Risk factors for SARS-CoV-2 virus infection among physiotherapists in Poland. Preparing for the 5th wave of the pandemic

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Abstract

Introduction: Since the beginning of the COVID-19 pandemic, over 532 million people have been infected with the SARS-CoV-2 virus. In the case of COVID-19, all medical personnel are particularly vulnerable. By becoming more familiar with the risk and protective factors among physiotherapists, we will be able to better prepare for similar occurrences in the future.

Aims: The objective was to distinguish risk and protective factors for COVID-19 incidence among physiotherapists in Poland.

Materials and methods: Links to the questionnaires were sent via email to all Polish registered physiotherapists in November 2020.

Results: The study was conducted on a sample of 2044 physiotherapists. Multivariate analysis results indicated that physiotherapists' having a child or children in the first grades of primary school increased their risk of COVID-19 infection by more than 70% (compared to physiotherapists who did not have children of that age). Individuals working in hospitals had a more than 50% higher risk of contracting the disease, while working in a private practice reduced the risk of contracting SARS-CoV-2 by nearly 40%. Working overtime increased the risk of contracting the disease by 30% compared to physiotherapists whose work did not exceed full-time hours.

Conclusions: In order to prevent exposure to infection, special protective measures would need to be implemented for physiotherapists with preschool children, who work in a hospital and work overtime.

Key words

SARS-CoV-2, risk factors, protective measurements.

Introduction

Since the beginning of the COVID-19 pandemic, SARS-CoV-2 virus infection has been identified in more than 677 million people worldwide, while more than 6.7 million patients have died as a result of the infection. In Poland, the infection has been confirmed in about 6.3 million people, while over 118,000 have died [1].

As for COVID-19, the group particularly vulnerable to severe course of the disease and risk of death are the elderly, a fact that has been under investigation since the beginning of the pandemic [2]. However, based on their professional status and role in combating the effects of the pandemic, all healthcare professionals should be recognized [3], i.e., primarily physicians, but also paramedics, nursing staff, laboratory diagnosticians, and physiotherapists. According to data from the Ministry of Health from February 2022, on average among 100 infected individuals there were 2 nurses (about 109,000, and over 250 died), almost 1% of all infected were doctors (about 46,000, and over 300 died), and 0.4% were physiotherapists (20,000, and 10 died) [4].

Medical professionals have a seven times greater risk of contracting a severe COVID-19 infection. [5]. The existing SARS-CoV-2 variants have led to the collapse of the healthcare system in some areas of the country in certain periods of the years 2020 and 2021 [6].

The epidemic emergency is still ongoing and with the possibility of a fifth wave of the pandemic, there is a growing need to adequately protect employees working in the healthcare system. As of today (end of July 2022), the degree of danger in the near future is not fully known. By becoming more familiar with the risk and protective factors among physiotherapists, we will be able to better prepare for similar occurrences.

Aims

The aim of this paper was to distinguish risk and protective factors for COVID-19 infection among physiotherapists in Poland, based on data from representative research commissioned by the National Chamber of Physiotherapists in Poland, conducted within the first year of the pandemic.

Materials and methods

Identification of factors that increase the risk of SARS-CoV-2 virus infection among Polish physiotherapists was carried out based on the results of a questionnaire conducted between November 9th and 12th 2020, commissioned by the presidium of the National Chamber of Physiotherapists (KIF). An invitation to participate in the research (links to the questionnaires) was sent via email to all registered physiotherapists in Poland. The research was conducted using the Computer-Assisted Web Interview (CAWI) method [7]. Ultimately, once incomplete responses were excluded, the sample size reached 2,044 individuals, which, taking into account the size of the population of registered physiotherapists in Poland (approximately 70,000), indicates a maximum measurement error of 2.14% (assuming the 95% confidence level). Therefore, the research can be considered representative, and its results (thanks to close cooperation with KIF), can be accepted as official national data referring to the population of physiotherapists in Poland.

Infection with the SARS-CoV-2 virus was determined through respondents' declarations of obtaining a positive test result confirming the infection. The statistical analysis was divided into two stages: preliminary and final. In the preliminary stage, risk factors for SARS-CoV-2 virus infection (possible to determine from the questionnaire assuming the veracity of the questionnaire declarations) were extracted using univariate logistic regression. At the final stage, multivariate logistic regression analysis was used to identify which set of factors (extracted at the preliminary stage of

analysis) statistically best determined the risk of contracting the SARS-CoV-2 virus by physiotherapists.

