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Use of Geographic Information Systems in the construction of maps of rescue operations undertaken by the State Fire Service officers in the years 2010-2017

ABSTRACT

Top priorities for emergency services include saving people's lives and rescuing personal and public property during fires and other disasters. State Fire Service (PSP) officers increasingly perform medical activities in the field of qualified first aid (KPP). Published data indicate that this trend has been on the rise in recent years. The work described in this dissertation was undertaken to:

(1) Examine whether the above mentioned trend can be observed in Poland,

and

(2) Test the hypothesis that in-depth spatial analyses of KPP rendered by the Polish State Fire Service in the years 2010-2017 may help to map the frequency of providing qualified first aid in specific locations and territories.

From a practical standpoint, the overall aim of the research presented in this dissertation was to develop a computer database that could be used to:

- create registries and maps showing locations where emergency rescue services were rendered;
- plan/schedule the deployment of National Firefighting Rescue System (KSRG) units;
- plan retrofitting KSRG units with additional medical equipment, supplies and/or EMT personnel;
- identify rescue team locations in the vicinity of the event (fire, disaster) and coordinate their activities;
- search for important (relevant) objects in the vicinity of the event to ensure that rescue services will be conducted in a safe and effective manner;
- estimate the percentage of events requiring qualified first aid but falling outside the 15-minute travel time.

In this study, statistical data on the implementation of KPP tasks by PSP officers, recorded in the Decision Support System of the State Fire Service (SWD PSP) during the period of 2010-2017, were used. Access to the data was granted by the National Centre for Rescue Coordination and Civil Protection (KCKRiOL), National Headquarters of the State Fire Service (KG PSP) of Poland. For graphic presentations, the source materials were obtained from the Head Office of Land Surveying and Cartography (GUGiK). A computer database of this data was developed by the author using Quantum GIS (QGIS) v.3.0.1 software, free open software for geospatial data collection and analysis.

Using this methodology, it was demonstrated that the State Fire Service (PSP) officers in Poland increasingly perform medical services in the field of qualified first aid (KPP). This trend was found to be on a rise in the years 2010 – 2017. Further, it was possible to identify, visualize and conduct spatial analysis of the KPP performed in specific locations and territories, including the ones where the KPP aid was most frequently used and those outside the 15-minute travel time. A total of 25 maps from 219 462 data entries were constructed, including 9 dedicated to specific types of KPP intervention and 8 showing data on Kernel Density Estimation (KDE) during various periods of time between the years 2010 and 2017. Additionally, the percentage of events requiring KPP in each location and territory was calculated. Overall, information and data contained in the author's database were found to be in keeping with that published by foreign sources, namely, that firefighters perform medical services, including but not limited to qualified first aid, with increased frequency.

In summary, the following conclusions were drawn from the results of the research described in this dissertation:

- GIS tools were found to be helpful in mapping medical rescue services undertaken by the State Fire Service officers;
- Implementation of spatial information systems in rescue operations enables observation of features not detected in the tabular record system;
- GIS analysis allows immediate spatial visualization and easy-to-modify input parameters with immediate tracking of changing results, making GIS an excellent decision-making support tool for the State Fire Service,
- Despite the relatively large number of Professional Fire and Rescue Units and Voluntary Fire and Rescue Units in the National Firefighting Rescue System (KSRG) in the country, we can still identify locations of events necessitating qualified first aid

intervention that were not covered by fire protection units' 15-minute response time area.

- The adopted methodology for determining the location of qualified first aid activities, together with the methodology for estimating the percentage of the population not covered by the fire protection units' 15-minute response time area, can become an important indicator of the need to build a network plan of Voluntary Fire and Rescue Units for incorporation in the National Firefighting Rescue System,
- The database that was created can be used as a foundation for further development of an interactive platform for coordination of rescue services that perform activities related to the protection of people's property, health and life.

Key words: Geographic Information Systems, State Fire Service, qualified first aid.