases with increasing age. A recent study from our lab showed that whole-body heat loss declines with increasing age by ~5% per decade. Regular physical activity can increase your body's ability to dissipate heat and your ability to tolerate those warm summer days.

As the warm summer days approach, take the opportunity to get more physically active. It is never too late. Start slowly and with each passing day or week gradually increase the amount of time you are physically active. An active lifestyle leads to a higher quality of life no matter what time of year it is. If you have questions, reach out to our team. We would be happy to give you some exercise tips!

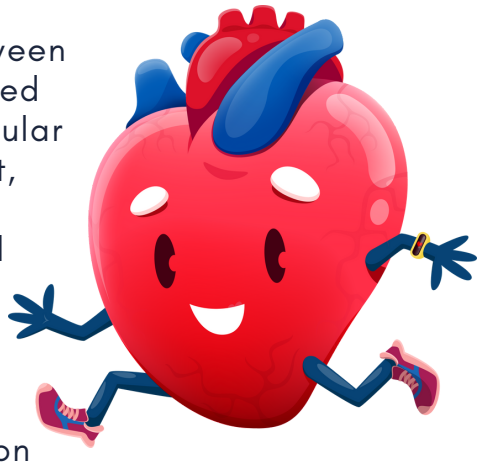
Dr. Glen P. Kenny

Director
Human and Environmental Physiology Research Unit

SPOTLIGHT FEATURE WITH DR. PIERRE BOULAY

CARDIORESPIRATORY FITNESS: A PREDICTOR OF MORBIDITY, MORTALITY AND QUALITY OF LIFE

Cardiorespiratory fitness refers to the ability of the circulatory and respiratory systems to supply oxygen to skeletal muscles during sustained physical activity or exercise. Often referred to as aerobic capacity or VO_{2max}. Its measurement has numerous clinical applications including assessment of cardiovascular health status, aerobic capacity (VO_{2max}), functional capacity and the ability to accomplish activity of daily living. Also, numerous studies have demonstrated a strong association between higher levels of cardiorespiratory fitness and a reduced risk of mortality from all causes, including cardiovascular disease, cancer, and other chronic conditions. In fact, it was shown that a 1 metabolic equivalent (MET) increment in cardiorespiratory fitness was associated with a considerably lower all-cause (12%), cardiovascular (16%), and cancer (14%) mortality independent of traditional risk factors such as hypertension, diabetes, high cholesterol levels and obesity. More recently, it was shown that the reduction in mortality associated to a 1 MET improvement in VO_{2max} could reach up to 36% (11 to 36%) with individuals in the lowest fitness category (below 25th percentile) demonstrating the greatest benefits. These benefits were not only shown for healthy individuals but also for those with hypertension, diabetes, dyslipidemia (high cholesterol levels) and coronary artery disease.



Moreover, cardiorespiratory fitness has been shown to be comparable or outperform traditional risk factors in terms of health outcomes. The studies are so convincing that in 2016, the American Heart Association advocated the need to recognize cardiorespiratory fitness as a clinical vital sign and the importance to assess cardiorespiratory fitness routinely. This statement was recently updated with new evidence that reinforces the notion that cardiorespiratory fitness should be a routine assessment as it is for blood pressure, cholesterol levels and glucose monitoring in health care settings.

You don't have to be an athlete and just a small gain in your cardiorespiratory fitness will improve your chances of walking away from the most common chronic diseases. Unfortunately, physical inactivity and a low cardiorespiratory fitness cannot be treated by medications like traditional risk factors, but you can take steps to improve your quality of life by having your VO_{2max} measured and knowing how to improve it.

SPOTLIGHT FEATURE (CONTINUED)

CARDIORESPIRATORY FITNESS: A PREDICTOR OF MORBIDITY, MORTALITY AND QUALITY OF LIFE

On average, 150 minutes per week (2.5 hrs) of structured exercise will move you up 1 category and 300 minutes per week (5 hrs) up by 2 categories or above average (>50th percentile) if you are in the lowest fitness category. Obviously, the amount of exercise needed may vary depending on your total daily physical activity level and what type of activity you are currently doing. Consulting a kinesiologist is key to having an efficient exercise program and maximizing the health benefits from an exercise program. Even if you already have a good aerobic capacity, maintaining it is crucial considering that a decrease of only 2 METs in VO_{2max} is associated with an increase in mortality risk of 76%.

