HEALTHY BUILDINGS

RESET

INTERNATIONAL STANDARD

Measurably Healthy Buildings™

The World's Standard for Data Quality in Real-Estate

RESET® Standard

RESET® is an international performance standard and certification program for healthy buildings based on data that is collected and analyzed on a daily basis.

RESET® Standard - Modules

RESET® can be implemented over-time, module by module. It does not attempt to do everything at once. Rather, it focuses on mastering and deploying one field of research at a time.

Materials

- Pilot Stage -

Health
Material Ingredients / Chemical Emissions

Carbon
Embodied / Operational

Circularity

Water
Embodied / Operational

Social

Safety

Air

PM2.5 — **Particulate Matter**
Indoor / Outdoor

TVOC — **Chemical Off-gassing**

CO_2 — **Carbon Dioxide**

CO — **Carbon Monoxide**

... — **Other ***

**RESET continuously tests sensors that detect other parameters of interest such as formaldehyde, Ozone and NO_2. New parameters are added as sensors are proven to meet the RESET Standard.*

Energy

- Pilot Stage -

Operational
Energy / Carbon

Water

- Pilot Stage -

Operational
Quality / Quantity

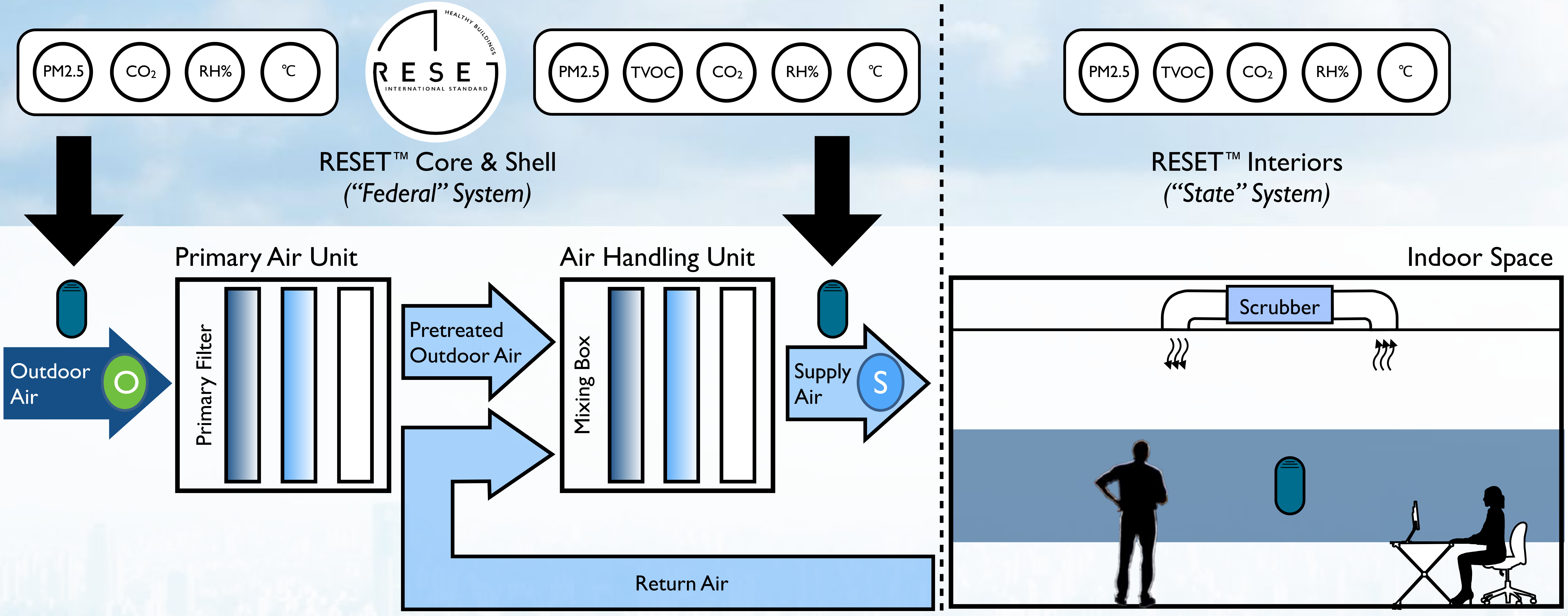
Waste

- In Development -

Circularity

RESET® Air - At a Glance

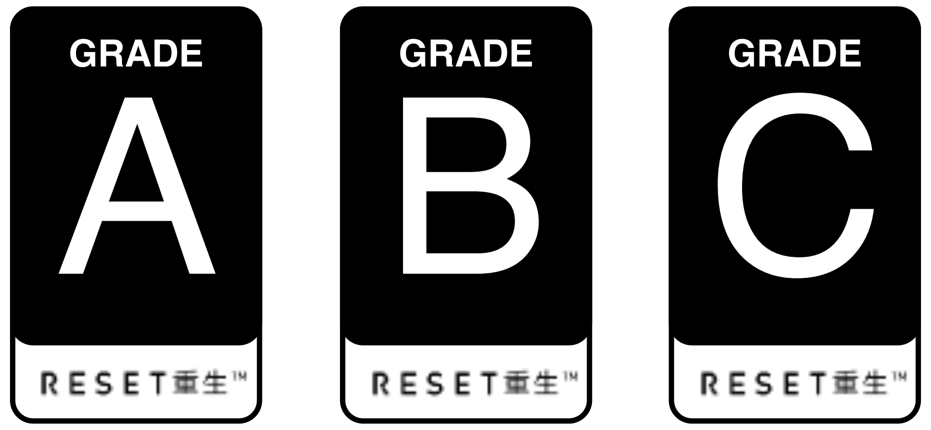
RESET® helps owners, operators and tenants achieve healthy performance targets by clearly defining and communicating their respective roles and responsibilities.



RESET® Air - A Comprehensive Standard for Quality

RESET® tracks the pulse of buildings primarily via monitors and sets standards for their performance, installation, calibration and data reporting.

1. RESET™ Monitor Standards



2. RESET™ Installation & Maintenance Standards

RESET™ AP

RESET™ Accredited Professionals (AP) are independent professionals trained to guide projects from the design of solutions through to installation & maintenance.

3. RESET™ Data Communication Standards

The RESET™ cloud collects data from accredited project networks and sub-clouds, analyses the data and reports the result.

Hines — *New Office Tower*

KERRY PROPERTIES 嘉里建設 — *Existing Office Tower*

lendlease — *Office Interior*

HEALTHY BUILDINGS
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CORDIS — *Hotel*

STARBUCKS RESERVE™ — *Retail*

SCHWARZMAN SCHOLARS — *Educational*

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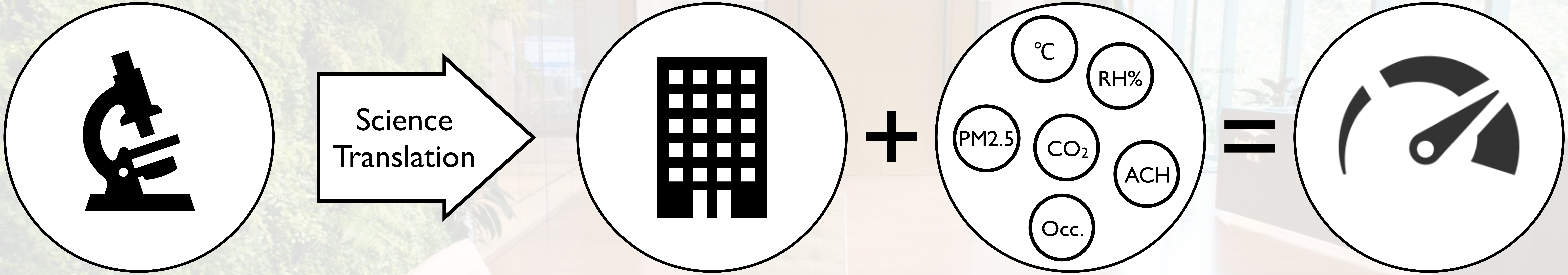
RESET® Air - Building Block for the Industry

As the industry's reference for data quality, the RESET® Standard can be used in combination with most building standards.

There is no lack of guidance on how to operate buildings during the SARS-CoV-2 pandemic.

What's lacking is empirical evidence.

As an industry, we are doing remarkably little monitoring for an airborne pathogen that is influenced by air quality controls in buildings.



Scientific Literature

Applied Science
(Standardized)

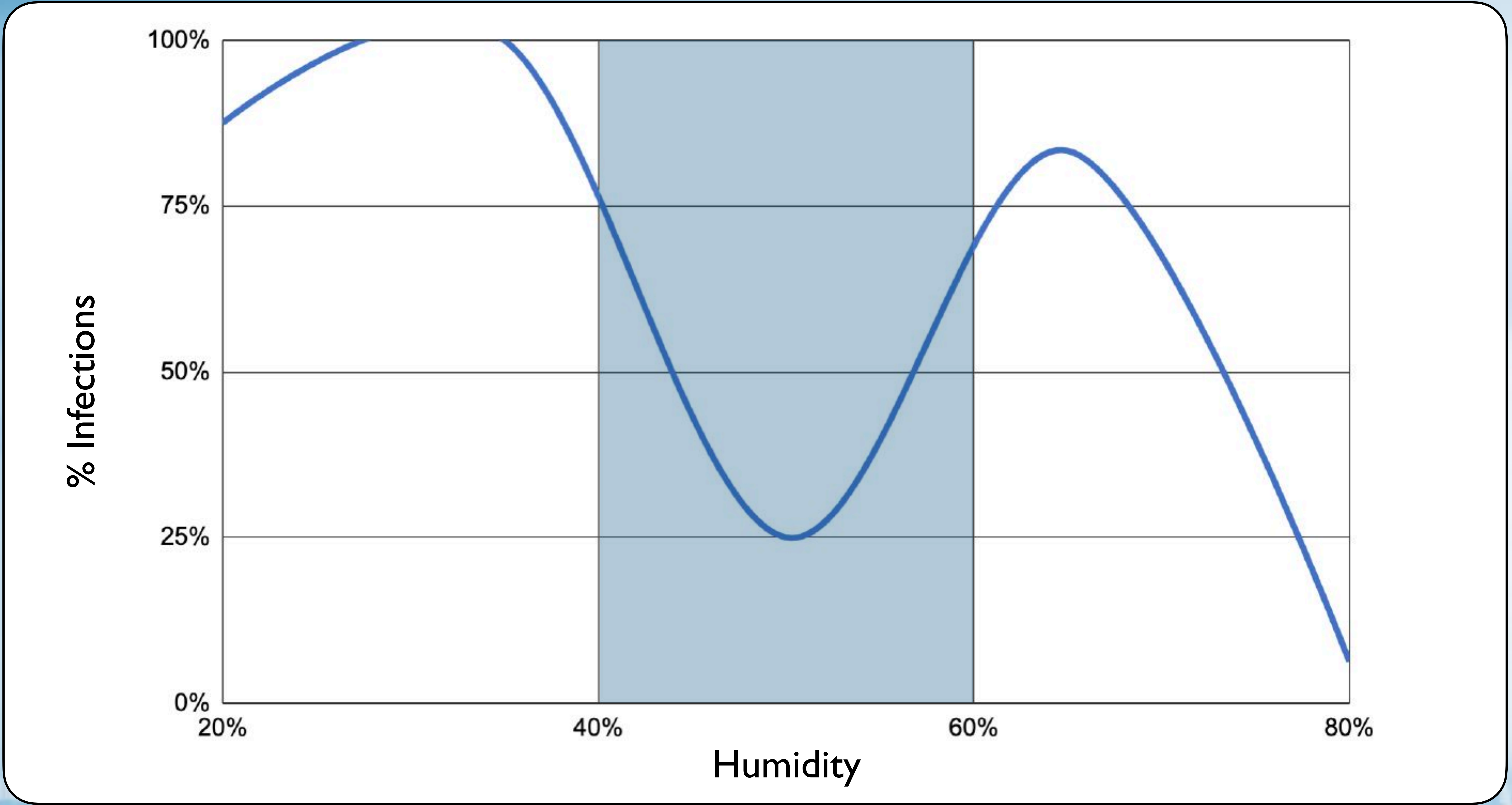
Sensor Data
(Standardized)

Real-time score
(Standardized)

Estimating the risk of virus transmission in real-time

We can't monitor airborne concentration of SARS-CoV-2 in real-time…

…but we can monitor the parameters that influence infection:
Temperature, Humidity, PM, Occupant Density, etc.



Roles of Humidity and Temperature in Shaping Influenza Seasonality, Anice C. Lowen, John Steel, Department of Microbiology and Immunology, Emory University School of Medicine, Atlanta, Georgia 2014

I heard humidity doesn't affect SARS-CoV-2. Is this graph relevant?

Does it matter how long I stay in a building?

Does it make a difference how healthy I am?

What's the impact of PM2.5 on infection rates?

Should I ventilate or not?

Does recirculation of air help or harm?

