K-HEALTH inAIR

Understanding what affects the air we breathe indoors

A summary of findings from K-HEALTHinAIR's study on household air quality

What Influences the Air We Breathe at Home

This summary is based on a report from the K-HEALTHinAIR project that analysed what affects indoor air quality (IAQ) in real residential settings. Using sensors installed in the kitchens of seven homes over a two-week period—and activity logs filled in by the residents—researchers tracked how everyday life impacts the air we breathe indoors.

Key Findings

- Daily activities matter: Common household activities like smoking, cooking, and cleaning were the main contributors to indoor air pollution. Smoking had the most harmful impact, followed closely by eating.

- Every home is different: Air quality levels varied significantly between households, mainly due to differences in daily routines and habits. This highlights the need for customised solutions for each home.

- Ventilation is crucial: Good ventilation was a major factor in improving indoor air quality. Homes that aired out rooms during and after activities had better air quality, showing the importance of fresh airflow to reduce pollutants.

How was the data collected and analysed?

To understand how daily life affects indoor air quality, researchers installed inBiot sensors in the kitchens of participating homes. These smart devices continuously tracked key environmental parameters, including:

- Particulate matter (PM2.5 and PM10)
- Carbon dioxide (CO_2)
- Total volatile organic compounds (TVOCs)
- Temperature and humidity
- Calculated indicators like the IAQ (Indoor Air Quality) Index and Virus Index

The collected data was then analysed using a mix of traditional statistics and advanced machine learning tools:

- Statistical analysis helped identify patterns and correlations between different air quality parameters.
- Machine learning techniques, such as UMAP (Uniform Manifold Approximation and Projection), were used to visualise complex trends and groupings in the data.
- A detailed activity impact analysis quantified how specific daily actions—like cooking or smoking—directly influenced indoor air quality over time.

Impact of activities on Indoor Air Quality

ACTIVITY	IMPACT ON IAQ	RECOVERY TIME	PRIMARY POLLUTANTS
Smoking	Severe immediate decline	>90 minutes	PM2.5 TVOC
Eating	Significant decline	>90 minutes	CO₂ PM2.5
Cooking	Moderate decline	>60 minutes	PM2.5 TVOC CO₂
Cleaning	Moderate decline	75 minutes	PM2.5 TVOC
Dishwashing	Mild decline	Variable	HUMIDITY
Washing	Mild decline	>60 minutes	HUMIDITY
Ventilation	✨ Improvement	Immediate	N/A

What can we learn and do?

Based on the data collected, several practical conclusions and recommendations emerged to help improve indoor air quality in everyday life:

- Rethink indoor activities
  Smoking indoors should be completely avoided, as it had the most harmful impact on air quality. Activities like cooking and eating should always be accompanied by good ventilation—before, during, and after—to limit pollutant buildup.

- Ventilation matters
  Keeping indoor spaces well-ventilated is one of the simplest and most effective ways to reduce indoor pollution. Regularly airing out rooms, especially after pollutant-generating activities, can make a noticeable difference.
- Tailored solutions for every home
  Since air quality varied significantly between households, it's clear that a one-size-fits-all solution won't work. Interventions should be adapted to each home's habits, layout, and lifestyle.
- Looking ahead
  In future project phases, this analysis will be expanded by integrating health data. This will allow researchers to better understand how specific pollutants impact human health—laying the groundwork for more personalised and health-focused IAQ strategies.

What's next?

The insights gained from this initial study are just the beginning. Here's what's coming up:

- Linking Air Quality and health
  Future phases of the project—starting with the ongoing work in ongoing in the project's Barcelona pilot site—will connect air quality data with participants' health information. This will help researchers directly assess how daily exposure to indoor pollutants affects people's well-being.

- Expanding the study
  The current analysis will be extended to include other environments and scenarios across the K-HEALTHinAIR project. This broader scope will offer a more complete understanding of how different indoor spaces and everyday activities shape the air we breathe.

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