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Original Research

The Spread of COVID-19 Among 15,000 Physical Therapists in Italy: A Cross-Sectional Study

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Abstract

Objectives. The purpose of this study was to explore the prevalence, personal- and work-related exposures, and signs and symptoms among physical therapists during the first wave of coronavirus disease 2019 (COVID-19) in Italy.
Methods. This cross-sectional, survey-based study collected demographic and exposure data from physical therapists from April to May 2020. All physical therapists working in inpatient and outpatient care in Italy were eligible. A self-administered questionnaire was distributed among all eligible physical therapists to collect (1) demographic characteristics, (2–3) personal- and work-related exposures, and (4) signs and symptoms of COVID-19. Factors associated with a COVID-19–positive nasopharyngeal swab (NPS) were explored through logistic regression models and multivariate methods.
Results. A total of 15,566 respondents completed the survey, with a response rate of 43.3%, achieving high statistical precision (99% CI, 1% type I error). Among physical therapists who received NPS testing, 13.1% (95% CI = 12.1–14.1%) had a positive result, with a peak reached in March 2020 (36%). The top 5 symptoms were fatigue and tiredness (69.1%), loss of smell (64.5%), aches and pains (60.8%), loss of taste (58.3%), and headache (51.1%). No symptoms were reported by 8.9%. Working in a health care institution (odds ratio [OR] = 12.0; 95% CI = 7.8–18.4), being reallocated to a different unit (OR = 1.9; 95% CI = 1.3–2.7), and changing job tasks (OR = 1.6; 95% CI = 1.2–2.3) increased the risk of being COVID-19 positive. In therapists with a confirmed diagnosis of COVID-19, comorbidities were associated with male sex and age older than 51 years.
Conclusion. During the first wave in Italy, almost 1 out of 7 physical therapists tested positive on the COVID-19 NPS test. Considering personal- and work-related exposures, health care organizations should adopt prevention measures and adequate preparedness to prevent high rate of infections during future pandemics.
Impact. This is the largest investigation about the spread of and main risk factors for COVID-19 in the physical therapy field.

Keywords: Coronavirus Infections, Coronavirus, COVID-19, Disease Outbreaks, Pandemics, Physical Therapy, Physiotherapy, Prevention and Control, Severe Acute Respiratory Syndrome Coronavirus 2, Surveys and Questionnaires, Transmission

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Introduction

Severe acute respiratory syndrome coronavirus 2 is a new coronavirus that emerged in 2019 and causes coronavirus disease 2019 (COVID-19).[1] The virus is transmitted from person to person through respiratory secretions or contact with fomites.[2]

The number of cases of COVID-19 increased rapidly, and on March 11, 2020, the World Health Organization declared the outbreak a pandemic.[3] During the first wave, Italy reported 17,997 cases of COVID-19 in health care workers on April 12, 2020, accounting for more than 10% of all cases of COVID-19 in the country,[4] recently increasing the cumulative cases up to 43,698 (November 2, 2020).[5] The rapid spread of the virus has affected all health care workers, including physical therapists. Indeed, on the one hand, physical therapists are on the front line of the fight against COVID-19 disease due to their participation in the rehabilitation of patients with COVID-19 in the acute and post-acute periods[6,7]; on the other hand, physical therapists continue to maintain essential rehabilitation services across the care continuum (eg, patients with trauma and stroke).[8,9] The physical therapy profession has had a more than 100-year tradition of responding to epidemics.[9]

The rapid growth in the number of patients with COVID-19 exceeded the capacity of the health care system in Italy. Many departments, including rehabilitation wards, were converted into COVID-19 wards during the surge. These changes impacted the specific tasks and activities performed by all health care workers, including physical therapists, who play a central role in the management of patients with acute COVID-19, providing bedside assistance.[10] Support during noninvasive mechanical ventilation, postural changes, mobilization, and support during the process of weaning patients from invasive mechanical ventilators are some of the main activities performed by physical therapists that contribute to the management of patients with COVID-19 in the acute phase.[11]

Physical therapy also plays a role in the post-acute phase, providing exercise, education, and rehabilitation interventions to survivors of critical COVID-19, with the goal of enabling patients to regain functionality and return home able to perform the activities of daily living.[7] However, the prevalence of COVID-19 in physical therapists is unknown. This study is the first, to our knowledge, to provide real-life data on the prevalence and signs and symptoms of COVID-19 and the work-related risk of exposure in physical therapists. Additionally, this study aimed to investigate personal-related risk of exposure.

