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ORIGINAL RESEARCH

Monitoring interhospital transfers in Western Greece during 2003-2011: its role in health policy

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ABSTRACT

Introduction: Interhospital transfers (ITs) could provide insight into regional healthcare efficiency and evidence for policy-making. The aim of this study was to analyse ITs carried out in the Western Greece region over a nine-year period.

Methods: Archives of the National Center of Emergency Medical Services of Patras and official healthcare resources were used to analyze patient transfers from rural to 'reception' hospitals in the area, during the period 2003–2011, by hospital, medical, seasonal and population variations.

Results: A total of 2500 ITs from the eight rural hospitals to the central ones in the metropolitan area of Patras were monitored yearly. Transfer rates per population ranged between less than 0.3% and more than 1.0%. Only a few patients transferred outside the area (0.9%). Almost 10% of total transfers regarded diagnostic evaluation (mostly CT scan). Transfer rates were inversely related to hospital admission rates (Pearson –0.973, p=0.027), while time (in minutes) (Pearson –0.903, p=0.036) and distance (in kilometers) between the rural and central hospitals (Pearson –0.907, p=0.034) also exhibited significant relationships. The level of understaffing does not have a clear effect on ITs.

Conclusions: By monitoring ITs, it becomes evident where efforts should be prioritized and which of the interconnections should be optimized in a specific network of health care. In this case, interventions should be focused towards the (a) very high transfer rates from the general hospital (GH) of Aigio, (b) lack of orthopedists at GH Kalavryta, which could provide a 24 hour emergency service in a tourist ski area, (c) understaffing in the microbiological laboratory and lack of a CT scanner at GH Mesologi, and (d) lack of radiologists in several hospitals, rendering the installed equipment worthless. By monitoring the ITs, real needs and win–win actions may emerge in the complex interplay of infrastructural factors.

Key words: decision-making, Greece, healthcare efficiency, healthcare management, interhospital transfer, personnel planning.

Introduction

The interhospital transfer (IT) of patients is a key element of the healthcare provider network. It is distinguished from the primary transfer, which involves the transfer of critically ill or injured patients from the site where the incident occurred to the nearby healthcare facility[1]. Secondary or interhospital transfer refers to transfer from one healthcare facility (with inpatient care ability) to another, especially from rural hospitals (those outside the metropolitan area of a region) that lack proper facilities and personnel. In Greece, in each one of the seven Health District Authorities, the major hospitals, including university hospitals, are located in the metropolitan town (ie a town of more than 50 000 inhabitants) providing both secondary and tertiary care at the highest level (ie the urban ones) in the whole region (periphery). As in other countries, the tendency during the first decade of the Greek National Health System (NHS) in the 1980s, was to develop rural hospitals with a capacity of around 120 beds, but the evolving hospital economic and healthcare environment has created an uncertain future for rural hospitals, which are being forced to shift their emphasis from filling acute inpatient care beds to providing a more diversified set of services through linkages with other institutions and provider groups[2]. Commonly, patients themselves choose well-known hospitals that provide physician expertise, far from their home. On the other hand, many rural communities highly value the local facilities, and advocate the maintenance of hospital services close to home even though patients will have to travel for more specialized services[3].

In Greece, over the past few years, economic constraints have led to rural hospitals gradually becoming obsolete and turning into satellite sites for regional county hospitals[4]. Greek rural hospitals struggle to overcome the effects of troubled local economies, shortages of health professionals and public policy inequities. Patients are increasingly referred to larger urban hospitals and a large number of rural residents choose other hospitals instead of their local facilities because of concerns about the quality of the local care, while rural hospitals struggle to maintain experienced skilled nurses, other health professionals and medical equipment[5,6].

