



## **Geomarketing As A Tool For Health Service Business: Private Hospital Application**

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### **Abstract**

Geomarketing, a new way of knowledge-based marketing, integrates geographic analysis, reasoning, and technology for the improvement of the business judgmental decision. Geomarketing can help you find out who your best customers are and apply geographic analysis techniques to discover where to find more of them. Solving almost any sales and marketing challenge start with knowing who your customer is. Therefore; private hospitals, as commercial businesses with huge investments, also need to find out their best customers and discover where to find more of them. In other words, private hospitals also need customer profiling with geomarketing tools. In this context, the aim of this study is to analyze spatial density, based on the demographic characteristics of customers of private hospitals. A small private hospital, located in Eskisehir city center was chosen for this study. In one year period, the address locations, frequency of visits, clinic choices and neighborhood concentrations of the patients, due to the demographic characteristics, were examined using Geographic Information Systems (GIS) from the hospital patient records.

**Keywords:** Geographic Information System (GIS), geomarketing, knowledge-based marketing, health, statistical analysis.

### **1. Introduction**

Information is defined as processed meaningful data in an existing or potential decision-making process. In other words, information is the appropriate form of processed and organized data, which is won meaning and value, to be used for a certain purpose. Today, customers expect to meet individual needs and preferences on an individual basis. Therefore, marketing tools, such as marketing information systems, model building, data mining, etc. have been used to produce useful information from the data obtained on the market and customers. When information is packaged or used for understanding or doing something, it is known as knowledge. Knowledge-based marketing use this packaged information in order to determine customer profiles, deviation analysis, and trend analysis.

Geomarketing is a new way of knowledge-based marketing, which is supported by digital maps and specialized GIS software. GIS is of interest to a wide range of businesses (Keenan, 2005). Customer profiling, market potential, trade area analysis, sales territory design, site selection, market analysis, advertising and media planning can be done with this new powerful magic tool (Parent, 2006).

Geomarketing integrates geographic analysis, reasoning, and technology for the improvement of the business judgmental decision (Longley vd., 2005). Without the demonstrated ability to improve the business decision, there is no business geography. This differentiates business geography from the traditional descriptive or explanatory objective of economic and urban geography (Thrall, 2002; Pick, 2005).

Geomarketing organizes and brings together disparate information on regional markets. This makes it possible to more efficiently manage your operations, increase your market penetration and make more informed location decisions (GFK, 2015; Radut, 2009). Geomarketing approach must begin with the understanding of the spatial behavior of consumers (Dion and Cliquet, 2006).

Large organizations allocate considerable resources for focus-groups, for market-polls and other instruments used to determine the consumer's profile and its behavior. But, it's obvious that, besides the demographic information regarding: age, sex, income, family situation, etc., managers need also the geographic information to control the expansion or to optimize presence on the market. GIS has the capacity to incorporate large databases with useful information that can be further used in customer profiling (Maguire et al, 2008; Viswanathan, 2005). In marketing research GIS applications help in knowing where clients live, in determining customer profiles based on location and in finding out how to reach the customers through promotional activities (Zeiller, 1999; Hess vd. 2004).

Geomarketing is today a basic part for the decision-making process. With the use of a system based on digital maps, GIS software and diverse databases, the information is graphically distributed, being able itself, for example, to analyze the market trends, to monitor the competition, to visualize opportunities and to launch marketing campaigns (Payton, 2010).

Location is one of the critical issues in marketing. An incorrect decision of localization causes a series of sequential errors in the concept of the marketing mix. This means that the 4 P's - place, price, product and promotion – are deeply related and depend one another. If a store is opened in the wrong place, all the others P's (price, product and promotion) will also have to be reviewed (Costa, 2004).

## **2. Methodology**

Health care in Turkey, given as a public service until the 2000s to the 1950s, has become a business sector in last decade. Depending on the payment of money from governmental social security institutions to the private health sector, market competition heated up, and private hospitals multiplied as mushrooms. Previously, a private hospital could be established with a small or medium-sized investment. But now, huge investments are needed, in order to grab customers in compatible environment.

