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VTT

FIELD STUDY ON THE MICROBICIDAL EFFICACY OF THE BIOVITAE® LIGHTS INSTALLED IN THE FIRST AID OF THE "LEONARDO DA VINCI" AIRPORT

October, 2019

CUSTOMER REPORT

VTT-CR-00976-19 | 11.10.2019

Field study of microbicidal efficacy of Biovitae® lights

Author: Satu Salo

Confidentiality: Confidential

Report's title

Field study of microbicidal efficacy of Biovitae® lights

Customer, contact person, address	**Order reference**
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Project name	**Project number/Short name**
BluelightStage3	124170

Summary

The aim of this study was to measure the microbicidal efficacy of Biovitae® lighting devices at first aid hospital of Rome's airport Fiumicino (co-operation with ADR Aeroporti di Roma Spa). The evaluation was based on comparison of the trend of the total bacteria count of samples taken from different surfaces both before and after the installation of the Biovitae® lighting systems.
According to the numbers of samples in each hygiene category the use of Biovitae® light has reduced numbers of sampling places with poor hygiene from 32.5% to 12.5% and the number of sampling places showing good hygiene has increased from 40% to 82.5% after Biovitae light installation.

Espoo, 11.10.2019

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Distribution (customer and VTT)

Customer (Rosario Valles) and VTT (archive, Satu Salo)

1. Description and objectives

The aim of this study was to measure the microbicidal efficacy of Biovitae® lighting devices in real environment. The *in vivo* study was performed at first aid hospital of Rome's airport Fiumicino. The goal was the evaluation of the trend of the total bacterial count through samples taken from different surfaces both before and after the installation of the Biovitae® lighting systems.

Customer was responsible of arranging the sampling and sending the samples to VTT for microbiological analysis and reporting. The sampling was planned to be performed for each surface twice before installing Biovitae® lighting systems and 4 times after the installation. Twenty surface spots was selected for sampling together with customer (table 1).

Table 1. List of sampling places in the emergency rooms of the Leonardo da Vinci airport (Fiumicino, Italy)

	SAMPLING SITE			
Sample identi-fication	**Room**		**Site**	**Height (meters) ***
A1	L1	Main entrance	Shelf	1.64
A2			Shelf	1.64
B1	L1	Registering station	Desk	1.97
B2			Desk	1.97
C1	L3	First-aid station	Doctor's desk (external side)	1.99
C2			Doctor's desk (external side)	1.99
C3			Doctor's desk (internal side)	1.99
C4			Doctor's desk (internal side)	1.99
C5			Examination bed	1.95
C6			Examination bed	1.95
D1	L9	Patient's recovery room	Patient's bed Table	1.69
D2			Patient's bed Table	1.69
D3			Patient's handle	1.39
D4			Patient's bed rails	1.79
D5			Patient's bed rails	1.79
E1	L4	Reporting room	PC Keyboard	1.96
E2			PC Monitor	1.96
E3			Sphygmomanometer	1.96
F1	L22	Doctor's Room	Doctor's desk	1.96
F2			Doctor's desk	1.96

* Height: the distance of the sampling site from the ceiling, measured by the means of a laser meter.

The description of rooms is following (provided by the customer):

L1 Main Entrance
The main entrance is accessed from the external space through an automated sliding glass door. It is the first area you come across when accessing the Hospital, where patients are registered from the staff. The patients, the ambulance crew that responded to the emergency call, and any companion must stop here. After only patients and crew come inside.

L1 Registering Station
In this room the operators register the patients before letting them go into the first aid station, in which they are brought by the ambulance crew. A glass windows separates this room from the main entrance.

L3 First Aid Station

In this room the patients access for the first clinical evaluation, and it can also be used for any minor surgical emergency. Inside the room there is the examination bed used for all medical assessments when the patient is awake and cooperative and doctor's desk.

L9 Recovery room
In this room are hosted patients who, after having been stabilized, require staying under observation for short a period of time (48 hours maximum). The presence of a companion is allowed.

L4 Reporting room
This room communicates directly with the first-aid station **(L3)** through a door. It hosts the devices for monitoring the most common vital functions (e.g. sphygmomanometer, ECG, etc.) and the PC is used by the medical and nursing staff to record the clinical activities performed on each patient.

L22 Doctors' room
This room is for exclusive use of the medical staff. Doctors use it both for resting and consuming meals.

2. Methods

Samples were taken at noon by customer's laboratory technician on 9.7.2019; 17.7.2019; 22.7.2019; 24.7.2019 and 30.7.2019. Swabs were sent to VTT and they were cultured on 11.7.2019; 23.7.2019; 24.7.2019; 26.7.2019 and 2.8.2019, respectively. Samples were taken from surfaces with sterile swabs, which were moistened with sterile water. Sampling area was 10 cm x 10 cm and disposable sterile mask was used to measure the area. Only exception was the pc board from which 10 different frequently used keyboard button was swabbed.

At VTT, microbes from the swabs were diluted to 4 ml of salt water containing peptone before traditional culturing on Plate Count agar plates (PCA) and Chromocult Coliform agar plates. Pour plate technique was used for determination of total bacteria on PCA in order to get detection limit 4 CFU(colony forming units)/100 cm^2. Coliforms were cultured using spreading technique on Chromocult agar plates with detection limit 40 CFU/100 cm^2. Incubation was performed for PCA-plates at 30°C for 3 d and for Chromocult -plates at 37°C for 2 d. After incubation period colonies were counted from the agar plates.

3. Results

Total bacteria counts from samples were from < 4 cfu/100 cm² to 2000 cfu/100 cm². From all 120 samples 59 samples were below 4 cfu/100cm² and two samples exceeded 2000 cfu/cm². For calculations samples with less than 4 cfu are counted as 4 cfu and samples exceeding 2000 cfu are counted as 2000 cfu. Total bacteria counts are presented in Figures 1 and 2.

Coliforms were detected only from 3 samples; 2 of them were from samples before Biovitae lights were installed and one after installation.

