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# Costs associated with COVID-19 in healthcare personnel in Greece: a cost-of-illness analysis

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## SUMMARY

**Background:** Healthcare personnel (HCP) are at increased risk of infection with severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2), the aetiological agent of coronavirus disease 2019 (COVID-19).

**Aim:** To estimate the costs related to SARS-CoV-2 exposure and infection among HCP in Greece.

**Methods:** Data were retrieved from the national database of SARS-CoV-2 infections and from the database of HCP exposed to patients with COVID-19. A cost-of-illness analysis was performed to estimate total, direct and indirect costs.

**Results:** In total, 254 HCP with COVID-19 and 3332 HCP exposed to patients with COVID-19 during the first epidemic wave were studied. Of the 254 HCP with COVID-19, 49 (19.3%) were hospitalized (mean length of hospitalization 11.6 days) and four were admitted to intensive care units (mean duration 10.8 days). Overall, 1332 (40%) exposed HCP had a mean duration of absenteeism of 7.5 days, and 252 (99.2%) HCP with COVID-19 had a mean duration of absenteeism of 25.8 days. The total costs for the management of the two groups were estimated at €1,735,830 (€772,890 Euros for HCP with COVID-19 and €962,940 for exposed HCP). Absenteeism accounted for a large proportion of the total costs (80.4% of all expenditures), followed by costs for reverse transcriptase polymerase chain reaction and hospitalization (10.2% and 6.5% of all expenditures, respectively).

**Conclusion:** COVID-19 is associated with increased rates and duration of absenteeism among HCP. Indirect costs, particularly absenteeism, are the major driver of total costs

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among exposed HCP and HCP with COVID-19. The estimated total costs are conservative. Studies are needed to explore the impact of COVID-19 vaccination of HCP on absenteeism and COVID-19-associated costs.

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## Introduction

Since late 2019, the world has faced a devastating pandemic caused by a new coronavirus named severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2), the aetiological agent of coronavirus disease 2019 (COVID-19). As of 22<sup>nd</sup> February 2021, it is estimated that there have been more than 111 million confirmed cases and almost 2.5 million deaths [1]. Moreover, several countries are facing unprecedented pressure on their healthcare systems, which far exceeds that of healthcare demands during influenza seasons [2–4]. Faust and del Rio estimated that the mean number of deaths due to COVID-19 is 20.5 times higher than the number of deaths due to influenza observed during the peak in the past seven influenza seasons in the USA [2]. From the very beginning of the pandemic, healthcare personnel (HCP) have been recognized as a high-risk group for SARS-CoV-2 infection, and increased rates of absenteeism and shortages of HCP were noted [5–10]. A recent systemic review of 594 sources found a total of 152,888 reported infections and 1413 deaths among HCP during the first pandemic wave worldwide [6]. Beyond the safety concerns of HCP, exposure and infection of front-line HCP result not only in the allocation of financial resources for their monitoring and management, but also exacerbate shortages of HCP due to increased rates of absenteeism [8], particularly in settings with already constrained capacity, such as the Greek healthcare system [11]. Despite evidence on the high rates of SARS-CoV-2 infection among HCP, the burden of COVID-19 in HCP on healthcare costs remains largely unknown. The objective of this study was to estimate the direct and indirect costs associated with SARS-CoV-2 infection and exposure among HCP during the first epidemic wave in Greece. The findings can enable health policy makers to understand the major cost drivers of COVID-19 in HCP, to allocate economic and physical healthcare resources efficiently, and to support HCP as the pandemic continues to challenge healthcare systems globally.

## Methods

### Data collection

COVID-19 is a notifiable disease in Greece. Data for notified HCP with COVID-19 were retrieved from the national database, and their clinical course and outcome were followed actively through telephone contact with them or their physicians. In addition, HCP occupationally exposed to patients with COVID-19 were traced by the infection control committee of their healthcare facility and the National Public Health Organization was actively notified; exposed HCP were followed for the onset of symptoms for 14 days post-exposure, as described previously [5]. The study period extended from 26<sup>th</sup> February 2020 (first case detected in Greece) to 3<sup>rd</sup> May 2020 (last date of the first national lockdown). Data from HCP with COVID-19 and data

from HCP exposed to patients with COVID-19 were collected using two separate structured questionnaires. Data included demographic and professional characteristics, co-morbidities, use of healthcare services, laboratory investigations, imaging tests and treatment. The duration of absenteeism and presenteeism (if any) was recorded.

