Perception of biohazards: a focus on schools in Western Attica, Greece

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Abstract

Biological disasters endanger the lives of teachers and students, causing serious disturbances to schools, and forcing them to shut down for a short or long period of time. Over the last few decades, the Greater Athens area and Attica Prefecture in Greece have experienced several natural disasters. These events have highlighted problems and weaknesses in emergency planning for school communities at both local and regional level, and have shown the need for new precautionary measures and effective risk management for modern society and school communities. The present study reports an investigation of the perception of the risk posed by biological hazards to teacher safety. The investigation utilized a questionnaire survey of teachers working in the secondary education directorate in Western Attica, which was carried out between May and December 2019. The teachers' perceptions of the extent to which their safety was affected by biohazards (i.e., infectious diseases and weather-related diseases) were investigated using a 5-point scale ranging from affected a lot (− 2) to not affected at all (+ 2). A multivariate statistical technique—principal component analysis—was used to explore the results of the survey. The results showed that the teachers' feelings of safety were affected a lot (− 2) or affected enough (− 1) by biohazards. 61.5% ($n = 72$) of the participants reported that their feelings of safety were affected a lot or enough by infectious diseases, and 55.6% ($n = 65$) of the participants noted that their feelings of safety were affected a lot or enough by weather-related diseases. Compared to other natural, technological, or social hazards, biological hazards seem to have a greater impact on teachers' feelings of safety. These results could have implications for the design of risk management plans for school communities.

Keywords Teachers' perceptions · Biohazards · West Attica—Greece

Introduction

The outbreak of the Coronavirus Disease 2019 (COVID-19) pandemic and the consequent lockdowns that have occurred

in many countries all over the world have greatly influenced everyday life. However, there has been considerable criticism and concern regarding the enforcement of lockdowns to limit the spread of the pandemic (Ioannidis 2020). Ioannidis (2020) focused on the negative consequences of lockdowns on social life, including education and school life. According to a technical report from the World Bank (2020), the COVID-19 pandemic threatens educational progress worldwide, mainly due to school closures and the economic recession caused by measures enacted to control the pandemic. The impact of closing schools is greater in countries and populations facing a learning crisis leading to lost learning and increased dropout rates. These negative effects may have a long-term impact on education.

Education can also be affected or interrupted by several nonbiological factors. The Centre for Research on the Epidemiology of Disasters (CRED; EM-DAT 2020) classifies disasters into two groups: natural, technological. Natural disasters include meteorological, geophysical, hydrological, climatological, and extraterrestrial hazards as well as biological hazards (biohazards). Technological disasters include industrial, transport, and miscellaneous accidents.

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Also social hazards may exist. They include illegal and criminal activities.

Natural and technological disasters have increased in frequency and severity over the last few decades. Their effects are drastic and are occurring at progressively larger scales and are having increasing effects on all sectors of human life (EM-DAT 2020). According to the CRED database (EM-DAT 2020), the frequency of natural and technological disasters in Greece has gradually increased, affecting population segments and causing deaths and economic losses.

Over the last two decades, the Greater Athens area, Attica Prefecture, and (especially) Western Attica Prefecture in Greece have experienced a series of natural disasters aside from the COVID-19 pandemic, namely:

- Two strong earthquakes on 7 September 1999 and 19 July 2019 with epicenters in Thriasio Plain, central Western Attica (Papanikolaou et al. 1999; Kouskouna et al. 2019; EM-DAT 2020).
- A catastrophic flash flood of Mandra on Thriasio Plain on 15 November 2017, resulting in 25 fatalities according to the EM-DAT database (Diakakis et al. 2018; EM-DAT 2020).
- A flash flood in the municipality of Mandra and the community of Magoula in June 2018 (EM-DAT 2020).
- A devastating wildfire in Kineta (23 July 2018). On the same day, a lethal wildfire with more than 100 fatalities also occurred in Mati, an area of Eastern Attica (Vlamaki et al. 2018; Alexakis 2020; EM-DAT 2020).
- A medicane (Mediterranean tropical-like cyclone) called *Zorbas* on 29 September 2018 (Dafis et al. 2020).
- An outbreak of West Nile virus leading to 44 casualties in Western Attica Prefecture during summer 2018 (Papavasileiou and Mavrakis 2018).
- A flood in Kineta in 2019 (Lekkas et al. 2019).

These natural disasters revealed problems and weaknesses in various sectors of public management, including emergency planning for school communities at both the local and regional level (Lekkas et al. 2014).

Disasters strongly affect risk perception. Teachers, who play a key role in the education of children and teenagers and in shaping the personalities of students, are no exception: disasters can trigger feelings of fear, vulnerability, and a lack of safety in teachers. Such feelings affect human behavior and their compliance with preventive measures. The purpose of this study was to investigate the perceptions of teachers working in secondary education regarding the risk presented by biological hazards (biohazards) to their safety, and to compare these perceptions with the teachers' perceptions of the risks to their safety posed by other natural hazards. The study focused on Western Attica, Greece, an environmentally and socially stressed area of the Eastern Mediterranean.

