



Research article

Executive and hierarchical models for participatory response to health emergencies in the workplace: Lessons from COVID-19

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ABSTRACT

Introduction: Workplaces are high-risk environments for epidemic transmission, and the COVID-19 pandemic has highlighted the significant impacts that health emergencies can have on both the healthcare system and the economy. This study presents executive and hierarchical models for participatory response to health emergencies in the workplace, with a focus on COVID-19.

Methods: The study was conducted in three phases. Content analysis of interviews with 101 stakeholders and national documents was used to identify key themes and dimensions for an executive model. A focus group discussion and review of international documents were then used to refine and expand the executive and hierarchical models. The alignment and trustworthiness of the final models, as well as feedback, were gathered from 117 informants working in various workplaces.

Results: The executive model highlighted that context understanding, management commitment, and participation play critical roles in developing tailored prevention and response plans, and adequate support is necessary for successful plan implementation. Monitoring and review processes should be established to ensure proper functioning. The hierarchical model emphasizes the need for collaborative efforts from various stakeholders to effectively implement pandemic prevention and participatory response plans.

Conclusion: Overall, the executive and hierarchical participatory models presented in this study provide a framework for effectively controlling pandemics and other health emergencies in the workplace, enhancing both health resilience and the sustainability of economic activities.

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1. Introduction

The COVID-19 pandemic, declared by the World Health Organization (WHO) on March 11, 2020, had a significant impact on global health and economic systems [1,2]. Social interactions, such as those that occur in the workplace have been identified as a key factor in the spread of infectious diseases [3,4].

The COVID-19 pandemic has demonstrated that behavioral changes, such as social distancing, can reduce the peak incidence of daily cases [5]. Nonetheless, these measures have also led to job losses and economic downturns, affecting millions of people worldwide [6].

International organizations such as the WHO, International Labor Organization (ILO), Centers for Disease Control and Prevention (CDC), and Occupational Safety and Health Administration (OSHA) have provided guidelines to help employers implement safety measures [7,8]. In line with the guidance provided by organizations like the WHO and ILO, governments are urged to adopt policies and plans to protect the health and safety of workers. These measures include quarantine, safety protocols, and occupational health practices [9]. To assist employers implement these measures, international organizations like the CDC and OSHA have published guidelines [7,8].

Countries such as China, the United States, Europe, South Korea, Turkey, and Iran have implemented various measures to control the spread of COVID-19 in workplaces. In response to the pandemic, the Chinese government implemented a series of policies including physical distancing in workplaces, limiting the number of individuals at workplaces, introducing flexible work hours, and continuing to provide salaries to employees even during closures [10]. Similarly, the United States and Europe implemented widespread measures, including the closure of schools, restrictions on gatherings, and the shutdown of non-essential businesses. People were encouraged to stay at home or work remotely, and jobs were categorized as essential or non-essential. Additionally, collaboration with the chamber of commerce led to the transition of businesses to online platforms, and financial support was provided to individuals affected by the virus and to small businesses experiencing hardships [11–13]. In Turkey, employees were required to consult with health authorities and follow their advice under the country's labor laws during the pandemic. There was also an established system for conducting purposeful audits, providing information to employees, and conducting necessary examinations [14]. South Korea conducted a targeted response to prevent the spread of COVID-19, including quarantine, widespread testing, and contact tracing [15–17]. In Iran, the government implemented widespread closures to control the COVID-19 pandemic. The National Health System (NHS) developed and announced workplace health protocols as the first step. Subsequently, efforts were made to reopen businesses while monitoring and controlling the pandemic within workplaces. Specific health protocols for different types of workplaces were established, and a registration system for trades and industries was created. Although, governments adopted policies and plans to protect the health and safety of workers during the pandemic, an executive model based on modern management systems has not yet been developed.

Occupational health and safety (OHS) management systems are powerful tools that rely on risk assessment and control and have found extensive applications in workplaces and work organizations [18]. Most organizations, industries, and workplaces use these systems to manage health and safety effectively and protect individuals, society, and the environment [18]. Management systems such as Health, Safety and Environment (HSE) and ISO45001 are effective in controlling and responding to communicable disease epidemics, including the COVID-19 pandemic [19]. The Plan, Do, Check, and Act (PDCA) cycle is an integrated framework that serves as a systematic approach to continuous improvement embodying the philosophy of ongoing improvement in systems and organizations for learning and knowledge creation [20]. Although, OHS management systems have played a crucial role in monitoring compliance with health and safety issues [18,19], they emphasize the management of inherent and predictable workplace risks and are not tailored for emerging emergencies such as health emergencies.

As the experience of dealing with COVID-19 has shown, various stakeholders are involved in workplace management while balancing economic considerations [21,22]. The implementation of coherent policies and programs to control and respond to epidemics in the workplace can help prevent crises from emerging. Safety and occupational health systems are powerful tools that rely on risk assessment and control [23]. These management systems have benefited from the PDCA cycle as the executive framework [20]. The adoption of a systemic approach requires establishing a participatory framework to identify vulnerable workplaces. Such a framework should involve various stakeholders, including international organizations, governments, healthcare systems, non-governmental organizations, unions, business organizations, employers, and employees [24–31].

An executive hierarchical model is needed to clarify the roles and responsibilities of these diverse actors in preventing and responding to emergencies, particularly during the COVID-19 pandemic. This model would assist organizations and workplaces in mitigating losses and provide guidance for governments and policymakers to implement effective interventions in participatory response to health emergencies like COVID-19.

This study aims to develop an executive hierarchical model for participatory response to health emergencies in the workplace. It would serve as a guide for governments, policymakers, organizations, and workplaces to mitigate losses and implement effective interventions in response to health emergencies such as COVID-19.

