

Major Trend in Post Pandemics
Briefing on Delta U+ Care 222 UV Bacteriostatic Series

Delta U+ Care222 series Has All You Need To Fight Bacteria

Building Automation Business Group
Lighting Solutions Division

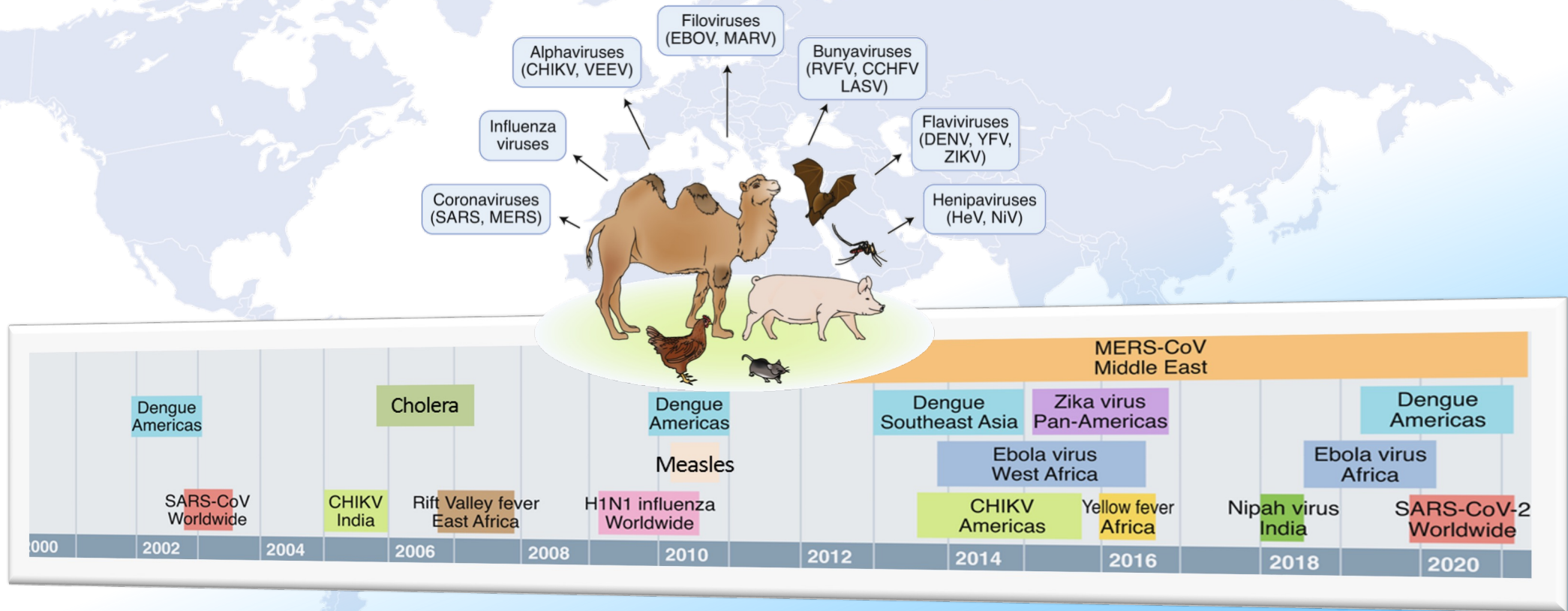
Care
222
DAY



The New Normal of Pandemics

From "never again" to the "new normal"

Outbreaks will occur – it's just a matter of when and where.



(modified from: Meganck RM *et al.* 2021. Nature Medicine. 27, 401-10)

Note: Outbreaks of emerging large-scale epidemics globally are becoming more frequent. Deadly diseases may occur frequently. We are experiencing a "new normal" now, according to World Health Organization (WHO)

Omicron "continues to be dangerous"



South Korean patient:
Undergoing COVID-19
was **three times** more
painful than having a
flu.



Source: International News Section, Liberty Times, 16 February 2022.

Note:

- As of late November 2021, **130 million cases and 500,000 deaths** had been reported worldwide since Omicron was declared a variant in the COVID-19 virus, according to Johns Hopkins University, USA. WHO experts have warned that the sheer number of Omicron cases known to date is staggering.
- A professor of respiratory medicine at Hallym University Sacred Heart Hospital pointed out that the omicron strain of COVID-19 is seven times more fatal than seasonal flu (0.2% vs. 0.03%).
- I suggest these all go to Note for the same reason stated above -- mainly to keep audience focused and save space.

COVID-19 Statistics:

