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Occupational safety, policy, and management in public health organizations and services

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ABSTRACT

A literature review of proposed scientific field in occupational safety, public health policy and management in public health organizations and services. Evidence of occupational safety, public health policy and management that are encountered by Greek public health organizations and services, also limited global literature. Connection and contribution of occupational health and safety with policy and management. Provided evidence of the exact risks that are perceived by occupational safety in public health services policy and management. Comprehensive relative to possible occupational safety in policy and management, with established and new evidence of only study include Greek public health organizations and services. New information's and knowledge produced, was verified scientifically. During the COVID-19 pandemic, global financial crisis, job insecurity, decreased salaries and social instability where working conditions changed, risk factors were affected, risk increased and interpersonal working relationships had a particular impact under the period of the pandemic, especially for health professionals who were in the frontline. This study can bear a significant impact and with the help of various reviews we give the global occupational safety, public health policy and management in public health organizations and services. Study conducted on the recent period for the last decade, published papers along in Scopus, Web of Science, Direct Science, and Elsevier Journals. There are very few papers published based on the very contemporary title considered for the article; hence, this identified several articles in the scientific literature, but only few articles were classified as eligible according to the previously established criteria.

Keywords: occupational safety, public health policy, public health management, organizations and services, COVID-19 pandemic, occupational public health

INTRODUCTION

One of the most important, key areas of public administration, which contributes fundamentally to the progress of the development and promoting of the well-being in modern societies, while protecting the security and survival of every society, is public health and public health services (Adamopoulos et al., 2022). The public health sector ensures, promotes, and acts proactively on health issues.

The term "public health" refers to *the science and art of disease prevention and prolongation of life and health promotion*. The most complete definition of public health is attributed to Winslow (1920) and is defined as *the science of protecting the safety and improving the health of communities through education, policy making and research for disease and injury prevention*. According to the European action plan for strengthening public health capacities and services (WHO, 2020)[1], public health is defined as *"the art and science of preventing disease, prolonging life and promoting health through the organized efforts of society"*.

Winslow (1920) argues that public health is serviced through community driven efforts, restoring the environment, educating the individual on principles and personal hygiene, organizing medical and hospital services for the early diagnosis and preventive treatment of the disease, and developing a social mechanism which will provide each person with a living standard suitable for maintaining their health.

[1] http://www.euro.who.int/en/health-topics/Health-systems/public-health-services/publications/2012/european-action-plan-for-strengthening-public-health-capacities-and-services

The activities that are developed to enhance public health capacities and service create the conditions for people to maintain their health and wellbeing as a whole and not only against particular diseases. These activities may include health campaigns and personal services such as vaccinations, behavioral counseling, or health advice (WHO, 2020).

Public health deals with health threats based on population health analysis. The population may be too small or too large so to include residents of many continents - as in the case of the pandemic COVID-19. The dimensions of health include "a state of complete physical, mental and social well-being, not just the absence of disease or disability", as defined by the International Health Conference, 1946.

Life expectancy, which is 81.5 years, is above the EU average, but afterwards the age of 65, two thirds of these years are accompanied by a disability. The difference in life expectancy between the two sexes remains and amounts to five years as well social inequality, with a difference of four years depending on the educational level. Ischemic heart disease, strokes and lung cancer still have significant impact on mortality, but deaths due to road accidents have been drastically reduced.

Access to healthcare presents some challenges with regard to availability of services and their economic accessibility too, resulting in high rates of unsatisfied medical need especially between low-income groups. And as for the durability, there is a pressure on financing of the health system. From 2010 health policies focus on cost control and improvement efficiency, especially in pharmaceutical and hospital sector. Emphasis is also given to increasing transparency and transparency accountability too.

Earlier studies such as the one of Hilliard and Boulton (2012), argued that public health workforce was of immediate need of high-quality training, infrastructure, human and technical resources as well as competitive salaries, opportunities for professional development, standards for workplace performance, and fostering environment with high levels of job satisfaction for effective delivery of services.

Feelings of fear, panic and pandemics have been linked historically (Rai, 2021). Yet, these feelings and altogether reaction to pandemics is related to cultural context, public health infrastructure, political and economic status of the country, as well as international situations. Nevertheless, in today's globalized economies, panic of pandemics is rapidly globalized as well, creating increased feelings of fear that are triggered by experience, such as wars and terrorism. Fear, anxiety, and panic also have been extensively used by governments to justify reforms and radical state interventions.