Scientific Research Data

Infection Potential

Controlled Air Quality Variables: °C, RH

Virus Health
(survivability)

SARS-CoV-1
SARS-CoV-2
Influenza

\+

Immune System Health

\+

Dosage
(Quantity over time)

=

Infection Potential

Virus Health
(survivability)

SARS-CoV-1
SARS-CoV-2
Influenza

+

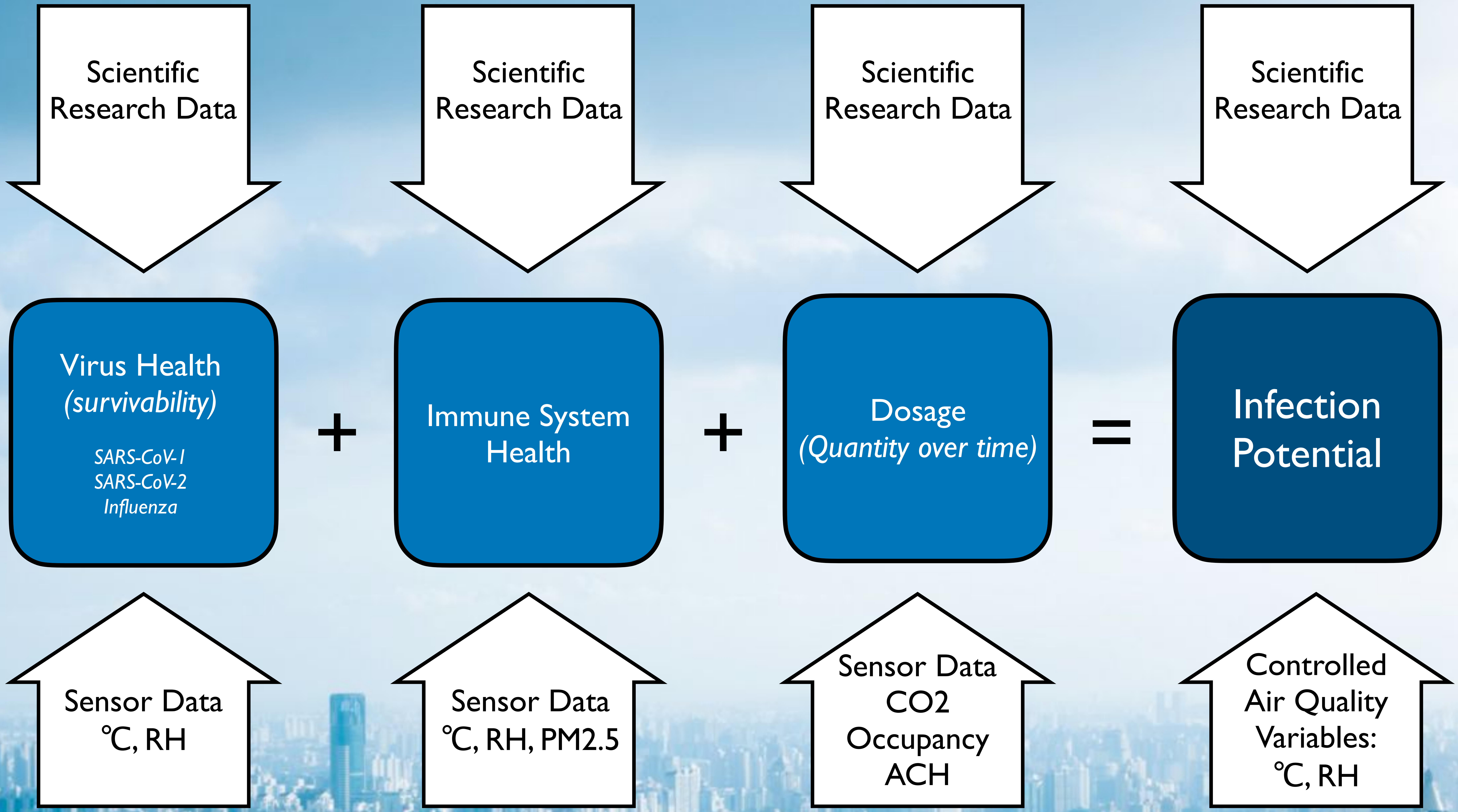
Immune System Health

+

Dosage
(Quantity over time)

=

Infection Potential


Scientific Research Data
Scientific Research Data
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Virus Health
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SARS-CoV-1
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+
Immune System Health
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Dosage
(Quantity over time)
=
Infection Potential
Sensor Data
°C, RH
Sensor Data
°C, RH, PM2.5
Sensor Data
CO2
Occupancy
ACH
Controlled Air Quality Variables:
°C, RH


100+ Science Publications
Indirect Health Effects of Relative Humidity in Indoor Environments
Association between short-term exposure to air pollution and COVID-19 infection: Evidence from China
Roles of Humidity and Temperature in Shaping Influenza Seasonality
An initial investigation of the association between the SARS outbreak and weather: with the view of the environmental temperature and its variation
Indoor transmission of SARS-CoV-2
Airborne micro-organisms: survival tests with four viruses
Survival Characteristics of Airborne Human Coronavirus 229E
Low ambient humidity impairs barrier function and innate resistance against influenza infection
High ambient temperature dampens adaptive immune responses to influenza A virus infection
Effects of air pollutants on the transmission and severity of respiratory viral infections
A physicist view of the airborne infection
The effect of environmental parameters on the survival of airborne infectious agents
The role of absolute humidity on transmission rates of the COVID-19 outbreak
Impact of ambient fine particulate matter (PM2.5) exposure on the risk of influenza-like-illness: a time-series analysis in Beijing,
Seasonality of Respiratory Viral Infections

Factor of
'I'
(100% 'healthy' virus)

Factor of
'I'
(100% 'healthy' immune system)

Factor of
'I'
(100% minimum infective dose)

Successful Infection
'I'

