



*”When I lost my mother to a hospital-acquired infection, a mission was
born
– a mission to attack the infections and to save lives around the world
.”*

Quote: Jørn Terkelsen
Co-founder of Dolphin Care ApS

THE COMPANY

- Dolphin Care was **founded** in Copenhagen, Denmark **in 2013**
- Company **headquarter** located in **Hvidovre/Copenhagen**
- Scientific advisor – MD Leif Percival Andersen – Specialist in Clinical Microbiology and Head of The Laboratory of Hygiene at Copenhagen University Hospital - Rigshospitalet
- Scientific advisor – MD Michael Tvede – Specialist in Clinical Microbiology and hygiene – **Former Head of department of clinical microbiology** at Rigshospitalet, **Copenhagen University Hospital**

PROJECT TEAM

Jørn Terkelsen

- When Jørn lost his mother to a hospital-acquired infection, a mission was born – a mission to fight the infections and save lives around the world
- Jørn graduated shipping man and ran his own freight forwarding company specialized in transporting wine and spirits worldwide from 1984 to 2009
- Jørn started working on this project back in 2013 in a corner of a warehouse in Roskilde

Michael Tvede

- Michael is Cand. med from Copenhagen University
- Specialist in clinical microbiology involving specialist medical training in the diagnosis of infectious diseases and hygiene
- Chief Physician Viborg Hospital clinical microbiological department till 1996. The department served 5 hospitals in Viborg County with the responsibility for hygiene – infection diagnosis – and antibiotic treatment
- Then Chief Physician at Copenhagen University Hospital – Rigshospitalet, **department of clinical microbiology until 2014**

Lars Geister

- Lars is an accountant and has worked with accounting, financial management, project management and development of companies for more than 20 years
- Has worked on the project since 2014

Jan Petersen

- Jan is an electrician
- Jan brings an experience that has proved worthwhile for a project like ours
- Jan started with Jørn the development of prototypes in the corner of the warehouse in Roskilde

FACTS

- **COVID-19** is the **infectious disease** caused by the most recently discovered **coronavirus**. **COVID-19** has become a **seriously pandemic infection**.
- Hospital related **infections** is an **ongoing problem** worldwide
- **7-10%** of **hospitalized** patients are **affected by infections**
- Hospital related infections are the reason for more than **200.000 deaths** every year alone in Europe and USA
- Hundred of millions of patients are affected every year by hospital associated infections leading to significant mortality and financial losses for health systems
- The infections cause annually **16 million extra days of hospital stay** alone in Europa.
- Hospital related infections cause **billions in increased healthcare costs**

Source: WHO

The image features a dark blue background with a microscopic view of numerous spherical bacteria and viruses. The bacteria are shown as large, textured spheres with a complex, crystalline surface. The viruses are smaller, more uniform spheres. The overall composition is dense and scientific, with the text centered over the middle of the image.

By reducing the presence of bacteria and
virus in hospital environments, we can
save lives...

The Products

DEVELOPED IN CORPORATION WITH COPENHAGEN
UNIVERSITY HOSPITAL, RIGSHOSPITALET

Kills virus bacteria and fungi

...in air



...on surfaces



...in water



AIR DISINFECTION

Product Description

Dolphin Care's Air Disinfector is a movable floor unit that uses a three-phase process to disinfect air in patient rooms. The result is an 86-92% reduction in Colony Forming Units (**bacteria**), reduction of allergens, and reduction in bad odors. **The continuous use of the instrument secure a low number of bacteria and virus present in the room when patients are treated**, decrease the risk of health care-associated infections (HAIs), creates a more pleasant environment for patients and staff, and ultimately saves money for hospitals.



