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REVIEW ARTICLE

PREVENTIVE MEASURES OF RESPIRATORY DISEASES AND IMPACT ON EMPLOYEE MORBIDITY - POSSIBILITIES OF USING ELECTRONIC PLATFORMS

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Summary

Aims: Prevention is one of the most effective methods in the fight against respiratory infections. Electronic platforms can streamline care and have positive applications in the case of infectious diseases. This study was conducted to search for and describe the current scientific knowledge on prevention and the use of electronic platforms and their impact on the application of prevention strategies.
Methods: A scoping review was conducted. In January 2022, a search was performed in selected licensed and free databases (EBSCOhost, Ovid, Scopus, Web of Science) based on PCC keywords using Boolean operators.
Results: A total of 1927 sources were retrieved, of which 21 were subjected to critical analysis. 8 sources were included in the final review. Vaccination, social isolation, hygienic hand disinfection and respiratory protection are described as the most common and effective preventive measures. The platforms described had a positive effect on prevention and improving the quality of care.
Conclusion: The effectiveness of the use of electronic platforms in prevention has been confirmed. Future research should be directed towards the development of these platforms to enable better diagnosis and treatment. Prevention-focused platforms can facilitate, simplify and improve care and access in the prevention of respiratory diseases.

Key words: respiratory diseases; preventive measures; electronic platforms; employee

Introduction

Acute respiratory diseases are the most common cause of morbidity in people worldwide, with a mortality rate exceeding 4 million people per year (1, 2). Although respiratory viruses most often cause only mild illnesses, they can lead to epidemics. Global pandemics of viral diseases have been devastating. In the 2003 SARS epidemic, 8,000 people were infected, 780 died, and a social and economic crisis ensued. Avian influenza H5N1 in 2006

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and swine flu H1N1 in 1009 caused global concern (3). Application of preventive measures is an important strategy in the fight against respiratory infections (4). Basic preventive measures include maintaining a safe distance, isolating patients, and using protective equipment, hand and environmental hygiene and vaccination (5). Several studies confirm the effectiveness of these measures. With the increasing amount of information available, it is important to assess its quality and facilitate the guidance of the general public. Education is important from the perspective of the state, as well as practitioners, schools and employers (6, 7). The ongoing COVID-19 pandemic has only highlighted the need for telemedicine and the use of new ways to prevent, diagnose and treat infectious diseases (8). Respiratory tract infections are common, and most result from viral upper respiratory tract infections, which account for a significant percentage of personal medical care in the emergency department. The use of electronic platforms is becoming one of the new prevention options, applicable also for respiratory diseases (9). In the basic division of areas within m-health research, four areas can be described - prevention, diagnosis, treatment and protection (10). E-health or m-health tools can significantly support the process of maintaining a person's current level of health (11). Involving individuals and monitoring their health status can have a significant positive impact on the level of disease prevention and its subsequent impact (9). At the same time, these technologies have an educational effect and facilitate the fight against a large amount of misinformation (4). Studies have been published that have produced clear conclusions on the positive impact of the use of electronic platforms on the health of individuals in the prevention or treatment of chronic diseases (12, 13, 14, 15, 16). The preventive function of platforms is particularly important in places of higher accumulation of people over longer periods of time, such as workplaces (17). The use of the preventive function of platforms offers benefits in the broad sphere of both the labour and healthcare sectors, where it streamlines human resource work (18), and enables the collection and management of large amounts of information about individuals (20). For individuals, the use of the platform delivers care characterized by high-quality disease management, and adds high practical value to their daily lives (19).

Materials and methods

Aims

The aim of the review study was to search and to describe current scientific knowledge on prevention, the use of electronic platforms and the impact of their use on the prevention of infectious diseases in employees.

