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THE SCIENTIFIC JOURNAL OF THE HELLENIC REGULATORY BODY OF NURSES

The Hellenic Journal of Nursing Science is the official journal of the Hellenic Regulatory Body of Nurses. It is a peer-reviewed, multi-disciplinary journal that aims at promoting Nursing Science in Greece.

Through this specific scientific publication, the Hellenic Regulatory Body of Nurses both contributes to the promotion of the scientific nursing knowledge and signals a new era for the contemporary Greek Nursing history.

Under this framework, this scientific journal intends to:

- promote Nursing Science
- contribute effectively to the quality of concern for people as individuals, groups and the society as a whole in every healthy and sick condition
- scientifically highlight and broaden Scientific Nursing issues
- produce Nursing Policy and Policies and
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The journal welcomes research studies, surveys, novel treatises as well as reviews of literature in the following areas:

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4. promotes free and open access to the scientific knowledge for health workers
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■ editorial

The Scientific Journal of the Hellenic Regulatory Body of Nurses, in the framework of its constant effort for improvement, announces that it will start the proper procedures that are necessary in order to add more international scientific journals to its website, offering them without any charge as usual to the members of the HRBN.

More specifically the planning includes the following international scientific journals:

Journal Name

Action Research
American Journal of Hospice and Palliative Medicine
American Journal of Men's Health
Asia Pacific Journal of Public Health
Biological Research For Nursing
Chronic Illness
Clin-Alert
Clinical Child Psychology and Psychiatry
Clinical Nursing Research
Complementary Health Practice Review
Dementia
Diabetes Educator;The Evaluation & the Health Professions
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Health Education & Behavior
Health Education Journal
Health Promotion Practice
Health:An Interdisciplinary Journal
Home Health Care Management & Practice
Journal of Aging and Health
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State and Trait Anxiety in Parents of Children with Diabetes Mellitus Type I

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Abstract

Introduction: A Diabetes Mellitus (DM) diagnosis in the child traumatic event that parents have to cope with.

Aim: It was the investigation of state and trait anxiety of parents of children suffering from DM and the comparison between the groups of fathers with that of mothers’.

Material and method: The sample of the study consisted of 83 parents (18 fathers and 65 mothers) of children with DM, accompanying their children during their regular examination as outpatients in the Pediatric Endocrinology Department of one University and one General hospital of a provincial town in Greece. The participants filled in the Spielberger’s State –Trait Anxiety Inventory. The statistical methods t-Test and Xp2 were used. Statistical significance was set at $p < 0.05$

Results: The mean age of fathers and mothers was 43.72 ± 7.50 and 40.15 ± 5.46 respectively. Mean values of fathers’ State and Trait anxiety were 45.67 ± 11.31 and 40.56 ± 12.83 , while mothers’ were 45.05 ± 10.33 and 45.22 ± 9.02 respectively. When parents were divided into two categories, depending on cut-off value 43, which is the mean value of the healthy population for both subscales, no statistically significant difference was observed.

Conclusion: Parents of children with DM have higher levels of state anxiety than the general population, without a statistical difference noted between fathers and mothers

Key words: State anxiety, Trait anxiety, Parents, Children, Diabetes Mellitus, Nursing, Psychology.

Introduction

Chronic diseases in childhood have a serious impact on little patient’s life as well as on family’s function (Raina et al, 2005, Boman et al 2005). The diagnosis of serious chronic disease in childhood is an anxiogenic factor, resulting in long term psychosocial problems for the parents and the remainder members of family (Lowes et al 2005). As the management of a chronic illness require the parental attendance and adaptation in new data the evaluation of the socioeconomic status and the function of parents is exceptionally useful (Goldbeck et al, 2006).

Type I DM is characterized by a complex management of therapeutic education that has bodily and psychological effect on the entire family (Lowes et al. , 2005). As it is pointed out in the study of Liakopoulou et al.(2001) the

maternal feeling expression (as the critical comments, the hostility and emotional over-involvement) are related with the metabolic control in children’s DM. In the research of Bowes et al. (2009) most parents reported that the management DM and the knowledge of the consequences of a control cause repeated stress and anxiety even a lot of years after the diagnosis was made, and they were still concerned in regard to the future health of their child. Mothers of children with DM are particularly vulnerable (Horsch et al, 2007).

The purpose of the present study was to investigate state and trait anxiety of the parents of children suffering of Diabetes Mellitus type I and the comparison between the two group of parents with the group of mothers. The

assumption of the research was that levels of both trait and state anxiety will be higher in parents of children with DM ,

than mean values of general Greek population and that mothers will exhibit higher rates of anxiety than fathers.

