Airborne Influenza in Dry Wintertime Indoor Air

Is 40%rh Indoor Humidity One Cure for "Flu Season"?

Environmental Protection Agency

Federal Interagency Committee for Indoor Air Quality

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Increased Airborne “viable” Influenza viruses causes the “flu season”

1. **Viable Airborne Flu viruses are highly infectious. Airborne flu viruses as “droplet nuclei” will penetrate deep into your lungs.**
2. **Breathing in only three (3) airborne flu viruses can infect you and make you ill with the “flu”. People can spew out Millions!**
3. **Humidity is the critical factor in how long flu viruses can live and far they can travel. Controlling indoor humidity (grains of moisture) is one key to preventing airborne flu transmission.**
4. **Schools with “super-emitter” children are “petri dishes” for flu.**
5. **Washing your hands to prevent the flu is not very helpful.**
6. **There are plenty of solutions to prevent man-made “flu season”.**

Three incorrect explanations for “flu season”

1. “Crowding”- people spend more time indoors so they breathe & cough in closer crowded situations creating “flu season”.
2. “Cold weather” makes people sicker in the wintertime which is around the time “flu season” occurs.
3. Low humidity, wintertime indoor air “dries up people’s mucus membranes” which allows germs to more easily infect them.

How do people eject viruses into the air?

1. Breathing
2. Coughing
3. Sneezing
4. Talking
5. Singing
6. Flatulence
7. Toileting “event” ie.- explosive diarrhea
8. Toilet flush aerosolization (indirectly)

How Airborne Droplet Nuclei are created

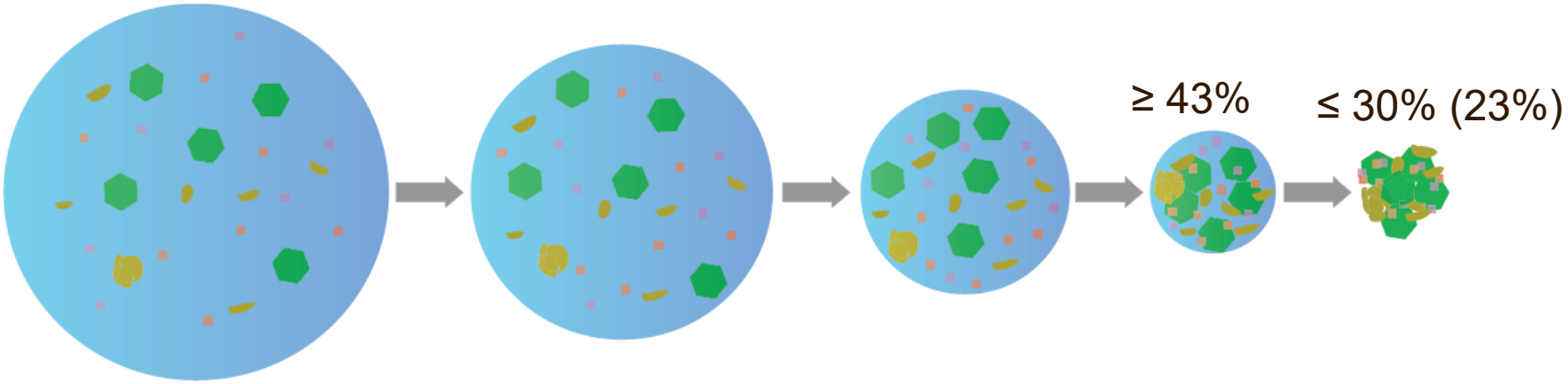


FIG. 2. Evaporation of a liquid droplet (left) to a droplet nucleus (right). As the liquid evaporates, the nonevaporative content concentrates until a droplet nucleus is obtained.

Airborne viral droplets are coughed, sneezed or expelled by humans. Toilet aerosolization also creates viral droplets.
This illustration shows how the mucus droplets filled with viruses eventually evaporate to create microscopic masses of viruses, salt and protein called Droplet Nuclei. Named and discovered by William F. Wells in 1934, droplet nuclei are the key to understanding airborne infectious disease transmission.

How does Influenza A Virus infect people?

1. Fingers to nose?
2. Fingers to eye?
3. Fingers to mouth?
4. Inhale Large droplets
5. Inhale Intermediate droplets
6. **Inhale droplet nuclei**

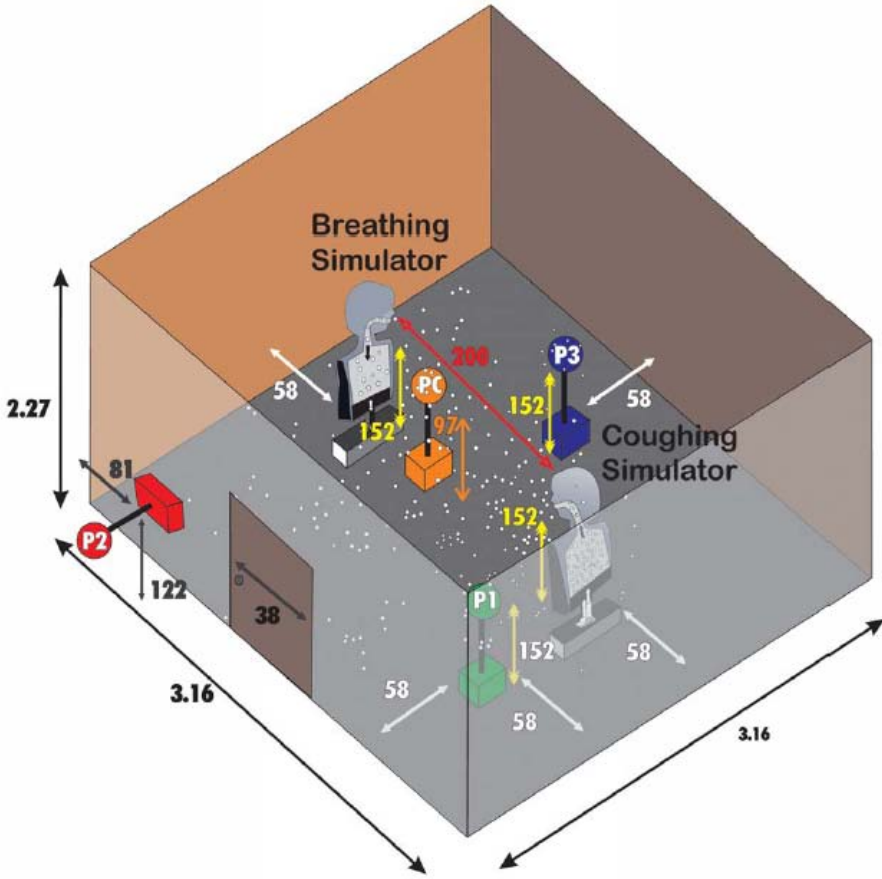
2013 CDC/NIOSH study shows how dry air increases airborne Flu survival, infectivity and transmission explaining “flu” season!

CDC/NIOSH researchers demonstrated[1] how low humidity air was the key factor in increasing airborne flu survival, infectivity and therefore successful transmission from a flu infected “simulated” (ie. manikin) to a healthy healthcare worker manikin.