### Definitions

HCP were defined as all persons employed in healthcare facilities, regardless of status of employment or direct contact with patients or biological specimens. HCP were grouped as follows: physicians; nursing personnel (nurses, midwives, nurse assistants); paramedical personnel (pharmacists, biologists, physiotherapists, laboratory technicians, social workers, health visitors, ambulance drivers); supportive personnel (waiters, cleaners, security personnel); and administrative personnel. Healthcare facilities were defined as public or private sector structures where healthcare services are provided. Healthcare seeking was defined as any healthcare visit related to SARS-CoV-2 infection or occupational exposure to patients with COVID-19. Occupational exposure was defined as exposure within the healthcare facility. Absenteeism was defined as absence from work duties because of COVID-19 or because of exclusion from work for isolation purposes. Presenteeism was defined as continuing to attend work despite being symptomatic for COVID-19, or having symptoms compatible with COVID-19 following occupational exposure to patients with COVID-19.

### Cost analysis

The cost analysis was conducted from the payer's perspective and included direct and indirect costs. Direct costs included costs for healthcare seeking, laboratory tests, reverse transcriptase polymerase chain reaction (RT-PCR) tests, imaging tests, treatment, hospitalization, admission to intensive care unit (ICU) and intubation [12,13]. Indirect costs included costs related to absenteeism and presenteeism. The indirect costs of lost productivity due to morbidity-related absenteeism or presenteeism were estimated as lost wages, with 1 day of absenteeism accounting for the full daily wage, while 1 day of presenteeism accounted for half of the daily wage [14]. The different wages per HCP category were considered. Wage rates were retrieved from Law 4472/2017 [15]. Out-of-pocket costs were not considered. All costs are given in Euros. The data were retrieved in Excel (Microsoft Corp., Redmond, WA, USA) and analysed using Stata Version 16.1 (StataCorp, College Station, TX, USA).

### Ethical issues

Data were managed in accordance with national and European laws. Approval was received by the Committee for Research of the National Public Health Organization.

**Table I**  
Characteristics of healthcare personnel exposed to patients with coronavirus disease 2019 (COVID-19) in Greece

|   | N=3332       | %    |
|---|--------------|------|
| Healthcare facility                             |              |      |
| Hospital  | 2780         | 83.4 |
| Primary healthcare centre                       | 205          | 6.2  |
| Private laboratory                              | 347          | 10.4 |
| Profession                                      |              |      |
| Physician                                       | 1064         | 31.9 |
| Nursing personnel                               | 1687         | 50.6 |
| Supportive personnel                            | 112          | 3.4  |
| Paramedical personnel                           | 281          | 8.4  |
| Administrative personnel                        | 188          | 5.6  |
| Gender  |              |      |
| Male  | 965          | 29.0 |
| Female  | 2367         | 71.0 |
| Mean age, years (SD)                            | 44.6 (±10.3) |      |
| Co-morbidities                                  |              |      |
| No  | 3261         | 97.9 |
| Yes <sup>a</sup>                                | 71           | 2.1  |
| Symptoms within 14 days of exposure             |              |      |
| No  | 2643         | 79.3 |
| Yes   | 689          | 20.7 |
| RT-PCR test for SARS-CoV-2                      |              |      |
| No  | 1804         | 54.1 |
| Yes   | 1528         | 45.9 |
| Healthcare seeking                              |              |      |
| No  | 3301         | 99.1 |
| Yes   | 31           | 0.9  |
| Treatment                                       |              |      |
| No  | 3302         | 99.1 |
| Yes   | 30           | 0.9  |
| Mean duration of treatment, days (SD)<br>(N=30) | 7.3 (±6.7)   |      |

SD, standard deviation; RT-PCR, reverse transcriptase polymerase chain reaction; SARS-CoV-2, severe acute respiratory syndrome coronavirus-2.

<sup>a</sup> Chronic pulmonary disease (N=18), chronic cardiovascular disease (N=18), diabetes mellitus (N=21), immunosuppression (N=9) and malignancy (N=10).