Before beginning the analysis, the sample was divided into two groups: "learner" and test in a 3:1 ratio. Prior to splitting participants into 2 subsamples, the initial sample was limited to 1,744 individuals, excluding those who refused to answer the question about SARS-CoV-2 virus infection. The parameters of the model were estimated on a "learning" sample, while the reliability of the impact of the factors highlighted in the model was confirmed on a test sample (to exclude the case in which the model only learns "itself" without a confirmed predictive value). The cutoff point for predictions made on the basis of the multivariate model was determined using the ROC curve [8]. It should be emphasized that the authors did not aim at constructing a model to predict the physiotherapists' SARS-CoV-2 infection status and the prediction procedure was used only to confirm the significance of the variables included in the multivariate model.

Results

The research was conducted on a sample of 2044 physiotherapists. Approximately ¾ of the participants were women. More than half of the respondents (52.9%) were under the age of 35, one in three were between 35 and 49 years old, while just over 13% were 50 years or older. The gender and age structure of the respondents is characterized by a high level of conformity with the relevant structure characterizing the population of physiotherapists in Poland (structure similarity index = 99.0%). Nearly ⅔ of the participants were those with a master's degree in physiotherapy, of whom less than 5% also had a specialization, one in five respondents had a bachelor's degree in physiotherapy, while nearly 12% were physiotherapy technicians. One in four respondents lived in a large city, one in five in a big city, about 45% in a small or medium-sized city, while 7% lived in a rural area (**Table 1**).

To determine the factors influencing the risk of contracting the SARS-CoV-2 virus by physiotherapists, a univariate logistic regression model was used in the first stage of the analysis. Potential risk/protective factors were divided into 4 groups: (1) sociodemographic factors; (2) factors related to working as a physiotherapist; (3) adherence to sanitary recommendations; (4) factors related to health status. A summary of the statistical significance of the analyzed variables in the aforementioned univariate model was provided in **Table 2**.

Statistically significant variables in the univariate logistic regression model were used in the multivariate model at a further step of the analysis, with only statistically significant variables left in the final form of the model ($p < 0.05$, **Table 3**).

The results of the multivariate analysis indicated that physiotherapists' having a child or children in the first grades of primary school increased their risk of contracting COVID-19 by more than 70% (compared to physiotherapists who did not have children of that age). Those who work in hospitals had a more than 50% higher risk of contracting the disease, while working in private practice reduced the risk of contracting SARS-CoV-2 by nearly 40%. Working overtime increased the risk of contracting the disease by 30% compared to physiotherapists whose work did not exceed full-time hours.

In order to determine the reliability of the parameters obtained in the model and the significance of the employed variables, a test of the model's predictive effectiveness was performed on the test sample, i.e., the part of the sample not used for estimating the model parameters. The test sample size was 450 subjects (25.0% of the total sample size). The cutoff point was determined using the ROC curve, with two independent predictions (using the Tangent method and the Youden index). The prediction efficiency of 71.3% (with the Tangent method) and 58.4% (with the Youden index), indicated that the variables used in the model with the obtained estimates of the

parameter scores significantly correlated with the real risk of infection by the subjects with the SARS-CoV-2 virus, and thus the results presented in this paragraph can be considered reliable (the results of the model predictions along with the parameters of the ROC curve are included in the appendix: **Fig. A1** and **Table A1**).

Table 1. Demographic structure of the sample.

Demographic character		N (%)
Sex	Male	532 (26.0%)
	Female	1512 (74.0%)
Age [years]	< 34	1082 (52.9%)
	35 – 49	687 (33.6%)
	50 <	275 (13.4%)
Education	Physiotherapy technician	240 (11.7%)
	Bachelor of physiotherapy	445 (21.8%)
	Master of physiotherapy	1264 (61.9%)
	Master of physiotherapy with specialization	95 (4.7%)
Place of residence	Large cities (more than 500 thousand residents)	529 (25.9%)
	Big cities (100 – 399 thousand residents)	436 (21.3%)
	Medium cities (20 – 99 thousand residents)	573 (28.0%)
	Small cities (up to 20 thousand residents)	355 (17.3%)
	Rural areas	151 (7.4%)

***Source*:** KIF research.

Table 2. Overview of univariate logistic regression analysis results (n=1229).