Solving almost any sales and marketing challenge start with knowing who your customer is. Geomarketing can help you find out who your best customers are and apply geographic analysis techniques to discover where to find more of them (Lesage and Pace, 2009). Private hospitals, as commercial businesses with huge investments, also

need to find out their best customers and discover where to find more of them. In other words, private hospitals also need customer profiling with geomarketing tools.

In this context, the aim of this study is to analyze spatial density, based on the demographic characteristics of customers of private hospitals. A small private hospital named X, located in Eskisehir city center was chosen for this study. In one year period, the address locations, frequency of visits, clinic choices and neighborhood concentrations of the patients, due to the demographic characteristics, were examined using GIS from the hospital patient records. The geographic scope of this study is limited with the city bounds of Eskisehir. There are 3 public and 5 private hospitals within the geographic scope, which is available under the scale of the study. Research data have been obtained for only X Hospital yet, other hospitals for the supply of data are thought to discuss.

**2.1. Research Hypothesis**

“Everything is related to everything else, but near things are more related than distant things” (Tobler, 1970). Due to the first law of geography by Tobler, the hypothesis of this study is defined as; “Patients prefer closer health care centers which are more easily reached.” In other words, customers of private hospitals, consist of people who are living in their vicinity.

**2.2. Research Sample Selection**

In this study, X Hospital patient records between April 1<sup>st</sup>, 2015 and March 31<sup>st</sup>, 2016 were used. As a result of the observations made on the data, X Hospital was visited 50,080 times, by 19,864 different patients within a year. Visit counts and patient counts within a year were summarized in tables given below.

**Table 1. Unique patient visit distribution**

Visit	Unique Patient	Percent (%)
Count	Count	(U.Patient Count/U.Total Patient)
1	9,308	46.86
2	4,448	22.39
3	2,256	11.36
4	1,253	6.31
5	772	3.89
6	530	2.67
7	349	1.76
8	228	1.15
9	190	0.96
10	109	0.55
11	97	0.49
12	78	0.39
13	58	0.29
14	42	0.21
15	36	0.18
16	28	0.14
17	29	0.15

18	13	0.07
19	10	0.05
20	5	0.03
21	6	0.03
22	5	0.03
23	2	0.01
24	1	0.01
26	2	0.01
27	2	0.01
28	2	0.01
30	2	0.01
35	1	0.01
37	1	0.01
39	1	0.01
<b>Total</b>	<b>19,864</b>	

**Table 2. Age distribution of patient visits**

<b>Age</b>	<b>Unique Patient Count</b>	<b>Percent (%) (Unique Patient Count/Total U. Patient)</b>	<b>Visit Count</b>	<b>Percent (%) (Visit Count/Total Visit)</b>
0-5	968	4.87	2,779	5.55
5-10	1,287	6.48	3,283	6.56
10-15	1,000	5.03	2,015	4.02
15-20	1,050	5.29	2,041	4.08
20-25	1,177	5.93	2,570	5.13
25-30	1,612	8.12	4,141	8.27
30-35	1,631	8.21	3,871	7.73
35-40	1,500	7.55	3,302	6.59
40-45	1,482	7.46	3,546	7.08
45-50	1,639	8.25	3,868	7.72
50-55	1,598	8.04	3,934	7.86
55-60	1,441	7.25	3,728	7.44
60-65	1,112	5.60	3,277	6.54
65-70	836	4.21	2,673	5.34
70-75	638	3.21	2,051	4.10
75-80	490	2.47	1,775	3.54
80-85	284	1.43	863	1.72
85-90	96	0.48	310	0.62
90-95	20	0.10	46	0.09
95-100	3	0.02	7	0.01
<b>Total</b>	<b>19,864</b>		<b>50,080</b>	