Literature Review Material and Methods

The present study was conducted in the context of the Post Graduate Course "Primary Health Care" of the Health Science Department of the University of Thessaly and Health Science Department of the Technical Institute of Larissa. It lasted from December 2008 until September 2009. 83 parents (18 fathers) of children with Type I diabetes mellitus, visiting as outpatients the Pediatric Endocrinology Departments of a University hospital and a General hospital of a provincial town were included in the study. The parents were consecutively recruited on the condition they were beyond 18 years old and they voluntarily participated. Every single participant was the caregiver of one diabetic child only. Participants gave their informed consent and were reassured that their responses would remain anonymous and confidential. Parents filled in the Greek version of Spielberg's STAI (State and Trait Anxiety Inventory). STAI consists of 40 questions referring to 2 subscales:

a) The emotional state of the participant at the moment

of filling the questionnaire (i.e state anxiety as a result of the present situation)

b) The emotional state of the participant in general (anxiety as a personality trait)

Evaluation is performed on the basis of a four-point Likert scale (1-2-3-4). In addition to the extracted index for each subscale, a general index of anxiety is produced, after totalizing the score of all sentences.

Questions n.1,2,5,8,11,15,16,20,21,26,27,33,36 and 39 are reversely scored (4=1), (3=2), (2=3), (1=4). Values in each subscale range from 20 to 80. The mean value in the general healthy Greek population for the first subscale is 43.21, for the second is 42.79 and for the total scale is 86.01 (Anagnostopoulou & Kioseoglou , 2002). The mean values mentioned and used in this study come from the second scale evaluation that is closer to the time of the conduction of the present study. The questionnaire has sufficient validity and reliability.

Statistics

Descriptive statistics was performed and contingency tables were created for the values examined. The distribution of the answers in the two subscales was normal and comparison between the group of fathers and mothers was performed with the Student's T-test. A binary variable was produced, based on the cut-off score 43, which is the mean

value for the general healthy Greek population. According to this variable parents were divided into two groups within each subscale: Those with a score < 43 and those with a score > 43. Comparison between the two groups was performed with Yates χ^2 (χ^2), which is used for a 2x2 table. SPSS , 13.0 was used.

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Results

Socio – demographic profile of individuals in both groups, as well as their answers to the additional questions posed in the socio-demographic questionnaire are presented in tables 1 & 2. The mean age of fathers was 43.72 \pm 7.50 years old, while the mean age of the mothers was 40.15 \pm 5.46 years old.. Regarding family status, the vast majority were married (N=78, 94%). Regarding number of children, most parents had one- two children (N=74, 90 %). Most parents were High School graduates (N=44, 53%), while 23 were unemployed (27.7%). Most parents lived in large urban centers (>150,000 residents, N=52, 62.7%). The majority of the children with DM were girls (N=44, 53.1%). Most children were 6-10 years old and in their majority (N=72, 90 %) the disease was diagnosed less than five years ago.

As shown in table 3, fathers' and mothers' state anxiety

mean value were 45.67 \pm 11.31 and 45.05 \pm 10.33 respectively, without any statistical difference. The comparison of the two groups after fusion of classes in a distribution consisting of two categories (\leq 43 points and >43, as 43.21 is the mean value for the state anxiety in the healthy population) with Yates χ^2 did not show a statistically significant difference between the two groups ($p < 0.05$).

Regarding fathers' trait anxiety, the mean value was 40.56 \pm 12.83 while mothers' mean value was higher; 45.22 \pm 9.02 in particular; without, however any statistically significant difference. Again, the comparison between the two groups, above and below the cut off value of 43 (<43 and >43, as 42.71 is the mean value for the trait anxiety in the healthy population), revealed no statistically significant difference ($p < 0.05$).

Discussion

The parents of the children with DM had higher levels of state anxiety in comparison to the Greek general population and mothers had higher scores in the subscale of trait anxiety. These results confirm our assumption that parents of children with DM will have higher levels of state anxiety than the general Greek population, but the assumption of the difference between fathers and mothers regarding state anxiety is not confirmed. It is noted that state anxiety mean values proposed in an older evaluation in Greece by Liakos & Giannitsi (1984) for the healthy individuals were about 39.69. These results are in accordance with those of international studies, which show that management of DM and the awareness of the consequences of their poor control cause relapsing stress and anxiety, even many years after the initial diagnosis Bowes et al. (2009). Most parents may exhibit signs of anxiety and depression, a phenomenon more intense in mothers (Kokkonen et al., 1997). Although maternal anxiety or depressive symptoms are not prominent in general, they do exist, at least in some mothers, even when they are informed of the possibility of a DM screening test in newborns (Kerruish et al., 2007, Horsch et al., 2007). Fathers' stress has been positively associated with mother-reported difficult child behaviour (Mitchell et al. 2009). Hearing about the diagnosis is a traumatic stressor for the majority of the parents, with 40% of them reporting moderate to severe symptoms of state-anxiety and 17% moderate to severe symptoms of depression (Streisand et al., 2008).

