USING ARCGIS SOFTWARE IN THE PRE-HOSPITAL EMERGENCY MEDICAL SYSTEM

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USING ARCGIS SOFTWARE IN THE PRE-HOSPITAL EMERGENCY MEDICAL SYSTEM (Abstract): Aim. To measure the accessibility to healthcare services in order to reveal their quality and to improve the overall coverage, continuity and other features. Material and methods. We used the software ESRI Arc GIS 9.3, the Network Analyst function and data provided by Ambulance Service of Iasi (A.S.I.) with emergencies statistics for the first four months of 2012, processed by Microsoft Office Excel 2010. As examples, we chose “St. Maria” Children's Emergency Hospital and “St. Spiridon” Emergency Hospital. Results. ArcGIS Network Analyst finds the best route to get from one location to another or a route that includes multiple locations. Each route is characterized by three stops. The starting point is always the office of Ambulance Service of Iasi (A.S.I.), a second stop at the case address and the third to the hospital unit chosen according to the patient's diagnosis and age. Spatial distribution of emergency cases for the first four months of 2012 in these two examples is one unequable, with higher concentrations in districts located in two areas of the city. Conclusions. The presented examples highlight the poor coverage of healthcare services for the population of Iasi, Romania, especially the South-West area and its vulnerability in situations of emergency. Implementing such a broad project would lead to more complex analyses that would improve the situation of pre-hospital emergency medical services, with final goal to deserve the population, improve the quality of healthcare and develop the interdisciplinary relationships. Keywords: HEALTHCARE SERVICES, EUROBAROMETER, ROUTING, SERVICE AREA

Accessibility to health care services is conditioned by the real availability of the facilities offered by the healthcare system and real demand for health. Within the European Union, the access to healthcare services is officially decided at the legislative level, representing a fundamental right of the individual to receive medical treatment and prevention.

Access to healthcare systems is a criterion that reveals that system is well organized and optimally conducted, among other criteria: overall coverage, continuity, the possibility to choose the healthcare provider, rehabilitation, a.s.o. (1).

Measuring access to healthcare services represents an element of equity and a right of the customer who pay taxes to the provider, but the quality of services as well. In order to measure access to healthcare, the
Eurobarometer uses indicators such as: the distance to the nearest hospital (under 20 minutes, between 20 and 50 minutes, an hour or more); accessibility by foot to the nearest hospital (walking).

In the European Union, rapid access (under 20 minutes) to the hospital is not universal. Between 38 and 50% of the population has access to the hospital so quickly. It must be taken into account that small countries have an advantage, because the distance rural-urban is more reduced, such as The Netherlands or Estonia. Meanwhile, large countries such as France or Poland, recorded better access than Romania (2).

**MATERIAL AND METHODS**

In order to initiate the study, we used the software ESRI Arc GIS 9.3, the Network Analyst function and data provided by Ambulance Service of Iasi (A.S.I.) with emergencies statistics for the first four months of 2012, processed by Microsoft Office Excel 2010.

GIS is a software environment for spatial analysis that has, as main feature, the representation of the real world or geographical space as layers or thematic maps (3). ArcGIS Network Analyst provides network-based spatial analysis such as routing, travel directions, the nearest emergency unit (closest facility) and service or coverage area (service area). It is built as a own subsystem and uses an advanced network model (Network Data Model) that allows the use of data sets with multiple attributes (4).

**RESULTS AND DISCUSSION**

**Route**

ArcGIS Network Analyst finds the best route to get from one location to another or a route that includes multiple locations. If we have more inside route stops, displaying the best route will be based on the order of locations specified by the user. ArcGIS Network Analyst will display the best routing for that path. Whether it is about finding a simple path between two points or a path with a sequence of locations, people usually try to find the best route. But "the best route" can assume different things to different situations.

The best route may be the fastest, shortest or most scenic path, depending on the chosen impedance. Impedance is the barrier or the limit set by the user. If the chosen barrier is time, then the best route will be one of the fastest routes. Therefore, the best route may be defined as the path with the lowest impedance. Any valid attribute can be used as impedance to determine the best route (5).

Accessibility refers to the facility with which you can get to a location. In ArcGIS Network Analyst, accessibility can be measured in terms of travel time, distance or any other impedance network (6). Each route is characterized by three stops. The starting point is always the office of Ambulance Service of Iasi (A.S.I.), a second stop at the case address and the third to the hospital unit chosen according to the patient's diagnosis and age. The route display is performed in a few seconds, after careful selection of these three points.

*Description of routes*

- First route (yellow route), departing from the A.S.I. to 64 Pacurari Street, for a major emergency - diagnosis: seizures in a 26-year female patient, transported by a type B ambulance to Clinical Hospital of Neurology.
- Route two (blue route), starting from the A.S.I. to 5 Minerva Street, for a major emergency – diagnosis: broken membranes of a 35-year female patient, transported by a type A ambulance to "Cuza Voda" Hospi-
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tal of Obstetrics and Gynecology.