2. Methods

2.1. Study design

In summary, this research was conducted in three phases, involving the development of a framework, upgrading and expanding an executive model, and adaptation and integration of a hierarchical model. The data was gathered and generated through interviews,

focus group discussions, and a review of national and international documents. Data was analyzed through inductive and deductive content analysis, considering the PDCA model. The final executive and hierarchical models were developed by aligning them with the OHS management systems and the findings were confirmed through the trustworthiness process. Fig. 1 shows the study design.

2.2. Data collection and generation

The initial phase involved reviewing and analyzing national documents, projects, and health protocols related to preventing and responding to COVID-19 in the workplace using content analysis. The research team searched all regulations including laws, requirements, health protocols, records, letters, reports, and other relevant documents related to the prevention and control of COVID-19 in Iran. These were obtained from the national general databases [32–34] and the NHS databases.

Qualitative methods were employed to gather data through interviews with various stakeholders. The interviews aimed to identify the challenges encountered in implementing measures to address the COVID-19 pandemic in the workplace. Data collection utilized two methods: semi-structured interviews and focus group discussions.

The participants included various stakeholders such as managers, policymakers, health supervisors, industry managers, business owners, and individuals from eight different provinces in the country. To adopt an appropriate sampling approach, the provinces were categorized based on their level of development, and one province was selected from each category using the available sampling method. The selected provinces for participation in the study were Tehran, Khuzestan, Shiraz, South Khorasan, Kermanshah, Kerman, Qum, and Kashan in Iran.

The research team developed four topic guides (policy-makers, supervisors, unions and business owners, and final beneficiaries) based on the literature review, relevant documents, and executive guidelines for preventing and responding to the COVID-19 pandemic in workplaces. Each topic guide was tailored to the specific target group of the interview. Before conducting the main interviews, the research team conducted pilot interviews with individuals from the target group to refine the questions and address any appearance or ambiguity issues. The final version of the topic guide was provided to the interviewers.

The interviews were conducted by faculty members from universities of medical sciences who possessed experience and expertise in conducting qualitative studies. The interviews took place at the participants' workplaces. The interviewers explained the purpose and interview process to the participants before conducting the interviews (see Tables S1 and S2, the supplementary file).

The interviews were conducted with a total of 101 participants involved in the control of COVID-19. The participants in the study

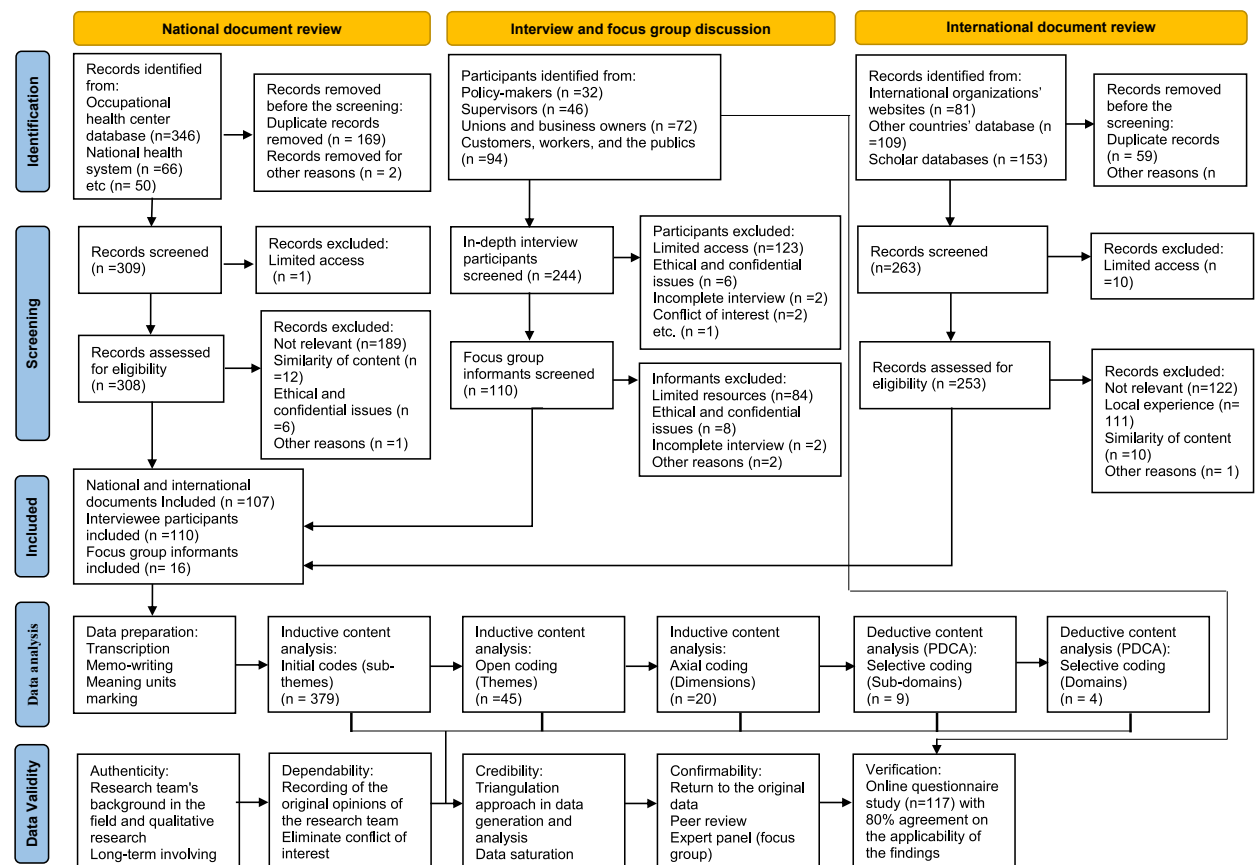


Fig. 1. The study design: adapted from PRISMA [71] for mixed-methods research.

were purposively selected to ensure maximum variety in terms of age, gender, and job (see Table 1). The participants included 18 policy-makers at the national and provincial level, 27 supervisors from provinces and universities of medical sciences, 38 members of unions and business owners, and 18 final interested parties (customers, workers, and the public). The interviewees participated were officially invited to participate in the interviews by the Iran University of Medical Sciences. The recruitment period for the interviews spanned from April 20, 2021, to September 20, 2021. The interview duration ranged from 15 to 45 min, and the interviews were conducted until data saturation was achieved.