Methods

Design and Study Protocol

We conducted a cross-sectional study involving a structured online closed survey that was distributed to all physical therapists registered in Italy with the National professional Registry (Federazione Nazionale Ordini dei Tecnici Sanitari di Radiologia Medica, delle Professioni Sanitarie Tecniche, della Riabilitazione e della Prevenzione [TSRM-PSTRP]). TSRM-PSTRP is the official national body that legally recognizes professional physical therapists allowed to practice in Italy. No incentives were offered to participants. We followed the Guidelines for Reporting Survey-Based Research[12,13] and Observational Studies[14] as reported in Supplement 1. We registered this project in the COVIDPhysio Registry of the World Confederation for Physical Therapy, which represents more than 625,000 physical therapists worldwide (https://www.wcpt.org/COVIDPhysio#project-6). The draft protocol was reviewed by the Scientific Committee of the Italian Association of Physiotherapy (AIFI) and approved after the required revisions were made. More details are provided in the protocol, shared publicly via the Open Science Framework on May 21, 2020, at the following link: https://osf.io/x7cha. No important protocol amendments were made.

Survey Invitation and Sample

We developed a web-based questionnaire using the Survey Monkey platform[15] to collect answer data. We launched the survey on April 28, 2020, with a reminder sent on May 15, 2020 (Fig. 1). We closed the data collection period 4 weeks later. Informed consent and data protection were explicitly given by the respondents before they completed and submitted the survey, which was fully available in the Italian version stored at the following link: https://osf.io/x7cha. Items of the questionnaire are reported in Supplement 2.

The registration of physical therapists in Italy with the national professional registry is managed by an authenticated e-mail address. All questionnaires were filled out anonymously, and responses, automatically captured, could not be traced back to the respondents. To avoid the possibility of a single user filling in the same questionnaire multiple times, the SurveyMonkey platform prevents multiple responses using the internet protocol address, minimizing the chance of multiple responses. More details about the survey invitation and sample size are provided in Supplement 3.

Survey Questionnaire

We conducted a pilot test of our survey involving all the members of the Scientific Committee of AIFI to assess its clarity and accuracy. After revision, the final version of the questionnaire consisted of "consent to participate and privacy" (item 1) and 4 sections: (I) demographic characteristics (items 2–3), (II) personal risk of exposure (items 4–12), (III) work-related risk of exposure (items 13–18), and (IV) prevalence of COVID-19 (items 19–27). All items were mandatory. To ensure that the questionnaire was well suited for collecting data from the target population, the questionnaire was developed in Italian. A translated version in English is available in Supplement 2.

Statistical Analyses

Descriptive statistics are presented as medians and interquartile ranges or absolute values, percentages, and frequencies, as appropriate. We report the data in either a narrative description or a quantitative summary in tables and plots. We primarily looked at the overall cohort, investigating the response rate, the prevalence of COVID-19, signs and symptoms, and work-related risk exposure to COVID-19. For the response rate, an automated count for each of the 4 sections to detect incomplete questionnaires (ie, users did not finish all questionnaire sections) was acquired. For the national response rate, we considered all active members of the TSRM-PSTRP Registry, as described in Supplement 3. For estimating the prevalence and signs and symptoms, we mainly reported the descriptive analysis grouped by nasopharyngeal swab (NPS) test because it is the "gold standard" for diagnosing COVID-19.[16,17] In addition, we collected information about any confirmed COVID-19 (via NPS or serological test) and suspected COVID-19 (ie, perceptions of physical therapists).