CDC/NIOSH researchers conclude:

1. **At low relative humidity (≤23%) influenza retains maximal infectivity (70.6–77.3%)**
2. **At higher relative humidity (≥43%) influenza has much lower infectivity (14.6–22.2%)**
3. **Inactivation of the virus at higher relative humidity (≥43%) occurs rapidly after coughing (within 15 minutes.)**

Their Recommendation: “Maintaining indoor relative humidity above 40% will significantly reduce the infectivity of aerosolized virus.”



1. High Humidity Leads to Loss of Infectious Influenza Virus from Simulated Coughs Noti, John et al. PLoS 2013

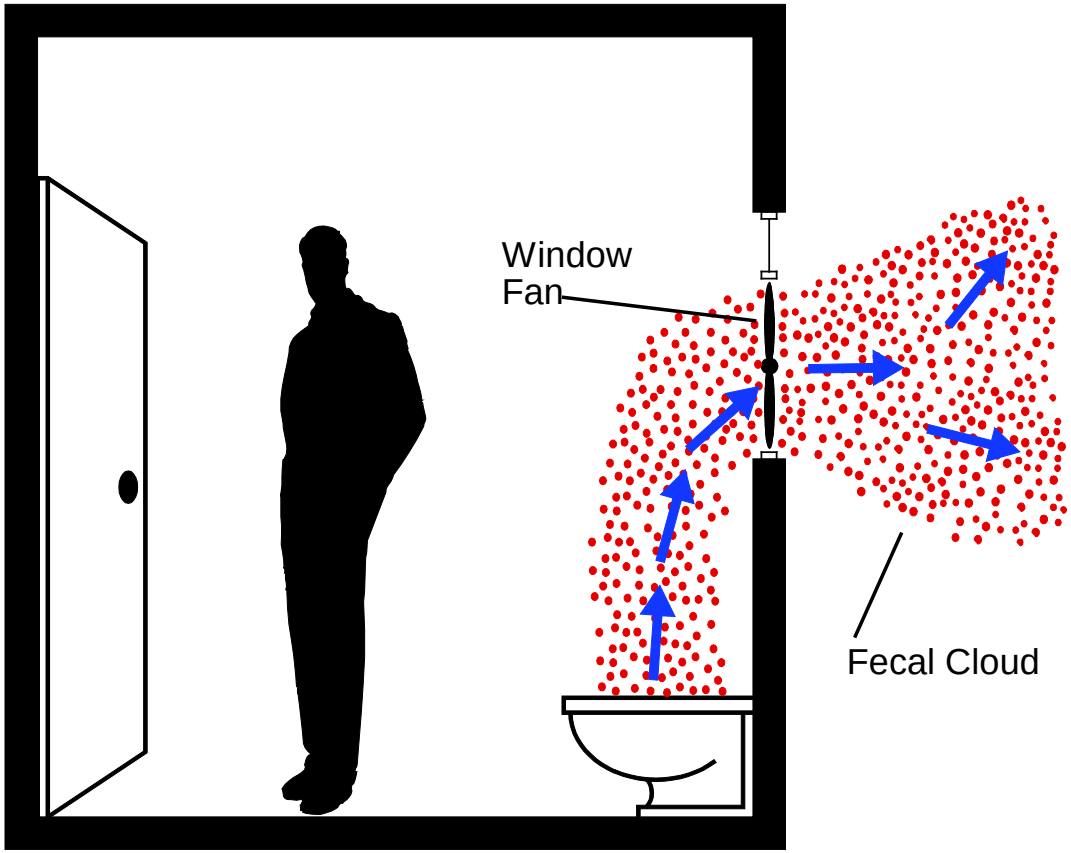
How far can Airborne Viruses Travel?

	Large Droplets/Aerosols	Droplet Nuclei
1. Coughing	1-6 feet	200+ feet
2. Sneezing	8-15 feet	200+ feet
3. Singing, Talking	1-3 feet	200+ feet
4. Mouth Breathing	1-3 feet	200+ feet
5. Diarrhea*	1-5 feet+	**1000+ feet**

*As a Result of Toilet Water Aerosolization and Mechanical Fan Dispersion into outdoor air (2003 Hong Kong Amoy Gardens SARS Virus Epidemic)

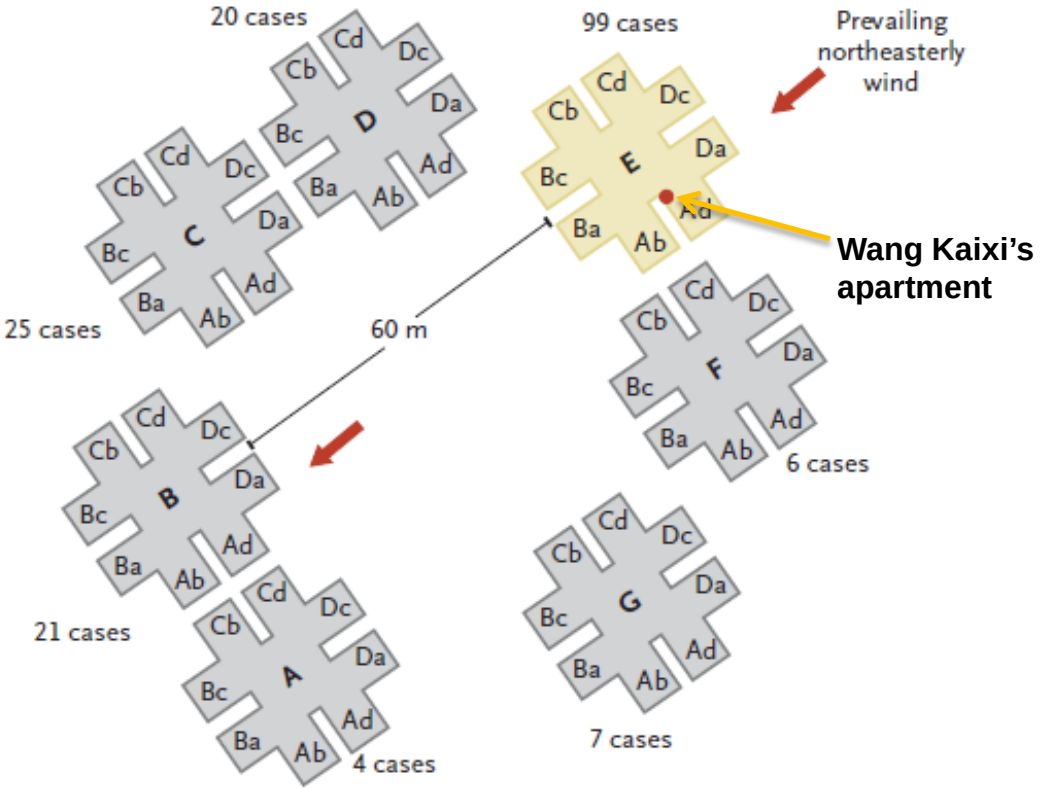
Airborne SARS Transmission at Amoy Gardens Apartments 03.19-20.2003

Wang Kaixi was infected by airborne SARS viruses that he breathed in at the Prince of Wales Hospital.
Since SARS produced diarrhea in the majority of patients, he flushed his toilet water likely heavily laced with his SARS thereby aerosolizing his SARS viruses into the most toxic Fecal Cloud ever recorded.
His window fan blew his SARS Fecal Cloud(s) outdoors where the wind and rising air currents spread them on to his unsuspecting Amoy Gardens neighbors.