Product Features

1. **Air entry** - contaminated air is sucked in through the bottom of the unit. At first, the air passes through a pre-filter located at the inlet, which is capable of removing air borne particles having a diameter bigger than 200 μm . The air is then moved via a ventilator housing into a cartridge filter.
2. **UV-C radiation** - inside the unit, the air is irradiated by light from powerful UV-C lamps (light wavelength is $\sim 254\text{ nm}$). The overall intensity of the lamps is $392\ \mu\text{W}/\text{cm}^2$. This radiation destroys the DNA/RNA of bacteria, fungi, and viruses (Including Corona virus).
3. **TiO₂-coated filter** - next, the air passes through a titanium dioxide-coated filter. Because this filter is irradiated with UV-C light, a photo catalytic reaction takes place. Strong oxidizing hydroxyl radicals are formed and will destroy the cell walls of the bacteria and viruses (Including Corona virus) present.
4. **Carbon filter** - after that, the air passes through an activated carbon filter that absorbs odors and other particulate pollutants.
5. **HEPA H14 filter** - as a final phase, the air is pushed through a pleated HEPA H14 filter that removes microorganisms and has a filtration efficiency of 99.995% of airborne particles (including bacteria and viruses (including Corona virus)) of less than 0,2 μm in diameter.
6. **Recirculation** - lastly, the disinfected air is recirculated into the surrounding space.

AIR DISINFECTION

Product Specifications

Small Air Disinfecter

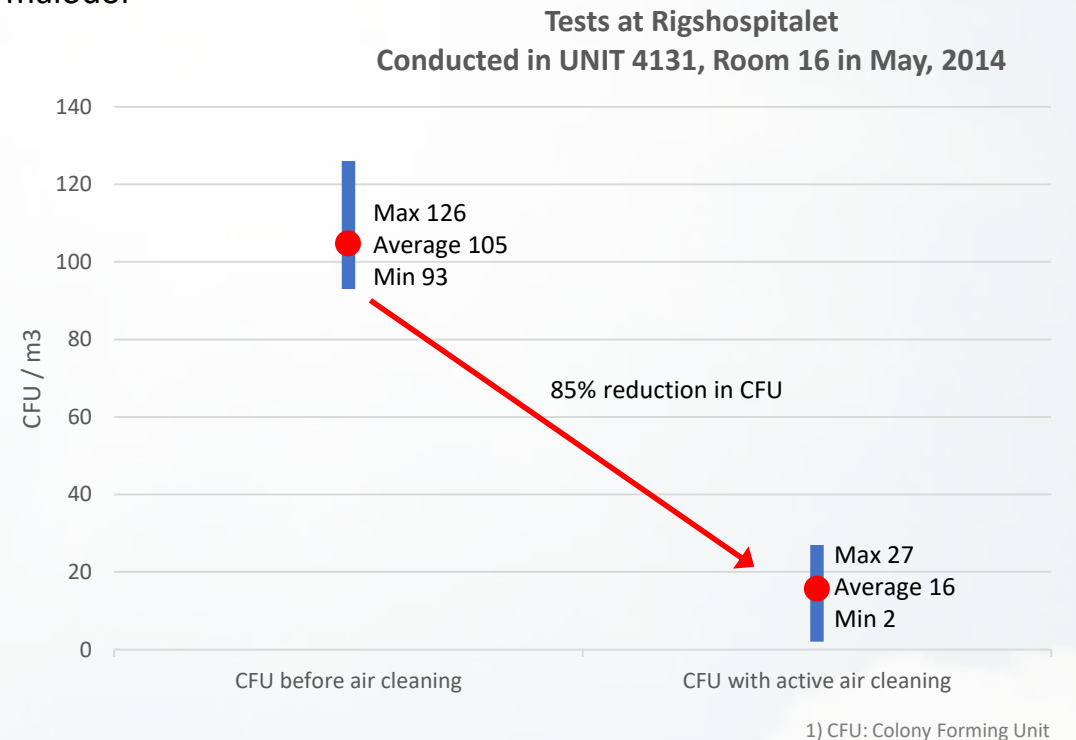
- Designed for rooms up to 80 m²
- Processes 400 m³ of air/hour during daytime
- Processes 200 m³/hour during nighttime
- Three powerful UV-C lamps (254 nm)
- 0,75 m² TiO₂ coated filter
- 0,8 m² activated carbon filter with 500 gram activated carbon per m
- 14,5 m² HEPA 14 filter

Large Air Disinfecter

- Designed for rooms over 80 m²
- Processes 800 m³ of air/hour during daytime
- Processes 400 m³/hour during nighttime
- Four powerful UV-C lamps (254 nm)
- 1,15 m² TiO₂ coated filter
- 1,2 m² activated carbon filter with 500 gram activated carbon per m²
- 22,5 m² HEPA 14 filter