Methods

A scoping review was conducted using the methodological steps according to Arksey and O'Malley (18): identification of the research question, identification of relevant studies, study selection, data mapping, data collection, description and summary of results, and the PRISMA-Sco checklist for the scoping review (21). The primary research questions were "What preventive measures, including the use of electronic platforms, are being used and what is their impact on the incidence of respiratory disease in employees?". Relevant keywords were identified for each part of the PCC research question (Table 1).

Table 1. Description of the PCC question and the corresponding keywords.

PCC question	Key words
P - population	Person, employment, employee, employer
C - concept	Preventive strategies, AI, platform
C - context	Impact, effect on morbidity

Eligibility criteria

The search was initiated by refining the inclusion criteria for studies. The search was limited to publications in English, availability of full text, and primary research. Studies without a clearly specified research sample (Studies for which it was not possible to evaluate all inclusion criteria, e.g. it was not possible to determine the age group of respondents. Secondary sources used were included because of thematic correspondence with keywords. None were included in the final analysis), studies in children under 18 years, review studies, dissertations, reviews and discussion papers were excluded.

Search strategy

A literature search was conducted in January 2022. Licensed and freely accessible electronic databases Scopus, Web of Science, EBSCOhost, and Ovid were selected. At the initial stage, a search of the EBSCO host database was conducted to identify appropriate terms that would be most relevant to the research question. The selected keywords were combined using Boolean AND and OR operators. Restrictive filters were used to reduce publications: structured abstract, children, chronically ill and non-infectious diseases. The retrieved records were screened for title, abstract and keywords and assessed for compliance with the criteria set for study inclusion. After exclusion of studies that did not meet the relevant criteria, 21 studies were referred for full-text review, of which 3 studies were secondarily retrieved by another searching. Based on full-text assessment, 8 studies were included in the scoping review that met all the established criteria and were relevant to the PICO question. The publication time range of the selected studies was between 2017 and 2021. An overview of the search procedure is shown in Figure 1 (PRISMA-sco diagram).