The largest airborne infection event ever recorded-Amoy Gardens March 19-20, 2003

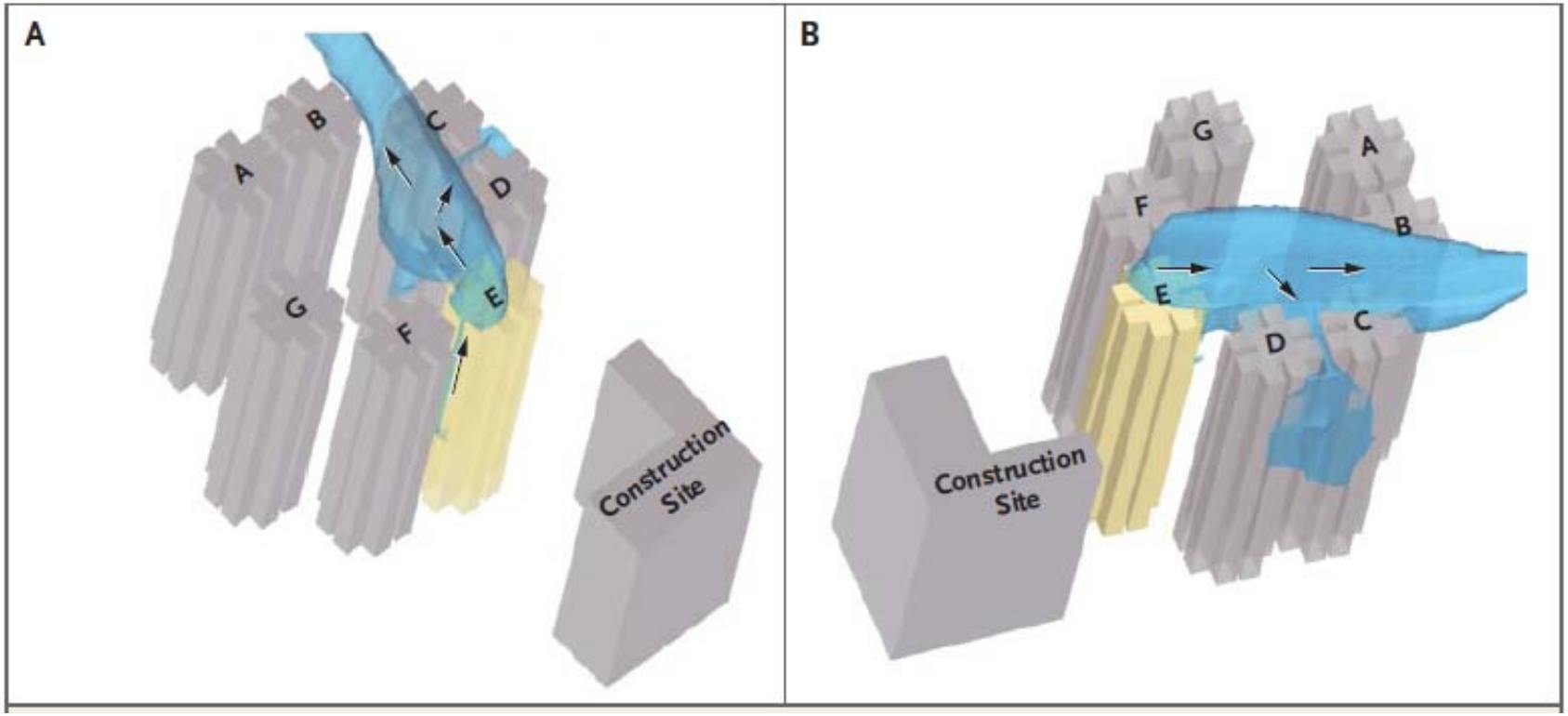
Retrospectively, Professor Yuguo Li documented the airborne toilet aerosolization SARS Plume created by Wang Kaixi. The plume traveled mostly upwards and infected nearly 100 neighbors in his building (Block E). It then traveled over 200 feet (70 meters) to infect more Amoy residents. Over 40 died.



Li, Yuguo et. al Evidence of Airborne Transmission of the Severe Acute Respiratory Syndrome Virus 2003 NEJM

This study is available @ GreenCleanAir.com

Wang Kaixi infected 440 people downwind- 40+ were killed @ Amoy Gardens by 1 person!

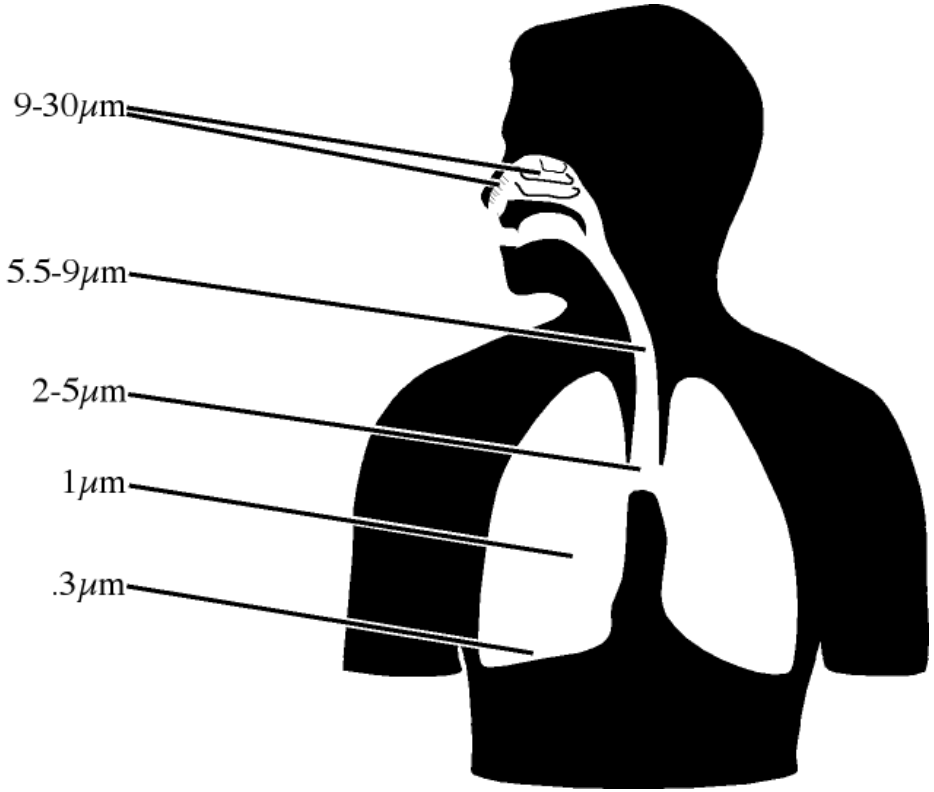


Wang Kaixi's SARS toilet flush fecal cloud visually demonstrated both the ability & power of airborne viruses to travel long distances to infect and kill new healthy naïve victims.

