



## RESEARCH ARTICLE

# The use of respirators and its impact on the COVID-19 pandemic in Europe between 1 June and 14 October 2020

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## Keywords

COVID-19 • Respirator • Correlation • Europe • Pandemic

## Summary

**Background.** Cases of COVID-19 infection have increased sharply in Europe since August 2020, and the WHO recommend the use of respirators in situations where keeping distance is not possible. The purpose of this study was to evaluate the impact of the use of respirators on infection cases and viral deaths in European countries. **Methods.** COVID-19 cases and related deaths in 29 countries relative to population were searched through the WHO database on 15.10.2020. Recent 14-day cases in relation to the population were retrieved from the European Center for Disease Prevention and Control's website, covering the period from 1 to 14 October

2020. Information related to the use of respirators was retrieved from the IHME database of the University of Washington at time point, 1.6.2020.

**Results.** The proportion of people using of respirators at 1.6.2020 correlate negatively to the reported cases of disease ( $R_s = -0.528$ ) and to deaths ( $R_s = -0.553$ ). No significant correlation was found for recent cases or mortality. Countries with at least 60% respirator use did not differ from other countries.

**Conclusion.** Long-term use of respirators appears to reduce disease incidence and death in the population.

## Introduction

The COVID-19 pandemic has had a profound and global impact on society. Since August 2020, cases in Europe have risen sharply. The use of respirators for SARS1 and COVID prevention appears to be effective [1]. However, most studies have been conducted in a healthcare setting [1]. It has been suggested that the reduced viral load resulting from the use of a respirator in an exposure situation could affect the severity of the disease [2]. In a study of 49 volunteers with influenza, the primary viral load at exposure affected the onset of the disease [3]. The appropriate kind of fabric respirator is also effective [4]. However, the use of respirators is associated with the possibility of contamination and, for example, improper washing can predispose users to respiratory infection [5]. In Denmark, a randomised control trial indicated no protective value for the user [6]. The World Health Organization (WHO) recommends the use of respirators in situations where distance cannot be maintained [7], but the use of respirators has varied widely across European countries.[8] The aim of this study was to investigate the significance of the use of respirators for identified cases of COVID-19 and the associated deaths and mortality rates.

## Methods

The study was conducted on 15 October 2020 using publicly available data [8-10]. Information searched the

European Centre for Disease Prevention and Control's website for data on cases of COVID-19 occurring over the previous 14 days in the European Union (EU), the European Economic Area (EEA), and the United Kingdom [9]. In practice, the preceding 14 days covered the period 1-14 October 2020. The cumulative numbers of cases and deaths per 1,000,000 inhabitants were retrieved from the WHO COVID-19 database [10].

Information on the use of respiratory protective equipment was retrieved from the University of Washington Institute for Health Metrics and Evaluation (IHME) COVID-19 database [8]. Data from 1 June 2020 were used in the analysis because the effect of respirator use would be seen over the longer time period. Data from 29 European countries were used in the analysis and were analysed using SPSS version 22 (IBM Corp, Armonk, NY, USA). A correlation analysis was performed using Spearman's correlation test. The Mann-Whitney U test was used to analyse the differences between groups.

## Results

The reported use of respirators ranged from 1 to 94% in different countries. The lowest use was observed in Sweden, Norway, and Denmark (1%), and the most frequent use was documented in Spain (94%). At the beginning of June, in five countries, at least 60% of respondents indicated they had always used a respirator in public. The highest number of infections per million inhabitants was 18,147 in Spain, and the lowest was

1,505 in Latvia. The highest mortality was observed in Spain (704 deaths per million inhabitants), and the lowest was in Slovakia (11 deaths per million inhabitants). The lowest mortality percentages were observed in Iceland and Slovakia at 0.3%, and the highest was in Italy at 9.9% (Tab. I).

The use of respirators had a significant negative correlation to disease cases (Spearman's  $r_s = -0.528$ ), deaths ( $r_s = -0.553$ ), and deaths within the last 14 days ( $r_s = -0.467$ ). The negative correlation obtained for recent cases was not statistically significant ( $r_s = -0.390$ ,  $p = 0.099$ ), nor was the correlation for mortality ( $r_s = -0.238$ ,  $p = 0.327$ ). Countries with respiratory protection utilisation rates of at least 60% did not differ from other countries except for the latter's higher mortality (median = 288 vs 89,  $p = 0.037$ ).