**Table 3. Clinic distribution of patient visits**

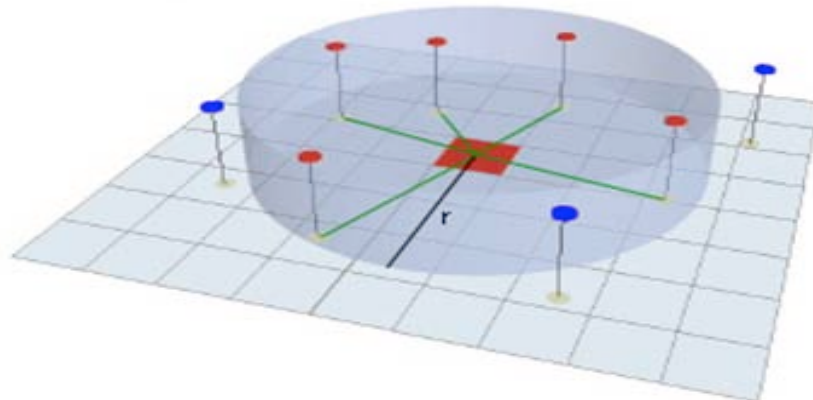
Clinics	Visit	Percent (%)
Emergency	7,030	14.04
Pediatrics	4,378	8.74
Internal Medicine	9,741	19.45
General Surgery	2,017	4.03
Pulmonary Medicine	1,114	2.22
Eye	6,678	13.33
Gynecology	6,671	13.32
Cardiology	3,291	6.57
Ear, Nose and Throat (ENT)	5,935	11.85
Urology	2,872	5.73
Other	353	0.70
<b>Total</b>	<b>50,080</b>	

**Table 4. Sex distribution of patient visits.**

	Unique Patient	Percent (%)	Visit	Percent (%)
Sex	Count	(U.Patient Count/Total U.Patient)	Count	(Visit Count/Total Visit)
Female	11,973	60.27	31,673	63.24
Male	7,891	39.73	18,407	36.76
<b>Total</b>	<b>19,864</b>		<b>50,080</b>	

### 2.3. Research Method

The aim is to analyze spatial density of customers, with locating the patient records on the map. For this purpose, point density analysis method was used. Point density method calculates the density of point features around each output grid cell (Uyguçgil, 2007). Units of density are points per unit of area. Conceptually, a circle region is defined around each grid cell center by a radius value, and the number of points that fall within the region is totaled and divided by the area of the region (Fig.1).



**Figure 1. Search radius**

Increasing the radius will not greatly change the calculated density values. Although more points will fall inside the larger region, this number will be divided by a larger area when calculating density. The main effect of a larger radius is that density is calculated considering a larger number of points, which can be farther from the raster cell. This results in a more generalized output raster (Lee and Wong, 2001).

$$d_{(x,y)} = \frac{\sum v_{(x_i)}'}{\pi r^2} \quad [1]$$

where;

$d_{(x,y)}$  : density value of the calculated cell

$v_{(x_i)}$  : visit count value of points within the circle

$r$  : radius in km. of the circle around the cell

Density surfaces show where point features are concentrated. A point value for each matched building representing the total number of visits were used to learn more about the spread of visits over the city. The predicted distribution of the visits throughout the city bounds were calculated, by density analysis.

#### 2.4. Research Findings

In this study, first of all due to the addresses of patients, buildings were found in the map and points were generated inside these buildings. Approximately, 50,000 visit records were matched with 8,500 buildings. Number of visits from the same buildings, such as different apartments of multi-storey buildings or multiple visits of the same patients, were counted and assigned to location points as an attribute (Fig.2).