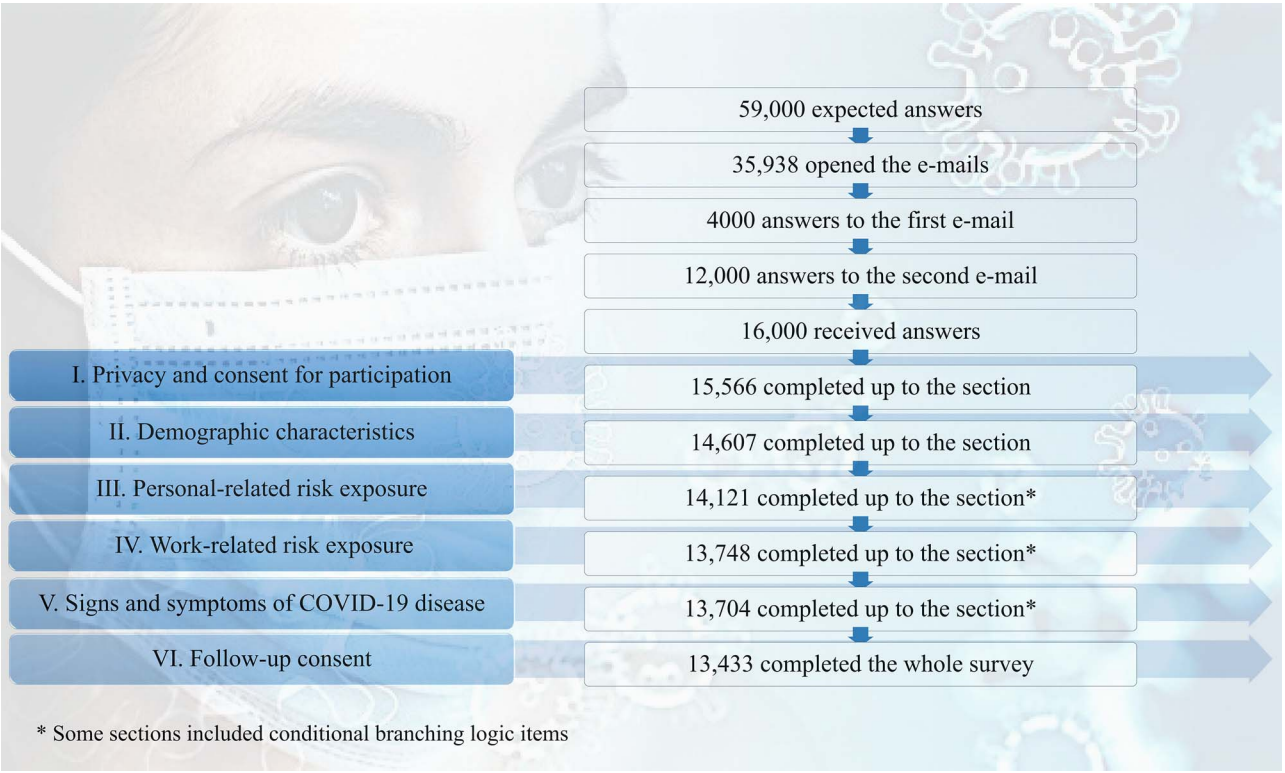

Figure 1. Flow diagram of the study. *, Some sections included conditional branching logic items.

For work-related risk of COVID-19 exposure (questions 13–18, section 3; Suppl. 2), we used univariate logistic regression to study the relationships of work-related characteristics grouped by NPS test and any confirmed and suspected diagnosis of COVID-19. For multilevel items (ie, item 15), we collapsed answers into 2 categories (ie, working in a health care institution or not). We determined the odd ratios (ORs) and their 95% CIs for each level of the independent variables. One level of each characteristic was used as the reference group against which the odds of having a diagnosis of COVID-19 were measured. The reference group used was the last category to enhance the relevance of the results. CIs provide information about the precision of the estimates. We chose to examine univariate associations rather than multivariate associations to present our information at the simplest level, thereby providing a foundation for future hypothesis testing.