Test Result

A prospective examination of the air-sterilizer carried out **in a room with two active treated patients** at the Intensive Care Unit 4131 at the Copenhagen University Hospital, Rigshospitalet in Denmark, showed a significant reduction of CFUs. Staff also experienced a considerably better work environment and noted a reduction of malodor



ROOM DISINFECTION

Product Description

The Dolphin Care Chemical Free UV-C Room Disinfector rapidly disinfects contaminated rooms without use of chemicals by radiating UV-C light from units placed on the floor. This UV-C radiation shines through air and on surfaces, destroying the DNA and RNA of affected bacteria, fungi, and viruses (including Corona virus). This includes elimination of:

- Corona virus
- MRSA (Methicillin-resistant Staphylococcus aureus)
- ESBL producing Gram-negative bacteria (Extended spectrum beta-lactamase)
- Multi-drug resistant strains of Pseudomonas aeruginosa (MDRPA)
- VRE (vancomycin-resistant enterococci)



Product Features

A few features to note about the chemical free uv-c room disinfector

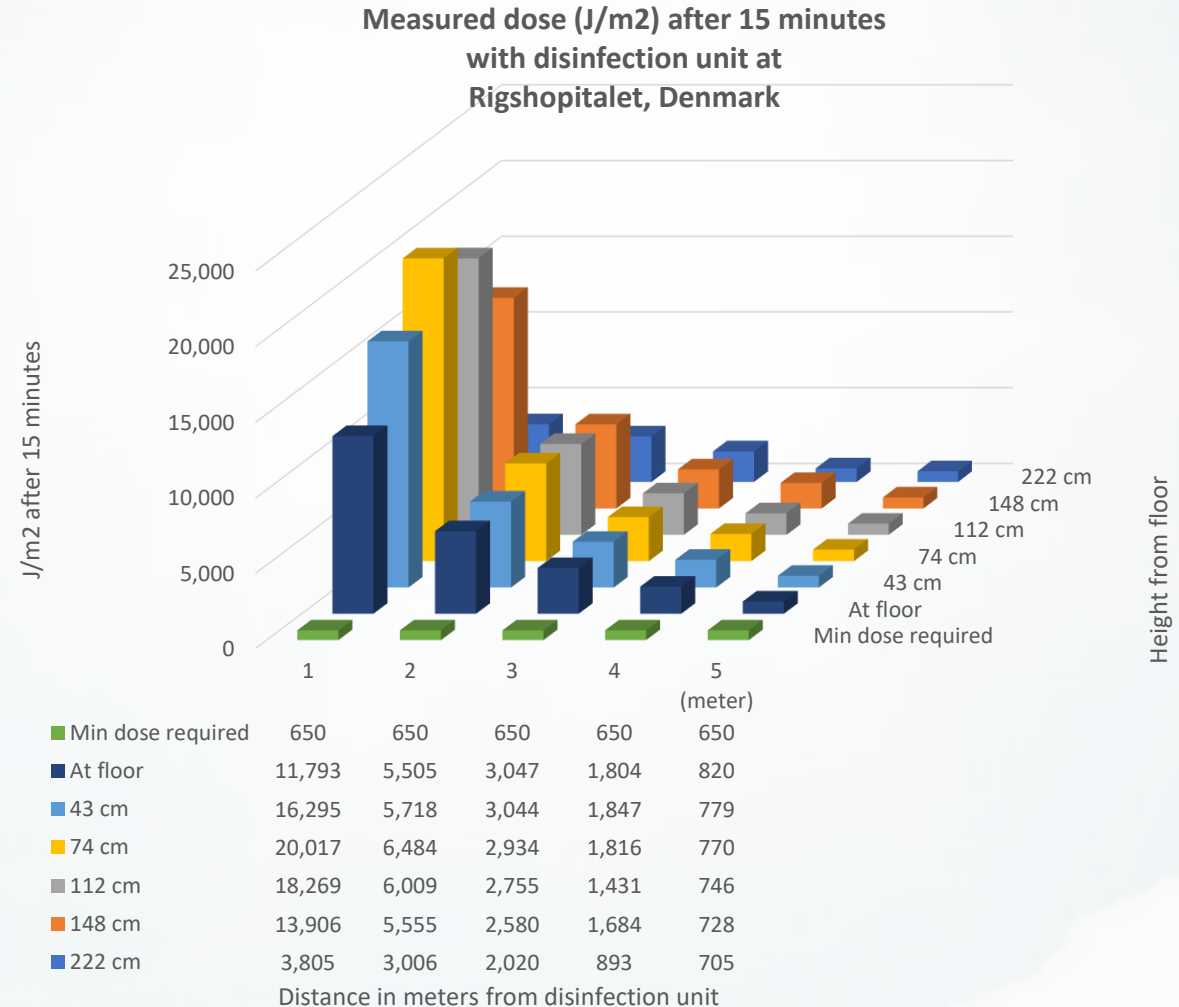
- Kills up to 99.9999% of all bacteria, fungi, and viruses (including Corona virus)
- 360-degree irradiation
- No chemicals
- No harmful by-products
- Faster room turnover
- Low operating costs
- Saves money

