SARS-CoV-2 assessment of non-healthcare workers: The potential role of work safety recommendations

Type

Research paper

Keywords

occupational health, COVID-19, preventative medicine

Abstract

Introduction
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Material and methods
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Results
A total of 1359 workers (out of 5850) underwent SARS-CoV-2 testing and answered the survey. Twenty-five participants (1.8%) had positive testing results.

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We observed low frequency of SARS-CoV-2 infection in a company that early on implemented policies to decrease COVID-19 risk.

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Introduction

Since its beginning, the COVID-19 pandemic has directly resulted in more than two million deaths worldwide[1]. According to the European Centre for Disease Prevention and Control, between March and July 2020, 1376 clusters of COVD-19 have been reported in occupational settings in 16 European countries, of which 540 were non-healthcare related[2]. In fact, the possibility of COVID-19 outbreaks associated with occupational settings has prompted governments, health agencies and employers to issue recommendations aimed at increasing safety at the workplace[3-5]. The latter include the use of personal protection equipment by workers, routine (at least more than once per day) cleaning of frequently touched surfaces, the provision of adequate ventilation (with recommendations ranging from leaving doors and windows opened whenever possible to installation of high-efficiency particulate air filtration or ultraviolet germicidal irradiation systems), the limitation of contact between workers, and the (at least partial) adoption of remote working[3-7]. With the aim of discussing the impact of these protective measures, we herein report the results of molecular and serological tests to SARS-CoV-2 performed along an epidemiological survey in workers of an electrical utility company.

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Material and Methods

Molecular (polymerase chain reaction – PCR) and serological (Immunoglobulin G – IgG) tests to SARS-CoV-2 were performed in 3163 out of 5850 workers of *EDP – Energias de Portugal* (selected as it is the largest electrical utility company in Portugal, and on account of its early adoption of protective measures in the context of SARS-CoV-2), in June 2020 (Supplementary Figure 1). For each participant, molecular and serological tests were performed on the same day. Molecular tests were performed with Allplex™ SARS-CoV-2 Assay (Seegene Inc, Seoul, South Korea), whose sensitivity and specificity are close to 100%

(as displayed in https://www.finddx.org/covid-19/sarscov2-eval-molecular/). Serological tests were performed with Euroimmun SARS-CoV-2 ELISA tests (Euroimmun AG, Lübeck, Germany), which have a sensitivity of 90% and a specificity close to 100% (as displayed in https://www.fda.gov/medical-devices/coronavirus-disease-2019-covid-19-emergency-use-authorizations-medical-devices/eua-authorized-serology-test-performance).

In the subsequent month, an electronic epidemiological survey – assessing participant demographic characteristics, clinical comorbidities, medication use, risk exposure (including that related to the workplace), and performance (and results) of previous tests to SARS-CoV-2 (Supplementary Digital Material 1: Supplementary Survey) – was sent by e-mail to all tested workers, with the first mail being sent on July 13, 2020, and two additional reminders each sent one week apart. The survey was purposely-developed by the authors of this study based on the most relevant epidemiological variables known at that time. On account of the low number of positive testing results, only descriptive analyses were performed.

This study has been approved by the Ethics Committee of the *Fundação D. Anna de Sommer Champalimaud e Dr. Carlos Montez Champalimaud* (Ethics approval number 15, dated of April 26, 2020). All participants gave informed consent prior to participation in this study. Testing was voluntary and costs were supported by the company.

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Results

A total of 1359 workers answered the epidemiological survey, corresponding to 43.0% of those who were sent that questionnaire (Supplementary Figure 1). Demographic variables had similar distributions among those workers who answered and who did not answer the epidemiological survey. Most participants were males (84.0%) and only one-third reported at least one comorbidity (Table I). More than two-thirds of participants (84.4%) worked from

home for at least one week (median number of weeks working from home=15). Only 19.3% of participants reported never using a mask when working.