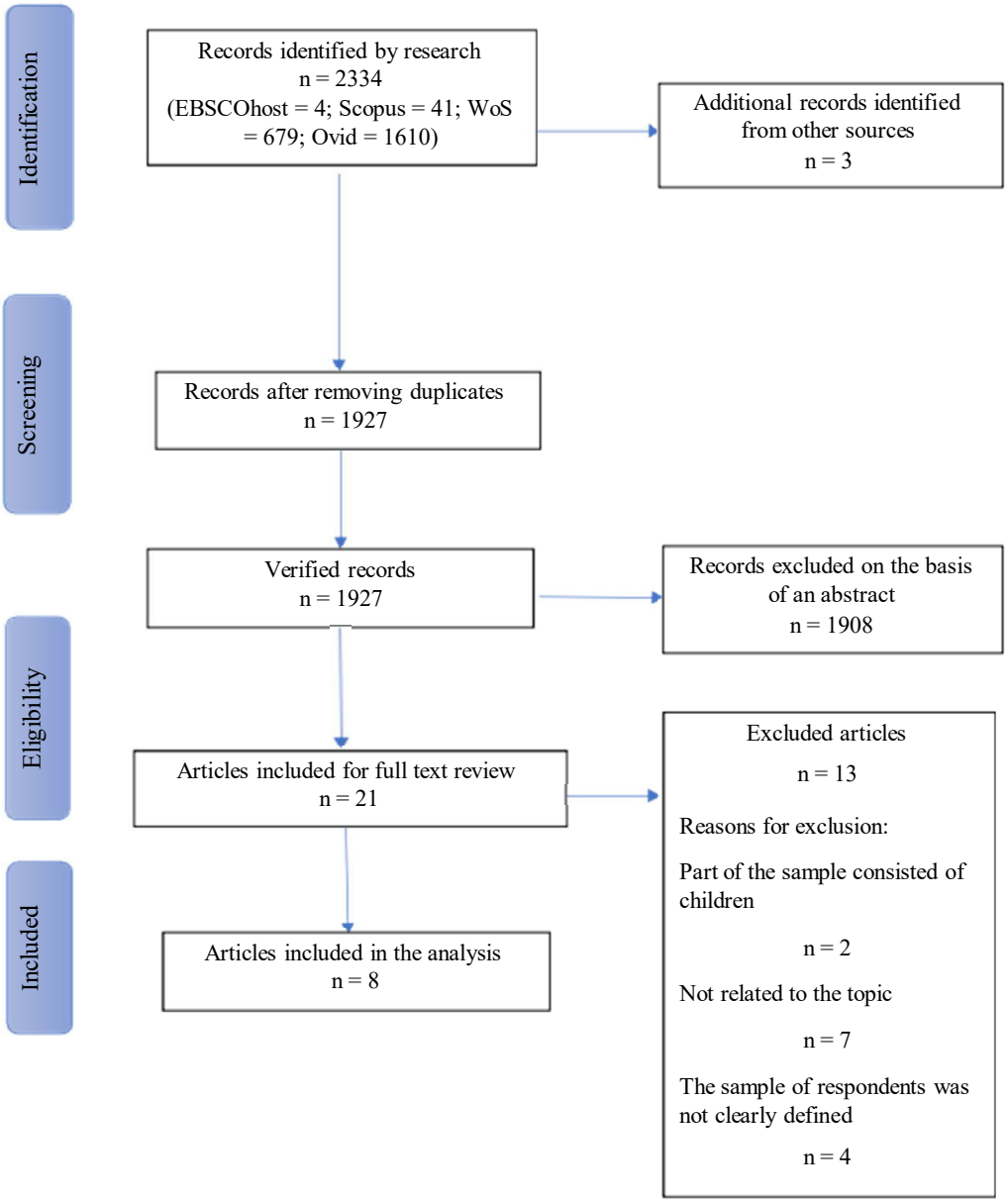

Figure 1. Flow diagram – PRISMA (sco) recommendation.

Quality assessment of articles

The quality of the articles was assessed by four independent assessors. All differences were discussed and the final version of the review was based on the discussion.

Data extraction

Four independent reviewers searched for relevant sources suitable for inclusion in the scoping review. The data were extracted and analysed into six main categories. The first category consists of the first author's name, year of publication and research location. The second category is the type of study and the assessment of the quality level. The aim of the study, the description of the sample and the methodology are described in the other three categories. The last category consists of the main results.

Results

Characteristics of included studies

A total of 8 studies were included in the review study. The selected studies were published between 2017 and 2021, with one study each published in 2017, 2018 and 2019. Three studies were published in 2020 and two in 2021. Two studies were conducted in the USA and China, and one each in Congo, Iraq, Iran, and Canada. Five included studies were cross-sectional, two retrospective and one experimental, interventional. The common theme of all included studies was to evaluate and assess preventive measures, adherence to the measures, and their effectiveness (17, 18, 23, 24, 25, 26, 27, 28). Furthermore, three of the selected studies also focused on evaluating the effectiveness of using E/E platforms (17, 18, 26).

Preventive measures

Social distance, respiratory protection, and careful hand hygiene disinfection were cited as the most common preventive measures (23, 25, 27). These mandated precautions were also the most frequently violated (25). At the same time, vaccination was cited as being essential in the prevention measures (28). Respondents' knowledge and awareness were significantly related to adherence to the recommended preventive measures. Improvement in theoretical knowledge and increased uptake of preventive measures after training was demonstrated (27).

Health platforms

Platforms were applied to streamline available care, monitor infectious disease incidence, increase respondent knowledge, and enable better use of preventive measures and monitoring of adherence (17, 18, 26). In reviewing the results, the positive effect of using platforms for infectious diseases (such as influenza or Covid-19) in the context in which the studies were conducted was described. Their importance in the prevention of infectious respiratory diseases was clearly confirmed (18). No significant differences were shown when the platform was used in the case of chronic respiratory disease on the number of physician office visits, the number of admissions of patients, and the frequency of acute complaints (17).

