CAP-AI App Instruction Manual

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CAP-AI's Goals

The aim of CAP-AI is **to create an environment of fresh air (CO_2≦1,000 ppm) without contamination through ventilation**.
As a result, ❶you will not be infected with respiratory infections (influenza, COVID-19, colds, etc.)
❷ We aim to realize an indoor environment that eliminates health hazards caused by CO_2 (carbon dioxide gas) and pollutants harmful to health (volatile organic compounds, mold, etc.).

❶ How not to get infected
In order not to get infected, it is necessary to know how pathogens such as viruses and bacteria infect our body and to stop this. There are three routes of respiratory infection, airborne infection, droplet infection and contact infection, so if you block all of these, you will not be infected ("Guidebook to avoid infection"： PointPath-Land (https://pointpath.jp/guide/)。

Airborne infection route: An aerosol containing pathogens that is expelled with the breath of an infected person floats and stays in the room, and the roommate inhales the aerosol of the infected person along with the breath and becomes infected.

Droplet infection route: The route by which droplets released by an infected person reach the mucous membranes of the mouth, nose, and eyes before they fall.

Contact infection route: A route of infection by touching the mucous membranes of the mouth, nose, or eyes with a hand that has been exposed to droplets sent by an infected person or a hand that has touched a droplet that has been adhered to it.

Of these three routes of infection, **preventing airborne infection, which is the main route, is the most important thing to prevent infection.** (10 Scientific Evidence Supporting Airborne Transmission of SARS-CoV-2, PointPath-Land https://pointpath.jp/guide/), (1)
For this purpose, it is essential **to have good ventilation at all times**.

It is easy to lack ventilation, so increase ventilation when it exceeds 1,000 ppm on the CO_2 monitor. And if you keep the indoor air fresh, you won't get airborne infection.
("CAP Science and Technology: The Practical Process" PointPath-Land・CAP, https://pointpath.jp/cap/ ）

To prevent droplet infection, wear a mask or keep a distance of at least 1 meter from others. You can also choose to avoid facing each other face to face within a distance of 1 meter. (However, in the medical field or face-to-face with symptomatic infected people, keep a distance of 2 m.)

In order to prevent contact infection, take measures by making a habit of washing your hands.

("A Guide to Not Getting Infected", PointPath-Land https://pointpath.jp/guide/)

Outbreak and the No More Pandemic

Airborne transmission by aerosols can be transmitted from a single infected person to several to hundreds of people at once. If there is even one person infected with a respiratory infection in a poorly ventilated room, aerosols containing pathogens such as viruses will continue to spread and stagnate in the room. And everyone in the room is more likely to be infected. (Figure 1: Outbreak)
If the CO_2 concentration is kept below 1,000 ppm and ventilation is maintained so that there is no lack of ventilation, mass infections will not occur. (2)

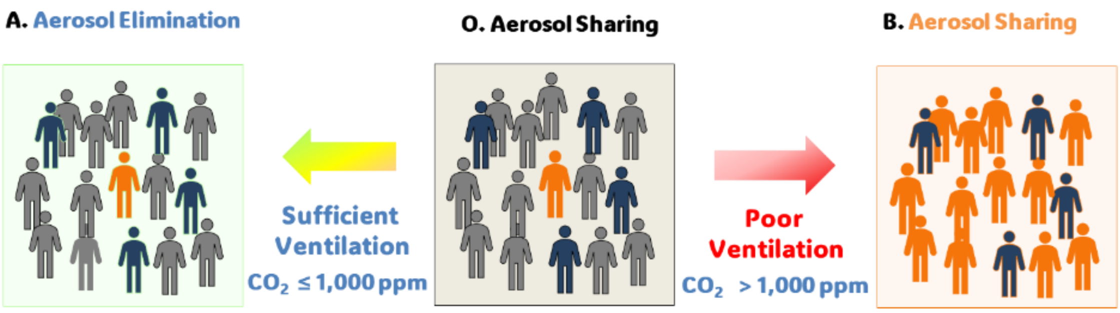


Figure 1: Group Infection

Orange people are infected, and gray and blue people are not infected.

People in blue are less susceptible to infection because they are immune to the virus.

Group Infections occur everywhere people live and gather, such as homes, workplaces, offices, public facilities, schools, nursery schools, hospitals, facilities for the elderly, movie theaters, theaters, churches, railroad cars, etc. Epidemics of COVID-19, influenza, and colds are spreading due to group infections. (For details, see "Group Infection Control for Ending Pandemics", PointPath-Land https://pointpath.jp/guide/ reference)

If you make the indoor space where you act fresh air with good ventilation ($CO_2 \leqq 1{,}000$ ppm), you will not be infected in a group. The more group infections are reduced, the more infected people will decrease at an accelerated rate, and the epidemic of respiratory infections (COVID-19, flu, colds, etc.) will end.