A total of 25 participants (1.8%) had positive molecular and/or serological results (Table II) – 14 participants had positive molecular results, while 17 patients had positive serological results, with 6 patients having positive results to both types of tests. Of those patients with positive molecular results, nine concerned PCR tests performed one or more months before our study began (in June 2020) – among them, only five had positive serological results. Eleven of those 25 patients reported comorbidities (the most frequent being hypertension), and nine reported taking regular medication for chronic diseases. Six patients reported not wearing a mask during work, while four did not work from home in any week; other potential risk factors (e.g., close contact with a patient with SARS-CoV-2 infection, or travel abroad) were reported by just over a quarter of the patients (*n*=7). Less than half of the patients (12 out of 25) reported any symptom compatible with COVID-19 infection during the year of 2020.

Discussion

Overall, only a small percentage of the assessed workers (1.8%) had results compatible with infection to SARS-CoV-2. This value is lower than the one obtained in a serological survey applied between May and July to the general Portuguese population (2.9%)[8]. In part, this may be explained by the early adoption (namely in February 2020) of several policies, which include remote and shift work schemes, provision of masks and disinfectant products in the workplace, space reorganization and implementation of access restrictions, regular workspace cleaning, implementation of a medical hotline which monitored suspected and confirmed cases of SARS-CoV-2 infection, and celebration of protocols with laboratories so that molecular and serological tests could be regularly performed to workers who were not

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working remotely (Supplementary Figure 2 for a timeline of policies). Taken together, these measures may have allowed for reduction of contacts among workers, and reduction of infection risk associated with each contact (as individual protection equipment was used and confirmed were early identified).

In this study, the frequency of current or past COVID-19 infection was assessed by means of molecular and serological tests. The latter are based on the quantification of antibodies to SARS-CoV-2, with IgM antibodies falling quickly within the first weeks post-infection (frequently becoming undetectable after six weeks after symptom onset[9]), and IgG antibodies persisting for a longer period of time. While, a systematic review has suggested that IgG titres start to decline after eight weeks post-onset, the period during when such antibodies remain detectable is still subject to research[9]. In fact, disappearance and persistence of IgG antibodies at the 12th week post-disease onset have both been described[10-11]. If disappearance happens to be the most common scenario, then the real frequency of SARS-CoV-2 infections in this study may have been underestimated, particularly concerning earlier infections. Further studies are, thus, required to assess IgG dynamics in the long-term.

In addition, other limitations are worth noting. Firstly, less than half of the workers answered the epidemiological survey, possibly resulting in selection bias. In fact, it is possible to hypothesise that those who answered the survey are more concerned about the COVID-19 pandemic, being also more careful with their own behaviours. Nevertheless, of all 4104 workers of that company undergoing serological testing, only a total of 66 had positive results, corresponding to a seroprevalence of 1.6% (close to the value observed for those workers answering the questionnaire). Another limitation concerns the possibility of information biases – as the survey was filled by the workers themselves, errors in question interpretation or in the introduction of responses may ensue. Misclassification may also stem from incorrect test results, particularly false negative results with serological tests, whose

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reported sensitivity is of 90%[12]). Finally, the low number of participants with positive PCR and/or serological results only allowed the performance of descriptive analyses.

Recommendations and conclusions

In conclusion, we observed low frequency of positive PCR and/or serological tests to SARS-CoV-2 in an electrical utility company that early on implemented policies to decrease the risk of COVID-19 spread in occupational settings. Such policies include the early adoption of remote and shift work schemes, the provision of individual protection equipment, the provision of medical monitoring, and regular testing of workers. The adoption of such policies may, thus, be recommended in order to increase safety in the workplace.

Keywords: COVID-19; occupational health; preventative medicine

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Supplementary material

Supplementary Figure 1. Flow chart of study participants selection.

