

STRATEGIES FOR INTRODUCING PREVENTIVE MEASURES AGAINST RESPIRATORY DISEASES (INFLUENZA AND COVID-19) IN COMPANIES IN THE CZECH REPUBLIC: META-ANALYSIS

STRATEGIE WPROWADZANIA ŚRODKÓW ZAPOBIEGAWCZYCH PRZECIWKO CHOROBYM UKŁADU ODDECHOWEGO (GRYPIE I COVID-19) W PRZEDSIĘBIORSTWACH REPUBLIKI CZESKIEJ: META-ANALIZA

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Wkład autorów:
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zaplanowanie badań
B. Data collection/entry
zebranie danych
C. Data analysis/statistics
dane – analiza i statystyki
D. Data interpretation
interpretacja danych
E. Preparation of manuscript
przygotowanie artykułu
F. Literature analysis/search
wyszukiwanie i analiza literatury
G. Funds collection
zebranie funduszy

Summary

The article focuses on the identification of the main preventive strategies employed in countering respiratory diseases with the risk of pandemic transmission (influenza and COVID-19). The research aimed to create a literature review focusing on preventive measures and strategies to minimize the occurrence and spread of respiratory diseases among employees in private businesses. These findings are intended to be employed to develop a preventive economic model for organizations in the Czech Republic against the spread of respiratory diseases. Data were obtained by systematically selecting studies from scientific databases (EBSCO host, Ovid, Scopus, Web of Science) and studying the hygienic recommendations of regional and government experts relevant to the objectives of this study. Based on a set of PICO questions and using a three-stage search, the authors analyzed a total of 1102 relevant scientific articles, and, subsequently, 15 relevant recommendations issued by the main experts of the Ministry of Health and other bodies of the Czech Republic between March 2020 and February 2022. The published studies point to a wide range of recommended preventive strategies against the occurrence and spread of respiratory diseases. The authors have proposed an organizational model that may strengthen preventive care in selected fields.

Keywords: economic impact, respiratory diseases, social impact, prevention, organization

Streszczenie

Artykuł koncentruje się na identyfikacji głównych strategii profilaktyki stosowanych w przeciwdziałaniu chorobom układu oddechowego wiążącym się z ryzykiem pandemii (grypie i COVID-19). Celem badań było opracowanie przeglądu literatury skupiającego się na środkach i strategiach zapobiegania, mających na celu zminimalizowanie występowania i rozprzestrzeniania się chorób układu oddechowego wśród pracowników w prywatnych przedsiębiorstwach. Wyniki te są przeznaczone do wykorzystania celem opracowania profilaktycznego modelu ekonomicznego dla organizacji w Republice Czeskiej przeciwko rozprzestrzenianiu się chorób układu oddechowego. Dane uzyskano poprzez systematyczny wybór opracowań z naukowych baz danych (EBSCO host, Ovid, Scopus, Web of Science) oraz analizę zaleceń higienicznych ekspertów regionalnych i rządowych istotnych z punktu widzenia celów niniejszego badania. W oparciu o zestaw pytań PICO i wykorzystując trójstopniowe wyszukiwanie, autorzy przeanalizowali łącznie 1102 istotne artykuły naukowe, a następnie 15 istotnych zaleceń wydanych przez głównych ekspertów Ministerstwa Zdrowia i inne organy Republiki Czeskiej w okresie od marca 2020 roku do lutego 2022 roku. Opublikowane badania wskazują na szeroki zakres zalecanych strategii profilaktyki występowania i rozprzestrzeniania się chorób układu oddechowego. Autorzy zaproponowali model organizacyjny, który może wzmocnić opiekę profilaktyczną w wybranych dziedzinach.

Słowa kluczowe: skutki ekonomiczne, choroby układu oddechowego, skutki społeczne, profilaktyka, organizacja

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Introduction

Inflammatory respiratory diseases have long been common causes of morbidity, not only in the Czech Republic, but also worldwide. These infections affect every individual approximately twice a year and across all age categories. Viruses are the most common etiological factor, bacteria less so. At present, the changing political, economic and social situation, as well as the nature of climatic, ecological and population changes associated with the emergence of a “borderless world” are contributing to the occurrence of this group of diseases. Moreover, it is necessary to mention the emergence of new virus mutations resulting in rapidly spreading viral epidemics. Respiratory infections affect both the upper and lower respiratory tract. Given the prevalence of viral etiology, these diseases are the responsibility of primary care physicians. These infections are also the most common reason why patients visit both pharmacies and GP’s surgeries. They are also the leading cause of absence from work and contribute significantly to mortality [1-3].