The West Attica Secondary Education Directorate (WASED) includes 49 high schools, with about 1000 teachers and 10,000 students annually. These schools comprise 24 junior high schools ("gymnasias"—one special education gymnasium and two gymnasias with lyceum classes), 14 general senior high schools ("lyceums"), a special vocational education training center, five vocational lyceums, and three laboratory centers. Some of these schools are within walking distance of at least one of the 26 SEVESO-type industries located in the prefecture; about one-fourth of those are registered in Greece according to EU Directives (Mavrakis et al. 2018).

Methodology

Background

A questionnaire survey was carried out between May and December 2019. The survey was completed a few days before the outbreak of the COVID-19 pandemic (5 January 2020; WHO 2020). Teachers working in the West Attica Secondary Education Directorate (WASED) were recruited via an email invitation. Overall, 200 teachers were invited to participate in the survey. The questionnaire (Bird 2009; Papagiannaki et al. 2019) was distributed via Google Docs. Official data on the schools were extracted from the Ministry of Education website (<https://maps.sch.gr/main.html>).

Questionnaire

The questionnaire used in the survey requested socioeconomic information on each participant (gender, age, education degree, job position, and workplace), their educator specification, and their opinion on the quality of life in the study area (items 1–9). Moreover, the questionnaire probed each participant regarding their general knowledge of civil protection plans, possible seminars, and warnings regarding hazard risks that had been issued to teachers, as well as the possible implementation of protection plans in the school (items 10–24). Finally, questionnaire items 26–29 aimed to evaluate the perceptions of teachers about vulnerable age groups and the information/communications they had received from the civil protection general secretariat. In this study, special attention was paid to questionnaire item 25 regarding the perception of natural, technological, and social hazards. Item 25 included 27 hazard subtypes defined in the EM-DAT database (EM-DAT 2020) and three items on social hazards (i.e., illegal activities and criminal acts inside and outside schools). Item 25 was formulated as follows: *Do the following natural/technological/social disasters affect your feeling of safety?* Participants could select from the following responses: affected a lot (score = 2);

affected enough (− 1); quite affected (0); little affected (1); not affected at all (2). In particular, item 25 asked teachers to report their perceptions of the safety risks posed by the following hazards (grouped according to EM-DAT): (a) meteorological (i.e., storms, severe storms, lightning, hail, snow, blizzards, long-lasting cold periods, extreme heatwaves, long-lasting hot periods, extreme weather phenomena); (b) geophysical (i.e., earthquakes, tsunamis, geological phenomena, landslides, volcanic activity); (c) climatological (large volumes of water, floods, draughts, wildfires); (d) biological (i.e., infectious diseases, weather-related diseases); (e) extraterrestrial; (f) technological (i.e., industrial accidents, technological accidents, miscellaneous accidents, infrastructural failure, natural gas network failure); and (g) social (i.e., illegal activities, criminal activities inside schools, criminal activities outside schools). The overall time required to complete the questionnaire was reported to be less than 15 min.

Statistical analysis

The present analysis focused on the two biological hazards considered in the survey: infectious and weather-related diseases. We compared the risk perceptions of teachers regarding biological disasters to their risk perceptions for other natural hazards as well as technological and social hazards. Principal component analysis (PCA) was used to summarize the data and facilitate the comparison. PCA is a multivariate statistical technique that is used to identify latent relationships. At the first step, a matrix of correlation coefficients including all variables of a dataset is developed. At the next step, the dimension of this matrix is reduced in order to keep the maximum amount of information, measured through the total variance of the dataset, from the initial dimension. The main results of the analysis were the component loadings (indicating the correlation of each input variable with each of the new components extracted) and the component scores (indicating the correlation of each input case with each of the new components extracted).

Results

In total, 117 teachers participated in the survey, representing > 11% of all high school teachers in the West Attica Secondary Education Directorate. A short description of the general characteristics of the participants is presented below.

There were slightly more female than male participants (male $n=49$, 42%; female $n=68$, 58%). 53% ($n=62$) of the respondents were aged between 45 and 54 years (30–34 years: $n=0$, 0%; 35–39: $n=11$, 9%; 40–44: $n=17$, 15%; 45–49: $n=26$, 22%; 50–54: $n=36$, 31%; 55–59: $n=18$, 15%; 60+: $n=9$, 8%). Many of the respondents were highly educated, holding a PhD ($n=8$, 7%), MSc ($n=17$, 16%), or

BSc ($n=82$, 70%) degree. Moreover, about 6% ($n=7$) held a technological educational institute degree, and 1% ($n=1$) held a two-year pedagogical academy degree. About 60% ($n=70$) of the participants served in senior high schools (lyceums) and 40% ($n=47$) in junior high schools (gymnasias). 11% ($n=13$) of the participants were school principals, 2% ($n=2$) were subprincipals, and 87% ($n=102$) were educators (i.e., classroom teachers).

