

# The Economic and Social Impact of Respiratory Diseases on Organisations

[Ekonomické a sociální dopady respiračních onemocnění na organizace]

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**Abstract:** The article is aimed at examining the economic and social impacts of respiratory diseases on organizations. The focus is on identifying preventive measures in organizations whose implementation is intended to prevent the spread of these diseases in individual workplaces. The objective of the article is a comprehensive literary survey with a specific emphasis on the economic and social ramifications of respiratory diseases on organizations and possible measures that can eliminate or at least mitigate these impacts. As part of the methodology, a four-stage search of academic texts for the actual research is conducted based on the research question. The findings are complemented by the results of a survey carried out in selected organisations, the conclusions of which document the importance of preventive measures against respiratory diseases in the workplace. The conclusions of this study are considered for the future as one of the bases for the development of a customized prevention model for organizations in order to use artificial intelligence in the field of preventive measures against the spread of respiratory diseases.

**Keywords:** economic impacts, e-Health, organization, prevention, respiratory diseases, social impacts, strategies.

**JEL classification:** M12, I10, L20

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## Introduction

The emergence of a new respiratory disease SARS-CoV-2 in December 2019 caused a global pandemic of COVID-19. This pandemic has raised an issue of the social and economic impact of respiratory diseases on the operations of organizations. Before, respiratory disease morbidity in organizations was hardly addressed as it did not threaten the operations of businesses. The COVID-19 pandemic alone instigated a paradigm shift in the perception of businesses towards the transmission of respiratory diseases, necessitating the implementation of novel measures or the expansion of existing ones.

The main objective of this study is to conduct an extensive search of the content of published studies dealing with possible preventive measures and strategies that are implemented or recommended to prevent the spread of respiratory diseases (influenza, Covid 19) among employees in organizations, to identify the basic tools for preventing the spread of these diseases in the workplace; and to verify the possibility of their use, including their possible consequences in selected organizations in the Czech Republic. The article points to the minimum of published methods for measuring the benefits (utilities), costs of preventive care, or the economics and management of respiratory diseases in enterprises. Current scientific texts are rather directed to the public health sector and are not applicable for implementation

at the level of organizations. Therefore, the authors' team proposed as a pilot pre-research project a questionnaire survey in organisations, the results of which could be a suitable basis for the construction of the Economic Model of Prevention of Respiratory Diseases in Organisations. The general aim of this study is then to open a public debate on the use of crisis management tools using dynamic modelling and artificial intelligence, to investigate the impact of these measures on the quality of life of employees and the population, as well as on the economic situation in organisations and society as a whole.

As the issue of the impact of respiratory diseases on businesses had not been studied prior to the pandemic, the research presented in this article is largely focused on studies related to COVID-19 that can be used for an insight into the whole issue of respiratory diseases. For a long initial period, antiviral medicine had not been available and a necessary approval of a vaccine against COVID-19 had not been granted. Therefore, the preventive measures were careful hand disinfection, protective face masks, respirators, and even restricting the movement of the population or operation of many businesses and organizations (Pradhan et al. 2020). Some studies show that free vaccination against respiratory diseases has a significant positive impact on reducing the number of patients, deaths, as well as costs associated with these diseases. (Singh et al. 2021).

COVID-19 itself, similarly to other respiratory diseases (e.g. influenza), causes health problems in the population and also has significant economic and social consequences. There are increased costs for businesses due to shutdowns, and costs of preventive measures in the workplace (e.g. provision of respiratory protective equipment, costs of vitamins and supplements, monitoring of at-risk groups, wearable devices to monitor the health status of employees, etc.). The social consequences of respiratory pandemics often lead to deterioration in interpersonal relationships and mood in the workplace. Furthermore, the absence of sick workers can result in work overload and increased fatigue in the remaining workers (Attanayake et al. 2000; Broughel, Kotrous 2021; Fendrick et al. 2003).

As many research studies have shown, preventive measures play an indispensable role in protecting the populations of countries around the world. A modern prevention method is wearable electronic devices, which are designed to prevent employees with suspected respiratory infections from being personally involved in the work process (De Korte et al. 2018; Fanta et al. 2018) and thus transmitting respiratory diseases within their workplace and throughout the enterprise.