Group of factors	Analyzed risk/protective factor	N (%)
Sociodemographic factors	Age	0.6012
	Sex	0.5035
	Having children (yes/no)	0.4944
	Number of children	0.4625
	Having children of preschool age (yes/no)	0.7752
	Having children in grades I - III of primary school (yes/no)	**0.0246**

Occupational factors	Seniority of employment	0.5154
	Number of entities for which the physiotherapist provides the services	0.9271
	Weekly working hours	**0.0040**
	Hospital	**0.0032**
	Private practice	**0.0291**
	Sports club, gym	0.9367
Adherence to sanitary recommendations	Way of welcoming	0.6879
	Using a mask while shopping	0.4025
	Attending social gatherings	0.2199
	Attending movies, theater, sports or music events	0.6390
Health-related factors	Having a chronic disease	0.2773
	Having a cardiovascular disease	0.3951
	Having diabetes	0.2316
	Tobacco smoking	0.1781
	Self-assessment of health status	0.9225

***Source*:** KIF research.

***Notes*:** Statistically significant values are marked in bold font.

Table 3. Overview of multivariate logistic regression results examining risk/protective factors for SARS-CoV-2 virus infection among physiotherapists in Poland.

Variable	Parameter rating	P-value	SE	t(1224)	OR
Constant work	-2.36	-	0.30	-7.93	0.09
Children in grades I - III primary school	0.55	0.0164	0.23	2.40	1.73
Weekly working hours	0.26	0.0439	0.13	2.02	1.30
Working in a hospital	0.45	0.0081	0.17	2.65	1.57
Working in a private practice	-0.46	0.0267	0.21	-2.22	0.63

***Source*:** KIF research.

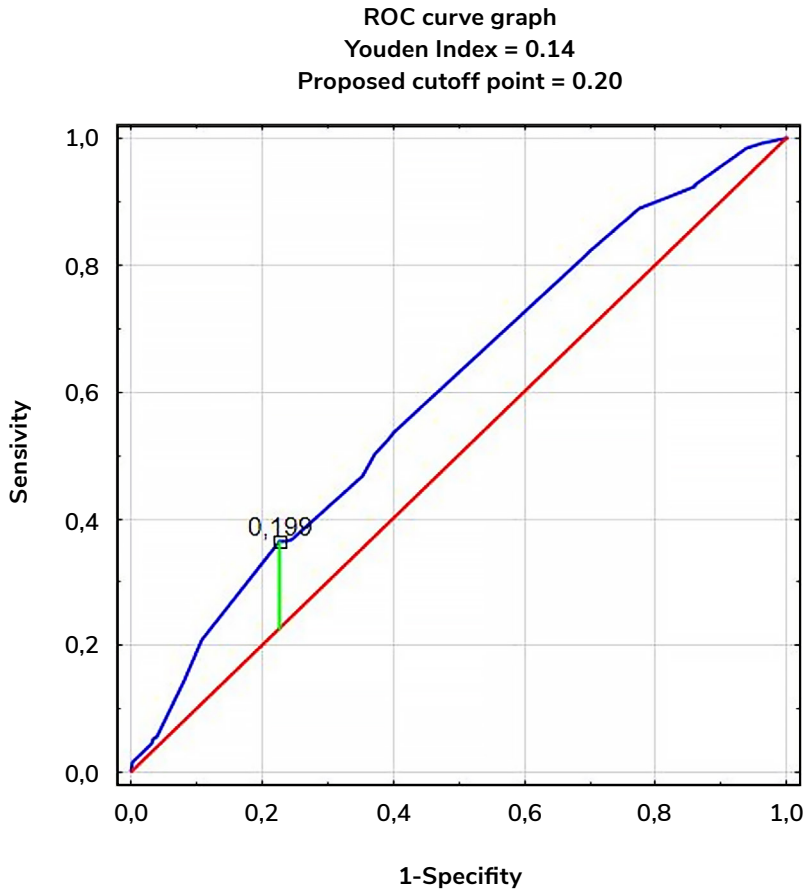

Fig. A1. The Parameters of the ROC curve.

Table A1. Evaluation of the effectiveness of prediction models according to the cutoff point method.