The health services are the competent authority for the implementation and control of the new harmonized food law and, in cooperation with all stakeholders, develop a unified and integrated policy to ensure food safety. This policy is based on the EU legislation and on the other hand, the continuous development of the world food industry related to the use of new technologies for the production, processing and preservation of food and the adoption of new methods of control by the competent authorities.

The policy is developed based on the following principles:

1. Protecting citizens' health from eating food and ensuring the quality of food produced in a country or imported from other countries.
2. The best possible information for consumers regarding both the food they consume and the possible dangers of food that may be in circulation in the market.
3. Meeting as much as possible consumers' expectations regarding food quality.
4. The best possible control by the competent authority (Ministry of Health–Sanitary Services) of the entire production process and in relation to all activities of the food industry.
5. Prevention/investigation of cellular diseases.
6. Health services, as part of their strategy, run programs to ensure food and water safety and thus help prevent the transmission of foodborne and waterborne diseases.
7. Epidemiological investigations are carried out to identify the source of infection of infectious diseases and to avoid the occurrence of new outbreaks. Measures are being taken to prevent the introduction of contagious diseases, and prevention programs are implemented systematically by Health Services to educate the public as well as other groups (e.g., food operators).

The health services, within the scope of their competencies, which derive from current EU and national legislation, intervene in a proactive manner mainly in the various areas of human activity. The environmental health sector covers a wide range of activities, where health services in cooperation with other services involved are responsible for monitoring and acting. Among others, they carry out the following activities:

1. Monitoring and control of the quality of water for human consumption.
2. Fighting insects of medical importance and monitoring the impact on public health through the Medical Intemmology Lab. Particular emphasis is placed on anti-malware work.
3. Inspection/control of public and private spaces with particular emphasis on hotels, recreation centers, etc.
4. Sanitary enlightenment on the subjects of the field.
5. Checking the health status of livestock farms to prevent and avoid unhealthy situations.
6. Control of public swimming pools and bathers' marine areas. Implementation of water quality monitoring programs for swimming pools.
7. Control of the manufacture and disposal of detergents on the basis of the new harmonized legislation.
8. Investigating citizens' complaints related to various health problems and taking corrective action, where necessary.
9. Control of smoking and tobacco products and implementation of legislation on smoking.

OCCUPATIONAL SAFETY, PUBLIC HEALTH POLICY AND MANAGEMENT

Damschroder et al. (2009) concluded that health services should have specific critical characteristics to be able to address the needs of the population effectively. These key features are, as follows (Damschroder et al., 2009):

1. Their availability to the population, in every demand for medical care and treatment.
2. The ability of citizens to access them to use them around the clock.
3. The provision of health services to the population is not limited to the stage of treatment of a disease but also covers the stages before and after its onset. Therefore, the continuity of their supply must be ensured.
4. The availability of health services and the continuity of their offer does not automatically mean solving the problems faced by the citizens who use them. The citizens must therefore accept them.

The introduction of management requires the introduction of a new concept in the management and design. Imposing management in public health services needs a support mechanism, setting up new structures, investing in technology and human resources, offering incentives, and using the right tools. The process by which the resources and activities of an organization are coordinated to achieve predetermined objectives is the organization's management (Pillay, 2010). This process (administration) includes planning/designing, organization, management, and control. Management's focus is on increasing productivity, human relations, mathematical models, and understanding of the organization's members (Griffith, 2009). Modern organizations operate in an ever-changing economic, technological, social, and legal environment. Today, the management of organizations is not exercised only by an interest-free person but by a group of individuals, who are characterized as leaders (Cook, 2000). These executives are assigned the management exercise and must have special skills, techniques, or overall vision. Understandably, it is not enough in the health care units to have the above skills only the president and the general manager, but also the other health professionals who exercise management (Haslam et al., 2016).

In the organizations providing health services, the administration's role is much more important since the correct and fast treatment of the citizens' health problems depends on its effectiveness (Pillay, 2010). Due to the complexity, the uniqueness of these organisms, and the peculiarity of good "health," the exercise of management requires a particular application, and the appropriate techniques must be selected in each case. There are many differences in how management is exercised between a health center and a hospital (Ginter et al., 2018).

Shilton et al. (2011) report that the structure of a health care unit consists of many levels, and the people who make it up (doctors, nurses, technologists, administrators, technicians, etc.) differ in education, social or economic, and personal status. The more the degree of specialization differs and the more employees there are, the more the power structure is broken down, resulting in more significant difficulties in the administration and management of the organization (Shilton et al., 2011). All public health services must have a new administration because times are changing, and technology is evolving because the needs and expectations of the world and patients multiply.

