

Imperceptible into the Perceptible

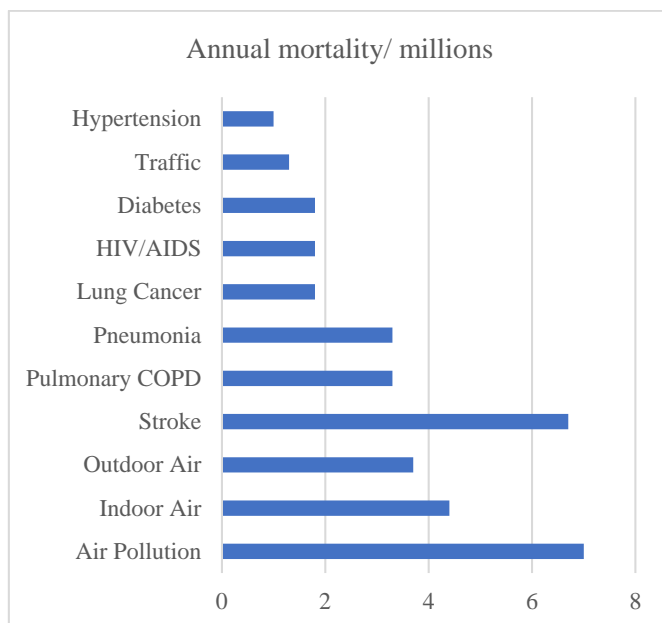
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Abstract—The vital aspect of human survival is the continuous process of breathing. If we think about all the things that can threaten human life, we at once think about natural calamities, dreadful diseases, and accidents, but least of all, we give no priority to the air we breathe. A million people a year lose their lives from traffic accidents globally or diabetes or AIDS, and then you look at what air pollution is doing. It is our most significant single environmental threat, and this is a global epidemic. It costs more than twice as many lives as these other three factors combined. Air pollution is an obvious and a subtle killer in less obvious ways. Every winter, Delhi Air is global news. Indoor air is invisible; we often ignore it or take it for granted because we cannot see it. However, this essential component of human life has continuous, 24X7 impacts on your health and well-being that can forever change your and your family's life. Have you ever tried to think: What makes up our indoor air? What impacts do the hidden pollutants have on the human body? What can we all do to improve the air that we breathe?

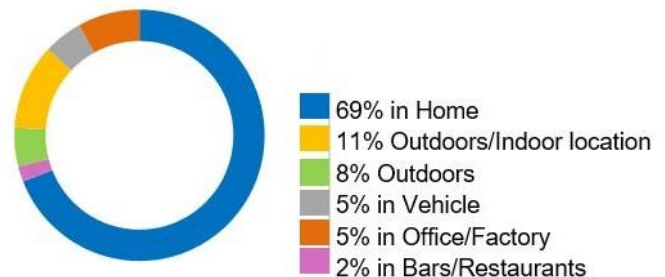
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Please take a deep breath, breathe for a second, feel your chest expand as you breathe in, and feel the exhale; we all know what breathing feels like. It is such an effortless inbuilt phenomenon, and we do it about 20,000 times daily. But very few of us know what is in the air we breathe. There is much more in every breath. Air in any enclosed space- be it an office, auditorium, shopping mall, hotel, or our homes, carries some chemicals from the carpets and the paints, some carbon dioxide exhaled from your neighbour, some bacteria from people with a cough and much more. We do not often think about indoor air because we have been told to focus on air quality only outside. Now we are coming to understand the importance of air indoors. The covid-19 pandemic was an enormous eye-opener. There is an entire movement today focused on the concept of indoor wellness. This indoor air needs to be of better quality because we spend 90% of our lives indoors.



Source: World Health Organization (WHO) Ambient air database

Figure 1: Annual Mortality caused by different diseases versus air pollution



Source: EPA United Environmental Protection Agency

Figure 2: Percentage of time spent indoors.

Most of us need to learn more about indoor air. We do not know what is in the air we breathe. We do not realize how this bad air quality is making us sick. Most important, we need to figure out what to do about it. It would be best to start fixing your indoor air today so that all the spaces where you live your lives are cleaner, healthier and happier.