ROOM DISINFECTION

Product Specification

The main unit is supplemented by two smaller satellite units that can be placed to ensure disinfection of blind angles, bathrooms, and storage rooms. It takes roughly 15 minutes of use to eliminate the most common varieties of antibiotic resistant bacteria, and about an hour for spore-forming Clostridium species.

This timeframe should be compared to the time typically spent using chemical evaporators, which require taping **off** windows and doors **leaving the room** unusable for half a day or more.



ROOM DISINFECTION

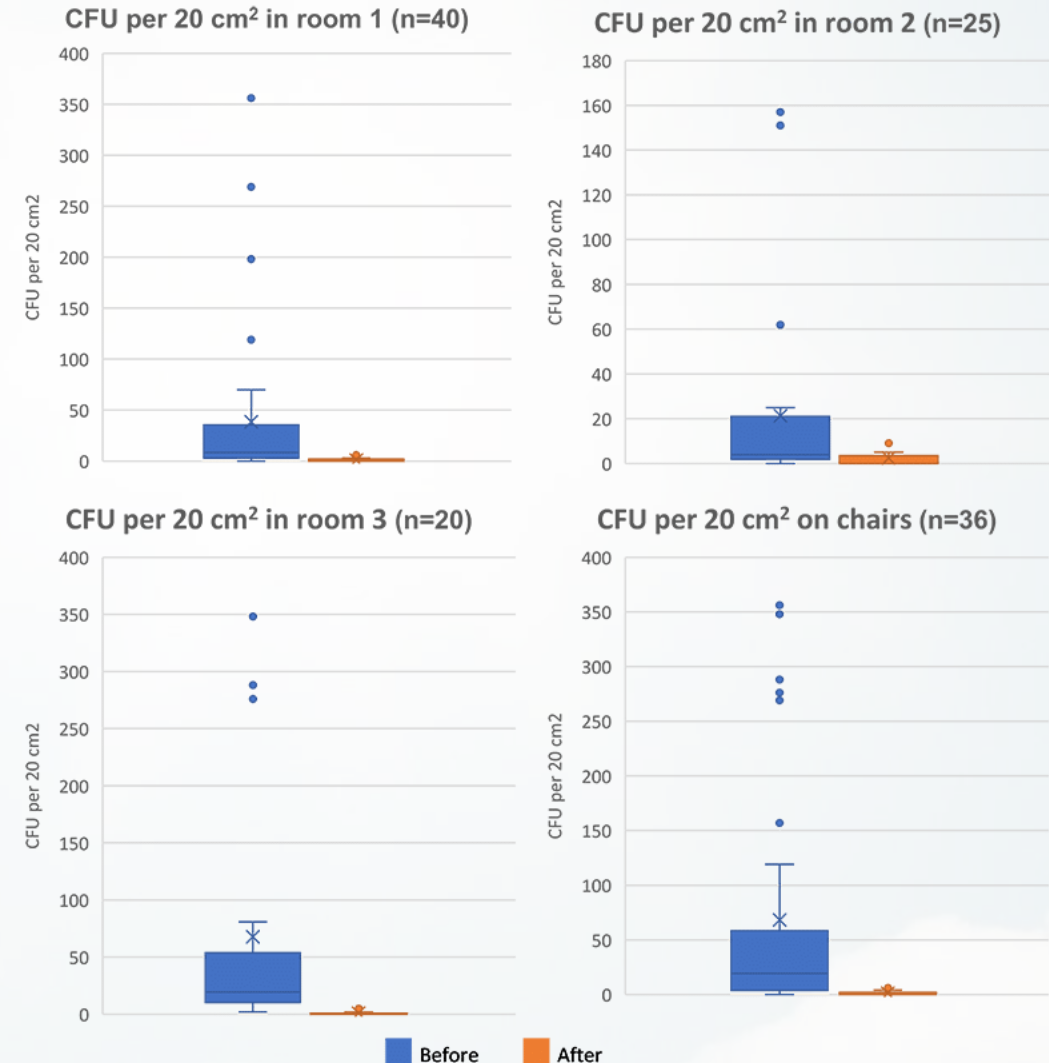
Test Result

Elimination of bacteria via UV-C radiation

Two scientific studies done by the Department of Clinical Microbiology, Copenhagen University Hospital, Rigshospitalet in Denmark showed a log 5-6 reduction of resistant facultative and aerobic bacteria at a 5-meter (16.4-foot) distance from the unit after 15 minutes of irradiation.

In the first study, testing focused on swabs taken from surfaces in four different outpatient clinics for patients suffering from Cystic Fibrosis. Swabs were taken before and after 30 minutes in-room exposure to high UV-C radiation. The bacteria present were virtually eliminated.

In the second study, in vitro samples were placed within 5 meters of a source of UV-C radiation. 99,999% of the bacteria present were killed after 15 minutes of exposure to radiation (bacteria tested included *Enterococcus faecium* (VRE), *Enterococcus faecalis*, *Staphylococcus aureus*, *Acinetobacter baumannii*, *Klebsiella pneumoniae*, and *Stenotrophomonas maltophilia*). This level of elimination is more than sufficient **to fulfill standards** for disinfection.



WATER TRAP DISINFECTION

Product Description

Washbasin water traps are some of the most contaminated areas in hospitals. For that reason, transmittance of multi-resistant bacteria from this area is increasingly recognized as a threat to patient health and safety.

The easily-installed Water Trap Disinfector uses UV-C light radiation to destroy the DNA/RNA of pathogenic microorganisms such as bacteria, viruses, and fungi, virtually eliminating them from the inner surfaces of the trap.

Experiments done by the Department of Clinical Microbiology at Copenhagen University Hospital, Rigshospitalet in Denmark demonstrated an effective and significant reduction of bacterial contamination in the washbasin water traps