Supplementary Figure 2. Timeline of adopted pandemic management policies

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Table I. Demographic and clinical characteristics of assessed participants

Variable	All participants (*N*=1359)
Males – *n* (%)	1141 (84.0)
Age group – *n* (%)	
<30 years old	198 (14.6)
30-39 years old	309 (22.7)
40-49 years old	300 (22.1)
50-59 years old	338 (24.9)
≥60 years old	215 (15.7)
Healthcare professionals – *n* (%)	15 (1.1)
Cohabitants of healthcare professionals – *n* (%)	140 (10.3)
Comorbidities – *n* (%)	464 (34.1)[a]
Hypertension	174 (12.8)
Overweight and obesity	135 (9.9)
Dyslipidaemia	15 (1.1)
Heart failure	8 (0.6)
Other cardiovascular diseases	24 (1.8)
Diabetes	33 (2.4)
Thyroid diseases	8 (0.6)
Asthma	53 (3.9)
Chronic obstructive pulmonary disease	3 (0.2)
Other respiratory and allergic diseases	81 (6.0)
Gastro-intestinal diseases	9 (0.7)
Kidney diseases	3 (0.2)
Neuropsychiatric diseases	12 (0.9)
Auto-immune diseases	30 (2.2)
Oncological diseases	8 (0.6)
Other diseases	31 (2.3)
Regular medication for chronic diseases – *n* (%)	385 (28.3)[b]
Antihypertensives	166 (12.3)
Antidyslipidaemics	105 (7.8)
Anticoagulants and antithrombotics	34 (2.5)
Other agents primarily affecting the cardiovascular system	13 (1.0)
Antidiabetic drugs	27 (2.0)
Other agents primarily affecting the endocrine system	31 (2.3)
Antihistamines	29 (2.1)
Antiasthmatics and bronchodilators	15 (1.1)
Agents primarily affecting the gastrointestinal system	40 (2.9)
Agents primarily affecting the genitourinary system	14 (1.0)
Sedatives and hypnotics	23 (1.7)
Antidepressants	17 (1.3)
Other agents primarily affecting the central nervous system	14 (1.0)
Nonsteroidal anti-inflammatory drugs	41 (3.0)
Acetaminophen and other analgesics	42 (3.1)

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Drugs for arthrosis or gout	21 (1.6)
Vaccination history – *n* (%)	
Bacillus Calmette–Guérin (BCG) vaccine	845 (62.2)
Influenza vaccine	103 (7.6)
Pneumococcus vaccine	20 (1.5)
Work from home – *n* (%)	1147 (84.4)
Number of weeks working from home – median (p25-p75)	15 (8-17)
Mask use when working – *n* (%)	1097 (80.7)[c]
Since >3 months before testing	39 (3.6)
Since 3 months before testing	457 (41.7)
Since 2 months before testing	187 (17.0)
Since 1 month before testing	414 (37.7)
***N* times per day washing hands with soap and water – median (p25-p75)**	10 (5-12)
***N* times per day disinfecting hands with alcohol-based sanitizers – median (p25-p75)**	8 (4-12)
Symptoms in the 4 weeks before testing – *n* (%)	51 (3.8)[d]
Cough	15 (1.1)
Fever	9 (0.7)
Dyspnoea	5 (0.4)
Anosmia	2 (0.1)
Pharyngitis	15 (1.1)
Headache	15 (1.1)
Myalgia	13 (1.0)
Diarrhoea	7 (0.5)
Contact with patients with COVID-19 – *n* (%)	36 (2.6)
Symptomatic patients	17 (47.2)
Contact with other patients with fever, cough, dyspnoea or other COVID-19 compatible symptoms – *n* (%)	18 (1.3)
Travels abroad during 2020 – *n* (%)	207 (15.2)

p25: Percentile 25; p75: Percentile 75; [a] Including 341 participants (73.5%) with a single comorbidity, 92 participants (19.8%) with two comorbidities, and 31 participants (6.7%) with more than two comorbidities; [b] Including 220 participants (57.1%) whose outpatient medication belonged to a single drug class, 73 participants (19.0%) whose outpatient medication belonged to two different classes, and 165 participants (42.9%) whose outpatient medication belonged to more than two different classes; [c] Including 91% (*n*=193) participants among those who did never work from home; [d] Including 36 participants (71%) reporting one single symptom, and 15 participants (29%) with more than one symptom.