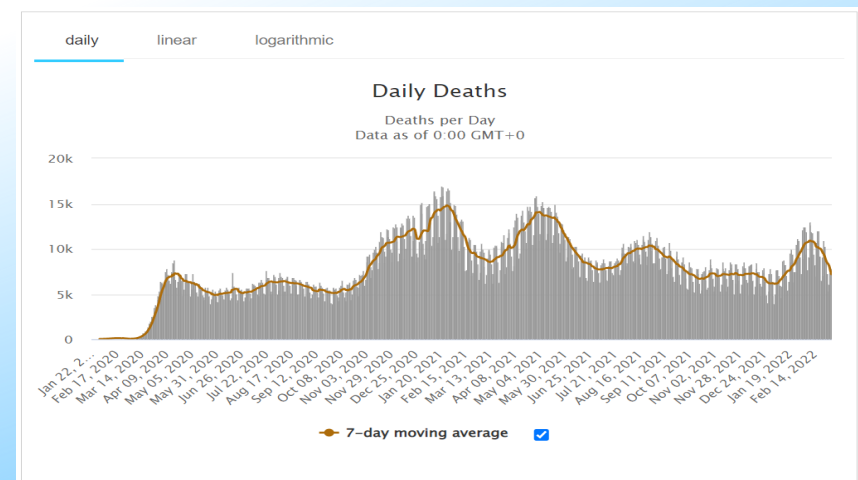
Confirmed cases worldwide

442,407,251

Deaths

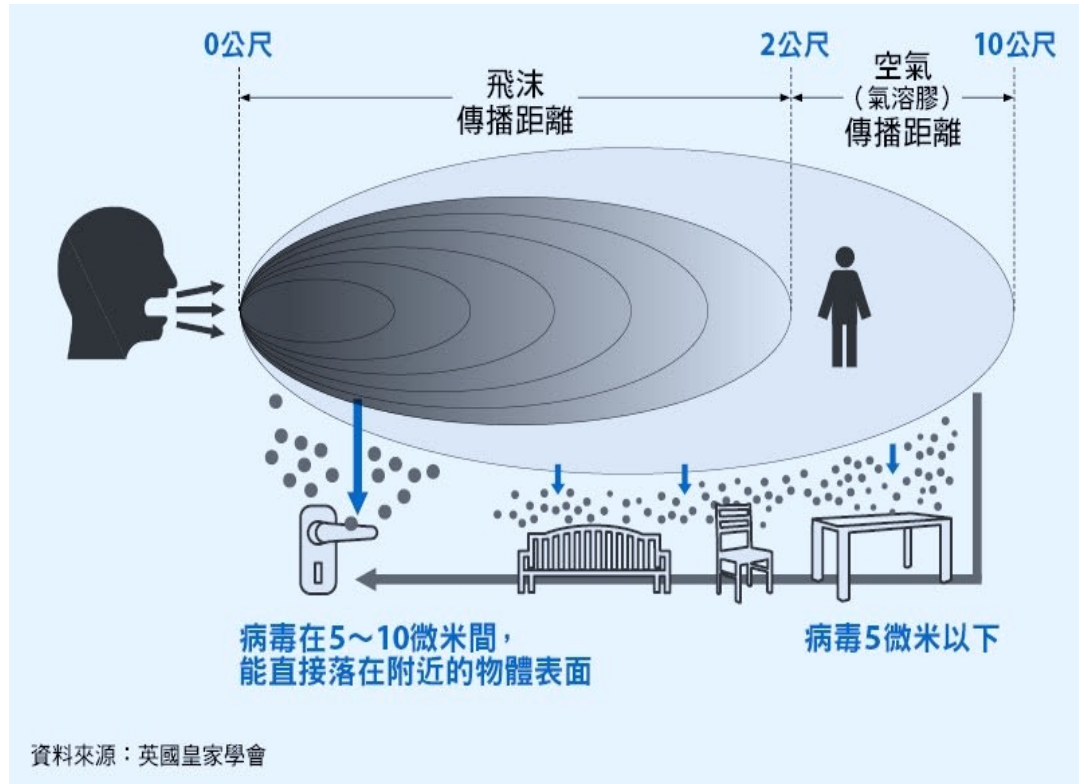
6,001,838

2022年3月4日



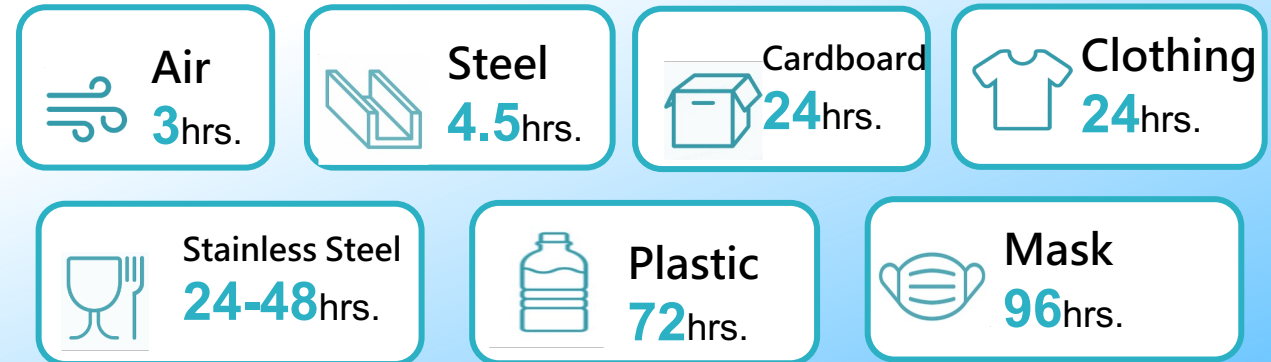
Hard-to-Kill Coronavirus

COVID-19 Spreads Through Aerosols



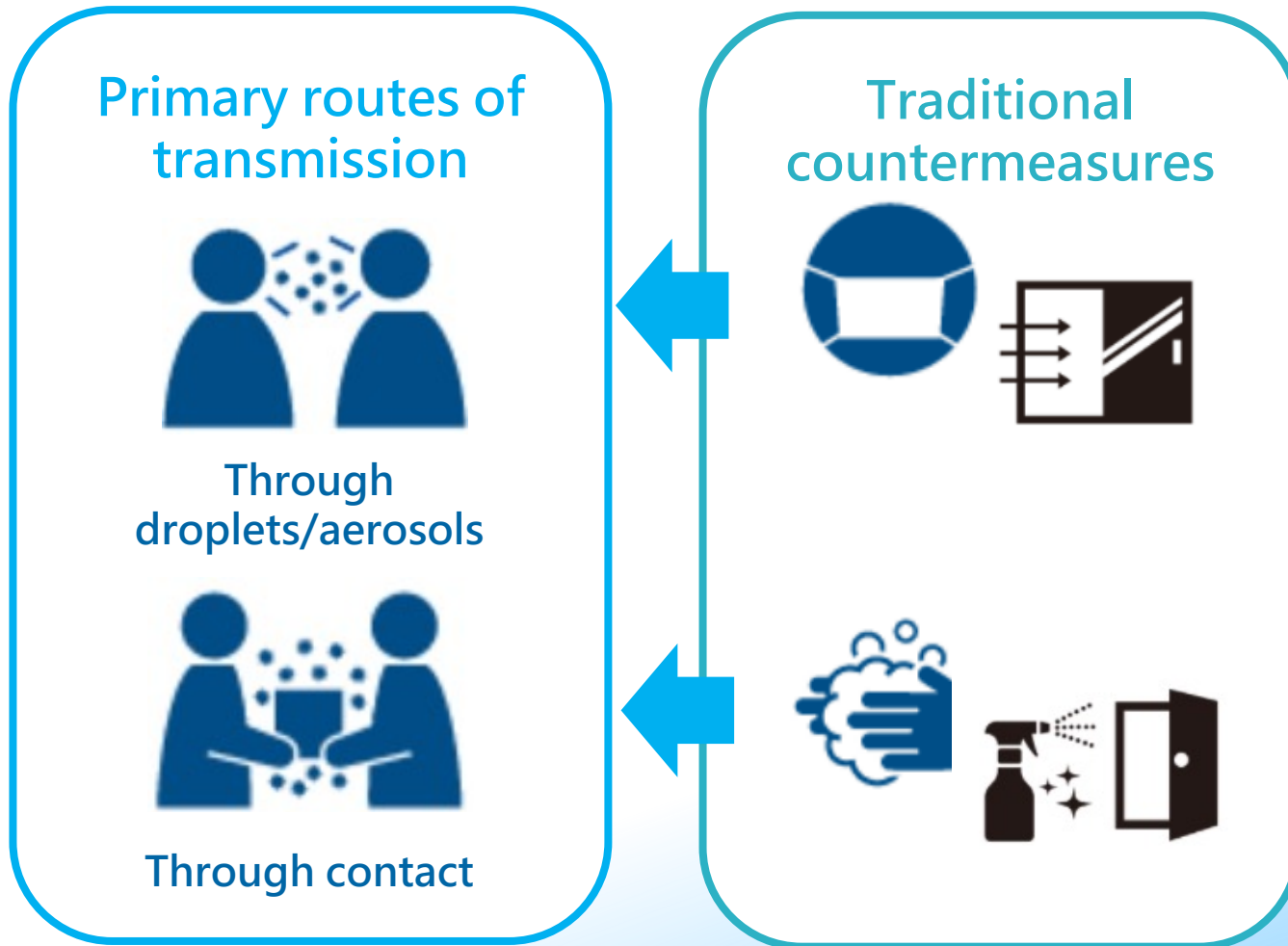
Aerosolized coronavirus can remain on the object surface for long

Research shows that the Alpha, Beta, Gamma, Delta, and Omicron strains can survive on the plastic surface for 191.3 hours, 156.6 hours, 59.3 hours, 114 hours, and 193.5 hours, respectively, namely, Omicron can live on the plastic surface for as long as eight days and remains infectious on skin surface for **more than 21 hours**.



Sources: New England Journal of Medicine, The Lancet, National Institutes of Health

How COVID-19 Spreads & How to Prevent



Public spaces are high-risk areas for contact transmission



Traditional surface cleaning methods – taking alcohol disinfection of hands as an example



Alcohol required per disinfection
3~5 c.c.



Time required per disinfection
20~30 sec.