## 1 Methods

Data were obtained by systematically selecting studies from scientific databases and studying the outputs of major research relevant to the stated objectives of this study. To meet the objective, it was first necessary to set the research question. A standardized PICO format with four basic components was used, where P stands for Population, I for Intervention, C for Comparison, and O for Outcome. The detailed classification of the PICO components is provided for the review question. For the literature search, a prognostic type of clinical/review question was selected that attempts to predict the likelihood of a relationship or outcome of a disease/condition and to determine what preventive measures (I) can influence the economic and social impact (O) of the spread of respiratory diseases in organizations (P)?

In the first or basic level of the search, the scientific databases Scopus, Web of Science, and Wiley Online Library were used to reach valid conclusions. Basic keywords (organization, prevention, respiratory disease, strategy) and their possible variants were entered into the

search fields of each database using Boolean AND and OR operators. Localization operators were not used in the search. The search for relevant articles was limited to English language, primary quantitative qualitative studies published in a relevant international scientific journal between January 2013 and October 2022. 162 articles were searched according to the specified criteria. In the second stage of the search, relevant keywords were determined (see Table 1). The search method was the same as the basic one including Boolean operators. The number of retrieved studies is shown in the PRISMA flow diagram. 95 articles were found in the above databases.

**Table 1:** Keywords assigned to the search question

Population (P)	enterprise or company or business or employer of firm
Intervention (I)	economic or social or impact or respiratory illness or companies
Comparison (C)	---
Result (O)	the effect of preventive measures on the economic and social impacts of respiratory diseases in organizations

*Source:* Authors' work

In the third stage of the search, the authors manually screened all selected studies to ensure that no relevant studies were overlooked or omitted. The search strategy was the same as in the previous stages. The number of eligible studies after thorough screening and removal of duplicates was 66.

In the fourth stage of the search, articles were screened. Based on the title, abstract content, and keywords, an initial review of articles was conducted using the established inclusion and exclusion criteria. This stage involved all the members of the research team. This process resulted in the exclusion of 19 articles that were deemed irrelevant. For the remaining 47 articles, efforts were made to locate their full texts. In total, 31 full texts were found. These were independently assessed in detail by individuals. This was followed by a peer discussion by all members of the team arguing whether the inclusion is relevant or not. The discussion resulted in the inclusion of 18 studies for the data search.

The literature search provided the basis for the questionnaire survey, which was carried out mainly in private sector organisations, and marginally in public sector organisations. The survey took the form of a qualitative pilot pre-survey, where a total of 90 organisations in East Bohemia, Central Bohemia and Prague were contacted. For the purpose of the survey it was possible to process responses from 82 organisations, 62% of which represent services, 34% industry and 4% construction. The size of these organisations by number of employees is described in Table 2.

**Table 2:** Organisation size by number of employees

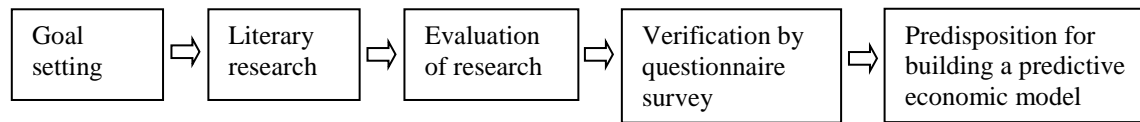
Number of staff	Number of enterprises
Up to 25 employees	22
26 to 250 employees	31
251 to 1000 employees	15
1001+ employees	14

*Source:* Authors' work

Through the evaluation of the developed research and the subsequent questionnaire survey in the organizations, it was possible to identify preventive and other organizational measures against respiratory diseases in the workplace, including the economic and social impact of these diseases on organizations. These findings provided the basis for the considered

predictive economic model of respiratory diseases in the organization, on which the authors would like to work further. The previously mentioned progression of work from determination to the achievement of the objective of this paper is illustrated in Figure 1.

**Figure 1:** Methodology scheme



Source: Authors' work

## 2 Results of the research survey

To achieve the first stated objective, a total of 20 international studies published between 2015 and 2022 were included in the literature review. The period was chosen because this was the time when the field of respiratory diseases expanded to include the new respiratory disease COVID-19, which had a significant economic and social impact on organizations.