Most of the participants reported that their feelings of safety were affected by biological hazards, while the perceived risk for infectious diseases was higher than for weather-related diseases or biological hazards (Fig. 1a). Responses of “affected a lot” or “affected enough” were reported by 61.5% ($n=72$) of the participants for infectious diseases and 55.6% ($n=65$) of the participants for weather-related diseases (Fig. 1a). Principal component analysis showed that the first two components explained about 95% of the total variance in participant responses (PC1: 70.4%, PC2: 24.6%, PC3: 4.3%, PC4: 0.8%, PC5: 0.01%). Figure 1b shows that participants’ feelings of safety were not affected by extraterrestrial or geophysical hazards such as volcanic activity, tsunamis, or wildfires. They were moderately affected by meteorological hazards such as severe storms, floods, or technological hazards. They were mostly affected by weather-related diseases and infectious diseases, as well as by social hazards (criminal activities inside or outside schools were perceived to be the greatest threat to participant safety by far).

Discussion

This study examined the risk perception of teachers with respect to biological hazards, and whether biological hazards affect how safe teachers feel. The study was conducted in an environmentally and socially stressed Mediterranean area. Most participants were women aged between 45 and 54 years. The participants reported that their perception of risk was affected by biological hazards, and the perceived risk from these hazards was greater than the perceived risks posed by natural, technological, or social hazards. These results are in agreement with results from previous studies in other regions (Wong et al. 2010; Mirzaei et al. 2019).

The natural disasters—mainly meteorological and geophysical—that occurred in Western Attica in the previous two decades did not seem to affect the teachers’ feelings of safety. The effect of geophysical hazards on the participants’ feelings of safety was lower than the effect of biological hazards. This can probably be attributed to an increased level of readiness and preparedness for earthquakes due to a long-lasting awareness campaign of these events that was supervised by the Greek Earthquake Planning and Protection Organization (EPPO). This campaign includes an

Fig. 1 **a** Responses (%) regarding participant perception of the risks posed by infectious diseases, weather-related diseases, and both combined (biological hazards). **b** PCA biplot for safety perceptions of the educational staff in the Western Attica Secondary Education Directorate

annual school emergency plan, at least three emergency drills and training sessions per year, the continual provision of information on earthquakes, and it encourages a culture of disaster prevention and resilience (Kourou et al. 2014). The relatively strong negative effect of technological hazards (i.e., industrial accidents) on participants' feelings of safety stems from the fact that the area hosts 26 SEVESO-type

industries, some of which are within walking distance of schools (Mavrakis et al. 2018).

A secondary finding of this study is the effect of social hazards on the participants' feelings of safety. Criminal incidents in the schools in West Attica are yet to be reported, but there is a general growing fear of such incidents due to the social conditions in Western Attica (Karakiozis et al. 2015; Clapp and Norfolk 2017). Western Attica Prefecture

has complex and severe social, economic, and environmental issues due to the presence of a myriad of social groups of diverse origins and backgrounds (Clapp and Norfolk 2017). The behaviors of these social groups are mirrored in the local school community. All of these complex issues have an indirect impact on the environment, leading to natural resource degradation and causing a loss of social cohesion and uncertain economic growth. The coexistence of different activities (housing, agriculture, industry, commercial, port facilities, road and train networks in the preexisting urban poles) within the same environment has been documented; this coexistence of various activities increases the complexity of daily life (Mavrakakis et al. 2020). The aforementioned problems and their consequences are transferred to school communities (teachers and students), causing additional difficulties in the educational system (Karakiozis et al. 2015; Mavrakakis et al. 2018; Papakitsos and Mavrakakis 2018).

The findings of this study could have implications for the future training of secondary school teachers. The aim of this training should be to increase the levels of awareness of and preparedness for biohazards, similar to how the earthquake mitigation policy was implemented in Greece. A new campaign could provide teachers with the background needed to respond to biohazards effectively. Teachers in public schools should have a comprehensive knowledge of infections and weather-related diseases, and they should be given access to the resources they need to better understand biohazards and control measures.

Limitations of this study include the relatively low number of participants and the limitations imposed by participant anonymity and the utilization of a self-completion questionnaire. Not all of the recipients of the structured questionnaire responded. This may have been due to a lack of interest in understanding of hazard risks and civil protection issues by secondary education teachers in the area studied. Nevertheless, this survey provided the opportunity to assess perceptions of public educators regarding the risks posed by biohazards, and the results could be compared with those obtained in future surveys.

Conclusion

In this study, the perceptions of teachers in a vulnerable prefecture of Greece regarding the risks posed by biohazards were examined just a short time before the start of the COVID-19 pandemic. Results from this study indicate that biohazards can affect how safe teachers feel. However, not all types of hazards significantly affected the participants' feelings of safety, even when their workplace had been affected by a disaster in previous years. Education, new policies, and the implementation of preparedness measures to mitigate the

consequences of biohazards (e.g., school feeding and school health initiatives) could help the teachers to feel safer. By learning from innovations and emergency processes, secondary education teachers could adapt and become more effective and resilient. The results of this study should prove particularly useful when designing future risk management plans for school communities.

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Compliance with ethical standards

Conflict of interest The authors declare no conflict of interest.

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