Li, Yuguo et. al Evidence of Airborne Trans-mission of the Severe Acute Respiratory Syndrome Virus 2003 NEJM

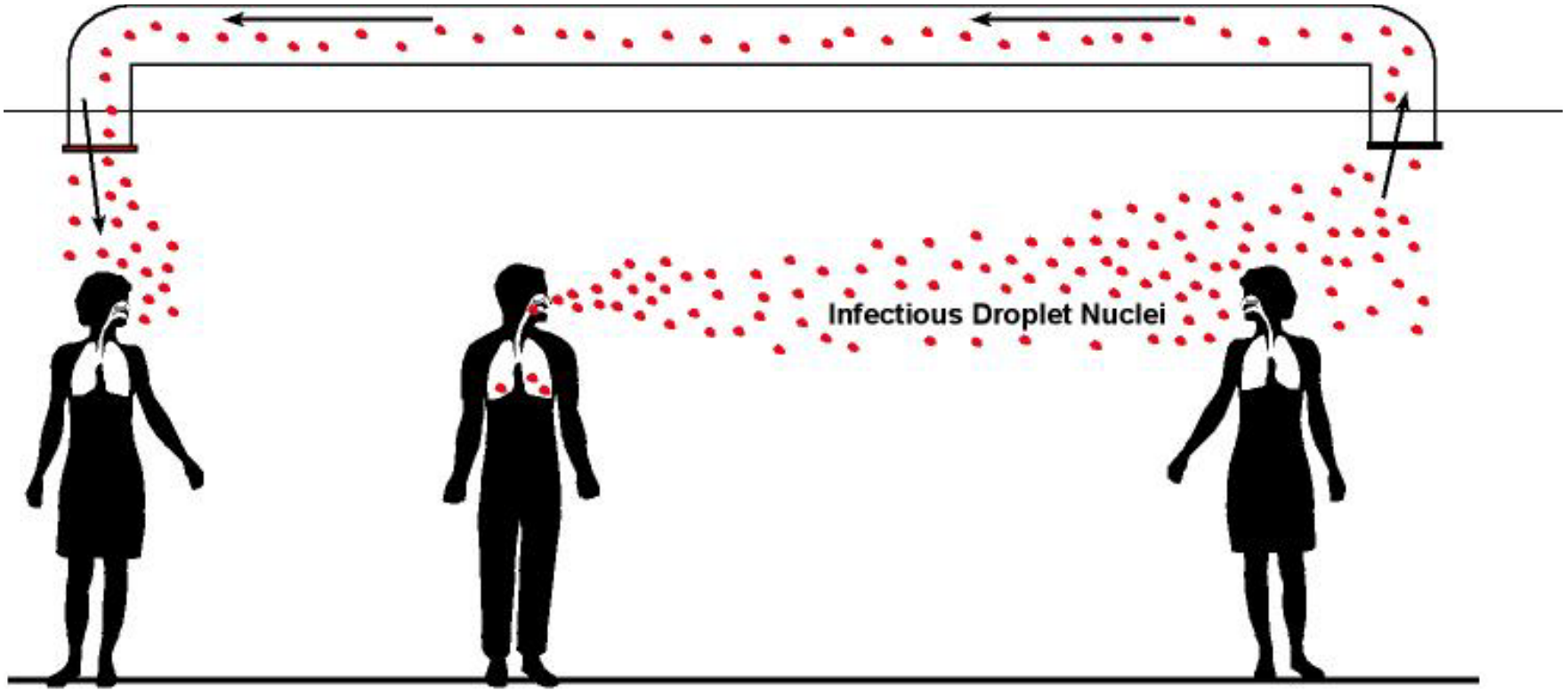
This study is available @ GreenCleanAir.com

Droplet Nuclei Viruses are .3µ or Less & Penetrate Deeply into the Human Lungs

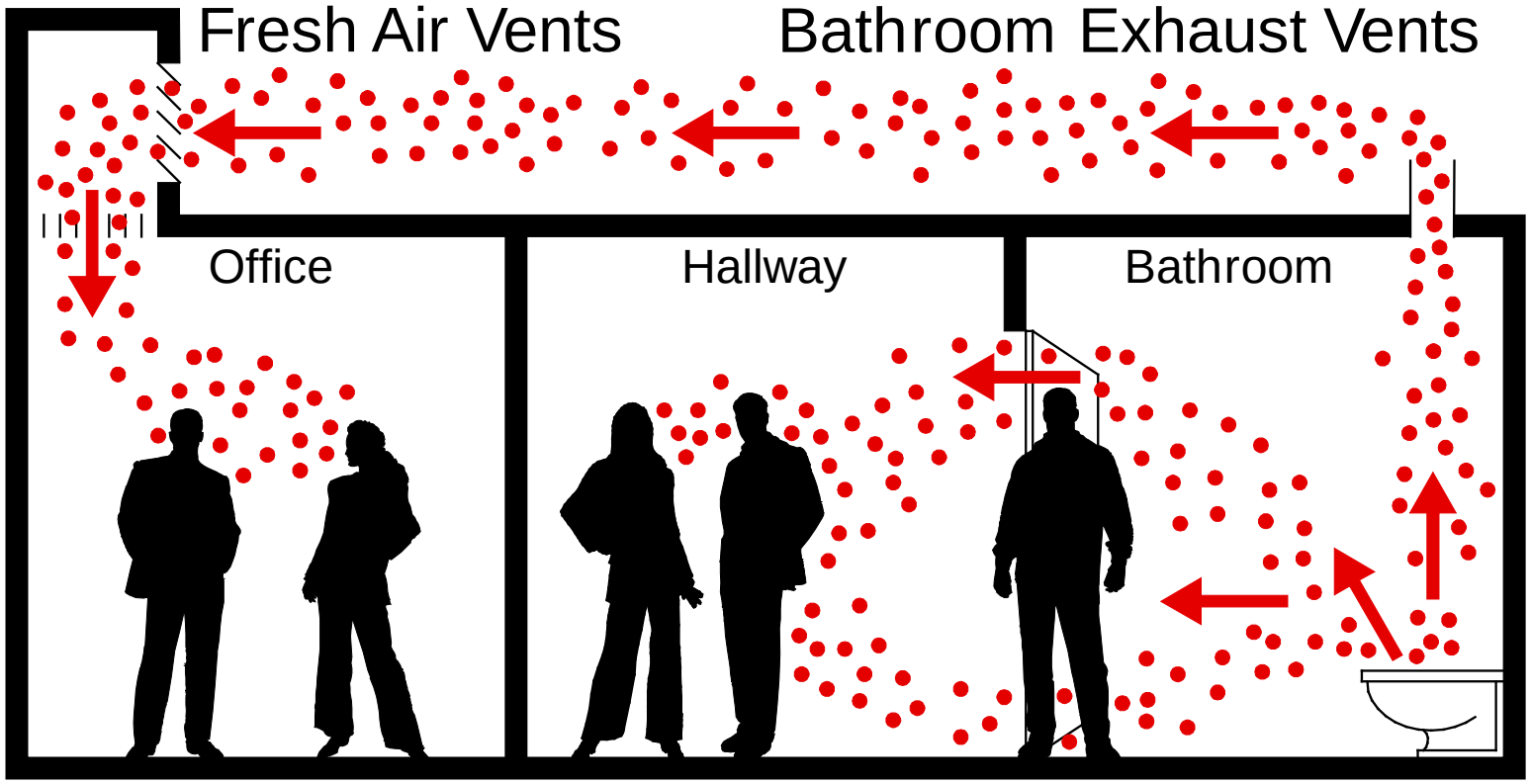


A µm is a micron or 1/1,000,000 of a meter.
The smallest particle you can see is 30µm.