An expert panel of sixteen informants participated in focus group discussions to identify strengths, weaknesses, challenges, and areas for improvement in controlling COVID-19 in the workplace. The informants were selected purposively to ensure maximum variety in terms of age, gender, and role from the health system and national and provincial executive bodies involved in the management of the pandemic (see Table 1). The informants were officially invited by the Iran University of Medical Sciences and participated in the focus group discussions from September 28th, to December 28th, 2021. The focus group discussions helped in identifying areas for improvement in the executive and hierarchical models of COVID-19 control in the workplace.

The research team conducted a review of national documents from other countries in the region and worldwide including China, Singapore, South Korea, Qatar, Egypt, and New Zealand [35–50], as well as international documents from organizations such as WHO, ILO, OSHA, CDC, and EU-OSHA. The team searched relevant websites and scholar databases (Google Scholar, PubMed, and Science Direct) with the relevant keywords (COVID-19 OR SARS-CoV-2) AND (workplace OR work environment OR control OR prevention OR response) AND (country name OR organization name) until April 2021. Based on this review, a list of suggestions for improvement opportunities was compiled to expand the executive model.

2.3. Data analysis

The research team transcribed the interview and document contents and converted them into text format. Two members of the team then carefully read the interview text multiple times to identify meaning units and extract open codes through an inductive coding process. The team then further categorized the open codes (themes) into axial codes (dimensions) through inductive coding and the thematic dimensions were then categorized and analyzed through selective coding using deductive content analysis, considering the sub-domains and domains of the PDCA cycle. The final hierarchical model was then developed, taking into account the unique characteristics of various stakeholders involved in managing the pandemic in the workplace. The hierarchical model highlighted the roles and responses of the headquarters, health systems, regional health services, trade unions, and workplaces in a hierarchical manner that allows for effective interaction among these independent entities.

2.4. Findings trustworthiness

The research team considered the Guba and Lincoln criteria to ensure the validity and strength of the research [51]. To achieve confirmability, the generated data was returned to the original data sources, and the opinions of qualitative research colleagues were sought. The approaches for confirmability included maintaining the researcher's impartiality and agreeing on the codes and themes by the two research members. The approaches for credibility included preparing and analyzing the data promptly, rereading the data thoroughly, conducting triangulation in data generation and analysis, and reaching data saturation. To achieve dependability, the original opinions of the research team were recorded, and any conflicts of interest cases were excluded. The approach for authenticity included involving long-term qualitative researchers in the research process.

For the verification of the findings, a total of 117 informants from various organizations and workplaces provided their input through an electronic questionnaire. The informants were selected purposively to ensure maximum variety in terms of age, gender, and job (see Table 1). The electronic questionnaire included the general framework of the model, domains, sub-domains, dimensions, and themes identified in the previous study phases. Based on the face and content validity process [52], participants completed the electronic questionnaire within two weeks. The participants confirmed the validity of the study findings with a content validity index

Table 1
Demographics of interview participants, focus group informants and online survey informants.

Demographic Characteristics	Category	Interview participants	Focus group informants	Online survey informants
		Number (Percent)	Number (Percent)	Number (Percent)
Age	Less than 30	9 (8.91)	3 (18.75)	19 (16.23)
	30–40	31 (30.69)	3 (18.75)	31 (26.49)
	41–50	34 (33.66)	5 (31.25)	39 (33.33)
	Above 50	20 (19.8)	5 (31.25)	28 (23.93)
Gender	Female	22 (21.78)	4 (25)	32 (27.35)
	Male	79 (78.21)	12 (75)	85 (72.64)
Job title/role	Polymakers	18 (17.82)	1 (6.25)	–
	Supervisors	21 (21.78)	2 (12.5)	17 (14.8)
	Businesses	38 (37.62)	3 (18.75)	11 (9.3)
	Customers, Workers, and the Public	18 (17.82)	–	76 (64.8)
	Academic experts	5 (4.95)	10 (62.5)	13 (11.1)
Total		101 (100)	16 (100)	117 (100)

of 80 %.

3. Findings

Table 1 presents the demographics of the individuals who participated in the interviews, focus groups and online survey. Participants were selected from a diverse range of backgrounds ensuring representation from various age groups, genders and job titles.

The analysis resulted in 266 sub-themes that were extracted through initial coding after reviewing documents and conducting interviews with stakeholders regarding their practical experiences with COVID-19. Additionally, 113 new sub-themes were gathered, including 37 sub-themes of improvement opportunities from focused group discussions, 36 new sub-themes from recommendations provided by international authorities, 8 sub-themes from experiences in other countries, and 32 sub-themes from the consensus of the research team.

In total, the inductive analysis resulted in 45 themes from the open coding and 20 dimensions from the axial coding. The deductive analysis resulted in 9 sub-domains the selective coding, and 4 domains from another round of selective coding. Based on these findings, the study developed the initial framework the executive model for implementing participatory response in workplaces.

The executive framework consists of four domains: plan, do, check, and action. The plan domain comprises three sub-domains, the do domain has two sub-domains, the check domain has one sub-domain, and the action domain also has one sub-domain. More details about the domains, sub-domains, and themes can be found in Table S3, the supplementary file.