Studies focused on screening strategies for awareness of the prevalence of viral disease in organizations (Chen et al. 2022, Hamer et al. 2021, Shaw et al. 2022, Blain et al. 2020), on examining the stress burden on employees during the COVID-19 pandemic (Gori et al. 2021, Zhou et al. 2021, Tagini et al. 2022), on modelling economic and loss of life due to viral illnesses (Talantsev et al. 2022, Shahmanzari et al. 2022, Perakis et al. 2022), on the impact of teleworking for firms and employees (Abulibdeh 2020, Daniels et al. 2022), on the use of knowledge management and the positive elements of the pandemic in different areas of social action (Singh et al. 2021, Liu et al. 2022, Rahaman et al. 2021, Hsiao et al. 2021).

In this context, it is also necessary to mention the element of uncertainty of limiting operations or even closing the organisation due to the emergence of a risk situation, which may also occur as a result of a pandemic situation. Organisations are therefore increasingly focusing on eliminating or mitigating potential risks. Various ways to prevent risk situations or to counter them if they already arise, such as by using some form of internal auditing (Babkin et al. 2017) or decision support tools using decision tree systems as well as appropriate software (Švecová, Kačín 2015), are presented in the literature.

In the second phase of the research, after mapping articles thematically focused on the economics of respiratory diseases from the perspective of organizations and e-Health implementation, and examining the economic and social impacts of respiratory diseases on organizations, the main consequence appears to be a change in costs or a change in efficiency or productivity, according to most authors. The proportionality of the costs incurred is addressed by a number of methods (Fanta et al. 2018).

One method is Cost Minimizing Analysis (CMA), where the lowest project cost is the evaluation criterion. Another method is Cost Benefit Analysis (CBA) which compares the total expected cost of an intervention with the total expected benefits. Cost-effectiveness Analysis (CEA) is used in case valuing benefits (utilities) in monetary units using CBA is too complicated. Another option for comparing benefits with costs is to use Cost-utility Analysis (CUA). The results are measured both in quantity (life years) and quality of life. The units to measure benefits are thus Quality-Adjusted Life Years (QALYs). It can be concluded that the above-mentioned methods of measuring benefits and costs in the field of healthcare provision can be a certain starting point or a guide for the evaluation of these economic variables in

enterprises, but only after adjusting their measurability for enterprise environment, which the current form does not reflect.

### 3 Discussion

Preventive measures are seen by most of the authors of the researched studies as a necessary tool to prevent the spread of respiratory infectious viral diseases in organizations and other public spaces. According to the review of relevant sources included in the scoping review, the authors of these studies focused mainly on awareness and prevention of viral diseases in the organization, as well as on the social and economic impact of the COVID-19 pandemic.

Many authors deal with awareness and prevention of viral respiratory disease in organizations. Chen et al. (2022) in their analytical study reported that the prolonged airborne route of viral respiratory infection is caused by poorly ventilated indoor environments. The great importance of preventive measures, such as testing, contact tracing, vaccination, and separation of employees by time or space, is highlighted by some authors, who observe the impact of prevention in, for example, manufacturing companies, university classrooms, and nursing homes (Hamer et al. 2021, Shaw et al. 2022, Blain et al. 2020). The impact of the pandemic on the way of working and especially the performance of 'telework' is examined in studies by Abulibdeh (2020). Daniels et al. (2022) compare its benefits and negative elements during the COVID-19 pandemic. The resilience of businesses in the context of the COVID-19 outbreak is examined in a paper by Liu et al. (2022). It emphasizes the importance of knowledge management elements in the context of the changes brought about by the COVID-19 pandemic. Zieba (2021) highlights the options to counter the COVID-19 pandemic in the business sector, outlines how to deal with crises and suggests changes to business models. The same study examines the impact of the pandemic on business operations and management.