Cost per disinfection
0.65 NTD

正確洗手這樣做

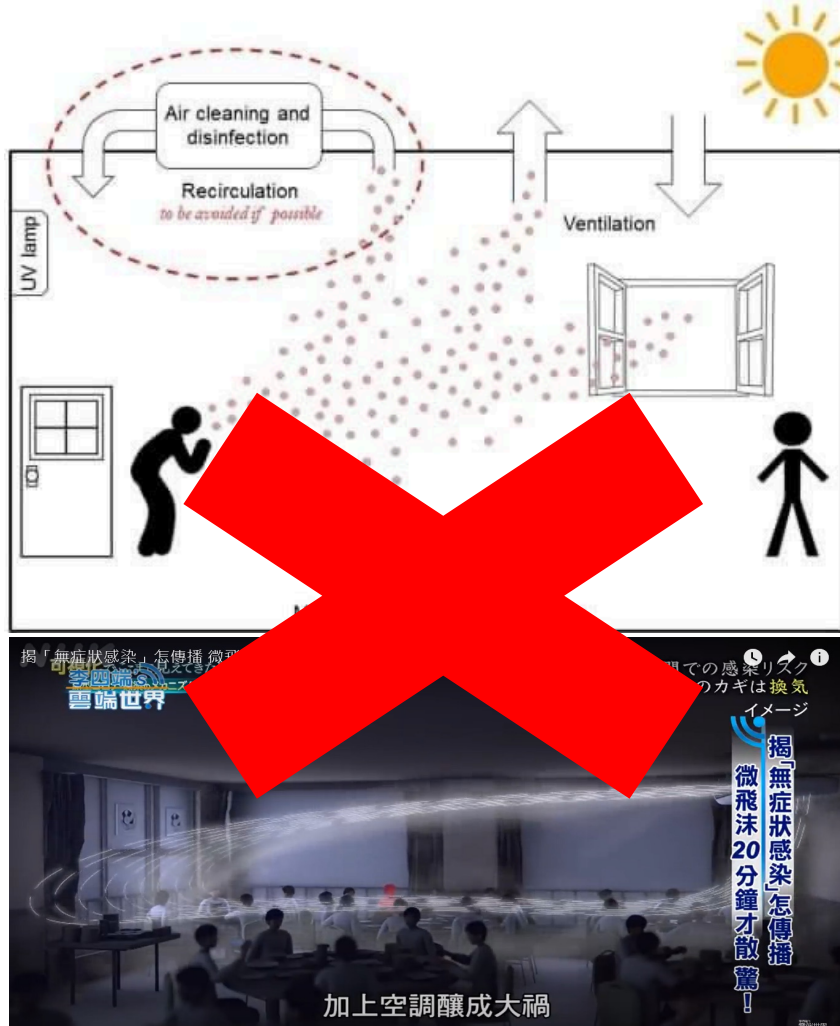
手沾濕，擠出約10元硬幣大小的洗手乳（酒精乾洗手則需2cc），雙手搓揉起泡。再依疾管署推廣「內外夾弓大立腕」洗手7字訣，字字做到位，且要洗20秒才算乾淨。



康健
For a better life



Traditional pandemic prevention with air – space ventilation

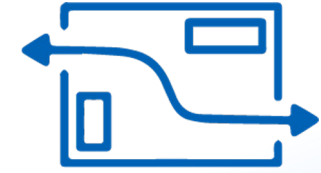


is the key
Ventilation



Natural ventilation

- Poor outdoor air
- Urban noise



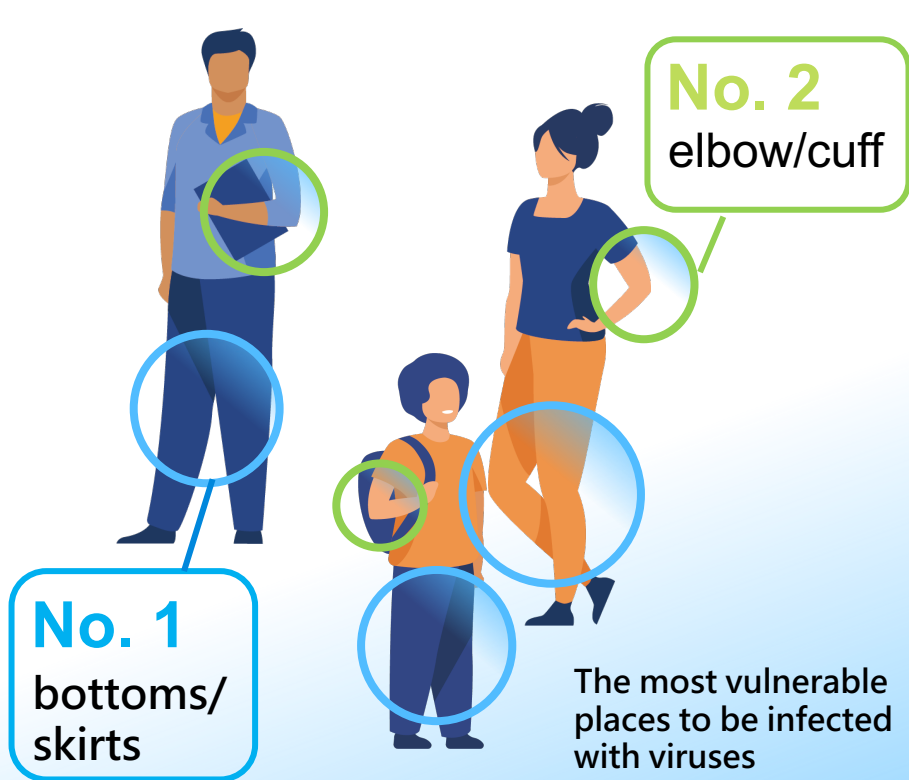
Mechanical ventilation

- Expensive
- Installation costs

In an experiment on the application of UVC222 to ambient air purification announced at a WHO meeting, the data showed that the effect of UVC222 in an experimental space of 30 cubic meters was equivalent to 3000 ACH per hour (equivalent to 25,000 liters of air change per second), which is much higher than the US CDC standard (6-12 ACH per hour).

Delta U+ Care222 Disinfection Solution – Coexistence of Humans and Machines

Surface cleaning

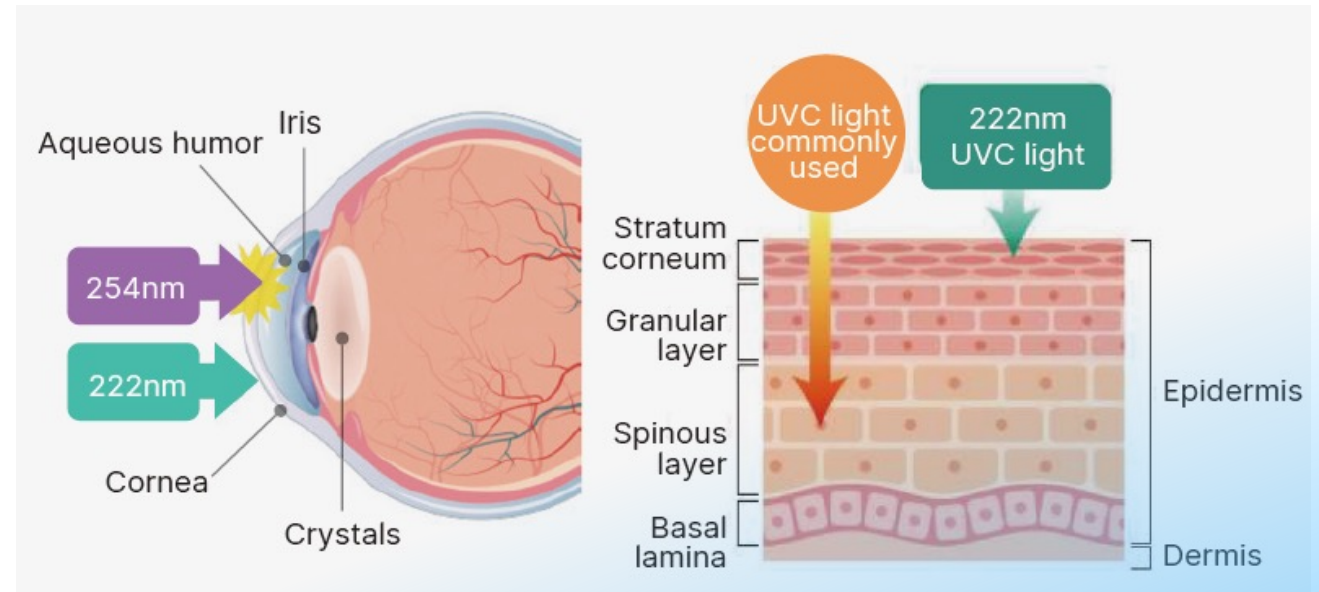
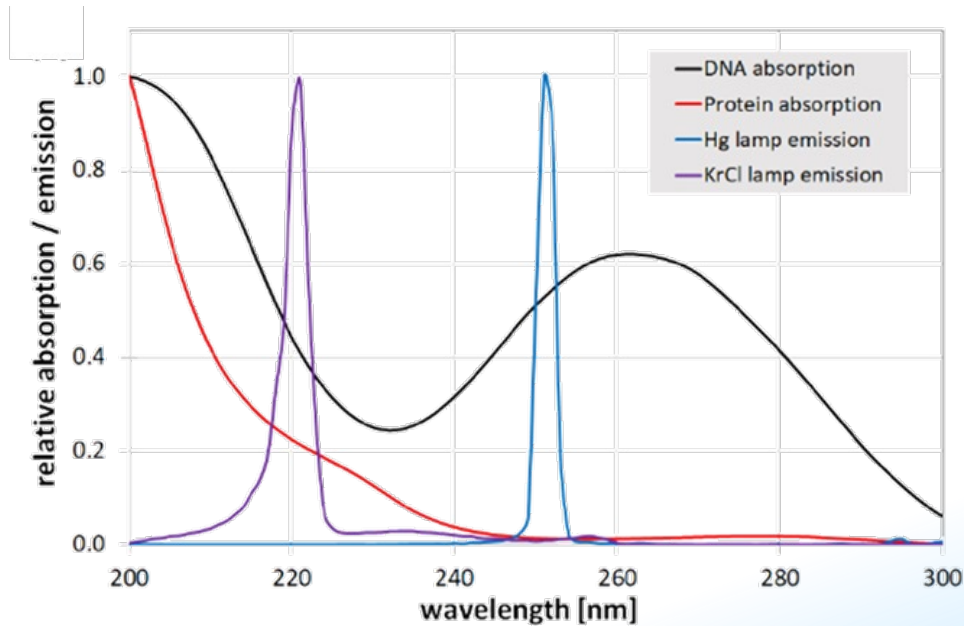


