



# RISK REDUCTION GUIDANCE

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## AIR CONDITIONING

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### ABSTRACT

Air conditioning, which mechanically cools indoor air, can be installed in a single room or building. Air conditioning strongly protects against adverse health impacts during extreme heat, and is on track to be the leading intervention against extreme heat globally. Air conditioning can be implemented quickly, over hours to days depending on the type of installation. Implementation costs from several hundred dollars for a window unit up to several thousand for air conditioning an entire home. While strongly protective, air conditioning is costly to install and operate and is not equitably distributed; its use can also contribute to air pollution and carbon pollution. Multiple more sustainable, albeit less effective, cooling strategies are available, and strategies for subsidizing installation and operating costs can decrease inequities in air conditioning distribution and utilization.

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### What is the intervention?

Air conditioners are devices that allow for the cooling of enclosed spaces by using electricity and complex systems of pumps and cooling fluid to transfer heat from indoor air and into outdoor air. Air conditioners include heat pumps, which can also heat indoor environments, which conventional air conditioners cannot.

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The two primary types of air conditioning systems are central air conditioners and room air conditioners. Like their name suggests, room air conditioners are designed to cool individual rooms rather than homes or larger areas, are generally less expensive to operate, and are easier to install and maintain. Window air conditioners are a common type of room air conditioner. Central air conditioners are integrated into entire houses or buildings, and are able to effectively cool large areas and multiple rooms at a time. They are generally more energy efficient than room air conditioners but are more expensive and more difficult to install.

While there are other types of air conditioning besides room and central methods, these two are the most commonly used in the United States (Air Conditioning).

## **How effective is the intervention at protecting people's health?**

Spending time in air-conditioned places, even a few hours a day, is the strongest protective factor against heat-related illness (Bouchama et al. 2007) and can therefore decrease the risk of heat injury and death (Medina-Ramón and Schwartz 2007; Cardoza et al. 2020). Consequences of heat injury like heat stroke have been strongly linked to lack of air conditioning in residential homes, further supporting the need for access to air conditioning, especially in areas that are more often impacted by extreme heat events (Ito et al. 2018). The protective effect of air conditioning for hospitalized patients was observed to be 40% (Nunes et al. 2011). Because of this strong protective effect and impact on thermal comfort, air conditioning is set to be the most widespread intervention to reduce health risk associated with heat globally (Khosla et al. 2020). Air conditioning is estimated to have prevented 195,000 deaths among people aged 65 and over globally in 2019 (Romanello et al. 2021). However, its protective effect is offset by several concerns, including cost and inaccessibility, environmental waste heat load, increased carbon and air pollution (depending on the energy source used for power) (Jay et al. 2021). In 2019, air pollution associated with air conditioning use is estimated to have caused 21,000 premature deaths (Romanello et al. 2021).

## **How long does the intervention take to implement?**

The time required to implement air conditioning depends on the type of installation. A room unit can be installed very quickly, and a window unit over a matter of hours. Ducted and whole-building installations typically take days. The protective effect of air conditioning is immediate.

## **How much does the intervention cost?**



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Room air conditioner costs vary. Window units typically cost at least \$200 and room units slightly more. Larger wall mounted “split” units will typically cost several thousand dollars, and whole-house air conditioning installations typically cost between \$5,000 and \$8,000, though costs vary widely based on the type and size of the unit and local climate (Borelli 2023). Air conditioners operational costs vary considerably based on the unit, electricity cost, and other factors, but \$0.60 per hour (in 2023 US dollars) on average is a reasonable initial estimate (Brown 2018).

## **Are there downsides to consider?**

Air conditioning units produce waste heat, which increases outdoor air temperatures. For example, in Tokyo the “waste” heat from AC units has been noted to cause rises in temperature of 1–2 °C or more (Cardoza et al. 2020). Depending on the source of energy used to power air conditioners, their use produces air and carbon pollution, as noted above. In addition, air conditioning requires electricity, and risk of heat-related illness and death increases precipitously in hot environments when electrical supplies are interrupted (Stone et al. 2021).

## **What other strategies should be considered?**

For those who are unable to implement air conditioning at home, visiting formal or informal cooling centers or spending time in other air-conditioned areas such as public libraries is also effective (Bouchama et al. 2007). Behavioral interventions for reducing heat exposure are also effective in increasing thermal comfort and reducing heat illness (Nitschke et al. 2017; Jay et al. 2021). State and local governments can reduce heat-health risk of vulnerable populations by subsidizing cooling devices and eliminating barriers to installing units for low-income, high risk households. For example, Senate Bill 1536 in Oregon and the [Simmons Initiative](#) in Illinois have been passed to help improve access to air conditioning (Simmons initiative to require air-conditioning in affordable housing passes Senate 2023, SB1536 2022 Regular Session - Oregon Legislative Information System).

## **What are some good sources of additional information?**

[As extreme heat grips the globe, access to air conditioning is an urgent public health issue from the Brookings Institution](#)

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