The social impact of the COVID-19 pandemic (and respiratory infections in general) is also significant, as described by the authors of selected analytical and case studies. In their study, Tagini et al. (2021) confirm the influence of certain factors such as age, education, gender or belonging to a certain territory, and personal knowledge of the ill persons on the increased perceived risk of respiratory diseases. Gori et al. (2021) confirm the important role of scoping strategies and defence mechanisms of anxiety and stress during the lockdown period. Zhou et al. (2021) discuss empirical research on elevated stress levels in frontline healthcare workers, which may have a negative impact on their mental health. Social impacts also affect personal and social life (Nichol et al. 2005, Tušl et al. 2021). The relationship between individuals' activity on social networks and the amount of respiratory infections has been investigated by Gour et al. (2022). His study confirms that negative posts on social media during a crisis outbreak can influence anxiety, emotions, and other uncomfortable states in the followers.

The consequences of respiratory diseases in terms of lives lost as well as economic losses are included in some predictive models. In their model, Shahmanzari et al. (2022) examine the relationship between the number of baseline containment measures in terms of lives lost and economic activity. Talantsev et al. (2022) simulate the prediction of the consequences of anti-epidemic interventions in their models and estimate public health impacts; they also calculate direct and indirect cost losses. Prediction of COVID-19 evolution is offered by a multi-wave model by Perakis et al. (2022), which can be essential for managing operations and supply chains during a pandemic. The control policy of the COVID-19 pandemic in Taiwan is discussed by Hsiao et al. (2021), which mainly consists of strict control at the country's borders, wearing protective gear, contact tracing, and monitoring of people testing positive for

COVID-19. Rahaman et al. (2021) in their study suggest that in addition to the negative aspects of the COVID-19 pandemic, the COVID-19 pandemic may also have some "benefits", such as environmental, social, and technical innovation, and online business. The main predictors that have a significant contribution to the number of COVID-19 cases in different countries are mentioned in the study by Singh et al. (2021), the results of this study can help in developing counter-epidemiological strategies for these countries. Based on the listing of the economic and social impacts of respiratory diseases on individuals and disease prevention in the articles, it can be argued that their authors try to measure these impacts.

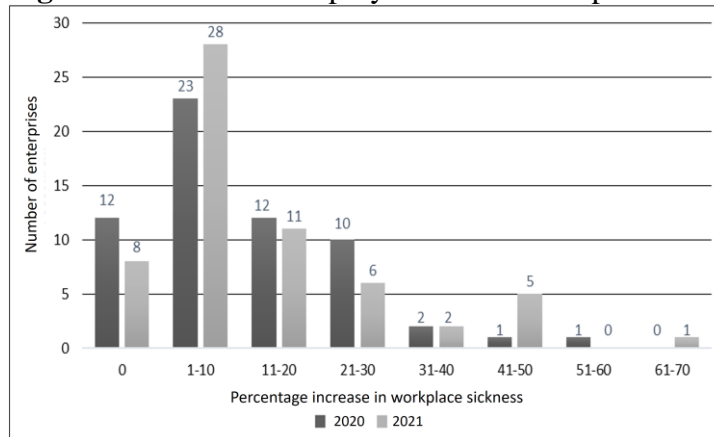
#### **4 Prevention and impact of respiratory diseases in organizations**

Based on the content analysis of the pre-selected texts and the subsequent literature review, a phase of questionnaire development for private and public organizations followed with an emphasis on identifying the economic and social impacts of respiratory diseases. The questionnaires were distributed in the selected organizations. They were then completed by the respondents with the expectation of using these survey results together with relevant literature sources as a pilot pre-survey for the future development of the Economic Model of Organizations against the Spread of Respiratory Diseases.

Based on the above analyses, the team of authors created a draft questionnaire called Economic and Social Impacts of Respiratory Diseases on Private and Public Administration Organizations, which should confirm or refute the above findings from the conducted research of scientific texts as a pilot pre-research qualitative investigation in selected organizations in the Czech Republic. The results obtained by interviewing organizations could become a foundation for the development of the Economic Model of Organisations against Respiratory Diseases.