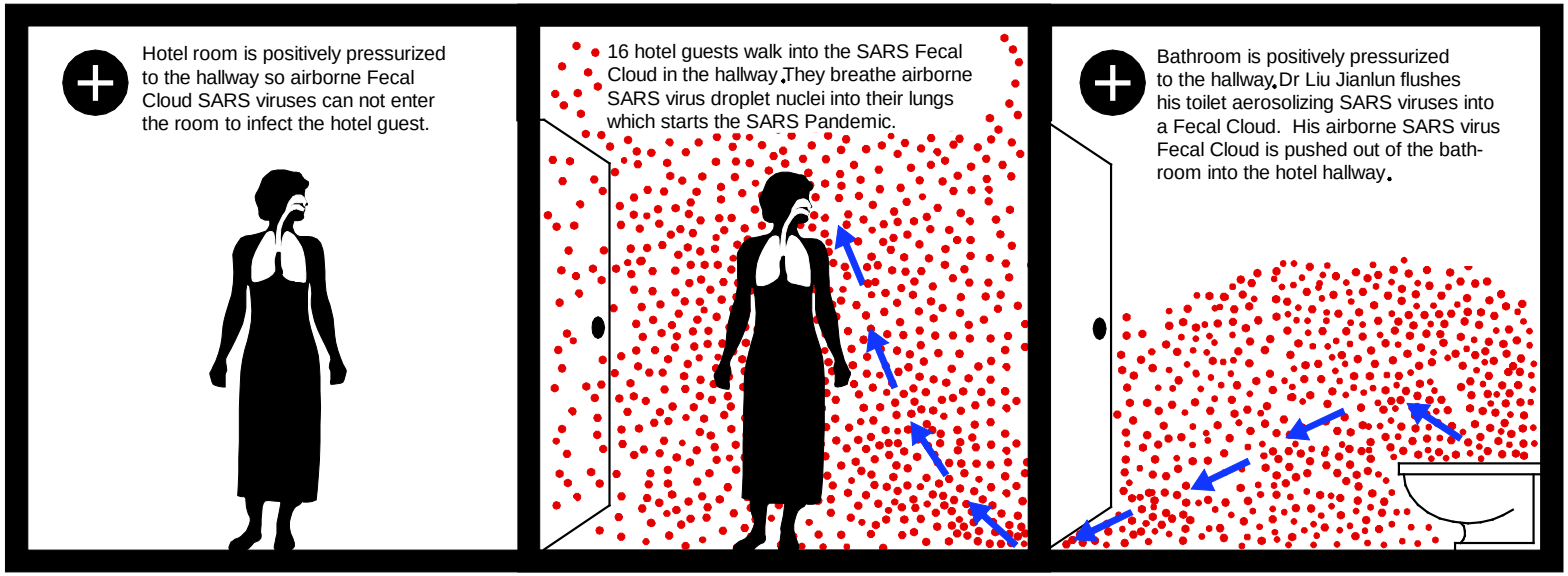
Droplet Nuclei Travel Within Buildings



How Toilets Aerosolize Flu Viruses
Recirculation Vents suck them back in



Airborne SARS Transmission at The Metropole Hotel 02.21-22 2003



The above scenario contradicts the current belief that Dr. Jianlun spread his SARS viruses to his fellow Hotel guests by vomiting on the carpet outside his room. The currently accepted vomit theory may be due to the World Health Organization's investigators speculating that Dr. Liu Jianlin may have vomited on the carpet outside his room. "It was speculated that he might have vomited, spit or heavily coughed near his room and, thus, contaminated this area of the corridor. In case of a vomit, the hotel staff might have been called for clean up. However, there is no record of such an incident.[1]" Most importantly, Thomas Tang, who was the epidemiologist with The Hong Kong Health authority, contacted Mrs. Jianlun who said her husband Liu never vomited.[2]

1. **Page 8 The WHO Metropole Hotel Report 2003 - available @ GreenCleanAir.com**
2. **Page 62 Twenty First Century Plague-The Story of SARS Thomas Abraham 2004**