Air cleaning in spaces



222nm UV Light - Safe & Effective Antipandemic Solution

UV light emitted at the wavelength of 222nm vs. 254nm

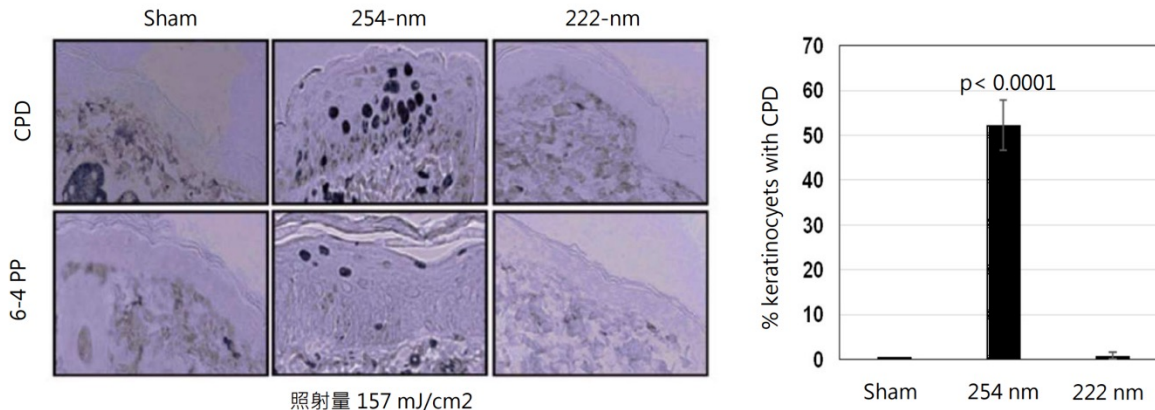


- Protein has a higher absorption rate for ultraviolet rays of 222nm, so when the human body is irradiated with 222nm ultraviolet light, it will be directly absorbed by the stratum corneum (dead cells) on the skin before reaching the DNA of living cells.
- Compared with the cells of the human body, the virus or bacteria are smaller, and the 222nm wavelength UV light can easily reach the DNA and RNA of the virus or bacteria to inhibit their activity.

222nm UV Light — Safety Study

Skin

1. Results of normal skin irradiation of mice from Columbia University



- 以254nm 照射157 mJ/cm²的能量・確認了NDA損傷物質CPD及6-4PPの發生。
- 在222nm沒有發現DNA的損傷。

M. Buonanno Brian Ponnaiya David Brenner et, al. Germicidal Efficacy and Mammalian Skin Safety of 222-nm UV Light · Radiation Research, 187(4):493-501. 2017

2. Irradiation results of normal and non-keratinocyte skin cells of mice from Hirosaki University in Japan and Harvard University *

3. Normal skin clinical trial results from Kobe University Plastic Surgery

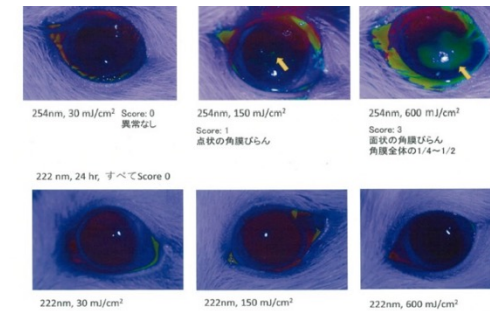
Erythema test: Irradiation was administered with 222nm equipment at 50, 100, 200, 300, 400, and 500 mJ/cm² to a 10mmX10mm area on the back of 20 healthy volunteers to detect whether erythema would emerge 24 hours later. The result showed no erythema in all 20 members.

Sterilization test: Irradiation was administered at 500mJ/cm² to a 40mmX40mm area on the back. Numbers of bacteria on the skin surface were recorded before irradiation, 5 minutes after irradiation, and 30 minutes after irradiation, respectively (application area 20mmX40mm). As a result, the bacterial counts were 7.21, 0.05, and 0.79, respectively. Sterilization (or Bactericidal) effect was confirmed.

*Irradiated at 254 nm/150 mJ/cm² and 222 nm/500 mJ/cm², normal and non-keratinocytes skin cell were confirmed to show CPD presence at 254 nm, but not at 222 nm.

Eye

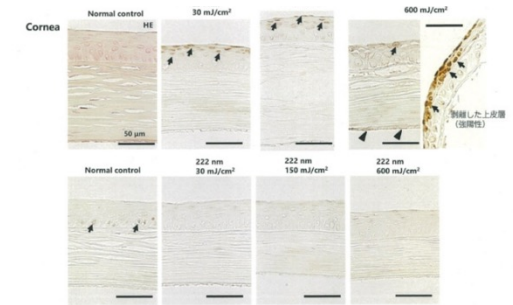
1. Acute eye injury test on keratitis in mice from the Department of Ophthalmology, Shimane University



螢光黃染色結果

- 222nm : 600 mJ/cm²為止沒有發生角膜炎。
- 254nm : 150 mJ/cm²即發生角膜炎。

Sachiko Kaidzu, Kazunobu Sugihara, Masahiro Sasaki, Aiko Nishiaki, Tatsushi Igarashi & Masaki Tanito
Free Radical Res. 2019 Apr 5:1-151. doi: 10.1080/10715762.2019.1603378. [Epub ahead of print]



角膜上皮CPD (DNA損傷) 測定

- 222nm : 600mJ/cm²為止沒有發生CPD。
- 254nm : 發生CPD、一部分上皮有損傷。

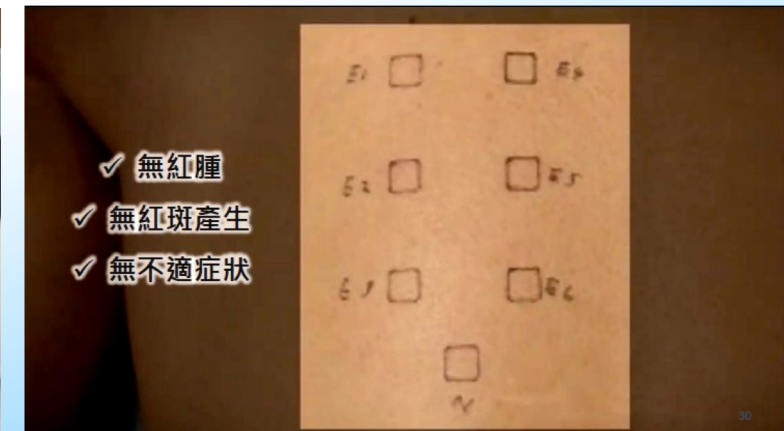
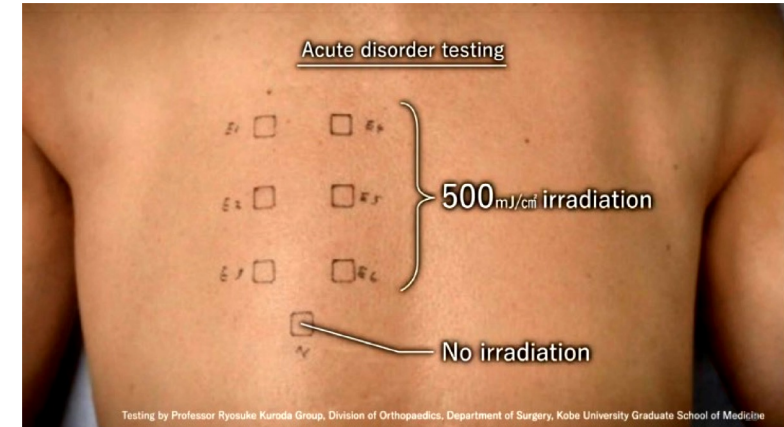
2. Chronic eye damage test of repeated exposure for a period of time (on mice)

Repeated irradiation for more than 6 months to observe and detect whether chronic injury would occur. Good results are obtained (thesis is in preparation).

