

Building temporary and field hospitals at home: our response to cope with the surge of COVID-19 patients

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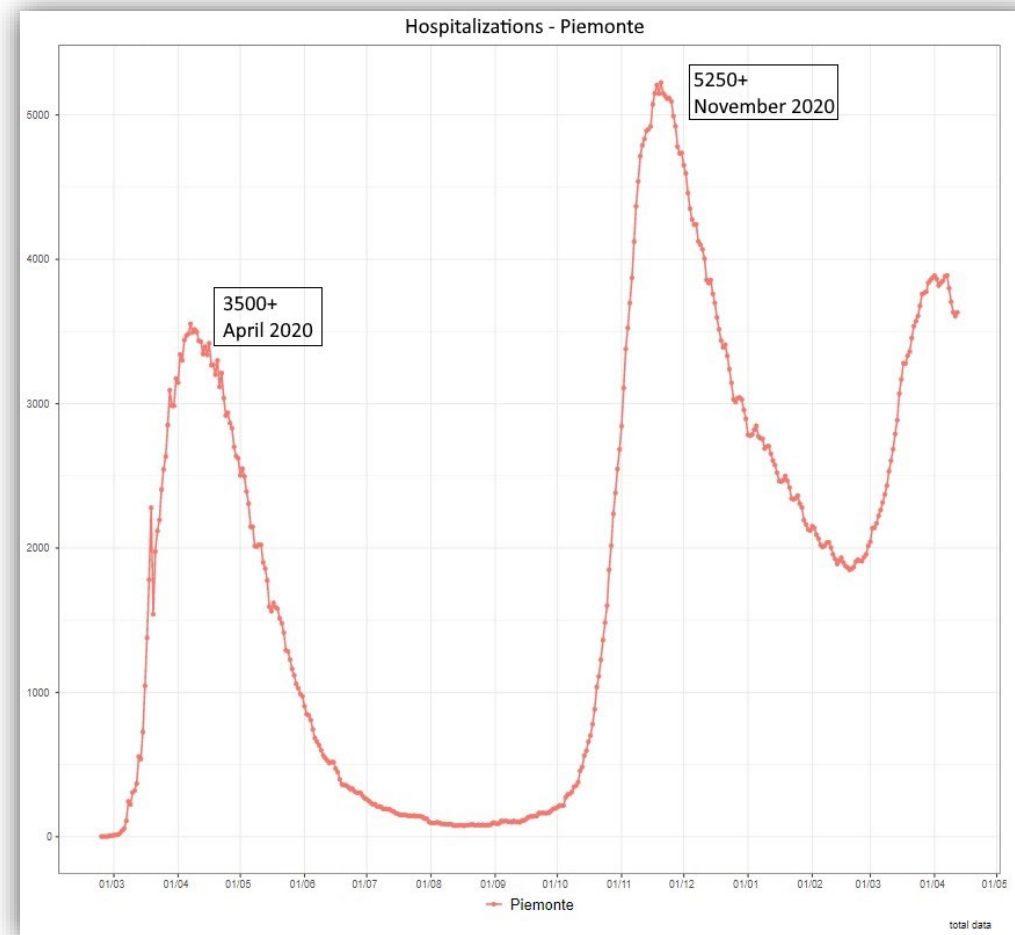
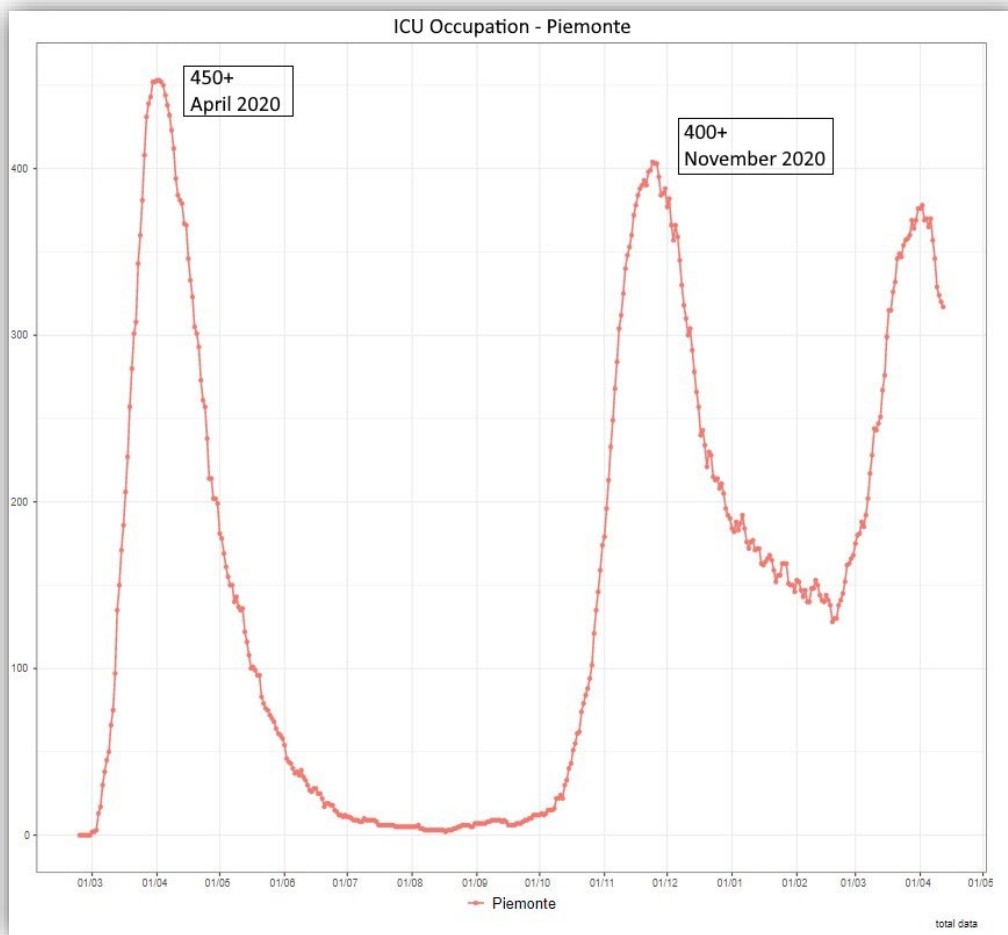
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- Two different local deployments
 - April 2020, **OGR Temporary Hospital**
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Context of the response: the surge of COVID-19 patients