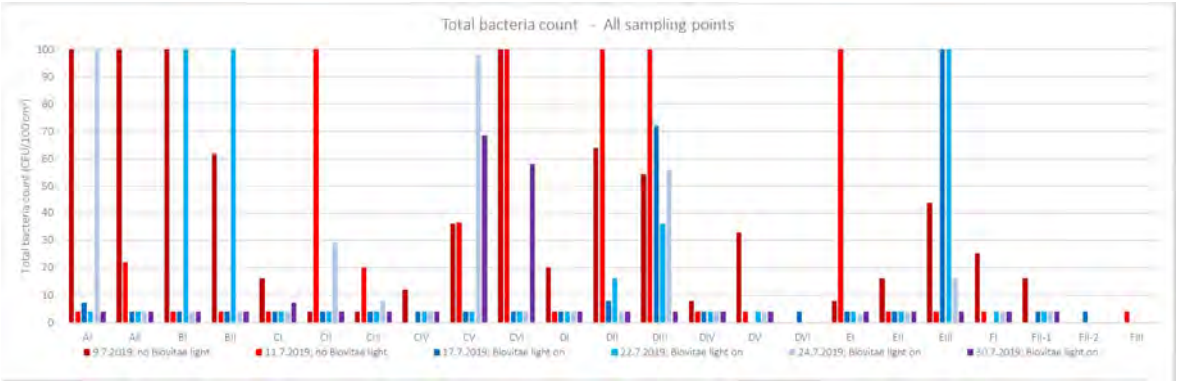


Figure 1. Total bacteria count by sampling points; some of the bars continue above 100 cfu/100 cm² but are shown here only to 100 cfu/cm². Detection limit 4 cfu/cm².

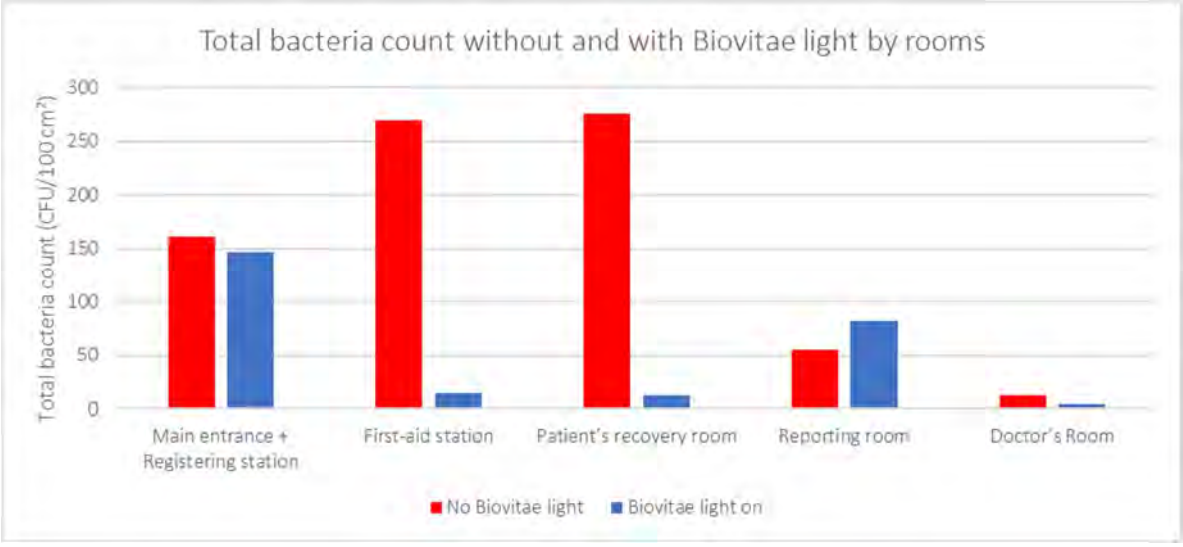


Figure 2. Average trend of the total bacteria count. The red bars represent the total bacteria count measured on the surfaces before installing the BIOVITAE® lighting devices; the blue bars represent the total bacteria count measured on surfaces after installing the BIOVITAE® lighting devices. Detection limit 4 cfu/cm².

4. Conclusions

In VTT's previous hospital studies we have defined for aerobic heterotrophic bacteria threshold limit <12 CFU/100 cm² for good result at hospital environmental surface with possible patient contact and 12-40 CFU/100 cm² for inadequate and >40 for poor hygiene (Wirtanen et al. 2012). The amounts of sampling places including to each hygiene category are shown in Table 2. According to the numbers of samples in each hygiene category the use of Biovitae light has reduced numbers of sampling places with poor hygiene from 32.5% to 12.5% and the number of sampling places showing good hygiene has increased from 40% to 82.5% after Biovitae light installation.

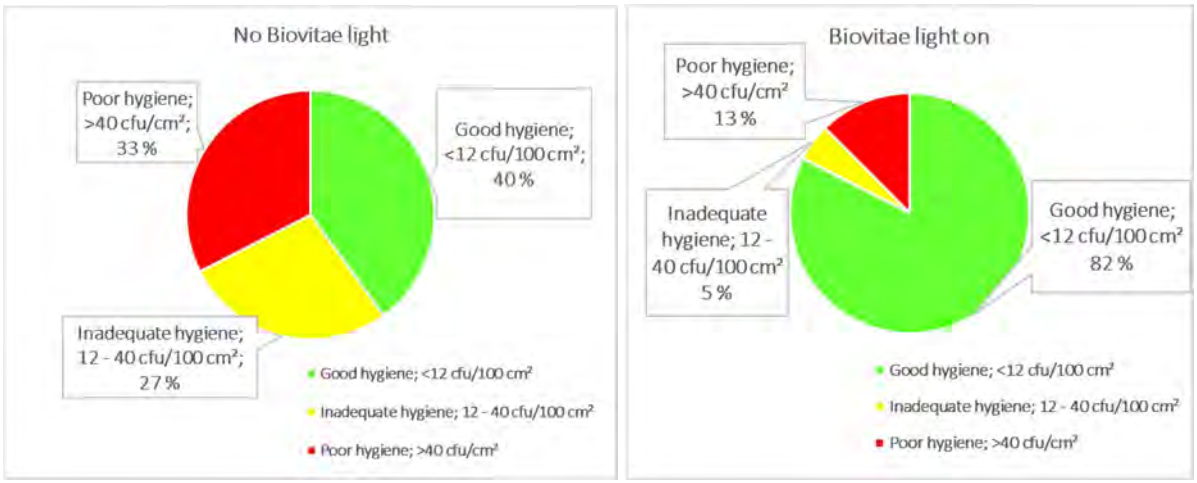


Figure 3. The amounts of sampling places included to different hygiene category percentually. Categories according to results from hospital environmental surface studies previously performed at VTT (Wirtanen, G., Nurmi, S., Kalliohaka, T., Mattila, I., Heinonen, K., Enbom, S., Salo, S. & Salmela, H. 2012. Surface and air cleanliness in operating theatre environments. Eur. J. Parent. Pharmaceut. Sci. 17:3, pp. 87-93).