Today is the age of management and decision-making based on evidence-based knowledge. When referring to large organizations, such as hospitals, with increased complexity, conflicting interests, multi-billion budgets, this need for effective management in the system and the hospital is one way (Haslam et al., 2016). The effective management of the hospital is the result and the component of many factors. We usually have good results with appropriate management conditions and a favorable management environment (Griffith, 2009).

OHS SUPERVISION

Niskanen et al. (2014) studied the effects of occupational health and safety inspectors' supervision in chemical plants in Finland, concluding that there is a need for general OHS enforcement operations in order to facilitate better results of inspection. Also, inspector's professional competence is related with all aspects of the inspection outcome for the company. Niskanen et al. (2014) point out the inspectors' lack of:

1. close follow up with the implemented management systems,
2. advice not only to meet the minimum legal level but also to achieve higher levels of safety and health,
3. imposing binding obligations,
4. professional skills of health inspectors updated to match today's workplaces, and
5. uniform enforcement approach.

These aspects of health inspection are very important for safety and health effectiveness in workplaces (Niskanen et al., 2014). In a prior study implemented by Niskanen (2013) on Finnish inspectors, it was found that there is a need of guidance and instructions on the implementation of the enforcement law, considering the functions of present enforcement practices and resolving the contradictions in quality and quantity criteria of inspections. Regarding the effectiveness inspection, improvements, where proposed in the effectiveness of proposals made by public health inspectors relative to quality, quantity, skills and advice, the inspections of safety management systems based on performance, harmonization of inspectors and inspectorates' activities, and the effectiveness of follow up enforcement. In the same frame, Niskanen (2015) found a need of harmonization between quantitative goals (number of inspection) and effectiveness of inspection. The practices should be coordinated in both local agencies and individual inspectors while it is important to focus on skill building of health inspectors and safety management systems monitoring.

The need for better education of occupation health and safety inspectors is pointed out by Pryor (2019), who states that the lack of a defined content of OHS education is an

obstacle to further professional development. Boustras et al. (2015) studied the under-researched critical issue of health and safety management in micro-firms. This is a challenge because micro-firms have limited resources and awareness, while, on the other hand, micro-firms present most of the business activities, especially in small economies. The authors conducted a survey for the perceptions of employees and owners/managers and compared the data with information for compliance and safety performance from safety inspectors. The results showed a relation between safety policy, good practices, and safety performance. The implementation of written risk assessment, as well as the willingness of employees to use personal protection equipment have a positive impact on safety performance aspects. In the same frame, the findings of Hagqvist et al. (2020) showed that the Swedish OHS system does not provide for the specific circumstances of micro-enterprises (one-nine employees) and further refinement is needed to address the needs of new forms of enterprises.

Holroyd et al. (2020) point out that the quality of risk communication is of great importance regarding the compliance of the public to health recommendations. Especially in times public health emergencies, trust in public health authorities facilitates the maintenance of health security. Holroyd et al. (2020) studied the communication from public health authorities in the context of public health emergencies, in terms of trust as perceived from the public. By utilizing interview, several factors have been found that are important for public trust, such as communication source, transparency, clarity of information, awareness of the role of public health authorities to provide reliable health information and recommendations during an emergency. Hence, the development of a framework for public health authorities' communication is of great importance.

RISK AND RISK PERCEPTION

According to the Oxford English Dictionary (OED), risk appeared as a construct in 1621. The third edition of OED defines risk as "(exposure to) the possibility of loss, injury, or other adverse or unwelcome circumstance; a chance or situation involving such a possibility" (OED, 2005). ISO Guide 73:2009 includes several risk-management concepts from various fields. Risk is defined as the "effect of uncertainty on objectives" and clarifications are made in terms of the definition of "effect" as a deviation from the expected. Objectives may include various aspects at different levels (i.e., financial, health and safety, environmental etc.). In most cases, risk is defined in relation to specific events and depicts the consequences of the event as well as occurrence likelihood. In this frame, uncertainty is derived from the lack of information relative to the event, its consequences, and its likelihood.