Details of the results are shown in Table 2 Overview of included studies.

Discussion

As can be seen from the above overview of relevant sources suitable for inclusion in the scoping review, the authors of the conducted studies targeted two related areas in the field of prevention, namely respiratory diseases (influenza or COVID-19) and the use of monitoring devices in the prevention of respiratory diseases.

The results of the US National Cross-Sectional Study to obtain and evaluate information on influenza vaccination and to determine associations between sociodemographic characteristics and subgroups of preventive behaviour (28) confirm the following fact. Although vaccination is the most important available resource against influenza prevention,

other preventive measures such as respiratory protection or hand disinfection may also play a considerable role in slowing its spread.

Table 2. Overview of included studies – part 1.

Author (year) country	**Type of study**	**Aim of study**	**Sample description**	**Methods**	**Main results**
Ditekemena et al. (2021) Democratic Republic of Congo	A cross - sectional study	To assess the level of adherence to preventive measures against COVID-19 and identify factors that lead to non-adherence.	The study population included persons aged ≥ 18 years permanently residing in the Democratic Republic of Congo (n -3268).	Online questionnaire survey (10 items on adherence to preventive measures); asked about the presence of symptoms of illness in the last 14 days and the result of the COVID-19 test. Sampling and snowball sampling techniques were used for collection of data.	Despite the regulations on anti-epidemic rules, half of the respondents did not follow their main principles (54.7% did not wear respirators or face masks; 41.7% did not observe social distance and 15.3% did not perform hand hygiene regularly). There was considerable variation in non-adherence between provinces and several factors also influenced non-adherence: level of education, living with multiple household members, employment/study, living with a partner, etc. However, frequent non-adherence did not lead to a higher burden and mortality than in Europe and the USA.
Kassim et al. (2020) Iraq	A cross-sectional study	To assess compliance with infection prevention and control (IPC) measures among health personnel working in Nineveh Governorate during the COVID 19 pandemic.	A total of 412 health workers were involved.	Online survey for different groups of employees working in the health sector, focusing on the preventive measures used. Self-developed questionnaire consisting of 14 items.	The most frequently violated recommendations are those related to keeping a distance of 1 m (28%), hygienic hand disinfection (13%) and wearing face masks (7%).
Schrager et al. (2020) USA	A cross-sectional study. (firstly redesigned from a previously validated web-based, epidemic screening tool for the current COVID-19 pandemic by multidisciplinary panel of medical experts at two academic medical schools)	To determine whether participants understood and recalled the recommendations provided by the COVID-19 web-based self-triage tool.	The sample consisted of 877 staff and students from two selected universities, with an average age of 32 years (19-84), 65.3% were female.	Online questionnaire - validating the web-based platform for self-triage during the COVID-19 pandemic, verifying user clarity.	Adult users were able to successfully equip themselves with health care guidelines (79.4%) and found them user-friendly (96.9%). The development of a web-based platform appears to be an appropriate tool to provide health advice to the adult population during a pandemic while reducing visits to health facilities.

Table 2. Overview of included studies – part 2.