PIEDMONT SITUATION (1)



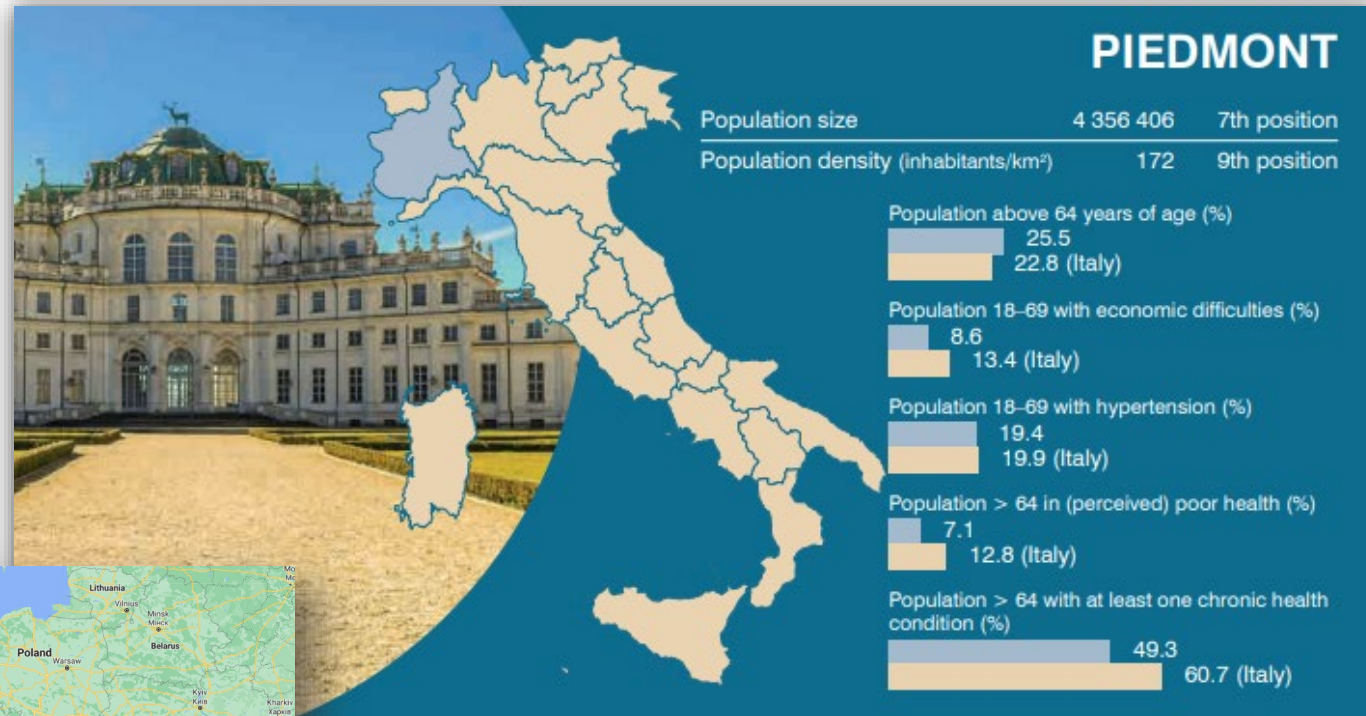
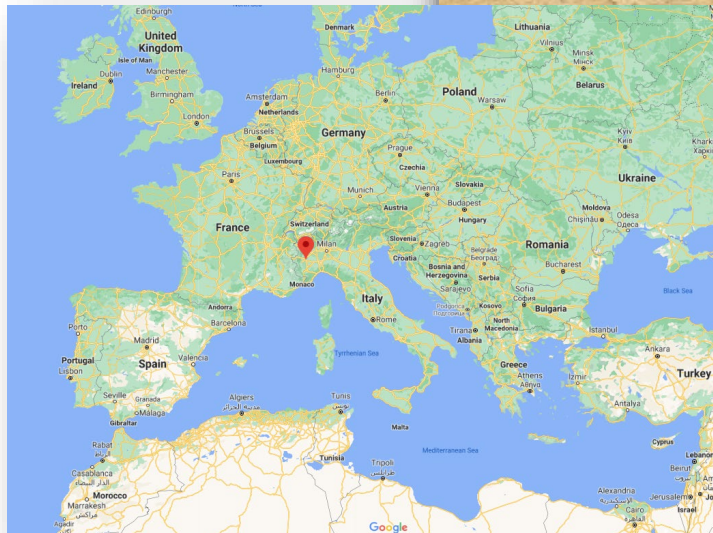
➤ April 2020, **OGR Temporary Hospital**

➤ November 2020, **Valentino Urban Field Hospital**

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Context of the response: the surge of COVID-19 patients