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Table II. Description of patients with positive molecular (polymerase chain reaction – PCR) and/or serological results (IgG)

Case	Sex	Age group	Professional activity	Comorbidities	Regular medication for chronic diseases	*N* months using mask when working	*N* weeks working from home	COVID-19-compatible symptoms during 2020	Potential risk exposures during 2020	COVID-19 related admission	PCR	IgG
1	Female	40-44 y.o.	Engineer	Allergic diseases	None	1	18	Yes (March; June)	Travel abroad (France)	No	+ [a]	+
2	Female	50-54 y.o.	Administrative technician	None	Antiacid/antiulcer agents	0	16	Yes (March)	No	No	+ [a]	+
3	Male	65-69 y.o.	Engineer	None	Antihypertensives; antidyslipidaemics	1	8	Yes (March)	No	Yes [b]	+ [a]	+
4	Male	65-59 y.o.	Executive manager	Hypertension	Antihypertensives; antidyslipidaemics; anticoagulants/ antithrombotics; antiacid/antiulcer agents	1	10	Yes (March; June)	Travel abroad (France)	No	+ [a]	+
5	Male	25-29 y.o.	Engineer	None	None	2	6	No	Travel abroad (Italy)	No	+ [c]	-
6	Male	40-44 y.o.	Manager	None	None	2	4	No	No	No	+ [c]	-
7	Male	60-64 y.o.	Engineer	Hypertension; overweight	Antihypertensives; antiacid/antiulcer agents	0	17	No	No	No	+ [c]	-
8	Male	35-39 y.o.	Production supervisor	None	None	3	8	No	No	No	+ [d]	-
9	Male	60-64 y.o.	Electrician	Unspecific systemic symptoms	None	2	0	Yes (March)	No	No	+ [d]	+
10	Male	20-24 y.o.	Electrician	None	None	3	8	Yes	Family contact with a patient with confirmed COVID-19 infection	No	+ [e]	+
11	Male	25-29 y.o.	Electrician	None	None	3	8	No	No	No	+ [e]	-
12	Male	35-39 y.o.	Electrician	None	Acetaminophen; non-steroidal anti-inflammatory drugs	1	12	No	Cohabitant with a healthcare professional	No	+ [e]	-
13	Male	50-54 y.o.	Electrician	None	None	3	0	No	No	No	+ [e]	-
14	Male	55-59 y.o.	Engineer	Hypertension	Antihypertensives	0	17	No	No	No	+ [e]	-
15	Male	35-39 y.o.	Engineer	None	None	0	18	Yes (January)	No	No	- [e]	+

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16	Male	30-34 y.o.	Maintenance technician	None	None	2	10	Yes (March)	Travel abroad (Spain)		No	- [e]	+
17	Male	40-44 y.o.	Engineer	None	None	1	15	No	No		No	- [e]	+
18	Female	40-44 y.o.	Architect	Bronchiectasis	None	2	19	Yes (March)	No		No	- [e]	+
19	Female	45-49 y.o.	Communication worker	Asthma	Acetaminophen; anti-asthmatics	1	18	Yes (March)	No		No	- [e]	+
20	Male	50-54 y.o.	Engineer	Sleep apnoea	None	0	12	No	No		No	- [e]	+
21	Male	50-54 y.o.	Electrician	None	None	3	0	No	No		No	- [e]	+
22	Male	55-59 y.o.	Maintenance technician	Hypertension, overweight	Antihypertensives	3	8	Yes (January)	No		No	- [e]	+
23	Male	55-59 y.o.	Electrician	None	None	3	11	No	No		No	- [e]	+
24	Female	60-64 y.o.	Nurse	Hypertension; overweight	Antihypertensives	3	0	Yes	Healthcare professional		No	- [e]	+
25	Male	60-64 y.o.	Topographer	Non-specified chronic respiratory diseases	Antihistamine	0	26	No	No		No	- [e]	+

[a] Results concerning a PCR test performed three months before this study was conducted (March 2020); [b] Including admission in intensive care unit; [c] Results concerning a PCR test performed two months before this study was conducted (April 2020); [d] Results concerning a PCR test performed one month before this study was conducted (May 2020); [e] PCR performed within the context of this study (June 2020).