Author (year) country	**Type of study**	**Aim of study**	**Sample description**	**Methods**	**Main results**
Sprivastav et al. (2018) USA	cross-sectional study (national)	To obtain information on early-season influenza vaccination and to assess knowledge, attitudes, and behaviours related to influenza and influenza vaccination in the U.S. adult population. Subsequently, to determine associations between sociodemographic characteristics and subgroups of preventive behaviours.	A random sample of 3301 respondents over 18 years of age.	Two main questions: "What do respondents do to avoid getting the flu?" and "What precautions do they take to avoid passing the flu on to others once they are sick?" Results from the first question were grouped into 14 behaviours = 4 subgroups, and results from the second question were grouped into 12 behaviours = 3 subgroups.	Although vaccination is the most important resource available to prevent influenza, and almost half of the respondents (49.8%) use it to prevent influenza, preventive behaviours such as hand washing (83.2%), covering the airways when coughing and sneezing (80.0%), avoiding people with respiratory problems (80.0%), and avoiding people with respiratory problems (80.0%) are not recommended. Infection (64.4%), using hand sanitizer (50.2%), and staying only at home if they themselves get sick (78.2%) were used by respondents to a higher extent than vaccination and can play an effective role in reducing or slowing influenza transmission and prevention efforts.
Tavakol et al. (2021) Iran	cross-sectional study	To assess risk factors, including unhealthy diet, obesity and physical inactivity, and to evaluate their impact on disease severity and duration.	The sample of respondents consisted of 206 individuals over the age of 18, in various job roles, who had a diagnosis of COVID 19.	BMI, diet quality (which was assessed by the food intake questionnaire), GPAQ (Global Physical Activity Questionnaire) MET (metabolic equivalent), smoking.	Increasing the level of physical activity may partially reduce the severity of COVID-19 ($p=0.21$). Certain dietary habits, such as increased fruit and poultry consumption, as well as less tea-drinking, were significantly correlated with less severe disease ($p=0.02$ - 0.05). The results did not support previous concerns regarding the potentially harmful effect of smoking on the severity or duration of the symptoms.

Some studies have also found that the introduction and adherence to preventive measures can have a significant impact on the severity and duration of the disease. For example, Tavakol et al. (24) report that a healthy lifestyle, consisting of increased physical activity, improved dietary habits, etc., is directly related to a less severe form of the disease. Preventive awareness measures for clients and mental health centre staff in China (27) demonstrate a positive effect on improving theoretical knowledge of healthcare associated infection control.

On the other hand, some studies cannot confirm or refute the importance of preventive measures as the recommended preventive measures are, unfortunately, not followed by the participants in these studies. The authors of the study Factors associated with adherence to COVID-19 prevention measures in the Democratic Republic of the Congo (23) reported that although about half of the respondents did not adhere to the mandated anti-epidemic rules, the burden on health and mortality from respiratory diseases was not shown to be higher in the Democratic Republic of the Congo

Table 2. Overview of included studies – part 3.

Author (year) country	**Type of study**	**Aim of study**	**Sample description**	**Methods**	**Main results**
To et al. (2019) Canada	interventional, experimental study	To find out whether the Breathe app reduces the use of healthcare services in asthma patients who used it compared to patients in control groups who did not use the app.	677 people with asthma - 132 in the intervention group, 149 in the internal control group, and 396 in the external control group.	Comparison of outcomes for patients in the intervention group and patients in the control groups. Particularly, vital signs and medication administration, acute and elective outpatient visits to medical facilities, and results of pulmonary function testing were compared.	There were no statistically significant differences in the change in the number of asthma-related hospital admissions, visits to a healthcare facility for acute problems or regular follow-ups with the treating physician (p=0.024).
Wang et al. (2017) China	retrospective study	To support monitoring of influenza diseases and influenza virus infections.	Three departments (military units), a testing laboratory, a control laboratory, and a monitoring control site.	Evaluation of the effect of the developed influenza monitoring platform and subsequent comparison with monitoring data from the national influenza control system. Also a summary of the experiences and challenges associated with the platform.	The platform has played a significant role in the prevention and control of influenza epidemics. In the study years 2014-2015 (n=8635; r=0.782; p=0.03) and 2016-2017, the amount of the sample (nasopharyngeal swabs) coincided with the amount of the sample obtained from the National Influenza Surveillance Programme. In the year 2015-2016, due to the strict prevention and control measures using the platform, the three monitored wards avoided an influenza epidemic and the monitoring data did not match the National Influenza Surveillance Program data. Several problems were also observed, including lack of attention, inadequate administrative intervention or subordination, and the need for detection at monitoring sites.

than in Europe or the USA. However, further follow-up studies focused on this issue would be needed to verify the validity of this study. Also, another study focusing on health care workers' adherence to preventive measures found (25) that the most violated recommendations for protection against respiratory diseases were non-adherence to social distancing, lack of respiratory protection, as well as self-isolation and disinfection.