PIEDMONT SITUATION (2)



Turin

- Main city of Regione Piemonte
- High income country
- People used to high standard hospitals

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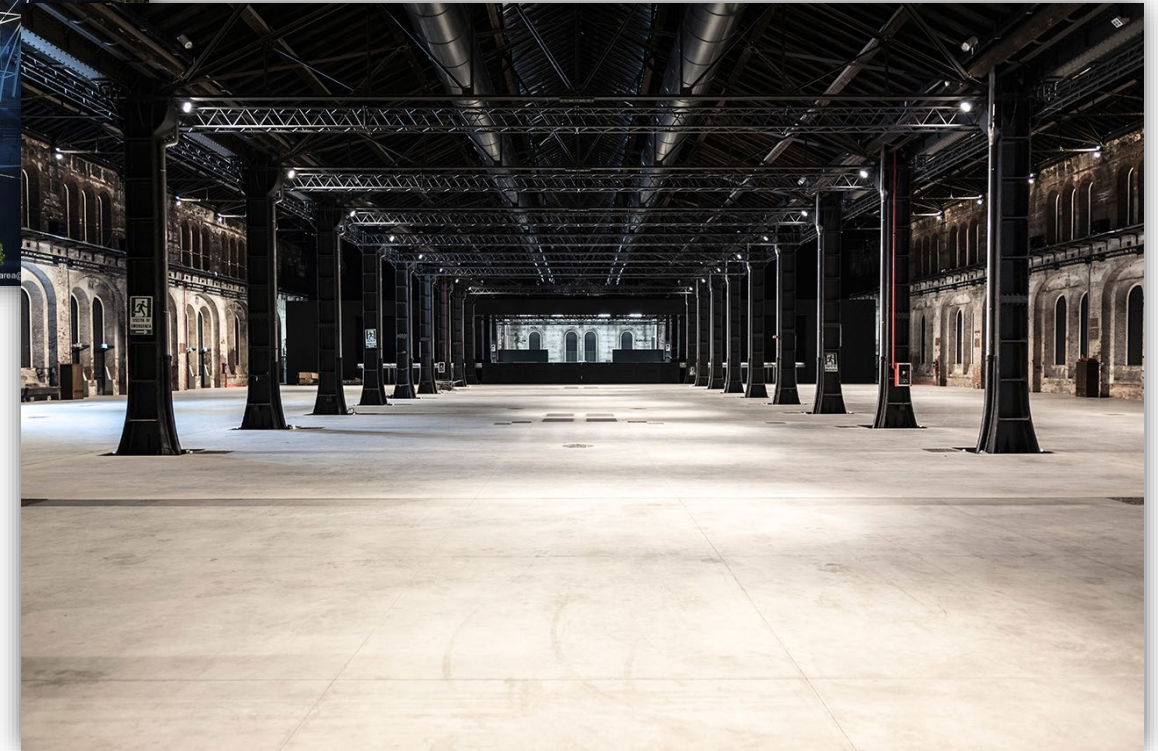
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OGR Temporary Hospital