Out of the viral respiratory pathogens, influenza viruses and the SARS-CoV-2 are currently the most common and most serious. Normally, the prevalence of viruses varies during the respiratory disease season. Respiratory Syncytial Virus (RSV), spread by droplets, is predominant in the autumn, while at the turn of the year, RSV is replaced by influenza viruses. For the third consecutive season, however, this principle has been disrupted by SARS-CoV-2, which has reduced the incidence of influenza in this period. Epidemics and pandemics of the diseases mentioned above have caused enormous health and economic damage [4].

Experts agree that measures against the coronavirus have recently helped limit the spread of influenza and other viruses. A study “Monitoring respiratory infections in COVID-19 epidemics” by Chan et al. (2020) demonstrates this fact by comparing influenza epidemics between the years 2015 and 2019, to the year 2020. They point towards a 62% reduction in influenza infections and deaths in 2020, compared to previous winter seasons. Meanwhile, the decline in the number of infections coincides with the deployment of social isolation and other measures to combat COVID-19 [5].

Respiratory diseases are classified as preventable. The introduction of preventive measures significantly mitigates the spread of infections. These measures are crucial both for individuals and groups. Preventive measures that companies have implemented include, in particular, banning business trips to affected areas, banning visits by people from affected areas, replacing face-to-face meetings with online meetings, increasing hygiene in workplaces (more frequent cleaning, increased disinfection options, employee training), and intensive internal communication of respiratory disease prevention. For instance, many workplaces have issued sets of recommendations for employees returning from foreign trips or holidays (e.g. contacting the supervisor by phone and agreeing on the next steps). It is also necessary to include immune-boosting measures in preventive measures. These measures include, for example, hardening, playing sports, and taking vitamin supplements and other natural remedies. These measures are primarily the personal responsibility of the individual employee; on the other hand, the employer can significantly support these activities, e.g. via employee benefits. The body’s resilience also has a positive effect, reducing the length of the disease which then requires just a symptomatic treatment [6,7].

In addition to specific preventive measures aimed at combating the emergence and spread of respiratory infections, we must not forget the prevention of mass diseases of both infectious and non-infectious nature. Risk factors reduce the body’s immunity and increase the predisposition for the development and complicated course of respiratory diseases (e.g. obesity, hypertension, hyperlipidemia...) [8].

Aims of the work

The aim of this work is to create a literature review focusing on preventive measures and strategies to minimize the occurrence and spread of respiratory diseases (influenza and COVID-19) among employees in private enterprises.

Another goal is to create, using the above-mentioned preventive measures and strategies employed to minimize the occurrence and spread of respiratory diseases (influenza and COVID-19), a preventive Economic Model against the Spread of Respiratory Diseases.

Methods

Data were obtained by systematically selecting studies from scientific databases and studying the outputs of the main studies relevant to the objectives of this study. The findings were synthesized into a prevention model: An Economic Model against the Spread of Respiratory Diseases.

Stage one – literary research

The main aim of the authors was to conduct a search of the content of published studies dealing with preventive measures and strategies implemented or recommended for preventing the spread of respiratory diseases (influenza, COVID-19) among employees in private enterprises, and then synthesize the findings of the relevant studies and recommendations retrieved.

To accomplish the objective, it was first necessary to set the research question. To do this, the standardized PICO format with four basic components was used, where P stands for the patient, I for intervention, C for comparison, and O for output. The detailed classification of the PICO components is given later with the review question. The prognostic type of clinical/review question was selected for the literature search, which seeks to predict the likelihood of a relationship or outcome of a disease/condition and to identify the prospect of improvement/health care. What preventive measures (strategies) (I) are implemented or recommended to prevent the spread of respiratory diseases (influenza, COVID-19) (O) in private enterprises (P). For the prognostic type of clinical question, the component C is not used.

Search strategy

Basic search

EBSCO host, Ovid, Scopus, Web of Science and PubMed databases were used to reach valid conclusions. Basic keywords (company, prevention, respiratory disease) 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 the English language, and to primary quantitative and qualitative studies published in a relevant international scientific journal in the time period 1/2013-1/2022. According to the given criteria, 1102 articles were found.