Fig. 2 shows the executive model of responding to pandemics in the workplace, based on the health and safety management system. The executive model illustrates the PDCA cycle, which is a continuous improvement process with four stages: plan, do, check, and act. Each stage represents a different aspect of the management process. During the planning stage, plans are set, and strategies are developed. In the do stage, these plans are implemented. The check stage involves assessing the outcomes and comparing them to the desired plans. Finally, in the act stage, adjustments and corrective actions are made based on the feedback received to improve the process. The PDCA cycle is a useful tool for organizations to improve their processes continually.

In contrast, Fig. 3 represents a hierarchical model of prevention and participatory response to pandemics in the workplace from top to bottom among workplace interested parties. The hierarchical model includes several actors, such as headquarters, regional health systems, integrated bodies, trade unions, and workplaces, each with specific roles and responsibilities in pandemic management.

In this hierarchical model, the output of each actor’s actions serves as the basis for planning by the next actor in the hierarchy. The feedback loop ensures that information flows from lower levels to higher actors, ultimately reaching the headquarters. This feedback loop allows for continuous improvement of the entire system.

By using these models, organizations can establish a structured approach to pandemic management, ensuring coordination,

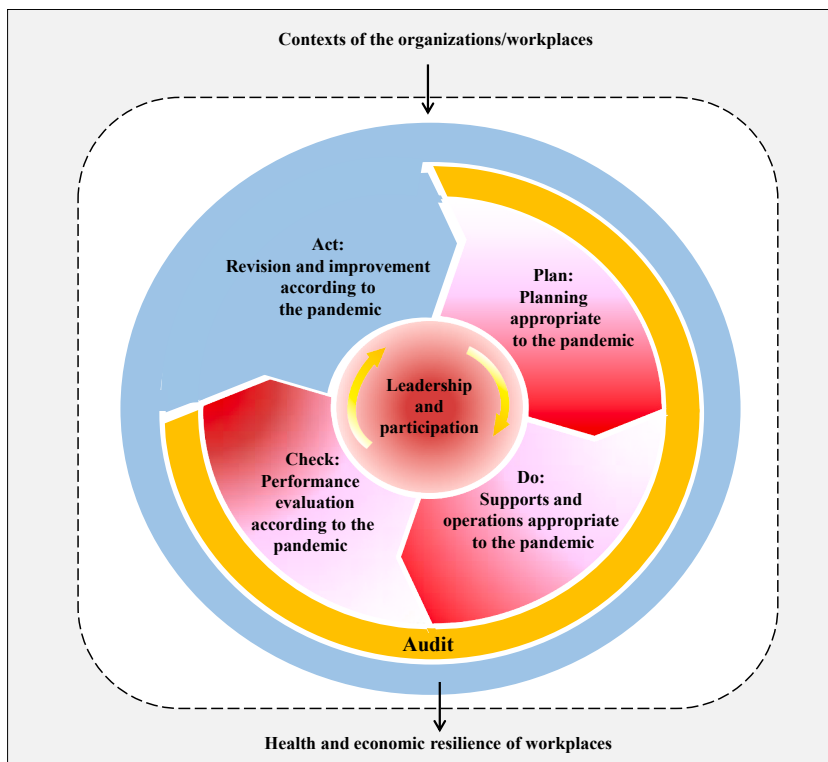


Fig. 2. Executive model of responding to pandemics in the workplace, based on the PDCA model [18,72].



Fig. 3. Hierarchical model of participatory response to pandemics in the workplace.

collaboration, and continuous improvement in their participatory response to pandemics and other health emergencies in the workplace. The current participatory models provide a framework for effective pandemic management, with clear roles and responsibilities for each actor in the hierarchy.

3.1. Understanding workplace settings

The planning stage of the executive model requires understanding workplace settings, which have one dimension and two themes. The dimension involves understanding employees' interests, while the themes relate to identifying internal and external issues that affect workplace operations and the legal requirements for employees.

Workplaces encompass various types of organizations, including administrative, industrial, service-oriented, and non-institutional ones. Decision-making bodies within these organizations should identify issues that impact disease control and organizational goals. These issues can be internal, such as workplace culture, or external, such as the impact of community transmission rates.

It is crucial to identify the needs and expectations of employees and assess their perceptions of measures for preventing and responding to pandemics. Organizations should establish measures to prevent and respond to pandemics, such as COVID-19, to ensure employee well-being and health. This includes assessing employee perceptions of the measures, identifying legal requirements, and ensuring compliance. By understanding workplace settings, organizations can tailor their pandemic management plans to ensure the well-being of their employees and the continuity of their operations.

One participant emphasized that: "Officials within organizations and workplaces are responsible for supervising the implementation of the rules and protocols specified by the Ministry of Health while taking into account their specific conditions. This highlights the importance of proper implementation and monitoring of measures to prevent and respond to pandemics."

3.2. Leadership and employee participation in the pandemic

This sub-domain of the planning stage includes the commitment of the organization to prevent and address the pandemic, health policies against the pandemic, appropriate roles and responsibilities, and organizational authority for the pandemic period, as well as employee consultation and participation during the pandemic.

Workplaces must adopt policies and structures that safeguard the health of their employees and align with national guidelines for dealing with COVID-19. They must also assign appropriate roles and responsibilities, guided by the NHS and supervised by the regional health services. Workplaces should prioritize policies outlined by the national headquarters for dealing with COVID-19 and facilitate employee consultation and participation. Each region should establish a process for engaging stakeholders and allocate necessary resources to effectively address the pandemic.

3.3. Planning appropriate to the pandemic

This domain encompasses risks and opportunities identified during the pandemic period with four themes and planning for the achievement of economic and human resource health resilience goals appropriate to the pandemic with two themes.

Workplaces should coordinate pandemic control efforts with local organizations and trade unions, assess risks and hazards in their work sites, and ensure compliance with legal requirements and conditions. They should establish emergency preparedness plans and create opportunities for adapting work practices to the pandemic situation. Additionally, workplaces should develop evidence-based implementation programs aligned with health goals and plan for both the risks and opportunities associated with the pandemic.