References

Wirtanen, G., Nurmi, S., Kalliohaka, T., Mattila, I., Heinonen, K., Enbom, S., Salo, S. & Salmela, H. 2012. Surface and air cleanliness in operating theatre environments. Eur. J. Parent. Pharmaceut. Sci. 17:3, pp. 87-93

SCIENTIFIC REPORT CONDUCTED IN THE FIRST AID OF THE "LEONARDO DA VINCI (FIUMICINO)" AIRPORT ASSESSING THE MICROBICIDAL EFFECT OF THE BIOVITAE® LIGHTING DEVICES

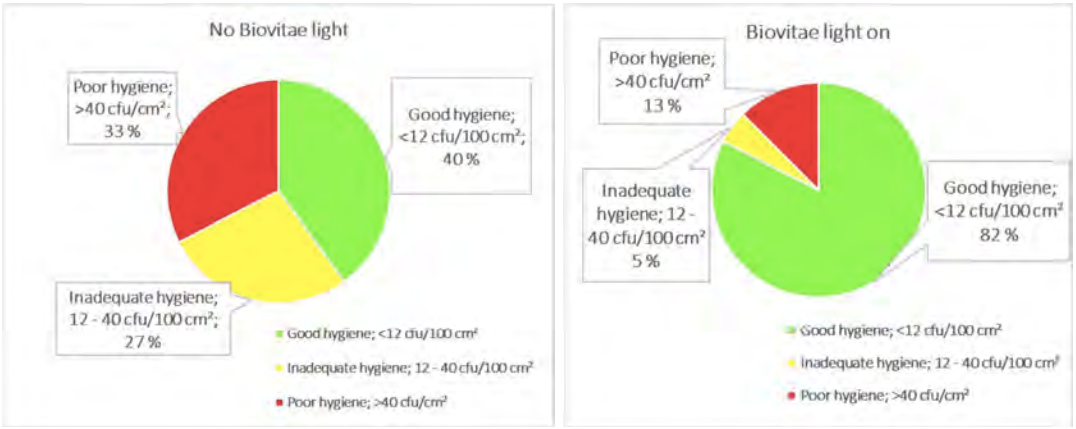
1. Introduction

The aim of these technical notes is to provide some explanation and useful reading keys to better interpret the results of the study conducted by **VTT - Technical Research Centre of Finland** during July 2019 at first aid hospital of Rome's airport Fiumicino (co-operation with ADR - Aeroporti di Roma S.p.a.) for measuring the microbicidal efficacy of Biovitae® lighting devices in a critical setting (the Airport's First Aid) which is inside one of the most visited European airports. The First Aid hospital of Rome's airport Fiumicino deals with any emergency raised from both the staff of the Airport and the companies operating therein, in addition to covering the approximately 50 million customers that fly to the airport each year, overall administering about 11,000 first aid services per year.

The evaluation of the study conducted by VTT was based on comparison of the trend of the total bacteria count of samples taken from different surfaces both before and after the installation of the Biovitae® lighting systems.

The goal was the evaluation of the trend of the total bacterial count and its quantitative determination through samples taken from different surfaces - adopting the appropriate sampling methods in respect of the surfaces under investigation – both before and after the installation of the BIOVITAE® lighting systems, also in relationship with the registered microclimatic parameters and the number of people attending each room.

The results have been extremely satisfying, and as it is clearly reported in the VTT's report, at page 6: "… *according to the numbers of samples in each hygiene category the use of Biovitae light* ***has reduced numbers of sampling places with poor hygiene from 32.5% to 12.5%*** *and the* ***number of sampling places showing good hygiene has increased from 40% to 82.5%***."



2. Hazards generated by biological agents in the airport

In recent years, airports have assumed an increasingly important role in containing biological risks, the increase in the flow of goods and people from and to every part of the world has exacerbated the risk of spreading biological agents from different areas of the world.

The problem is not easy to resolve, the front includes both sick travelers, who have not yet shown the symptoms of any infection (which are not distinguishable from other travelers), and healthy carriers of some biological agents, to travelers who are even clinically healthy naturally carry some symbiotic biological agents for them but potentially harmful for other populations. Not to mention the risk inherent in the handling by the operators inside the airport of goods and the promiscuity during the baggage collection phase.

Unfortunately, airports are also facing risks that are not linked to their production cycle but also to the risks that potentially derive from aircraft internal systems, such as water tanks or air conditioning systems or that are linked to potentially infected waste.

The issue of health and safety at work, in health facilities, is a matter of considerable importance and of great complexity from the point of view of its realization. Healthcare professionals during their patient care activities are exposed to various risk factors, including in particular the biological one.

Working in the First Aid ward as a nurse, doctor, auxiliary and managing numerous cases of emergency-urgency during the work shift, involves a considerable commitment both physically and mentally. In such situations, ensuring adequate assistance and at the same time guaranteeing one's own safety and health at work is not an easy task.

The Emergency Department is an operative unit dedicated to emergency-urgency cases in which patients are given first care. This is a bio-risk department in which direct assistance services are performed to patients in conditions of great stress and professional commitment, involving the performance of often invasive activities and the continuous exposure of health workers to biological agents through direct or indirect contact with the patient source.

