BreezoMeter & Airthings Explore US Asthma Hotspots & Patient Behavior
What You’ll Learn

- Which U.S. cities show the highest concentration of PM$_{2.5}$ air pollution and highest levels of humidity.
- How asthma sufferers alter their lifestyles to avoid environmental factors that exacerbate their asthma symptoms.
- Asthma sufferers’ beliefs about environmental triggers, indoors and outdoors.
- The breakdown of asthma sufferers tracking their symptoms and the air around them.
- Understanding of an opportunity to increase awareness among asthma sufferers of the quality of the air they breathe, when it comes to both indoor and outdoor settings, as a way of improving their decision-making and preventing exacerbation of their symptoms.
01 Asthma & the Environment: Why Now?

Why Now?

According to the Asthma & Allergy Foundation of America (AAFA), asthma affects an estimated 25 million people in the US alone, with a higher prevalence among female adults. (Source). This long-term respiratory condition is also the leading chronic disease in children, affecting an estimated 4.2 million US children (under 18), according to the most recent stats from the CDC.

Unlike other chronic diseases, asthma triggers can vary from person to person and don’t often originate from a single, direct cause. However, environmental factors such as pollen and air pollution - both indoors & outdoors - do disproportionately impact asthma sufferers, with reaction-severity and symptoms varying significantly between individuals - and potentially compounding the impact of other health conditions.

In this report, we aim to explore the ways asthma sufferers across the US currently manage their asthma, understand how they deal with the impact of different environmental triggers, and consider an effective solution that can empower individual asthma patients to lead healthier and less restrictive lives.

a) The Growing Health & Economic Impact of Uncontrolled Asthma

According to the American Asthma Foundation (AAF), asthma is responsible for 3,500 annual deaths in the USA as well as an estimated 13 million missed school days for children, and 10 million missed work days every year.

Current reports suggest annual asthma costs in the US to total $82 billion in terms of direct and indirect expenses.

- Medical costs as a result of 14.2 million doctor’s office visits.
- 1.8 million emergency visits a year.
- 440,000 hospitalizations a year.

The problem is also growing. Experts project that the total direct and indirect costs of uncontrolled asthma could exceed $963.5 billion from 2019 to 2038.
b) More Awareness Needed of the Connection Between Asthma & Allergies

Higher pollen counts mean more frequent and stronger allergic reactions in people who suffer from what's known as 'allergic asthma'. As many as [70% of asthma sufferers] suffer from this type of allergic asthma, making them especially vulnerable to pollen, in addition to environmental changes connected to air quality, humidity, temperature, and more. As many of North America's pollen seasons peak around the warmer months of the year - it's important for treatment providers and sufferers to be aware of this reality.

c) New Opportunity From Environmental Awareness & Digital Health Innovation

New forms of environmental intelligence and connected health technology means asthma treatment providers can empower sufferers to monitor their surroundings, understand the air they breathe, and proactively manage their symptoms and exacerbations like never before.

02 Results & Discussion

What We Found

BreezoMeter identified three cities in the U.S. as “asthma hotspots” due to the levels of PM2.5 and humidity in 2021. Our surveys indicated that although respondents make adjustments to their day to manage their asthma, they may not have all the data at their fingertips to make the right decisions. Based on this finding, there is an opportunity to improve awareness among asthma sufferers of the quality of the air they breathe - for both indoor and outdoor settings.
### Asthma Hotspots in the USA

**Indianapolis, Houston & Nashville are Asthma Hotspots**

- In 2021, Indianapolis, Houston, and Nashville were among the top ten cities with the highest number of days of difficult conditions for asthma sufferers - demonstrating both high fine particulate matter (PM$_{2.5}$) concentration (μg/m$^3$) and challenging Relative Humidity (RH) levels (%).

- PM$_{2.5}$ levels in these cities varied throughout 2021, but all three cities showed elevated PM$_{2.5}$ levels associated with wildfires in California during the summer. Wildfires such as Dixie, Caldor and McFarland spread smoke containing PM$_{2.5}$ across most of the country. In addition, Houston is occasionally influenced by dust storms arriving to the southern U.S. from the [Saharan Desert](https://en.wikipedia.org/wiki/Sahara) in Northern Africa.