Second level search

Relevant keywords were identified according to the focus of the retrieved studies (Table 1). The search method was the same as the base search, including Boolean operators. The number of retrieved studies is shown in the PRISMA flow diagram (Figure 1). Of note: 912 articles were found in the above-mentioned databases.

Table 1. Keywords assigned to the research question

Keywords of the research question	
Patient (P)	enterprise or company or business or employer or firm
Intervention (I)	prevention of respiratory diseases or health strategy respiratory hygiene or crisis plan
Comparison (C)	-----
Outcome (O)	elimination of respiratory diseases transmission or reduction of respiratory infections in employees

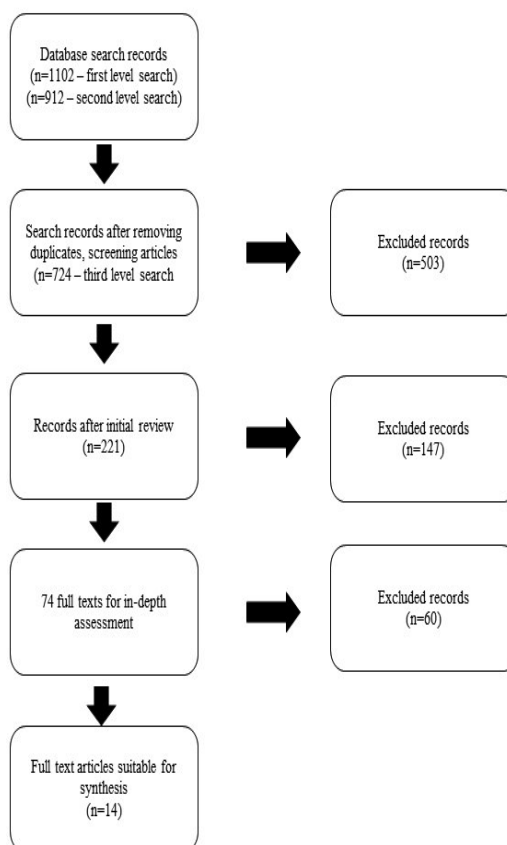


Figure 1. Prisma diagram

Third level search

At this 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. Subsequently, 724 eligible studies remained after thorough screening and removal of duplicates, as shown in the PRISMA protocol in Figure 1.

Consequently, screening of articles was performed. An initial screening of the articles based on the title, abstract content and keywords was performed according to the established inclusion and exclusion criteria, involving all the members of the research team. This process resulted in the exclusion of 503 articles that were deemed irrelevant.

For the remaining 221 articles, efforts were made to locate their full texts, the outcome of which was that a total of 74 full texts were found. These were independently assessed in detail by individuals in the research team. This was followed by the peer discussion on the relevance of the inclusion of the articles by all the team members. The discussion resulted in the inclusion of 14 studies for the data search.

Stage two – creating a prevention Economic Model against the Spread of Respiratory Diseases

In the second phase of the research, the research team focused on the content analysis of recommendations from government and leading Czech authorities in the field of prevention of respiratory diseases (COVID-19, influenza) in 2019-2022.

The following recommendations were included in the main phase of the analysis (the condition was primary official documents and websites), which met the requirements of timeliness, validity and reliability (the authors of the recommendations are leading experts in the field of epidemiology, microbiology, virology, preventive medicine, infectious medicine and immunology). The authors are from clinical and academic settings, but also from influential institutions (National Institute of Health – Center of Epidemiology and Microbiology, Ministry of Health of the Czech Republic, Regional Hygiene Stations).

In the first phase, the research team retrieved the main documents (15 in total). All the documents were subjected to a source critique according to the above requirements, followed by the quantification process. According to the focus of the individual recommendations in the documents, they were categorized into individual-focused and organizational-focused recommendations. Furthermore, the recommendations were categorized as general, or relating to primary and tertiary prevention. Subsequently, specific recommendations were assigned to the above-listed three types.

Search results

To achieve the first stated objective, a total of 14 international studies published between 2013 and 2021 were included in the literature review. The studies focused on screening strategies for awareness of the prevalence of viral illness in organizations [9-11], measures to prevent the spread of infection in public buildings [12-15], and on preventive measures to reduce active morbidity among their employees [16-22]. A more detailed description of the studies is provided in the overview Table 2.