In a certain area, **if all indoor spaces where people gather are constantly filled with fresh air through good ventilation**, the epidemic of respiratory infections in that area will end. And then **an area free of infection is born.** Even if infected people come in from other areas, the infection will not spread in this region.

If such areas with indoor air quality spread to local governments and the entire country, a country free of infectious diseases will be born. It will also stop the next pandemic. If the indoor air quality around the world is in this state, **humanity will be able to escape from the long history of infectious diseases that have brought misery and chaos, and a world of no more pandemics will be opened**.

❷ Fresh air environment

The challenge of indoor air quality is something that countries around the world have been working on in terms of air pollution and health hazards. Air pollution has been identified as a major cause of diseases ranging from asthma to heart disease, stroke, lung cancer and, more recently, dementia (where air pollution can promote amyloid β accumulation). There are many sources of harmful substances that pollute indoor air, such as combustion products, building materials, housing appliances, and household items, and they release chemicals and volatile organic compounds that irritate the lungs and eyes. It is also contaminated by microorganisms such as various types of bacteria and mold. (3)

Evidence of CO_2 health problems has been reported by researchers in Japan, Germany, the United States, Sweden, France, Denmark, and other countries. In summary, when the CO_2 concentration exceeds 1,000 ppm, symptoms such as fatigue, headache, tinnitus, and breathlessness increase, the degree of fatigue increases significantly, physiological changes (CO_2 partial pressure in the blood, heart rate, etc.) and SBS (Sick Building Syndrome). (4)

It has also been reported that CO_2 concentrations in elementary school classrooms have a negative impact on students' abilities and academic outcomes, as well as effects on labor productivity (decision-making and problem-solving skills) due to low concentrations of CO_2 around 1,000 ppm. (4) In the wake of the pandemic, more global efforts have been launched than ever before to make indoor air safer. Renovation of existing buildings is an enormous and costly undertaking, but it has become clear that the benefits outweigh the cost.

CAP-AI can be used as a useful tool to solve the two major challenges that everyone faces: ❶the epidemic of respiratory infections and the next pandemic ❷ air pollution and health problems.

References

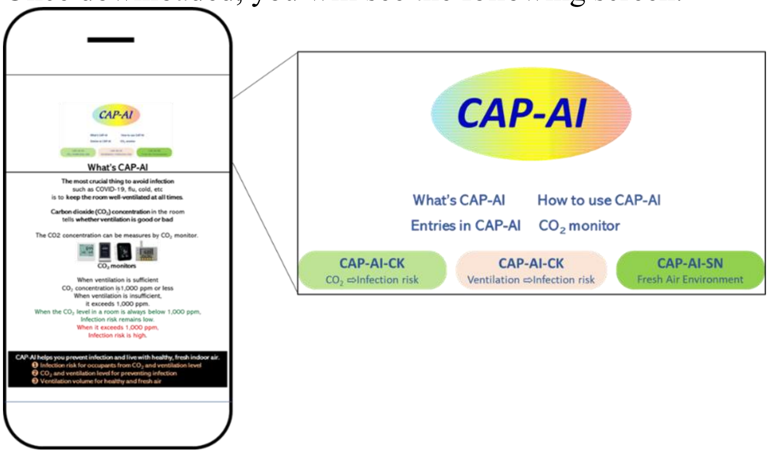
(1) A multinational Delphi consensus to end the COVID-19 public health threat, Nature 611, 332-345 (2022)
(2) Motoya Hayashi: The 37th Symposium of the Japan Society for Infectious Diseases, Evaluation and Improvement of Ventilation, 28 June 2022. http://www.kankyokansen.org/uploads/uploads/files/jsipc/COVID-19_cluster.pdf
(3) The fight for clean indoor air. Nature Features vol.615, 07 March 2023.
(4) Kenichi Higashi, Effects of inhalation exposure to carbon dioxide in indoor environments on humans. Indoor Environment, 21, 113-130, 2018.

How to use CAP-AI

CAP-AI is an app that calculates and provides the degree of pollution of indoor air and the probability of infection of people in the room. This app is applicable to respiratory infections (COVID-19, influenza, colds, pneumonia, tuberculosis, measles, etc.).