Virus Health *(survivability)*

SARS-CoV-1
SARS-CoV-2
Influenza

\+

Immune System Health

\+

Dosage *(Quantity over time)*

=

Infection Potential

Sensor Data
°C, RH

Sensor Data
°C, RH, PM2.5

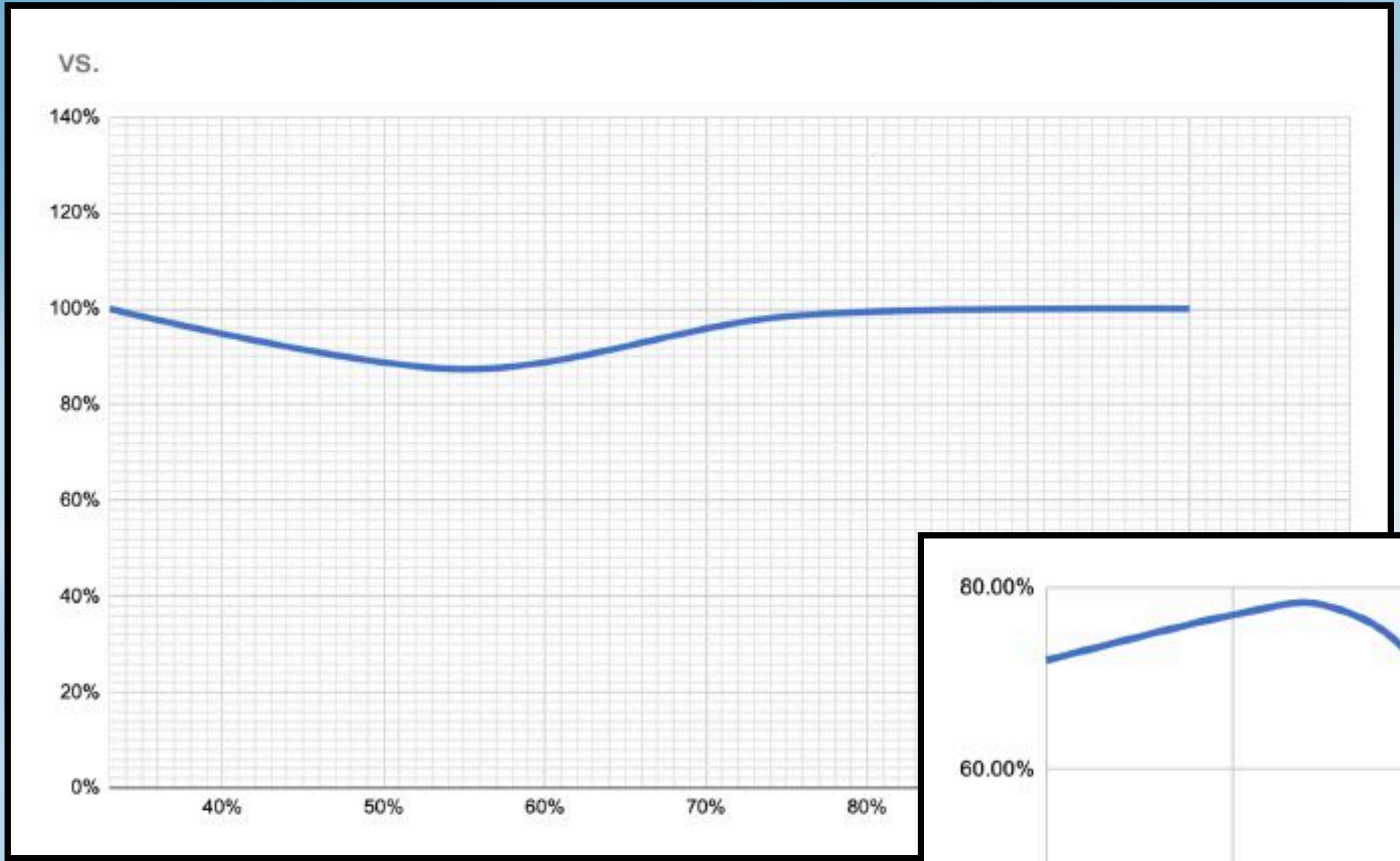
Sensor Data
CO_2
Occupancy
ACH

Controlled Air Quality Variables:
°C, RH

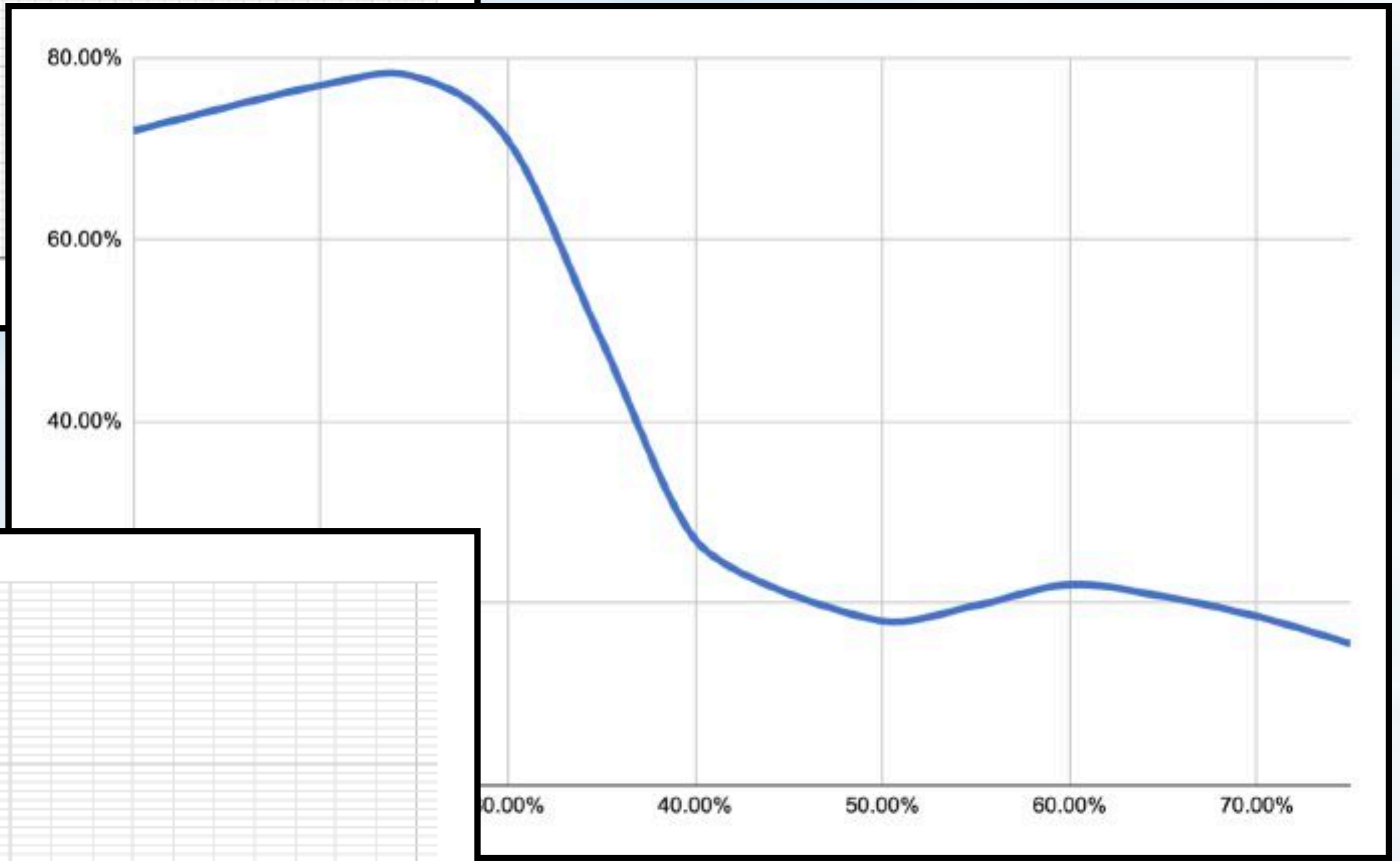
Scientific Research Data

Virus Health *(survivability)*

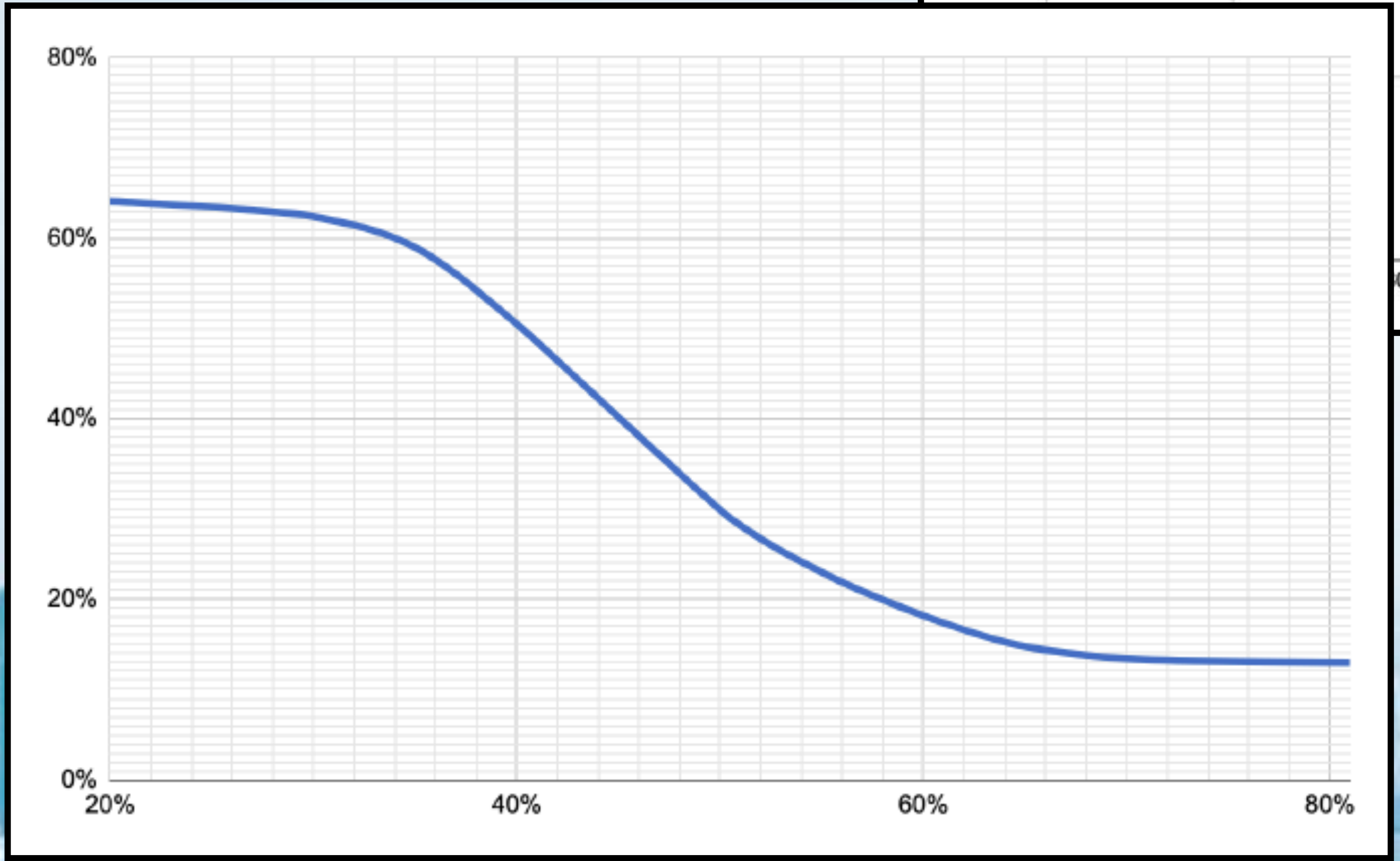
SARS-CoV-1
SARS-CoV-2
Influenza



Influenza (humidity impact): K. Lin, L.C. Marr: Humidity-Dependent Decay of Viruses, but Not Bacteria, in Aerosols and Droplets Follows Disinfection Kinetics, 2020



Influenza (humidity impact) J.D. Noti; High Humidity Leads to Loss of Infectious Influenza Virus from Simulated Coughs, 2013

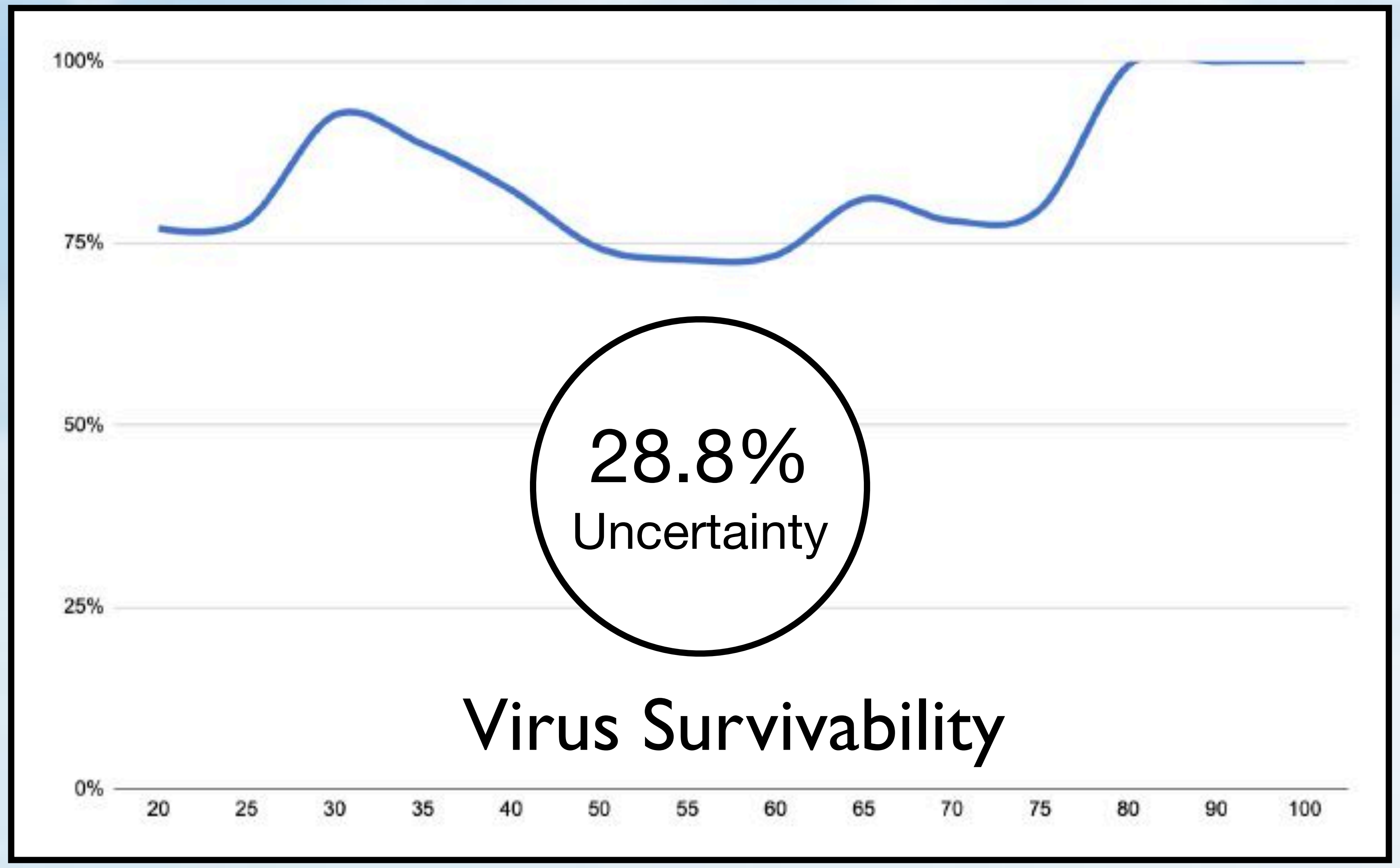


Influenza (humidity impact) G.J. Harper, Airborne micro-organisms: survival tests with four viruses, 1961