- The asthma hotspot cities analysis showed that when high PM$_{2.5}$ levels were experienced in each of these cities, they often coincided with Relative Humidity at levels that could be challenging for asthma sufferers.
How Asthma Sufferers Alter their Lifestyles

91% of Respondents Adjust their Days to Contain Asthma Symptoms

- A high majority of respondents (91%) don’t have a quick fix to make their asthma tolerable during the day. Instead, they adjust their day-to-day routines and lifestyles.
- 63% of asthma sufferers say they stay indoors and 58% rest up. This is closely followed by limiting their exercise routines (48%), reducing workload (40%) and using AQ apps (30%) to monitor air quality before resuming their regular routines.
- Only 9% do not change their daily activity.
- Increased awareness of environmental asthma triggers can be helpful to sufferers so they can make the right sorts of adjustments to their day to prevent exacerbation. Care providers can also recommend pre-emptive changes in medication to offset triggering factors.
The Likelihood of Staying Indoors to Avoid Asthma Triggers Increases with Age

- Besides young children (14 and under), asthma is most prevalent in the elderly (65+).
- 55% of 18-24 year olds choose to stay indoors as part of adjusting their day for their asthma.
- The likelihood of staying indoors to avoid asthma triggers increases with the age of asthma sufferers: 63% of 25-34 year olds say they stay indoors, followed by 65% of 35-44 year olds, 79% of 45-54 year olds and 84% of 55-64 year olds.
Asthma Sufferers’ Beliefs About Environmental Triggers

Most Asthma Sufferers Believe their Asthma Symptoms are Triggered More by Outdoor Air than Indoor Air

- 72% of asthma sufferers say they associate asthma triggers more frequently with outdoor air (as compared to indoor air).
- Certain activities create indoor air pollution. Cooking and heating homes with fuels such as wood and other biomass, kerosene and coal can cause harmful indoor air quality. Other products including personal care products, laundry detergent, paint, and pesticides and certain types of chemical cleaning products like bleach, can create indoor air pollutants. As we spend 90% of our time indoors, on average, these sources should not be underestimated, especially by asthma sufferers.
It is also possible for outdoor air pollution to migrate indoors through open doors, windows, ventilation shafts, and cracks and there are indoor air pollutants that can be triggering for asthma sufferers.

Scientists today prefer to speak of the indoor-outdoor air pollution continuum to underline the fact that we shouldn’t focus on air quality indoors vs outdoors, or on each one of these aspects in isolation.

There is an opportunity for asthma sufferers to prevent exacerbation of their symptoms by reducing exposure to poor air quality both indoors and outdoors. This can be done through better understanding of outdoor air quality to help asthma sufferers make informed decisions about their outdoor activities and by controlling indoor asthma triggers. For example, what and how they cook, which cleaning and cosmetic products to use, limiting the presence of allergens or by using an indoor air filtration system to clean the air.

Most Asthma Sufferers said their Symptoms are Worse During Allergy Season

![BreezoMeter Graph]

Do Asthma Symptoms Get Worse During Allergy Season?

- Most asthma sufferers surveyed (94%), said their symptoms are worse during allergy season.
- Only 6% report that their asthma is not exacerbated by pollen.
- Climate change seems to contribute to the increased duration and potency of pollen allergy season. Like traditional air pollution, pollen can also enter our homes when we open windows, or by getting trapped on human hair and clothes after being outdoors, further impacting the health of indoor environments, especially for asthma and allergy sufferers.
Indoor Dust and Pollen are Seen as the Two Factors Most Likely to Trigger Asthma Attacks

- More than 70% of respondents stated that they believe dust is the most significant trigger for their asthma attacks.
- Exposure to dust is more common indoors than outdoors and yet more than two out of three people (72%) associated asthma triggers with outdoor rather than indoor air.
- Pollen was the second most likely trigger (54%), followed by pet dander (39%), strong odors/scents (34%) and cooking or fire smoke (29%).
06 Do Sufferers Track their Symptoms?