Cardiorespiratory fitness is a modifiable indicator of long-term mortality, and everyone should be encouraged to achieve and maintain high levels of aerobic capacity. A small-time investment that will not only improve your quality of life, but also increase your life expectancy and the number of years lived without a chronic disease or disability.

Dr. Pierre Boulay
Clinical Exercise Physiologist
University of Sherbrooke

FRESH OFF THE PRESS

Effects of Daylong Exposure to Indoor Overheating on Thermal and Cardiovascular Strain in Older Adults: A Randomized Crossover Trial

Robert D. Meade, Ashley P. Akerman, Sean R. Notley, Nathalie V. Kirby, Ronald J. Sigal, and Glen P. Kenny

CLICK HERE TO READ MORE!

"Breaking down in tears, soaked in sweat, and sick from the heat": Media-based composite narratives of first responders working during the 2021 Heat Dome

Emily J. Tetzlaff, Casey Cassan, Nicholas Goulet, Melissa Gorman, Brooks Hogya, and Glen P. Kenny

CLICK HERE TO READ MORE!

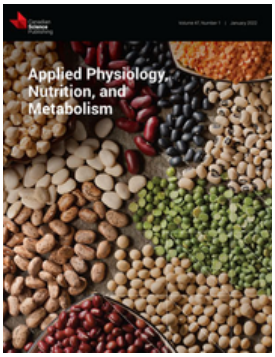
Hot Topic: A Systematic Review and Content Analysis of Heat-Related Messages During the 2021 Heat Dome in Canada

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

CLICK HERE TO READ MORE!

Effect of daylong exposure to indoor overheating on autophagy and the cellular stress response in older adults

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



CLICK HERE TO READ MORE!

Temperature-Dependent Relationship of Autophagy and Apoptotic Signaling During Cold-Water Immersion in Young and Older Males

Kelli E. King, James J. McCormick, and Glen P. Kenny

CLICK HERE TO READ MORE!

Impaired autophagy following ex vivo cooling of simulated hypothermic temperatures in peripheral blood mononuclear cells from young and older adults

Kelli E. King, James J. McCormick, Morgan K. McManus, Nicholas Goulet, Kristina-Marie T. Janetos, and Glen P. Kenny

CLICK HERE TO READ MORE!

HEPRU TEAM HIGHLIGHT

MEET SARAH JOHNSON

Sarah Johnson, a third-year Health Sciences student, joined the Human and Environmental Physiology Research Unit at the University of Ottawa in September 2022. In her role, she actively contributes to pioneering research projects exploring cellular and physiologic responses to heat and cold exposures, demonstrating a palpable passion for research. Sarah has gained a comprehensive understanding of various exercise physiology research approaches, including stress testing, VO_{2max} testing, laser-doppler flowmetry, microdialysis techniques, and calorimetry. Her hands-on experience extends to the molecular physiology lab, where she has honed skills in techniques such as cell collection, protein standards, and sandwich ELISAs. Beyond technical proficiency, Sarah has delved into qualitative research processes and software, showcasing a notable command of NVivo. This multifaceted skill set positions her as a valuable contributor to the research endeavors of the unit. Currently, Sarah is actively involved in impactful projects, collaborating with the Workplace Safety and Insurance Board to investigate regulations for workers exposed to heat. Sarah's joy in being part of research is evident, and this experience has been transformative, providing her not only with hands-on expertise but also a deep appreciation for the critical intersection of human and environmental physiology. Her dedication reflects not only in the projects she contributes to but also in the comprehensive understanding she has gained in a relatively short period, highlighting her commitment to advancing knowledge in health sciences research.