Scientific Research Data

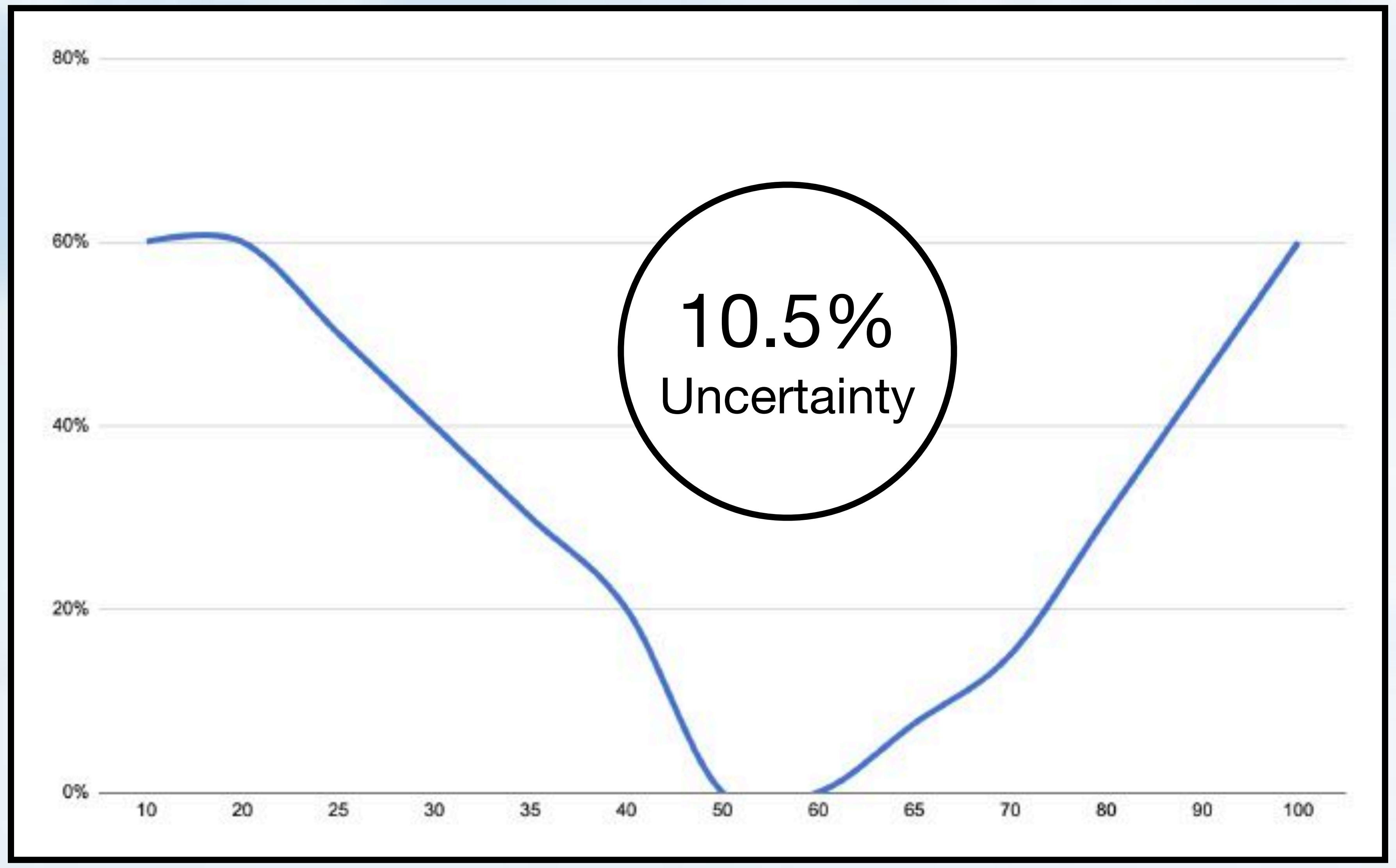
Virus Health *(survivability)*

SARS-CoV-1
SARS-CoV-2
Influenza

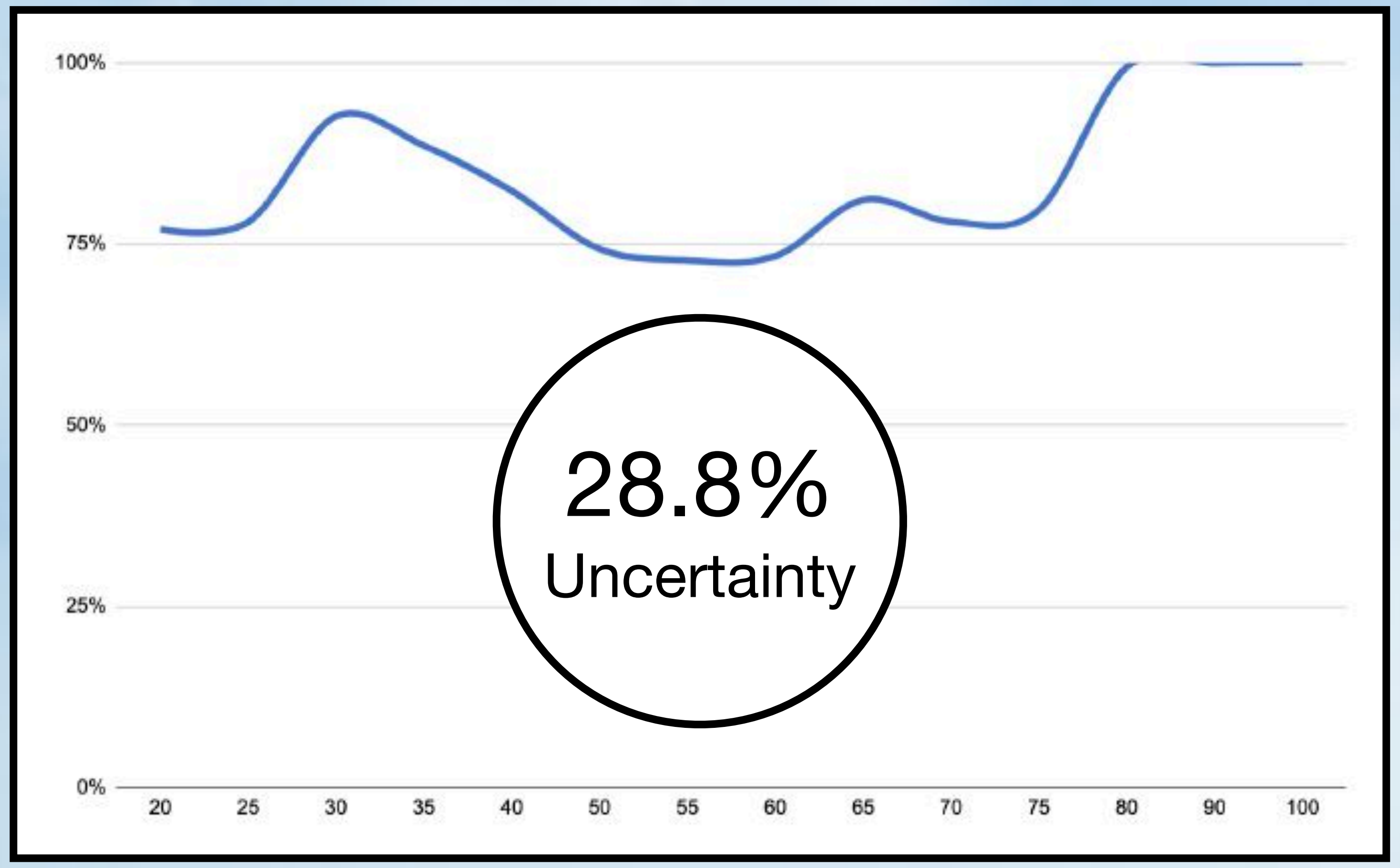


Scientific Research Data

Immune System Health

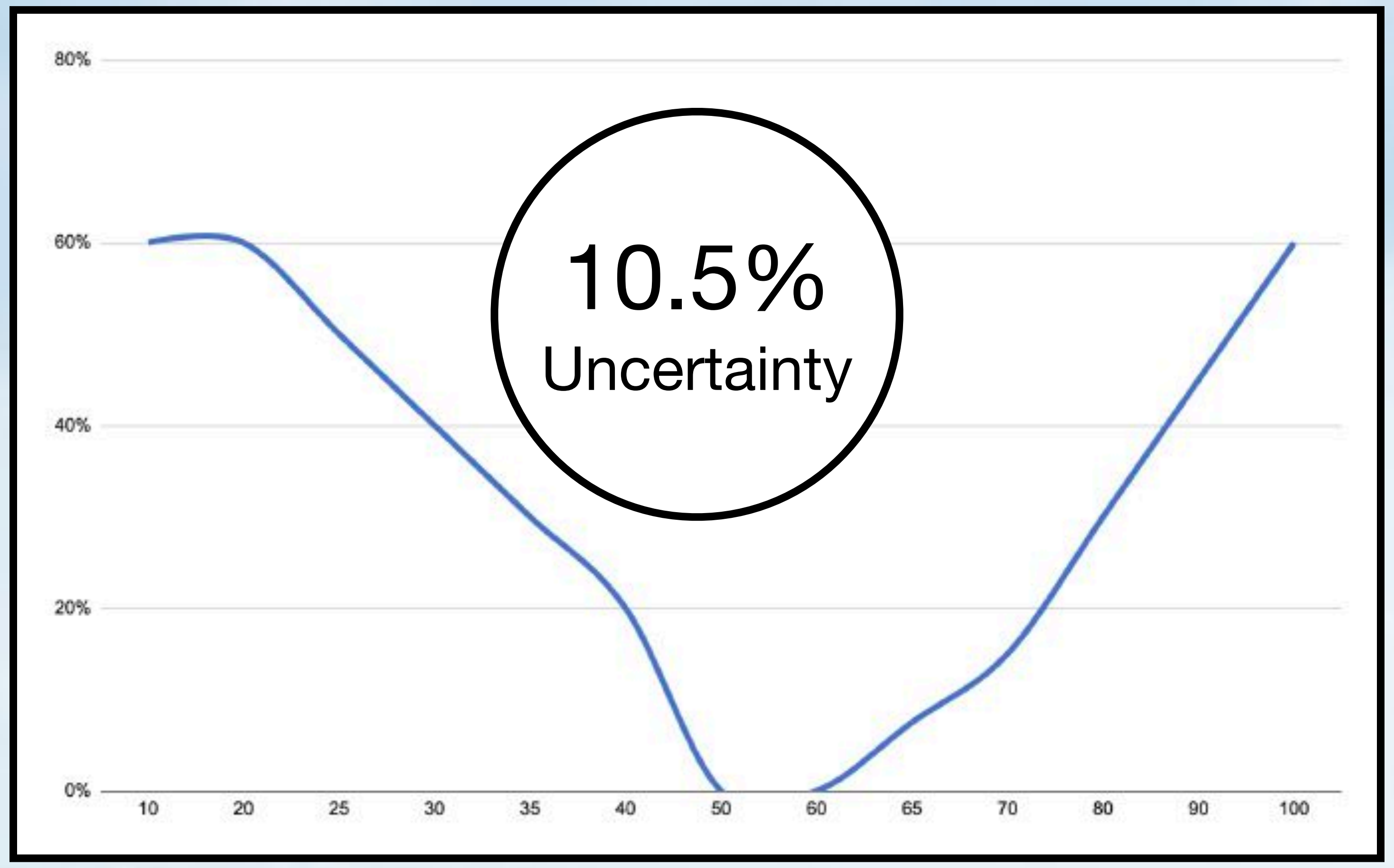


Virus Survivability



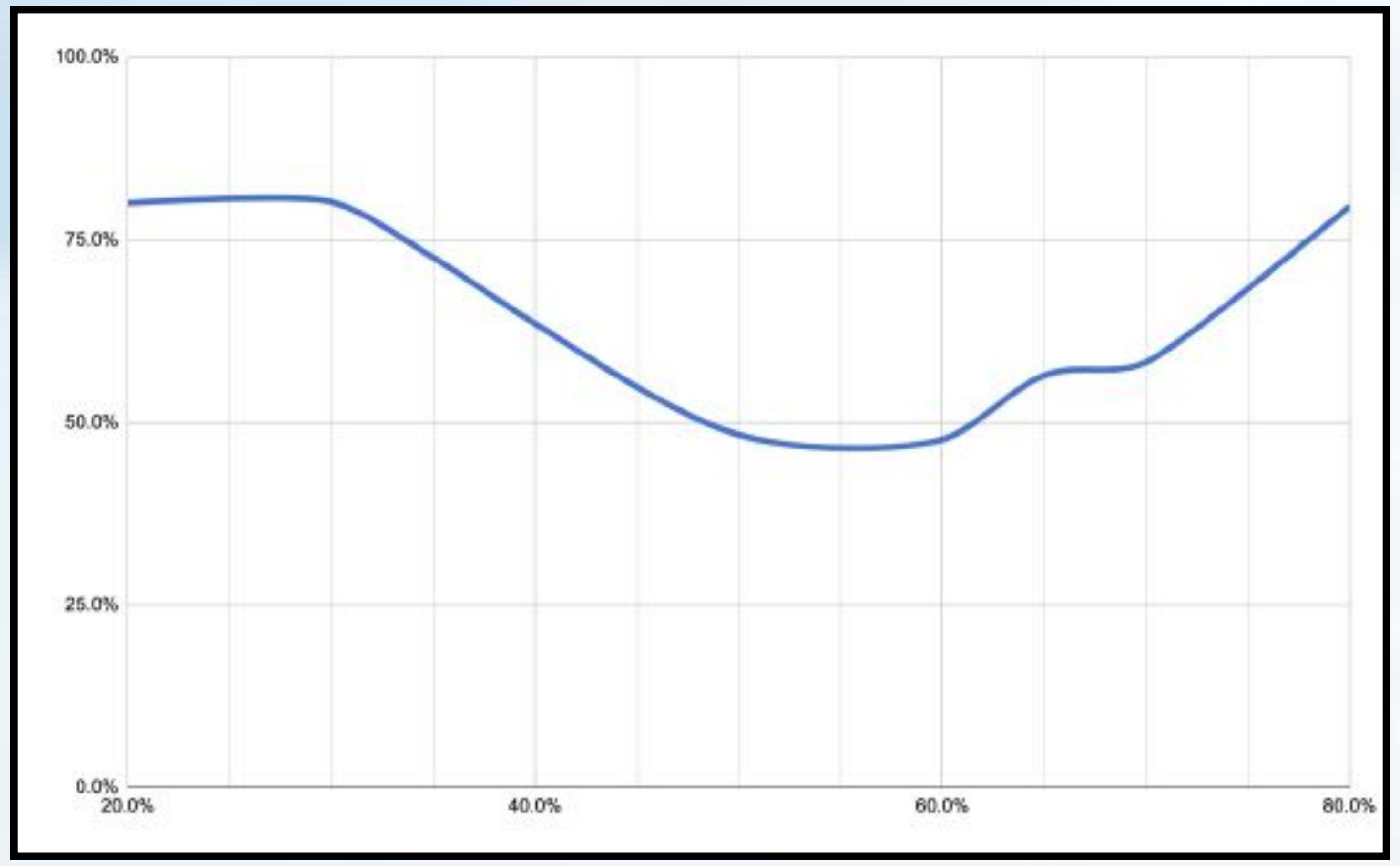
\+

Immune System Impact

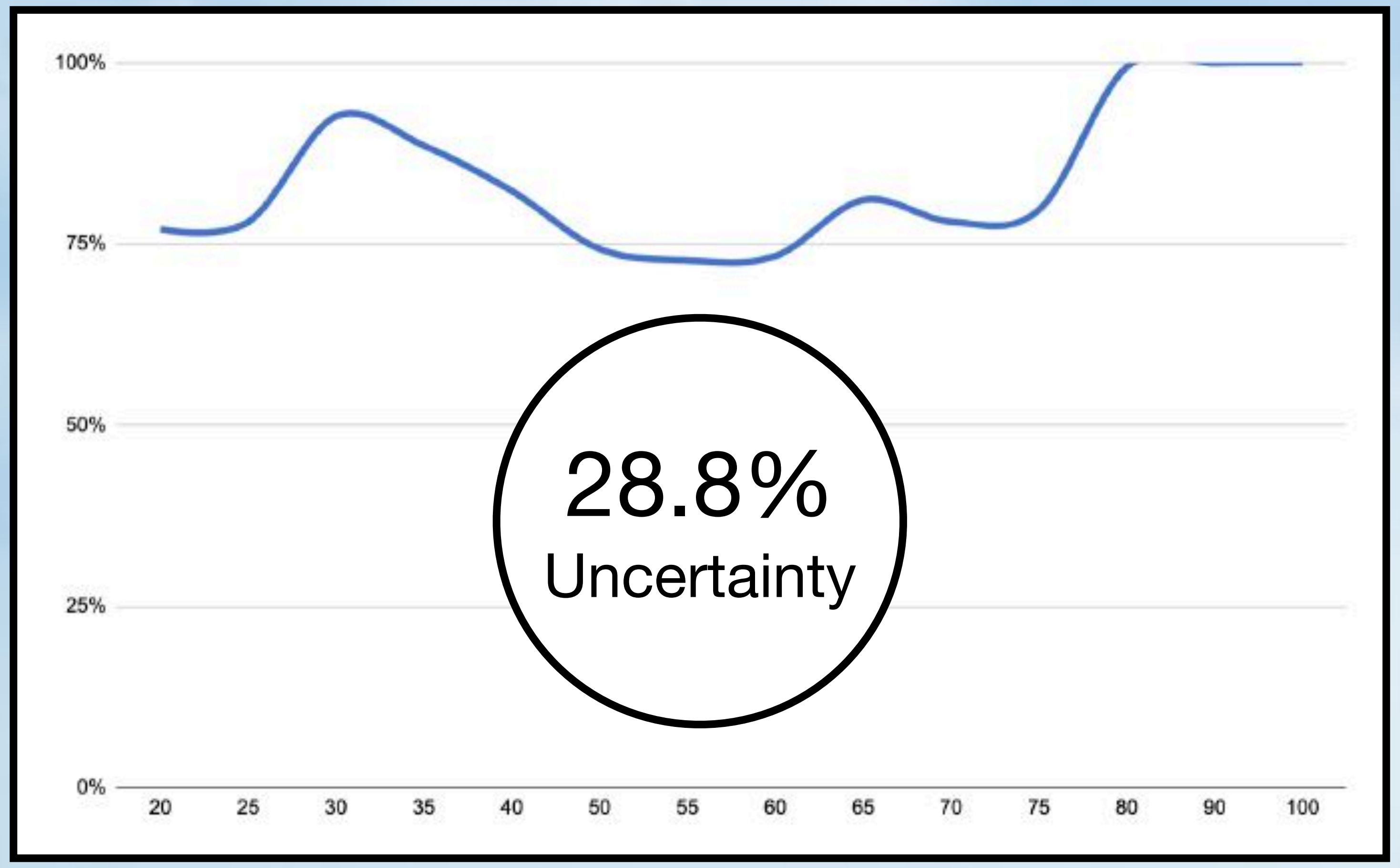


=

Infection Potential



Virus Survivability



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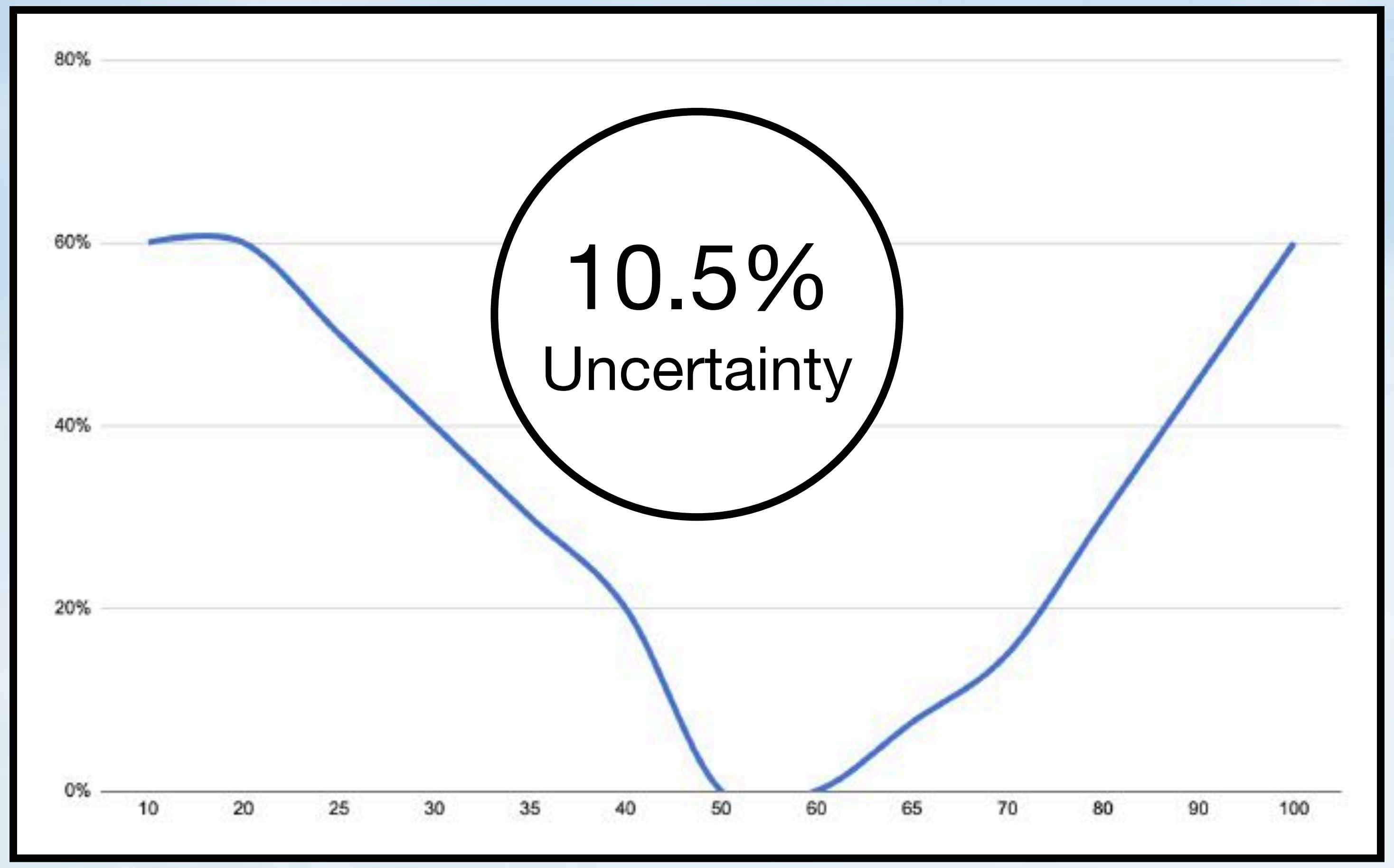
Immune System Impact