Additionally, we investigated the associations between personal-related risk of COVID-19 exposure (sections 1 and 2 in Suppl. 2), with any confirmed diagnosis of COVID-19 by means of multiple correspondence analysis, a multivariate method, presenting the similarities and association among variables in a graphical form.[18] Statistical significance was set at $P < .05$. Data were exported from SurveyMonkey and prepared for analysis with SPSS statistical software version 25.0[19] and R Core Team (2019) version 3.6.2.

National Context

According to the national data (updated on May 30, 2020),[20] in Italy the infection rate was 0.38% with 228,125 cumulative cases (60,244,639 units[21]), and the prevalence of NPS testing performed in the same period on the general population was 3.7% (n = 2,253,252).[22] To better contextualize the survey investigation, the integrated surveillance of COVID-19 national data in Italy is reported in Supplementary Appendix A, and the COVID-19 protocols in place in Italy during the period covered by the survey are listed in Supplementary Appendix B.

Role of the Funding Source

The Associazione Italiana di Fisioterapia (AIFI) only supported the acquisition of the Survey Monkey license. The Scientific Committee of AIFI did not receive any fee in conducting the study design and in preparation, review, and approval of the manuscript.

Results

Response Rate

The delivery rate was 99.7%. Overall, we had 15,566 respondents out of 35,938 active members, yielding a response rate of 43.3%. Among those who responded, 589 did not give consent (3.7%), and 370 failed to complete the questionnaire after the first question (2.4%). The sample obtained for every section is reported in the flow diagram (Fig. 1).

Respondents' Characteristics

Table 1 shows the demographic and occupational characteristics of the overall cohort of respondents. The median age was 40 years (IQR = 32–50 y), with the main prevalence of women (63%). Most physical therapists did not have a habit of smoking (63%) and did not receive a flu vaccination in the previous year (83%). One-third of physical therapists (33%) had at least 1 comorbidity, and the majority were physically active (78%). Considering occupational characteristics, 67% (n = 9215) were active at their own workplace. Of these, 8.8% (n = 807) were reallocated to a different unit and 8.5% (n = 782) changed job tasks.

Table 1. Characteristics of Overall Responders[a]

Characteristic	No.	(%)
Demographic characteristics		
Overall	14,607	100
Sex		
Men	5405	37
Women	9202	63
Age group (y)		
20–29	2737	19
30–39	4301	29
40–49	3493	24
50–59	3222	22
60–69	803	6
>70	51	0
Smoking status		
>5 cigarettes/d	1294	9
<5 cigarettes/d	1167	8
Ex	2754	19
Never	8906	61
No reply	486	3
BMI (kg/m^2)		
<18.5	440	3
18.5–24.9	9760	67
25–29.9	3156	22
30–39.9	649	4
>40	26	0
Unavailable	576	4
Physical activity (min/wk)		
≥150	6211	43
<150	5208	36
0	2702	19
No reply	486	3
Flu vaccination (last 12 mo)		
Yes	1992	14
No	12,129	83
No reply	486	3
Health status[a]		
Pulmonary diseases	624	4
Cardiac diseases	221	2
Hypertension	1000	7
Kidney diseases	121	1
Immune system disorders	1798	12
Rheumatic diseases	345	2
Oncology diseases	286	2
Metabolic diseases	345	2
Depression/anxiety	414	3
Pregnancy	273	2
Other (surgery . . .)	819	6
Nothing	9791	67
Occupational characteristics		
Overall	13,748	100
Professional field		
Cardio-respiratory	363	3
Geriatric	1654	12
Neurologic	1311	10
Oncologic	82	1
Orthopedic-musculoskeletal	4971	36
Pediatric	389	3
Urogynecologic	48	0
Mixed	4930	36
Working facilities		
Residential care home	1594	12
Private/public rehabilitation clinics	3041	22
More than 1 (eg, residential care home + private setting)	1636	12
Private/public hospital	2933	21
Private setting	3149	23
Home	1395	10
Current employment status		
On duty at the workplace	9215	67