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Supplementary Digital Material 1: Supplementary survey

Epidemiological survey answered by the participants of this study

[Below, we list the questions displayed in the epidemiological survey answered by the participants of this study. Such questions were presented after a preamble and after participants gave informed consent for their participation in this study]

1. Date: __ __ / __ __ / __ __ __ __
2. Name: _____
3. Company number: _____
4. City: _____
5. Sex: ○ Male ○ Female
6. Age group: ○ Less than 20 years old ○ 20-24 years old ○ 25-29 years old ○ 30-34 years old ○ 35-39 years old ○ 40-44 years old ○ 45-49 years old ○ 50-54 years old ○ 55-59 years old ○ 60-64 years old ○ 65-69 years old ○ 70 years old or more
7. Occupation: _____
8. Are you a healthcare professional? ○ Yes ○ No
    a. Indicate the service where you work*: _____
    b. Indicate your occupation*: ○ Doctor ○ Nurse ○ Technician ○ Other
9. Do you live with a healthcare professional? ○ Yes ○ No
10. Do you wear a mask in your professional activity? ○ Yes ○ No
    a. Since when*? ○ Since before March ○ Since March ○ Since April ○ Since May
11. How many times per day do you wash your hands with soap and water? _____
12. How many times per day do you disinfect your hands with a alcohol-based sanitizer? _____
13. Did you work from home for at least some time? ○ Yes ○ No
    a. For how many weeks did you work from home*? _____
    b. When did you start working from home*? __ __ / __ __ / __ __ __ __
14. In the 2 weeks prior to being tested you had (select all that apply): ☐ Fever ☐ Cough ☐ Shortness of breath ☐ Sore throat ☐ Muscle pain ☐ Headache ☐ Smell loss ☐ Diarrhoea ☐ No complaints
15. In the 2-4 weeks prior to being tested you had (select all that apply): ☐ Fever ☐ Cough ☐ Shortness of breath ☐ Sore throat ☐ Muscle pain ☐ Headache ☐ Smell loss ☐ Diarrhoea ☐ No complaints
16. Did you experience any symptom compatible with COVID-19 infection (fever, cough, shortness of breath, sore throat, muscle pain, headache, smell loss or diarrhoea)? ○ Yes ○ No
    a. The symptoms were experienced in*: ○ March 2020 ○ February 2020 ○ January 2020 ○ December 2019 ○ November 2019 ○ Before November 2019
17. Have you undergone any other COVID-19 test with a nasopharyngeal swab? ○ Yes ○ No

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a. When were you tested*? __ __ / __ __ / __ __ __ __
b. What was the test result*? ○ Positive ○ Negative