<u>Download the app</u>

This app can be downloaded free of charge from the CAP-AI QR code.
The QR code can be read from PointPath-Land “https://pointpath.jp/ ".
Once downloaded, you will see the following screen.



If you click on the letters under the CAP-AI logo, you will be taken to each site.

Click on the words "Guide", "How to use**"**, "Numerical value to enter", and "CO_2 monitor" in CAP-AI to go to the respective site.
Please read the instructions on these sites carefully before using CAP-AI.

There are three types of CAP-AI:
CAP-AI-CK The risk of infection can be determined from the CO_2 concentration.
CAP-AI-VK The ventilation volume indicates the concentration of CO_2 and the risk of infection.
CAP-AI-SN The degree of air pollution can be determined from the ventilation volume.
If you click on the letters above light green, pink, and dark green, you will be taken to the CAP-AI-CK, -VK, and -SN apps, respectively**.**

<u>Instructions for use</u>

1. Fill in the following five values that are common to your app:
   Infecters (Number of infected people), Non-infecters (Number of non-infected people), Occupied (Total number of people in the room), Body Weight, Room, and Duration (Time in the room).
2. For each app, fill in the numerical values of the questionnaires.
   CK: CO_2 concentration, VK/SN: Ventilation volume

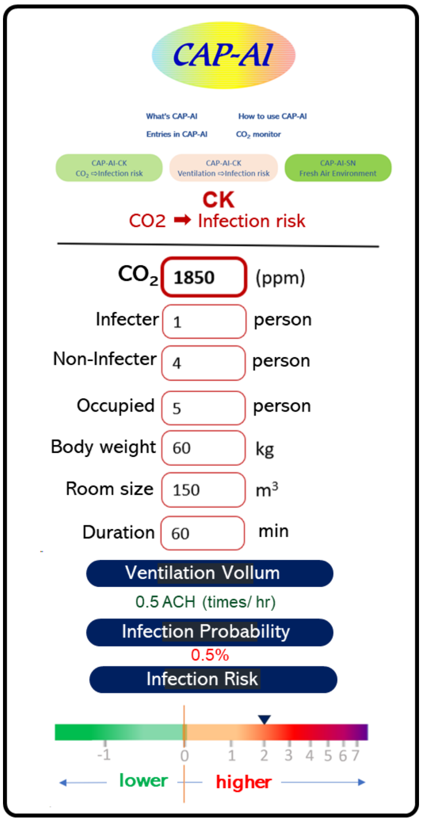
3. Click Finish or press Enter to see the answer.

CAP-AI-CK

The CO_2 concentration tells us the following.

① Ventilation in the room (times/1 hour; the number of times the air in the room is replaced with the outside air per hour)

② Probability of infection among people in the room (%) and Infection risk intensity (high or low risk of infection)



- First, let's fill in the five values that indicate the situation in the room.

Infecter: If you know the number of infected people in the room, enter the number, and if it is not specified, enter 1 person or the estimated number.

Non-infecter: The number of people in the room who are not infected.

Occupied: The total number of people in the room (infected + uninfected). If you enter the number of infected people and the number of non-infected people, the total number of people in the room will be automatically displayed.

Body Weight: The weight of one individual in kg. Enter the average weight of the occupants in the room.

Example 1: Enter the average weight of Japan men and women 60 (kg).

Example 2: In the case of an elementary school classroom, enter the average weight (≈40 (kg)) of 10 and 11 year olds as a representative value.

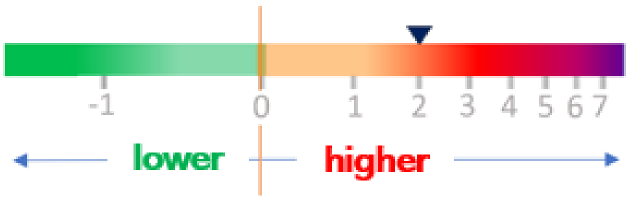
Room size: Room area (frontage × depth) × ceiling height = volume of the room. The unit is m^3 (cubic meter)

-  Fill in the CO_2 concentration (ppm) of the questionnaire.
  If you want to know the risk of infection and the amount of ventilation in the room, enter the CO_2 concentration indicated by the CO_2 monitor.
  When using it for the purpose of freshening the air in buildings and rooms and keeping the risk of infection low, enter 1,000 as the CO_2 concentration value.
- The answer is shown below each bar

Ventilation Volume: Times/1 hour [ACH (Air Changes per 1Hour)]
Infection Probability: Probability of infection in this room (%)
Infection Risk; High or low risk of infection:

The darker the red color, the higher the number, the more likely it is to be infected, and the darker the green, the less likely it is to be infected. The number represents the risk intensity, the higher the positive number, the higher the risk of getting infected, and the higher the negative number, the lower the likelihood of getting infected.
When the concentration of CO_2 in the room is 1,000 ppm, the risk of infection is 0. (Less likely to be infected)

The triangular arrow points to the answer to the risk of infection



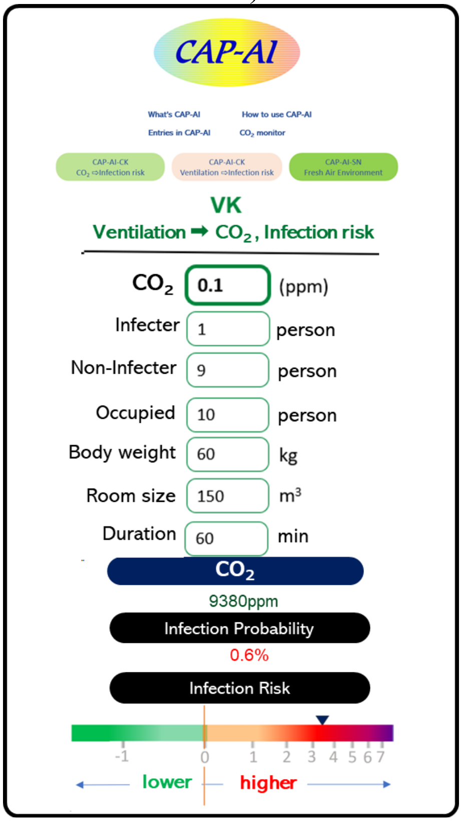
*CAP-AI-CK can be applied to the evaluation of CO_2 concentrations of 400 ppm or more.

CAP-AI-VK

Ventilation volume tells us the following.

① CO_2 concentration in the room (ppm)

② Probability of infection among people in the room (%) and Infection risk intensity (high or low risk of infection)



- First, let's fill in the five values that indicate the situation in the room.

Infecter: If you know the number of infected people in the room, enter the number, and if it is not specified, enter 1 person or the estimated number.

Non-infecteer: The number of people in the room who are not infected.

Occupied: The total number of people in the room (infected + uninfected). If you enter the number of infected people and the number of non-infected people, the total number of people in the room will be automatically displayed.

Body Weight: The weight of one individual in kg. Enter the average weight of the occupants in the room.

Example 1: Enter the average weight of Japan men and women 60 (kg).

Example 2: In the case of an elementary school classroom", enter the average weight (≈ 40 kg) of 10 and 11 year olds as a representative value.

Room size: Room area (frontage x depth) x ceiling height = volume of the room. The unit is m^3 (cubic meter)

- Fill in the ventilation volume, ACH (Air Changes per 1Hour) of the questionnaire.
- The answer is shown below each bar.

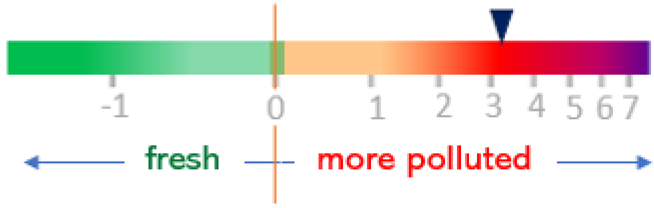
CO_2 | Infection Probability | Infection Risk

Indoor CO_2 concentration (ppm): **If it exceeds 1,000 ppm, ventilation is insufficient.**
Infection Probability: Probability of infection in this room (%)
Infection Risk: High or low risk of infection:

The darker the red color, the higher the number, the more likely it is to be infected, and the darker the green, the less likely it is to be infected. The number represents the intensity of the risk, and the higher the positive number, the higher the risk of infection, and the higher the negative number, the lower the probability of infection.