Increasingly, web-based tools, platforms and mobile health apps are emerging as preventive measures to protect against respiratory diseases. A cross-sectional study conducted in a university setting among staff and students

Table 2. Overview of included studies – part 4.

Author (year) country	**Type of study**	**Aim of study**	**Sample description**	**Methods**	**Main results**
Yang et al. (2020) China	retrospective study	To analyse infection control procedures for COVID-19 in a mental health centre and to evaluate their effectiveness.	The sample of respondents consisted of 732 mental health centre employees.	Predetermined risk assessment strategy using: man, equipment, material, method, and environment. Control and prevention measures to minimize risks were defined and then theoretical knowledge before and after the intervention was assessed in the areas of infection control related to the stay in the health care facility, hand hygiene compliance and accuracy, use of personal protective equipment and effectiveness of disinfection and sterilization.	There was a significant improvement in the theoretical knowledge of healthcare-associated infection control after the intervention (63.39% passed before the intervention, 87.28% passed after the intervention), compliance with hygienic hand disinfection (from 56.97% to 79.47%), correct use of personal protective equipment (28.95% to 37.81%), and effectiveness of disinfection and sterilization (35.27% to 83.18%).

in the USA aimed to validate the information provided by a web-based tool (29). Its results confirmed significant importance of web-based platforms in providing information to staff and students during pandemics. By evaluating the effect of the creation of the influenza monitoring platform and comparing them with the results of the National Influenza Surveillance Program in China (18), it was found that the use of the platform contributed to influenza non-containment in the departments that used it.

Modern mobile health applications can also be effective in the management of patients suffering from chronic diseases (e.g. hypertension, asthma, etc.) (29, 30), whose health status could worsen in the context of respiratory diseases. Mobile health apps (mHealth) offer a way to monitor a patient's health status, diet composition, body weight, blood pressure, mood and sleep, and can be used in combination with traditional healthcare to facilitate access to health information. In this way, mHealth apps could raise awareness of necessary behavioural changes and adherence to healthy habits, along with the healthcare provider's awareness of what the patient is doing. Furthermore, these apps can provide self-management of diseases, provide psychological and decision support to patients, and facilitate collaboration between healthcare professionals, patients and their families. Mobile health apps can remind patients of healthy habits such as checking blood pressure regularly and taking medication as prescribed, all of which lead to better adherence to treatment.

Ambiguous results of the use of the Breathe health app in patients with asthma were reported by the authors of a study focused on monitoring chronic respiratory diseases (17). The conclusion of the study confirms that there were no statistically significant differences (e.g. in the number of visits to the doctor, acute care facilities, and hospital admissions) between patients who used the device and others who were treated with conventional methods.

The use of mobile apps has also proven successful in the latest Covid-19 pandemic, which broke out in December 2019 in Wuhan, China. This disease poses a greater risk, especially for elderly people, as well as those with comorbidities such as diabetes, hypertension and cardiovascular problems, manifesting more severe symptoms, and may even lead to the death of these individuals (28). The use of mobile health resources has been an important aid in identifying infected individuals, as well as tracking their contacts. Examples include the use of Bluetooth technology for contact tracing in Singapore (32), the GPS bracelet in Hong Kong (33), the Corona-Datenspende smartwatch in Germany (34), and the Covid-19 Sounds App, a web-based application developed in the UK, which records coughing sounds and thus is able to determine whether a user is infected with the coronavirus (35).