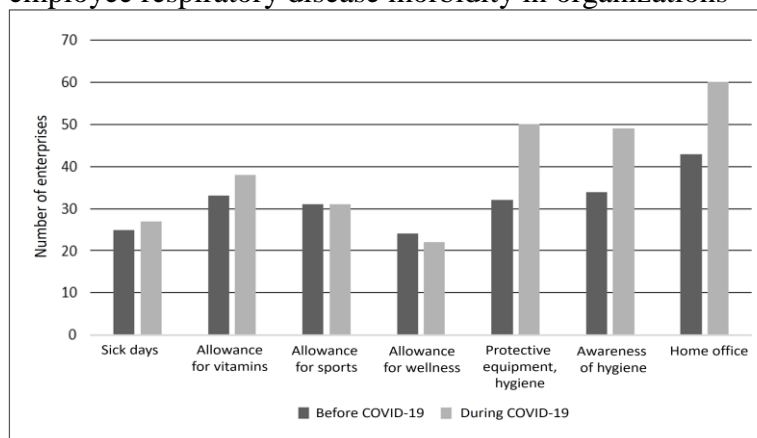
One of the aims of this study was a comparison of literature research findings with the results of the questionnaire survey in selected Czech organizations within the project PIDOZ (Preventive Intelligent Digital Prevention for Health) CZ.01.1.02/0.0/0.0/20\_321/0024397) in the period between August 2021 and March 2022. One of the objectives of the questionnaire survey in organizations was to find what changes occurred related to the spread of respiratory diseases and what measures were adopted by organizations in reaction to the COVID-19 pandemic. The questionnaire "Economic and Social Impacts of Respiratory Diseases on Private and Public Administration Organizations" was distributed to the contacted organizations, completed by their representatives - respondents, and then evaluated to map the situation in the field of prevention of the spread of respiratory diseases. The questions focused on the following key areas: recording employee sickness in the organization, organizational measures for increased sickness, the economics of employee sickness, the social impact of sickness, with the use of technology in the workplace. Not all respondents answered all questions in the questionnaire.

In the area of recording employee sickness in organizations, it was found that around half of the employers in the survey conducted a sickness analysis, which revealed that sickness in organizations increased by 1-10% between 2020 and 2021. Figure 2 shows that the COVID-19 pandemic was reported as the main reason. This question was left unanswered by 18 organisations.

**Figure 2:** Increase in employee sickness compared to 2019

Source: Authors' work

There was a major change in the use of home office, hygiene supplies and hygiene awareness during COVID-19 in the area of preventive measures against increased staff sickness in organizations as can be seen from the responses in Figure 3. This increase corresponds to the government directive to wear disposable protective masks and respirators in confined spaces, as well as increased appeal for hygiene awareness regarding spacing rules, regular hand washing, etc. Other preventive measures such as sick days and allowances for vitamins, sports and wellness are still perceived as benefits and their intensity has not changed significantly.

**Figure 3:** Frequency of responses to the application of preventive measures against increased employee respiratory disease morbidity in organizations

Source: Authors' work

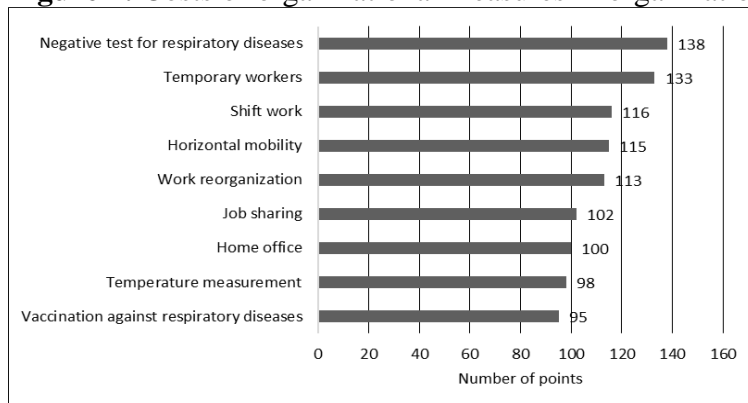
In the area of organizational measures taken in the event of increased employee sickness, the most frequently reported measures were the use of a negative test for respiratory diseases (65 answers) and home office (64 answers), followed by temperature measurement (44 answers), work reorganization (43 answers) and shift work (37 answers). Thus, home office is used in organizations not only as a preventive measure as a benefit but also as an organizational measure (during a pandemic employer regulation). Extreme increases during a pandemic were seen in negative test (due to government regulation) and in temperature measurement. Employers have also started to make more use of work reorganization and shift work to help them ensure the necessary operations, especially in manufacturing enterprises.