222nm UV Light — Safety Study (Human Skin Irradiation)

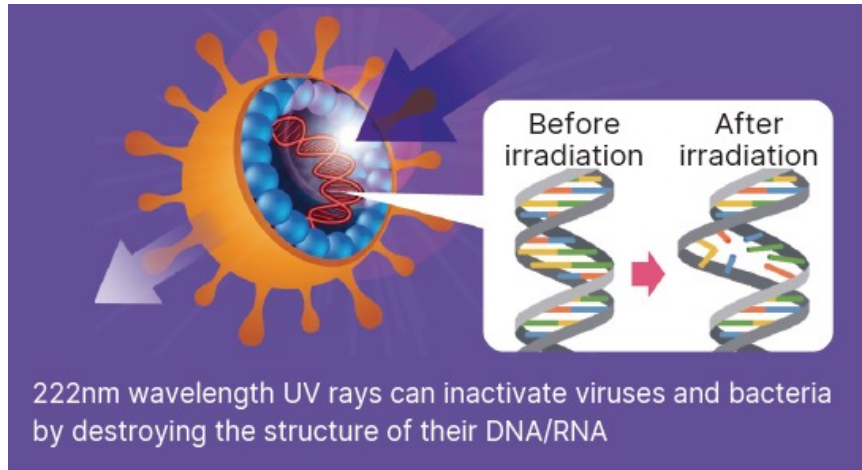
Results of normal skin clinical trial at Kobe University Plastic Surgery

- Irradiation was administered with 222nm equipment at 50, 100, 200, 300, 400, and 500 mJ/cm² to a 10mmX10mm area on the back of 20 healthy volunteers.
- Test results confirmed that none of the 20 subjects had erythema or other conditions after 24 hours
- ACGIH recommends a safe daily dose of 478 mJ/cm² per person.

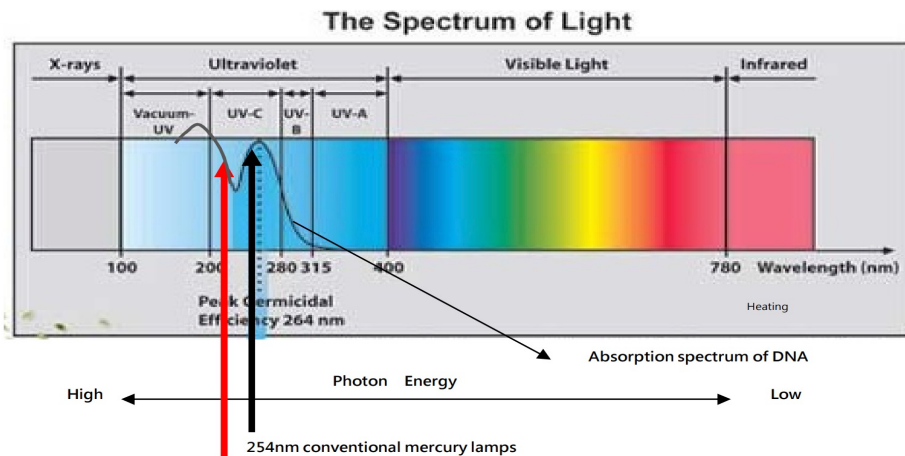


Delta U+ Care222 as Excellent UV Light Disinfectant

The excellent bactericidal power of ultraviolet rays directly damages the DNA and RNA of viruses and bacterial cells



222nm UV light has the same bactericidal effect as 254nm. It has been confirmed that 222nm light can achieve better effects than 254nm on killing bacillus that ethanol fails to.



| Domain | Species | Dose for 99.9% [mJ/cm ²] | |
|---|---|---|--------------|
| | | 222nm | 254nm |
| Vegetative Bacteria | MRSA Methicillin-Resistant Staphylococcus Aureus | 15 | 10 |
| | <i>Pseudomonas aeruginosa</i> Pseudomonas aeruginosa | 8 | 4 |
| | <i>Escherichia. coli O157</i> Coliform O-157 | 9 | 5 |
| | <i>Salmonella typhimurium</i> Salmonella typhimurium | 10 | 4 |
| | <i>Campylobacter jejuni</i> Aspergillus | 4 | 4 |
| | <i>Bacillus subtilis</i> Bacillus subtilis Vegetative cell (nutritional) | 7 | 8 |
| | <i>Bacillus cereus</i> Bacillus cereus/Cactus Spore | 44 | 90 |
| | <i>Bacillus subtilis</i> Bacillus subtilis (spore) | 30 | 60 |
| | <i>Clostridium difficile</i> Bacillus difficile | 30 | 60 |
| | Molds and Yeasts | <i>Candida albicans</i> Candida albicans | 24 |
| <i>Penicillium expansum</i> Penicillium expansum | | 50 | 50 |
| <i>Aspergillus niger</i> Hypha Spore | | >1000 >500 | >700 >700 |
| Virus | MS2 Bacteriophage MS2 | 23 | 50 |
| | <i>Feline calicivirus</i> Feline Calicivirus/Feline Calicivirus | 24 | 24 |
| | <i>Influenza virus</i> Influenza virus | 6 | 6 |
| | <i>Covid-19</i> Covid-19 or coronavirus | 3 | 5 |

Table. Inactivation effect of 222nm, 254nm UVC irradiation on the species.

Dose of UVC radiation to achieve 3-log reduction of the species.

Prepared by Lecture on Infective Biological Defense, Graduate School of Medicine, Hirosaki University



Experiment on Bactericidal Power Against COVID-19 (Department of Public Health, National Taiwan University)