(*Continued*)

Table 1. Continued

Characteristic	No.	(%)
On duty (tele-work)	459	3
Not on duty (on vacation, leave, parental leave, layoff, sick leave)	1694	12
Not on duty (professional activity suspended by law or suspended due to COVID-19 outbreak)	1994	15
Not on duty (diagnosis of COVID-19)	280	2
Quarantined (suspected COVID-19)	106	1

[a] More than 1 answer was possible. BMI = body mass index.

Two-thirds of physical therapists worked in a health care institution (67%) and a few in the cardiorespiratory field (3%). Details about respondents' characteristics stratified by all diagnoses of COVID-19 are reported in Supplement 4, Table S1.

Prevalence of COVID-19

Considering the overall cohort of respondents, 3.6% of the physical therapists had a positive NPS test for COVID-19 (n = 14,607). In our sample, 4055 physical therapists received NPS testing (27.8%; 95% CI = 27.0%–28.5%), with a positive result in 530 (13.1%; 95% CI = 12.1%–14.1%).

Overall, 11.1% of the participants (1620 out of 14,607) answered "yes" to suspected COVID-19 (Question no. 19, "Do you have or think you might have COVID-19?"); among those, 57% (928 out of 1620) received NPS testing, with a positive result in 31.7% (n = 514) and negative results in 22.4% (n = 362). Supplement 4, Table S2 shows the prevalence stratified by NPS test results among suspected COVID-19.

The peak in positive results on NPS tests was reached in March 2020, when more than one-third (348 out of 959; 36%) of the tested physical therapists had a positive result for COVID-19 (Suppl. 4, Box S1).

Signs and Symptoms of COVID-19

In the overall cohort, we assessed the prevalence of symptoms reported by respondents with a positive NPS test of COVID-19 (n = 530). The top 5 symptoms were fatigue and tiredness (69.1%), loss of smell (64.5%), aches and pains (60.8%), loss of taste (58.3%), and headache (51.1%). No symptoms were reported by 8.9% (Fig. 2). In Supplement 4, Figure S1 we reported the symptoms stratified by any confirmed and suspected diagnosis of COVID-19.

Work-related Risk of Exposure

For work-related risk of exposure, we refer to questions 13 to 18 (Sec. 3 of Suppl. 2). In Table 2, we investigated whether work-related variables were associated with a positive NPS test of COVID-19. Working in a health care institution, being reallocated to a different unit (eg, from the musculoskeletal unit to the respiratory unit), and changing tasks (eg, triage operator) increased the risk of contracting COVID-19. In Supplement 4, Table S3, we reported the work-related variables associated with any confirmed and suspected diagnosis of COVID-19.

Among the physical therapists with a positive NPS diagnosis, 42% reported contacts with suspected/confirmed COVID-19 patients while wearing personal protective equipment (PPE); 37.4% reported contacts without wearing PPE and 20.6% did not report any contact. Supplement 4, Table S4 contains the descriptive analysis about NPS test results stratified by use of PPE.

Personal Risk of Exposure

The relationship between personal characteristics (questions 4–12, Section 2 in Suppl. 2) in physical therapists with COVID-19 is summarized in Supplement 5, Figure S1. The multiple correspondence analysis biplot showed a global pattern along the first axis for physical therapists with and without comorbidities. In physical therapists with a diagnosis of COVID-19, all the evaluated comorbidities were associated with male sex and with an age older than 51 years. In contrast, younger age (ie, the fourth decade of life) was associated with the absence of all evaluated comorbidities and the investigated risk factors, such as smoking or excessive weight. Moreover, having received the seasonal influenza vaccination was strongly associated with smoking and with the presence of immune system disorders and other chronic conditions.