To identify and capitalize on opportunities for pandemic control, relevant organizations such as unions and regional health systems can leverage the potential of organizations capable of producing essential pandemic-related products. During the pandemic period, many factories shifted their operations to produce items that could contribute to pandemic control efforts, such as masks and disinfectants.

Overall, workplaces must take into account specific work situations, the needs of stakeholders, and health management systems while identifying risks and opportunities. By ensuring compliance with legal regulations and guidelines, establishing emergency preparedness plans, and adapting work practices, workplaces can mitigate the impact of the pandemic and safeguard the health and well-being of employees and stakeholders.

3.4. Support

This sub-domain covers resources during the pandemic, competencies relevant to the pandemic, awareness and preparedness against the pandemic, communication and information exchange during the pandemic, and documentation of pandemic information.

The study emphasizes that support and protection are fundamental principles in participatory responses to emergencies and pandemics. Decision-making organizations and institutions should identify critical areas of risk in addressing pandemics and establish relevant committees to respond to and control the pandemic. This may include scientific and executive committees at national, regional, and provincial levels.

Organizations should take proactive steps to raise awareness and enhance competencies in dealing with the pandemic within their workforce. This may involve developing educational content to train employers and other healthcare providers in industries and workplaces. Workplaces should identify employees who possess the necessary competencies to manage health and pandemic control programs and functions, ensuring they have received essential training in this field.

To promote coordination and cooperation necessary to control the pandemic, organizations and workplaces should remain aware and alert to the spread of the disease. Health warnings and recommendations communicated to business owners and organizations through various media platforms can significantly enhance their awareness and vigilance in implementing proper control and response measures to combat the pandemic.

Effective communication and information exchange are crucial factors in pandemic control. Various structures such as primary health care centers, unions, and associations, as well as systems and hotlines like 4030 and 190, play a vital role in effectively responding to crises in a participatory manner.

Workplaces should establish processes for both internal and external communication concerning the pandemic and response to COVID-19, under the guidelines provided by the NHS. They should form dedicated working groups to supervise the implementation of health protocols issued by the NHS and ensure smooth internal communication for a participatory response to the COVID-19 pandemic. Workplaces should be capable of responding appropriately in different and unexpected situations arising from the pandemic through effective communication and information exchange and remain vigilant.

Allocating sufficient financial resources to workplaces, in collaboration with the NHS and other relevant organizations, is critical for developing, implementing, and continuously improving pandemic-related programs. Policymakers should ensure the provision of necessary resources for the production of equipment essential for controlling the pandemic and participating in emergency responses, such as masks, disinfection materials, and other preventive measures.

Securing the human resources and operational forces necessary for effective control and participatory response to the pandemic requires adequate planning. This entails utilizing existing resources within the health system and mobilizing external forces, including military personnel and national health forces specializing in occupational health, environmental health, and public health. By strategically deploying these resources, an executive and participatory response to the pandemic can be achieved.

A lack of sufficient funding for effective response and preparedness is a significant problem in many crises, including epidemics. Countries must allocate enough resources for future epidemics and include a dedicated budget for these purposes on an annual basis. Prioritizing funding and proactive planning for future epidemics is crucial to mitigate the impact and enhance preparedness.

3.5. Operation

This sub-domain focuses on implementing micro and macro projects for pandemic prevention and participatory response, with a focus on emergency preparedness. The study suggests prioritizing national-level projects for pandemic prevention. In Iran, the national headquarters for COVID-19 collaborated with the NHS and other organizations to implement various projects, including workplace closures and gradual re-openings with categorization and guidelines for different occupations. To effectively respond to the pandemic, organizations and workplaces should implement risk reduction programs, control and reorganize work processes, provide training, and use personal protective equipment. They should develop a comprehensive plan aligned with national policies and instructions from the NHS. Supervision and oversight by decision-making organizations such as the NHS are necessary to ensure compliance with social distancing measures and to prepare for emergencies. In Iran, the NHS implemented a strategy to enhance workplace inspections and monitor the implementation of health protocols during the pandemic.

3.6. Performance assessment

This sub-domain focuses on monitoring, measuring, analyzing, and assessing the performance of organizations in their participatory response to the pandemic and revising management practices to align with the demands of the pandemic. Workplaces should undergo performance assessment during the pandemic through audits conducted by inspectors from the regional health system, including occupational health experts from industries and inspectors from relevant guilds and mobilization forces. Their role is to ensure compliance with health protocols and guidelines issued by decision-making organizations.

In Iran, a trade and industry registration system has been implemented to facilitate this process. Individuals can scan QR codes

using their mobile phones and provide feedback on the level of compliance with health protocols. This system enables for comprehensive evaluation of workplaces' adherence to health protocols, allowing for effective monitoring and performance improvement during the pandemic.

Workplaces and organizations should align their supervisory and performance assessment plans with the indexes, criteria, and guidelines issued by competent authorities and revise their management plans if necessary. They should establish a systematic process for monitoring, measuring, analyzing, and evaluating their performance, including assessing compliance with legal requirements and guidelines.

Conducting occupational health monitoring and visits, public monitoring and visits, and internal monitoring specific to epidemics and disease control are essential tasks for organizations and workplaces to carry out at this stage. By implementing these measures, they can effectively assess their performance and ensure adherence to necessary protocols and regulations.

One participant stated: "The protocols developed by the NHS require checklists in place to ensure compliance. Each organization should conduct internal evaluations, and an external organization should be involved in monitoring these evaluations. This approach ensures the implementation of necessary measures to control the virus spread. Another participant mentioned: "Health inspectors play a crucial role in ensuring adherence to protocols and maintaining a safe environment."

