

Changes in the spatial distribution of dominant IHD care providers over a 10 year period in Hungary

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Abstract: Hungary has a single, unified healthcare reimbursement database which can be effectively used to analyze Ischemic Heart Disease (IHD) care patterns at various care centers. In this paper, we determined the dominant tertiary IHD provider for each municipal district on a single case vote basis in a 10 years long period between 2003 and 2013, covering the cases of 1,256,664 patients. We found that the number of providers increased from 10 to 18, resulting in a natural decrease from an average of 911,552 to 545,392 in the population treated by the greatest providers. We also performed a spatial analysis of the assignment of municipal districts to care providers in the countryside, separately for the first and second five years. This showed a characteristic decrease in the fragmentation of the patches that make up the regions belonging to the providers, resulting in much more compact areas.

Key words: ischemic heart disease, spatial analysis, tertiary care

Introduction

The national healthcare reimbursement database can be used to analyze the health care patterns at various care providers. The goal of this work was to determine the de facto dominant care centers for each municipal area for the ‘primary’, ‘secondary’ and ‘tertiary’ Ischemic Heart Disease (IHD) care, and analyze the spatial distribution of the areas belonging to the centers over a 10 year long period.

Methods

The source data came from the National Health Reimbursement Register. Since this register is focused on financial funding, thorough data cleaning was necessary [1]. The database contained cases between 30 April 2003 and 30 April 2013 in outpatient or inpatient care, a total of 1,256,664 patients. The case data contained the recorded diagnoses and procedures, excluding cases with acute myocardial infarction. We performed data cleaning steps to classify events based on ICD and WHO codes in a manner similar to [2] and to remove redundant events due to the well-known healthcare coding

techniques. For more details on data cleaning and the code sets used for event classification, see [3]. Then we identified the ‘primary care center’ as the dominant care provider for each municipal district (ZIP area) by a simple voting scheme based on the local patients’ Stress Electrocardiography procedures in the observation period. In a similar manner, we found the ‘secondary care center’ for the non-invasive imaging procedures like Single Photon Emission Computed Tomography cardiac test and Stress Echocardiography, and the ‘tertiary care center’ for invasive procedures like Cardiac Catheterization and Percutaneous Coronary Intervention. We performed the above procedure for the whole 10 years long observation period, and also for the first five years and the second five years separately, such that the changes in time could be detected. The assignment of municipal districts to care providers were visualized on color-coded maps.

Results

The number of tertiary care providers increased from 10 to 18 during the observation period. The average population size served by the providers decreased from $911,552 \pm 496,300$ to $545,392 \pm 347,968$, the minimum and maximum values from 267,536 and 1,895,439 to 108,301 and 1,452,544, respectively. At the beginning of observation period, 6 of 10 tertiary center served 79,96% of the evaluated population, while this figure decreased to 54,26% for these centers by the end of the observation period. The greatest decrease occurred at the Medical University of Debrecen and at the Military Hospital (-67,38% and -65,54%, respectively), and only one institute, Semmelweis University increased the size of the served population, by 20,86%.

However, the population is not evenly distributed among the municipal districts, so the changes detected in the number of districts per center between the first five years and the second five years’ data are slightly different. Since we were interested in spatial aspects, we excluded the capital. In the countryside, the spatial distribution pattern of the ZIP areas belonging to the dominant centers showed a remarkable change in favour of the less separated, more compact provider area shapes. Table 1 summarizes the results for the eight most significant centers, for the two 5-year periods. We computed the total number of municipal districts, the number of those districts that are completely enclosed within the patch of the center’s region (external districts), and the number of the districts that belong to the center, but fall outside of the patch of the center’s region (separated districts).

Location	2003-2008			2008-2013		
	# mun. dist.	# ext. reg.	# sep. reg.	# ZIP reg.	# ext. reg.	# sep. reg.
Szeged	273	7	0	239	3	0
Szolnok	42	4	4	66	0	2
Debrecen	497	32	43	254	2	112
Miskolc	227	35	30	319	8	21
Pécs	469	4	3	410	6	4
Zalaegerszeg	341	21	15	226	4	8
Balatonfüred	193	13	25	231	1	3
Győr	82	2	29	189	9	6

Table 1 Changes in the total number of municipal districts, external and separated districts. The institutions are the Hospital for Cardiology (Balatonfüred), Univ. of Debrecen, Petz Aladár County Teaching Hospital (Győr), MISEK (Miskolc), Univ. of Pécs, Albert Szent-Györgyi Health Centre (Szeged), Hetényi Géza County Hospital (Szolnok), County Hospital (Zalaegerszeg)

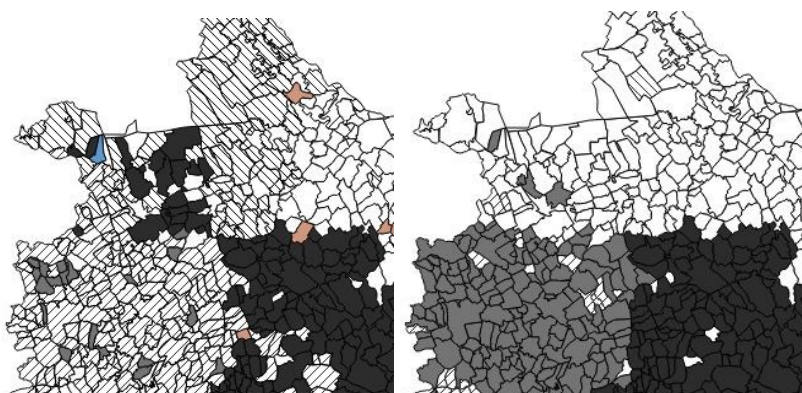


Figure 1 The North-Western region of Hungary, with the municipal districts belonging to the hospitals in Balatonfüred (dark), Győr (white), Zalaegerszeg (right diagonal), Budapest/Gottsegen (left diagonal) and Szombathely (light grey), the latter, Markusovszky University Hospital, not included in Table 1 because it started tertiary service in 2006. Left figure: 2003-2008, Right figure: 2008-2013

Discussion

The dominant provider area of tertiary cardiac centers changed dramatically between 2004 and 2013 in Hungary, due to some new tertiary cardiac centers entering the system. This was accomplished by a natural decrease in the population treated by the greatest providers. With respect to the shapes of the geographical regions that make up the patch of a healthcare center, the numbers in Table 1 clearly show how the fragmentation of these regions decreased by the end of the 10 years long period. This process is visualized in Fig. 1 for the North-western part of the country as the Markusovszky County Teaching Hospital started tertiary service and occupied a significant area along with the Balatonfüred and Győr hospitals, resulting in quite compact geographical patches. The only remarkable counter example is the Petz Aladár County Teaching Hospital, Debrecen having much more (112) separated districts than in the first five years (43). The reason for this is the Jósa András Hospital, Nyíregyháza starting tertiary service in 2006, and gaining several municipal districts that effectively detached several districts from the Debrecen hospital and fragmented a large area between the border and Nyíregyháza. This process has yet to complete.

Conclusion

In this paper, we tracked the process of changing tertiary IHD service in a 10 years long period. The work is still in progress, a further goal is to assess the consequences of this change on the frequencies of invasive and noninvasive patient evaluations pathways, revascularization frequencies and one year mortality of the affected sub-populations.

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