In any case, it is crucial for the patient to be transferred when the required definitive care cannot be provided locally. The failure to recognize the need for transfer results in delays in the diagnostic and therapeutic interventions and can put the patient's life in serious danger[7]. Non-clinical reasons for transfer include the lack of an appropriately staffed critical care bed, or repatriation[8]. It is common in many countries that organizational structures have not been developed enough to ensure that ITs are optimized to improve patient outcomes. Patients should be transferred to the highest quality nearby hospital. However, transfer destinations are selected by organizational routines or non-patient-centered organizational priorities[9]. Outcomes for patients could be improved through better resourcing of the rural hospitals and education of the staff, improved communication with transfer services, and involvement in the development of regionalized transfer protocols[10]. In Greece, the entity responsible for the coordination of the transfers by land, air or sea is the National Center of Emergency Medical Services (EKAB), which provides its own vehicles and trained personnel nationwide. For the Western Greece region, the local department resides in the city of Patras. In contrast with other countries that conduct annual censuses of all hospitals, providing data about the facilities, capabilities and staffing of hospitals[11], Greece has only recently developed a database (ygeiamap.gov.gr) that offers valuable information about the functionality of hospitals[12].

Besides the organizational factors, the importance of trained personnel to conduct a safer transfer has been highlighted in many studies[13-16] but current constraints due to the financial crisis result in transfers led by junior doctors and residents who lack the education and legal competence to perform specialized interventions, such as intubation to secure the airway.

Under this framework, IT monitoring can be used to measure the cost-effectiveness of the system and can also be used as an index

that influences the quality of care, since ITs have been linked to rural hospital evaluation[17], and their proper management has been linked to cost reduction and improvement of patient outcomes[18]. The purpose of this study was to analyse ITs over a nine-year period among hospitals of the Western Greece region in order to acquire insights on quantifying patient flow, its evolution over time and causality, and to evaluate the interplay of hospital organization, management and efficiency in a large healthcare district.

Methods

Type of study: data collection

This was a retrospective study of the cases that have required IT in the hospitals of the Western Greece region during the period 2003–2011. The data were provided by the archives of the National Center of Emergency Medical Services of Patras (EKAB Patras), regarding transfer details (date, origin, destination, ie hospital and department, distance). All the hospitals under the jurisdiction of EKAB Patras were included in the study. In addition, data on healthcare indexes (doctors and nurses per bed, hospital admissions, visits in emergency departments etc) were collected from the official site of the Ministry of Health[12]. Data on understaffing were provided by the administration offices of the various hospitals. The Health District Authority (DYPE) provided the license to use the data and conduct the study[19]. Changes (as provided by the administration offices) related to the hospitals under study (even after the study period in some cases) are presented to enable interpretation of the findings. Seasonal and annual variations of the transfers per hospital and other indexes are calculated.

Setting

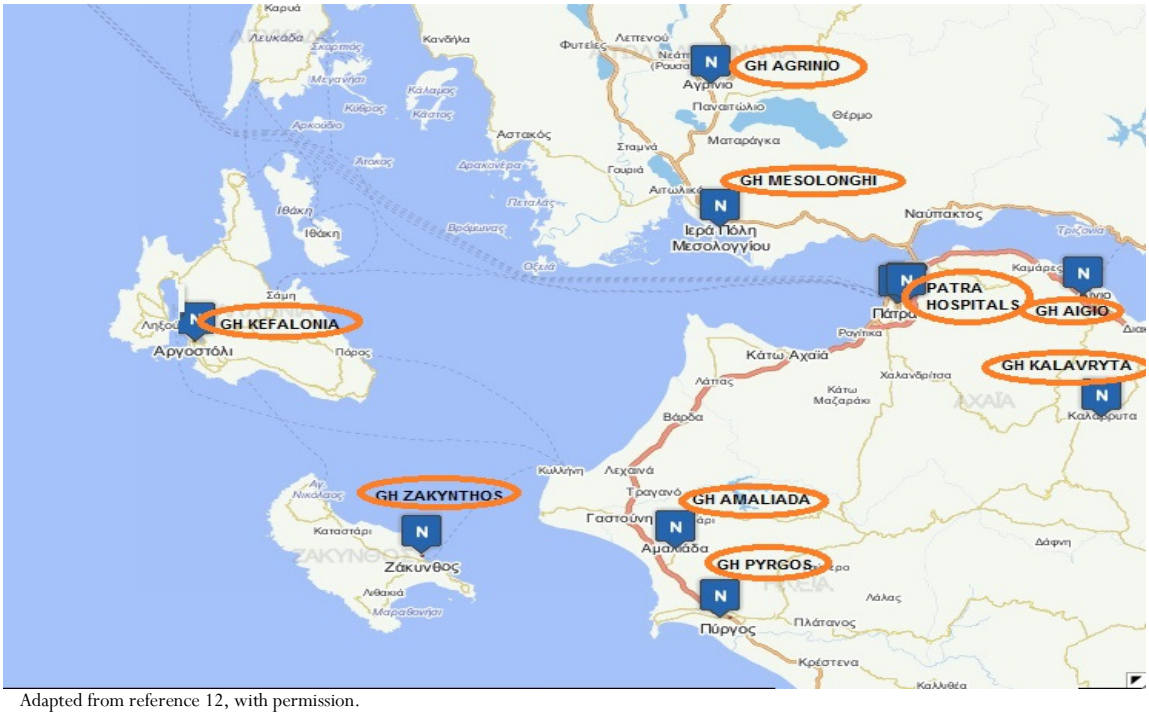
The local (rural) hospitals that transfer patients (primary hospitals) included the general hospitals (GH) of Aigio (100 beds), Kalavryta (20 beds), Agrinio (230 beds), Mesologi (120 beds), Pyrgos (220 beds), Amaliada (100 beds), Zakynthos (160 beds) and Kefalonia (120 beds) (Fig1), and the receivers (reception hospitals) included the University Hospital of Patras (730 beds), GH St Andrea, the 409 Military Hospital, the Pulmonary Disease Hospital of Patras 'St Lucas' (50 beds), the Karamandanio Pediatric Hospital (97 beds) and the hospitals of Athens. GH St Andrea was severely damaged by the earthquake that hit the city of Patras in 2008. In 2012, 'St Lucas' was merged with GH St Andrea and the 409 Military Hospital to form GH Patras (450 beds).