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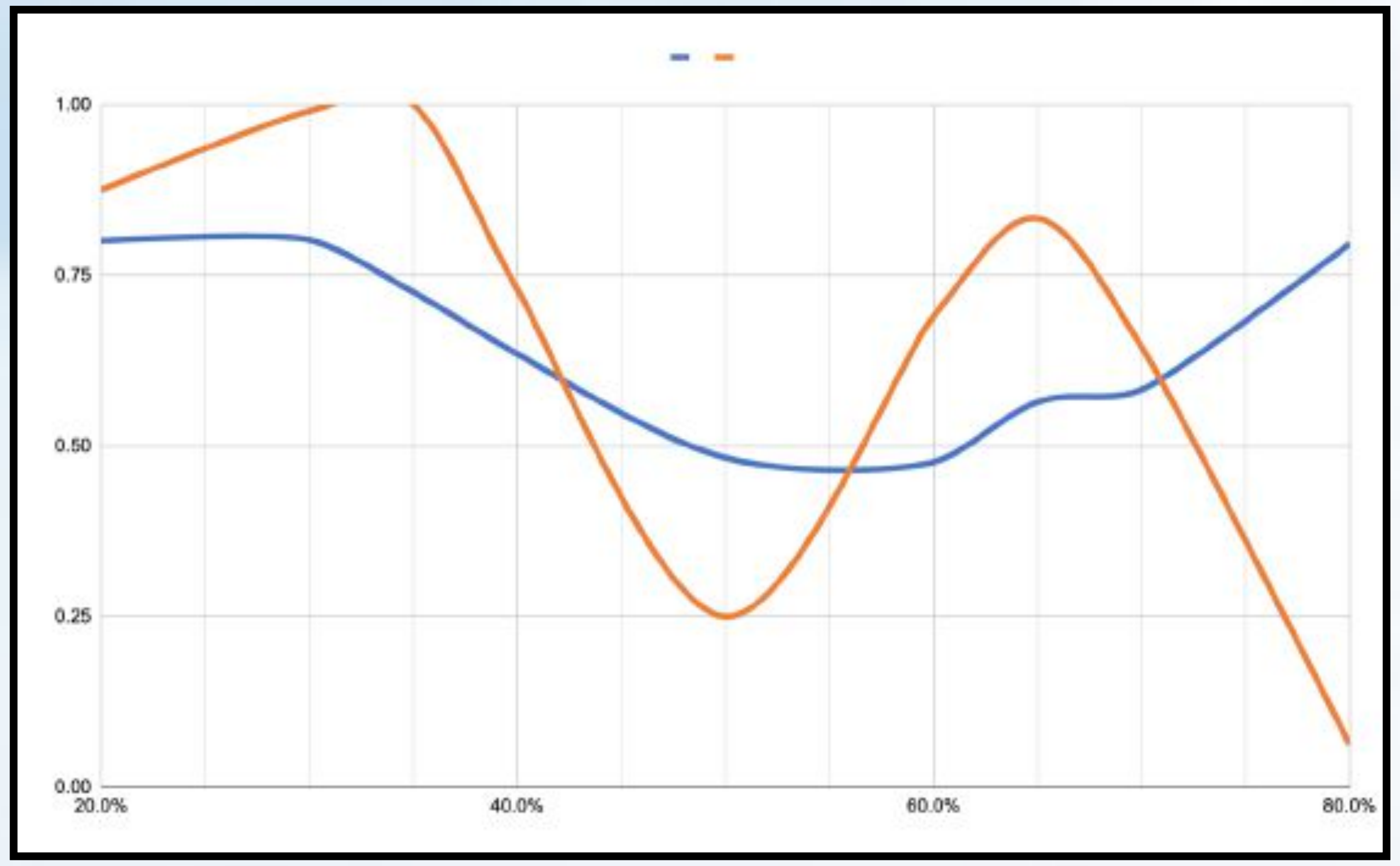
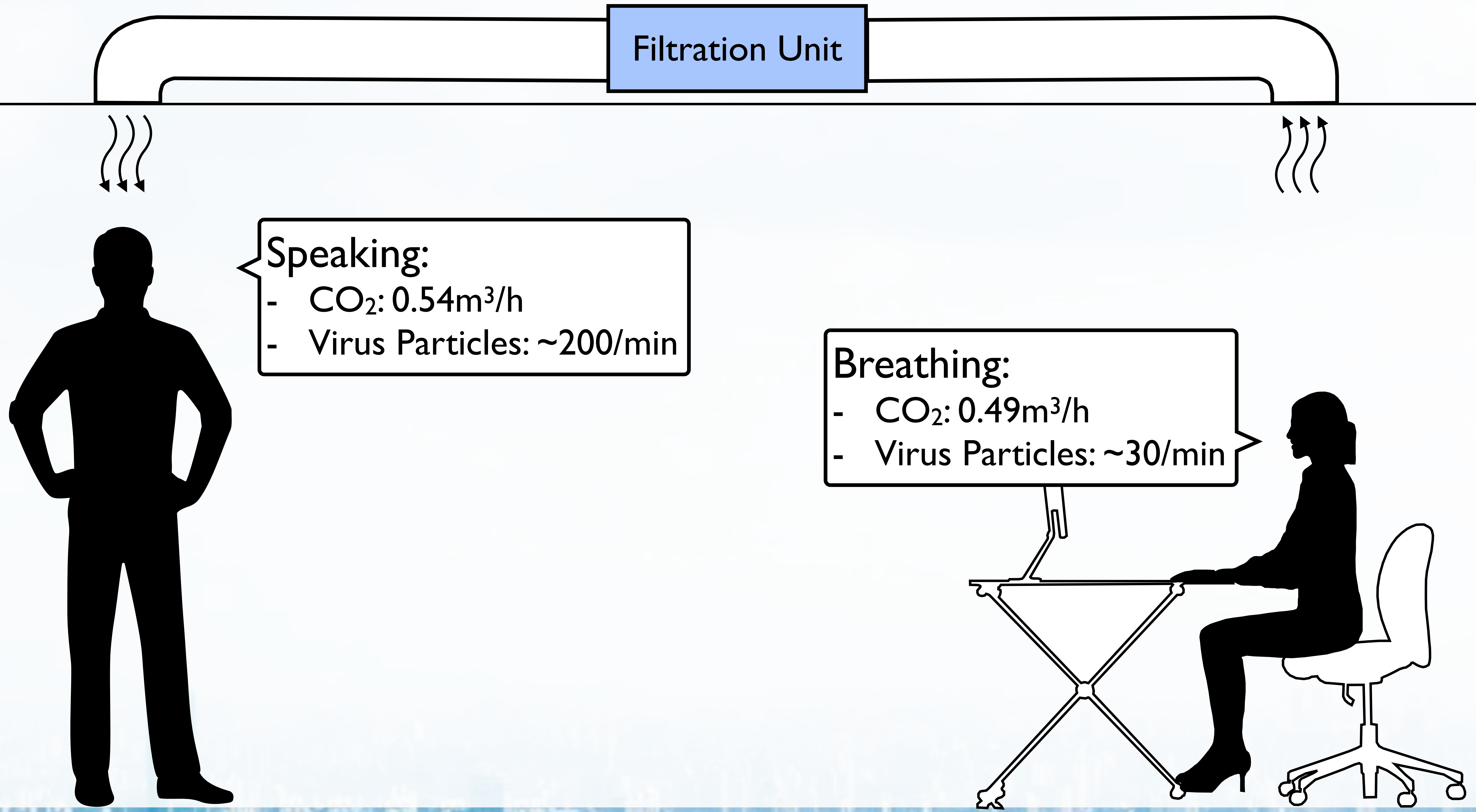
Infection Potential



Roles of Humidity and Temperature in Shaping Influenza Seasonality, Anice C. Lowen, John Steel, Department of Microbiology and Immunology, Emory University School of Medicine, Atlanta, Georgia 2014

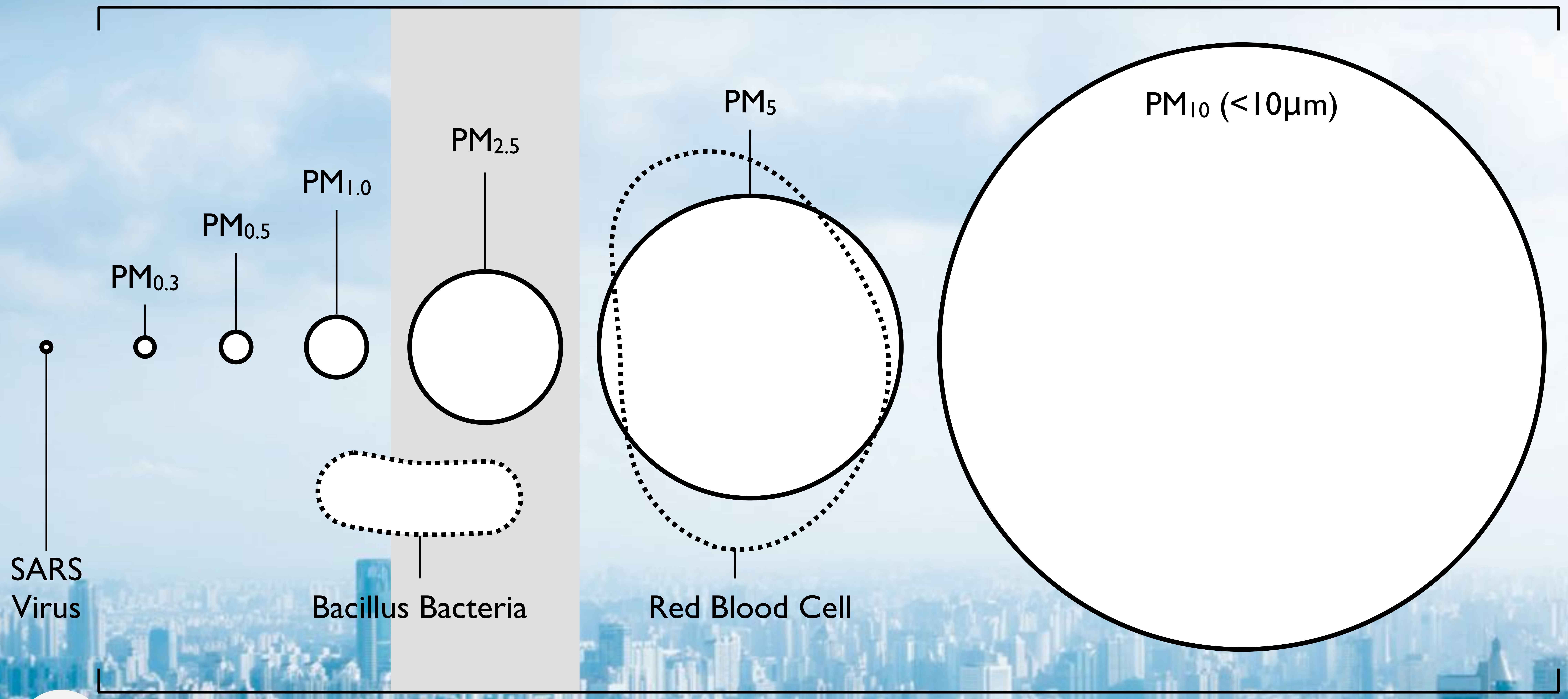
Dosage: Quantity over time

- Using CO2 as a proxy for virus particle accumulation
- Air Cleaning Rates



Dosage: Quantity over time

- Broad Spectrum Monitoring: PM0.3 to PM10 (common range of SARS-CoV-2 virus in airborne respiratory fluid)
- Occupancy Sensors



Fundamental Sensor Data

℃	Real-Time
RH%	Rolling average (days)
CO_2	Real-Time
PM2.5	Rolling average (months)