The biological risk in this structure is not given by a deliberate use of microorganisms but by a presence, more or less high, consequent to the work activities and to the numerous presences of subjects who go there to receive assistance.

The First Aid of an airport structure accentuates the classic risks with those related to some characteristics of the patients who arrive there:

a. communication difficulties (speak other languages).
b. difficulty in knowing the general greeting status of the patient prior to the emergency episode.
c. any pharmacological therapy in place for the treatment of acute or chronic pathologies.
d. correct understanding of symptoms.
e. lack of comfort from a family member creates very high and difficult to manage stress conditions in the patient.

Furthermore, patients generally come from more or less long periods in which they have shared spaces with hundreds of other people.

3. Areas covered by the study

First, the different areas to be sampled were divided into **homogeneous areas for risk category**, as described in the VTT's report. Below is a description of the different areas and the risks associated with them.

- **L - 1 Main Entrance**
- **L - 1 Registering Station**

These areas represent particularly critical areas. In fact, the patients transported by ambulance arrive here. The nursing staff and the acceptance staff carry out checks the triage and collect the patient's data.

In this place any accompanying persons will stay and through it you will access the shelter areas reserved for recovery room.

Type of risk:

a) **Transmission by direct contact** involves a direct contact from person to person and a physical transfer of microorganisms by the infected or colonized individual to a susceptible host. (clinical management of the patient, first clinical assessment)
High

b) **Transmission by indirect contact** involves a contact of a nurse or doctor susceptible to a vehicle, a contaminated carrier that does as an intermediary. (body fluids, syringe, other tools)
Low

c) **By droplet:** the infected subject during coughing, phonation, sneezing, generates aerosols containing pathogenic microorganisms that they are expelled at short distances, 1-2 meters.
Medium

- **L -3 First Aid Station**

This is the area with the greatest microbiological risk. Contact with microorganisms can occur in different ways:

Type of risk:

a) **Transmission by direct contact** involves a direct contact from person to person and a physical transfer of microorganisms by the infected or colonized individual to a susceptible host. (clinical management of the patient, first clinical assessment)
Very High

b) **Transmission by indirect contact** involves a contact of a nurse or doctor susceptible to a vehicle, a contaminated carrier that does as an intermediary. (body fluids, syringe, other tools)
Very High

c) **By droplet:** the infected subject during coughing, phonation, sneezing, generates aerosols containing pathogenic microorganisms that they are expelled at short distances, 1-2 meters.
Very High

- **L - 9 Recovery room**

  Type of risk:

  a) **Transmission by direct contact**, involves a direct contact from person to person and a physical transfer of microorganisms by the infected or colonized

individual to a susceptible host. (clinical management of the patient, first clinical assessment)
High

b) **Transmission by indirect contact**, involves a contact of a nurse or doctor susceptible to a vehicle, a contaminated carrier that does as an intermediary. (body fluids, syringe, other tools)
Medium/ High

c) **By droplet:** the infected subject during coughing, phonation, sneezing, generates aerosols containing pathogenic microorganisms that they are expelled at short distances, 1-2 meters.
Level Low/medium

- **L - 4 Reporting room**

  Type of risk:

  a) **Transmission by direct contact**, involves a direct contact from person to person and a physical transfer of microorganisms by the infected or colonized individual to a susceptible host. (clinical management of the patient, first clinical assessment)
  Very High

  b) **Transmission by indirect contact**, involves a contact of a nurse or doctor susceptible to a vehicle, a contaminated carrier that does as an intermediary. (body fluids, syringe, other tools)
  Very High

  c) **By droplet,** the infected subject during coughing, phonation, sneezing, generates aerosols containing pathogenic microorganisms that they are expelled at short distances, 1-2 meters.
  Very High

- **L - 22 Doctors' room**

  Type of risk:

  a) **Transmission by direct contact**, involves a direct contact from person to person and a physical transfer of microorganisms by the infected or colonized individual to a susceptible host. (clinical management of the patient, first clinical assessment)
  Very Low

  b) **Transmission by indirect contact**, involves a contact of a nurse or doctor susceptible to a vehicle, a contaminated carrier that does as an intermediary. (body fluids, syringe, other tools)
  Very Low

c) **By droplet,** the infected subject during coughing, phonation, sneezing, generates aerosols containing pathogenic microorganisms that they are expelled at short distances, 1-2 meters.
Very Low

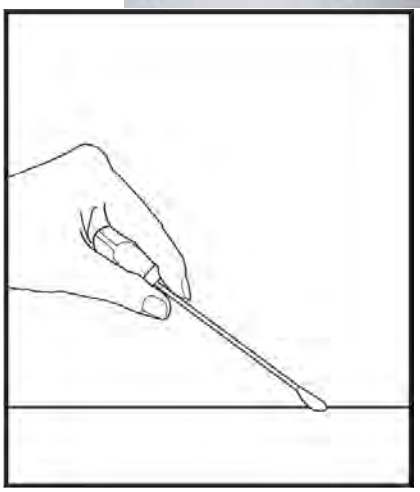
4. Material and methods

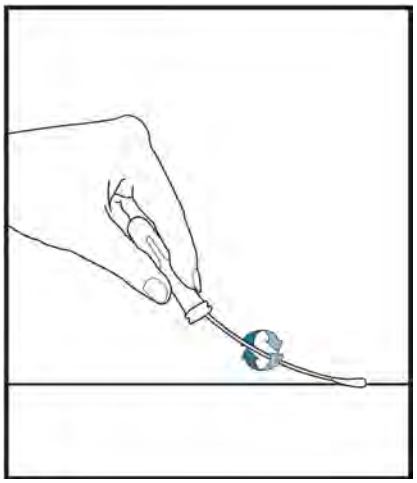
Microbiologic sampling of air, water, and inanimate surfaces (environmental sampling) is complicated by many variables in protocol, analysis, and interpretation. Well-designed and controlled experimental methods and approaches can provide the information about the spread of the bacteria population.

