BRIEF REPORT

Disaster Early Warning Systems: The Potential Role and Limitations of Emerging Text and Data Messaging Mitigation Capabilities

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ABSTRACT

Objective: The increased risk of mass accidents or major catastrophes taking place necessitates the organization of remedial measures to help protect against these unusual events and adequate preparation in order to minimize their effects. One such initiative is the early notification of residents within a specific area about the risk of a particular calamity. Nowadays, the prevalence of mobile devices enables the installation of various mobile applications allowing for the communication and receiving of information about potential dangers. In many countries there are variously developed systems of notification in place based specifically on text messages.

Methods: Currently, new laws introduced in Poland establish that it is the obligation of operators of mobile networks to send text messages to all customers of these networks who are within the area where there is a serious risk of a catastrophe. Such messages are in the form of a short alert, to be sent only in extraordinary situations when there is an immediate threat to health or life. The alert is intended to help in the avoidance of danger or to mitigate its impact.

Results: This article presents the potential implementation of the early warning system based on text message alerts in Poland, and in particular focuses on decreasing the risks associated with natural disasters.

Conclusions: While early text messaging is essential to disaster communications and mitigation, the article further states that means must be found to ensure equal access to the most vulnerable populations and all those, vulnerable and not, who do not have immediate access to text messaging systems. (*Disaster Med Public Health Preparedness*. 2019;13:709–712)

Key Words: disaster management, remote early warning systems, vulnerable populations, disaster prevention & preparedness, electronic messaging, security systems

INTRODUCTION

Every year there are numerous mass accidents of different types and intensity that occur within Poland, with those caused by natural phenomena being the most common. Increased risk of a mass accident or catastrophe taking place necessitates the organization of remedial measures intended to protect against these types of unusual events and to facilitate the preparation required to mitigate their impact.

The ability to protect a particular country against the ramifications of a catastrophe differs greatly depending on the level of the country's development. Developed countries are characterized as possessing a high level of organization, whereas developing countries have insufficient organizational and technological resources. Among developed countries, there are many that possess sufficient means, technical capacity, and planning capabilities to deal with a catastrophe that may occur at any given moment.[1] In developing countries, a natural disaster or other extraordinary event may destroy essential infrastructure and supplies and induce chaos and panic, as well as jeopardize that country's future plans for development.[2] The effects of such events often cannot be contained by local measures and forces, and often outside help is necessary.

It has been emphasized that disasters have the uncanny ability to immediately expose deficiencies in a government's protections and protective infrastructure, especially those related to public health. Various undertakings that are prepared and implemented beforehand are vital for the better organization of rescue operations, for example, and the reduction of a disaster's aftermath. Without these measures, both direct and indirect mortality and morbidity will increase. Areas without public health protections such as early and sustained notification capabilities will experience increased indirect mortality and morbidity. One public health protection initiative is the early notification of residents who are

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residing within the given area where danger connected with a mass accident exists.[3,4] The wide accessibility of portable technology facilitates the installation of various mobile applications, which in turn allows for the communication and receiving of information about potential dangers.

The aim of this paper is to present the implementation of an early warning system based on text message alerts in Poland. The article describes the structure and rules behind the system's functioning and characterizes benefits of the current usage of the system, in particular the decreased risk connected to mass accidents and natural disasters. Possible approaches to improve communications in the future, especially to the most vulnerable populations such as the poor, elderly, women, children, people with disabilities, and those without immediate electronic communications capacity or capability, are also discussed.[5]

GOVERNMENT CENTRE FOR SECURITY ALERT

A Government Centre for Security (GCS) Alert, a text notification from the GCS, is one element of the early warning system. This notification informs the residents of a specific area within a given country about events causing immediate threat to health or life.[6] The information will mainly concern potential natural incidents linked to strong winds, intense rainfall, and violent storms. A GCS Alert will be activated only in the most serious of situations, as not all meteorological phenomena carry the risk of immediate threat.

Information concerning the level of danger is drawn from the prognosis prepared by the Institute of Meteorology and Water Management.[7] The GCS will send a notification to mobile network operators as soon as it receives information about approaching meteorological danger (and other phenomena which may pose a threat to health or life). Operators will then send this notification to all their customers who are within the reach of their base stations, and thus people will be notified via text message about possible danger.

The creation of such a system for transmitting important information was made possible by new telecommunication laws which make it compulsory for all telecommunication providers to send a message to all mobile telephone users immediately and free of charge when the GCS director deems it necessary.[8] This system will be fully realized beginning on December 12, 2018 (the date when the new telecommunication laws come into force).

Currently, a pilot program for the early warning system is being conducted. The pilot program is being conducted country-wide by all mobile service providers in Poland. Implementation of the pilot program during the holiday season is intended to ensure the safety of all people vacationing in different areas of the country. All people, especially those vacationing far from their place of residence, will receive a notification about potential dangers (for example violent meteorological phenomena such as storms). Thanks to this, the information about potential danger will reach those within the areas that are expected to be affected. The GCS Alert pilot program is being used primarily to test the system. The findings of this test will then able to be used for its future optimization.

A GCS Alert does not need to be subscribed to. People in the area of potential danger will receive a short text message containing information about the type of danger, consisting of its location and the source of the warning. The message will be received regardless of the telecommunication operator one is a customer of, and there is no need for special telephone settings. No program or application needs to be installed in order to receive the notification.