As the above-mentioned sources show, preventive measures have an indispensable place in the field of respiratory diseases. In addition to vaccination against diseases such as influenza, Covid -19 and other viral respiratory diseases, these include the more 'traditional' ways of protecting against infections, such as rigorous respiratory protection and hand disinfection (5). However, the existence of an effective vaccine against all respiratory diseases is not always assured, and if one already exists, there is still a risk of transmission, whether because not all individuals can be vaccinated, vaccination is not absolutely effective or even in some countries it is not available to the entire population. In terms of basic prevention, good health is important, supported by sporting activities, the use of supportive preventive measures (vitamins and supplements), the promotion of telework from home, as well as rigorous respiratory hygiene or monitoring of risk groups. In many cases, maintaining a healthy lifestyle also prevents individuals from chronic 'diseases of civilisation' such as hypertension, diabetes and asthma.

Recently, mobile technology has been increasingly used in healthcare in some countries (32, 33, 34, 35). The development of modern prevention methods using mobile technologies in healthcare seems to be the right direction to further improve the efficiency of preventive care and, simultaneously, improve the quality of life of patients. Current literature suggests that user factors, such as high levels of engagement with a mobile health (mHealth) app, are often associated with better outcomes, and physicians may be better able to support patients by setting goals for treating their disease (36) At the same time, some limitations to the use of these technologies need to be acknowledged, such as the recently introduced data security regulations (GDPR) in Europe; the difficulty of counselling patients on mHealth apps because there is still no standardised evidence-based approach; and, in many cases, the lack of guidance on how to integrate digital technologies into already established treatments.

Conclusion

The aim of the review study was to search and to describe current scientific knowledge on prevention, the use of electronic platforms and the impact of their use on the prevention of infectious diseases in employees.

The conclusions of the studies point to the need to implement and strictly adhere to preventive measures in the fight against infectious diseases. The electronification of healthcare is linked to the rapid development of information and communication technologies that are dominating the world. The coronavirus pandemic has caused both positive and negative changes. One of the pros has been increased interest in healthy lifestyles and disease prevention. The massive overloading of the healthcare system during the crisis opened the door to the new field of 'telemedicine'. The use of mobile apps, health-enhancing activities, vitamins and other benefits can lead to stronger employee immunity (37, 38).

Nowadays, organisations and countries are trying to provide significant protection against respiratory diseases. There are several means of preventing the spread of respiratory diseases, the most important of which so far appear to be vaccination, strict adherence to hygiene measures and good public health, supported in particular by good quality preventive care. Current developments in this area show that mobile healthcare (mHealth) is becoming an increasingly important tool for prevention and monitoring, both in the field of viral respiratory diseases and in the care of chronically ill patients.

Also in the Czech Republic, development teams are working to create mobile applications that would monitor the health of the population. For example, they are focusing on measuring body temperature, blood pressure, heart rate and other areas that can indicate certain problems in a person’s health. One of them is the VANDA platform, which is aimed at daily targeted protection of individual citizens against viral respiratory infections, the spread

of which most often takes place between individuals through transmission in close contact. The development of this device is the aim of a joint project of Principal engineering, s.r.o. and the University of Pardubice entitled "Development of a platform for intelligent digital health protection and research on the impact of its deployment on the economy of the private and public sector", supported by the Ministry of Industry and Trade of the Czech Republic.

In the economic and social field, the project is focused on the effective protection of the state's economy from the impact of viral respiratory infections using artificial intelligence tools in synergy with other current and future digital systems. It is also expected to contribute to the effective protection of the work capacity of companies and organizations from the impacts of viral respiratory contagious diseases through the deployment and use of appropriate artificial intelligence tools, which should contribute to the effective management of the human resources needed to keep companies and organizations running.

In healthcare, AI solutions are able to provide doctors with data on the progression of a patient's disease to help improve diagnosis, treatment and recovery. Telemedicine and smart chatbot technologies can obtain data from healthy individuals and patients with respiratory infections in the quantity and quality needed. With additional data sources, data models and simulations can be created to predictively analyse the onset, incidence, and course of respiratory viral diseases.

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Conflict of Interests

The authors declare that they have no conflicts of interest regarding the publication of this article.

Adherence to Ethical Standards

Not applicable.

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