In the literature, risk has been defined as a probability of loss (epidemiology), as a degree of potential loss (environmental protection), as a weighted loss (in insurance), or as a variance of loss (in the stock market). For Magnusson (1997), risk is the possibility of suffering harm or loss or danger, which entails risk acceptability "a multi-dimensional concept, comprising numerically calculated values as well as risk perception and risk communication issues". However, for people outside a business context, the term can indeed mean anything of the above and much more (Breakwell, 2009, p. 179-180).

Industrial psychology, respectively, studied how people assess risk in their workplace. Decision-making research also provides a set of models and empirical data for making decisions that involve the concept of risk. But the psychology of risk appeared in a wider, non-psychological context only when there was a clash between citizens and experts on the nuclear sector at the end of the 1970s: in particular, while engineers and physicists argued that nuclear plants are at a low risk, many people, outraged by the possibility of massive and long-term destruction for man and nature from the creation and use of nuclear plants, considered that nuclear plants are indeed one of the greatest dangers in modern societies. Since then, the controversy over the dangers (from mobile phones, nutrition, medical treatments, genetic engineering, global warming, and financial investment) has become a recurring issue in the social, political, and academic community (Breakwell, 2009, p. 377).

Risk perception, or in other words, the perceptual sensitivity of an individual, to an imminent or potential threat, may diverge from the "objective" risk, since people are affected by their environment and the environment affects their knowledge, behavior, and personal decisions. Risk perception is the subject of many theories of change in health behavior. This is because, risk perception, is a major parameter that is often very useful in designing interventions, to change a person's health behavior and attitudes. Many research and reviews suggest that interventions that are crucial and change perceptions, produce subsequent positive increases in health behaviors. Existing research emphasizes that an individual's perception of disease risk is a key determinant of his health behavior but the exact nature of the relationship, between risk perception and health behavior, depends mainly on personality characteristics and the profile of different types of risk perceptions (Becker, 1974). In decision-making on health issues (prevention, effective treatment, etc.), individuals consider elements that include risk weighting and benefits of the action.

Risk behaviors that contribute to the challenge and development of a disease are often pleasant for the individual. The motivation for adopting such behaviors is believed to be largely driven by the individual's beliefs about the likelihood of having a specific health outcome that has to do with personality traits (Rogers, 2015). In fact, there is a significant degree of correlation between a person's perceived health behaviors and the characteristics of an individual's personality (Brewer et al., 2007; Floyd et al., 2000).

SAFETY MANAGEMENT AND SAFETY INSPECTION

According to Ge et al. (2019), safety is not yet a clear science, despite the development of various types of accident models and their respective analyses in the past decades. In

Table 1. Standards for general safety management systems (Li and Guldenmund, 2018)

Organization	Industrial sector	Name/year	Aim for
ISO	General	ISO 45001/Under development	Occupational health & safety management systems
	General	General ISO 9000 serise/1987, 2008, 2015	Quality management systems
	General	General ISO 14001/1992, 1995, 1996, 2004, 2015	Environmental management systems
	General	General ISO 31000/2009	Risk management
EU (European Union)	Chemical industry	Seveso Directive (Directive 82/501/EEC)/1982 Seveso II (Directive 96/82/EC)/1996 Seveso III (Directive 2012/18/EU)/2012	Control of major-accident hazards involving dangerous substances
	General	(Directive 89/391/EEC)/1996	Guidance on risk assessment at work
BS (British Standard)	General	BS 5750/1979	Quality management systems
	General	General BS 7750/1994	Specification for environmental management systems
	General	General BS 8800/1996, 2004	Occupational health & safety management systems
	General	General BS OHSAS 18001/2007	Occupational safety & health management systems
OHSA (United States)	General	PART 1910 (Standards-29CFR)/since 2001	Occupational safety & health standards

terms of research, safety science is quite young and, thus, fundamental challenges arise. More specifically, the object and scope of safety science are under debate. Also, there is a lack of a uniform paradigm, or a theoretical model that would be necessary for a pure science. Ge et al. (2019) point out the professional identity crisis that accompanies the inability of the field to be perceived as a group of researchers/scientists.

The main purpose of safety management systems is risk control and accident prevention. For example, Autenrieth et al. (2016) argue that occupational health and safety management systems in the frame of a comprehensive risk management approach, may help reduce the rates of injury and illnesses in the US dairy industry. In this frame, accident prevention was first carried out by insurance companies and then the industry (Li and Guldenmund, 2018). Due to the overwhelming costs, accidents were an issue for insurance companies and researchers explored loss patterns.