Discussion

During the first 5 months of 2020, we found 13.1% (95% CI = 12.1%–14.1%) of positive NPS among those physical therapists who received the NPS test, the standard diagnosis for COVID-19.[17] This percentage translates into a 3.6% infection rate considering the overall sample of respondents as denominator.

The infection rate was 10 times higher than that reported in the Italian general population according to the national data (updated on May 30, 2020), with a prevalence of 0.38%[20] (Suppl. Appendix A). However, physical therapists, as all health care workers, could have been tested more than the general population during the same period. In our sample, 27.8% of physical therapists received NPS tests, compared with 3.7% of the general population of Italy.[22]

The peak of positive cases was reached in March, when 1 out of 3 physical therapists (36%) had received the diagnosis of COVID-19. The peak period overlaps with the integrated COVID-19 surveillance national data in Italy about all infectious cases and all health care worker COVID-19 cases.[20]

Regarding the symptoms described, we found that loss of smell and loss of taste were in the top 5 symptoms in all groups analyzed, whereas fever was not.[26] Our findings agree with those of a multicenter European study (n = 417)[27] in which the prevalence of olfactory and gustatory dysfunction were relatively higher in European patients with COVID-19, often as the only significant complaint. Moreover, these symptoms seem to be potential predictors of COVID-19, and they could be included as part of routine triage screening for COVID-19.[28,29]

