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Simple Strategies to Reduce Cardiac Strain in Older Adults in Extreme Heat

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Complete List of Authors:	<p>Chaseling, Georgia; The University of Sydney, Health sciences Vargas, Nicole; Australian National University; The University of Sydney, Faculty of Medicine and Health Hospers, Lily; The University of Sydney, Barry, Hadiatou; Montreal Heart Institute, Centre ÉPIC Harwood, Amy; The University of Sydney, Faculty of Medicine and Health Graham, Connor; The University of Sydney, Faculty of Medicine and Health Bartlett, Audrey-Ann; Montreal Heart Institute, Centre ÉPIC Debray, Amelie; Montreal Heart Institute, Centre ÉPIC Lynch, Grant; The University of Sydney, Faculty of Medicine and Health Capon, Anthony; Monash University Crandall, Craig; UT Southwestern Medical Center Fiatarone Singh, Maria; University of Sydney, Faculty of Health Sciences Mavros, Yorgi; University of Sydney CAR, School of Health Sciences Bi, Peng; The University of Adelaide School of Public Health Nigam, Anil; Montreal Heart Institute, Prevention Chabot-Blanchet, Malorie; University of Montreal, Montreal Heart Institute Gagnon, Daniel; Montreal Heart Institute, Centre ÉPIC Jay, Ollie; The University of Sydney, Faculty of Medicine and Health</p>
Abstract:	

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Simple Strategies to Reduce Cardiac Strain of Older Adults in Extreme Heat

To the Editor:

Heat-related health impacts are increasingly common with climate change and disproportionately affect older adults, especially those with heart disease¹ owing to heat-induced elevations in cardiac strain^{2,3}. Air-conditioning is protective but often unavailable for low-income people⁴. Electric fans and skin wetting are simple, low-cost strategies for people without air-conditioning⁴, but their efficacy is unproven in heat-vulnerable groups. Public health authorities state fans can worsen heat stress above 32.2°C/90°F.⁵ We assessed the effects of fan use, skin wetting, and their combination on heat-induced cardiac strain in older adults with and without coronary artery disease (CAD) exposed to high temperatures with high or low humidity.

We conducted randomized crossover studies at 2 centers: (1) The University of Sydney (31 adults without CAD; mean 70 years, 17 women) and 2) the Montreal Heart Institute (27 adults with CAD; mean 66 years, 2 women). Participants were exposed to different heat conditions; completing up to 8 exposures each separated by >72h. Participants sat for 3h at 38.0±0.1°C/60±1% humidity (hot/humid) or 45.0±0.1°C/15±1% humidity (hot/dry) with no cooling (control), fan use, skin wetting, or fan plus skin wetting. During hot/dry exposures, only control and skin wetting were tested in participants with CAD. The primary outcome was the increase in rate pressure product (RPP), -using linear mixed models in a prespecified analysis combining the 2 sites and comparing each intervention to control.

(See supplementary appendix for details of study methods, participant characteristics, and study representativeness. [The protocol and SAP are available at NEJM.org](#)).

Commented [CGS1]: OK as added?

RPP increased during hot/humid and hot/dry exposures (**Fig.1A-B**). For hot/humid exposures, heat-induced rises in RPP were reduced by fan use (-517 bpm×mmHg, 98.33%CI [-941,-93], p=0.004), skin wetting (-468 bpm×mmHg, 98.33%CI [-903,-32], p=0.01), and fan plus skin wetting (-750 bpm×mmHg, 98.33%CI [-1185,-314], p<0.001) (**Fig.1C**). For hot/dry exposures, all fan trials were halted after 14 people (all non-CAD) participated, due to a 3-fold greater rise in RPP relative to control (2139 bpm×mmHg, 95%CI: [1437,2842], **Fig.1D**), and 43% (6/14) of participants failing to complete 3h (**Table S5**). In contrast, skin wetting blunted heat-induced rises in RPP (-478 bpm×mmHg, 95%CI [-943,-13], **Fig.1D**). Results appeared broadly similar- irrespective of CAD status (**Fig.1E-F**; **Table S6-7**). Comparisons stratified by β -blocker use, sex, and season are provided in **Tables S6-7**.

