Do we really have a lack of ventilators?

Vladimír Nosál (✉ vnosal@gmail.com)

Clinic of Neurology, Jessenius Faculty of Medicine in Martin, Comenius University in Bratislava, Slovak republic <https://orcid.org/0000-0001-6044-8294>

Short Report

Keywords: COVID-19, pandemia, ventilators, epidemiology

Posted Date: May 11th, 2020

DOI: <https://doi.org/10.21203/rs.3.rs-26405/v2>

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Abstract

The pandemic of COVID-19 is considered as „ventilator dependent“ disease. In a short study there are presented data from Switzerland showing that there was only short period of time when the most of ventilators were needed, and moreover, their lack is highly probably not associated with increased frequency of deaths. COVID-19 showed us, that others parameters such as number of hospitalizations, patients on ICUs and ventilated patients may be important epidemiological markers.

Introduction

The pandemic of COVID–19 has severely hit our world. Many attempts have been made to predict its course since beginning of the outbreak. Basic epidemiological data such as the numbers of confirmed cases, of deaths, of recoveries, and of tested individuals are readily accessible, even to the public. Despite this, most of the classic prediction models have failed. These failures have several reasons: the application of lockdown at different times within the countries of the world, the inconsistent selection of the population for testing, and the low sensitivity of the employed tests (PCR or ELISA) resulting in false-positive and false-negative results. The last-mentioned problem means that both a patient who is actually infected with COVID–19 and one who is COVID–19-free can receive a positive or negative result after the test. Additionally, the sensitivity of the tests varies during the phase of the disease. Death may appear to be a good epidemiologic factor. Unfortunately, this is not the case for the COVID–19 infection. Many patients have died who were positive for COVID–19 but not because of COVID–19, and of course, not all patients who have died have been tested for COVID–19. All of these above-mentioned factors have made the construction of prediction models extremely difficult.

The survival of patients with a severe COVID–19 course is considered to be mainly dependent on access to mechanical ventilation. Because of the well-known exponential growth of confirmed cases and deaths, state and health authorities began to feel afraid of the lack of ventilators in their hospitals as the pandemic progressed. For example, Prof. Dr. Thomas Van Boeckel from the Department of Environmental Systems Science at ETHZ suggested that Switzerland would run out of intensive care beds on April 2 as a result of the progression of the coronavirus pandemic (1). The opinions of other authorities around the world were similar. As we now know, the system did not collapse. However, why did it not happened, and do we still run the same risk?

Material And Methods

Publicly accessible data from Switzerland were analyzed. The data source was GitHub: https://raw.githubusercontent.com/openZH/covid_19/master/COVID19_Fallzahlen_CH_total_v2.csv. The number of confirmed cases, currently hospitalized patients, patients currently requiring intensive care units (ICU), currently ventilated patients, and deaths were included in an analysis from eight cantons in Switzerland, covering approximately 56% of the whole country population. Data were taken from the following cantons: Canton of Valais, Canton of Genève, Canton of Basel, Canton of Aargau, Canton of

Bern, Canton Ticino, Canton of Neuchâtel, and Canton of Zürich. The Canton of Zürich does not publish data about patients currently hospitalized in ICUs.

Basic descriptive statistical methods were used for the data analysis. Two y-axis graphs with separate axes for confirmed cases were used to provide better visualization.

Results

Results are shown in the Figures 1–8. In all cantons, an initial exponential growth of confirmed cases and deaths occurred, with the curve flattening at the end of April. The curves of currently hospitalized, ICU, and ventilated patients are different. A continual decrease of cases is clearly visible after the peak had been reached at the end of March and the beginning of April. Such a course is similar in all cantons enrolled in the study. The peak is lasting only several days and is not related to faster increase of deaths.

Discussion

The gradual decrease of hospitalized patients and of patients who needed admittance to an ICU, or the use of a ventilator is an interesting finding of this small study. The main reasons for the decrease are as follows: 1. the flattening of the curve of COVID–19 infections, and 2. discharge from the hospital because of death or disease recovery. In my opinion, this decrease in cases was probably underestimated or overlooked in models predicting the numbers of required ventilators. Another hypothesis for the observed reductions, but only at a speculative level, is that the decrease of hospitalizations and the requirement for ICUs and ventilators are caused by the decrease of some virus properties. Moreover, the fact that the number of deaths is continually growing, despite the availability of medical facilities, is very difficult to explain. Deaths seem to be independent of ventilator use. A recent analysis of deaths in New York, where an unbelievable 88.1% of ventilated patients have died, supports this supposition (2). One question of increasing importance is whether the accessibility of ventilators is indeed a major factor for the survival of infected patients.

Conclusion

The number of hospitalizations, the need for ICUs, and the numbers of ventilated patients in eight Switzerland cantons are decreasing. The death of COVID–19-positive patients seems to be independent of ventilator use. In the case of the COVID–19 pandemic, the numbers of hospitalizations, ICUs, and ventilated patients seem to be a useful parameter for epidemiological predictions. Similar analyses from other countries are needed.

Acknowledgement

I would like to thank Rudolf Straka, M. D., and Kostaricke sviste for advice and support.

Literature

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2. Richardson S, Hirsch JS, Narasimhan M, et al. Presenting Characteristics, Comorbidities, and Outcomes Among 5700 Patients Hospitalized With COVID–19 in the New York City Area. JAMA. Published online April 22, 2020. doi:10.1001/jama.2020.6775

Figures

Figure 1

Canton of Aargau. Cumulative number of confirmed cases, deaths, currently hospitalized, ICUs, and ventilated patients.

Canton of Bern, pop. 1,035 mil (2018)

Figure 2

Canton of Bern. Cumulative number of confirmed cases, deaths, currently hospitalized, ICUs, and ventilated patients.

Figure 3

Canton of Basel. Cumulative number of confirmed cases, deaths, currently hospitalized, ICUs, and ventilated patients.

Canton of Genève, pop. 499 480 (2018)

Figure 4

Canton of Genève. Cumulative number of confirmed cases, deaths, currently hospitalized, ICUs, and ventilated patients.

Canton of Neuchâtel, pop. 176 850 (2018)

Figure 5

Canton of Neuchâtel. Cumulative number of confirmed cases, deaths, currently hospitalized, ICUs, and ventilated patients.

Canton of Ticino, pop. 353 343 (2019)

Figure 6

Canton of Ticino. Cumulative number of confirmed cases, deaths, currently hospitalized, ICUs, and ventilated patients.

Figure 7

Canton of Valais. Cumulative number of confirmed cases, deaths, currently hospitalized, ICUs, and ventilated patients.

Canton of Zürich, pop. 1,521 mil (2018)

Figure 8

Canton of Zürich. Cumulative number of confirmed cases, deaths, currently hospitalized, and ventilated patients.