The accident models of Heinrich (1931) were based on the domino theory and 300-29-1 ratio injury model, while also models of organizational management and risk management were proposed. Also, Bird and Loftus (1976) analyzed accident reports from insurance companies and developed a loss control management system. According to Khanzode et al. (2012), injury epidemiology theory puts uncontrolled energy as immediate predecessor of accidents, supporting the argument that accidents could therefore also be considered an epidemic phenomenon (Heinrich, 1931).

Yet, loss control and accidents association matured after the concept of risk emerged in the literature, mainly due to the mid-1950s development of self-insurance plans that protected against risks. Today, safety management focuses on managing risk. Therefore, safety management systems may be roughly described by risk management systems. More specifically, Greenwood and Spadt (2004) argued that "a risk management system consists of a policy, a risk data system, and a risk system for assessing and evaluating risks". With the term risk not only safety but also economic risks are represented, while these principles are similar to risk management systems of any kind (ISO, 2009).

Yet, a risk control system is more frequently utilized at site, while control is very important in order to have a specific safety level (You, 2003). The socio-technical concept of system safety developed due to projects of the British coal mining industry. In the twenty coming years, the concept increasingly was used in other industries (Trist, 1981). Socio-technical systems, relative to safety management were mentioned for the first time as a methodology for organizational design (Robinson, 1982).

In the 1970s and 1980s, demand of regulations in Europe, major disasters' reports, and international standards, made safety management systems more common (Hale, 2006). In order to publish specific laws and regulations, a number of organizations were established in the 1970s, such as the Occupational Safety and Health Administration (OSHA), the Health and Safety Executive (HSE), and the World Safety Organization (WSO). As the accidents and the safety awareness increased, so did the laws, rules, and regulations. International standards were developed, general or specific to industry, by organizations such as ISO (general), ILO (general), HSE (general), ICAO (civil aviation), IAEA (nuclear), IChemE (chemical), IOGP (oil and gas), SPE (petroleum), and NASA (aeronautics and space travel). These standards contributed to the foundation of international structural safety standards, which were developed during the 1980s (**Table 1**).

Li and Guldenmund (2018) attempt to break out the different safety management systems (SMSs) to create a general SMS model with global facets based on previous literature. The aim of an SMS is to implement safety management activities in order to protect and reduce risk. Hence, the content of an SMS is based on these principles. Safety standard development and related theories about management and systems, boosted the development of SMS to its current multidisciplinary form, currently at need of a generic framework to enhance its effectiveness.

According to Li and Guldenmund (2018), SMS models' definition is always concerned with "safety, management and systems". They can be divided in two groups:

1. models that relate to accidents and
2. models that are based on organizational aspects.

These two model types are linked because organization controls and actions are used by management to mitigate accident causes. Issues related to safety management systems are presented in **Figure 1**.

The core two objectives of SMSs are control and compliance. The SMS implements systems in order to control risks. These systems should be subjected to continuous improvement while at the same time complying fully to the standards and regulations of safety.

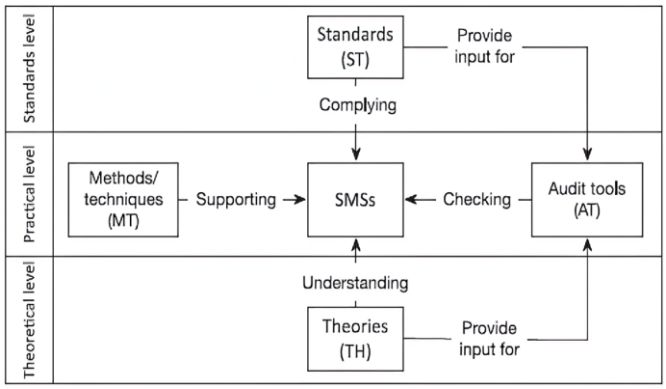

Figure 1. Issues related to safety management systems (Li and Guldenmund, 2018)

By reviewing the literature of SMSs, Li and Guldenmund (2018) propose a generic SMS model, utilizing Hale's (2006) SMS model which consists of two main elements, the risk control system, and the learning system. The risk control system includes in all life cycle phases the following elements:

1. business processes,
2. risk inventory and analysis,
3. risk barriers and controls, and
4. a management system to provide good functioning of the above.

The learning system includes

1. inspection and monitoring,
2. auditing and management review, and
3. incident and accident registration and analysis.

The relationships between scenarios, barriers and safety management are presented in **Figure 2**.