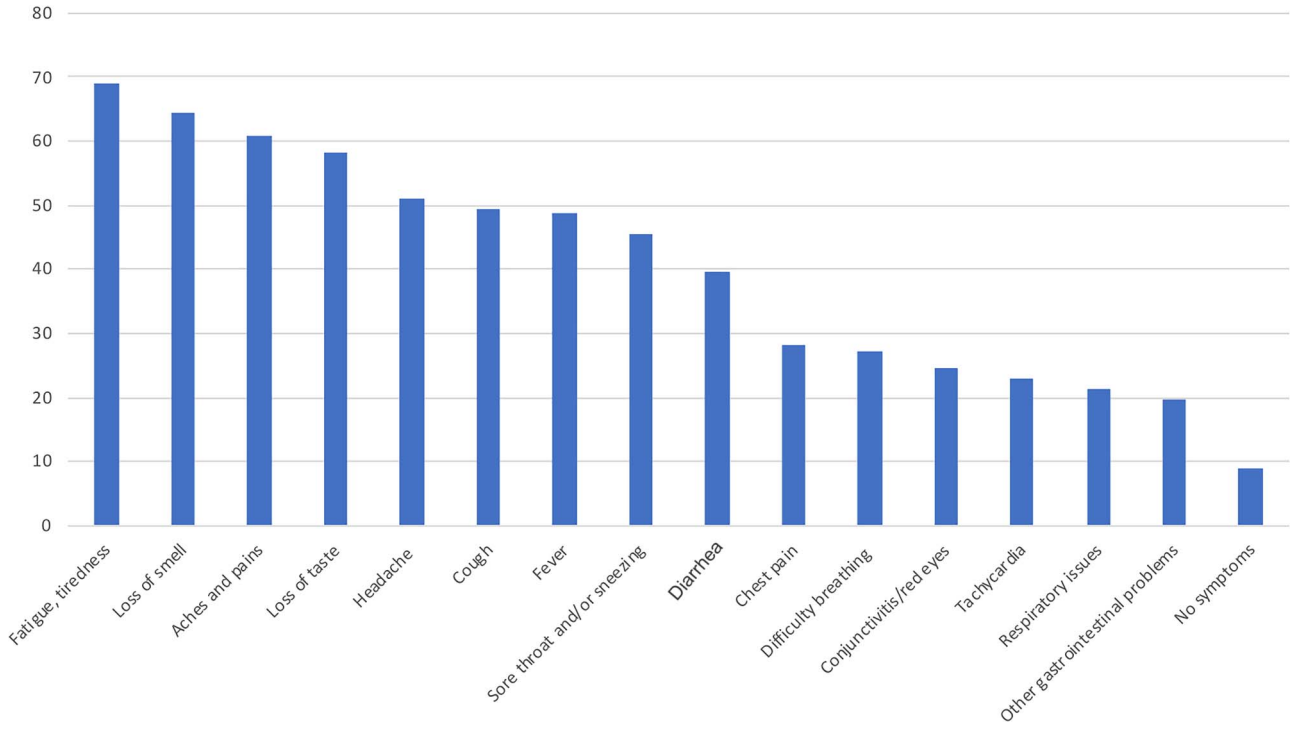

Figure 2. Symptoms stratified by positive NPS.

Table 2. Work-Related Risk Exposure Associated With Positive NPS COVID-19 Test in All Respondents[a]

Investigated Work-Related Risk Factors	Positive NPS Test		
	N	OR Value	95% CI
Working in health care institution[b]	13,671	12.0	7.8–18.4
Reallocation to different unit[c]	6426	1.9	1.3–2.7
Changing job tasks[d]	6430	1.6	1.1–2.3

[a]NPS = nasopharyngeal swab; OR = odds ratio. [b]OR calculated as the ratio between the odds in the presence of characteristic variable against the odds of another category used to the reference group (ie, working in health care institution. The OR is the ratio between the odds of working in health care institution against the odds of working in private practice. For working in health care institutions, we included all answers except working in private practice (ie, working at home and private setting). See item 15, Section 3 of Supplement 2. [c]OR calculated as the ratio between the odds in the presence of characteristic variable against the odds in the absence of the variable (ie, reallocation to different unit. The OR is the ratio between the odds of reallocation to different unit against the odds of no reallocation to different unit). See item 17, Section 3 of Supplement 2. [d]OR calculated as the ratio between the odds in the presence of characteristic variable against the odds in the absence of the variable (ie, changing job tasks. The OR is the ratio between the odds of changing job tasks against the odds of no changing job tasks). See item 18, Section 3 of Supplement 2.

Our data should be contextualized in the first-wave pandemic era during which protocols for prevention and control of COVID-19 were susceptible and changeable due to the national and international epidemiological context (eg, availability of NPS testing, use of PPE, quarantine period, and readmission to work), as reported by the operating instructions in Supplementary Appendix B. In fact, these data could be an underestimation of the real-world situation. Among physical therapists, who had the opportunity to verify the positive diagnosis by NPS test, few were asymptomatic (approximately 10%). Similar estimates were found in a recent systematic review.[30] Among physical therapists with suspected COVID-19, approximately one-half had the opportunity to verify the diagnosis of COVID-19 by NPS test, with negative results in one-fifth of cases.

As with the lack of widespread availability of NPS testing, the widespread unavailability of PPE could have contributed to an increased risk of COVID-19. A living rapid review showed that PPE use decreased infection risk in health care workers.[31] However, in our sample, the relationship between the use of PPE and risk of COVID-19 is unclear due to the number of NPS tests received and the heterogeneity of use of PPE (ie, surgical or N95 masks). In Italy, surgical masks were considered sufficient protection in most cases unless the health care workers were engaged in high-risk aerosol-generating procedures or operating in a high-intensity care area with prolonged exposure,[32] as was the case for the 3% of our physical therapist sample who were working in respiratory units at the time of the pandemic.

Regarding the risk factors, our findings showed that there were some work-related exposures that could increase the risk of contracting COVID-19. During the COVID-19 emergency, the work of professionals in the clinical physical and rehabilitation medicine (PRM) departments significantly changed. Most of the clinical PRM departments in Europe suspended some of their activities, and PRM professionals were reallocated to units in charge of treating COVID-19 patients.[33] In our sample, one-fifth of physical therapists

active at their own workplace were reallocated or changed job tasks. In fact, we found that working in a health care institution, being reallocated to a different unit, and changing job tasks increased the risk of being positive by an important amount (OR = 12.0, 95% CI = 7.8–18.4; OR = 1.9, 95% CI = 1.3–2.7; OR = 1.6, 95% CI = 1.1–2.3; respectively).