The area under study extends from the north-west part of Peloponnese to the west of Central Greece and is formed by the counties of Aitoloacarnania, Achaia and Ilia. It covers an area of 11.350 km², about 8.6% of the total national area. Its population according to the 2011 census is 679 796 persons[20]. In the Greek NHS, this geographical region belongs to the 6th Health District (DYPE). Even though the GH of the islands of Zakynthos and Kefalonia do not administratively belong to the Western region, they were included in this study as under the jurisdiction of EKAB Patras (Fig1).

According to Greek law, these hospitals are on duty 24 hours, 7 days a week and at least five specialists should be employed in each of the main departments in order to be able to cover the whole month[21,22]. Personnel adequacy has been evaluated on that basis (Table 1).

Data analysis

Statistical analysis was performed using Statistical Package for Social Sciences v17 (SPSS Inc; www.spss.com). Variables checked by the Kolmogorov–Smirnov test for normal distribution included 'doctors/bed', 'nurses/bed', 'understaffing compared to GH Agrinio', 'mean of transfers yearly', 'mean transfer time (min)' and 'hospital admissions'. In multivariate regression analysis, due to colinearity, the highly interrelated variables were analysed. There was a high interrelation (>0.975) between the pair 'distance and time' and 'hospital admissions and nurses per bed'. When controlled for each one within the pair, neither distance or time, nor nurse per bed or hospital admissions hold a significant effect. So, two composite categorical variables were created, 'distance–time' and 'admission–nurse power', by using median values as cut-offs. For all analyses, a level of significance 5% ($p<0.05$) was adopted.



Adapted from reference 12, with permission.
GH, General Hospital

Figure 1: Map of hospitals in Western Greece.

Ethics approval

Ethics approval was not required because the research was a service evaluation involving anonymised records and data sets available through the EKAV where appropriate permissions have already been obtained.

Results

More than 20 000 ITs took place during the period 2003–2011. Even though the total distance traveled by ambulances per year was stable, through the study period, trends varied per hospital (Fig2). It was calculated that at least 1.5 million kilometers were traveled every year by EKAB ambulances in the area under study (primary and secondary transfers). ITs covered between 307 000 km/year and 401 000 km/year in the study period.

Table 1 shows the level of understaffing per hospital and other basic hospital indexes. As far as doctor specialties are concerned, there was a great lack of cardiologists in Amaliada and Kefalonia, surgeons in Amaliada, orthopedists in Kalavryta, ophthalmologists in Zakynthos and Kefalonia, pediatricians in Aigio and Mesologi and microbiologists in Pyrgos. Most understaffed were the hospitals located more than 90 km away from the metropolis of Patras.