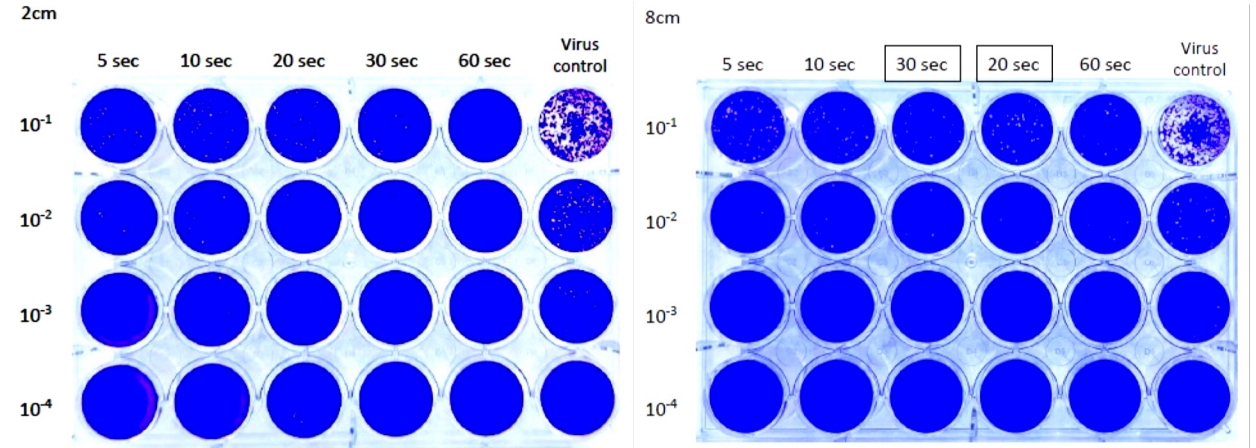
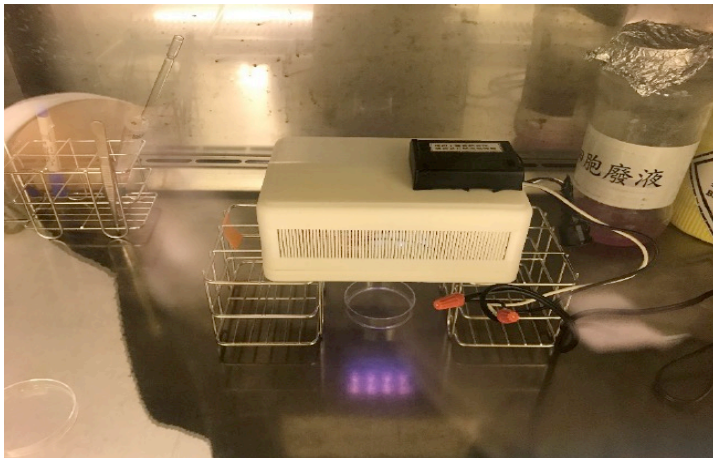
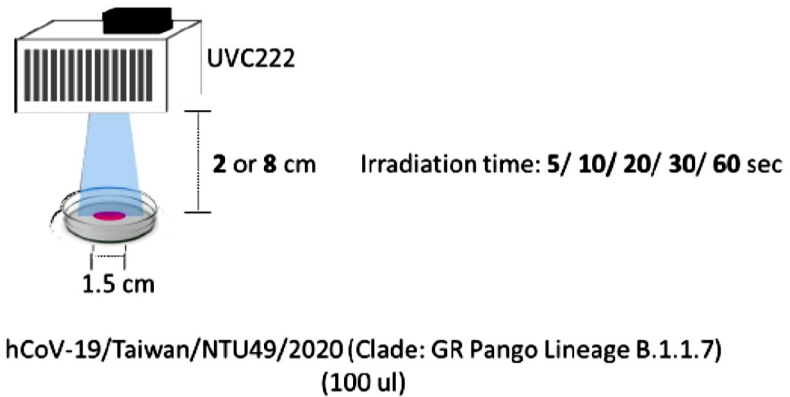
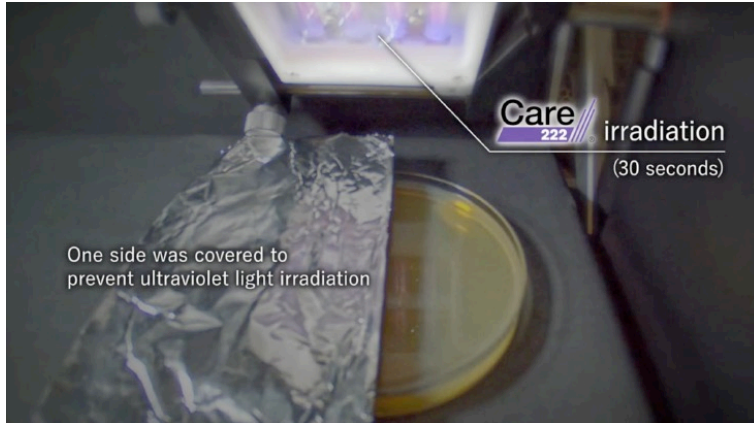


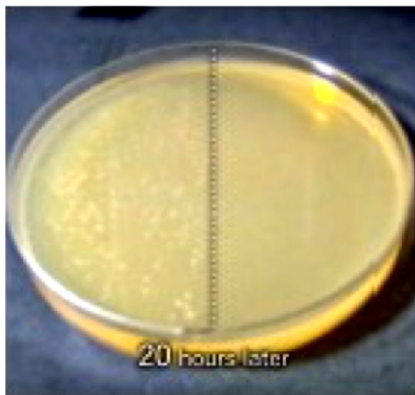
Table. Inhibition of SARS CoV2 by far-UVC

| (cm) | 2 | | | 8 | | |
|-------|--------------------|--------|----------------|--------------------|--------|----------------|
| (Sec) | mJ/cm ² | PFU/ml | inhibition (%) | mJ/cm ² | PFU/ml | inhibition (%) |
| 0 | 0 | 42500 | | 0 | 18500 | |
| 5 | 27.325 | 1450 | 96.58823529 | 5.805 | 3400 | 81.62162162 |
| 10 | 54.65 | 2800 | 93.41176471 | 11.61 | 1700 | 90.81081081 |
| 20 | 109.3 | 1600 | 96.23529412 | 23.22 | 2150 | 88.37837838 |
| 30 | 163.95 | 450 | 98.94117647 | 34.83 | 850 | 95.40540541 |
| 60 | 327.9 | 50 | 99.88235294 | 69.66 | 700 | 96.21621622 |

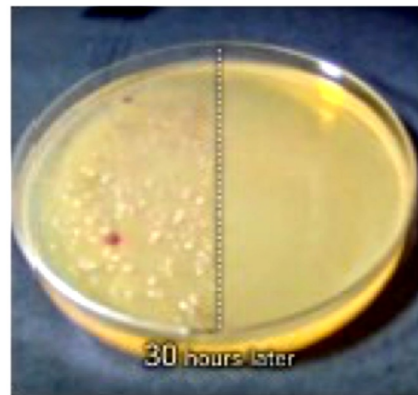
Germicidal features test against Escherichia coli



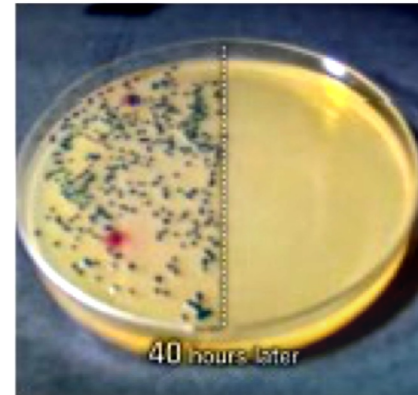
- The area receiving irradiation with 222nm UV light (right side) has obvious bacteriostatic effect.
- Where unirradiated (left side), the area covered by Escherichia coli significantly increased.