Finally, considering personal variables, we found that some physical therapists who contracted COVID-19 had various chronic conditions. The presence of risk factors such as obesity and smoking tobacco, coupled with preexisting health conditions, is known to increase the likelihood of poor outcomes (eg, multiple organ failure).[34–36]

Consistent with physical therapy being a female-dominated profession,[37] our sample was predominately female; however, the men in the sample were likely to be more vulnerable, especially when they had more underlying diseases,[38] which would increase the likelihood of poor outcomes in the sample.

Strength and Limitations

To our knowledge, this is the largest cross-sectional survey exploring the spread of COVID-19 among physical therapists in Italy and worldwide. We enrolled 15,566 respondents, of whom 14,607 (94%) completed at least 1 question after giving consent and 13,433 (86%) completed the entire survey. We were able to reach the sample size required to achieve high statistical precision at a 99% confidence level with a type I error of 1%; however, this does not guarantee the absence of selection bias because we did not perform an analysis of nonrespondents.

Some other limitations must be acknowledged. Factors such as questionnaire length, the term "survey" in the text of the e-mail, and the lack of incentives might have influenced the response rate: a Cochrane review showed a lower odds of response in such situations.[39] However, the final percentage of respondents did not seem to bias our results, as we reached the planned target sample size even for the completion of the entire questionnaire.

We kept the survey open for a month, and some of the questions necessitated retrospection on the part of the participants; thus, there may have been recall bias. Moreover, we cannot ignore the fact that our findings may have been affected by Neyman bias, because our investigation collected data pertaining to a span of time[40]; therefore, we could not completely elucidate the relationship between exposure and disease development (eg, symptoms suggesting a diagnosis of COVID-19 that occurred in February might not be accurately reflected in the negative results of a NPS test performed in April).

Finally, the accuracy of the data regarding perceived knowledge is uncertain, as the data were collected via a self-reported survey.

Implications for the Future

Our results might lead health care organizations to learn important lessons. Health care organizations should adopt prevention measures and adequate preparedness to prevent high rate of infections in future pandemics, such as: (1) avoid changing the tasks in which physical therapists engage and avoid reallocating them to different units; (2) guarantee an adequate number of respiratory physical therapists with expert knowledge, dedicated to respiratory units; and (3) pay attention to more vulnerable categories of physical therapists.

Conclusion

During the first wave of the pandemic, 13.1% (95% CI = 12.1%–14.1%) of physical therapists who received NPS testing experienced COVID-19 in Italy. Working in a health care institution, being reallocated to a different unit, and changing job tasks might be risk factors associated with a positive diagnosis of COVID-19; being male with underlying disease was the main feature that characterized infected physical therapists aged older than 51 years. These associations should be confirmed by adequate cohort studies.

Author Contributions

Concept/idea/research design: S. Gianola, G. Castellini, A. Turolla
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Funding

This study was funded by the AIFI.

Study Registration

This study was registered in the COVIDPhysio Registry of the World Confederation for Physical Therapy, which represents more than 625,000 physical therapists worldwide, at the following link: https://www.wcpt.org/COVIDPhysio#project-6.

Data and Material Availability

All data generated or analyzed during this study are included in this published article and its supplementary files. Raw data are stored in an open platform at the following link: https://osf.io/x7cha.

Ethics Approval

Ethics approval was exempted according to the "ethics and data protection" regulations of the European advisory body and European Commission. The recruitment of physical therapists was based on the TSRM-PSTRP Registry. The study project and data collection were managed by the National Directive Committee of AIFI and anonymously entrusted to an independent unit for data analysis. The data subject cannot be reidentified and therefore outside the scope of the data protection law.[23–25] The study complies with the Declaration of Helsinki.

Disclosures

The authors completed the ICMJE Form for Disclosure of Potential Conflicts of Interest and reported no conflicts of interest.

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