



An Efficient Financial Profitability Performance Analysis of ODHCs Distribution in Turkey in the GIS Environment

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Keywords

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ABSTRACT

The increased number of Oral and Dental Health Centers (ODHC) constructed under the Health Transformation Program (HTP) in Turkey meets an important healthcare service requirement. Evenly distribution of these dental services all over the country facilitates public access and allows these services to gain continuity. Accessibility to sufficiently distributed dental service centers increases citizens' physical and also mental well-being, which is the therapeutic aspect of providing such public health services. Service's social contribution is uncountable in terms of health issues for the people of the country. On the other hand, they need quite an amount of financial support. Therefore, authorities in the country, especially health service authorities should consider running a financial performance analysis plan. In the ODHC system, dentists are the main component for keeping the system running to provide interrupted, continuous and regular dental health services. For this reason, in the study, financial performance analyses of existing ODHCs w.r.t the profitability- per dentist were carried out with the help of Geographical Information Systems (GIS). Inverse Distance Weighting-IDW analysis technique provided by GIS is used to create several performances distribution maps were produced w.r.t the several factors per dentist which are effective on the financial performance of ODHCs. For the sake of understandability, the two most effective factors and the profitability as target factor are assigned to three primary colors for an effective visual interpretation of the relationship between these most effective factors in terms of profitability per dentist in GIS environment. When the outputs are evaluated, more understandable results on the relationship between the factors affecting the ODHCs' financial performance are obtained by this visualization technique for 128 public ODHCs in Turkey, and the importance levels of the variables are then revealed in terms of ODHC's financial performances w.r.t. the locational data.

1. INTRODUCTION

There are several services provided for us to survive and live better. Health services are one of the most important services that are required because of their vital importance to human life. The oral-dental health in providing and promoting public health is considered extensively, insofar as nowadays, it is known as one important slogan of the 21st century (Gharlipour et al., 2016).

Provision and sustainability of these services are other issues to be solved efficiently by the authorities providing these services to us. Therefore, financial performance analysis then becomes an important

challenge area when it comes to healthcare. A performance analysis gives authorities a chance to test the efficiency of their existing services. To ensure efficiency and productivity in the use of resources, minimizing expenses and maximizing revenues and financial performance analyses of public attention services are also closely related to politicians and decision makers. A performance analysis lets the authorities act consciously and give effective and efficient decisions on the public services, Works, and actions (Ercan et al., 2013). Therefore, it is suggested authorities build a sustainable performance analysis system, especially for public services to run them efficiently as it is suggested for ODHCs here in this research.

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In this study, data were obtained for 128 ODHCs distributed all over Turkey from the Department of Statistics, Analysis, Reporting, and Strategic Management of the Ministry of Health, based on the first 6 months of 2016. Using this data, the number of canal treatments per dentist, the number of fillings per dentist, the number of teeth extracted per dentist scaling per dentist, the number of surgical treatments per dentist and fixed prostheses per dentist, and the number of removable prostheses per dentist were computed for these 6 months to use them as variables in financial performance analysis for representing the locationally most effective variable in terms of profitability per dentist. Outcomes are obtained after following an interpolation procedure to produce maps for every variable mentioned above in the GIS environment and to determine the distribution of all these factors on a spatial base. The maps are used to show the financial status of the existing ODHCs in terms of locational effective factors on profitability. This study then emphasizes the importance of GIS in the financial performance analysis of ODHCs.

2. METHOD

In this study, the performance analysis of ODHCs and the spatial distributions according to several factors which are effective on the current performances of ODHCs are revealed, and the performance improvement of ODHCs has been determined by Inverse distance weight interpolation (IDW) which is an interpolation technique and is capable of providing it in a GIS environment as well. The inverse distance weight interpolation method is based on the use of inverse weighting of the distance between points whose values are known and the point whose values are to be estimated, as weight (Göğsu & Hastaoğlu, 2019). Rather than point representation, the IDW technique was used because it enables the raster representation of the comparison of the variable values at the points whose values are known w.r.t. the values of other points visually and much more effectively. In short, the positional distribution of the variables obtained after running the inverse distance weight interpolation technique was then represented in the raster notation of the variable distribution maps.