The three most common pollutants in indoor spaces are carbon dioxide (CO₂), volatile organic compounds (VOCs), and particulate matter. Each of these three has a different source and a different solution. Carbon dioxide can be called human pollution because the bulk of it comes from us, as exhaled air. It is a problem when there is too much of it. Buildings with poor ventilation may result in trapped carbon dioxide inside the building, causing various health effects like fatigue and

impaired decision-making. A recent study from Harvard found that just a moderate rise in Carbon dioxide caused test scores to drop by 20 per cent. Just imagine that 20 per cent of your brainpower is lost just because of excess Carbon dioxide in a room. But the other two pollutants make Carbon dioxide look mild in comparison. Carbon dioxide makes you tired and retards your productivity, but particulates and VOCs are lethal.

We all have experienced the new-car smell whenever we get into a new car. This smell results from off-gassing, which happens when all those new car parts start releasing the chemicals used to make them, which are the VOCs. Not all VOCs are harmful; the smell of a lovely perfume is an example of a VOCs, but some VOCs, like those found in carpets, paints, and furniture, may hurt us, potentially causing organ damage or even cancer. For easy understanding, particulates have a faster damaging effect if VOCs kill us slowly. Our lungs cannot filter particulates that are smaller than 2.5 microns. They go directly into our bloodstream, causing organs to wreak. An increasing number of studies suggest the link between dementia in the elderly and delayed brain development in children because of particulate matter of 2.5 microns. So, these pollutants are dreadful and found everywhere. But once we know how to detect them, we have the technology to remove them. The real problem is not the particulates but our need for knowledge about them. We do not know enough about the air in our schools, homes, or offices, and because we do not know enough, we are not doing enough to fix them, as everything comes back to knowledge. So let us unpack that knowledge problem. Why do we not know what is in our air? The first solution is the most uncomplicated indoor air is invisible. We need to have good monitoring equipment. There is no way to guess and no rule of thumb. It requires hardware that measures data, so the crucial reason why indoor air is such a mystery is that it is invisible, but the causes are more complex.

How to design and operate spaces to maximize the health and well-being of our occupants? When we build or renovate, we should choose green-certified materials like paints, low-VOC furniture or certified flooring. There are some simple steps we can take to improve our air:

1. Plants are a cheap and fun way to clean our air. We've known since NASA started researching this in the 1980s that plants do an incredible job at scrubbing the mood for things like VOCs, and of course, plants survive by taking in carbon dioxide and breathing out fresh oxygen.
2. Open your windows to allow Co2 and VOCs to escape. Mobile apps can be downloaded anywhere in the world that tell you how good the air quality is.
3. Invest in filtration like a standalone air purifier filtration technology these days does an incredible job at removing everything from particulates to even cigarette smoke.

In short, there are a lot of simple steps to make sure indoor environments are making us healthier. People spend most of their lives indoors, significantly influencing their health and productivity. Despite the two decades of indoor air quality (IAQ) research from different perspectives, there is still a lack of comprehensive evaluation of the internal characteristics of varying building environments with IAQ. COVID-19 brings indoor air quality monitoring upfront. We are now looking at solutions to reduce aerosol transmission of viruses. As the world opened after the pandemic, occupiers have tentatively emerged back into their places of work. Landlords have a more significant challenge with optimizing the operational performance of buildings to the greatest extent possible, in conjunction with the enactment of behavioral change, to minimize risk and give their tenants peace of mind.

With significant links to cognitive function and risk of disease, including cancer, historic efforts regarding indoor environmental quality have typically focused on carbon dioxide, volatile organic compounds (VOCs) and particulate matter (PM). However, modern threats have led to a broader focus, encompassing humidity, temperature, and lighting, essential in determining viral survivability, immune system health and infection potential. This air we breathe is imperceptible, but its perceptible threats have surfaced in many ways, demanding closer monitoring and appropriate design considerations.

Indoor Air Quality (IAQ) is closely related to the comfort of occupants. Physical parameters of IAQ such as: thermal comfort, acoustic conditions, air quality and lighting, will result in plan decisions and building procedures. IAQ effects on occupant productivity. That is why general definitions of green building accentuate employing design and building process strategies to improve IAQ. Civilizing IAQ is essential in all buildings, because incorporation aims to provide a space for healthy and creative occupants in building design. It is mainly significant in green buildings because a low-energy building with high resident uneasiness is only as sustainable as a high-energy one. Building occupants are usually worried about their indoor health because they generally spend more time indoors than outdoors.

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