Table 2. Overview of researched studies

Author / year / country	Study type	Research intention	Respondent file	Results
Lucan et al., 2021 USA [9]	Observational (descriptive) study – pilot testing	To develop own strategy of screening infected workers in the food industry.	Two US manufacturing plants (n1 – 243 + n2 – 188 respondents)	Pilot screenings have shown advantages along with limitations: (1) detecting asymptomatic infections – but at questionably relevant time points; (2) identifying clusters of infections - but with uncertain sites of transmission; (3) showing relatively low infection rates – but lacking details for meaningful community comparisons.
Morawská et al., 2020 International [12]	Recommendations for practice	To emphasize the possibility of introducing technical controls as additional measures to prevent the spread of COVID-19 infection.	Not defined	The use of technical controls (e.g. sufficient and effective ventilation) in public buildings with the effective application of other controls (e.g. isolation, quarantine) could be another important measure to reduce the transmission of infections. Measures can be easily implemented and without great cost if they are recognized as important for infection control.

Author / year / country	Study type	Research intention	Respondent file	Results
Ahmed et al., 2020, USA [20]	Analytical study	To assess the association between access to telework, paid leave benefits, and short-term work attendance in employed adults during a physician-diagnosed respiratory infection or influenza.	1374 respondents	Access to paid leave was associated with fewer days worked overall and at the usual workplace during sickness. Respondents who were discouraged from coming to work with flu-like symptoms were less likely to attend their usual workplace. Compared to workers without telecommuting access, those with telecommuting access worked more days overall during illness, but there was no difference in the number of days worked at their usual workplace.
Coimbra et al., 2020 USA [21]	Recommendations for practice	To describe the prerequisites and strategies for resuming surgical activity in the outpatient or inpatient setting at the time of COVID-19.	Not defined	The strategy is to impose measures both at the time of the clinic visit due to the patient's health problem and at the time of surgery planning, just before and after surgery.
Ham, 2020 Korea [13]	Experiment	To investigate the impact of air purifiers in the prevention of COVID-19 in call centers.	Not defined	The experiment showed that the flow of water mist into the inlet of the air purifier depends on the height of the water vapor source. Since most air purifiers are installed at floor level and not on a table near a person's face, there is some debate as to whether the installation of air purifiers helps in preventing the spread of COVID-19. Therefore, other measures (e.g. appropriate ventilation, insulation, etc.) are also appropriate in the prevention of COVID-19.
Nguyen et al., 2021 UK [11]	Clinical (interventional) study	To evaluate the effectiveness of the intervention strategy using an ABM model to simulate the dynamics of COVID-19 transmission through contacts.	Senior citizens home in Scotland, 30,000 simulations	Model predictions suggest that routine testing should focus on staff in conjunction with adherence to consistent hand hygiene and use of personal protective equipment to reduce the risk of transmission on contact so that it is effective and feasible in the senior citizens home setting.
Hetzmann et al., 2021 Germany [22]	Qualitative study	To examine OHSM (Occupational Health and Safety Measures) which have been implemented in ambulatory care since the outbreak of the COVID-19 pandemic and identify associated shortcomings. In addition, the needs of outpatient care providers were examined with respect to OHSMs in their work environment.	15 outpatient care providers	OHSM (Occupational Health and Safety Measures) have been largely adapted to the health threats posed by COVID-19. However, an optimum has not yet been reached. Improvements are still needed in the quality and quantity of PPE on offer and at the organizational level, e.g. with regard to the development of pandemic plans or in the organization of work.