Table 2 shows healthcare indexes per prefecture. In the island hospitals (Fig1), more beds per 1000 inhabitants were monitored compared with the mainland hospitals, and fewer doctors and nurses per bed. Transfers per 100 visits in the emergency department were low for the island of Kefalonia. The prefecture of Achaia, which includes the metropolitan area, had the best health indexes, especially compared to other mainland prefectures.

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Table 1: Transfers and understaffing in basic physician specialists per hospital

	GH Aigio	GH Kalavryta	GH Pyrgos	GH Amaliada	GH Agrinio	GH Mesologi	GH Zakynthos	GH Kefalonia
Mean of transfers yearly (SD)	609 (54)	125 (44)	391 (57)	284 (45)	386 (43)	361 (118)	204 (49)	65 (36)
Mean transfer time (min)	25	85	88	77	67	38	130	230
Distance (km)	36	85	103	90	78	44	82 (+17NM)	82 (+42NM)
Beds	100	20	220	100	230	120	160	120
Mean of total visits yearly	50 000	14 300	45 350	44 766	114 433	62 547	56 014	–
Inhabitants and tourists (minimum estimation)†	27 345	11 866	85 750	75 420	137 377	74 240	47 219	40 500
Population for each bed (range)‡	273–500	593–715	206–390	447–754	497–597	521–618	295–350	337
Beds per 10 000 (range)¶	20–36	14–17	26–49	13–22	17–20	16–19	28–34	26
Transfers per 1000 inhabitants and tourists	22.27	10.53	4.56	3.77	2.81	4.86	4.32	1.60
Doctors§								
Internists	0–25%	0–25%	0–25%	0–25%	0–25%	0–25%	26–50%	0–25%
Cardiologists	0–25%		26–50%	>50%	0–25%	0–25%	0–25%	>50%
Surgeons	0–25%		0–25%	>50%	0–25%	0–25%	0–25%	0–25%
Orthopedists		>50%	0–25%	26–50%	26–50%		26–50%	26–50%
Ophthalmologists	0–25%		26–50%		0–25%	26–50%	>50%	>50%
Anesthesiologists	0–25%		26–50%	26–50%	0–25%	26–50%	26–50%	26–50%
Pediatricians	>50%	0–25%	26–50%	26–50%	26–50%	>50%	26–50%	0–25%
Radiologists	0–25%	0–25%	26–50%	26–50%	0–25%	0–25%	26–50%	0–25%
Microbiologists	26–50%	0–25%	>50%	0–25%	26–50%	26–50%	26–50%	26–50%
Sum of points	13.5/8	9/5	20.5/9	21/8	13.5/9	16.5/8	22/9	21.5/9
Understaffing compared with GH Agrinio‡	1.12	1.2	1.52	1.75	1	1.4	1.63	1.59

GH, General Hospital; NM, nautical miles; SD, standard deviation.
†Data from the 2011 Census (ref. 20).
¶The range for these values was calculated by using either the minimum estimation of inhabitants and tourists in the area, or the mean number of annual visits to the hospital.
§Understaffing: 0–25%=1 point, 26–50%=2.5 points, >50%=5 points, according to the health personnel positions; data from ref. 12 and Human Resources Departments, 2010.
‡Prefectural data (less accurate estimation for Achaia due to large hospitals not being included) also taken into account.

The hospital of Aigio had the highest number of transfers (24.7% of total transfers), followed by GH Agrinio (16.3%) and GH Pyrgos (16.3%). The hospitals with the lowest transfer rate per total inhabitants (including tourist nights divided by 365) were GH Agrinio (0.28%) and GH Kefalonia (0.16%). However, an inconsistency was traced between the data received by the human resources department of Kefalonia hospital and those published in the national database (www.ygeianet.gov.gr). The highest ratios were monitored in GH Achaia (ie GH Aigio and Kalavryta), where the large reception hospitals are also located.