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OGR Temporary Hospital – The SITE



Building temporary and field hospitals at home: our response to cope with the surge of COVID-19 patients

OGR Temporary Hospital – The CAPACITY



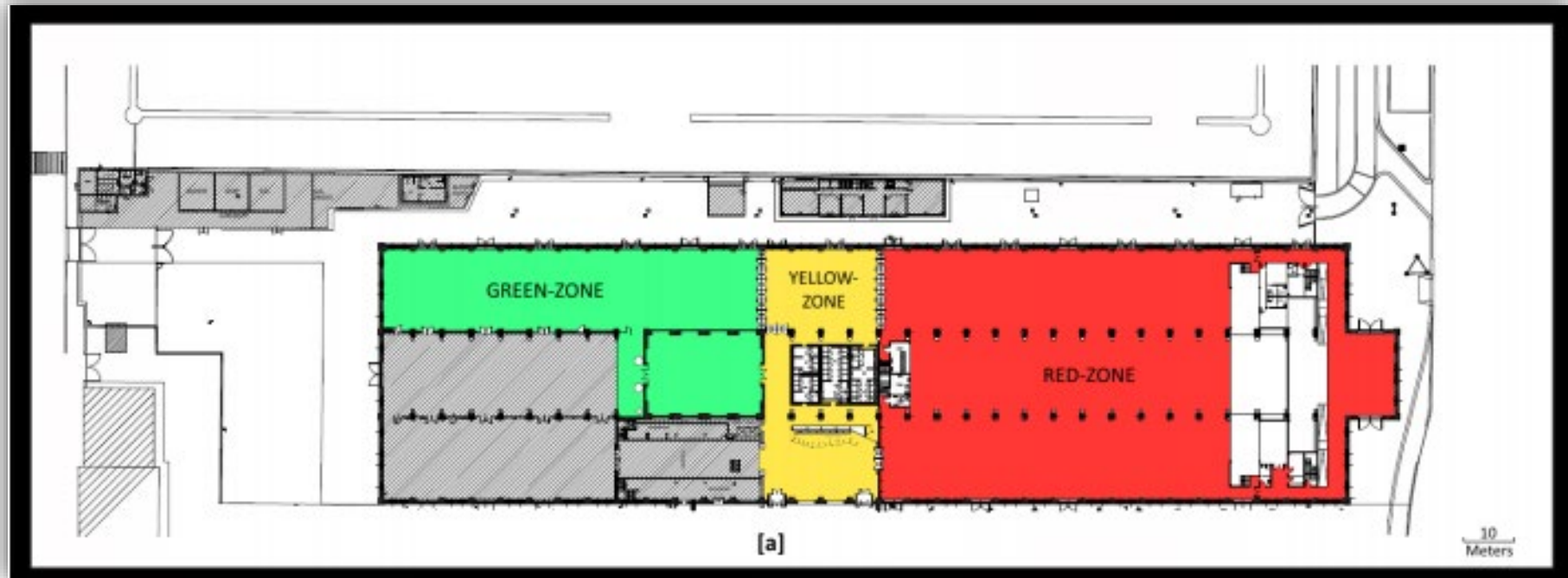
- COVID+ facility for **mild and moderate patients** with scalability in case of worse scenarios
- **90 beds total**