Author / year / country	Study type	Research intention	Respondent file	Results
Moroni-Zentgraf et al., 2021 Germany, France [10]	Pilot study (case study)	To establish a protocol and evaluate the appropriateness of diagnostic tools prior to initiating a program to detect and monitor SARS-CoV-2 and immune status.	20 respondents who have previously had COVID-19 and 121 respondents without COVID-19 experience (in 4 visits at 2-week intervals)	Testing strategies using a combination of viral RNA detection (or PCR with antigen-LFA and antibodies directed against various SARS-CoV-2 proteins) along with a comprehensive baseline assessment of medical history and the likelihood of infection may be important for effective screening and workforce monitoring.
Fragala et al., 2021 USA [16]	Recommendations for practice	To provide employers with informed perspectives on population health management during the COVID-19 pandemic.	Not defined	COVID-19-19 changed the outlook for employer health benefit plans. Employers must now maintain health management and also follow cost mitigation strategies that not only target chronic diseases, but also prevent the spread of a new infectious disease.
Piper et al., 2017 USA [17]	Descriptive study	To examine demographic and workplace characteristics associated with employees' decisions to stay home from work due to flu, flu-like illness, or illness of their child.	12 044 respondents	The option of taking advantage of the paid sick days (PSD) offered by an employer is associated with a higher likelihood of an employee staying home due to their illness or the illness of a child. This is also likely to reduce the economic burden on minorities, women, and families that results from staying home. Encouraging employees to stay at home is important. Higher rates of PSD use were among Hispanics and women.
Zhai et al., 2018 USA [18]	Descriptive study	To quantify workers who had PSL (paid sick days), to examine sociodemographic characteristics associated with receipt of these benefits, and to explore the association between PSL benefits and use of sick days and influenza vaccination.	15,933 respondents employed full-time	It appears that only three out of five workers reported PSL (paid sick leave) in 2009-2010. This proportion varied by socio-demographic characteristics and groups (industry and occupation). Lack of PSL was associated with a lower likelihood of workers receiving the flu vaccine and seeking treatment for flu illness.
Kumar et al., 2013 USA [19]	Case simulations	To investigate the impact of access to paid sick days (PSD) and 'stay at home' behavior in the context of influenza in the workplace.	American Community Survey data, LandScan USA data and aggregated census data (575,866 respondents)	In the simulated influenza epidemic, the rate of infection among employees due to workplace transmission was 11.54%. A large proportion (72.00%) of this rate was due to employee-to-employee contact among sick employees. Universal PSD reduced workplace infection by 5.86%, providing 1 or 2 „flu days” to allow employees with the flu to stay home.

Author / year / country	Study type	Research intention	Respondent file	Results
Srivastava et al., 2021 USA [14]	Applied research	To assess the impact of RM3 UV-C units (UV-C air disinfection equipment) on the risk of infection, the number of units required and the strategy to reduce the risk of infection using CFD (Computational-fluid-dynamics) numerical simulations.	Office building with a combination of individual offices and workplaces	The risk of infection in an office building could be reduced to negligible levels after using a combination of 100% outdoor air and UV-C in the heating, ventilation and air conditioning (HVAC) ductwork with air disinfected with RM3 UV-C units.
Zhang et al., 2021 China [15]	Recommendations for practice	Design of a strategy for using ventilation to reduce the risk of airborne infection and minimize loss of work productivity.	Not defined	Two mechanisms of occupancy scheduling (normal occupancy and reduced occupancy) were identified to reduce the risk of airborne infection and loss of work productivity. The optimization of the occupancy schedule is developed to maximize the total time of normal occupancy for minimum loss of labor productivity while meeting the airborne infection risk containment.

According to the derived data, the most common general recommendations for an individual concerning prevention includes strengthening the body's defences to mitigate civilization diseases (exercise, fresh air, wellness activities, rational nutrition with sufficient vitamins and minerals, dietary supplements, not smoking and not living/working with smokers, training of blowing nose correctly, hand hygiene, use of personal protective equipment, proper handling of protective equipment (PPE), adequate hydration, alcohol restriction, detection of risky environments and persons, vaccination).

Specific recommendations for an individual concerning primary prevention involve care of the environment (home and surroundings – cleanliness, ventilation, disinfection).

Specific recommendations for an individual concerning secondary prevention include care of the environment (home and surroundings – cleanliness, ventilation, disinfection), isolation from people at risk and risky environment, regular preventive testing, implementation of artificial intelligence – monitoring of initial symptoms and risks.

Specific recommendations for an individual concerning tertiary prevention involve regular preventive testing, vaccination, implementation of artificial intelligence – monitoring of initial symptoms and risks.

The most frequent general recommendations for an organization concerning prevention include prevention of civilization diseases, collective or individual exercise - outdoor and indoor activities aimed at strengthening immunity organized by the employer, financial and non-financial health benefits (wellness stay, spa, healthy eating and drinking, vitamins and minerals, dietary supplements, smoking cessation programmes), sufficient and correct handling of personal protective equipment, sufficient disposable hygiene equipment – disinfectants, paper towels, liquid soap, adequate hydration, sick days, home office, support for vaccination of employees, establishing of a position of a health protection officer.

Specific recommendations for an organization concerning primary prevention involve care of the working environment and surroundings – cleaning, ventilation, disinfection, hygiene breaks.

Specific recommendations for an organization concerning secondary prevention include care of the work environment and surroundings (cleaning, ventilation, disinfection, hygiene breaks), detection of risky environments and people, use of artificial intelligence – monitoring of primary symptoms and risks, establishing of a position of a health protection worker, monitoring of the body temperature of employees on arrival at work, job-sharing, reorganization of work.