As mentioned in Hale's (2006) SMS model, the generic model of safety management systems proposed by Li and Guldenmund (2018), safety inspection is a common element of SMS. The purpose of safety inspection is to control hazards through early detection and correction, both in external and internal systems (Woodcock, 2014). Nevertheless, research on safety inspection process is limited as pointed out by Woodcock (2014).

After studying the domain of amusement ride inspection and validating her results on three other domains, Woodcock (2014) concluded that safety inspection is highly complex task that makes consecutive use of checklists, risk-informed decisions, and lack of performance feedback. The author was able to form a generalist model of safety inspection tasks, recognizing that the actual sequence of practices would vary by inspectors' experience, familiarity with the subject of inspection, preferences, and knowledge. Also one must notice that burnout of rural environments was higher compared to urban and semi urban in Public Health Workforce Inspection Services (Adamopoulos et al., 2022).

The first stage of the safety inspection model is the preparation phase, where the inspector plans the elements of the inspection. Less experienced inspectors review notes and workbooks, checklists, and other documentation relative to the task at hand, while prior familiarity facilitated the immediate construction of a mental model of inspection.

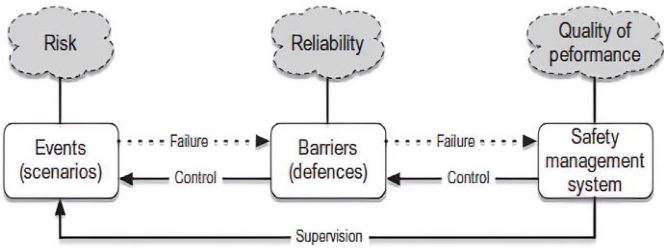

Figure 2. Associations between scenarios, barriers, and safety management (Li and Guldenmund, 2018)

Secondly, during the inspection a holistic overview is implemented in order to identify potential concerns. Another study argues that occupational stress and burnout combined with insufficient resources and health services during the pandemic may put Health Workers at greater risks of mental health disorders (Adamopoulos and Syrou, 2022).

The holistic overview enables the inspector to form a general opinion about the facility. During this stage, inspectors observe and note areas of concern, in a process that may be inside-out or outside-in, mainly focusing on consistency. In the case of one or more concerns, further process is dependent upon the inspector's uncertainty level of the possible defects behind the concerns, a factor that is also related to inspector's experience. In the face of uncertainty, the inspector may search for permissive sources (e.g., manufacturer's manual) and then check if the observed concern is explicitly permitted. If there is no uncertainty about an observed concern, or when the permissive sources do not explicitly permit it, then the inspector evaluates the risk of the defect and if the discrepancy is tolerable, the condition is accepted with close monitoring.

Also, when the permissive sources do explicitly permit the condition and there is no justifiable reason of rejection, the condition is accepted with close monitoring. In the case of a justifiable rejection reason, the inspector negotiates the rejection. If the holistic overview does not reveal any concerns, the checklist is consulted. Note that the checklist is consulted after and note prior to holistic overview. In the case of no additional points and no violations, the inspection is completed, and the condition is accepted.

Checklists include reference points, and it is possible for the inspector to observe additional points that require inspection. In this case the specific inspection points are compared to standards and if there is an explicit violation, the condition is rejected, else the condition is accepted (Woodcock, 2014). Given the breadth of their duties, it comes as little surprise that face many health and safety issues while at work (Adamopoulos, 2022; Adamopoulos and Syrou, 2022: Adamopoulos et al., 2022). Health and safety, as well as employee well-being at has been found to relate to several qualitative values that influence the workplace (Adamopoulos et al., 2022).

CONCLUSION

The purpose of this study was to investigate scientific field in occupational safety, public health policy and management

in public health organizations and services in Greece. Identified the frequency, severity, and average impact of several occupational safety hazards interactive with policy and management in public health organizations and services in Greece.

According to research and the literature review, the level, especially was found to be most important were affected by demographics and more specifically the workplace environment. This study contributes to the literature, were provided relative to that are encountered by Greek Public Health Workforce, updating the evidence from a limited global literature.

In fact, there is no connection in the literature and scientific publications of occupational health and safety with public health and hygiene, this connection is essential because they are interrelated as occupational health and safety is part of public health. A benefit from this research literature review was that it may benefit the public administration in making decisions in the management of health services, health policies and future training programs.

May be a very useful tool for the managers of public health organizations in create product guidelines policy, administrative management, and health and occupational safety and future training programs of public health professionals.