The University Hospital of Patras was the main receiver of transfers (56%), followed by GH St Andrea (18.8%). Only a few cases ended up in the hospitals of Athens (0.6%) or the University Hospital of Ioannina (0.3%).

Most common causes of transfers included cases transferred to internal medicine wards (16.7%) followed by cardiological (13.4%) and surgical wards (11.9%). Ten percent of the total cases were transferred in order to carry out examinations or diagnostic evaluations before returning to the original hospital. Half were for CT scans (200–300/year) followed by MRI and ultrasound (less than 50/year). Since 2009, there was a slight increase in transfers for CT scans. The ITs of car accident victims were 100–150/year, showing a 40% decrease since 2007 (average annual number of 129 cases in the first half of the study period declined to 81 in the last 5 years). In regards to seasonal variation, an increased rate during the summer season (May–September) was evident due to higher population mobility.

Doctors and nurses per bed were highly correlated (Pearson 0.954, $p<0.05$) and both variables were inversely related to hospital admissions (Pearson –0.936, $p=0.064$ for doctors; and Pearson –0.977, $p=0.023$ for nurses). Transfers were also inversely related to hospital admissions (Pearson –0.973,

p=0.027), transfer time (in min) (Pearson –0.903, p=0.036) and distance (in km) (Pearson –0.907, p=0.034). Understaffing size (see Methods section) was not correlated to transfers or hospital admissions. 'Distance–time' factor was strongly negatively correlated (–0.999, p<0.05) to yearly transfers even when controlled for 'admission–nurse power'. 'Admission–nurse power' was not correlated to transfers when controlled for distance–time factor.

Analysis per hospital and prefecture is as follows.

Achaia prefecture

GH Aigio was the one of the better staffed (the other was GH Agrinio) hospitals, but with functional problems. GH Aigio has a capacity of 100 beds; considering the population served, each bed would serve 273–500 persons, depending on whether the annual visits or the estimated population would be considered its target group. The hospital had only two microbiologists who could cover the hospital needs for 15 days at most, so all analyses were performed in other hospitals. There was an increase of the transfers during years 2004–2009 followed by a declining tendency (Fig2). Most cases concerned neurosurgical and cardiological cases (100–150/year) and CT scan (50–100/year) but the hospital acquired a CT scanner in 2012. There was a seasonal variation with an increase of transfers from May to June of the neurosurgical cases (10–15/month) and a peak for the transfers regarding orthopedic cases (2–5/month) during the winter season from January to March, mostly due to road and ski accidents from the nearby ski center.

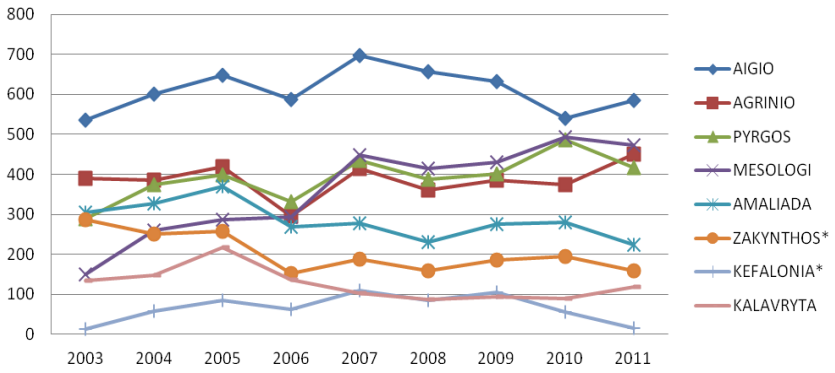
GH Kalavryta is a small 20-bed hospital 50 km (31.3 miles) from Aigio, situated in a very popular destination for winter sports and destinations. Each bed, as previously described, would serve 593–715 persons. The hospital has very limited staffing: one cardiologist; and every two weeks a general surgeon, a urologist and an ophthalmologist, from GH Aigio, visit the hospital. There is neither an orthopedist nor an anesthesiologist. The hospital does not have a CT scanner. The majority of the transfers were surgical and orthopedic cases (20–25/year). There has been an increase in surgical case transfers since 2008 and a seasonal increase of the transfers due to internal medicine cases through the summer (May–September) and winter season (November–December) as well as car-accident victim transfers. There was also a slight decrease between 2008 and 2010. In 2012, the administrative merging with GH Aigio took place and it's yet to be decided what will become of the hospital.