First of all, the surfaces subject to sampling in the different areas were identified, preferentially choosing the ones that are more suitable, because they are used more frequently or by a high number of living beings. In the studied places, the humidity and the total number of accesses of living beings, the cleaning routine, were monitored. Because surfaces' contamination can be caused by both deposition of suspended bio-aerosol and contact with contaminated humans and media, the samples have to be collected with nylon swabs moistened by dipping them in sterile saltwater. Always were used, a 10x10cm disposable sterile mask to make sure that the sampling space was always the same.

All samples were carried out by a specialized technician Dott. Vincenza Cafaro (Biologist Tor Vergata University Rome) in the presence of Engineer Marco Braccini (ADR) and Dott. Rosario Valles CSO Nextsense.

The technician responsible for the samples always wore a clean medical gown and sterile gloves.





The areas were swiped 20 times back and forth from left to right and back, 20 times from up to down, 20 times diagonally, 20 times diagonally.

The following factors was considered before engaging in environmental-surface sampling:

1. **Location of surfaces** to be sampled;
2. **Method of sample collection** and appropriate equipment for this task;
3. **Number of replicate samples needed**, and which control or comparison samples are required;
4. **Parameters of the sample assay method** and whether the sampling will be qualitative, quantitative, or both;
5. **Some anticipation** of a corrective action plan.

Microbes from the swabs were diluted to 4 ml of saltwater containing peptone before traditional culturing on Plate Count agar plates (PCA) and Chromocult Coliform agar plates. Pour plate technique was used for determination of total bacteria on PCA in order to get detection limit 4 CFU (colony forming units)/100 cm2. Coliforms were cultured using spreading technique on Chromocult agar plates with detection limit 40 CFU/100 cm2. Incubation was performed for PCA-plates at 30°C for 3 d and for Chromocult plates at 37°C for 2 d. After incubation period colonies were counted from the agar plates

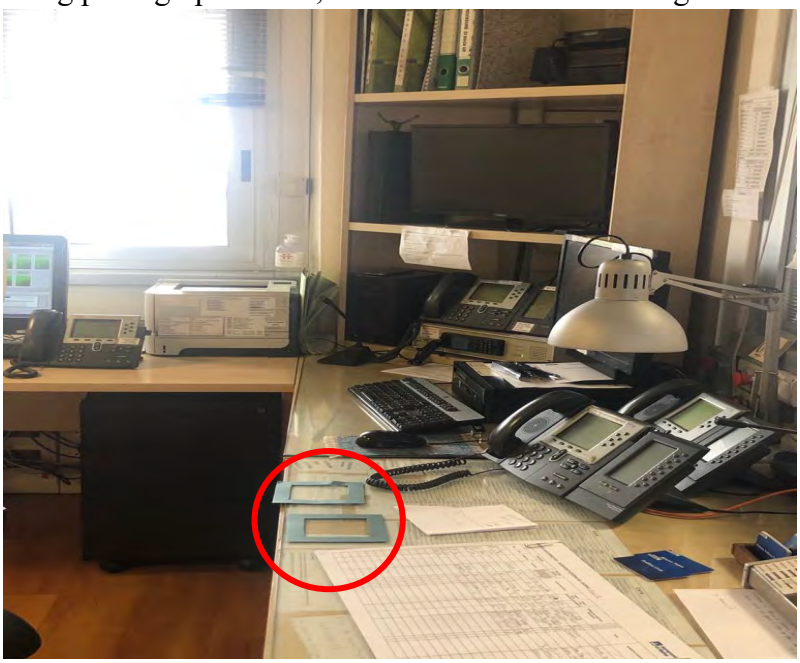
5. Reading keys to interpret the final results

As shown by the report provided by VTT, the overall sanitation levels have been significantly improved in all the areas under investigation, with a noteworthy change before and after the installation of the devices incorporating the Biovitae® technology.

However, there was two spots where the results show a bucking trend. In the following paragraph we are going to deepen and how we correct this trend through corrective action plan.

1. L1 Registering Station: desk.

As the following photograph shows, the desk holds a reflective glass.



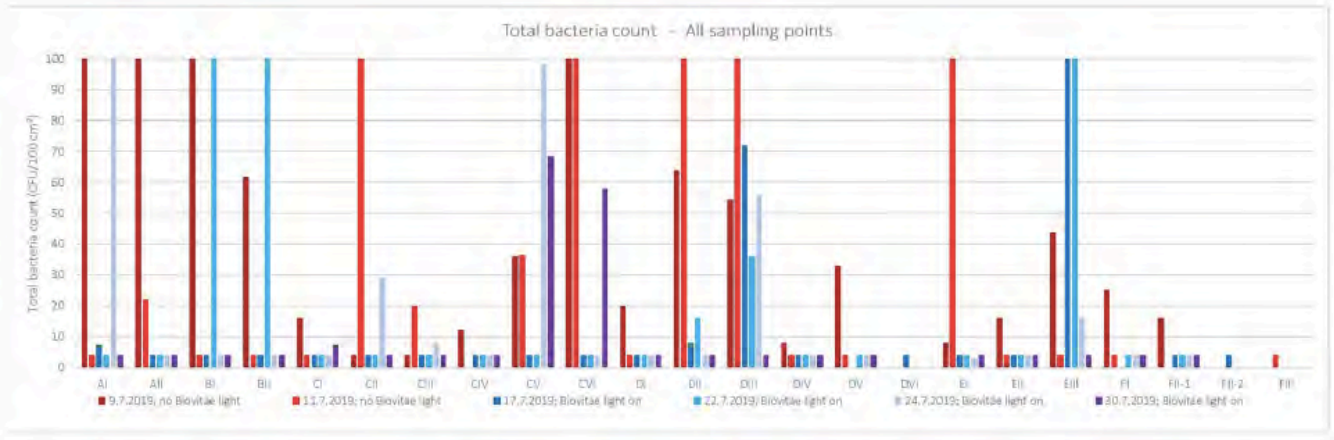
The two green masks identified the B1 and B2 collection spots on the staff's desk, chosen because they were in a very critical point, where operators' hands were kept most of the time, as well as in proximity of the phone which is a main source of droplets.

Due to the reflective surface and because of the inward daylight coming from the front door access, after the installation of the Biovitae® devices we were informed that the staff was keeping them non-operational for most of their working hours, introducing an important disruption of the sanitizing process for that area.