- Services: **infectious disease wards, laboratory, imaging** (X-Ray, ultrasound), emergency stabilization and referral (**ICU**)

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OGR Temporary Hospital – The LAYOUT (1)



The site was divided into the 3 main areas:

- **RED-ZONE**, a contaminated area in which patients are admitted and personnel can enter only wearing adequate personal protective equipment (PPE)
- **YELLOW-ZONE**, a semi-clean area where the health workers put on the PPE
- **GREEN-ZONE**, a clean area in which personnel can work as usual, without PPE and in which there is a clean warehouse for expensive material that is safer to not keep in the red-zone, such as drugs or backup devices

OGR Temporary Hospital – The LAYOUT (2)

- **86 beds** organized in 11 “rooms” containing 6 or 8 beds each, designed to assure different levels of care
- 1 “room” and 1 shelter containing 2 beds each for emergency stabilization (ICU)
- 2 main aisles
- the separating **walls of “rooms” were designed 1.5 m tall**: the idea was to assure both privacy and reduction of personnel needed to take care patients.



4 ICU beds

30 Sub-intensive
beds

56 ward beds

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OGR Temporary Hospital – INFECTION RISK CONSIDERATIONS (1)

All the ways to enter in and to exit from the red-zone for personnel, patients, and materials were protected by **passages (filter areas)**; each of these passages was designed as a small room closed with a ceiling, provided with 1 window to see inside before entering and with a swing door in the side closest to the red-zone.



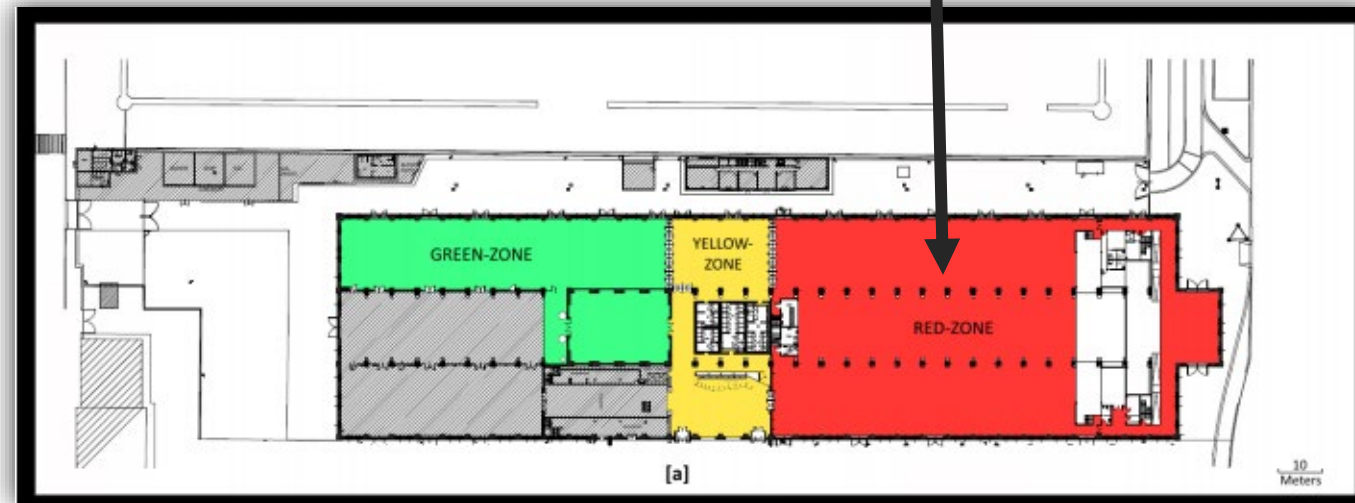
PPE

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OGR Temporary Hospital – INFECTION RISK CONSIDERATIONS (2)

- A fundamental strong point that the site demonstrated, especially in case of an infectious emergency such as the COVID-19 pandemic, was the presence of **two separated air treatment units**.
- This allowed to have **a light difference of pressure between** the area identified as where COVID-19 patients will be admitted (red-zone) and the area identified to allocate materials and to carry out activities not directly connected to patients (yellow and green-zones).

