An Analysis of the Spatial Accessibility of 119 Emergency Services to the Elderly Population Using 2SFCA

Jaeseong Ahn[a], Jinmu Choi [b,*], Jisoo Lee[c],

[a] *Department of Land and Information science, Kyungil University, Daegu, Republic of Korea – jsahn@kiu.ac.kr*
[b] *Department of Geography, Kyung Hee University, Seoul, Republic of Korea – cjm89@khu.ac.kr*
[c] *Department of Fire safety, Kyungil University, Daegu, Republic of Korea – jisoo@kiu.ac.kr*

* Corresponding author

Keywords: Spatio-Temporal Analysis, Spatial Accessibility, 119 Emergency Service, 2SFCA, Accessibility Time Index

Abstract:

119 paramedics must arrive at the scene quickly in emergency situations such as fires, disasters, and emergency patients. The time to perform first aid after arrival is called golden time. The golden time accessibility of 119 emergency services is affected by road traffic conditions and the spatial distribution of emergency service demand and supply capacity. In this study, the characteristics of spatio-temporal changes in the golden-time accessibility of 119 emergency services reflecting real-time traffic conditions were analyzed using the 2SFCA (2 Step Floating Catchment Area) accessibility measurement method.

2SFCA can measure the accessibility that considers the spatial extent provided by the service facility and the effect of distance friction between consumers who wish to use the facility (Luo and Wang, 2003; Ahn et al., 2014). In this study, the accessibility of 119 emergency services changing hourly for Daegu City in Korea was calculated using 2SFCA. The Accessibility Time Index (ATI) was also calculated to confirm the change in accessibility of 119 emergency services by time. ATI was defined as the ratio of accessibility by time unit in order to average accessibility per day. For analysis, a link-based directional network was established and utilized. The entire link was divided into 50 meters and a node was added. When a node is added, the analysis using more detailed node information can be performed in the network analysis process of analyzing the connectivity of the node.

The analysis results are as follows. First, the accessibility of the 119 emergency service golden time of the elderly population changed through time. The accessibility was relatively high in the late-night time zone, and it was relatively low in the morning and afternoon. Second, there was a spatial difference in the accessibility of the 119 emergency service golden time of the elderly population. When the accessibility index was classified as level 4, the first-class area was distributed on the boundary of Daegu, and the fourth-class area was mainly distributed in the central area of Daegu. Third, the change in accessibility at peak traffic time compared to the average accessibility per day was different by region. In this study, the change in accessibility was quantified into ATI. When ATI was graded as four classes, the spatial distribution in the first-class area and the fourth-class area could be identified. The first-class area can be interpreted as an area where accessibility is relatively not bad, and the fourth-class area can be interpreted as an area where accessibility is relatively worse. The distribution of Class 1 and class 4 regions were different in the morning and afternoon. The results were presented as thematic maps.

In particular, there were areas where ATI was classified into 4 grades both in the morning and in the afternoon. These areas can be interpreted as areas that require additional measures for 119 emergency services during the period. Daegu has enough 119 safety centers. There is a limit to improve the spatial accessibility of 119 emergency services by building 119 safety centers in the city. If it is not possible to add 119 safety centers in the city, deploying additional paramedics or ambulances may be one of the countermeasures. For example, 119 ambulances that can be added to ambulances located at each 119 safety center can be patrolled in class 4 areas at the peak time, or waited in areas with fast access to class 4 areas. The 2SFCA-based ATI analysis method proposed in this study can be applied to analyze spatio-temporal changes in the accessibility of 119 emergency services and can be used to supplement 119 emergency service policies.

References

Ahn, J., L. Kim, M. Park, 2014, "An Analysis of Variation of Spatial Accessibility Pattern Based on 2SFCA : A Case Study of Welfare Facilities for the Aged in Gumi City," Journal of the Korean Association of Geographic Information Studies, 17(4), 112-128.

Luo, W. and Wang, F., 2003, Measures of spatial accessibility to health care in a GIS environment: Synthesis and a case study in the Chicago region. Environment and Planning B: Planning and Design, 30(6), 865-884.