Only 67% Of Asthma Sufferers Actually Track their Asthma Symptoms

- While 91% of people report having to adjust their daily routine to contain asthma symptoms, only 67% of asthma sufferers actually track their asthma symptoms.
- One-third of asthma sufferers do not track their symptoms at all.
- Tracking asthma symptoms can help sufferers manage their condition in a more proactive manner.
Asthma Sufferers Below Age 55 Showed More Likelihood to Track Asthma Symptoms

Asthma respondents in age groups younger than 55, showed a higher likelihood of tracking their asthma symptoms to stay informed about their health, while those aged 55-64 are the least likely to track their symptoms.

Men are Nearly 20% More Likely to Track their Asthma Symptoms than Women

- Men are nearly 20% more likely to track their asthma symptoms than women.
- 79% of men are likely to track their asthma symptoms, compared to 62% of females.
- In children, aged 17 and under, asthma is more prevalent in boys than girls.
- In adults (18+), women are more likely to suffer from asthma, but are less likely to track their symptoms, according to these findings.
**Do Sufferers Track Air Quality?**

Less than Half of Asthma Sufferers Surveyed Use an Air Quality App to Predict Environmental Triggers that Contribute to Asthma Flare-Ups

- Despite the adjustments they have to make to their daily life, less than half of asthma sufferers surveyed (45%), use an air quality app to predict environmental triggers that contribute to asthma flare-ups.
- Even though AQ apps have grown in popularity among consumers in recent years due to concerns around smoke inhalation during wildfire season, many people are still not aware of them or have not adopted them.
- Tracking air quality to predict environmental triggers eliminates the need to second guess when exacerbation may occur and can improve the quality of life of asthma sufferers, giving them freedom to partake in or adjust the location of outdoor activities that may otherwise have been unnecessarily avoided.
Asthma Sufferers’ Tendency to Use an Air Quality App to Track Environmental Triggers Differs by Age

- Asthma sufferers’ likelihood of using an Air Quality app to track environmental triggers differs by age.
- Asthma sufferers aged 18–24 are the most likely to track air quality to stay informed about the air they’re breathing (60%).
- Despite being the most informed about their asthma symptoms, surprisingly, respondents aged 35–44 (35%) were less likely than respondents aged 55–64 (48%) to track air quality.
- Respondents aged 55–64 were just as likely to track their air quality as those aged 25–34 (both at 48%).
Conclusion & Recommendations

While 91% of survey participants reported needing to adjust their daily routine to contain asthma symptoms, it is possible they may not be making the right adjustments. Our findings suggest that asthma sufferers may be unnecessarily limiting their activities and staying indoors without truly understanding the contribution of both indoor and outdoor factors to the exacerbation of their symptoms.

One-third of asthma sufferers surveyed (34%) do not track their symptoms at all. Less than half of respondents (45%) track air quality to predict asthma flare-ups and most respondents (72%) believe their asthma symptoms are triggered more by outdoor than indoor air.

Overall, there is an opportunity for asthma sufferers to better manage their condition by tracking symptoms and checking for correlations with exposure to environmental factors, thereby eliminating the need to guess when exacerbation may occur.

Asthma sufferers should pay close attention to their exposure to asthma triggers over the course of an entire day, both indoors and outdoors. Using BreezoMeter’s free air quality app to become more aware of, and track, current and forecast outdoor conditions, and by monitoring and controlling indoor asthma triggers via an air quality tool such as the Airthings’ View Pollution monitor and connected app. It is also recommended to adhere to guidelines provided by official organizations to control asthma triggers:

- CDC’s National Center for Environmental Health
- US Environmental Protection Agency
- American Lung Association

Looking into the future, there is certainly a market opportunity to provide asthma sufferers with solutions that will further simplify and improve their decision-making, providing a personalized view of their environmental risk and taking into account the full spectrum of environmental factors, both indoors and outdoors, that are known to impact asthma.
Methodology

To arrive at the conclusions in this report, we adhered to the following methodology.