Negative Air Pressure with respect to adjacent areas



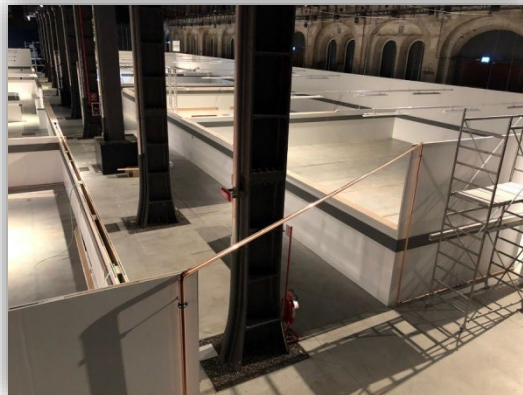
OGR Temporary Hospital – The PERSONNEL

- **Disaster Medicine Service 118** involved in the building, set up and project management phase
- The Turin local hospitals staff served as the leading clinical team (anesthesiologists, emergency doctors, nurses, etc). In addition to these personnel, a team of **37 health care professionals came from Cuba** to help Piedmont face the COVID-19 pandemic.
- Working on shifts of **max 4-6 hours in the red-zone**
- **Specialists** on call (X-ray and laboratory technicians for example)
- **Training:**
 - people from different countries, different experiences and different training programs
 - unique setting
 - PPE and staff behavior in infection prevention control



OGR Temporary Hospital – The OXYGEN SUPPLY

- **PSA** (pressure swing adsorption) **oxygen production plant**
- **Oxygen 93%**
- **60 m³/hour** → Oxygen supply also in case of **100 severe patients** (100 patients, 10 l/min)
- **Copper pipeline** to distribute oxygen to the bed-side
- Totally **self-sufficient** (no external supply chain mechanism)
- **No risks** associated with higher pressures



OGR Temporary Hospital – TIMELAPSE



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Valentino Urban Field Hospital

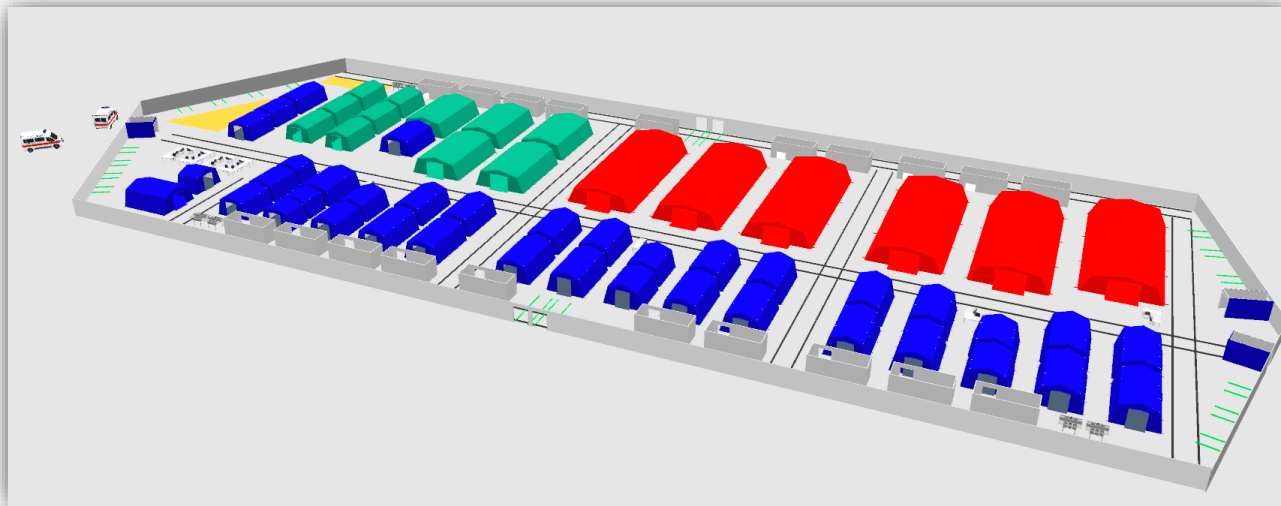
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Valentino Urban Field Hospital – The SITE

- An **underground parking** of about **8000 sqm** in the city of Turin
 - **Just 3 minutes** by car from the ER of the main hospital of the city
- The **advantages** of the site were multiple:
- a large free covered area
 - easily accessible
 - really close to a real hospital.