## Results

During the study period, a total of 3398 HCP exposed to patients with COVID-19 were notified from 88 healthcare facilities (66 hospitals, 20 primary healthcare centres and two private laboratories) [5]. Of them, 66 HCP developed COVID-19 and were included in the analysis of HCP with COVID-19 (see below), in order not to duplicate cost estimations. Therefore, the study group of exposed HCP consisted of 3332 HCP. Their demographic, occupational and clinical characteristics are presented in Table I. Of the 3332 exposed HCP, 689 (20.7%) developed symptoms within 14 days of exposure, 31 (0.9%) sought health care and 30 (0.9%) received treatment. Overall, 1528 (45.9%) exposed HCP were tested for SARS-CoV-2 infection by RT-PCR.

During the study period, there were 254 notified cases of COVID-19 among HCP from 77 healthcare facilities (60 hospitals, 11 primary healthcare centres, four private laboratories

and two long-term care facilities), including 66 HCP as described above. Table II shows their characteristics. Physicians accounted for most cases (N=104, 40.9%), followed by nursing personnel (N=89, 35.0%). Most of the notified cases (N=217, 85.4%) worked in hospitals. All were tested for SARS-CoV-2 by RT-PCR at least once. Of the 254 HCP with COVID-19, 205 (80.7%) were treated as outpatients and 49 (19.3%) were hospitalized for a mean duration of 11.6 days. Overall, 66 (26.0%) of the 254 HCP with COVID-19 underwent chest computed tomography (CT) and 62 (24.4%) underwent chest radiography in an outpatient setting, 71 (28%) sought health care and 93 (37.1%) received treatment. Of the 49 hospitalized HCP, all (100%) underwent chest CT, 17 (34.7%) underwent chest radiography and 41 (83.7%) received treatment. Overall, 25 (49%) hospitalized patients developed pneumonia, two (4.1%) developed acute respiratory distress syndrome, and four (8.1%) were admitted to ICUs and were intubated for a mean duration of 10.8 days. Three of the four ICU patients died (6.1% in-hospital mortality).

Table III shows the rates of absenteeism and presenteeism among HCP. Among the 3332 HCP who were exposed to patients with COVID-19, 1332 (40%) were absent from work from a mean duration of 7.5 days, while working with symptoms (presenteeism) was reported by 53 (1.6%) HCP for a mean duration of 5.4 days. Among the 254 HCP with COVID-19, 252 (99.2%) reported absenteeism for a mean duration of 25.8 days, while the two cases without absenteeism were due to clinic closure and receiving special permission to miss work for non-COVID-19 reasons (one case each). The mean duration of absenteeism of the 49 hospitalized HCP was 29.1 days. Presenteeism of a mean duration of 2.2 days was reported by 38 HCP with COVID-19 (15%).

Table IV shows the healthcare resources used and the respective costs by HCP group and by cost category. The total costs for the management of HCP during the first epidemic wave in Greece were estimated at €1,735,830. The total healthcare costs for the 254 HCP with COVID-19 and the 3332 exposed HCP were €772,890 and €962,940, respectively. Absenteeism accounted for the largest share of total costs (80.4% of all expenditures), followed by costs for RT-PCR tests and hospitalization (10.2% and 6.5% of all expenditures, respectively). Overall, indirect costs were €1,409,720 (81.2% of total costs).

## Discussion

The aim of this study was to estimate the direct and indirect costs associated with COVID-19 in HCP in Greece from the payer's perspective. The total costs for the management of HCP with COVID-19 and HCP exposed to patients with COVID-19 during the first epidemic wave in Greece were approximately €1.73 million, which is conservative. In this study, total costs for exposed HCP far exceeded total costs for HCP with COVID-19, which is explained by the large number of traced and self-isolated contacts per COVID-19 case in healthcare facilities. In a previous study, the authors estimated that a median of 14 HCP were traced per source of COVID-19 exposure, ranging from one to 113 exposed HCP [5].