RESET Air Index

98%

Optimized For Human Health

<1%

*Aerosol Infection Potential: SARS-CoV-2**

72.2%

Certainty

RESET HEALTHY BUILDINGS INTERNATIONAL STANDARD


Fundamental Sensor Data
°C
RH%
CO_2
PM2.5
Additional Sensor Data
ACH
Occ.
PM0.3
PM1.0
PM5.0
PM10
RESET Air Index
98%
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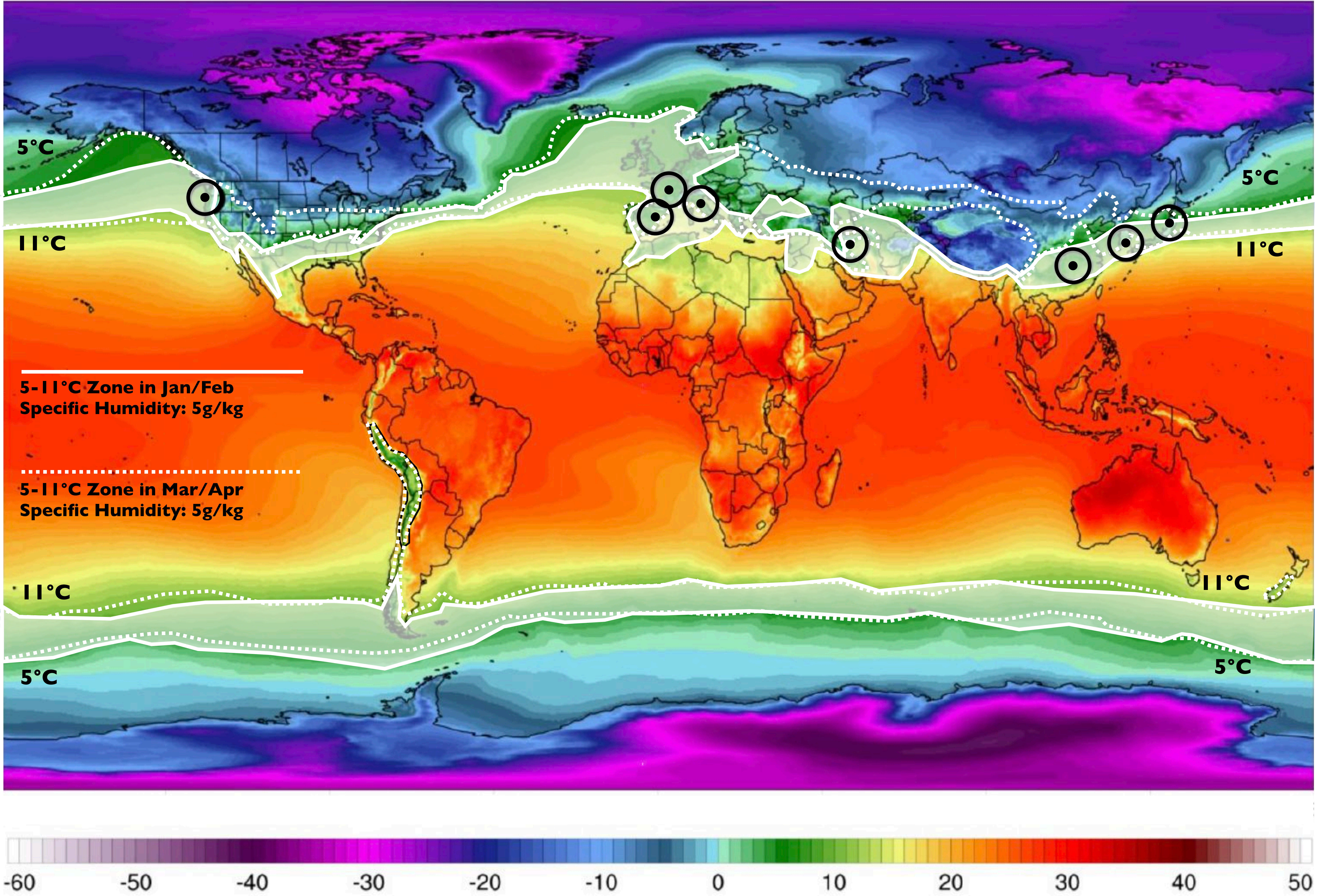
RESET
INTERNATIONAL STANDARD

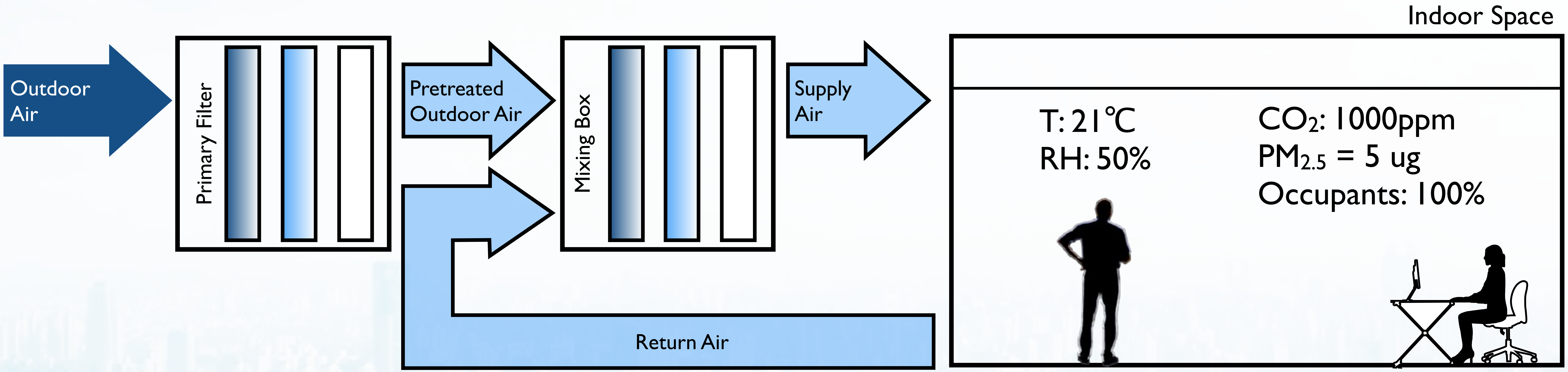

5°C
5°C
11°C
11°C
5-11°C Zone in Jan/Feb
Specific Humidity: 5g/kg
5-11°C Zone in Mar/Apr
Specific Humidity: 5g/kg
11°C
11°C
5°C
5°C
-60
-50
-40
-30
-20
-10
0
10
20
30
40
50

Case Study Example

Standard office. Pre-pandemic. Winter scenario.

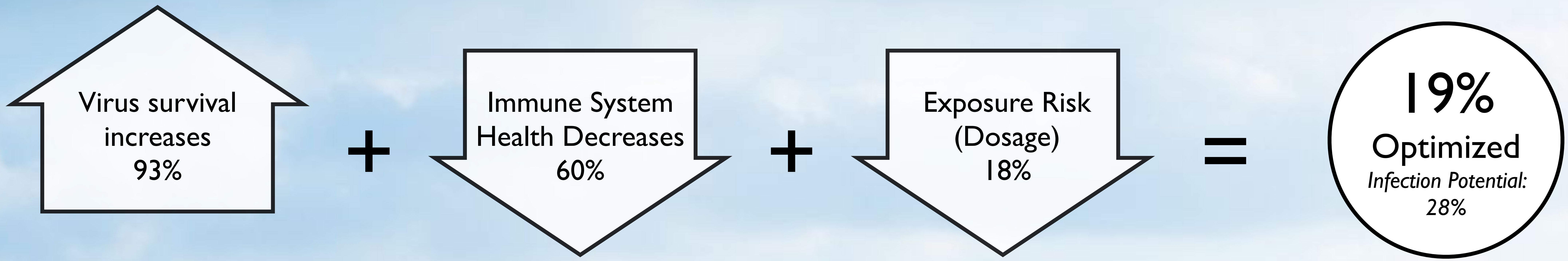
Virus survival 73% + Immune System Health 100% + Dosage 53% =

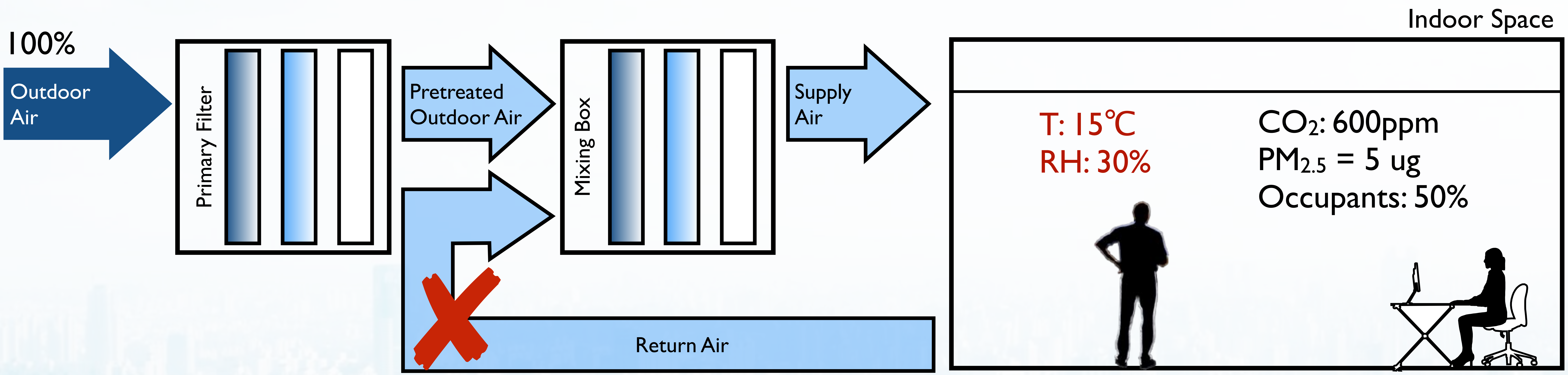
93%
Optimized
Infection Potential: 40%



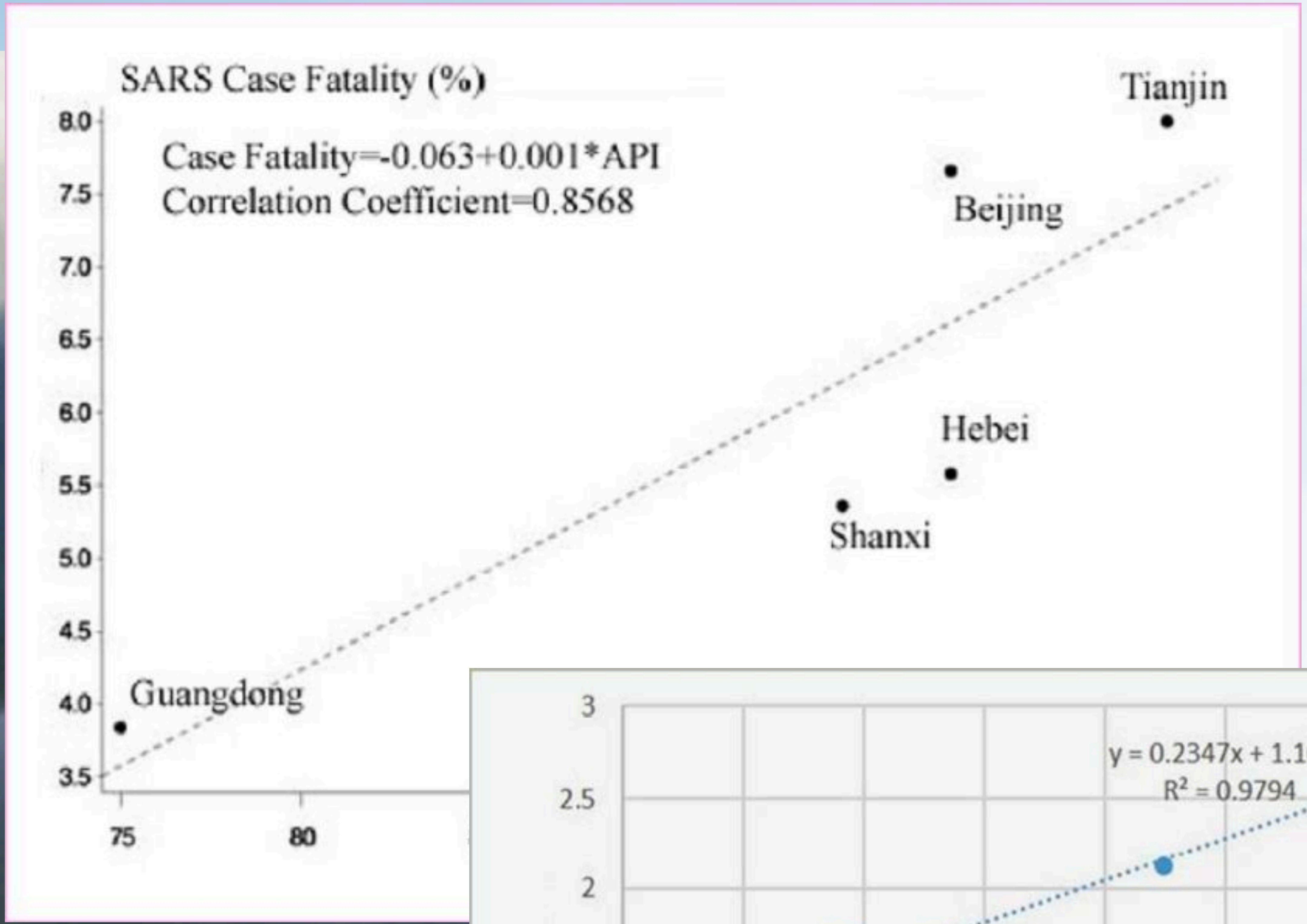
Ventilate! Don't recirculate! *(Blind advice)*

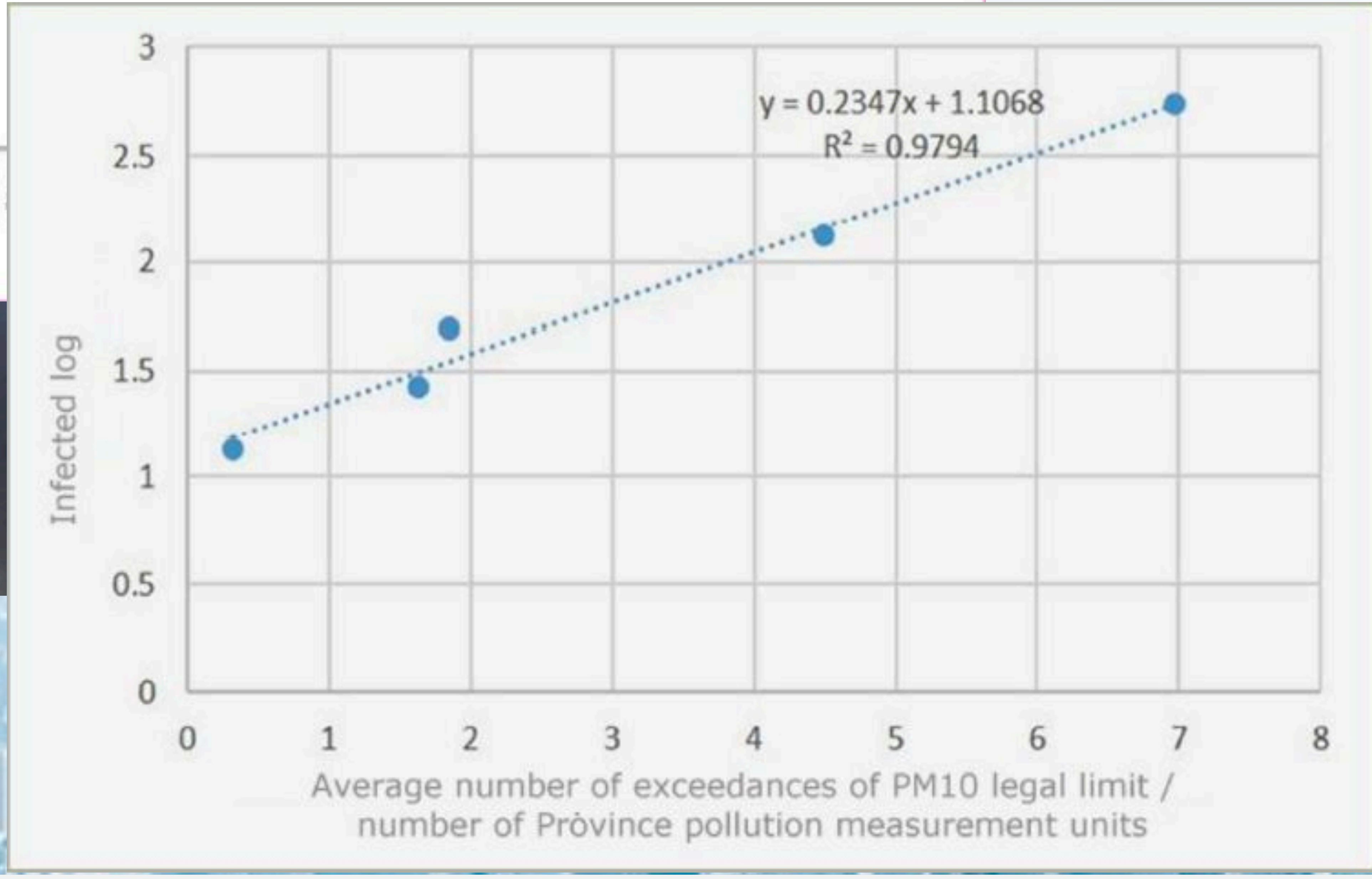
100% Outdoor ventilation assumes a building's ability to meet additional heating and cooling loads.
Below is a cold weather scenario, with 100% outdoor air delivery.