The questionnaire asked which organizational measures the respondent organizations considered to be the most cost-effective. To differentiate the intensity of the costliness of the

organizational measures, organizations responded on a three-point scale. In the evaluation, individual responses were scored as follows: 1. not costly – a positive answer was scored 1 pts, 2. more costly - a positive answer was scored 2 pts, 3. very costly - a positive answer was scored 3 pts.

Employers identified a negative test for respiratory disease and the help of temporary workers as the most expensive. On the other hand, they consider home office, measurement of temperature, and vaccination against respiratory diseases (free in case of COVID-19, subsidized by the health insurance company in case of influenza) as the least costly. Figure 4 shows the assessment of the costliness of the organizational measures.

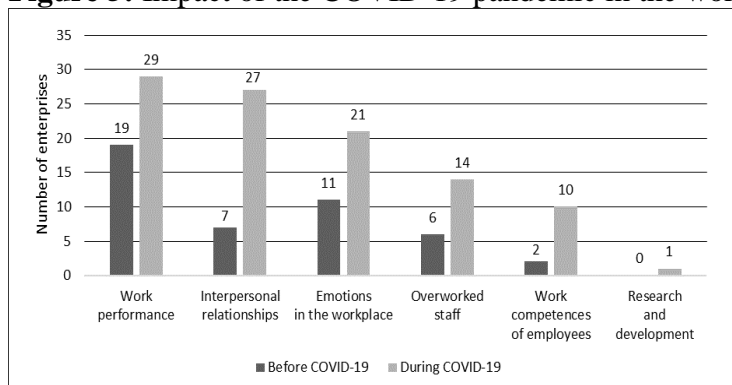
**Figure 4:** Costs of organizational measures in organizations during the COVID-19 pandemic



Source: Authors' work

In terms of the social impact of employee sickness, the COVID-19 pandemic had the most severe impact on interpersonal relationships in the workplace, according to the responses of the surveyed organizations. Compared to the situation before COVID-19, 20 more organizations responded that the increase in employee sickness had a major impact on interpersonal relations in the workplace. Fewer organizations reported an impact on employee overwork and work competencies. Research and development was not significantly affected by the increase in employee sickness, as shown in Figure 5.

**Figure 5:** Impact of the COVID-19 pandemic in the workplace



Source: Authors' work

In the area of the use of IT technology and its potential use in health protection, it was found that in most cases employees use a mobile phone at work (either provided by a company or their own device). Only 10 employers claimed that their employees do not use any mobile phones. This is in line with the current trend, which is also facilitating the use of modern



technology in health protection. Of the 72 organizations that commented on this question, 70 responded that they use Android or iOS devices, i.e. with the ability to install applications.

If it were possible to provide employees with the benefit of assessing their health and fitness using new technologies, 40 organizations would choose a mobile app only, while 37 employers would prefer a combination of a mobile app and other devices.

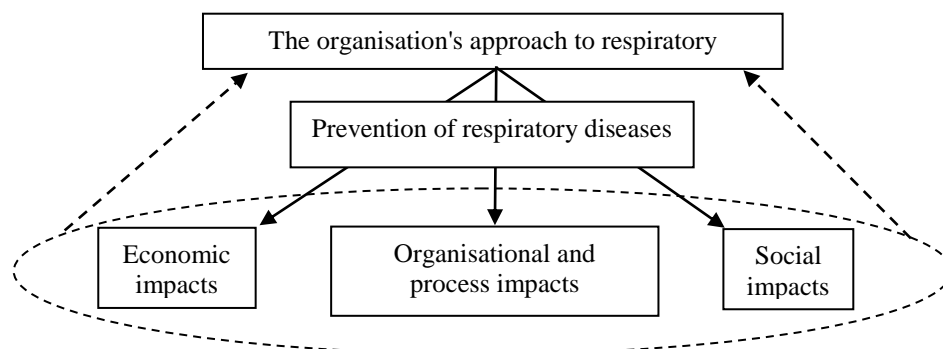
The results of the questionnaire survey prove that most companies are interested in implementing preventive measures protecting the health of their workers, as workplace morbidity has a significant economic and social impact on these organizations including uncertainty in long-term planning and decision-making. This uncertainty stems not only from concerns about ensuring sufficient staff capacity and ensuring the continued operation of the organization.