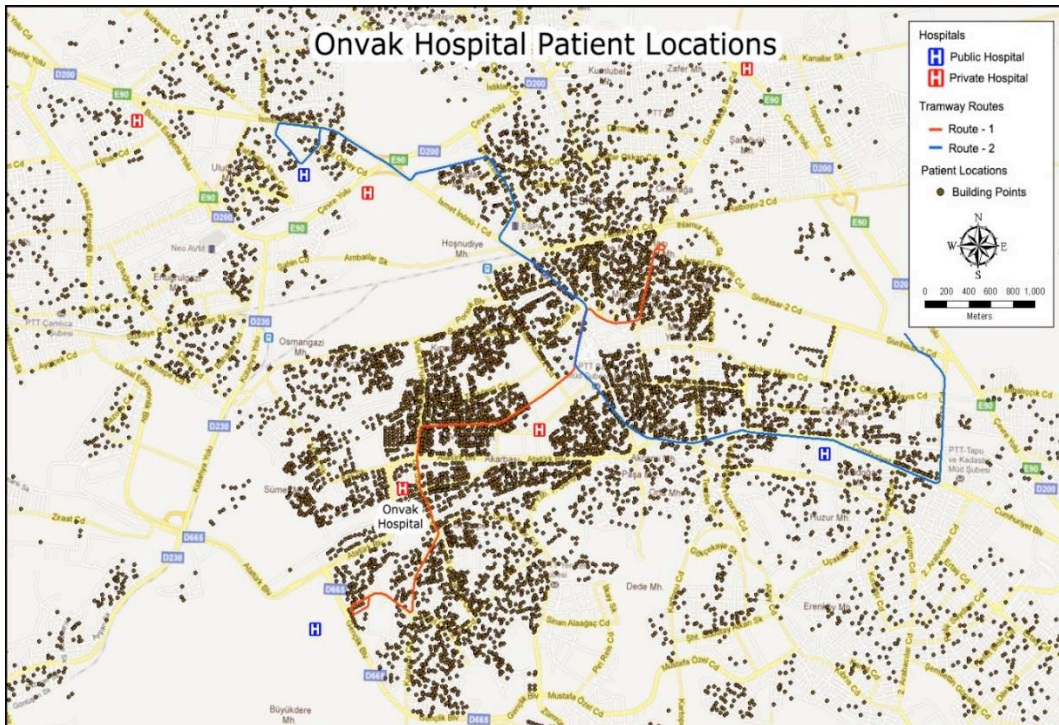
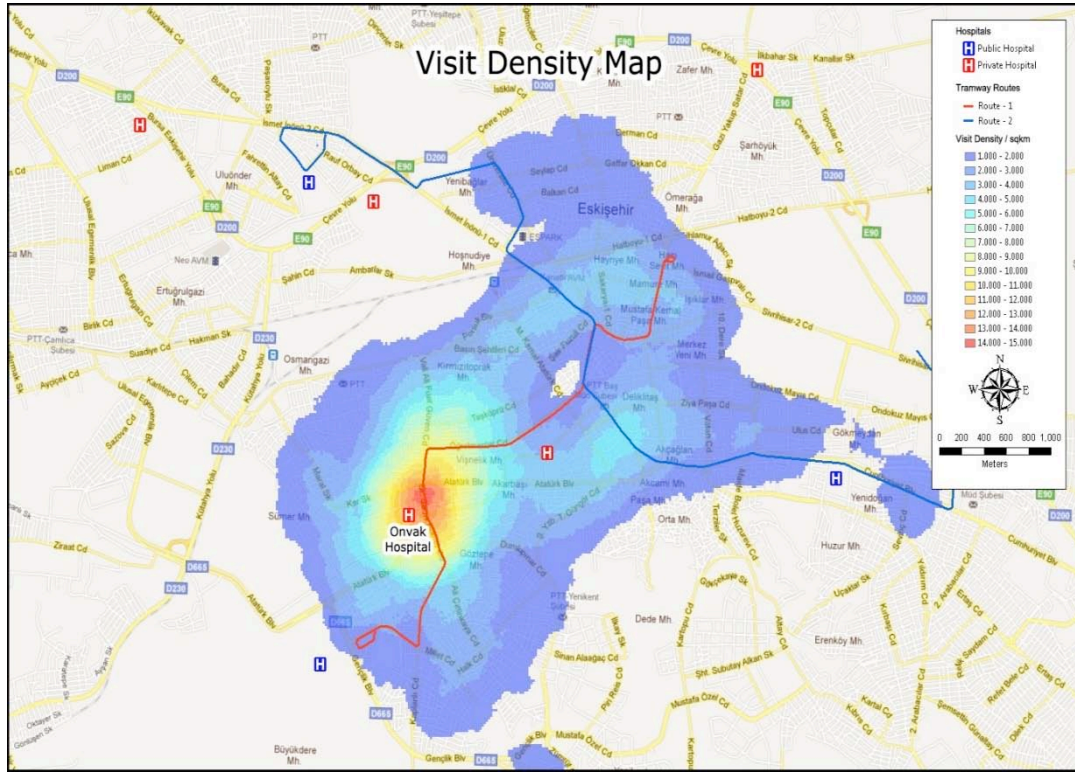