Decontamination of water traps with ultraviolet-C light

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¹ Department of Clinical Microbiology, Copenhagen University Hospital, Rigshospitalet, Denmark



Background

Water traps are some of the most contaminated areas in hospitals and increasingly recognized as potential vehicles for transmission of multidrug-resistant bacteria to patients. The aim of this study was to evaluate the efficacy of ultraviolet-C (UV-C) light to decontaminate water traps.

Materials/Methods

A newly developed UV-C decontamination device (patent pending) developed by Danish company Dolphin Care Aps for washbasin water traps (Figure 1) was mounted on four separate washbasins (HygLab, 211, 103A and 200B).

Experimental design:

In two washbasins UV-C light was active while two washbasins were used as controls without UV-C exposure (part 1). After eight weeks, the experiment was swapped and the initial UV-C active washbasins were used as controls and the initial control washbasins were exposed to UV-C light (part 2), see Table 1.

Table 1. Experimental design.

	Part 1	Part 2
Day	0 - 58	59 - 95
UV-C Active	HygLab, 211	103A, 200B
Control	103A, 200B	HygLab, 211

Collection and identification of samples:

- Swabs were taken weekly from the top and the bottom of the washbasin tailpipes and grown on blood agar- and lactose agar plates. Bacteria were quantified semi-quantitatively.
- Water was collected from the water traps weekly and serial 10-fold dilutions were made in order to determine total bacterial counts (CFU/mL).
- Bacterial colonies were identified by MALDI-TOF MS technique.

Results

Bacterial counts (CFU/mL):

- A marked reduction in bacterial counts was observed within the first week in the UV-C active water traps compared with the control washbasins in both part 1 and 2 of the experiment. Bacterial counts were reduced by a factor $10^5 - 10^6$ in the UV-C active water traps in part 2 of the experiment (Figure 2).
- Overall a marked difference in bacterial counts was observed between water traps exposed to UV-C light and control water traps throughout the experimental period.
- Within the first two weeks of part 2 of the experiment the bacterial counts in the new control water traps markedly increased to a level similar to the control water traps in part 1 of the experiment (Figure 2).