3.7. Revision of management in participatory response to the pandemic

This sub-domain focuses on the assessment of pandemic-related audits and the evaluation of the performance of committees, provincial headquarters, regional health systems, and other stakeholders involved in participatory response to the pandemic. To adapt management strategies in participatory response to evolving pandemic situations, a high supervisory committee should convene monthly meetings to review reports, analyze strengths and weaknesses, and provide recommendations to the national headquarters of COVID-19 management. Similarly, provincial oversight committees should hold meetings, summarize field surveys, and offer suggestions to the high supervisory committee.

It is recommended that workplaces establish a high supervisory committee responsible for implementing pandemic prevention protocols and designate authorities to oversee compliance within the organization. The presence of structures such as occupational health centers, labor health houses, and Behgar stations in workplaces facilitates inter-organizational decision-making through technical committee meetings and inter-organizational inspections. This process should be complemented by submitting reports to relevant organizations, including the regional health system and other supervisory bodies.

Committees and various working groups should submit weekly reports to the central committees and the national headquarters responsible for dealing with COVID-19. These reports provide valuable insights into the trend of the COVID-19 outbreak, which informs decision-making at the national level. In Iran, medical sciences universities as regional health services were required to submit weekly reports of their response performance to the NHS during COVID-19. These reports are forwarded to the national headquarters dealing with COVID-19 to serve as the foundation for decision-making.

Additionally, committees conduct weekly webinars in collaboration with the health departments of universities. These webinars serve as a platform to discuss the results of province inspections and the statistics related to the province's situation. The feedback and discussions from these webinars are utilized to improve the situation in the respective provinces. One participant emphasized that: "An active inspection commission was established in Iran on March 12th last year when the COVID-19 pandemic started. This commission has been conducting inspections and oversight activities since its formation to ensure compliance with health protocols and guidelines."

3.8. Non-compliance and corrective action appropriate to the pandemic

Organizations and workplaces should closely monitor their operational processes to ensure compliance with the prescribed preventive measures and protocols for pandemic prevention. It is essential for them to continuously evaluate and revise their action plans to address any identified non-compliance and take appropriate corrective actions.

In case of non-compliance, workplaces should take swift corrective actions to rectify the situation. This may include isolating affected individuals, implementing additional preventive measures, and reviewing and revising their protocols and procedures. Additionally, workplaces should report any non-compliance to the relevant authorities and take necessary steps to prevent similar incidents from occurring in the future.

Corrective actions should be taken promptly and effectively to prevent the spread of the virus and ensure the safety of employees and customers. It is recommended that workplaces establish a system for tracking and monitoring non-compliance incidents and the corresponding corrective actions taken. This system can identify patterns and trends in non-compliance, enabling workplaces to take proactive measures to prevent future incidents.

By monitoring compliance and taking appropriate corrective actions, organizations and workplaces can effectively prevent the spread of the virus and ensure the safety of their employees and customers.

3.9. Continuous improvement according to the pandemic

Organizations at various levels should establish processes for reviewing and evaluating the effectiveness of their actions and plans in dealing with and responding to the pandemic. Workplaces should develop mechanisms to promptly and appropriately address instances of non-compliance with pandemic-related guidelines and regulations under the oversight of the NHS and the regional health

system.

Workplaces must investigate and assess non-conformities in collaboration with employees, stakeholders, and relevant organizations, following the guidelines provided by the NHS. To ensure the efficacy of their pandemic response plans and procedures these processes should be continuously improved in response to the ever-evolving nature of the pandemic, with regular supervision and inspections conducted by the regional health system.

Continuous improvement is essential in the pandemic response, as the situation is constantly changing. Organizations and workplaces should regularly review and evaluate their pandemic response plans and procedures, seeking feedback from employees, stakeholders, and relevant authorities. This feedback can inform necessary updates and revisions to the organization's pandemic response plan, ensuring that it remains effective and up-to-date.

Furthermore, organizations and workplaces should leverage technology and data to improve their pandemic response. For instance, they can use data analytics to identify patterns and trends in the spread of the virus, allowing them to take proactive measures to prevent future outbreaks. They can also employ technology to facilitate remote work and minimize contact between employees and customers.

Regular supervision and inspections by the regional health system can provide organizations and workplaces with valuable feedback, helping them identify areas for improvement in their pandemic response plans and procedures. These inspections can also ensure compliance with pandemic-related guidelines and regulations, promoting the safety of employees and customers.

4. Discussion

The objective of this study was to develop and explain executive and hierarchical models for preventing and responding to pandemics in the workplace through a participatory approach. This study highlights the importance of adopting a participatory approach to control pandemics in the workplace. Despite the presence of established roles and structures related to occupational health in the workplace, the current finding based on the COVID-19 pandemic highlighted the need for enhanced coordination among all related organizations, workplaces and other interested parties, not limited to the health system and healthcare services. In addition to its human and physical impact, COVID-19 has created an unprecedented crisis across multiple dimensions, including social and economic aspects [53]. Numerous reports indicate that the prevalence of COVID-19 has led to significant losses for various businesses including informal businesses and independent workers which lacked insurance coverage to safeguard them through discounted employer insurance premiums or access to government facilities and financial assistance [54]. Considering that employment is one of the social factors influencing health, its optimization plays a crucial role in shaping the well-being of individuals and society as a whole. In addition to the social implications of health concerning employment and businesses, the COVID-19 crisis has introduced a climate of uncertainty and confusion regarding workplace risks, stakeholder pressures, employee exposure risks, and so on. This posed a significant challenge for numerous organizations, as these uncertainties and changes could prove even more perilous [55]. Therefore, during the pandemic, effective coordination and cooperation between departments, along with the implementation of appropriate rules and structures, were necessary to ensure both the health and job security of individuals and society [56].

This study presents an executive model and illustrates the PDCA cycle, which is a continuous improvement process with four stages: plan, do, check, and act. Each stage represents a different aspect of preventing and responding to pandemics in the workplace.