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Ethics statement: The authors state that the study was carried out in accordance with the rules and current Bioethics legislation, all the conditions and specifications of the National and European Union Legislation for the protection of personal data as well as in accordance with the instructions of the Quality Assurance and the study was carried out according to the Declaration of Helsinki.

Availability of data and materials: All data generated or analyzed during this study are available for sharing when appropriate request is directed to corresponding author.

REFERENCES

Adamopoulos I., Lamnisos D., Syrou N. and Boustras G. (2022). Inspection of job risks, burn out syndrome and job satisfaction of Greek Public Health Inspectors. *Safety and Health at Work*, 13(Supplement), S294. https://doi.org/10.1016/j.shaw.2021.12.1670

Adamopoulos, I. P. (2022). Job satisfaction in public health care sector, measures scales and theoretical background. *European Journal of Environment and Public Health*, 6(2), em0116. https://doi.org/10.21601/ejeph/12187

Adamopoulos, I. P. and Syrou, N. F. (2022). Associations and correlations of job stress, job satisfaction and burn out in public health sector. *European Journal of Environment and Public Health*, 6(2), em0113. https://doi.org/10.21601/ejeph/12166

Adamopoulos, I. P. and Syrou, N. F. (2022). Workplace safety and occupational health job risks hazards in public health sector in Greece. *European Journal of Environment and Public Health*, 6(2), em0118. https://doi.org/10.21601/ejeph/12229

Adamopoulos, I., Lamnisos, D., Syrou, N. and Boustras, G. (2022). Public health and work safety pilot study: Inspection of job risks, burn out syndrome and job satisfaction of public health inspectors in Greece. *Safety Science*, 147, 105592. https://doi.org/10.1016/j.ssci.2021.105592

Adamopoulos, I., Syrou, N. and Lamnisos, D. (2022). Workplace environment and burn out in public health workforce inspection services: Research study. *International Research Journal of Pharmacy and Medical Sciences*, 5(5), 28-35. https://doi.org/10.13140/RG.2.2.18619.28966

Autenrieth, D., Brazile, W., Sandfort, D., Douphrate, D., Román-Muñiz, I. and Reynolds, S. (2016). The associations between occupational health and safety management system programming level and prior injury and illness rates in the U.S. dairy industry. *Safety Science*, 84, 108-116. https://doi.org/10.1016/j.ssci.2015.12.008

Bird, F. E. and Loftus, R. G. (1976). *Loss control management*. Duluth, GA: International Loss Control Institute.

Boustras, G., Hadjimanolis, A., Economides, A., Yiannaki, A. and Nicolaides, L. (2015). Management of health and safety in micro-firms in Cyprus–Results from a nationwide survey. *Safety Science*, 79, 305-313. https://doi.org/10.1016/j.ssci.2015.06.014

Breakwell, G. M. (2007). *The psychology of risk*. Cambridge: Cambridge University Press.

Cook, R. J. (2000). Advances in plant health management in the twentieth century. *Annual Review of Phytopathology*, 38(1), 95-116. https://doi.org/10.1146/annurev.phyto.38.1.95

Damschroder, L. J., Aron, D. C., Keith, R. E., Kirsh, S. R., Alexander, J. A. and Lowery, J. C. (2009). Fostering implementation of health services research findings into practice: A consolidated framework for advancing implementation science. *Implementation Science*, 4(1), 1-15. https://doi.org/10.1186/1748-5908-4-50

Floyd, D. L., Prentice-Dunn, S. and Rogers, R. W. (2000). A meta-analysis of research on protection motivation theory. *Journal of Applied Social Psychology*, 30(2), 407-429. https://doi.org/10.1111/j.1559-1816.2000.tb02323.x

Ginter, P. M., Duncan, W. J. and Swayne, L. E. (2018). *The strategic management of health care organizations*. Hoboken, NJ: John Wiley & Sons.

Greenwood, Y. and Spadt, F. W. (2018). Safety management systems: A broad overview of the literature. *Safety Science*, 103, 94-123. https://doi.org/10.1016/j.ssci.2017.11.016

Griffith, J. R. (2009). Advancing education for evidence-based healthcare management. *The Journal of Health Administration Education*, 26(2), 83-112.