Figure 2. Patient locations on map

Afterwards, point density method was used for visit density map. Density value was calculated for every cell inside the spatial extends of point features with the attribute of visit counts. The short edge length of the spatial extend was divided by 30 to

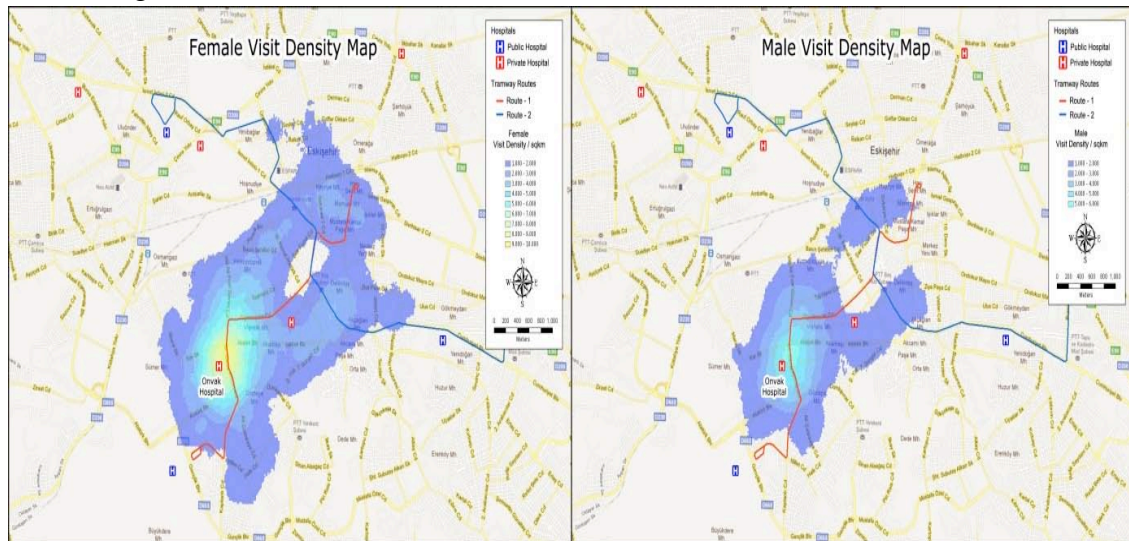


choose the search radius and define the neighbors, as 400 m. A raster density surface map was generated with this method with 20 m cell size, and map output were displayed using graduated colors (Fig.3).



**Figure 3. Visit density map**

As shown in Fig.3, visits were concentrated around the X Hospital. Also, it shows that, easy reach to hospital is an important parameter. Around the tram routes used for public transportation are also concentrated regions due to the visit density map. Density maps were also prepared using demographic characteristics, such as sex and age with the same methodology, in this study. First, patient records were categorized using sex, age and clinic attributes, respectively. Then density maps were calculated according to these categories.