Hospital Toilet Droplet Nuclei Infection Prevention

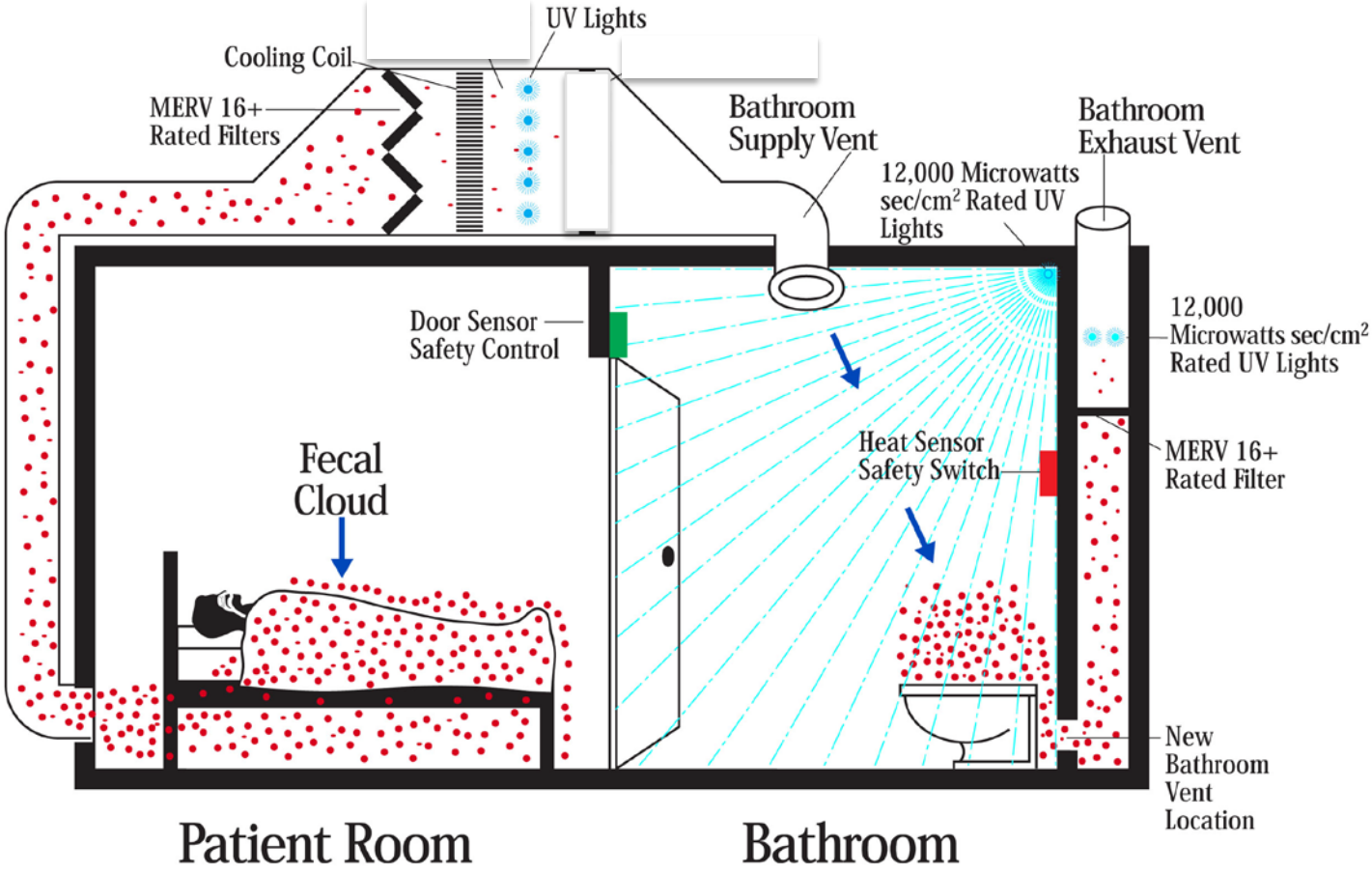
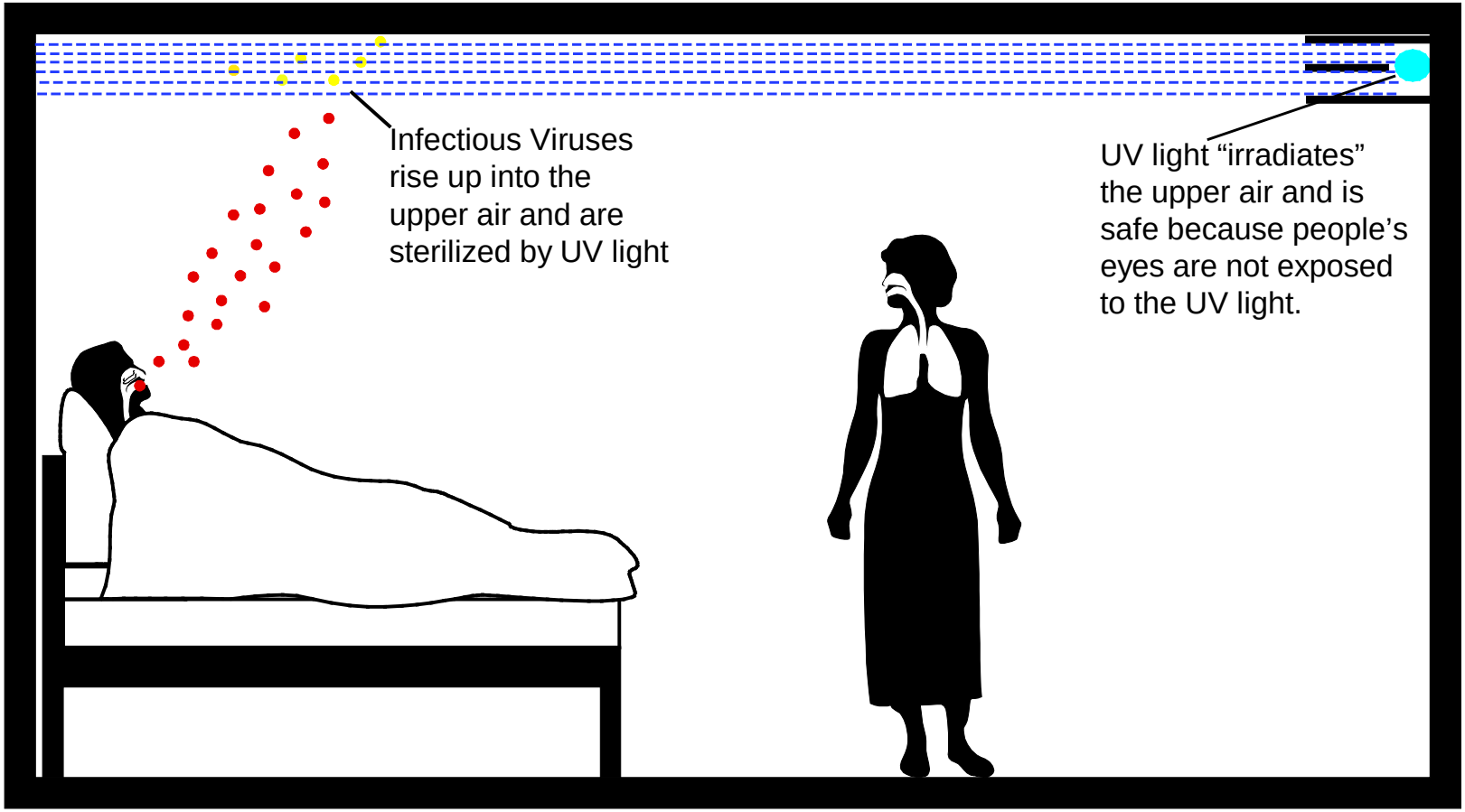


Illustration by Steven A Welty from article in Engineered Systems August 2011 – See GreenCleanAir.com

How Upper UV Room works to prevent airborne virus transmission



Veteran's Hospital 1957 Flu Pandemic Upper Room UV Study: 100% Effective

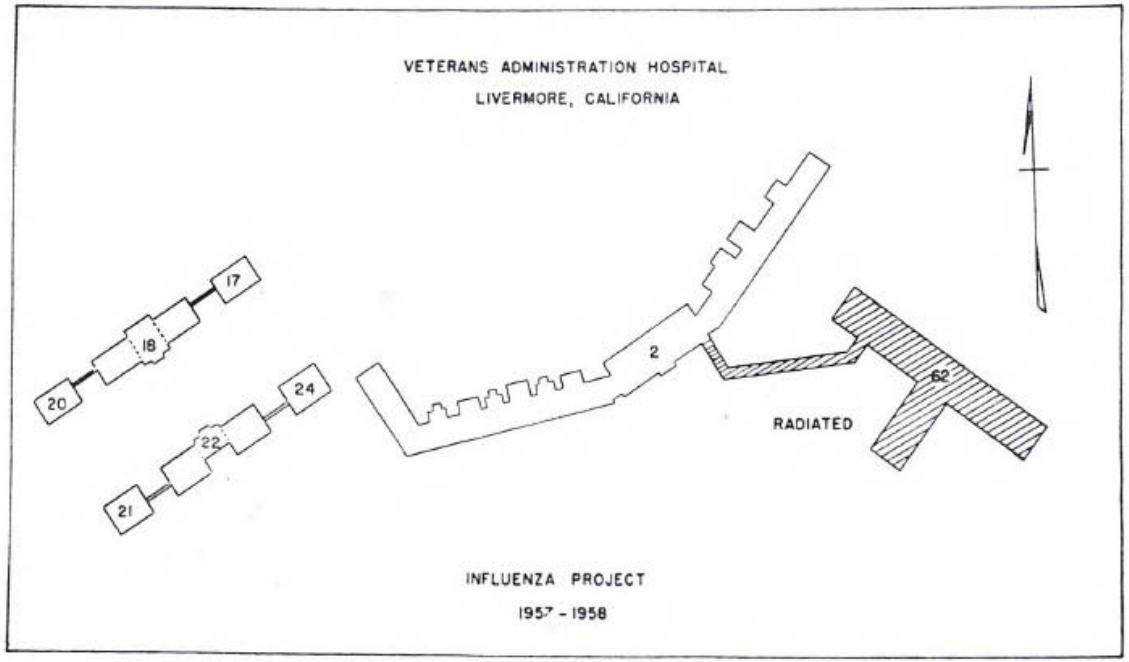


FIG. 4. Illustrates the plan of the hospital grounds and depicts the area which was isolated from the rest of the hospital by radiant disinfection of the upper air of all rooms and corridors.