GCS Alerts are created based on information about potential dangers received from ministries and services such as police, fire departments, and agencies, as well as central institutions like the Institute of Meteorology and Water Management and voivodship (areas administered by a governor) offices.[6] The GCS, which takes the role of crisis management center, monitors the situation nonstop for various dangerous occurrences, and does so 24 hours a day, 7 days a week.

During the pilot program, the smallest area that may receive the GCS Alert is a voivodship. Mobile network operators are working intensely towards the technical development required to enable the sending of notifications to those within a smaller area than this, with the ultimate goal being to send messages to those within a specific county. Mobile network operators will send text messages with a GCS Alert to areas designated by the GCS director. The decisive factor in receiving these messages is being within reach of the base station which is located in the area impacted by the potential danger.

IMPROVING DISASTER RISK REDUCTION AND RESPONSE

In many developing countries there is a lack of available warning systems containing basic information about risks.[9-12] This makes it harder to prepare a community for the occurrence of a mass accident and hinders individuals' ability to make conscious decisions concerning how to behave and what should be done.

Usage of wireless mobile technology is prevalent in Poland. According to data shared by the Central Statistical Office at the end of December 2017, the number of active SIM cards was 52.9 million among the country's 38 434 000 residents.[13]

Over the past several years in Poland, information concerning dangers has only reached a marginal number of people in areas at risk, despite the potential that there exists the

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possibility of predicting many dangerous events. The problem is, the vast number of people simply ignore widely accessible information.[13-15]

A GCS Alert is sent for safety, only in extraordinary situations, when there is an immediate threat to health or life. A message with a warning is intended to help people avoid the dangers or minimize their effects, and all customers of a mobile network will receive it without exception. Notifications sent directly to a private number in this manner have been shown to increase the sense of awareness and responsibility in those receiving such information this way.[16-18]

The current early warning system is still in the implementation stage and will continue to be enhanced up to the moment of first activation. Analysis of this implementation of the early warning system pilot program in Poland has already demonstrated that the first stage of sending notifications about violent storms has resulted in changes in the behaviors of those citizens involved, such as moving their cars to safer places.[6,19,20] What is more, the damages experienced by those who received the text messages concerning the dangerous events were noticeably smaller than the damages experienced by those in situations in which there was no text message warning system.[19] People who receive current information about a potential danger become more self-sufficient, and this allows emergency services personnel to focus on those who need help the most.

LIMITATIONS

With any new proposals, especially those that immediately involve the entire population, there will be concerns raised as to its limitations. This is understood, and what is proposed here is only an immediate first step leading to broader mitigation potential of the system. As stated, the system must show how it further incorporates and mitigates the risks for the entire population, including those who are most vulnerable. Those without electronic communication capabilities and capacity must be added to the traditional list of most vulnerable populations. While it may be expected that those with electronic messaging capability will take responsibility to notify those around them, in the long run this is not acceptable. What will occur is that those without electronic communications will have higher rates of preventable direct and indirect mortality and morbidity, which is unacceptable. The authors feel that this proposal is but a first step in mitigation that must also charge immediate debate among citizens and governments alike to ensure universal and equal coverage capability to all traditional and newly exposed vulnerable populations. We are reminded that a recent nuclear alert in the state of Hawaii in the United States immediately exposed the vulnerabilities among both the traditional list of vulnerable populations and those without electronic capacity. To date this limitation has not been resolved.[21] The GCS was started in 2008 and serves as the Polish crisis management office under the direction of the prime minister. It is the current alert system for weather-related crises and requires the agency to warn the population on mobile networks of "extraordinary situations when life and health are in immediate danger."[22] Country-level decisions are now being discussed under existing laws to not only incorporate weather-related crises but also include terrorist threats under a proposed GCS Alert system. To date, no data have been gathered or analyzed.

CONCLUSIONS AND POTENTIAL FUTURE OUTCOMES

A GCS Alert takes into consideration all meteorological and other phenomena that threaten human life. Unfortunately, not all events, especially local ones, can be predicted in advance. For example, violent and unpredictable wind gusts may knock down a damaged tree, which could prove to be life-threatening. What is important is for all people to act in accordance with the basic principles of safety, no matter whether a GCS Alert is received or not.

GCS Alerts should be sent to mobile phone users within areas at risk, during any time, all year long, depending on the current situation concerning potential threats to health or life. The GCS Alert pilot program is being used to test the early warning system. It is also intended to encourage the members of local communities to intensify activities aimed at decreasing the risks associated with natural disasters and mass accidents, as well as increasing the potential for dealing with such dangers. These initiatives, in turn, may have an impact upon optimizing the system.

Text messages warning about life-threatening crisis situations are provided as a free service, and none of the telecommunications operators can charge additional fees for them. When receiving a GCS Alert, each recipient should comply with the content of the text message.

More extensive analysis of the system's efficiency can only be conducted after a longer period of activation, following the official activation of the system in Poland. However, already we can confirm that positive outcomes have occurred as part of the implementation of this system. It is essential to clarify the doubts concerning the early notification system's implementation by conducting an information campaign about GCS Alerts in the widest social circles, such as within schools and the media.

Text messages sent as a mandatory alert provide the possibility of reaching a large number of people at risk of various dangers. Thanks to the fact that so many people possess devices that are capable of receiving text messages, implementing a system using this particular form of communication as a carrier will considerably increase the likelihood that those at risk will undertake responsible and deliberate actions

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when faced with the potential dangers of natural disasters and mass accidents.

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Conflict of Interest Statement

The authors declare no conflicts of interest.

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