Thus, at the first opportunity made available from the ADR technical director, on the 22nd July 2019, we moved the installed devices in a more favorable position for the staff.

The refit coincided with the day when the samples had to be collected, and the episode, as you can see from the histogram of the total bacterial count, altered the expected outcome.

However, in the following days, when the devices were kept normally operational, we could witness that the increase in the bacterial count that resulted from having the Biovitae® devices switched off was promptly corrected. And despite the incident, it offered a great opportunity to verify the effectiveness of the devices also following a non-constant operating pattern.



It is relevant to have the knowledge that if we exclude from the data collection all samplings gathered on the 22nd July 2019, that is after the disruption period, the outcomes befit the average values measured in the previously collected specimens, thus returning to good hygiene levels that require a bacterial count below 4 CFU/100 cm^2.

2. L4 reporting room: the Sphygmomanometer.

The sphygmomanometer is one of the most used tools when it is necessary to evaluate the general health conditions of an individual. In this case the device is used in the available emergency rooms, by both the medical and the paramedical staff.

The study related to the sphygmomanometer shows how the number of people who attend an environment is relevant to the growth of the bacterial count on it.

During the sampling process, the number of accesses has been as follows:

Pre Biovitae® installation

- **07th July 2019**: 16 patients, 9 medical and paramedical staff;
- **11th July 2019**: 20 patients,7 medical and paramedical staff

Post Biovitae® installation

- **17th July 2019**: 36 patients, 12 medical and paramedical staff;
- **22nd July 2019**: 33 patients, 9 medical and paramedical staff;
- **24th July 2019**: 30 patients, 14 medical and paramedical staff;
- **30th July 2019:** 26 patients, 9 medical and paramedical staff.

From the data collected during the sampling process, clearly, every upturn in the number of accesses from patients and medical staff led to a noticeable higher proliferation in the bacterial count on the sphygmomanometer.

As shown in the VTT "*Total bacteria count*" table, in the samples collected during the 17th July 2019 and the 22nd July 2019 the total microbial count shows a bucking trend in respect of the one verified before that the Biovitae® devices were installed.

Also, as can clearly be seen from the photo below, the sphygmomanometer is housed in a metal box and the samples were taken on the upper surface of the box, inside the area identified by the green mask.

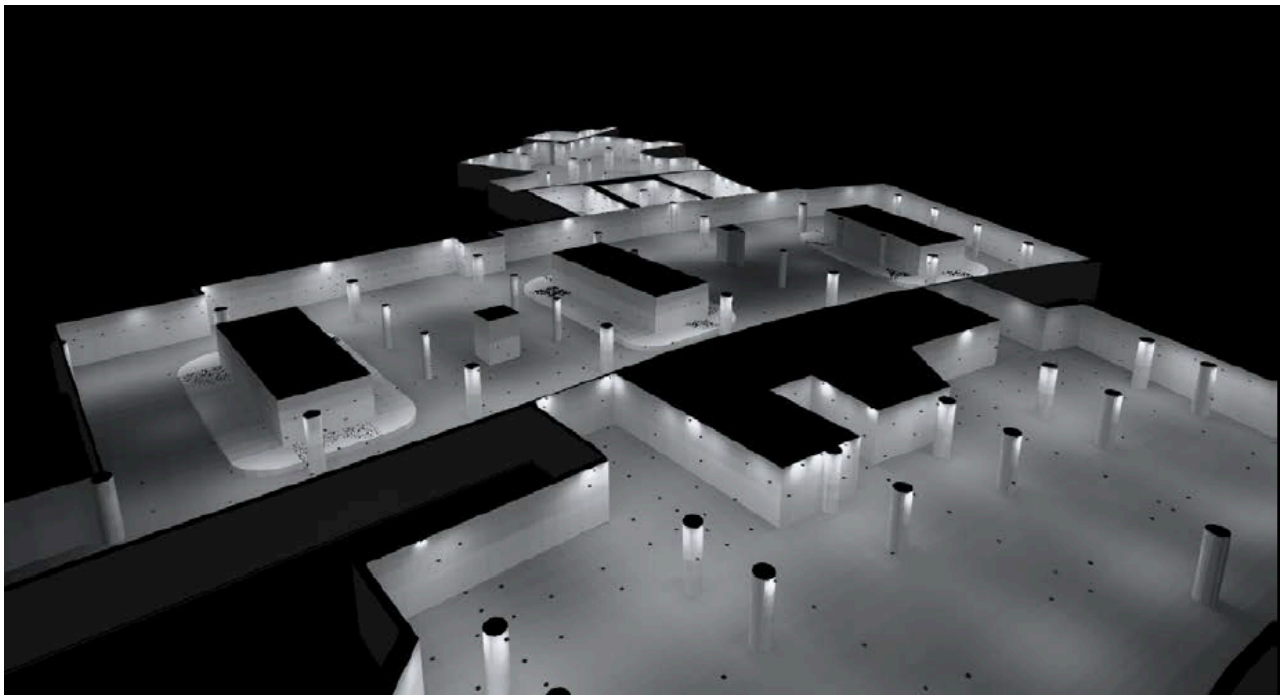
Because the sphygmomanometer was placed under a metal shelf holding the ECG, it prevented the light from reaching the area subject to sampling.

We therefore asked to the ADR staff to introduce a corrective action, by placing the device in a position where the light could reach its surface. Hence, according to the corrective action plan, the bacterial count from this point onward shows to have reached the expected good hygiene levels, although the number of patients and medical staff was much higher in those days, and although the number of accesses to the emergency room by patients and medical nursing staff had almost doubled.

Rosario Valles, MD, PhD
Nextsense CSO (Chief Science Officer)

Technical report of the field study conducted in the emergency rooms of the Leonardo da Vinci (Fiumicino) Airport for assessing the microbicidal effect of the Biovitae® lighting devices

by Carmelo R. Cartiere, MSc (Oxon), MBCS



The Lighting Project

It is well known that lighting systems, overall, contribute to the health and safety of people within their workplace; both because: **a)** visual sharpness contributes to a more relaxed workplace and, **b)** the easier it is to see a hazard, the quicker it is to evaluate the possible risks involved and to avoid them.

