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

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Abstract:	

Simple Sstrategies to Rreduce Ceardiac Sstrain of Oolder Aadults in Eextreme Hheat

To tThe Editor:

Heat-related health impacts are increasingly common with climate change and disproportionately affect older adults, especially those with heart disease[1] owing to heat-induced elevations in cardiac strain[2,3]. Air-conditioning is protective but often unavailable for low-income people[4]. Electric fans and skin wetting are simple, low-cost strategies for people without air-conditioning[4], 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).

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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.

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~~CONFLICTS OF INTEREST~~

~~None to declare.~~

DATA AVAILABILITY

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

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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% confidnce intervals stratified by CAD status. × denotes absence of data because fan trials during very hot/dry exposures were not perfromed 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.

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