TABLE 9

NUMBER OF PATIENTS WITH ACUTE RESPIRATORY SYMPTOMS

Phase 2, November 16, 1957–March 16, 1958

Week of	Radiated		Nonradiated	
	Influenza	Other	Influenza	Other
12/15	0	0	2	0
12/22	0	1	1	5
12/29	0	0	0	8
1/5	0	2	7	4
1/12	0	0	18	6
1/19	0	0	10	4
1/26	0	1	1	1

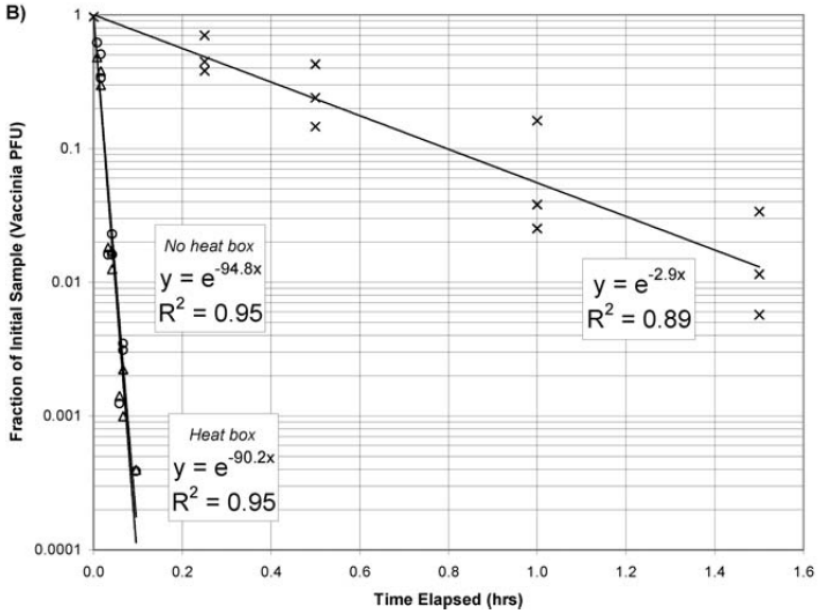
0 **39**

McLean, RL International Conference on Asian Influenza at The National Institutes of Health 1960 p36

Harvard Professor James McDevitt 2008 upper room UV virus Experiment

Professor McDevitt installed upper room UV lights to replicate the success of the 1957 Flu pandemic.

"Air disinfection using upper-room (UV) light can lower the airborne concentrations of infective organisms in the lower part of the room, and thereby control the spread of airborne infections among room occupants.
These data demonstrate that upper-room UVC has the potential to greatly reduce exposure to susceptible viral aerosols.
These data may also be relevant to influenza, which also has improved aerosol survival at low RH."



99.9% of airborne viruses were killed (inactivated) in just 6 minutes (.1 hour).

Inactivation of Poxviruses by Upper-Room UVC Light in a Simulated Hospital Room Environment McDevitt, James 2008 PloS ONE v3 e-page 3186.

This open source study is available @ GreenCleanAir.com

Harvard Professor James McDevitt 2012 upper room UV virus Experiment

Again in 2012, Professor McDevitt published the results of installing upper room UV lights to replicate the success of the 1957 Flu pandemic experiment by Dr. RL McLean and this time he used airborne influenza viruses.

“Using our experimental system, we measured influenza reductions as low as 98.2% by comparing samples with the UV light on to subsequent samples control samples with the UV light off.

This work provides an essential scientific basis for designing and utilizing effective upper-room UV-C light installations for the prevention of the airborne transmission of influenza.”

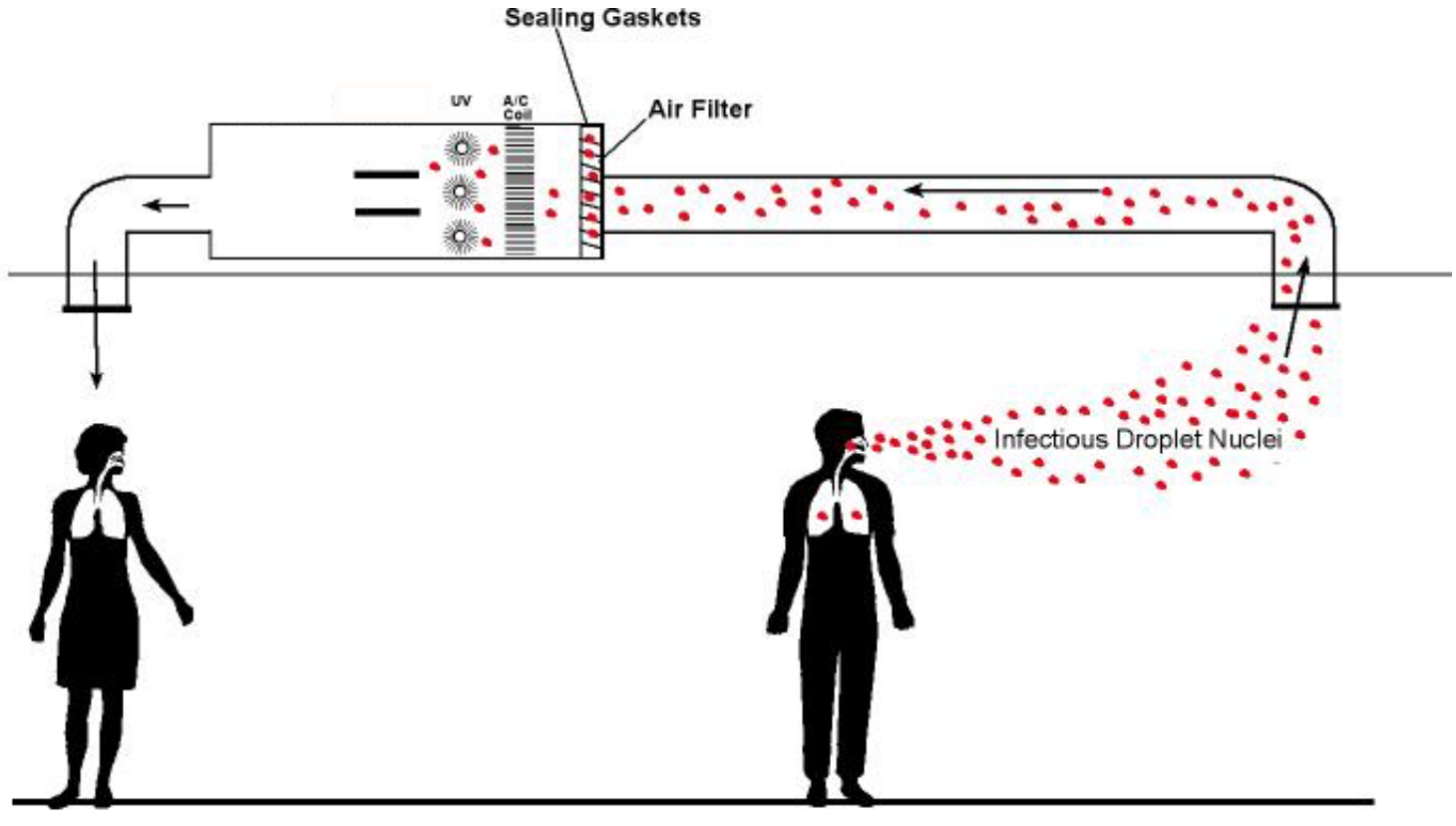
Aerosol Susceptibility of Influenza Virus to UV-C Light McDevitt, James et al. Applied Environmental Microbiology 2012 v78 p1666.