- The **challenges**:
- absence of heating and air treatment systems
 - presence of totally inadequate electrical and water systems
 - building phase had to be as quickly as possible



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Valentino Urban Field Hospital – The CAPACITY



- COVID+ facility for **mild patients** with scalability in case of worse scenarios
- **455 beds** in 55 tents of different types



- Services: **infectious disease wards, laboratory, imaging** (X-Ray, ultrasound), emergency stabilization and referral (**ICU**)

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Valentino Urban Field Hospital – The LAYOUT

- All the parking area was converted into a huge **red-zone**, in which patients were admitted and personnel had to wear adequate Personal Protective Equipment (PPEs)
- 3 of 4 tunnels, originally dedicated to the evacuation of people in case of fire became **green-zones** (dressing rooms for men and for women, warehouse to stock material)
- The remaining tunnel was **the dirty line reserved to exit material** (linen and clothes to be sanitized, waste, bodies, etc).



Valentino Urban Field Hospital – INFECTION RISK CONSIDERATIONS

- All the ways to enter in and to exit from the red-zone for personnel, patients and clean materials were protected **by passages (filter areas) to ensure the adequate separation between contaminated and not-contaminated areas**



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Valentino Urban Field Hospital – The PERSONNEL

- **Disaster Medicine Service 118** involved in the building, set up and project management phase
- The main hospital of the city recruited **emergency doctors, nurses and care givers.** Low intensity hospital → **residents and young professionals** worked syde by syde with experienced ones.
- Permanent nursing presence (**nurse/patient ratio: 1/30**)
- Working on shifts of **max 4-6 hours in the red-zone**
- **Specialists** on call (X-ray and laboratory technicians for example)
- **Training:**
 - unique setting
 - guidance in Disaster Medicine: working in a field hospital
 - PPE and staff behavior in infection prevention control



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Valentino Urban Field Hospital – The OXYGEN SUPPLY

- **Liquid oxygen plant** (tank of **14.000 l**), refilled periodically by a truck from a supplier
- Cryogenically produced off-site, not at the field hospital site
- **Oxygen system for > 80% beds**
- Low flow rates (**< 6 l/min**) with possibility of high-flows for the ICU and sub-intensive beds

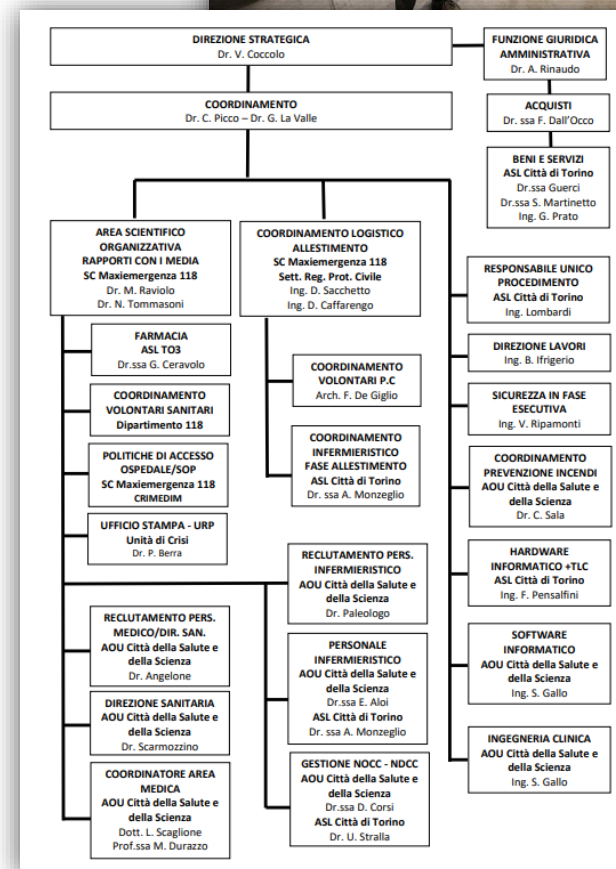


- **Copper pipeline** to distribute oxygen to the bed-side
→ necessity to create **customed structure to secure pipeline inside the tents**

Good Practices for future (1)

PROJECT MANAGEMENT and COORDINATION

- Really short time:
 - OGR Temporary Hospital → **16 days**
 - Valentino Field Hospital → **11 days**
- Multiple actors involved:
 - **logistics people**
 - people in charge for the **purchase of material, medical devices, drugs and consumables**
 - Authorities such as **policemen or firefighters** involved to evaluate the change intended use of the site
 - **staff** (health workers and logistics people) working in a new, different type of hospital, needing training during the preparation stage
- Pills:
 - **Clear timeline**
 - Defined **chain of command/roles' organogram**
 - **Team working attitude**