These results support benefits of fan use, skin wetting, or their combination for reducing heat-induced cardiac strain in older adults with and without CAD at temperatures up to 38°C/100°F with high humidity. In hot/dry (45°C/~15% humidity) heat, results indicate harm with fan use, and benefit with skin wetting. The results may not be generalizable to exposures longer than 3 hours or to patients with untreated CAD or other comorbidities. Potential barriers to using these interventions warrant assessment in field studies.

[Georgia K. Chaseling, Ph.D.](#)

[Daniel Gagnon, Ph.D.](#)

[Montreal Heart Institute](#)

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6
7
8
9 [Montréal, QC, Canada](#)

10 daniel.gagnon.3@umontreal.ca

11
12
13 [Ollie Jay, Ph.D.](#)

14 [University of Sydney](#)

15 [Sydney, NSW, Australia](#)

16 ollie.jay@sydney.edu.au

17
18
19
20 [And Others](#)

21 [A complete list of authors is available with the full text of this letter at NEJM.org.](#)

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30 [NEJM.org.](#)

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32 **CONFLICTS OF INTEREST**

33
34 [None to declare.](#)

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37 **DATA AVAILABILITY**

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39 Raw data used for the analyses reported in this manuscript are freely available without
40 restriction

REFERENCES

1. Liu J, Varghese BM, Hansen A, et al. Heat exposure and cardiovascular health outcomes: a systematic review and meta-analysis. *Lancet Planet Health* 2022;6(6):e484-e495. DOI: 10.1016/S2542-5196(22)00117-6.
2. Barry H, Iglesias-Grau J, Chaseling GK, et al. The Effect of Heat Exposure on Myocardial Blood Flow and Cardiovascular Function. *Ann Intern Med* 2024;177(7):901-910. DOI: 10.7326/M24-3504.
3. Ebi KL, Capon A, Berry P, et al. Hot weather and heat extremes: health risks. *Lancet* 2021;398(10301):698-708. DOI: 10.1016/S0140-6736(21)01208-3.
4. Jay O, Capon A, Berry P, et al. Reducing the health effects of hot weather and heat extremes: from personal cooling strategies to green cities. *Lancet* 2021;398(10301):709-724. DOI: 10.1016/S0140-6736(21)01209-5.
5. CDC. About Heat and Your Health: Stay Cool. (<https://www.cdc.gov/heat-health/about/index.html>). [Accessed: 9 August, 2024]

FIGURE CAPTION

Fig.1. Effect of personal cooling strategies on cardiac strain during hot/humid or very hot/dry heat exposure. Panels A-B: change scores in rate pressure product (RPP) during control (CON, no cooling), fan use (Fan), skin wetting (SW), or fan use combined with skin wetting (F+SW) interventions. Data are presented as the mean change with 95% confidence intervals (white circles) with individual data overlaid for adults without (blue) or with (red) coronary artery disease (CAD). Panels C-D: mean difference from control for change in RPP with 98.33% (hot/humid) or 95% (very hot/dry) confidence intervals. Panels E-F: mean difference from control for change in RPP with 95% confidence intervals stratified by CAD status. × denotes absence of data because fan trials during very hot/dry exposures were not performed in adults with CAD due to safety concerns. 95% confidence intervals are not adjusted for multiplicity and should not be used in place of hypothesis testing.