This study is available @ GreenCleanAir.com

Combined UV Light & Filtration Capture/ Kill/Sterilize this % of Flu Viruses:

MERV & UVR Combined	%Viruses Killed/Sterilized
6	10%
7	12%
8	19%
10	35%
13	84%
15	97%
16	98.8%

HEPA Air Filters, UV Lights can Kill, Sterilize & Capture Viral Droplet Nuclei



Japanese Hospital Humidity Guidelines

Table 1. An example of environmental control recommendations for hospitals in Japan. Used with permission (translated and slightly edited) from the Human and Society Environment Science Laboratory Co. Ltd, Japan (http://www.h-and-s.biz/index2.htm).

		summer		winter	
section	location	dry-bulb temperature (°C)	RH (%)	dry-bulb temperature (°C)	RH (%)
hospital ward	patient bedroom[a]	24–26–27	50–60	22–23–24	40–50
	nurse station	24–26–27	50–60	20–22	40–50
	day room	26–27	50–60	21–22	40–50
outpatient department	consulting room[b]	26–27	50–60	22–24	40–50
	waiting room	26–27	50–60	22–24	40–50
	dispensary	25–26	50–55	20–22	40–50
	ER	23–24–26	50–60	22–26	45–55–60
central medical care areas	operation room	23–24–26	50–60	22–26	45–55–60
	recovery room	24–26	50–60	23–25	45–50–55
	ICU	24–26	50–60	23–25	45–55–55
	birthing room[c]	24–25–26	50–60	23–25	45–55–55
	newborn baby room	26–27	50–60	25–27	45–55–60
	general survey room	25–26–27	50–60	20–22	40–50
	X-ray studio	26–27	50–60	24–25	40–50
	X-ray operation room[d]	25–26	50–60	20–22	40–50
	hydrotherapy treatment room[e]	26–27	50–65	26–28	50–65
	dissection room	24–26	50–60	20–22	40–50

Julian Tang , MD, PhD. J. Royal Soc. Interface (2009) v6, pS737

This study is available @ GreenCleanAir.com

Can Hand washing prevent flu transmission? CNN's Elizabeth Cohen challenged the CDC

In my June 2009 EPA Flu presentation, I said: "**Since your fingers can't touch your lungs, <u>washing your hands</u> won't likely prevent flu viruses from entering deep into your lungs**." I did this to indirectly challenge the CDC's recommendation, widely heralded by the media that, aside from a flu shot, the best advice to prevent you from getting the flu was to "wash your hands". I knew that there was **no** published scientific study **anywhere** which showed that someone with flu viruses on their fingers could infect themselves.

In September 2009, CNN Medical reporter Elizabeth Cohen was the first correspondent that pressed the CDC to produce the scientific documentation backing up their hand washing/ sanitizing recommendation.

She pressed the CDC to admit that hand washing to prevent <u>influenza flu transmission by self inoculation</u> was **not supported by any peer-reviewed, published papers anywhere**: "We don't have solid data on the effect that hand washing has on the transmission of H1N1 (flu virus)," CDC spokesman Tom Skinner wrote in an e-mail to Ms. Cohen. That "lack of solid data" really means there's no published data or paper or successful experiment showing someone getting the flu by hand inoculating themselves by touching their nose, lips, eye or mouth.

"Some doubt hand washing stops H1N1" CNN Elizabeth Cohen September 24, 2009

More expert dismiss hand washing to prevent flu transmission

In Ms. Cohen's article "Some doubt hand washing stops H1N1" (link below) she posits: "Hand washing: A false sense of security from H1N1? Some infectious disease experts said they're concerned messages from the CDC to wash hands to prevent H1N1 have given people too much faith in hand washing.

'Washing hands really is wonderful for preventing many diseases, such as the common cold, but it's **not very helpful to prevent influenza**,' said Arthur Reingold, professor of epidemiology at the University of California-Berkeley.' 'Everyone's eager to promote hand washing, and certainly it won't do any harm, but to rely on a hand washing as a way to prevent influenza is a serious mistake,' said Reingold.

Dr. Monto is a world renown influenza expert with over 60 peer reviewed & published articles on influenza: 'Don't kid yourself that you're going to protect yourself from the flu completely by washing your hands,' said Arnold Monto, a professor of epidemiology at the University of Michigan School of Public Health."

She also reported: "Dr. Peter Palese, a professor of medicine and infectious diseases at Mount Sinai School of Medicine in New York City, said 'hand washing isn't all that helpful against the flu because the flu isn't like other respiratory diseases. 'The flu virus isn't very stable on the hand,' he said. 'The virus has a lipid membrane that flattens out when it's on your hand, and it gets inactivated."

"Some doubt hand washing stops H1N1" Elizabeth Cohen September 24, 2009

Recommendations to prevent and mitigate airborne flu transmission

1. Increase the indoor humidity to 45%.
2. Get the highest MERV rated filter that your air handling fan can tolerate.
3. Put as much UV light within your coil plenum to achieve a 99.9% single pass kill rate along with Upper Room UV.
4. Add HEPA MERV 17 or 18 Filtration for viral capture and inactivation.
5. Install bathroom exhausts 1-12” above the floor behind the toilet to capture aerosolized toilet water. Supply in ceiling.
6. Seal your filter rack & HVAC system.
7. Coughing/sneezing occupants wear a mask or stay at home.

How to Solve “Flu Season”

- Raise Humidity to 45%+
- Increase air changes to 12 per hour
- In-Duct UV
  - Upper Room UV
- Toilet Seat Lowered
  - Exhaust behind & below toilet
- MERV 13
  - +URV 13 UV Lights
  - MERV 17 HEPA (best)

→ Lower Airborne Flu “in Season”