In this study, absenteeism was the major driver of total costs in both groups of HCP. The considerable impact of absenteeism is partially attributed to its prolonged duration, either for

**Table II**

Characteristics of healthcare personnel (HCP) with coronavirus disease 2019 (COVID-19) overall and stratified by healthcare management

|   | Total       |              | Outpatient   |       | Hospitalization |       |
|---|-------------|--------------|--------------|-------|-----------------|-------|
|   | N%          |              | N%           |       | N%              |       |
|   | 254         |              | 205          | 80.7% | 49              | 19.3% |
| <b>Facility</b>                                       |             |              |              |       |                 |       |
| Hospital  | 217         | 85.4         | 173          | 84.3  | 44              | 89.8  |
| Private laboratory                                    | 19          | 7.5          | 17           | 8.3   | 2               | 4.1   |
| Primary healthcare centre                             | 14          | 5.5          | 11           | 5.4   | 3               | 6.1   |
| Long-term healthcare facility                         | 4           | 1.6          | 4            | 2.0   | 0               | 0.0   |
| <b>Profession</b>                                     |             |              |              |       |                 |       |
| Physician   | 104         | 40.9         | 81           | 39.5  | 23              | 46.9  |
| Nursing personnel                                     | 89          | 35.0         | 73           | 35.6  | 16              | 32.7  |
| Administrative personnel                              | 30          | 11.8         | 26           | 12.7  | 4               | 8.2   |
| Paramedical personnel                                 | 21          | 8.3          | 17           | 8.2   | 4               | 8.2   |
| Supportive personnel                                  | 10          | 3.9          | 8            | 3.9   | 2               | 4.1   |
| <b>Gender</b>   |             |              |              |       |                 |       |
| Female  | 163         | 64.2         | 137          | 66.8  | 26              | 53.1  |
| Male  | 91          | 35.8         | 68           | 33.2  | 23              | 46.9  |
| Mean age, years (SD)                                  | 44.4 (11.9) | 43.38 (11.7) | 48.84 (11.8) |       |                 |       |
| <b>Co-morbidities</b>                                 |             |              |              |       |                 |       |
| No  | 202         | 79.5         | 171          | 83.4  | 31              | 63.3  |
| Yes <sup>a</sup>                                      | 52          | 20.5         | 34           | 16.6  | 18              | 36.7  |
| <b>Treated as outpatient (N=205)</b>                  |             |              |              |       |                 |       |
| <b>Type of laboratory tests</b>                       |             |              |              |       |                 |       |
| RT-PCR for SARS-CoV-2                                 | 1016        |              | 820          |       | 196             |       |
| Biochemistry, complete blood count and/or urine tests | 41          | 16.1         | 32           | 15.6  | 9               | 18.4  |
| <b>Imaging tests</b>                                  |             |              |              |       |                 |       |
| Chest CT  | 66          | 26.0         | 17           | 8.3   | 49              | 100.0 |
| Chest radiograph                                      | 62          | 24.4         | 45           | 22.0  | 17              | 34.7  |
| <b>Healthcare seeking</b>                             |             |              |              |       |                 |       |
| No  | 183         | 72.0         | 157          | 76.6  | 26              | 53.1  |
| Yes   | 71          | 28.0         | 48           | 23.4  | 23              | 46.9  |
| <b>Treatment</b>                                      |             |              |              |       |                 |       |
| No  | 161         | 62.9         | 129          | 62.9  | 32              | 65.3  |
| Yes   | 93          | 37.1         | 76           | 37.1  | 17              | 34.7  |
| <b>Type of treatment (N=93)</b>                       |             |              |              |       |                 |       |
| Azithromycin  | 78          | 89.3         | 64           | 84.2  | 14              | 82.4  |
| Hydroxychloroquine                                    | 43          | 46.2         | 38           | 50.0  | 5               | 29.4  |
| Other   | 22          | 23.7         | 17           | 22.4  | 5               | 29.4  |
| <b>Hospitalization (N=49)</b>                         |             |              |              |       |                 |       |
| Mean hospitalization, days (SD)                       |             |              |              |       | 11.6 (±7.9)     |       |
| <b>Complications</b>                                  |             |              |              |       |                 |       |
| Pneumonia   |             |              |              |       | 25              | 49.0  |
| ARDS  |             |              |              |       | 2               | 4.1   |