During the planning stage, decision-making organizations and systems should employ a systematic approach to identify the risks and opportunities associated with pandemics. Based on the findings of this study, organizations and other interested parties at various levels should identify their organizational settings and ensure they have the necessary preparedness and plans to respond to and build resilience against health emergencies, considering their capacity, facilities, equipment, and the nature of their products or services. A past study has demonstrated that the COVID-19 crisis compelled organizations to modify their work processes. Despite the uncertainties surrounding the pandemic, it became evident that people's work methods would need to adapt [57]. Some organizations had to develop entirely new work processes in response to the new conditions. To accommodate these changes, organizations and workplaces had to identify and reassess their inter-organizational processes, geographic considerations, and functional structures [58]. As an example, as the pandemic persisted, organizations recognized that a significant portion of jobs could be performed remotely for an extended period [59].

This study emphasizes the importance of adopting an accountable approach to control pandemics in the workplace. It stresses the need for policy-making, managerial commitment, employee engagement, risk assessment, and the utilization of opportunities. Furthermore, to foster a system that enhances the well-being of employees, their families, and ultimately the community, it is essential to conduct evaluations of implemented initiatives. If any issues arise, prompt action must be taken to address them and enhance the response and resilience system to crises like the COVID-19 pandemic. Nonetheless, past research on health promotion planning in work environments has revealed that organizations lack a comprehensive comprehension of workplace health promotion measures [60].

The well-being of individuals and communities encompasses more than just disease prevention and treatment [56]. Relying solely on healthcare providers and the healthcare system to deliver these services does not necessarily result in societal health improvement; thus intra sectoral collaboration is fundamental to delivering healthcare in any given society. The Alma Ata Declaration, Ottawa Charter, and Bangkok Charter of 2000 have all emphasized the significance of inter sectoral cooperation as a crucial strategy for promoting health [61,62]. Inter sectoral cooperation involves collaboration between health sectors and sectors outside of healthcare to implement measures that contribute to desired outcomes or consequences of the healthcare system. The results achieved through such collaboration are likely to be more effective, efficient, and sustainable than those achieved by the health sector alone [63].

One of the key factors for successful planning and proper participatory response to health emergencies such as COVID-19 is effective leadership and the active participation of stakeholders, employees, and health and safety authorities in workplace programs.

A study conducted by Chughtai and Milner highlighted the significant role of management and leadership in cultivating a health-promoting environment. They emphasize the importance of aligning health goals with the organization's strategies. Management and relevant stakeholders should actively support health promotion plans by adopting health-related policies, creating necessary facilities, and allocating resources accordingly [64].

In the context of this study, inter-sectorial cooperation at the national and international levels was identified as a key policy adopted by the healthcare system to advance the objectives of the pandemic participatory response plan and COVID-19 management in workplaces. The establishment of appropriate structures and settings for cooperation and participation across all sectors is necessary even before an emergency like COVID-19 occurs. Effective coordination and cooperation between departments, along with the implementation of appropriate rules and structures, are necessary to ensure both the health and job security of individuals and society [53]. Organizations and workplaces need to identify and reassess their inter-organizational processes, geographic considerations, and functional structures to accommodate changes. The participation and engagement of employees in health-related plans and participatory response initiatives are vital for the success of workplaces in managing crises. Accountability plays a crucial role in health and emergencies such as the COVID-19 pandemic. Keshavarz et al. emphasized the responsibility of organizations for the health and well-being of their employees, customers, the surrounding community, society at large, and the environment [65].

During the implementing stage, adequate support should be provided to the organization for the successful execution of the prepared plan and to carry out prevention and participatory response operations under the leadership and participation of interested parties. Based on the plans and decisions communicated by relevant institutions, workplaces should have the opportunity to adapt their work processes, organizational structures, and physical work environments in a participatory response to the pandemic. This may include implementing measures like remote work, physical distancing, improved ventilation, modified work shifts, and providing health facilities for employees and beneficiaries. Similar to considering risks of chemical pollution that may arise in workplaces, it is essential to also take into account the risks associated with diseases and biological contamination within workplaces. Based on the level of risk, appropriate programs and measures should be implemented to mitigate these risks [66,67]. Indeed, previous research has demonstrated that developing and implementing a plan to assess and control biological risk factors in the workplace, as outlined in the occupational health management systems, plays a crucial role in effectively controlling COVID-19 [67]. Furthermore, a study by Zisook et al. highlights that infection control measures for COVID-19 can vary across different job roles [68].

In addition to preparing resources and obtaining managerial support for health promotion plans in the workplace, employees must understand the implementation of these plans. Thus, the role of managers becomes paramount [69]. The participation and engagement of employees in health-related plans and participatory response initiatives are vital for the success of workplaces in managing crises. The current findings emphasize the importance of workplaces gaining the participation and trust of their employees and stakeholders by promoting health-related policies and enhancing their understanding of crises such as infectious disease pandemics and the corresponding management systems. This allows for the identification of opportunities to address these crises and plan appropriate actions. Furthermore, a study by Panahi et al. highlights that enterprises with an occupational health management system demonstrate higher levels of employee education and participation in improving occupational health compared to enterprises without such a management system. The establishment of these management systems can be an effective measure in reducing the prevalence of diseases, especially infectious and communicable diseases like COVID-19 [19].

Legal frameworks, structures, and regulations within countries are essential for facilitating the success of health systems, decision-making committees, relevant organizations, and workplaces in effectively controlling and responding to crises in a participatory manner. The supervision and care systems need to transition from a surveillance and inspection mode to implementing comprehensive plans promptly and efficiently. This shift allows for the optimal utilization of resources and minimizes energy expenditure in managing pandemics and emergencies. A study by Khorram-Manesh et al. also highlights a positive aspect of the COVID-19 pandemic, which is the opportunity for countries to reflect on past events and identify areas for improvement in future responses. Effective management of future crises necessitates knowledgeable leadership and functional infrastructures. Strong leadership that can make accurate decisions based on limited data is necessary for managing disasters and incidents. This type of leadership is essential from the national or international level [70].