As a result of the analysis carried out in ArcGIS using the IDW method whose mathematical model is given below, coloured maps can be produced to show the spatial distribution of the financial performance of the Centers effectively w.r.t. several criteria. Since the weighted moving average is a widely used interpolation approach in GIS, IDW is also preferred as an interpolation form here in this research, although various methods including different weight functions are available in the literature. The IDW estimator can be given by the following equation (Demircan et al., 2011).

$$Z(X_0) = \frac{\sum_{i=1}^n z(X_i) \cdot d_{i0}^{-r}}{\sum_{i=1}^n d_{i0}^{-r}} \quad (1)$$

The location X_0 , where the predictions are made is a function of n neighboring measurements giving the number of neighboring measurements ($z(X_i)$ and

$i=1,2,\dots,n$); r is the exponential value that determines the assigned weight of each of the observations, and d_{i0} is the distance that separates the observation location X_i and the prediction location X_0 . As the exponent grows, the assigned weight of observations far from the prediction location shrinks; increasing the denominator indicates that the forecasts are very similar to the nearest observations (Demircan et al., 2011).

3. RESULTS & DISCUSSION

In the study, the financial performance analysis of the centers was carried out w.r.t. out the profitability variable per dentist which is obtained by adding the incomes and expenses of 128 public ODHCs into the process. The IDW interpolation method was used to reveal the spatial distribution pattern of the variances of variables mentioned above for the financial performance analysis of the Centers, and maps were then created to represent graphically the spatial distributions of the financial performance of the Centers so such an effective way. In this way, the pattern of financial performance of existing ODHCs in terms of profitability per dentist in the country was demonstrated by measuring. Profitability per dentist financial performance of centers visualized by interpolating them with GIS.

The profitability per dentist analysis for ODHCs in turkey was obtained as a result of statistical processes using the numbers of scaling treatment, root canal treatment, surgical treatment, fixed prosthesis treatment, extraction, and filling treatment. Then the variables that are locationally most effective on the profitability were determined. After that, the variables with the highest impact on the profitability were analyzed all together in a GIS environment, and maps were created to determine the current situation through a graphical representation. When the maps are examined for every subset including two variables affecting profitability their effects on the performance are seen and analyzed.

When scaling treatment is analyzed together with surgical treatment, the profitability map of Turkey is formed as that given in Fig 1.

Looking at the profitability map of Oral and Dental Health Centers, the variables that affect profitability together are shown as scaling treatment and the number of surgical treatments. The centers where the effects of these two variables are observed are Beyhekim ODHC, Van ODHC, Batman ODHC, Ordu ODHC, and Kütahya ODHC.

Another variable that affects profitability is the number of surgical treatments. The centers in Erzurum and İzmir are ODHC where this factor is effective on profitability.

When we look at Fethiye, the Middle Black Sea region, and the western part of Marmara, it appears as a variable scaling treatment that affects profitability.

When the areas where other variables are effective in profitability are examined, centers in Antalya, Zonguldak, Burdur, and Kilis stand out.

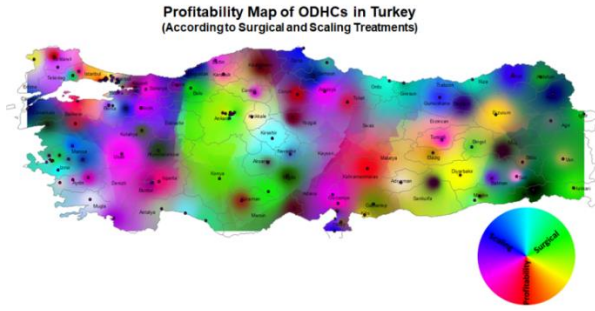


Figure 1. According to Surgical and Scaling Treatment

When scaling treatment is analyzed together with root canal treatment, the profitability map of Turkey is formed given in Fig 2.

The centers where scaling treatment affects profitability are similar in Fig 1 and Fig 2. In addition, Ordu ODHC differs from the first map in the effect of scaling treatment on profitability.