Specific recommendations for an organization concerning tertiary prevention involve detection of risky environments and persons, support for vaccination of employees, use of artificial intelligence – monitoring of initial symptoms and risks, establishing of a position of a health protection worker, monitoring of the body temperature of employees on arrival at work, job-sharing, reorganization of work, recruitment of new employees – temporary workers [23-28].

The team of authors has taken inspiration from the above analyses and developed a proposal for a preventive model called the Economic Model against the Spread of Respiratory Diseases (Figure 2).

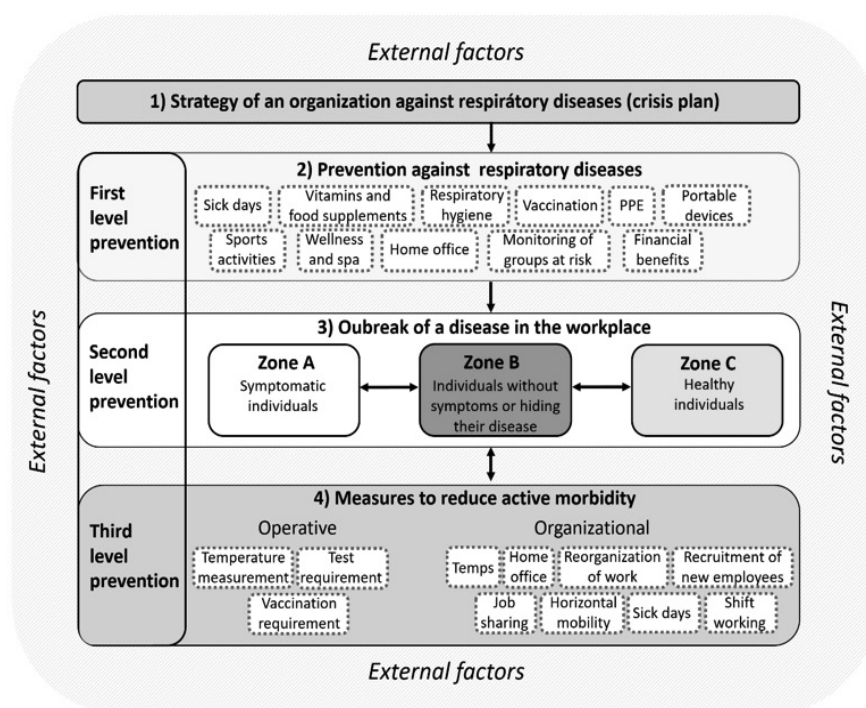


Figure 2. Economic Model against the Spread of Respiratory Disease

Conclusions

Acute viral infections, such as common seasonal influenza or COVID-19 disease, spread easily from person to person at any age category. In healthy persons, it can usually cause only a few days of disability, but in at-risk groups and older individuals it can bring about serious complications or even death. Influenza epidemics and other pandemics cause significant morbidity and mortality, costs to health services, and economic losses due to the absence of sick people from work. Pandemic influenza poses a serious threat, not only to the lives and health of national populations, but also to their economies. Analyses of the relations between the overall economic consequences and potential influenza outbreaks can be made, for example, on the basis of differences between the disease severity and the availability or absence of vaccination. Assessments can be carried out using data and parameters of influenza waves obtained from national statistical data sources and generally available literature. Moreover, state-of-the-art economic impact modelling approaches can be applied to analyze the wide

range of potential impacts arising from data in affected areas and outbreaks. Such studies then ascertain, for example, the economic impacts of changes in medical spending and workforce attendance. They also determine the dependencies of various measures and barriers to the spread of pandemics, including further increasing the resilience and protection of the able-bodied population. In the area of prevention, the authors of the conducted studies have mainly targeted the introduction of measures to avoid or mitigate the impact of the COVID-19 pandemic on organizations if this respiratory disease has already occurred in workplaces or other premises.

We found that the published methods for measuring the benefits or costs of preventive care are focused more on the field of public health and are not applicable for implementation at the level of private enterprise without major modifications. Therefore, the team of authors proposed an organizational model that could be a way to enhance preventive care in the selected areas. A growing number of authors in their studies confirm the fact that preventive measures, despite the costs involved, represent a more comfortable solution for business entities, which is less costly than measures implemented during an outbreak of a pandemic.

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