Good Practices for future (2)

LOGISTIC HINTS

- **Site choice**
 - Dimension and cover of the possible sites
 - Heating, WASH and electricity system state of art
 - Main hospitals proximity
 - Free of fees availability
 - Availability of adequate space for personnel
- **Oxygen supply**
 - Oxygen needs estimation
 - Systems availability
 - Safety and security prescriptions of the site
 - Accessibility of the site
 - Availability of power supply
- **Staff**
 - Estimate of personnel needed
 - Training

Good Practices for future (3) RESEARCH LITERATURE and GUIDELINES

- Continuous updating
- Sharing experiences

Disaster Medicine and Public Health Preparedness

www.cambridge.org/dmp

Report from the Field

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COVID-19 Surge Capacity Solutions: Our Experience of Converting a Concert Hall into a Temporary Hospital for Mild and Moderate COVID-19 Patients

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Abstract

The 2019 coronavirus disease (COVID-19) pandemic has stressed the health care system in Italy as well as around the world, with hospitals implementing their surge capacity to increase the number of available beds for patients positive to the virus. At the end of March, the Piemonte (Northern Italy) Government decided to build a temporary rapid-assembly emergency hospital for the treatment of mild and moderate COVID-19 patients, converting an existing concert hall in the city of Turin. The decision was prompted not only by the urgent need of hospital beds, but also by a forward-looking approach for the months immediately after the emergency, when it will be essential for conventional hospitals to return to a normal configuration. This paper documents the temporary hospital project, describing the site, the layout and the equipment, the ideas behind structural choices and the staff involved. The aim of the work is to share the experience of the work for professional-

March 2020

Severe Acute Respiratory Infections Treatment Centres

Practical manual to set up and manage a SARI treatment centre and a SARI screening facility in health care facilities

World Health Organization

Oxygen sources and distribution for COVID-19 treatment centres

Interim guidance
4 April 2020

World Health Organization

Background

This is interim guidance on oxygen sources and distribution strategies for COVID-19 treatment. It has been adapted from WHO and UNICEF's technical specifications and guidance for oxygen therapy devices, which is part of the WHO medical device technical series,¹ and is based on current knowledge of the situation in China and other countries where cases have been identified.

This guidance is intended for health facility administrators, clinical decision-makers, procurement officers, planning officers, biomedical engineers, infrastructure engineers and policy-makers. It describes how to: quantify oxygen demand, to identify oxygen sources that are available, and select appropriate surge sources to best respond to COVID-19 patients' needs, especially in low-and-middle income countries. WHO will update these recommendations as new information becomes available.

COVID-19 and oxygen

Data from China suggests that although the majority of people with COVID-19 have mild illness (40%) or moderate illness (40%); about 15 % of them have severe illness requiring oxygen therapy, and 5% will be critically ill requiring intensive care unit treatment. In addition, most critically ill COVID-19 patients will require mechanical

considerably and can even support the combustion of materials that normally do not burn.

- Do not go near any open flames when using oxygen – Do not smoke near to oxygen sources!

Oxygen sources

Oxygen therapy or supplemental oxygen is the provision of medical oxygen as a health-care intervention. Medical oxygen contains at least 82% pure oxygen, is free from any contamination and is generated by an oil-free compressor. **Only high quality, medical-grade oxygen should be given to patients.**

Oxygen systems must consist of an oxygen source, or production combined with storage. Common oxygen sources are: oxygen generating plants and liquid oxygen in bulk storage tanks, and oxygen concentrators. The most common source of oxygen storage used in health-care settings is a cylinder.

The appropriate choice of oxygen source depends on many factors, including: the amount of oxygen needed at the treatment centre; the available infrastructure, cost, capacity and supply chain for local production of medicinal gases; the reliability of electrical supply; and access to maintenance services and spare parts, etc. Details about these different oxygen source options are provided in this guidance, and in

TAKE-HOME Message

EMT experience and DISASTER MEDICINE

- EMTs' skills: **flexibility**, “**thinking outside the box**”, **interoperability**
- In case of **unexpected events** or things going wrong, it is important **to find a way to go ahead** with the resources that you have, that is one of the main principles of the disaster medicine.



Thank you

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