Aitoloacarnania prefecture

GH Agrinio (230 beds) and GH Mesologi (120 beds) (merged administratively in 2012) covered a large county of 5461 km² and 224 429 people. Since 2006, more than 100 transfers/year to internal medicine wards and an increase of the cardiological transfers (about 100/year) was evident. An interesting fact is the decrease in orthopedic transfers from 15–20/year during 2002–2004 to a little over 5/year in 2010. The same tendency was evident for cases needing ICU; the transfers were reduced from 15/year during 2002–2004 to less than 5/year in 2008 onwards. There was not any clear seasonal variation of the transfers. GH Mesologi is located almost halfway between Patras and Agrinio and a strong increasing tendency of the transfers since 2007 was evident (Table 1). Most cases were cardiological cases (over 100 transfers/year), with an average of 6–8 transfers/month during the winter season and a peak in 2008; followed by internal medicine cases (50–100 transfers/year), neurosurgical cases and transfers for CT scan (about 50/year each). There was a noticeable peak of the pneumological cases (20–25/year) during 2006–2009.

Ilia prefecture

GH Pyrgos with 220 beds is located nearby Kyllini port, gateway for the Ionian Islands. Even though a new facility was established in 2004, it was severely damaged in the floods of 2012 and it hasn't fully recovered. Today it is the central hospital of the merger with GH Amaliada and the Health Center of Krestena, under the name GH Ilia with 330 total bed capacity and increased personnel. An increased rate of transfers has been monitored since 2007, peaking in the period 2008–2010. Most cases (about 150 transfers/year) were cardiological; another peak was also evident through 2004–2006 regarding orthopedic cases (15–20/year). An increase in the transfers of neurosurgical cases during the summer season (May–September) was also noticed.



*Islands.
Source: Archives EKAB Patras

Figure 2: Transfers (number per year) from rural hospital of Western Greece during 2003–2011.

Table 2: Basic health indexes per prefecture (data 2009–2011)[12]

	Achaia†	Ilia	Aitoloacarnania	Zakynthos	Kefalonia
Inhabitants (×1000)	349	179	217	41	38
Indexes per 1000 inhabitants					
Health service users	363	374	388	364	450
Health service users for acute illness	113	121	86	91	300
Visits in ED	58.82	37.38	50.36	45.45	100
Hospital admissions	63.73	56.07	43.17	136.36	150
Hospital beds	3.15	1.44	1.17	2.86	3.61
Hospital doctors	2.81	0.8	0.75	1.43	1.58
Hospital nurses	4.53	1.97	1.98	2.17	2.71
Doctors/bed	0.89	0.56	0.64	0.5	0.44
Nurses/bed	1.44	1.37	1.7	0.76	0.75
Transfers (mean 2009–2011)		3.88	4	4.39	1.55
Transfers per 100 visits in ED		10.38	7.94	9.66	1.55

ED, emergency department.
†Achaia is excluded for prefectural analysis because the reception hospitals are located there.

GH Amaliada (100 beds) is located in a popular tourist summer destination, 20 km (12.6 miles) away from GH Pyrgos. The decreases in transfers since 2006 may be due to the increase in patients transferred directly to GH Pyrgos. Most cases were internal medicine ones (80–100/year), followed by neurosurgical and cardiological cases (20–40/year). There was an increasing tendency of transfers for oncological cases (10–15/year) through 2006–2008, followed by a decreasing trend. There was a seasonal variation of the transfers regarding neurosurgical cases during the summer season (May–September).

Zakynthos and Kefalonia prefectures

GH Zakynthos and Kefalonia with 160 and 120 beds, respectively, are both located on islands (Table 2 and Fig1). Besides the impact of distance and time on the decision for IT, the very low number of transfers from GH Kefalonia needs further evaluation. There was a decreasing rate of transfers from Zakynthos since 2006–2011; most cases were cardiological (40–60/year), followed by internal medicine cases. Noticeable was the sharp decrease of transfers made for CT scans from 40/year to less than 10/year after 2004. There was a seasonal increase in the transfers regarding the

orthopedic and neurosurgical cases during the summer season.