And the type of hazards that a workplace is presented with, shall establish the minimum lighting requirements for the safe conduction of all operations within.

The laws that regulate the management of health and safety of all processes conducted within a workplace require that employers put in place adequate measures, including lighting system that meet the particular tasks involved (e.g., general tasks or precision tasks).

Therefore, in our project – where we identified six areas to be monitored and where the BIOVITAE® lighting devices were installed – according to the Health and Safety regulations issued by ICNIRP (International Commission on Non-Ionizing Radiation) the microbicidal systems had to be positioned in a way to never fall under the minimum lighting values required by law.

For each room a measurement was therefore conducted using a PCE-174 data logger light meter (an instrument suitable to analyze led lights) in order to assess the lighting levels produced by the BIOVITAE® devices, so that the radiative power needed to set-off the microbicidal effect could be obtained within the light emission levels deemed acceptable.

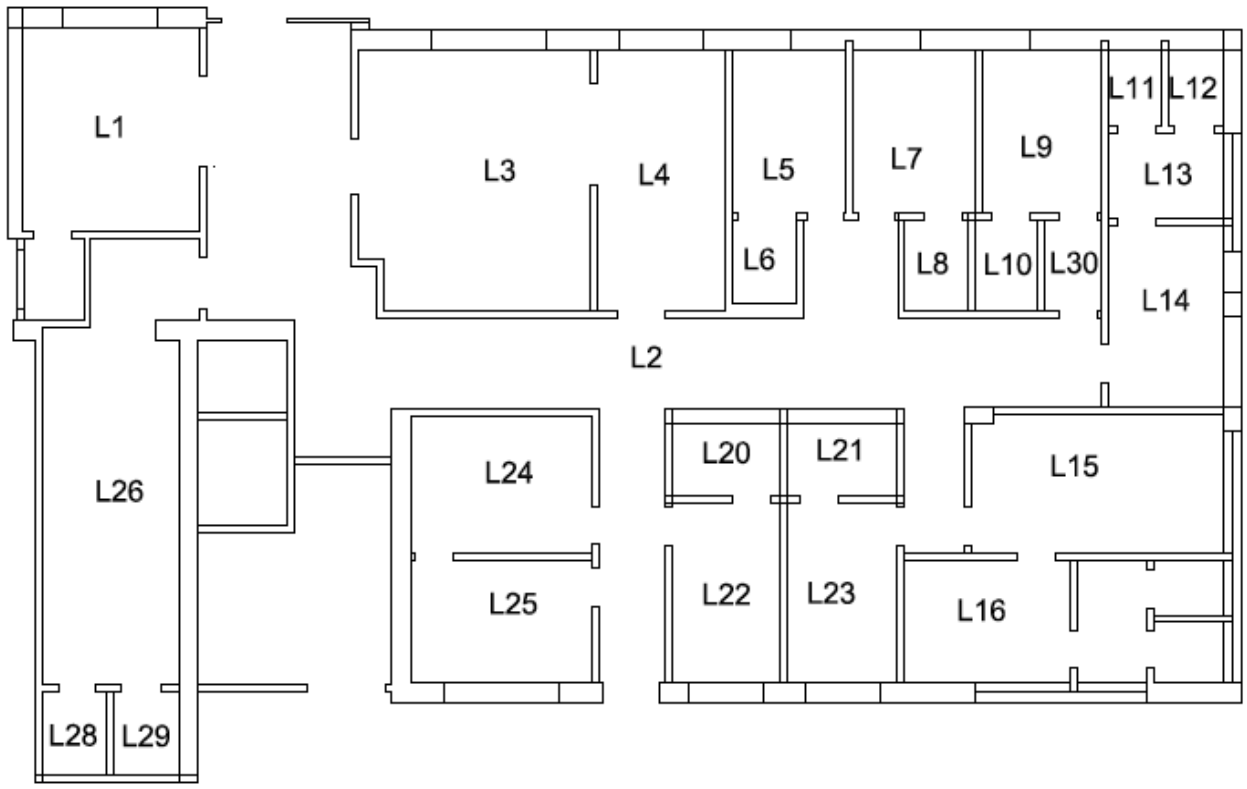


Fig.1 - Planimetry of the Fiumicino Airport First Aid.