Centers, where the effect of scaling and root canal treatment on profitability are analyzed together, are given in Fig 2. These centers are located in the southern and central parts of the Central Anatolia Region and Van.

In Fig 2, the centers where root canal treatment affects profitability is Erzurum and İzmir ODHCs.

Other variables that affect profitability are effective in Burdur, Zonguldak, and Siverek ODHC.

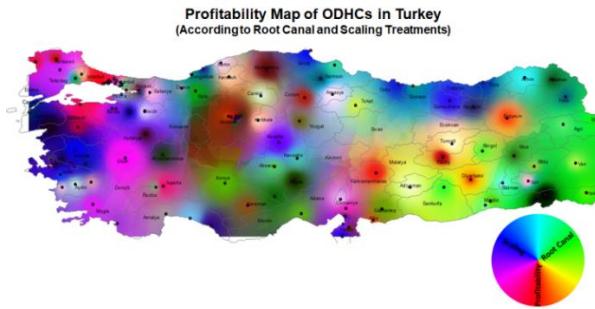


Figure 2. According to Root Canal and Scaling Treatment

When scaling treatment is analyzed together with fixed prosthesis treatment, the profitability map of Turkey is formed given in Fig 3.

When looking at the centers where scaling treatment affects profitability, it differs from the maps in Fig 1 and Fig 2. This difference is encountered in the centers in Eastern Anatolia Region and Aksaray.

In the profitability map, when scaling and fixed prosthetic variables are evaluated together, Adiyaman ODHC is the only center.

Another variable that affects profitability is fixed prosthesis treatment.

As can be seen on the map, it is seen that fixed prosthesis treatment affects profitability in the centers in the western part of the country.

Other variables are effective in profitability in centres in Zonguldak and Rize.

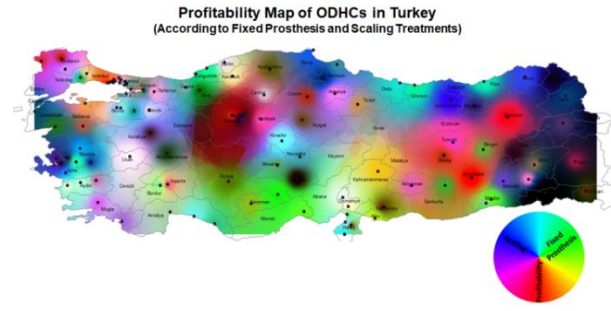


Figure 3. According to Fixed Prosthesis and Scaling Treatment

When root canal treatment is analyzed together with surgical treatment, the profitability map of Turkey is formed given in Fig 4.

Considering the effect of surgical treatment on profitability, it is seen that it is similar to Fig 1 surgical treatment is the factor affecting profitability in centers in Çanakkale and Aksaray.

Root canal treatment is the factor affecting profitability in ODHCs in the central parts of the Central Anatolia Region, Erzurum, and İzmir. This is similar to Fig 2.

When the effects of root canal treatment and surgical treatment on profitability are evaluated, it can be seen that they affect profitability together in Kütahya, Beyhekim Van, and Batman ODHCs. Considering the effects of other variables on profitability, there are centers in almost every region where these variables are effective.

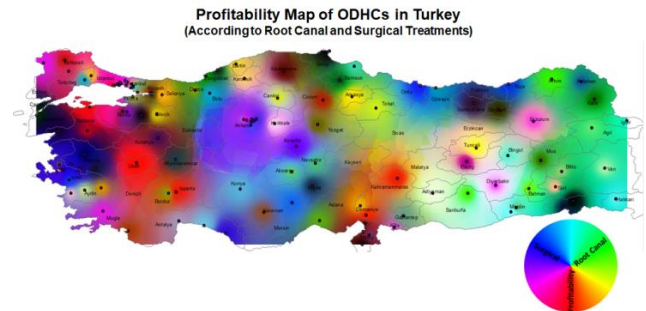


Figure 4. According to Root Canal and Surgical Treatment

When root canal treatment is analyzed together with fixed prosthesis treatment, the profitability map of Turkey is formed given in Fig 5.