It has also been found that parents of children with DM consider their child as less healthy in comparison to his peers, despite the fact in evaluation of physical activities, children with DM have similar scores with the rest of the children (Kaloudi,

2009). Parental stress is reversely related to the age of the parent and the socioeconomic status of the family (Mitchell et al., 2009). The regimens in use also affect the psychological status of the parent with insulin injections placing a greater burden on parental psychological status compared to pumps (Streisand et al., 2005). The importance of investigation and management of stressors and parental psychological burden is proven by the fact that the bad emotional status of the parent places a risk for the development of psychiatric disturbances in children, with unpleasant effects on DM control (Piazza-Waggoner et al., 2008, Mullins et al., 2007).

It would be important for future research on this issue to compare parents of children with DM, depending on the years suffering from DM and/or which side (fathers' or mothers') is likely responsible for the inheritance of the disease.

It would be interesting to compare the psychological features of parents of diabetic children with those of parents of healthy children and those suffering from other chronic diseases. It has been found that, comparing to other chronic illnesses diseases, children with DM exhibit a rather better quality of life (Kaloudi, 2009, Boman et al. 2004).

Limitations of the study include the small sample size of fathers, which limits the statistical power of the comparisons of the subgroups.

As a conclusion, both parents of children with DM present higher state anxiety levels in comparison with the mean value of the healthy general Greek population, while mothers also exhibit higher levels of trait anxiety. No statistically significant difference is observed between fathers and mothers.

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Tables

Table I. Distribution of the 83 parents of children with DM, depending on age, family status and number of children.

	Fathers N(%)	Mothers N(%)	Total N(%)
Age (years)			
≥ 24-30	1 (5.5)	3 (4.6)	4 (4.8)
31-40	5 (27.8)	30 (46.2)	35 (42.2)
41- ≤54	12 (66.7)	32 (49.2)	44 (53.0)
Total	18 (21.7)	65 (78.3)	83(100.0)
Family status			
Unmarried	0 (0.0)	1 (1.5)	1 (1.2)
Married	16 (88.9)	62 (95.4)	78 (94.0)
Divorced	2 (11.1)	2 (3.1)	4 (4.8)
Total	18 (21.7)	65 (78.3)	83 (100.0)
Number of children			
1	1 (5.6)	34 (52.3)	35 (42.2)
2	15 (83.3)	25 (38.4)	40 (48.2)
3	2 (11.1)	4 (6.2)	6 (7.2)
4	0 (0.0)	2 (3.1)	2 (2.4)
Total	18 (21.7)	65 (78.3)	83(100.0)
Educational level			
Junior High School graduate	0 (0.0)	1 (1.5)	1 (1.2)
High School graduate	9 (50.0)	35 (53.8)	44 (53.0)
University/TEI graduate	9 (50.0)	29 (44.6)	38 (45.8)
Total	18 (21.7)	65 (78.3)	83(100.0)
Profession			
Unemployed/ Housekeeping	0 (0.0)	23 (35.4)	23 (27.7)
Freelancer	1 (5.6)	5 (7.7)	6 (7.2)
Employee in private sector	10 (55.6)	12 (18.4)	22 (26.5)
Public servant	7 (38.9)	25 (38.5)	32 (38.6)
Total	18 (21.7)	65 (78.3)	83(100.0)
Place of residence			
Village-small town	3 (16.7)	8 (12.3)	11 (13.2)
Town < 150.000 residents	5 (27.8)	15 (23.1)	20 (24.1)
Town > 150.000			
Residents	10 (55.6)	42 (64.6)	52 (62.7)
Total	18 (21.7)	65 (78.3)	83(100.0)

Table 2. Distribution of the 83 parents of children with DM, depending on children's age, gender and duration of the disease.

	Fathers N(%)	Mothers N(%)	Total N(%)
Children's (age years)			
1-5	1 (5.6)	17 (26.2)	18 (21.7)
6-10	9 (50.0)	35 (53.8)	44 (53.0)
11-15	8 (44.4)	11 (16.9)	19 (22.9)
16-20	0 (0.0)	2 (3.1)	2 (2.4)
Total	18 (21.7)	65 (78.3)	83 (100.0)
Children's gender.			
Male	14 (77.8)	24 (38.1)	38 (46.9)
Female	4 (22.2)	39 (61.9)	43 (53.1)
Total	18 (21.7)	65 (78.3)	83 (100.0)
Duration of the disease(years)			
≤ 5	16 (88.9)	56 (90.3)	72 (90.0)
6-10	2 (11.1)	3 (4.8)	5 (6.2)
> 10	0 (0.0)	3 (4.8)	3 (3.8)

Table 3 . Distribution and comparison of the 83 parents of the children with DM, depending on STAI subscales.