COMPLETE LIST OF AUTHORS, FOR PUBLICATION AT NEJM.ORG:

Georgia K. Chaselings (Ph.D.)^{1,2,3}
Montreal Heart Institute
~~Université de Montréal~~
Montréal, QC, Canada
~~University of Sydney~~
Sydney, NSW, Australia

Nicole T. Vargas (Ph.D.)³
Lily Hospers (Ph.D.)³
~~University of Sydney~~
~~Sydney, NSW, Australia~~

Hadiatou Barry (M.Sc.)^{1,2}
Montreal Heart Institute
~~Université de Montréal~~
Montréal, QC, Canada

Amy Harwood (Ph.D.)^{3,4}
Connor Graham (Ph.D.)³
~~University of Sydney~~
~~Sydney, NSW, Australia~~

Audrey-Ann Bartlett (M.Sc.)^{1,5}
~~Montreal Heart Institute~~
~~Université de Montréal~~
~~Montréal, QC, Canada~~
Amélie Debray (Ph.D.)¹
~~Montreal Heart Institute~~
~~Montréal, QC, Canada~~

Grant Lynch (Ph.D.)³
~~University of Sydney~~
~~Sydney, NSW, Australia~~

Anthony Capon (M.D.)⁶
~~⁶Monash Sustainable Development Institute~~
~~Monash University~~
~~Melbourne, VIC, Australia~~

Craig G. Crandall (Ph.D.)⁷
~~⁷Institute for Exercise and Environmental Medicine~~
~~Texas Health Presbyterian Hospital Dallas~~

University of Texas Southwestern Medical Center
Dallas, Texas

Maria Fiatarone Singh, (M.D.)⁸
Yorgi Mavros, (Ph.D.)³
University of Sydney
Sydney, NSW, Australia

Peng Bi, (Ph.D.)⁹
University of Adelaide
Adelaide, SA, Australia

Anil Nigam, (M.D.)⁴
Montreal Heart Institute
Montréal, QC, Canada

Malorie Chabot-Blanchet, (M.Sc.)¹⁰
Montreal Health Innovations Coordinating Center
Montréal, QC, Canada

*Daniel Gagnon, (Ph.D.)^{1,2,5}
Montreal Heart Institute
Université de Montréal
Montréal, QC, Canada
daniel.gagnon.3@umontreal.ca

*Ollie Jay, (Ph.D.)³
University of Sydney
Sydney, NSW, Australia
ollie.jay@sydney.edu.au

¹Montreal Heart Institute, Montréal, QC, Canada

²Department of Pharmacology and Physiology, Faculty of Medicine, Université de Montréal, QC, Canada.

³Heat and Health Research Centre, Faculty of Medicine and Health, University of Sydney, NSW, Australia

⁴Department of Sport and Exercise Sciences, Institute of Sport, Manchester Metropolitan University, Manchester, M1 7EL, UK

⁵School of Kinesiology and Exercise Science, Faculty of Medicine, Université de Montréal, QC, Canada.

⁶Monash Sustainable Development Institute, Monash University, Melbourne, Australia

⁷Institute for Exercise and Environmental Medicine, Texas Health Presbyterian Hospital Dallas, and University of Texas Southwestern Medical Center, Texas, USA

⁸Discipline of Exercise and Sport Science, Faculty of Medicine and Health, University of Sydney, NSW, Australia

Commented [LL2]: ME: "Fiatarone Singh" is the author's last name/surname.

Commented [LL3]: ME: We are publishing the email addresses of both Gagnon and Jay.

1
2
3
4
5
6
7
8
9 ⁹Faculty of Health and Medical Sciences, University of Adelaide, SA, Australia

10 ¹⁰Montreal Health Innovations Coordinating Center, Montreal, QC, Canada

11
12 ***Co-corresponding authors**

13 Ollie Jay, Ph.D.

14 Heat and Health Research Centre, University of Sydney

15 Camperdown, NSW, Australia

16 ollie.jay@sydney.edu.au

17 Daniel Gagnon, Ph.D.

18 Centre ÉPIC, Montreal Heart Institute

19 5055 rue St-Zotique Est, Montréal, QC, Canada H1T 1N6

20 daniel.gagnon.3@umontreal.ca
21
22
23
24
25
26
27
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Hot/Humid (38°C/60%) Very Hot/Dry (45°C/15%)