Hagqvist, E., Vinberg, S., Toivanen, S., Hagström, M., Granqvist, S. and Landstad, B. (2020). Falling outside the system: Occupational safety and health inspectors' experiences of micro-enterprises in Sweden. *Safety Science*, 125, 104631. https://doi.org/10.1016/j.ssci.2020.104631

Hale, A. R. (2006). Safety management, what do we know, what do we believe we know, and what do we overlook? *Tijdschrift voor toegepaste Arbowetenschap* [*Journal of Applied Health & Safety Science*], 18(3), 58-66.

Haslam, C., O'Hara, J., Kazi, A., Twumasi, R. and Haslam, R. (2016). Proactive occupational safety and health management: Promoting good health and good business. *Safety Science*, 81, 99-108. https://doi.org/10.1016/j.ssci.2015.06.010

Heinrich, H. W. (1931). *Industrial accident prevention: A scientific approach*. New York, NY: McGraw-Hill.

Hilliard, T. and Boulton, M. (2012). Public health workforce research in review. *American Journal of Preventive Medicine*, 42(5), S17-S28. https://doi.org/10.1016/j.amepre.2012.01.031

Holroyd, T., Oloko, O., Salmon, D., Omer, S. and Limaye, R. (2020). Communicating recommendations in public health emergencies: The role of public health authorities. *Health Security*, 18(1), 21-28.https://doi.org/10.1089/hs.2019.0073

Khanzode, V. V., Maiti, J. and Ray, P. K. (2012). Occupational injury and accident research: A comprehensive review. *Safety Science*, 50(5), 1355-1367. https://doi.org/10.1016/j.ssci.2011.12.015

Li, Y. and Guldenmund, F. (2018). Safety management systems: A broad overview of the literature. *Safety Science*, 103, 94-123. https://doi.org/10.1016/j.ssci.2017.11.016

Magnusson, S. E. (1997). Risk assessment. *Fire Safety Science*, 5, 41-58. https://doi.org/10.3801/IAFSS.FSS.5-41

Niskanen, T. (2013). The effects of the enforcement legislation in the Finnish occupational safety and health inspectorate. *Safety Science*, 55, 135-148. https://doi.org/10.1016/j.ssci.2013.01.002

Niskanen, T. (2015). Investigation into qualitative discourses of the occupational safety and health inspectors in order to promote enforcement. *International Journal of Occupational Safety and Ergonomics*, 21(4), 426-439, https://doi.org/10.1080/10803548.2015.1096062

Niskanen, T., Louhelainen, K. and Hirvonen, M. (2014). An evaluation of the effects of the occupational safety and health inspectors' supervision in workplaces. *Accident Analysis & Prevention*, 68, 139-155. https://doi.org/10.1016/j.aap.2013.11.013

OECD. (2017). *State of health in the EU–Greece*. Available at: https://ec.europa.eu/health/sites/health/files/state/docs/chp_gr_greece.pdf (Accessed: 2 June 2022).

Pillay, R. (2010). The skills gap in hospital management: A comparative analysis of hospital managers in the public and private sectors in South Africa. *Health Services Management Research*, 23(1), 30-36. https://doi.org/10.1258/hsmr.2009.009015

Pryor, P. (2019). Developing the core body of knowledge for the generalist OHS professional. *Safety Science*, 115, 19-27. https://doi.org/10.1016/j.ssci.2019.01.013

Rai, S. K. (2021). The state of panic and pandemics in history. *Academia Letters*, 1805. https://doi.org/10.20935/AL1805

Robinson, G. H. (1982). Accidents and sociotechnical systems: principles for design. *Accident Analysis & Prevention*, 14(2), 121-130. https://doi.org/10.1016/0001-4575(82)90078-1

Shilton, T., Sparks, M., McQueen, D., Lamarre, M. C. and Jackson, S. (2011). Proposal for new definition of health. *BMJ*, 343, d5359. https://doi.org/10.1136/bmj.d5359

Trist, E. L. (1981). *The evolution of socio-technical systems*. Toronto: Ontario Quality of Working Life Centre.

WHO. (2020). *Health impacts of chemicals*. Available at: https://www.who.int/ipcs/assessment/en/ (Accessed: 2 June 2022).

Winslow, C.-E. A. (1920). The untilled field of public health. *Science*, 51(1356), 23-33. https://doi.org/10.1126/science.51.1306.23

Woodcock, K. (2014). Model of safety inspection. *Safety Science*, 62, 145-156. https://doi.org/10.1016/j.ssci.2013.08.021

You, C. (2003). United States Patent No. US20060136327 A1. *United States Patent and Trademark Office, Washington, DC*.