When the concentration of CO_2 in the room is 1,000 ppm, the risk of infection is 0. (Less likely to be infected)

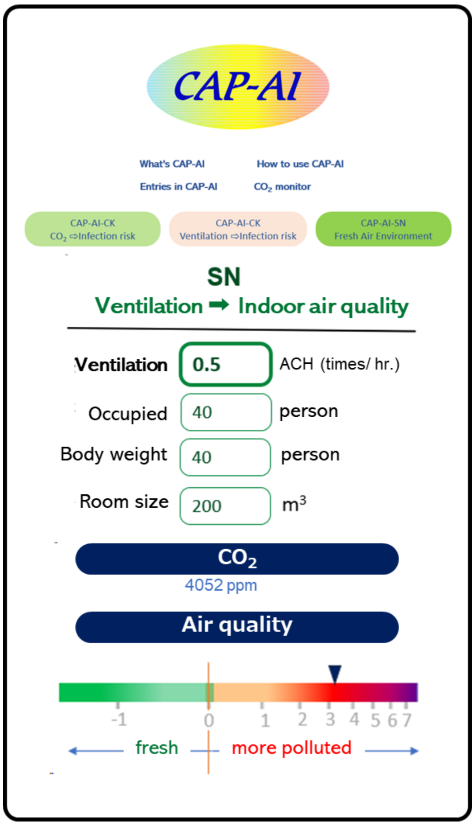
The triangular arrow points to the answer to the risk of infection



*CAP-AI-VK can be applied to ventilation volumes of 0.05 ACH or more and CO_2 concentrations of 401 ppm or more.

CAP-AI-SN

With CAP-AI-SN, you **can determine the freshness and dirtiness of indoor air from ventilation volume**.



- First, let's fill in the three values that indicate the situation in the room.

  Occupied: Enter the number of people in the room.

  Body Weight: The weight of one individual in kg. Enter the average weight of the occupants in the room.

  Example 1: Enter the average weight of Japan men and women 60 (kg).

  Example 2: In the case of an elementary school classroom", enter the average weight (≈ 40 kg) of 10 and 11 year olds as a representative value.

  Room size: Room area (frontage x depth) x ceiling height = volume of the room. The unit is m^3 (cubic meter)

- Fill in the ventilation volume, ACH (Air Changes per 1Hour) of the questionnaire.
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- **Answer: The CO_2 concentration (ppm) in the room** and the degree of air contamination are displayed.

  In Japan, the concentration of CO_2 in fresh air is around 420 ppm. The freshness of indoor air increases when the CO_2 concentration is 1,000 ppm or less and approaches 420 ppm. The higher the CO_2 concentration exceeds 1,000 ppm, the higher the degree of contamination of the indoor air.
  The indoor air environment is fresh, healthy, and there is little risk of infection, and the CO_2 concentration is always below 1,000 ppm.

  Under the indoor conditions of 40 people in the room, a weight of 40 kg, and a room size of 200 m3, the answer is as follows when the ventilation volume is entered as 0.5 times / 1 hour.

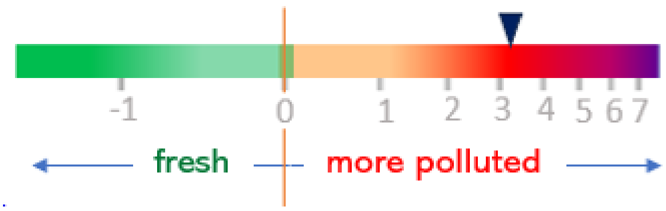
CO_2

4052ppm

Air quality

The darker the red color and the higher the number, the higher the degree of air pollution, and the darker the blue color and the lower the negative value, the fresher the air.

The triangular arrow points to the answer to the degree of air pollution.



*CAP-AI-SN can be applied to ventilation volumes of 0.05 ACH or more and CO2 concentrations of 401 ppm or more

Privacy Policy and Notes and Disclaimers for Using the App

This application complies with privacy standards and does not collect personal data from users.

The main function of the app is to provide users with the probability of infection and the degree of indoor air pollution based on six values: carbon dioxide (CO_2) concentration, number of infected people, number of uninfected people, average body weight, room size, and occupancy time.

The app applies these values and calculates the user's infection risk assessment and indoor air pollution level based on the MK-AQIP model [1)].

The app provides an infection risk assessment as well as actionable recommendations for optimizing the indoor air quality cycle. The level of risk of infection must be clearly stated that it is affected by the health and immunity of the individual.

This application is based on theoretical grounds and can only be used under certain indoor conditions. In response to only the six values that the user provides, it provides an infection risk assessment and air pollution rating for the room.

The App is designed strictly for informational purposes only and is not intended to make a medical diagnosis, medical decision, recommendation of treatment, or other medical practice.

The App Provider is not responsible for any users who may be infected under the conditions specified by the App.

1) Mikawa, Y.G. & Kase, H., MK-Aerosol Quantum Infection Potential (AQIP) model, appendix 1, “No More Pandemics: Toward a World Free from Infectious Diseases”, Cambridge Scholars Publishing 2024.