|   |              |       |
|---|--------------|-------|
| Death   | 3            | 6.1   |
| ICU admission and intubation                  | 4            | 8.2   |
| Mean ICU duration, days (SD)                  | 10.8 (±13.6) |       |
| Imaging tests                                 |              |       |
| Chest CT                                      | 49           | 100.0 |
| Chest radiograph                              | 16           | 32.7  |
| Treatment                                     |              |       |
| No  | 8            | 16.3  |
| Yes   | 41           | 83.7  |
| Type of treatment (N=41)                      |              |       |
| Azithromycin                                  | 28           | 68.3  |
| Hydroxychloroquine                            | 34           | 82.9  |
| Quinolones                                    | 7            | 17.1  |
| Lopinavir and ritonavir                       | 5            | 12.2  |
| Other   | 15           | 36.6  |
| Treatment after discharge (N=46) <sup>b</sup> |              |       |
| No  | 37           | 75.5  |
| Yes   | 9            | 19.6  |
| Type of treatment after discharge (N=9)       |              |       |
| Anticoagulants                                | 3            | 33.3  |
| Quinolones                                    | 2            | 22.2  |
| Hydroxychloroquine                            | 1            | 11.1  |
| Levofloxacin                                  | 1            | 11.1  |
| Inhaled steroids                              | 1            | 11.1  |
| Unknown antibiotic                            | 3            | 33.3  |

SD, standard deviation; RT-PCR, reverse transcriptase polymerase chain reaction; SARS-CoV-2, severe acute respiratory syndrome coronavirus-2; CT, computer tomography; ARDS, acute respiratory distress syndrome; ICU, intensive care unit.

<sup>a</sup> Chronic cardiovascular disease (N=13), hypertension (N=11), obesity (N=10), chronic pulmonary disease (N=7), diabetes mellitus (N=6), immunosuppression (N=5), malignancy (N=5) and chronic neuromuscular disease (N=2).

<sup>b</sup> Excludes three HCP who died.

**Table III**

Absenteeism and presenteeism among the 3332 healthcare personnel (HCP) exposed to cases of coronavirus disease 2019 (COVID-19) and the 254 HCP with COVID-19

|                          | Total            |             | Outpatient  |      | Hospitalization |       |
|--------------------------|------------------|-------------|-------------|------|-----------------|-------|
|                          | N                | N%          | N           | N%   | N               | N%    |
| HCP exposed to COVID-19  |                  |             |             |      |                 |       |
| Absenteeism              | 1332             | 40.0        | -           | -    | -               | -     |
| Mean duration, days (SD) | 7.5 (3.3)        |             |             |      |                 |       |
| Presenteeism             | 53               | 1.6         |             |      |                 |       |
| Mean duration, days (SD) | 5.4 (4.0)        |             | -           | -    | -               | -     |
| HCP with COVID-19        |                  |             |             |      |                 |       |
| Absenteeism              | 252 <sup>a</sup> | 99.2        | 203         | 99.0 | 49              | 100.0 |
| Mean duration, days (SD) | 25.8 (12.6)      | 25.2 (12.1) | 29.1 (13.6) |      |                 |       |
| Presenteeism             | 38               | 15.0        | 30          | 14.8 | 8               | 16.3  |
| Mean duration, days (SD) | 2.2 (2.0)        |             | 2.1 (1.7)   |      | 2.5 (3.1)       |       |

SD, standard deviation.

<sup>a</sup> Excludes two HCP who missed work due to clinic closure (first case) or received special permission to miss work for non-COVID-19 reasons (second case).

isolation purposes (healthy absenteeism) in accordance with the national guidelines [5], or in the context of symptomatic illness (COVID-19). Absenteeism was documented in 40% of exposed HCP for a mean duration of 7.5 days, and in 99% of HCP with COVID-19 for a mean duration of 25.8 days. It should be noted that the highest burden of absenteeism among exposed HCP concerned high-risk exposure (defined as neither the HCP nor the infectious patient wearing a surgical mask), and therefore could be largely preventable [5]. The present results are in line with a study from Spain, where 65 symptomatic

employees (24.6%) at a long-term care facility were absent for a mean of 19.2 days during a COVID-19 outbreak [16].

Moreover, 15% of HCP with COVID-19 in this study reported presenteeism for a mean duration of 2.2 days. Beyond loss of productivity, poorer quality of services and financial losses [17], presenteeism represents a threat for infection control in the context of the ongoing pandemic, given the potential of SARS-CoV-2 shedding, especially shortly after the onset of symptoms when the viral load peaks [18]. The increased workforce needs due to absenteeism were mainly managed by internal movement of HCP from low-to high-demand departments; this was facilitated by the fact that selective surgical procedures and healthcare services for chronic co-morbidities were transferred later.