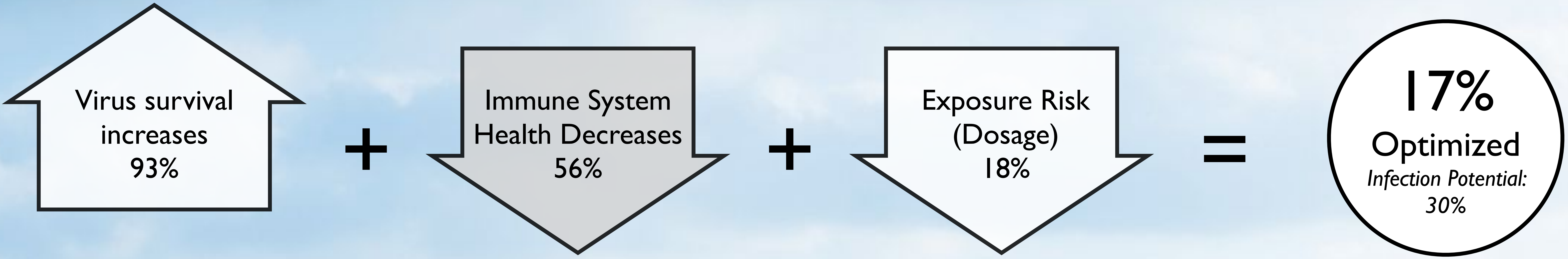
And now… back to particulate matter

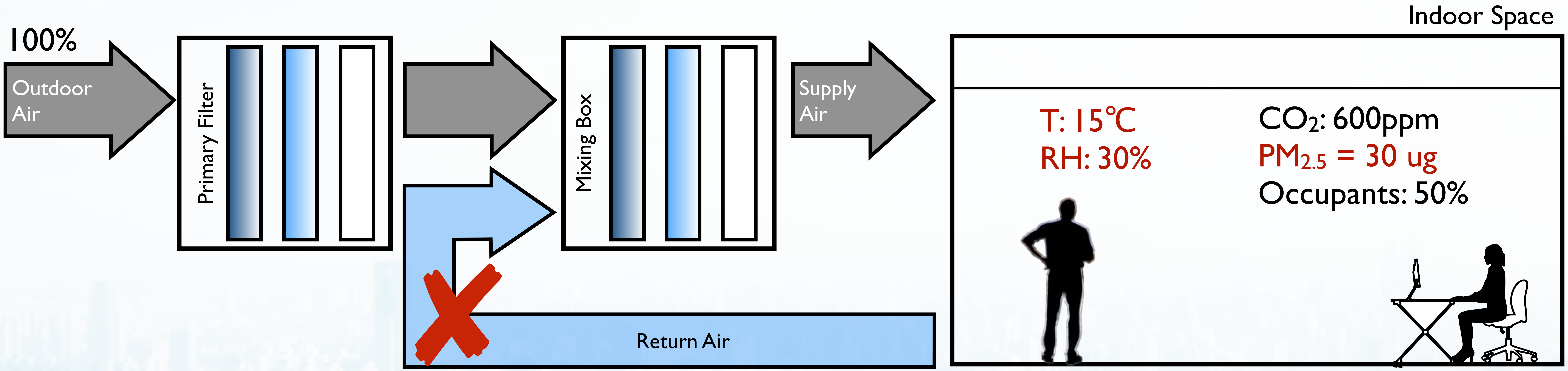




Ventilate! Don't recirculate! *(Blind advice)*

100% Outdoor ventilation also assumes a building's ability to meet additional filtration loads.
Factoring in the impact of outdoor pollution further increases the infection rate potential.





Ventilate! Don't recirculate! *(Blind advice)*

Assumes a building's ability to meet additional heating and cooling loads without recirculation.
Taking for example a cold weather scenario, with 100% outdoor air delivery.

Virus survival
73%

+

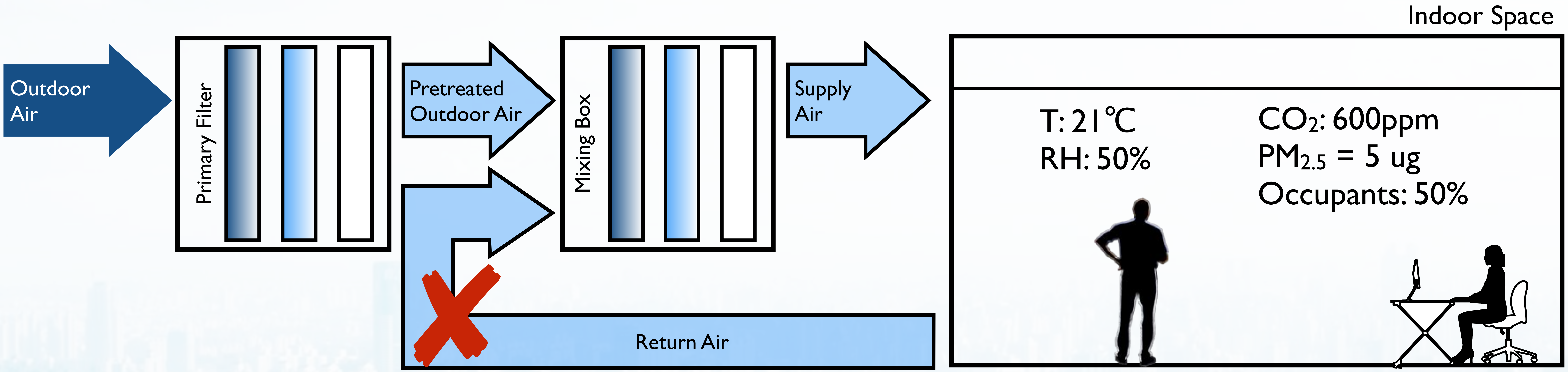
Immune System
Health
100%

+

Exposure Risk
(Dosage)
18%

=

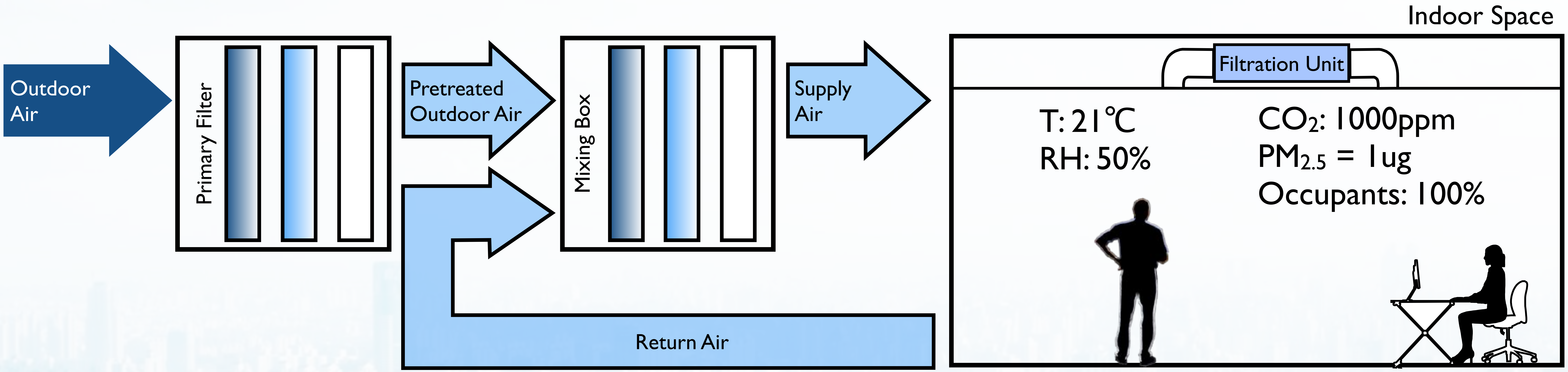
99%
Optimized
IP = 14%



Ventilate! Don't recirculate! *(Blind advice)*

Assumes a building's ability to meet additional heating and cooling loads without recirculation.
Taking for example a cold weather scenario, with 100% outdoor air delivery.

Virus survival 73% + Immune System Health 100% + Exposure Risk (Dosage) 18% = **99%** Optimized *IP = <1%*

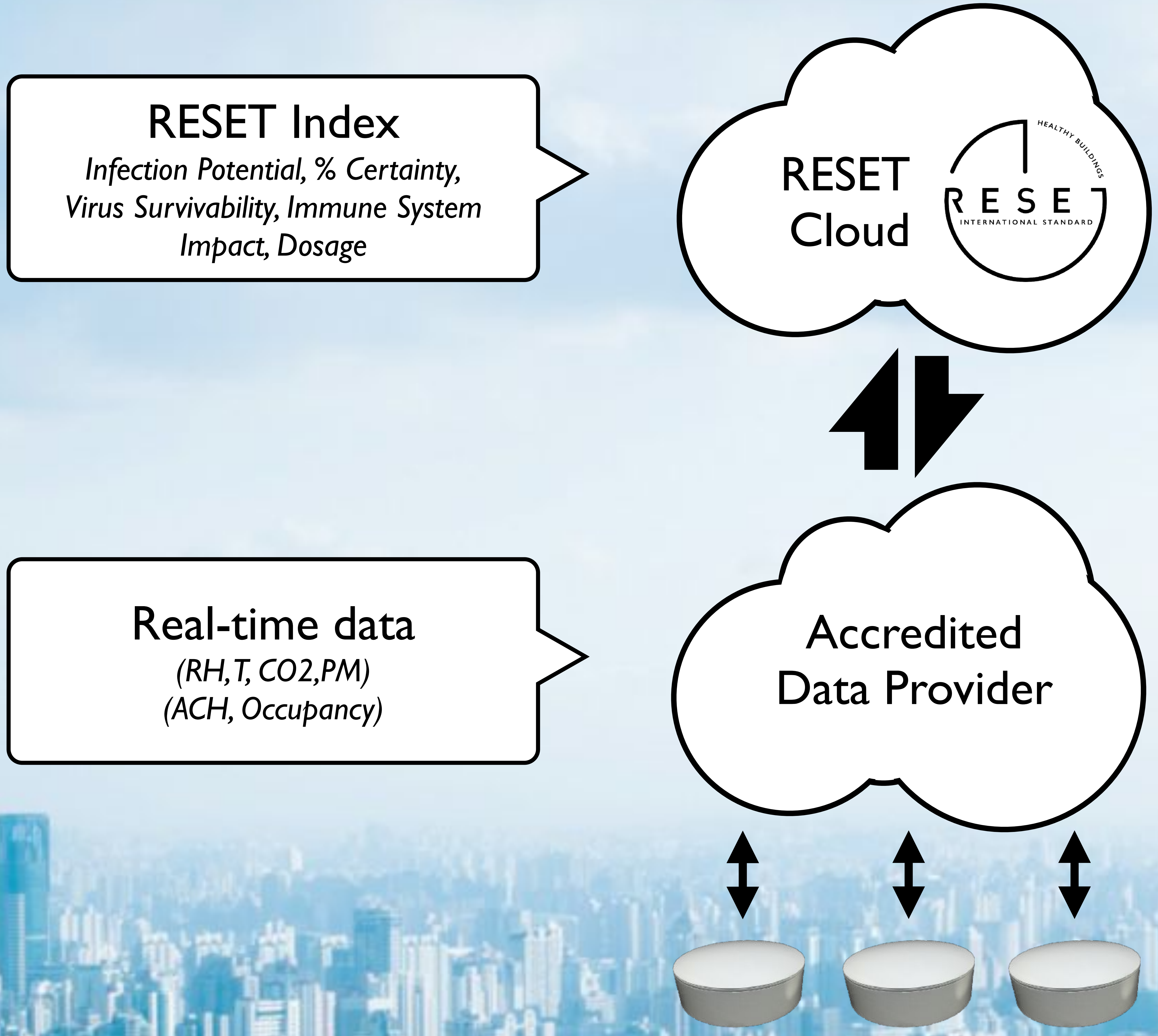


Why are we managing our spaces without data?

Why are we running blind?

Analytics & Data Exchange

The RESET Index and its component parts will be computed within the RESET Cloud, with results sent back to Accredited Data Providers for actionability. There is no additional cost for the RESET Index.



Current Stage: Global Pilots

Owners & Operators
Tenants
Academics
Building Management Systems

RESET Air Index

98%

Optimized For Human Health

<1%

*Aerosol Infection Potential: SARS-CoV-2**

72.2%

Certainty

*Communicates optimization of air quality management by building systems, as measured by sensors. Not an expression of total infection potential.