The effect of fixed prosthesis treatment on profitability differs from the map in Fig 3.

When the effects of the canal and fixed prosthesis treatment variables on profitability are evaluated together, Erzurum ODHC stands out as the only center.

Root canal treatment is effective on profitability in centers located in the central and southern parts of İzmir, Kütahya, Van, Batman, and the Central Anatolia Region.

ODHC, where the effect of fixed prosthesis treatment on profitability is most evident, is located in the east of the Central Anatolia Region, Adiyaman, Tunceli, and Siirt.

The areas where other variables are effective in profitability are generally distributed in the coastal regions of the country.

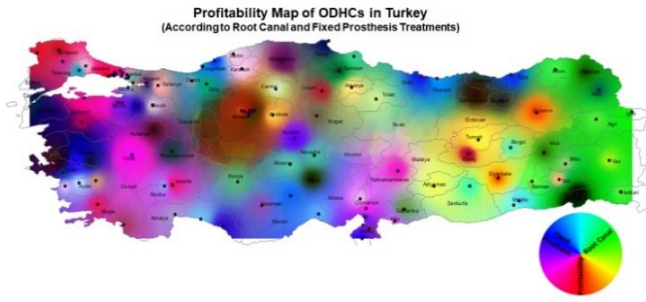


Figure 5. According to Root Canal and Fixed Prosthesis Treatment

4. CONCLUSION & SUGGESTIONS

Today, it is important for healthcare enterprises to evaluate their performance to increase their competitiveness and ensure their continuity (Samut, 2014). Since areas that need to be improved can be easily identified in performance analysis, regular performance analysis is a report card for institutions. Performance analysis of ODHCs, which facilitate public access to treatment in the health sector, is important.

In this study, the financial performance assessment of 128 ODHCs in Turkey was carried out in GIS. Performance evaluation is based on the variable profit per dentist. The variables affecting profitability per dentist are more; several scaling treatments, surgical treatment, root canal treatment, and fixed prosthesis treatment. In addition to the profit variable per dentist, other variables with a high impact rate were taken into account during the analysis. As a result of the analysis, maps were created where the contribution of these variables to profitability can be seen.

The profitability maps created in the study shows how the variables that affect profitability are distributed on the map. In addition, as a result of evaluating the variables together, factors that are more effective in the profitability of the centers can be determined.

In the maps created in the study, an idea can be obtained about the effect of the variables included in the assessment on profitability. Thanks to the created maps, one or more variables that are effective in the profitability of ODHCs can be determined. If there is more than one variable that is effective in the profitability of the centers, the effect of these variables can be understood.

Factors that are effective in the profitability of each center vary. These differences can be reached when the profitability maps are compared. On the other hand, there are similarities between maps. These similarities are also related to the same reasons.

When the resulting situation is evaluated, it can be seen that different variables are effective in the profitability of the centers located in the same region.

This situation can be considered a surprising finding of the study. It is possible to interpret that there is no

competitive relationship between centers, after examining the spatial patterns that explain financial performance. The fact that the centers are financed by the state is considered to be effective in this situation.

In this study, the financial performance of ODHCs was measured and the importance of variables affecting performance was revealed. As a result of the literature review, there are only a few studies on financial performance analysis on ODHC. It shows that a financial performance analysis for ODHCs that require high amounts of resource use will provide important information that can be used by individuals, institutions, and organizations.

Potential population information from the centers was not taken into consideration in the study. How the financial performance changes by keeping the population information served from the centers under control is also a new research topic. Furthermore, to develop a holistic understanding of the financial performance of the centers, it can also be investigated how variance changes over the years. Thus, more valid findings can be obtained from the financial performance of the health system.

Author Contributions

The contributions of the Authors of this article is equal.

Statement of Conflicts of Interest

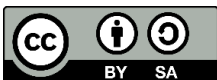
There is no conflict of interest between the authors.

Statement of Research and Publication Ethics

Research and publication ethics were complied with in the study.

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