## Discussion

Under the right conditions, the use of respirators will undoubtedly protect against infection, [1], but most of the research material has been obtained from healthcare contexts. In daily life, many things, such as face contact,

affect the use of respirators, re-use of a dirty respirator (after a meal, for example), the type of respirator (fabric protector or disposable respirator), and the handling and washing of an old respirator. Therefore, research into the widespread use of respirators by the general public has less impressive results [6].

The protective effect of respirators may also be impaired if people engage in unsafe behaviours during the lockdown, such as gathering in groups, in violation of government guidelines. Keeping distance seems to be the most important way to prevent the spread of the disease. It should be remembered that respirators do not protect well against aerosolised contagion.

Respirators have consistently been used in public by about half of the European population. In five countries (Spain, Hungary, Portugal, Romania, and Italy), use exceeded 60%, but those countries did not have better results than other nations. A possible reason for this may be the "wrong" sense of security created by respirators, thus, no other key actions were taken, such as keeping distance, hand hygiene, and isolation when symptoms appear. This supports the findings of a Danish study indicating that respirators did not protect users [6].

A limitation in the study is the collection of data on respirator

Tab. I. Respiratory protection use, reported cases and deaths, cumulatively and during the previous 14 days (1-14 October 2020).

Country	Use of mask 1.6 (%) <sup>1</sup>	Cases (number) <sup>2</sup>	Deaths (number) <sup>2</sup>	Recent cases (number) <sup>3</sup>	Recent deaths (number) <sup>3</sup>	Mortality (%) <sup>4</sup>
Austria	45	6,413.4	97.6	148.5	0.9	1.5
Belgium	33	14,939.8	386.5	469.5	2.0	5.9
Bulgaria	44	3,709.3	132.8	74.7	1.6	3.6
Croatia	5	5,113.7	80.4	113.2	1.3	1.6
Cyprus	43	1,695.4	20.7	34.7	0.3	1.2
Czech Republic	42	12,115.7	103.3	581.3	4.4	0.9
Denmark	1	5,714.8	116.4	97.1	0.4	2.0
Estonia	57	1,505.7	21.7	57.9	0.2	1.7
Finland	2	2,255.8	62.5	47.2	0.1	2.8
France	38	11,164.5	500.7	307.1	1.6	4.4
Germany	50	3,993.4	115.5	54.6	0.2	2.9
Greece	20	2,212.4	44.3	46.0	0.7	2.0
Hungary	61	4,221.6	105.9	146.5	2.6	2.5
Iceland	43	10,748.9	29.3	272.6	0.0	0.3
Ireland	10	8,943.1	370.6	171.7	0.6	4.1
Italy	79	6,044.6	599.5	86.9	0.6	9.9
Latvia	57	1,505.7	21.7	57.9	0.2	1.4
Lithuania	57	2,338.5	38.9	64.0	0.5	1.7
Luxembourg	43	15,719.4	212.5	229.5	1.5	1.6
Norway	1	2,884.8	51.1	34.7	0.1	1.8
Poland	53	3,574.4	81.9	119.3	1.6	2.3
Portugal	67	8,740.2	206.9	140.2	1.4	2.4
Romania	75	8,341.0	287.7	180.5	3.8	3.5
Slovakia	57	3,825.5	11.2	207.5	0.3	0.3
Slovenia	48	4,400.3	179.9	179.9	0.4	1.6
Spain	75	18,417.6	704.3	293.8	3.4	3.7
Sweden	1	9,966.5	584.1	79.3	0.2	5.9
Netherlands	3	11,010.4	386.5	412.2	1.4	3.5
United Kingdom	9	9,352.8	633.7	283.2	1.4	6.8

<sup>1</sup> Percentage of inhabitants wearing a mask in public; <sup>2</sup> Cases per 1,000,000 people; <sup>3</sup> Cases per 100,000 people, 1-14 October 2020; <sup>4</sup> COVID deaths (% of diagnosed cases).

use through the IHME COVID database and through Facebook. However, the information can be considered as indicative and corresponds well to our understanding of respirator use in different countries. Moreover, the different lockdown conditions employed in each country (*e.g.* school closures) can be considered a limitation of the present study. In addition to respiratory protection recommendations, it is important to share information on the proper use of respirators while recalling other principles of communicable disease control. These data on the benefits of respirators provide evidence for both disease prevention and COVID death prevention.

## Ethics

Using only publicly available worldwide data, the approval of Ethics Committee was not needed.

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## Conflict of interest statement

The authors declare no conflict of interest.

## Authors' contributions

The study protocol, manuscript and analysis were made JB.

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