18. Have you recently been hospitalized? ○ Yes ○ No
    a. Have you been admitted to an intensive care unit*? ○ Yes ○ No
19. Before being tested, were you in contact with any patient with COVID-19? ○ Yes ○ No
    a. When did such contact occur*? ○ Within 2 weeks before testing ○ Between 2 and 4 weeks before testing ○ More than 4 weeks before testing
    b. Was the patient with whom you had contact symptomatic*? ○ Yes ○ No
    c. In what context did that contact occur*? ○ Professional ○ Familiar ○ Other (e.g., leisure, civic, religious…) ○ Unknown
20. In the month before testing, did you contact with anyone else who was sick (with fever, cough, or shortness of breath)? ○ Yes ○ No
    a. When did such contact occur*? ○ Within 2 weeks before testing ○ Between 2 and 4 weeks before testing
21. Since the beginning of 2020, did you travel abroad? ○ Yes ○ No
    a. Did you travel abroad in the 2 weeks prior to being tested*? ○ Yes ○ No
        i. To which place(s)? _____
    b. Did you travel abroad in the 3-4 weeks prior to being tested? ○ Yes ○ No
        i. To which place(s)? _____
    c. Did you travel abroad more than 4 weeks prior to being tested? ○ Yes ○ No
        i. To which place(s)? _____
22. Do you have any of these diseases? (select all that apply): ☐ Asthma ☐ Chronic obstructive pulmonary disease ☐ Other chronic respiratory diseases ☐ Hypertension (high blood pressure) ☐ Heart failure ☐ Other cardiovascular diseases ☐ Diabetes ☐ Chronic kidney disease ☐ Chronic liver disease ☐ HIV ☐ Oncological diseases ☐ Autoimmune diseases ☐ Overweight/obesity ☐ Others (indicate which: _____)
23. Are you undergoing haemodialysis? ○ Yes ○ No
24. Did you get the BCG vaccine? ○ Yes ○ No
25. Did you get the flu vaccine? ○ Yes ○ No
26. Did you get the pneumonia vaccine? ○ Yes ○ No
27. What medication do you do for chronic diseases? _____

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* Question presented only if an affirmative answer was provided to the question here displayed at an upper level.

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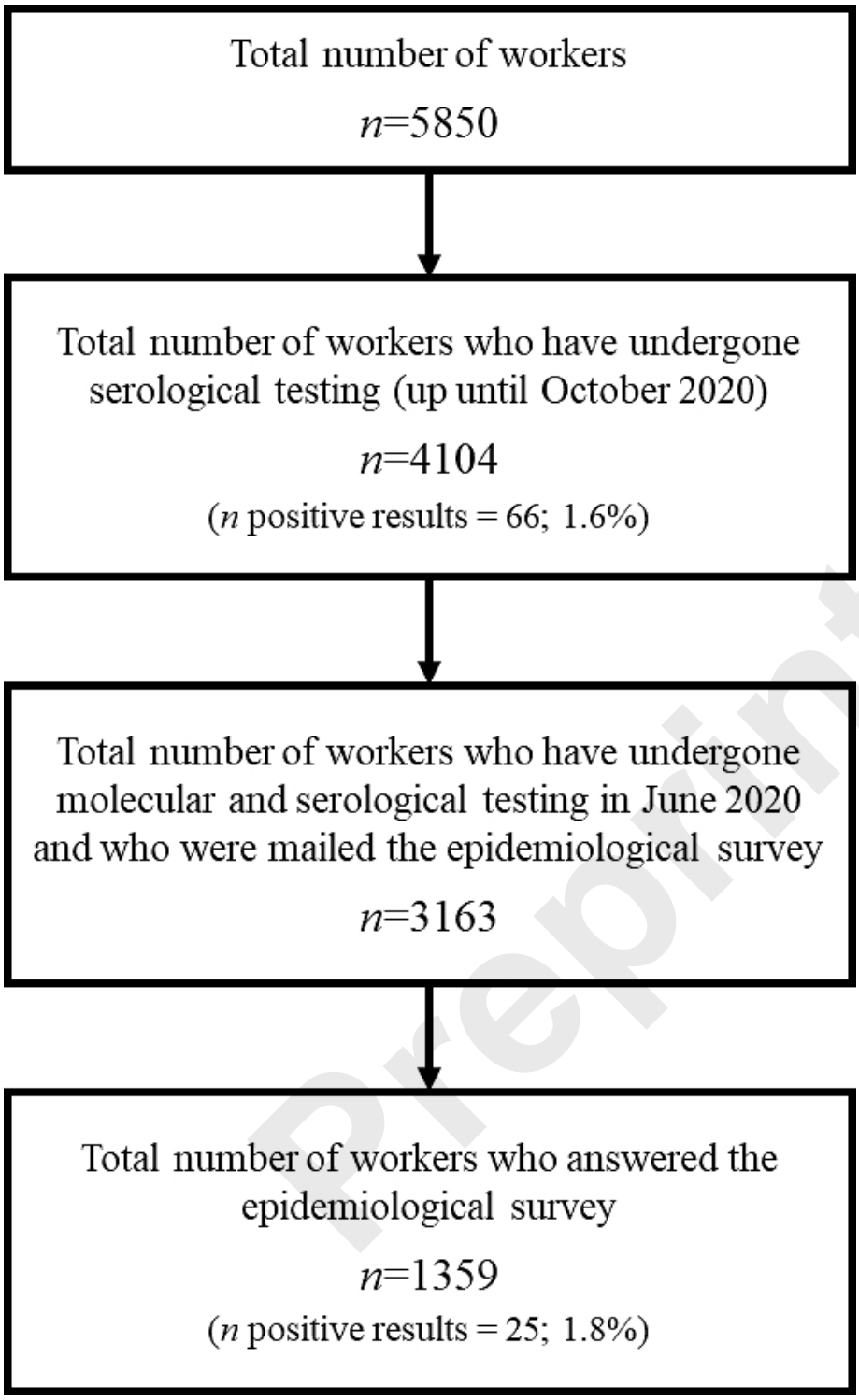
Total number of workers
n=5850
Total number of workers who have undergone serological testing (up until October 2020)
n=4104
(n positive results = 66; 1.6%)
Total number of workers who have undergone molecular and serological testing in June 2020 and who were mailed the epidemiological survey
n=3163
Total number of workers who answered the epidemiological survey
n=1359
(n positive results = 25; 1.8%)