In this study, direct costs, driven mainly by costs for RT-PCR tests and hospitalization, were relatively low, accounting for 18.8% of total costs. This result is explained by the small proportion of HCP that required inpatient care, coupled with the relatively lower re-imbursment prices for such services in Greece compared with other European countries as a result of austerity policies over the last decade [19].

Furthermore, this study sheds light on the disproportionately increased risk of exposure to COVID-19, SARS-CoV-2 infection and absenteeism among HCP, consistent with the growing literature on this topic [5,8–10,20,21]. In accordance with the World Health Organization, HCP constitute a high-priority group for COVID-19 vaccination [22]. It is highly likely that the implementation of vaccination programmes for HCP will have a considerable impact on reducing their risk for SARS-CoV-2 infection and absenteeism. Further studies are needed in order to investigate the impact of COVID-19 vaccines on COVID-19-associated morbidity and absenteeism among HCP and the protection of essential healthcare services.

This study has a few limitations. First, the total costs of SARS-CoV-2 infection in HCP are underestimated in the context of the Greek healthcare system. This is due to the underpricing of medical services and HCP salaries, and this has traditionally produced deficits for the healthcare system, subsidized retrospectively by the government budget [23]. Therefore, the third

**Table IV**

Healthcare costs for healthcare personnel (HCP) overall and stratified by group of HCP [exposed HCP vs HCP with coronavirus disease 2019 (COVID-19)]

|   | Total<br>(N=3586) | Exposed<br>(N=3332) | COVID-19<br>(N=254) |
|---|-------------------|---------------------|---------------------|
| <b>Direct costs</b>                                   |                   |                     |                     |
| Hospitalization                                       | €113,200          | NA                  | €113,200            |
| RT-PCR for SARS-CoV-2                                 | €178,080          | €106,960            | €71,120             |
| ICU stay  | €24,000           | NA                  | €24,000             |
| Healthcare seeking<br>(outpatient)                    | €5100             | €1550               | €3550               |
| Chest radiograph and CT<br>Treatment                  | €2680             | NA                  | €2680               |
| Hospitalization                                       | €2020             | NA                  | €2020               |
| Outpatient  | €760              | €610                | €150                |
| Post-discharge  | €100              | NA                  | €100                |
| Biochemistry, complete blood<br>count and urine tests | €170              | NA                  | €170                |
| <b>Indirect costs</b>                                 |                   |                     |                     |
| Absenteeism   | €1,395,770        | €843,270            | €552,500            |
| Presenteeism  | €13,950           | €10,550             | €3400               |
| <b>Total</b>  | <b>€1,735,830</b> | <b>€962,940</b>     | <b>€772,890</b>     |

NA, not applicable; RT-PCR, reverse transcriptase polymerase chain reaction; SARS-CoV-2, severe acute respiratory syndrome coronavirus-2; ICU, intensive care unit; CT, computed tomography.

party payer perspective is rarely representative of the actual costs of healthcare services in Greece. Additionally, in the third party payer context, the study excludes any indirect/societal cost. In addition, repeated imaging tests were not considered. In particular, only costs related to the acute phase of infection were considered; follow-up costs were not included, and these may be considerable in patients with COVID-19-associated complications. Further, the authors were not able to estimate costs potentially resulting from adverse patient outcomes attributed to decreased work productivity for both HCP who were on-site with symptoms (presenteeism) and those who had to work longer shifts (fatigue/burnout). Another limitation is that the notification and follow-up of exposed HCP started on 13<sup>th</sup> March 2020, which was 2 weeks after the first case of COVID-19 was detected in Greece. Finally, costs associated with the use of personal protective equipment were not considered, although their provision has been identified as a primary concern by HCP during epidemics [24]. A clear strength of the current study is the retrieval of all notified cases of COVID-19 among HCP and HCP exposed to patients with COVID-19 during the study period in Greece. This offered the opportunity to record case-based incurred costs prospectively without data generated by the healthcare system.

In conclusion, this study provides insight into the costs associated with COVID-19 exposure and infection in HCP in Greece. The estimated costs associated with COVID-19 in HCP during the first epidemic wave were approximately €1.73 million, which is conservative. Prolonged absenteeism was the prevalent driver of expenditures among HCP with COVID-19, as well as among exposed HCP. Further studies are needed to investigate the impact of COVID-19 vaccination on COVID-19-associated morbidity and absenteeism among HCP.

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### Conflict of interest statement

None declared.

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None.

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