MEET BRODIE RICHARDS

Brodie recently completed his master's degree at the Human and Environmental Physiology Research Unit where he assessed the impact of cold fluid ingestion on heat loss mechanisms when consumed prior to exercise in the heat. He joined the laboratory in January 2019 during his undergraduate degree in human kinetics at the University of Ottawa and has assisted with numerous studies investigating the impact of heat stress on human health including occupational heat health messaging, the efficacy of inexpensive cooling interventions in the home, and how individual factors such as menstrual cycle can impact body temperature responses. This year, Brodie is currently involved in a project examining occupational heat stress in young and older adults during both full workday simulations and shorter work sessions at varying environmental temperatures to determine appropriate working durations that can be safely completed in the heat prior to implementing breaks.

Brodie hopes to continue pursuing his research interests of investigating the effectiveness of current safety guidelines for work and exercise in hot environments and strategies to mitigate heat-related illnesses.

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.

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

- Women 18-30 or 55-69 years of age
- Men 18-30 or 55-69 years of age
- Habitually active (not enduranced trained)

Please contact 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-to-older men: a preliminary assessment

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's research 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 serious lack of research into how women change in their heat loss responses as we age. Furthermore, it is unknown whether menopause—which is a normal part of the aging process—is a factor in how women respond to heat stress. Women have diverse experiences of menopause and may be affected by the heat in diverse ways.

In our first study, we are using an innovative imaging technique to investigate how aging affects tolerance of whole-body heating. We will be comparing how younger and older women differ in facial skin vasodilation ("flushing").

In our second series of studies, we seek to better understand 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 and type 2 diabetes on heat loss responses.

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

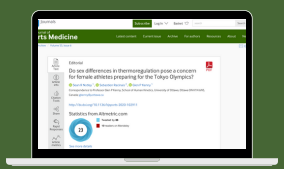
- Women 55-85 years of age
- No history of cardiovascular disease or type 2 diabetes

Additionally, if you are interested in our menopause-related studies we are looking for women 50-69 years of age with:

- Type 2 diabetes **OR**
- Currently experiencing severe or frequent hot flashes

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

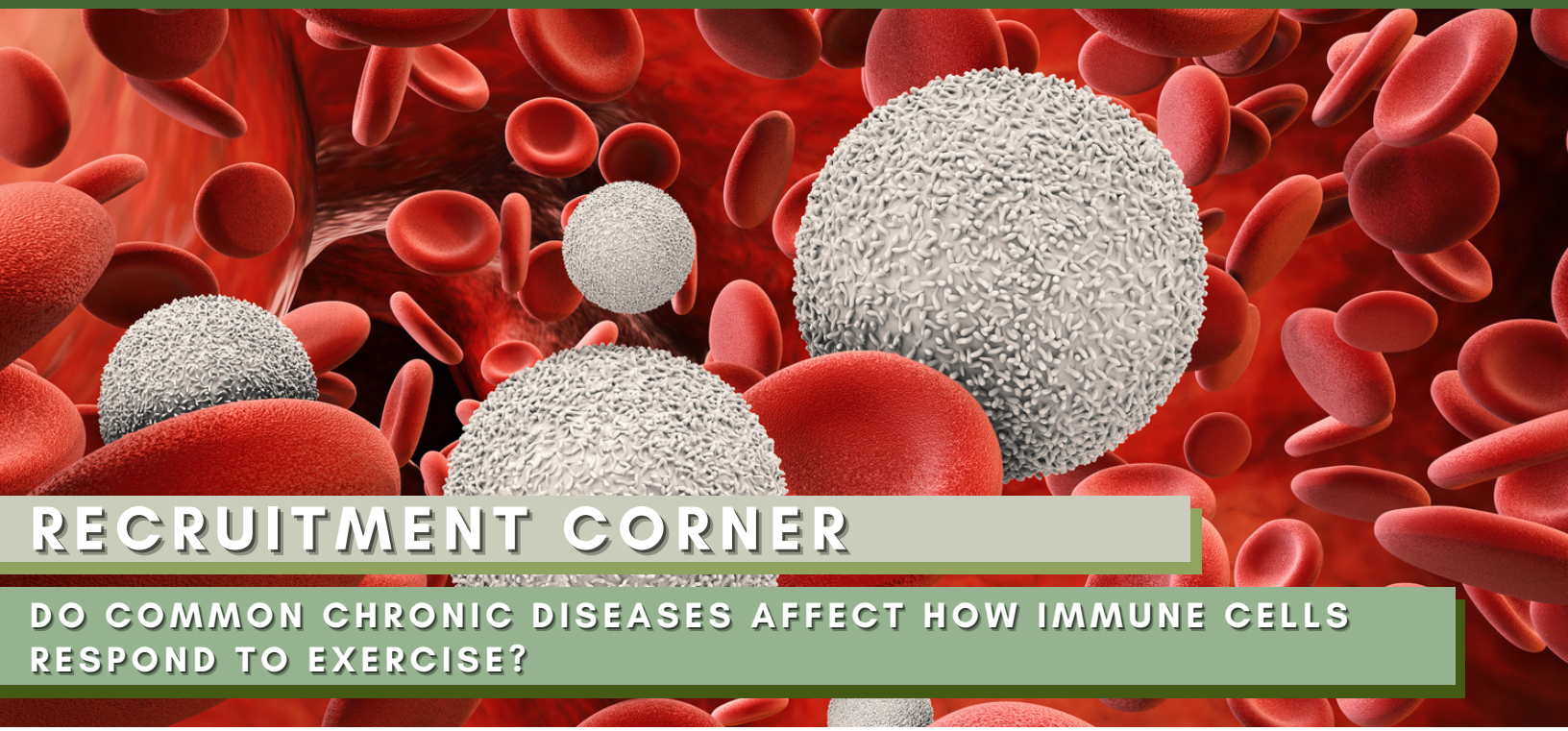
Learn more about how age and sex affect thermoregulation at www.hepru.ca



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.

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



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.

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

- Men & Women 60-85 years of age
- With type 2 diabetes **OR** hypertension

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

Learn more about how age can affect cellular responses during exercise

Autophagic response to exercise in peripheral blood mononuclear cells from young men is intensity-dependent and is altered by exposure to environmental heat

Autophagic response to exercise in peripheral blood mononuclear cells from young men is intensity-dependent and is altered by exposure to environmental heat

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

NEW IN THE NEWS

Over the course of the 2024 winter and 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!**

Hot off the press: Women's Health and Sleep Apnea

On February 8th, one of our HEPRU team members, Nicholas Goulet, got the opportunity to talk about his master's project during an interview on CBC Ottawa's All in a Day with Alan Neal. In collaboration with the Institut du Savoir Montfort and under the supervision of Dr. Pascal Imbeault, Nicholas' work shows that, compared to men, women's blood lipid metabolism is better in countering the adverse effects of sleep apnea, potentially explaining why women living with sleep apnea experience lower rates of certain comorbidities. The study's findings have also recently been published in The Journal of Physiology and been cited in a translational perspective article. Nicholas is looking forward to further sharing his results during the upcoming Congrès de l'Acfas, the largest multidisciplinary scientific research gathering in the French-speaking world, being hosted this year at the University of Ottawa from May 13-17th. While his master's degree was completed in a different laboratory at the University of Ottawa, Nicholas has been involved in the Human and Environmental Physiology Research Unit for three years and is now pursuing his doctorate under the co-supervision of Dr. Pascal Imbeault and Dr. Glen Kenny.

CONFERENCE PRESENTATIONS

This month one of our undergraduate students, Farah Mourad, presented research on "Defining initial stay-times for heavy intensity work in young and older adults" at the University of Toronto's Bertha Rosenstatdt National Undergraduate Research Conference in Kinesiology and Education. Farah considered this opportunity as a pivotal step in her research journey and hopes to continue gaining such experiences to improve her skills as a prospective scientist.

uOttawa

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