During the checking stage, monitoring and reviewing all processes related to pandemic prevention and participatory response is essential to ensure their proper functioning. The organization should implement corrective measures and continuously improve the program based on feedback received, with active participation of employees and the leadership of senior managers. Evaluations of implemented initiatives should be conducted to foster a system that enhances the well-being of employees, their families, and ultimately the community. Previous research has revealed that organizations lack a comprehensive framework of workplace health promotion measures [60]. Zisook et al. emphasized that to determine the specific risks and opportunities associated with the pandemic, workplaces should evaluate various factors, including roles and responsibilities, communication protocols, employee hygiene practices, facility cleaning, and disinfection procedures, reporting mechanisms, product delivery methods, and case management strategies; the definitions and approaches to addressing these issues will differ based on the unique characteristics and requirements of different workplaces [68]. Kwang-Yeong stated that a systematic response to preventing the spread of COVID-19 in South Korea, including measures such as quarantine, widespread testing, and contact tracing, was based on lessons learned from previous experiences with influenza H1N1 in 2009 and MERS in 2015 [16].

The current hierarchical model emphasizes the need for participatory policy-making and response planning, requiring collaboration efforts from various interested parties, including national headquarters, NHS, regional health services, trade unions, and workplaces (employers, employees, and customers) to implement an executive model for preventing and responding to pandemics in workplaces. In this hierarchical model, the output of each actor's actions serves as the basis for planning by the next actor in the hierarchy with a feedback loop ensuring that information flows from lower levels to higher actors, ultimately reaching the

headquarters. This feedback loop allows for continuous improvement of the entire system. The national headquarters should lead the participatory organization to ensure the resilience of health employees and the continuity of organizational economic activities during pandemics and other health emergencies. Leadership at each level of the participatory organization plays a critical role in pandemic response requiring senior management to have a comprehensive understanding of the needs of interested parties, organizational issues, and external factors to develop effective prevention and response plans tailored to their specific context.

By using the current executive and hierarchical models, national health and economic systems can establish a structured approach to pandemic management, ensuring coordination, collaboration, and continuous improvement in response to pandemics and other health emergencies in the workplace. These models provide a framework for effective pandemic management, with clear roles and responsibilities for each actor in the hierarchy, and potential to enhance both health service resilience and the sustainability of economic activities.

However, this study had some limitations. Accessing participants was difficult and limited due to the COVID-19 situation, which was partially solved through virtual meetings and online questionnaires. Additionally, implementing a similar interview procedure was challenging, which was partially addressed by preparing interview guides, holding pilot interviews, and coordinating meetings with the interviewers. Moreover, the current participatory model presented in this study is primarily based on experiences with the COVID-19 pandemic at the national level and adapted by incorporating insights and experiences from other countries and the international level. It is important to recognize that each country has its own unique context and circumstances, and thus it is recommended that other countries customize and adjust the current findings based on their lessons learned from COVID-19 and previous pandemics. This customization should take into account specific economic conditions, social dynamics, and organizational backgrounds. Future studies should thus focus on customizing and adjusting the current findings to fit specific economic conditions, social dynamics, and organizational backgrounds. To enhance the relevance and effectiveness of participatory model in addressing the challenges posed by pandemics and similar health emergencies.

5. Conclusion

The study emphasizes the importance of adopting a participatory approach to control pandemics in the workplace. The hierarchical model highlights that collaborative efforts from various stakeholders, including national headquarters, NHS, regional health services, trade unions, and workplaces (employers, employees, and customers), are necessary for implementing an executive model for preventing and responding to pandemics in workplaces. The national headquarters should lead the participatory organization to ensure the resilience of health employees and the continuity of organizational economic activities during pandemics and other health emergencies. The executive model emphasizes that response management plays a critical role in pandemic participatory response and should develop effective prevention and response plans tailored to their specific context. Adequate support should be provided for the successful implementation of the plan, and monitoring and review processes should be in place to ensure proper functioning. In the hierarchical model, the output of each actor's actions serves as the basis for planning by the next actor in the hierarchy; the feedback loop ensures that information flows from lower levels to higher actors, ultimately reaching the headquarters. The current participatory models can serve as a framework to effectively control pandemics and enhance health service resilience and economic sustainability.

Ethics statement

This study was reviewed and approved by the Ethics Committee of Iran University of Medical Sciences, with the approval number IR.IUMS.REC.1400.614. All participants provided informed consent to participate in the study.

Data availability statement

Data included in article/supp. material/referenced in the article.

CRediT authorship contribution statement

Masoud Motalebi Ghayen: Writing – review & editing, Writing – original draft, Validation, Supervision, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Mitra Faghihi:** Writing – review & editing, Writing – original draft, Validation, Methodology, Investigation, Formal analysis, Data curation. **Ali Asghar Farshad:** Writing – review & editing, Supervision, Methodology, Conceptualization. **Elahe Ezati:** Writing – review & editing, Validation, Investigation, Formal analysis, Data curation. **Mohammad Aligol:** Writing – review & editing, Validation, Investigation, Data curation. **Soudabeh Yarmohammadi:** Writing – review & editing, Validation, Investigation, Data curation. **Shayesteh Shirzadi:** Writing – review & editing, Investigation, Data curation. **Narmin Hassanzadeh-Rangi:** Writing – review & editing, Writing – original draft, Visualization, Validation, Methodology, Investigation, Formal analysis, Data curation. **Yahya Khosravi:** Writing – review & editing, Writing – original draft, Validation, Supervision, Methodology, Investigation, Formal analysis, Data curation, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.heliyon.2024.e24930>.

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