Discussion

In the present study, approximately 2500 IT yearly were recorded during the period 2003–2011, from all the rural hospitals of the district (ie GH Mesologi, Zakynthos, Kefalonia, Kalavryta, Pyrgos Aigio, Amaliada and Agrinio) to the metropolitan area of Patras, in a radius of less than 100 km in Western Greece. Transfer rates per population ranged between less than 0.3% and more than 1.0%. A very small fraction of patients (0.9%) ended up transferring outside the area. Almost 10% of total transfers regarded diagnostic evaluation (mostly CT scan). Transfer rates were inversely related to hospital admission rates while time (in min) and distance (in km) between the rural and central hospitals have also exhibited significant relationships. Most important results also included the very high transfer rates from GH Aigio; the lack of orthopedists at GH Kalavryta, which could provide a 24 hour emergency service in a tourist ski area; the understaffing in the microbiological laboratory and lack of a CT scanning at GH Mesologi and the lack of radiologists in several hospitals, rendering the installed equipment worthless.

The responsibility of these transfers lies with the physician alone and if patients wish to be transferred to another facility, they need to use private means. Records were not kept for this type of transfer. By analysing some basic characteristics of the hospitals (such as physician staffing and total visits), it was concluded – as other studies in rural health have also done[11] – that most of the hospitals were understaffed and perform a smaller variety of procedures than the urban hospitals, and in some degree were transformed into a link to urban healthcare facilities[23].

ITs were responsible for only a fraction of the total distance that was travelled by the 40 ambulances of Patras EKAB (around 24%). So the majority of the transfers may be primary transfers (from site) and transfers from regional health centers to local (rural or metropolitan) hospitals. The latter could in many cases be avoided if some form of inpatient care, through close monitoring and nursing, was available in health centers, for a limited number of beds. All these transfers accounted for a total travelling time of more than 9000 hours yearly, ie at least one ambulance was continuously in motion in the area under study.

One out of four transfers originated from GH Aigio, which is located near the University Hospital of Patras. Better coordination and services allocation might be necessary between these two hospitals. Compared to GH Agrinio, which serves many patients in a fairly big area, the other big rural hospital, GH Pyrgos, seems less efficient, perhaps due to understaffing. This is in accordance with other papers[24] highlighting the lack of resources and the limited range of definitive care service of the rural hospitals. GH Kalavryta met the standards of a Critical Access Hospital[25] as a small geographically remote facility that could provide a 24 hour emergency service, but its understaffing makes this impossible. GH Mesologi has many functionality problems (eg understaffing especially in the microbiological laboratory and it lacks a CT scanner), facts that led patients to other hospitals or to private diagnostic centers. All these factors play a role in the decision to transfer but the distance and transfer time seem to be of great significance as was evident by the very different rates between Aigio and Kefalonia hospitals.

A very positive finding was that very few patients ended up transferring to hospitals outside the area (Athens or Ioannina). Most were served by the University Hospital of Patras and GH St Andreas, which is a strong quality marker for the urban hospitals of Patras that manage to serve a vast area, since in Greece there has always been a concentration of the healthcare providers in the capital. Privately facilitated transfers are not considered to play a major role due to their cost, and usually the destination is a private hospital, therefore not directly influencing the planning of the public national health system. However, it is a factor to be considered outside the setting of a financial crisis such as the one Greece has been facing in recent years.

These data show that most transfers were to internal medicine departments, followed by cardiological and surgical wards. An unknown percentage of cardiovascular cases was transferred in order to undergo primary angioplasty during an episode of acute myocardial infarction instead of thrombolysis in the local premises. This procedure can only be performed in the hemodynamic laboratory of the University Hospital of Patras where 1917 percutaneous trans-luminal coronary angioplasties were performed during the study period. This constitutes a large center by Greek standards[26]. Research has shown the effect on survival after an acute myocardial infarction if patients are admitted to large hospitals[27].