20 hrs.later



30 hrs.later




40 hrs.later



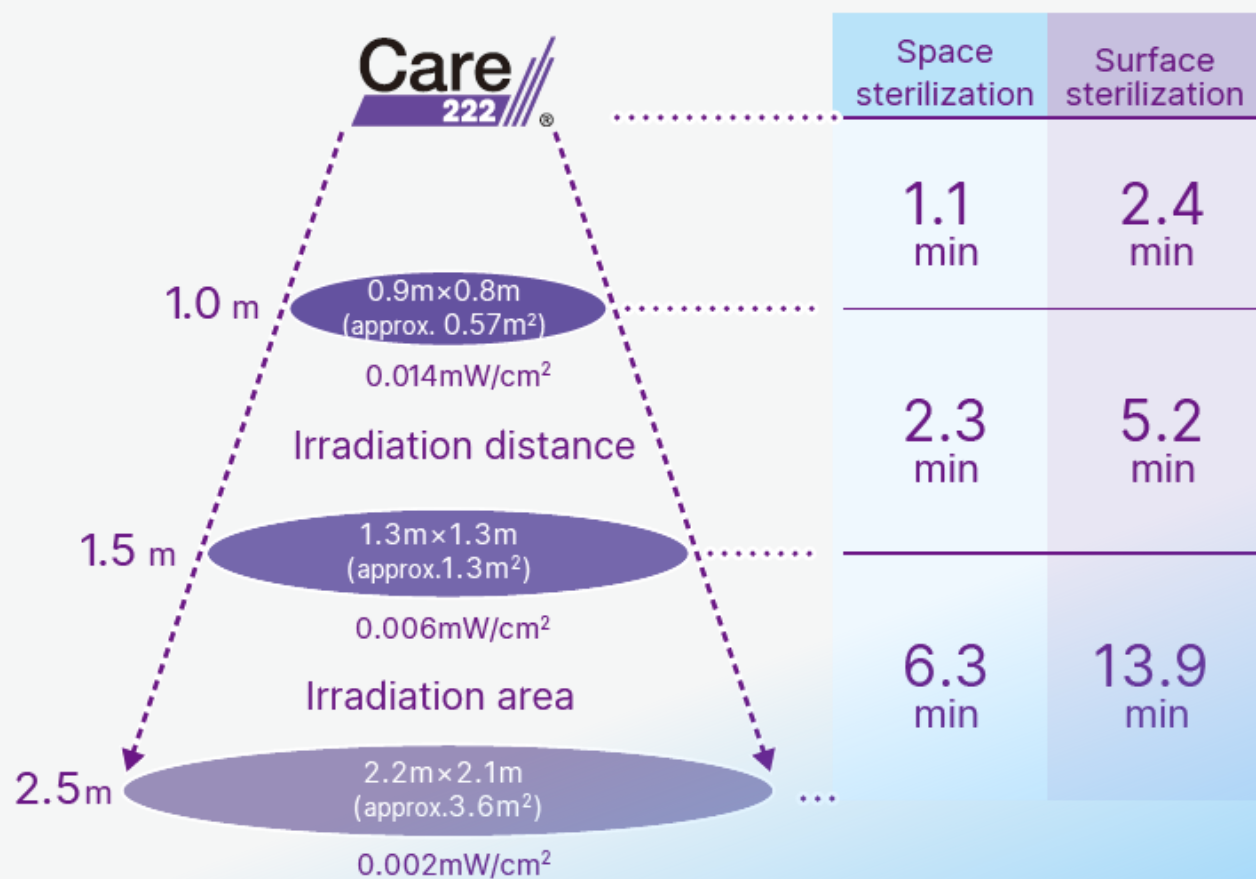
48 hrs.later

Delta U+ Care222 Bacteriostatic Solution — Addresses Both Surface and Air

| | | |
|-------------------------------|---|--|
| <p>Multi- module</p> |  <p>Gate Type</p> <p>Floor Lamp type</p> | <p>Ideal for entrance/exit areas; provides rapid bacteriostatic when people pass quickly</p> <ul style="list-style-type: none"> Activated upon sensing motion Adjustable angles for the floor lamp type |
| <p>Single module</p> |  <p>Panel</p> <p>Wall-mounted</p> <p>Recessed</p> <p>Ceiling-mounted</p> <p>Pendant</p> <p>Desk lamp type</p> | <p>Various designs to meet the needs of different installation conditions</p> <ul style="list-style-type: none"> Human motion sensor detection  Timed bacteriostasis Motion-sensing activation for desk lamp type (contactless switch) |
| <p>Other applications</p> |  <p>Handheld</p> <p>Hand purifier</p> <p>Post type</p> | <p>Antibacterial for hands and objects</p> <ul style="list-style-type: none"> Human motion detection (except for handheld type) Rapid bacteriostasis |

Conditions for germicidal irradiation

(can kill 99% of bacteria, molds, and viruses)



Safety precautions

- * The Threshold Limit Value (TLV) of an ultraviolet light exposure dose at 222nm for a person is 478mJ/cm² or less a day (within 8 hours a day).
- * As with other lighting fixtures, avoid looking directly at the Care222[®] fixtures at close range (as it may irritate the eyes).
- * Users who are allergic to light or are pregnant should take regular UV light protection measures as a daily precaution.

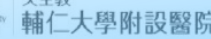
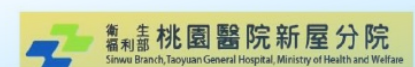
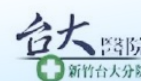
Sources: ACGIH (the American Conference of Governmental Industrial Hygienists) and JIS Z 8812 (Japanese Industrial Standards: Measuring Methods of Eye-Hazardous Ultraviolet Radiation)

Usage scenario example: crowd entrance/exit

Delta U+Care222 bacteriostatic cabin is suitable for entrance/exit checking in and out over **400** people per hour.

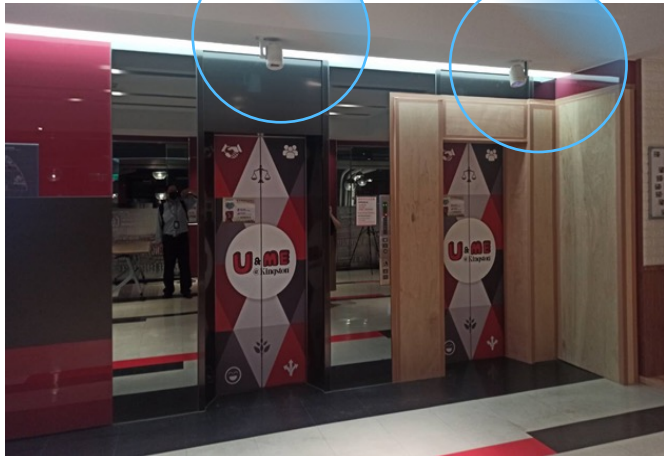
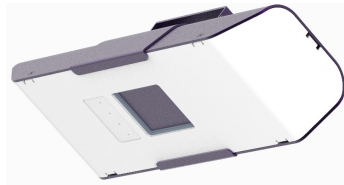


| | Consumables cost | Volume | Time/volume per person | Number of people to be served | Cost per use |
|---------------------------|------------------|----------|------------------------|-------------------------------|--------------|
| Alcohol spraying gate | 2500 | 20L | 0.05L | 400 | 6.25 |
| Delta's disinfection gate | 600000 | 3000 hr. | 5 sec. | 2,160,000 | 0.2778 |



Usage scenario example: elevator

Wall-mounted or ceiling-mounted types of products can inhibit viruses or bacteria on elevator buttons, handrails, people, and those in the air.



udn / 要聞 / 疫情最新跑馬燈

疑電梯混搭、抽風差 防疫旅館群聚3例境外改列本土

2022-03-04 14:38 聯合報 / 記者謝承恩、沈能元、許政瑜 / 台北即時報導

台北某防疫旅館防治作為

根據病毒基因定序及檢測結果，4(4)日復列台北某防疫旅館相關之3例境外移入個案(案20016、案20118及案20256)為本土個案。

與疫定序及檢測結果，經復2本土個案之傳染關係串連：
台北某防疫旅館相關之本土個案(案20016、案20119及案20254)與同種之境外移入個案(案19934)相關。

衛生單位針對防疫旅館，防治作為如下：
◆ 該樓層所有客房、整層清潔。
◆ 邀請10名員工採檢PCR抗體活性，其中同樓層、上下通號、同時採檢之住戶11人、11人陽性、2人待採檢，並無新增採檢個案。
◆ 衛生單位已與該旅館溝通，要求加強電梯分送、門禁管制、注意系統等。

註：2022年12月以來，累計共18家防疫旅館，23個採檢個案均與該旅館(其中22例由境外移入改列本土)

羅一鈞表示，旅館完成環境調查，發現電梯沒有確實分流，可能有員工跟住客混搭情況，再與住客會間接觸可能性，針對一樓要加強門禁管制。圖／指揮中心提供

Usage scenario example: bus

Wall-mounted type of products installed at the front and rear of the vehicle can inhibit bacteria and viruses of passengers or those in the air.

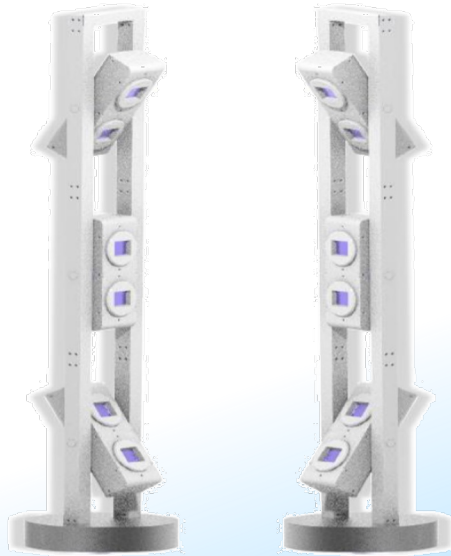


Usage scenario example: clinic

Suspended or recessed types of products can carry out regular, large-scale environmental bacteriostatic for unspecified people accessing the place, equivalent to **3000** ACH of bacteriostatic effect.