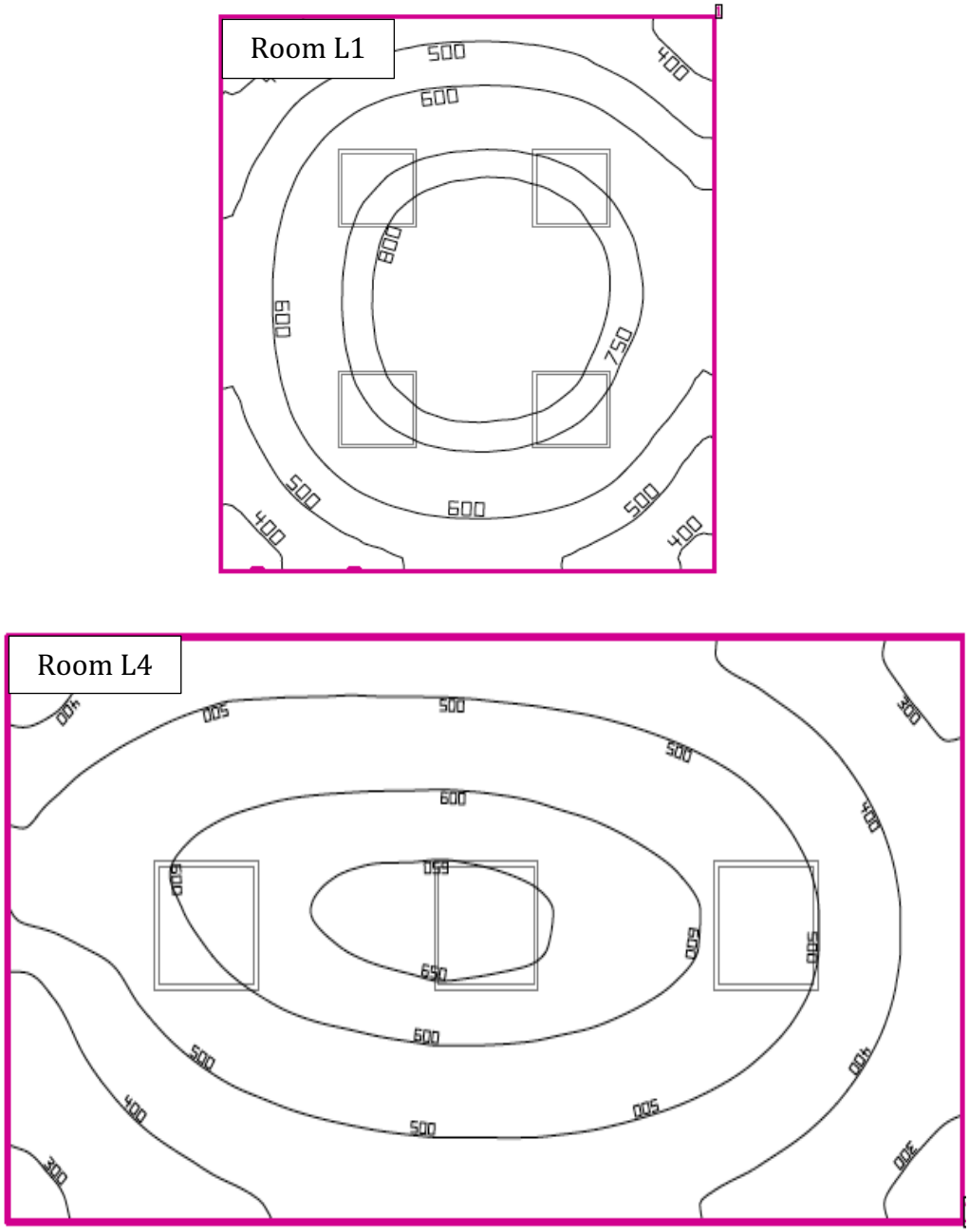


Fig. 2 – Example of the calculated minimum illuminance levels, as required by regulation, for rooms L1 and L4.

Description of the areas covered by the present study

Main Entrance and Registering Station (L1)

The main entrance is an area accessible from the front space through an automated sliding glass door. It is the first area you come across when accessing the Hospital, and it is where patients are recorded from the staff. The patients, the ambulance crew that responded to the emergency call, and any accompanying person must stop here. And only patients and crew are thereafter allowed to proceed further.

The registering station is where the staff records the patients' personal data before letting them into the first-aid station, with the aid of the ambulance crew. There is a glass windows that separates the registering station from the main entrance.

First aid Station (L3)

In this room patients receive their first clinical evaluation, and it can also be used for administering minor surgical emergencies. Inside the room there is a medical couch for all medical assessments when the patient is awake and cooperative, as well as the doctor's desk.

Reporting room (L4)

This room communicates directly with the first-aid station **(L3)** through a door. It hosts the devices for monitoring the most common vital functions (e.g. sphygmomanometer, ECG, etc..) and the PC that is used by the medical and nursing staff to record the medical therapies administered to patients.

Patient's recovery room (L9)

Patients are accommodated in this room. After stabilized, they remain under observation for a maximum of 48 hours. In this room, it is allowed the presence of a person accompanying the patient.

Doctors' room (L22)

This room is for exclusive use of the medical staff. Doctors use it both for resting and for consuming meals.

Room description	Room ID	Site	Installation height (m) [1]
Main entrance	L1	Shelf	1.64
Registering station		Desk	1.97
First aid station	L3	Doctor's desk (external)	1.99
		Doctor's desk (internal)	1.99
		Examination bed	1.95
Reporting room	L4	PC keyboard	1.96
		PC monitor	1.96
		Sphygmomanometer	1.96
Patients' recovery room	L9	Patient's bed side table	1.69
		Patient's bed overhead handle	1.39
		Patient's bed rails	1.79
Doctors' room	L22	Doctor's desk	1.96

Fig.3a - List of the surfaces from where all microbiological samples were collected.

NOTE:

[1] The distance of the sampling site from the floor to the ceiling, measured by the means of a laser meter.

Room description	Samples label	Collection point
Main entrance	A1 A2	Shelf
Registering station	B1 B2	Desk
First aid station	C1 C2	Doctor's desk (external side)
	C3 C4	Doctor's desk (internal side)
	C5 C6	Examination bed
Reporting room	E1	PC keyboard
	E2	PC monitor
	E3	Sphygmomanometer
Patients' recovery room	D1 D2	Patient's bed side table
	D3	Patient's bed overhead handle
	D4 D5	Patient's bed rails
Doctors' room	F1 F2	Doctor's desk

Fig.3b - List of the surfaces from where all microbiological samples were collected.

Basic calculated values related to the installed lighting devices

Room description	Luminous flux (lm) (1)	Peak illuminance level (lx) (2)	Average daily operating time	Total dose (J cm-2) (3)
Main entrance and Registering station	5541	1010.26 @ 1.81 m	1h 15m	5.48 (0.1566 J cm-2 @ 35.00 h)
First aid station	5541	852.82 @ 1.97 m	23h 29m	63.05 (0.0959 J cm-2 @ 657.50 h)
Reporting room	5541	861.54 @ 1.96 m	17h 37m	84.26 (0.1709 J cm-2 @ 493.05 h)
Patients' recovery room	5541	1261.13 @ 1.62 m	16h 08m	133.76 (0.2961 J cm-2 @ 451.75 h)
Doctors' room	5541	861.54 @ 1.96 m	17h 37m	142.98 (0.29 J cm-2 @ 493.05 h)

NOTE:

(1) The luminous flux is referred to each device installed.

(2) The peak illuminance levels are referred to all the installed Biovitae® devices in each room, with respect to the mean heights of the installations.

(3) The total dose has been calculated as a mean value in respect of the total operating time registered for all devices installed in each room during the 28 days period of the field study, included any disruption period.

NEXTSENSE SRL

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