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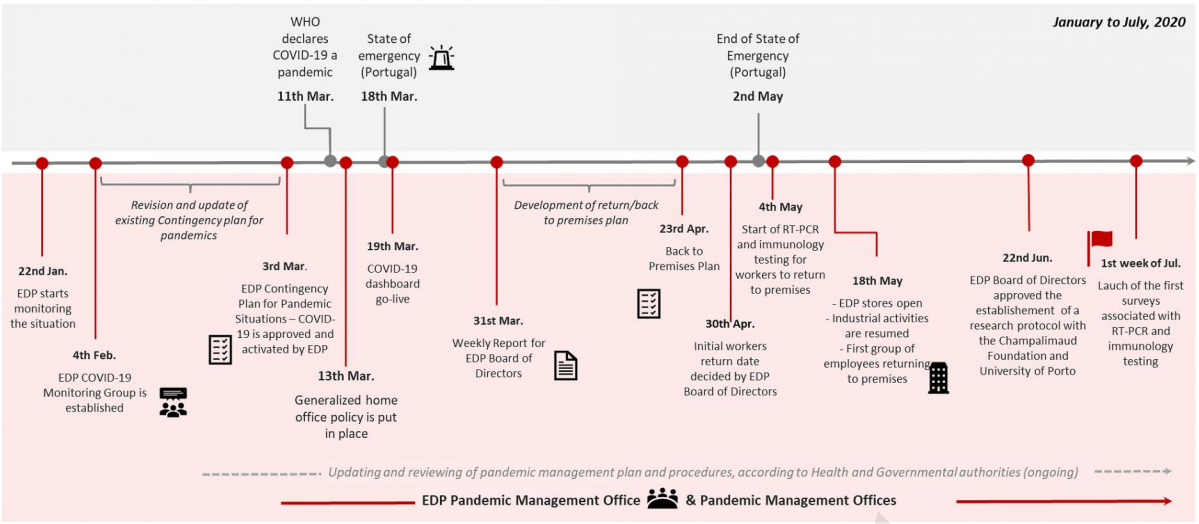
COVID-19 - Pandemic Management in EDP

Timeline – Summary



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