Species identified:

- UV-C decontamination reduced the total number of different bacteria identified in water traps exposed to UV-C light (UV-C active=5; controls=9).
- After exposure to UV-C light was interrupted the total number of species identified increased.
- Under UV-C light exposure *Pseudomonas aeruginosa* and Gram negative intestinal commensals disappeared while *Stenotrophomonas maltophilia* was markedly reduced.

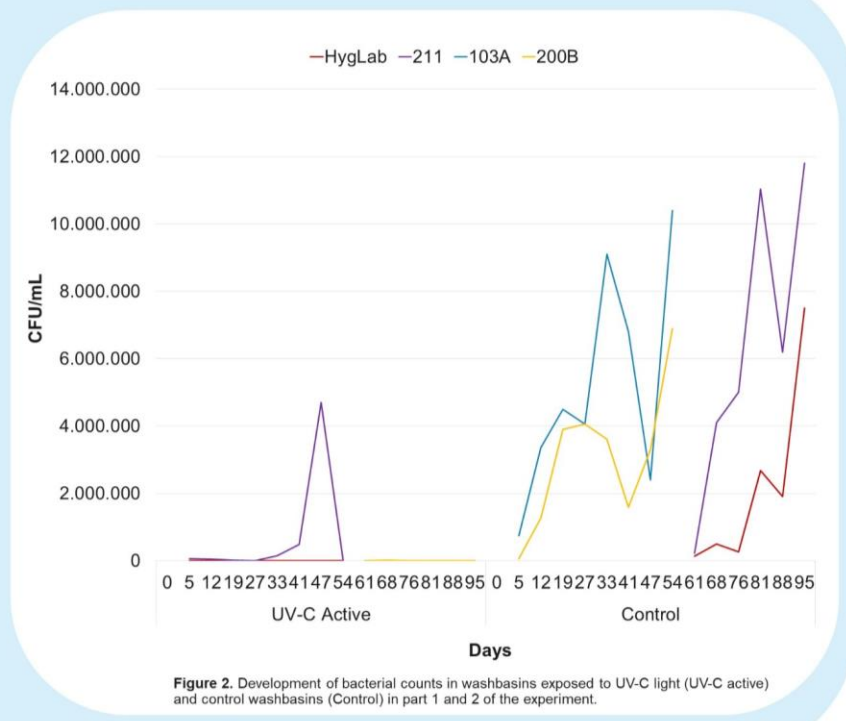


Figure 2. Development of bacterial counts in washbasins exposed to UV-C light (UV-C active) and control washbasins (Control) in part 1 and 2 of the experiment.



Figure 1. UV-C decontamination device for washbasin water traps.

Conclusion

UV-C decontamination of water traps reduces bacterial counts effectively within the first week of use. However, they are quickly contaminated after discontinued UV-C exposure.

UV-C decontamination of water traps may be a feasible adjunctive for prevention of spread of multi-resistant water bacteria from washbasins to immunocompromised patients.

Contact

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I have been in charge for, and conducted all the clinical tests of the three Dolphin care products – The Air Disinfector – The Room Disinfector and The Water Trap Disinfector

By using these three products in the environment of hospitals I am convinced you will have a significant reduction of Health care-Associated Infections (HAI) in hospital treated patients

You will save patient lives and shorten the stay at the hospital

MD Leif Percival Andersen

Specialist in Clinical Microbiology
Head of the Hygiene Laboratory
Rigshospitalet Copenhagen Denmark

The air disinfectant is thought to be stationed in a patient room - operating theaters - treatment rooms and in acute reception in waiting rooms. When needed it can also be moved from one room to another.

Especially patients with a weak immune system would benefit from the air disinfectant.

Examples are patients treated at:

- 1) infectious medical departments
- 2) lung medical departments
- 3) Haematological departments
- 4) transplant departments
- 5) Burn units
- 6) intensive care departments
- 7) gastrointestinal departments
- 8) Neonatal departments

Likewise use of the air-disinfectant outside hospitals could be for:

- 1) Kindergartens
- 2) Nursing homes
- 3) Persons with allergy affecting the respiratory function
- 4) Waiting rooms for private doctors and dentists



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