Almost 10% of the total transfers were performed in order to carry out exams (more than half for CT scan). In regard to ultrasound, it was noticed that even though they could be performed in every hospital, often there is no radiologist on duty to execute them. Seasonal variability was also evident. There was an increase in transfers in summer, mostly due to neurosurgical cases because of increased number of accidents involving head injuries, and an increase in the transfers involving orthopedic cases in winter, mostly in locations providing winter sports. As other studies have shown, the transfers could be used as an epidemiological marker and an initiative for patient education and prevention programs[28].

By monitoring ITs in an area through the only available source, it becomes evident how efforts should be prioritized (which hospital, ward, season etc) and which of the interconnections should be optimized in a network of health care. This might provide invaluable health policy data for win–win choices but also for avoiding mistakes in covering the population's needs. In this case, interventions between others should be focused towards (a) the very high transfer rates from a hospital located near to the central reception one (GH Aigio), (b) the small remote facility (GH Kalavryta) that could provide a 24 hour emergency service in a tourist ski area but a lack in orthopedists was observed, (c) another hospital (GH Mesologi) that led many patients to other hospitals or to private diagnostic centers (due to understaffing in a microbiological laboratory and lack of a CT scanner), and (d) the lack of radiologists in several hospitals, which made it impossible to utilize the installed equipment.

Limitations

This study is limited by the unknown data reliability (since, for example, diagnoses monitored in EKAB archives many times are based on symptoms and in many cases the decision is made by a junior doctor), although all the official and available sources were included and analyzed. Transfers outside EKAB are very few but do exist, thus the exact total number of transfers and the distribution between hospitals remains unknown. Although most of the results were based on descriptive statistics; in international literature such evidence is scarcely published even though it holds strong potential for regional (rural) health policy-making. The authors are aware of the complex interplay between various factors for optimizing provision of health care. The main message is that within a fairly homogeneous setting (by regional, infrastructural, demographic and morbidity characteristics), it is important to monitor ITs. Within this frame, the exploration of differences may add to more informed decisions in resource allocation.

Expected impact of the study

Studies on the transfer network have focused on how hospitals are interconnected and have realized that patients are moving towards better resourced hospitals. According to them, network analyses can help policy-makers form an aggregate structure that is invisible to the individual hospitals and patients[17]. In this case, it seems possible to use the network analysis in order to understand how hospitals in one region are interconnected and share patients. Closing a highly interconnected hospital or reducing its services could affect the region more than closing another more isolated hospital[28].

Since 2012, when the administrative mergers of hospitals begun, the Greek NHS has been in a remodeling process, although actual results remain to be seen. Therefore, it is too early to evaluate the outcome but many studies have shown that hospital efficiency increases with size, and hospitals of

250–400 beds are considered most cost-effective[29,30]. On the other hand, abolition of the rural service as a whole will force patients to travel for basic care and this may undermine overall quality and population access[27]. It is anticipated that mergers would benefit GH Pyrgos and GH Agrinio and indirectly Patras hospitals. The provision of CT scans may be cost-effective for some hospitals and should be evaluated by taking into account transfers, among other factors. In addition, the paradox of a negative correlation between nurses per bed and hospital admissions and a positive correlation between nurses per bed and transfers has been noticed, while this was far less significant for doctors per bed. A possible explanation is that the number of beds is not in accordance with the needs in each area and/or there is a large ratio between doctors and nurses. Interventions could be made towards better distribution of personnel and bed capacity.

Conclusions

As other studies on the quality of care of rural hospitals have proposed, evidence of the usefulness of monitoring ITs was provided[23]. This evidence may guide health policy and decision-making towards minimizing and integrating ITs in the healthcare system in an optimal way. By monitoring ITs, real needs and win–win actions may emerge in the complex interplay of infrastructural factors. In particular, decisions could be influenced on priorities regarding road network, bed capacity, personnel changes and hospital infrastructure. There is the prospect of the healthcare system in Greece in the near future being associated with either an increase and higher quality in transfers, or a decrease and allocation of its resources in order for a patient to be able to find definite care in their place of origin. The first case would be accompanied by a different role of rural hospitals, such as using them for minor medical situations and stabilization of patients before sending them to a central hospital. In this situation, it is strongly advised to assess and prioritize the needs of a specific population before decisions on healthcare restructures. This has to be nationally integrated to optimize transfer efficiency and patient outcomes.

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