Determining the Asthma Hotspots

We reviewed historical outdoor air quality data, from January to December 2021, to determine which U.S. cities have the highest concentrations of PM2.5 and humidity. We focused on humidity and poor air quality as these are two potent, and lesser-known triggers of asthma symptoms.

Daily PM2.5 concentration (µg/m3) and RH (%) were categorized according to the Airthings View Pollution device thresholds shown below. Cities were ranked according to the number of days in 2021 with challenging conditions for asthma sufferers.

Airthings View Pollution Device Thresholds

<table>
<thead>
<tr>
<th>Relative Humidity</th>
<th>Fine Particulate Matter PM&lt;sub&gt;2.5&lt;/sub&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;25 and ≥70%</td>
<td>≥25 µg/m³</td>
</tr>
<tr>
<td>≥60 and &lt;70%, ≥25 and &lt;30%,</td>
<td>≥10 and &lt;25 µg/m³</td>
</tr>
<tr>
<td>≥30 and &lt;60%</td>
<td>&lt;10 µg/m³</td>
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</tbody>
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Particulate Matter (PM)

Toxic PM2.5 particles—invisible to the naked eye and small enough to get deep into the lungs—are triggering for asthma sufferers as it causes inflammation and oxidative stress in the airways, similar to the inflammation caused by smoking. Additionally, viruses, certain metals, or other inflammation-inducing particles attach to the surface of Particulate Matter, thereby making PMs the chaperones of these particles into the lungs.
Humidity

High levels of humidity affect asthma symptoms in a variety of ways. Increased moisture in the air can directly irritate the airways, and humid air usually means high temperatures, which can also irritate the airways. Moreover, humid air can increase the levels of substances in the air that irritate the bronchial tubes. Common allergens that aggravate allergic asthma, like dust mites and mold, thrive in humidity.

Combining Indoor Air Quality Data & Analyzing Feedback from Respondents

The U.S. hotspot cities data was combined with the following data sources to give a more complete picture of indoor air quality and sufferers’ perspectives on managing their condition.

- Airthings historical Indoor Air Quality data (between 01/01/2021-31/12/2021) to identify Indoor Air Quality stats in cities in the U.S.
- Direct survey of asthma sufferers in U.S. hotspot cities, conducted with third-party research technology platform Feedback Loop (213 participants in U.S. hotspot cities, Indianapolis, Houston and Nashville).
- Asthma awareness survey by Airthings, conducted with third-party research technology platform Attest (4024 participants in U.S. cities, Chicago, New York and San Francisco).
About BreezoMeter & Airthings

About BreezoMeter

BreezoMeter improves the health and safety for billions of people worldwide, by providing accurate and actionable environmental data and insights. The company transforms live environmental intelligence into actionable insights and delivers them to consumers through mobile apps, smart home IoT devices, cars and other connected experiences. Brands like Apple, Volvo and AstraZeneca rely on BreezoMeter to provide real-time air quality data to their customers, so they can make informed decisions about when to go outside, how to best protect themselves, which travel routes to take, and even where to live. BreezoMeter uses AI and machine learning to gather and understand data from multiple sources — including more than 49,000 sensors worldwide. The result is street-level air quality resolution (within 5 meters), and pollen, pollutants and fire data, in more than 100 countries.

About Airthings

Airthings is a global technology company and producer of award-winning radon and indoor air quality monitors for homeowners, businesses, and professionals. Founded in 2008, Airthings is on a mission to ensure that people around the world recognize the impact of indoor air quality and take control of their health through simple, affordable, and accurate technology solutions while optimizing energy consumption in buildings. Airthings’ products have made radon detection and indoor air quality monitoring easy to deploy, accurate, and user friendly, and have received several accolades including the TIME’s Best Inventions of 2019 award and CES Innovation Award Honors in 2019 and 2021. Headquartered in the heart of Oslo, Norway, and with offices in the US and Sweden the company has over 140 employees from more than 30 nationalities—and counting. To see the full range of Airthings indoor air quality monitors and radon detectors or to learn more about the importance of continuous air quality monitoring, please visit airthings.com.
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