Youden Index; CoP = 14.0%				
Actual state / Prognosis	Infected	Healthy	Total	Predictive Effectiveness
Infected	55	50	105	52.4%
Healthy	137	208	345	60.3%
Total	192	258	450	58.4%
Youden Index; CoP = 19.9%				
Actual state / Prognosis	Infected	Healthy	Total	Predictive Effectiveness
Infected	21	84	105	20.0%
Healthy	45	300	345	87.0%
Total	66	384	450	71.3%

Discussion

The results of the conducted research demonstrated that based on respondents' declarations, during the first 8 months of the pandemic, coronavirus infection was diagnosed in more than 16% of Polish physiotherapists. Comparing this figure with population data indicates that physiotherapists - compared to the general Polish population - had as much as a 9 times greater risk of SARS-CoV-2 infection during this period. The disparity was particularly large in the early stages of the pandemic. A follow-up investigation almost a year later showed that the percentage of infected physiotherapists was more than twice as high as the average percentage of infected Polish citizens. On the other hand, data published by the Ministry of Health in February 2022 showed that more than 28% of physiotherapists have been infected with the SARS-CoV-2 virus, while among the general Polish population the percentage was approximately 14%. Certainly, such a high percentage of infections among healthcare professionals, including physiotherapists, occurred due to the particularly high risk of infection associated with the nature of their work. A number of scientific research have been devoted to exploring this topic, especially during the initial phase of the pandemic, but also studies summarizing the period of the pandemic [9]. For instance, research conducted on a sample of more than 10,000 medical personnel in the United Kingdom confirmed a significantly higher rate of infection among healthcare professionals, at the same time pointing out the particular importance of direct contact with patients as a factor increasing the risk of infection [10]. This is especially relevant for nurses, but also for physiotherapists. An exceptionally hazardous workplace, from the point of view of exposure to the virus, is a hospital as confirmed by the research conducted among Polish physiotherapists, but also, for example, a study carried out on a sample of nearly 30,000 healthcare professionals in Denmark [11]. This conclusion is also supported by a study investigating COVID-19 prevalence factors among Italian physiotherapists [12] (a study conducted after the first wave of the pandemic on a sample of more than 15,000 individuals). The study also supported the relatively lower disease risk of physiotherapists working in private physiotherapy clinics. Similarly, to the above-mentioned research conducted on Polish physiotherapists, providing services in several different locations had no significant impact on increasing the risk of contracting the disease among Italian physiotherapists.

Among the sociodemographic factors that can significantly increase the risk of contracting the disease in the study carried out on Polish physiotherapists, it was only possible to support the impact of having children in the early grades of primary school, which was associated with a relatively short period of children's remote learning at this stage of education, therefore a greater potential risk of virus transmission. A more widely considered factor of potential routes of transmission - as the number of people living together with the respondent in the household - has been confirmed as a significant factor in increasing the risk of infection through studies conducted among British communities [13] as well as healthcare professionals in Turkey [14]. The majority of the research, similarly to the study conducted on Polish physiotherapists, does not support the importance of gender as a feature that differentiates the risk of infection, although it is possible to find studies showing that men were significantly more likely to be infected (see, for example, studies carried out on Italian physiotherapists [12] or Danish [11] and American [15] healthcare professionals). These studies emphasize the gender-specific variation of the work and the associated greater exposure of men to the virus. The second key demographic characteristic under investigation was age, of which the impact on the risk of infection among Polish physiotherapists was found to be statistically insignificant, consistent with a number of other studies. Although the higher risk of infection in the older population may be due to their poorer overall health (comorbidities),

but at the same time, in healthcare units, elderly employees are more likely to perform work of an administrative nature, less likely to have direct contact with patients, hence they are less likely to come into direct contact with the virus [10].

Personal protective equipment used continuously by healthcare professionals was identified as a factor that significantly reduces the potentially great risk of infection [16, 17]. It is certainly surprising to observe that adherence to sanitary recommendations among physiotherapists was not associated, in a statistically significant manner, with a reduction in their risk of contracting SARS-CoV-2. According to the authors, this is related to the fact that the vast majority of physiotherapists in Poland followed epidemiological and sanitary recommendations quite strictly, which is confirmed by the fact that: nearly 85% of physiotherapists in Poland completely refrained from greeting others (people with whom they do not live in a common household) by shaking hands or kissing on the cheek during the pandemic, or did it occasionally (several times a month);

As many as 89% of physiotherapists wore a face mask every time they shopped in enclosed areas during the pandemic. More than 80% of physiotherapists have completely given up attending family or social gatherings during the lockdown. Furthermore, 85% of the physiotherapists did not go to a gym and they also refrained from playing sports indoors during the lockdown.

Conclusions

The aforementioned observations can be used to identify a group of physiotherapists with certain demographic or socioeconomic characteristics particularly vulnerable to viral infections, and therefore requiring additional protection against epidemiological threats, including the future ones. The research indicates that in preventing exposure to infection, it would be necessary to implement special protective measures among physiotherapists who have a child(ren) in their early school years, work in a hospital, and work overtime.

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