**Figure 4. Visit density maps according to patient sex.**



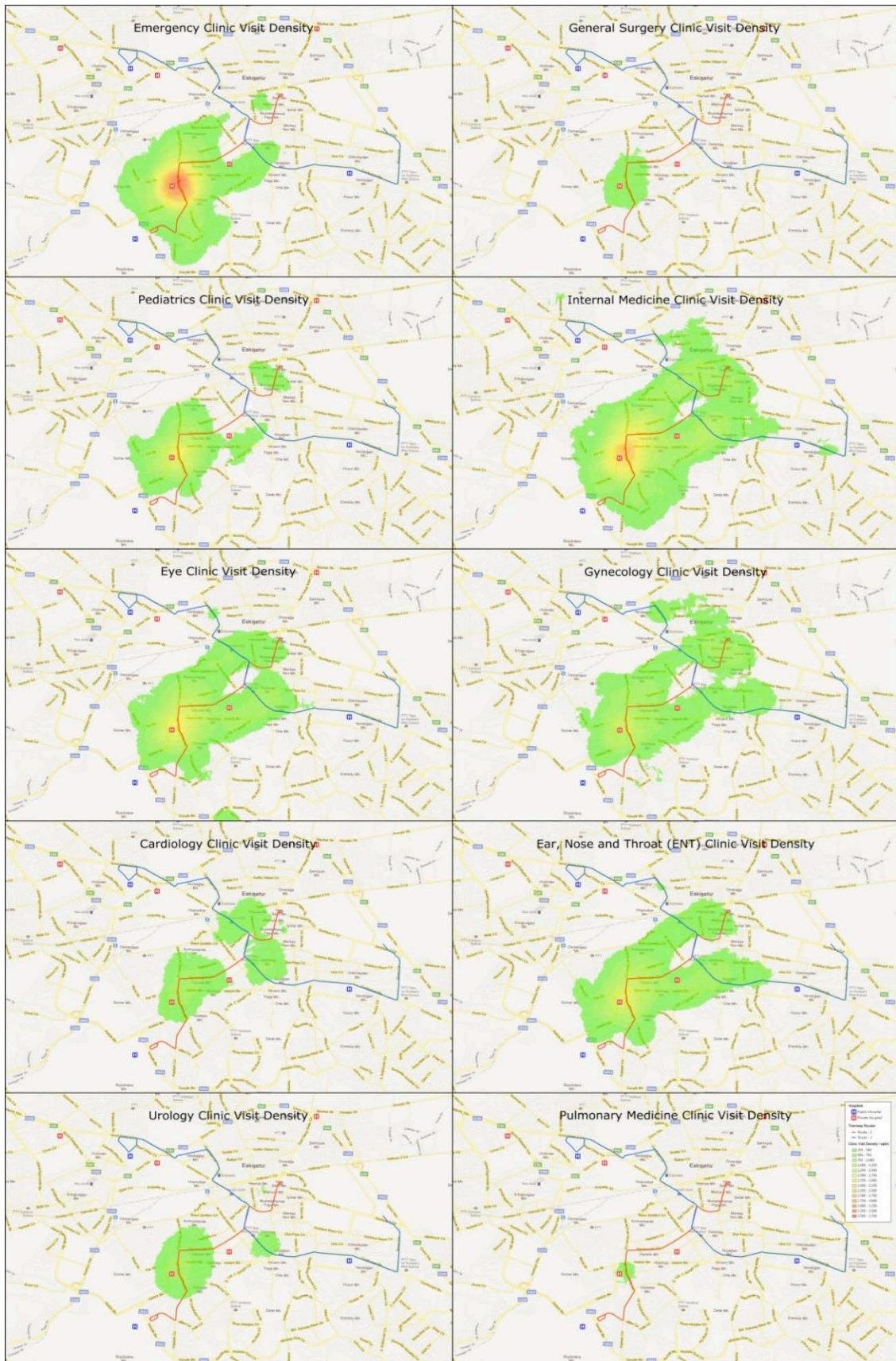


Figure 5. Visit density maps according to clinic visits.



## 2.5. Conclusion

In this study, “customers of private hospitals consist of people who are living in their vicinity” or “patients prefer closer health care centers which are more easily reached” hypothesis was asked to be substantiated. For this reason, unlike traditional methods over customer profile analysis, annual patient records of X Hospital were used to obtain spatial density. In density maps it can be seen that, patient visit density increased around, and inversely decreased away from the hospital. Additionally, due to easy access the visit density also increased along the tramway routes.

In the examination by gender, more women visit than men were observed, but the main visit concentration for both genders still focused around the hospital. Similarly, in the investigations based on age ranges, although concentration locations differed due to age ranges, the basic density was still observed around the hospital.

In addition, the spatial density analysis on the patients' clinical profiles, the intensity of emergency clinic visits around the hospital, stands out very clearly. This situation suggests the importance of proximity and easy access in emergency cases. On the other hand, why some clinics, such as general surgery and pulmonary medicine, are not preferred in comparison to its competitors should be investigated by X Hospital management. Due to marketing strategy.

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