RESET

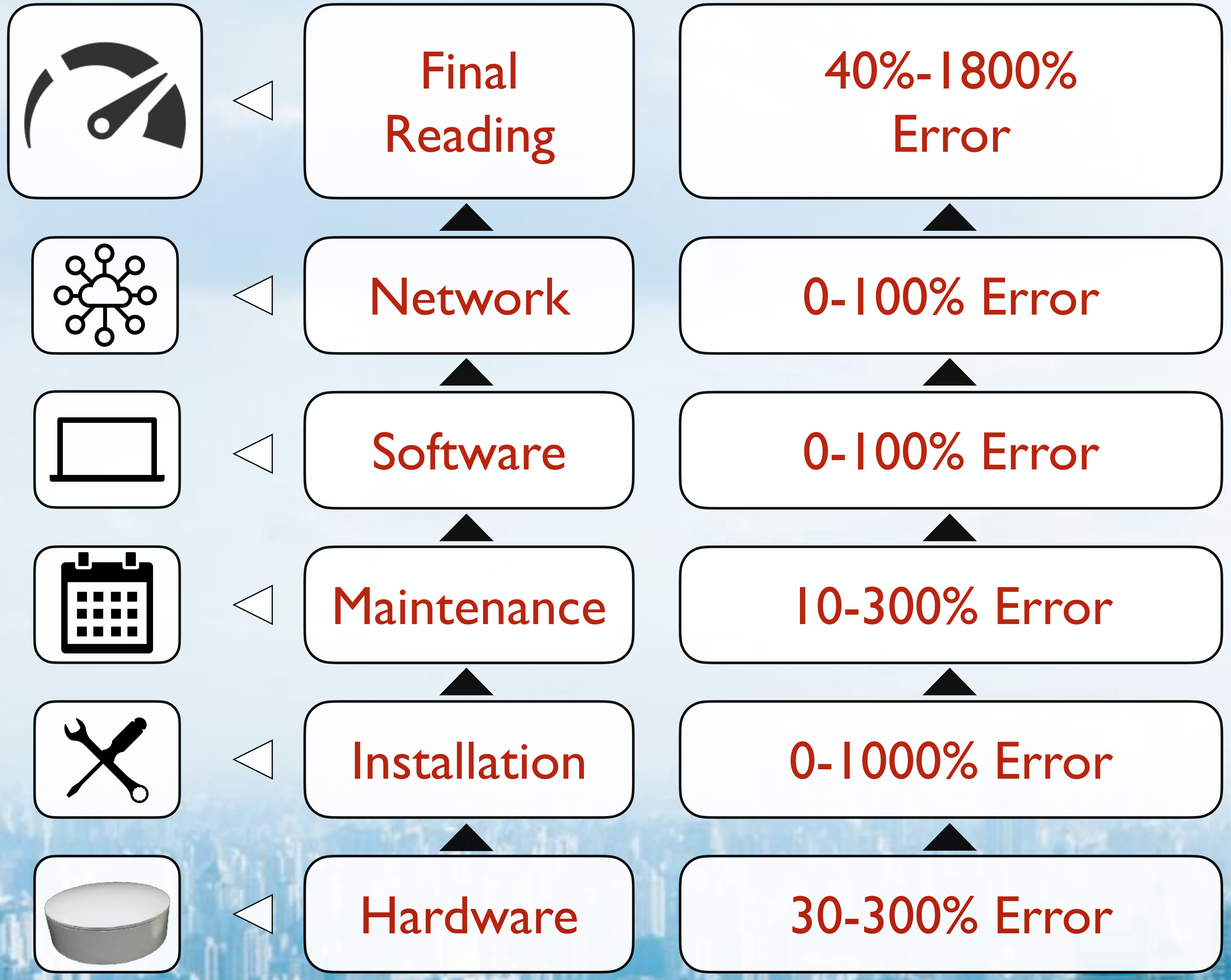
The results are only as good as the data coming in.

NEW YORK Updated: 30 min

AIR OPTIMIZATION *(SARS-CoV-2)*	EXCELLENT	96%	
$PM_{2.5}$	GOOD	6	µg/m³
OUTDOOR $PM_{2.5}$		15	µg/m³
FILTRATION LEVEL	GOOD	2.5	x
$PM_{0.3}$	GOOD	32	µg/m³
CO_2	GOOD	405	ppm
AIR CHANGES	GOOD	18	min
TEMPERATURE		21	℃
HUMIDITY		46	%RH
AIR STERILIZATION		ACTIVE	

RESET® Air - A Standard for Data Quality

RESET® tracks the pulse of buildings primarily via monitors and sets standards for their performance, installation, calibration and data reporting.



RESET® Air - Understanding Error: Hardware

RESET® tracks the pulse of buildings primarily via monitors and sets standards for their performance, installation, calibration and data reporting.

Hardware Error: Two key tests

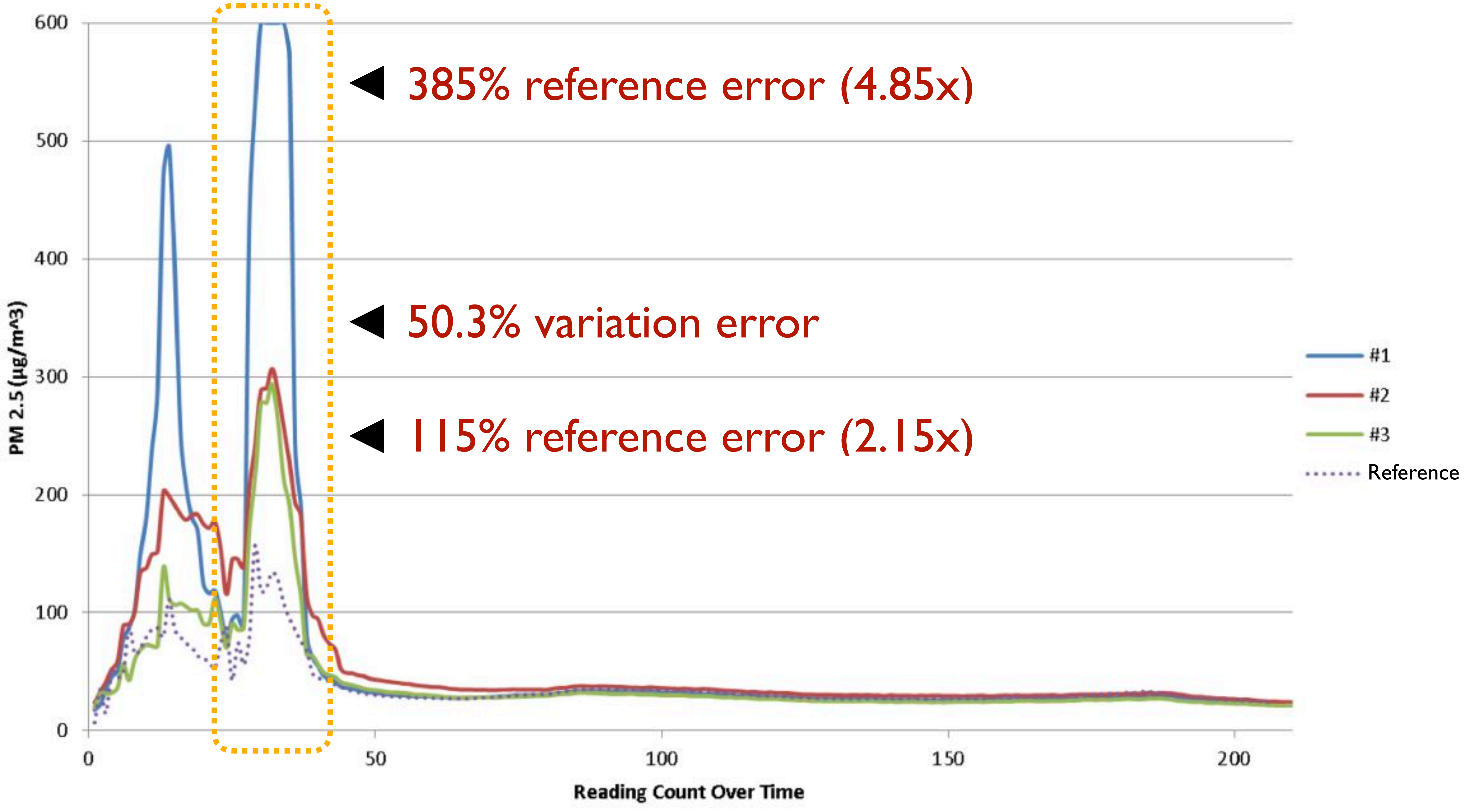
1) How IAQ monitors compare to a reference device.

2) How IAQ monitors compare to one another.

RESET® Air - Understanding Error: Hardware

RESET® tracks the pulse of buildings primarily via monitors and sets standards for their performance, installation, calibration and data reporting.

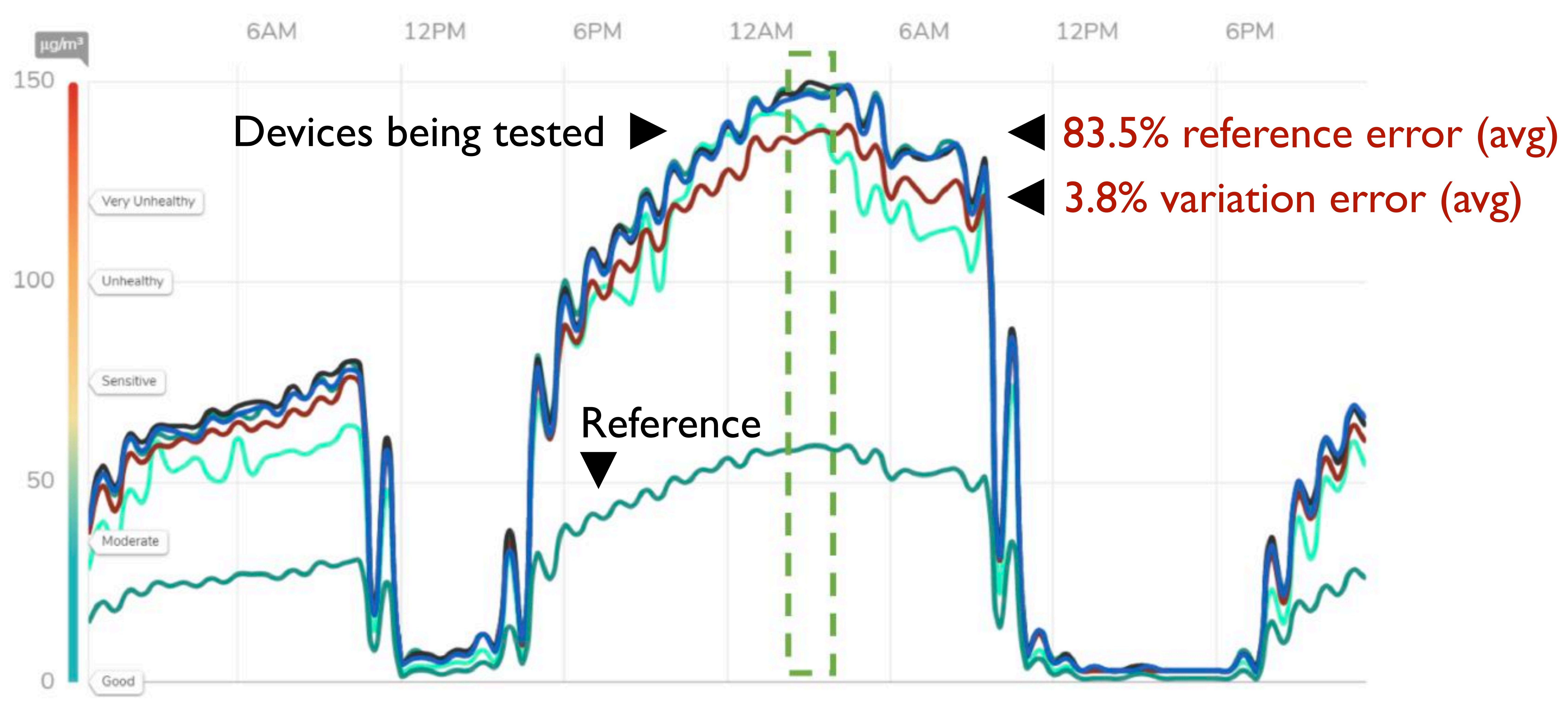
Test Data from 2015



RESET® Air - Understanding Error: Hardware

RESET® tracks the pulse of buildings primarily via monitors and sets standards for their performance, installation, calibration and data reporting.

Test Data from 2020



RESET® Air - Understanding Error: Installation

Case Study: Shopping mall, whereby IAQ monitors were installed on the ceiling, next to a supply duct (non-compliant with RESET Standard), resulting in a reporting inaccuracy of 1085%.

* *Note that results lower by one order of magnitude (2.8 µg/m³ and 33.2 µg/m³) in areas with cleaner outdoor air would also yield a reporting inaccuracy of 1085%.*

RESET® Air - A Standard for Data Quality

RESET® tracks the pulse of buildings primarily via monitors and sets standards for their performance, installation, calibration and data reporting.

NEW YORK — Updated: 30 min

$PM_{2.5}$	GOOD	6 µg/m³
OUTDOOR $PM_{2.5}$		15 µg/m³
FILTRATION LEVEL	GOOD	2.5 x
$PM_{0.3}$	GOOD	32 µg/m³
CO_2	GOOD	405 ppm
AIR CHANGES	GOOD	18 min
TEMPERATURE		21 ℃
HUMIDITY		46 %RH
AIR STERILIZATION		ACTIVE

Final Reading	10%-30% Error
Network	0% Error
Software	0% Error
Maintenance	5-15% Error
Installation	0% Error
Hardware	5-15% Error

As an industry, we are doing remarkably little **air quality monitoring** for an **airborne pathogen** whose infectivity is influenced by controlling **air** in buildings.

Let's change that.

RESET Air Index

98%

Optimized For Human Health

<1%

*Aerosol Infection Potential: SARS-CoV-2**

72.2%

Certainty

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RESET INTERNATIONAL STANDARD HEALTHY BUILDINGS