Gate type, floor lamp type



Suitable for Crowd entrance/exit



Airport



Hospital



Office building hall

- Effective bacteriostatic for people in five seconds
- Easy to move (floor lamp type)
- Adjustable irradiation angles (floor lamp type)
- Activated upon sensing motion, energy saving and carbon reduction
- Fashionable design

Hand purifier, post type, and handheld type



Suitable for Receptions



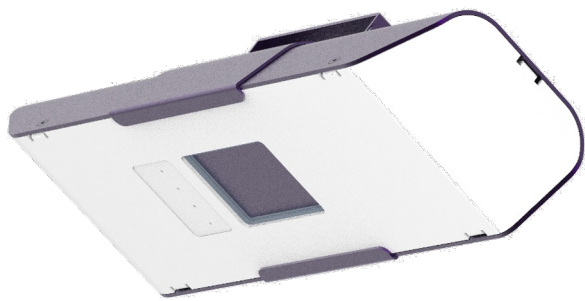
High-end
retail store



Factory/office
building

- Bacteriostatic for hands or objects
- Portable or easy to move
- Able to be placed wherever required
- Fashionable design

Ceiling-mounted type



Suitable for Elevators



Buildings

- Adjustable irradiation angles provide targeted irradiation on the human body, elevator buttons, handrails, and other places that are easily contaminated with viruses
- Regular bacteriostatic
- Easy installation
- Activated upon sensing motion

Recessed type, suspended type, wall-mounted type



Suitable for Receptions and other places where people gather



Office



Clinic



Restaurant



Hotel

- Bacteriostatic for both air and surface
- Product design fits easily into the interior
- Activated upon sensing motion
- Adjustable irradiation angles and hanging height

Success Cases



Medical institutions

- Taipei Veterans General Hospital
- Taipei Hospital, Ministry of Health and Welfare
- Taipei Medical University-Shuang Ho Hospital, Ministry of Health and Welfare
- Tri-Service General Hospital
- MacKay Memorial Hospital, Taipei Branch
- MacKay Memorial Hospital, Hsinchu Branch
- Zhongxing/Renai/Heping Branch, Taipei City Hospital
- NTUH Hsin-Chu Branch
- Sanchong Branch, New Taipei City Hospital
- Sinwu Branch, Taoyuan General Hospital, Ministry of Health and Welfare



Public institutions

- Taiwan Taoyuan International Airport
- National Sports Training Center
- Changhua County Council

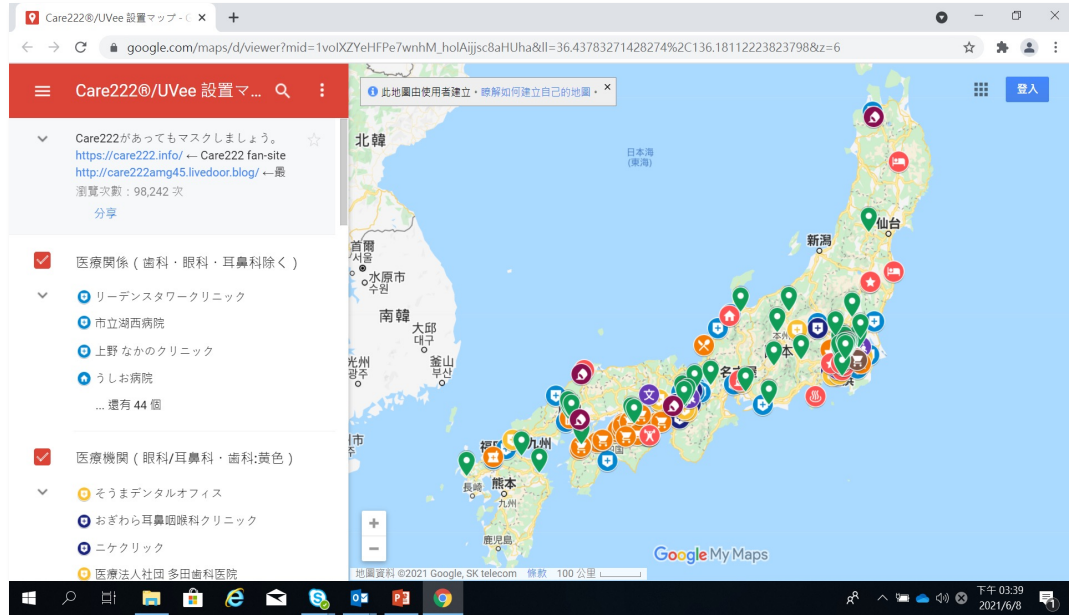


Other applications

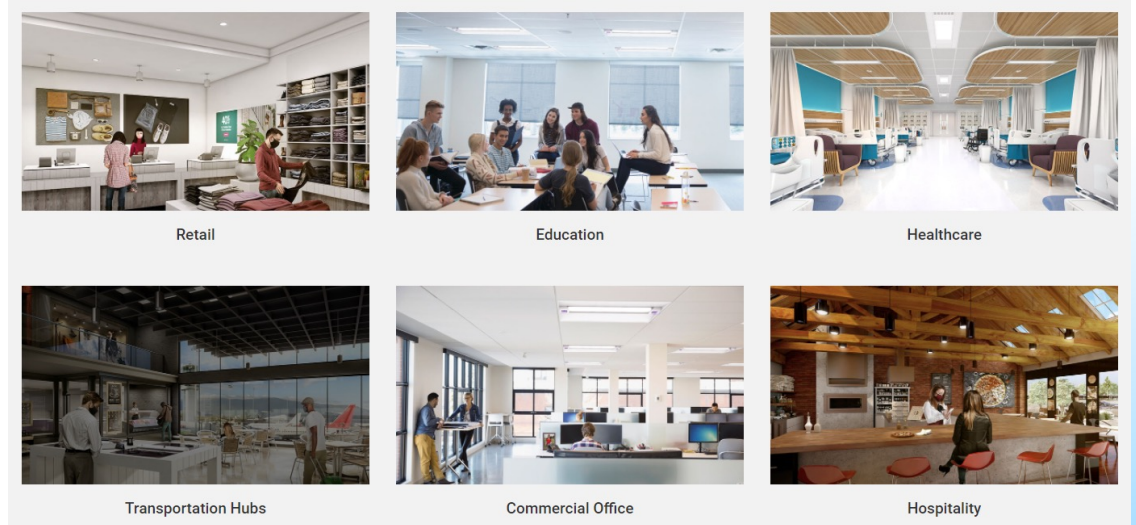
- Delta's 24 plants (including Cyntec)
- Kingston Technology Corporation
- Cathay Financial Holdings
- Mega International Commercial Bank Co., Ltd
- Taipei Nangang Exhibition Center
- Taipei International Convention Center

Care222 Overseas Applications

Japan



USA



https://www.google.com/maps/d/viewer?mid=1voIXZeHFPe7wnhM_hoIAijisc8aHUha&ll=37.403959432580216%2C137.50514040000004&z=6

Appendix

USA UV-C 222 Papers

| 國家 | 論文題目 | 出版 | 日期 | 發表單位 | 實驗類別 | | 備註 |
|-----|--|---|---------|---|-------|-----|-------|
| | | | | | 環境/消毒 | 安全性 | |
| USA | [1] Extreme exposure to filtered far-UVC: a case study 極端暴露於過濾後的遠紫外光：一個案例研究 https://doi.org/10.1111/php.13385 | Photochemistry and Photobiology | 2021/01 | Ninewells Hospital and Medical School (英國丹地的醫學院) University of St Andrews (英國的聖安德魯斯大學) | | ○ | USHIO |
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USA UV-C 222 Papers (cont.)

| 國家 | 論文題目 | 出版 | 日期 | 發表單位 | 實驗類別 | | 備註 |
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USA UV-C 222 Papers (cont.)

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UK UV-C 222 Papers

| 國家 | 論文題目 | 出版 | 日期 | 發表單位 | 實驗類別 | | 備註 |
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Netherlands UV-C 222 Papers

| 國家 | 論文題目 | 出版 | 日期 | 發表單位 | 實驗類別 | | 備註 |
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Germany UV-C 222 Papers

| 國家 | 論文題目 | 出版 | 日期 | 發表單位 | 實驗類別 | | 備註 |
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