- First route (purple route), departing from A.S.I to 6 Jelea Str., for a major emergency – diagnosis: attempted suicide of a 52-year male patient, transported by a type B ambulance to "St. Spiridon" University Emergency Hospital.

- First route (green route), departing from the A.S.I. to 10 Chimiei Blvd., for a major emergency – diagnosis: seizures in a 19-year male patient transported by a type C ambulance to Clinical Hospital of Neurosurgery (fig. 1).

Service areas

The Network Analyst may identify service areas around any location on a network. A service area is a region that encloses all accessible streets, representing the streets that are in the specified impedance area (7).

As examples, we chose “St. Maria” Children's Emergency Hospital and “St. Spiridon” Hospital. Spatial distribution of emergency cases for the first four months of 2012 in these two examples is one unequal, with higher concentrations in the districts of “Dacia”, “Alexandru cel Bun”, “CUG”. For “St. Maria” Hospital, the service area was performed compared to the emergencies cases in population age group under 18. It notes that it serves a small area of the surface of the city, which leads to solve the cases in a longer period of time, especially a small number of emergency cases. Districts that do not enclose in the service area (0-2000 meters) were located in the North-West and South-West of the city, such as districts of “Ticau”, “Copou” “Pacurari”, “Dacia”, “Galata”, “Nicolina”, and “CUG” (fig. 2).

Instead, for “St. Spiridon” Hospital, the service area covers the central area of the city, facilitating more rapid resolution of emergencies cases, due to a high accessibility to other districts. Districts that do not enclose in this service area is those of South-West and South-East (fig. 3). This representation was applied to emergency patients over 18 years old.

Nowadays, Public Health problems are much larger than the field of their application. Specialists depend on modern technologies such as GIS, and mapping of applications useful in their analyses. GIS leads to understanding and improving public health problems and improve quality of healthcare and increase accessibility.

Mapping and analysis solution consign to dispatchers and field workers vital information. It allows “911” centers use real data of incident to predict expected emergency calls. Mapping intelligence allows an ambulance to be put to a better location to reach an incident in the fastest time.

CONCLUSIONS

In this research, we have considered accurate exemplify of relationships between the access to healthcare services, the health of the population, and pre-hospital emergency medical services. The presented examples revealed the poor coverage of healthcare services for the population of Iasi, especially the South-West area and its vulnerability in situations of emergency.

Initially, we calculated the population accessibility to emergency care units from the City of Iasi, highlighting the fact that at this scale of analysis, we can correlate the centrality with the accessibility. Implementing such a broad project would lead to more complex analyses that would improve the situation of pre-hospital emergency medical services, with final goal to deserve the population, improve the quality of healthcare and develop the interdisciplinary relationships.
Fig. 1. Optimal routes for various medical emergencies, aleatory chosen from the database.
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Fig. 2. Service area for “St. Maria” Children’s Emergency Hospital
Fig. 3. Service area for “St. Spiridon” Emergency Hospital
CALCICUM AND VITAMIN D SUPPLEMENTS AND CHOLESTEROL PROFILE

Vitamin D has multiples roles in the calcium metabolism, modulation of cell growth, immune function and reduction of inflammation. Many studies have linked low levels of the vitamin D with an increased risk of type 1 diabetes, various types of cancers (breast, colon, prostate, and ovaries), heart attacks, rheumatoid arthritis or multiple sclerosis. In a recent study, Schnatz and colleagues assessed influence of calcium and vitamin D supplements on cholesterol profile in postmenopausal women. The researchers administered a daily dose of 400 units of vitamin D and 1,000 milligrams of calcium and respectively placebo to a group of 576 postmenopausal women. They followed serum 25-hydroxyvitamin D3 (25OHD3) concentrations and lipid levels before and after calcium and vitamin D administration. The results showed a significantly increase of serum 25OHD3 concentrations for women who took the supplement (24.3 ng/mL) compared with placebo (18.2 ng/mL) and a 4.46-mg/dL mean decrease in low-density lipoprotein cholesterol. In addition, the supplement users had elevated levels of high-density lipoprotein cholesterol and lower levels of triglycerides. These results support the importance of an increased serum level of 25OHD3 for improving cholesterol profiles (Schnatz PF, Jiang X, Vila-Wright S et al. Calcium/vitamin D supplementation, serum 25-hydroxyvitamin D concentrations, and cholesterol profiles in the Women’s Health Initiative calcium/vitamin D randomized trial. *Menopause*, 2014; 1 DOI: 10.1097/GME.0000000000000188).