The results of the survey confirmed that it is appropriate to implement preventive measures in organizations in the following stages of prevention:

- In the period before the outbreak of respiratory infection at the workplace, i.e. at a time when a respiratory infection has not yet been confirmed. These include, for example, the provision of certain benefits to strengthen the health of employees, such as an allowance for vitamins and other food supplements, compliance with hygiene habits, a contribution to preventive vaccinations (e.g. against influenza), subsidy for sports activities, and the popular home office.
- During the period when the infection has already occurred in the workplace, the management's effort is to separate healthy individuals from sick ones to prevent the further spread of respiratory diseases.
- Ongoing implementation of operational and organizational measures to protect workers and reduce active sickness. Operational measures include workplace temperature measurement, testing, or vaccination, while organizational measures include, in addition to the aforementioned home office, sick days, the introduction of job sharing, shift patterns, horizontal mobility, work reorganization, or the use of temporary workers.

These three levels of prevention should also be included in an organization's strategy against respiratory diseases. However, from the point of view of the management and control of the organization, it is necessary to understand the problem procedurally. Simplistically, the process can be divided into three interrelated parts: there are no indications of respiratory disease in the workers themselves, there are already workers in the organization with indications of respiratory disease infection, and there is a confirmed respiratory disease infection in the organization. According to the research team, there is an analogy between the prevention stages themselves and the different parts of the process.

The above can be summarized in Figure 6 below, which characterizes the organization's approach to establishing preventive measures against respiratory diseases with their subsequent potential impacts, including feedback on the organization's approach to respiratory diseases.

**Figure 6:** Diagram of the impact of respiratory diseases on the organisation

Source: Authors' work

## Conclusion

The objective of the article was to identify the most important economic and social impacts on organizations due to respiratory diseases determining which preventive measures can eliminate or at least mitigate these impacts. Preventive measures have an indispensable role to play in this area, as shown by the results of the research, which focused mainly on the period when the new COVID-19 disease emerged in addition to the existing respiratory diseases. In the economic field, for example, the costs associated with the need to replace sick or quarantined workers were examined. In the social field, the negative impact of the COVID-19 pandemic on interpersonal relations in the workplace and on work performance, which was often increased by covering for co-workers, was described. The consequences of respiratory disease in these areas are addressed by some of the predictive models mentioned above. The results of the studies reviewed confirm that the negative effects of respiratory diseases can be, in many cases, prevented by consistent prevention.

A questionnaire survey carried out by the authors' team between August 2021 and March 2022 confirmed some of the published conclusions, while in certain areas the findings did not concur. This is due to some specifics of our economy and different working conditions of Czech enterprises. According to the results of the literature searches, it was found, and to some extent confirmed by the questionnaire survey, that important tools for the prevention of respiratory diseases include respiratory hygiene, vaccination, home office, promotion of employees' sports activities, or provision of other benefits to promote good health. If there are already employees in the organization who demonstrate a possible respiratory illness, it is necessary to separate them in time and space, monitoring their contacts to prevent the further spread of respiratory disease in the workplace. A few operational and organizational measures can be used to achieve this, such as taking employees' temperature, testing or vaccination, introducing job sharing, shift patterns, horizontal mobility, reorganizing work, and using temporary workers. Last but not least, the use of mobile devices with the possibility of installing the necessary health monitoring applications was found important in prevention.

A significant number of scientific studies track these economic and social consequences in their predictive models; for example, they simulate the prediction of the consequences of anti-epidemic interventions and their impacts on public health. However, most of these models are more focused on the public health domain and are not applicable for implementation at the organizational level without major interventions. Therefore, the authors' collective, after studying relevant resources in the field of respiratory disease prevention and then testing individual tools, is considering the future development of a prevention model for organizations in the framework of the PIDOZ (Preventive Intelligent Digital Prevention for

Health) project using artificial intelligence in the field of preventive measures against the spread of respiratory diseases.

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