

## Silent hypoxia and the use of pulse oximetry for COVID 19 patients in the pre-hospital setting

Lessons observed presented in NO FEAR WP4 webinar October 30<sup>th</sup> 2020

### A. Background:

1. Hypoxia – lack of Oxygen in the tissues (Hypoxemia – lack of Oxygen in the blood), is a life threatening condition
2. Direct measurement of the Oxygen requires a blood test (gases in the blood). An assessment of the oxygenated blood can be achieved using a technology called Pulse Oximetry (very sensitive to color)
3. As per WHO standards – a COVID patient with Pulse Ox of 94% and below is seriously sick
4. **As per the text book – Hypoxia is clinically manifested**
5. During COVID 19, a growing body of evidence on patients who don't feel very sick, and are apparently well in a preliminary evaluation, but have low O<sub>2</sub> saturation (some time as low as 80%). This Phenomena is called "**Silent Hypoxia**" (as there is very little clinical presentation of the Hypoxia), or "**Happy hypoxia**" (as the patients seems happy despite being hypoxic).

### B. Main issues observed:

1. Health Care Workers (HCW) must be familiarized with "silent hypoxia", as this is a potentially life threatening condition. Training must include the proper use of pulse oximetry.
2. Assessment of possible / confirmed cases requires modified skills that has to be created among responders (with the limitations of simulation in a social distancing environment, creating major challenges to those trainings).
3. While for some EMS Pulse Oximetry is considered as a basic vital sign to be obtained by BLS (Basic Life Support) personnel, this is not the case for all the services. (Introduced in the past, to support care for patients who need their saturation level within a certain range of parameters (as Acute Coronary Syndrome, Stroke, some trauma patients).
4. Though Pulse Oximetry is a simple and very useful technology, EMS personnel has to be well trained in its use, and possible pitfalls due to issues around the way the reading is obtained, issues with the device, external temperature, color of the finger nail etc.
5. Commercially available pulse oximeters, while being accessible to the general public as per their low price, does not always meet a good quality standard.
6. Though the limitations of pulse oximetry with regards the accuracy of the reading are well known they are mainly around the lower spectrum of readings, thus have little impact on the decision making (no real difference in the decision for a patient with Sat O<sub>2</sub> 84% and for the one with 78% in the pre hospital setting).
7. For patients suspected / confirmed as COVID 19 patients, Pulse Oximetry has proven as a very useful tool to assess the severity of patient's condition.
8. Pulse Oximetry (together with temperature measurement and report on sign and symptoms) has proven as very useful for long distance monitoring of patients staying at home, after an initial assessment and training by a physician (reducing the need for direct physician – patient contact).

9. Having patients equipped with pulse oximeters at home, increases the confidence of family members in their capacity to handle the situation and the sick person.
10. Having patients at home with pulse oximeters, provides health care providers with an important decision making tool for their treatment decisions.
11. Due to the difficulty to properly auscultate patients while wearing PPE, HCW rely more and more on pulse oximetry to assess patients. Saturation becomes a key parameter in the triage of suspected / confirmed COVID patients, and their categorization into the appropriate referral path.
12. Some patients have rather normal saturation while in rest. It is advised to ask to patient to engage in minimal effort (e.g. short walking around). Some patients present a dramatic drop in saturation following this minimal effort (a very important indicative sign for patients with "silent hypoxia").
13. More scientific research as needed:
  - 13.1 To better understand the pathophysiology of the syndrome (though there are some possible explanations, e.g. that since the onset of the hypoxia is gradual, the receptors "get used" thus does not activate "emergency respiratory response mechanisms" until a very late phase of the situation).
  - 13.2 Better understanding of the epidemiology of "silent hypoxia" (e.g. prevalence, reports it is more frequent in elderly patients).
  - 13.3 The relation between alteration in cardiac functions and respiratory functions has to be studied further, e.g. the origin of chest pain complaint of COVID patients (cardiac or hypoxic) (a study conducted by BioBeat, on 500 COVID patients, points out the alteration in cardiac function comes first).
14. New remote sensing (tele medicine) of several parameters, with wearable devices, allow for 24/7 safer monitoring of patients. These tools are also useful for the monitoring of the wellbeing of responders using PPE.
15. "Traditional tele medicine" (a video chat with the patient), with the patient might be misleading, as the patient may have minimal complaints and seems clinically rather well. Best practice: Self-monitoring of pulse oximetry by patients. These recommendations could be considered as recommendations for primary health care providers as well.
16. In order to have better decision making based on saturation, more index should be developed. The prehospital SpO<sub>2</sub>i/RRi ratio needs further investigation because it might help to identify non-clinically obvious ARFs (Acute respiratory Failure) and correlation with severity
17. COVID 19, highlighted that clinical decisions on the field with regards to the treatment given to a patient, are influenced by availability of resources in the health care chain. Besides the ethical implications, real time coordination mechanisms, tools and technology should be studied.
18. As high flow Oxygen therapy is considered of high risk for the HCW (potential spread of aerosol), new technologies for the pre-hospital setting, especially for the crowded back of an ambulance should be studied. High flow Oxygen therapy and other none-invasive ventilation, are key, as the prognosis of these patients is better than that of those mechanically ventilated. The risk to the HCW and the precautions taken should be taken into consideration while taking these decisions.

19. As the use of pulse oximetry at home is becoming more and more popular, along with 24/7 monitoring of other clinical parameters, data management tools and technologies will be needed, especially due to the cases of "false alarms" of cheap devices.