	Fathers N(%)	Mothers N(%)	Total N(%)
State anxiety			
≤ 43	8 (44.4)	32 (49.2)	40 (48.2) $\chi^2=0.39$
$P<0.05$			
> 43	10 (55.6)	33 (50.8)	43 (51.8)
Total	18 (21.7)	65 (78.3)	83 (100.0)
Mean value ($\bar{x} \pm SD$)	45.67 \pm 11.31	45.05 \pm 10.33	45.18 \pm 10.49 $t=0.221$
$p<0.05$			
Trait anxiety			
<43	8 (44.4)	22 (33.8)	30 (36.1) $\chi^2=0.30$
$P<0.05$			
≥43	10 (55.6)	43 (66.2)	53 (63.9)
Total	18 (21.7)	65 (78.3)	83 (100.0)
Mean value ($\bar{x} \pm SD$)	40.56 \pm 12.83	45.22 \pm 9.02	44.20 \pm 10.07 $t=-1.759$
$p<0.05$			

Looking into the Factors Affecting Low Back Pain Incidents in General Hospital Nurses: a Questionnaire Research.

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Abstract

Background: Literature review has focused on occupational health issues associated with musculoskeletal system. Nursing personnel, a group with serious incidents of low back pain (LBP) and injuries, have attracted researchers' attention.

The objectives of this research are to explore factors affecting the onset of LBP incidents in nursing personnel (NP), aiming at suggesting prevention and coping techniques.

Design/Methods: Dutch Musculoskeletal Questionnaire (DMQ) was distributed to NP of a general hospital (85F, 15M) and it was filled anonymously. NP on long term sick leave and pregnancy/maternity leave were excluded.

Results: Our NP have mean age 38.39(±5.9) years and Body Mass Index 25.11(20.44-37.97) kg/m². Forty six and forty nine percent of NP carry more than once a day >5Kg and >20Kg, respectively. Ninety percent of NP experienced low back pain last year, grading its intensity with 4.89. NP experiences LBP after carrying weight (53.8%) and classifies it as sharp, sudden localised pain (43%). Half of the NP prefers taking painkillers.

Conclusion: Implementation of patient handling regulations, team lifting when required and training nurses, in both schools and workplaces, on handling weights and on using mechanical aids in everyday work, is essential. However, when the problem is established visiting specialised doctors and physiotherapists is prerequisite, combining a special exercise program.

Key words: hospital, nurse, lift load, low back pain, move load

Introduction

During the past decades, there has been increasing interest in occupational health issues relating to musculoskeletal system. One of these is low back pain (LBP), a phenomenon with particular high prevalence (Cooper et al, 1996, Yip, 2001). To identify critical basic risk factors or to distinguish between causative and prognostic ones, multicenter cohort studies are required (Feyer et al, 2000)!

LBP is a social problem due to the negative impact in daily/professional life, cost and mental/physical health (Jansen et al, 2001, Hoogendoorn et al, 2002, Smedley et al, 2003, Eriksen et al, 2004, Underwood, 2004). Researchers report that 65-80% of general population will have at least one LBP incident during adulthood (Maul et al, 2003).

Nurses, as professionals, have serious incidents of

occupational LBP and traumas in the lumbar area, as their profession is unique with heavy emotional and physical work, and are exposed to a combination of mechanical and psychosocial stress at work (Ando et al, 2000, Smith et al, 2003b, Smith & Leggat 2004a, Smith et al, 2004b, Eriksen et al, 2004, Engkvist, 2006).

Working positions often are uncomfortable due either to lack of space or movement restriction caused by special circumstances, such as in dialysis unit, operating theatre, intensive care unit. It has been found that nurses have to walk and stand up during their shift more than warehouse workers (Lagestrom et al, 1998) a lot of times more than 6 hours a day (Vasilidou et al, 1995, de Bono et al, 2001).

Aim

The present paper aims to study the prevalence of LBP in a General Hospital Nursing Personnel (NP) and enquire into a range of potential causative factors. Furthermore it aims at

offering solutions to minimise and prevent the risks, and to cope with the problem.

Methods

Sample

Nursing personnel of a general hospital (n=135) was investigated. Nurses on long leave of absence due to pregnancy, maternity, accident or disease were excluded.

Research Tool

Dutch Musculoskeletal Questionnaire was used (Hildebrandt et al, 2001) designed to self-report, anonymously, possible physical, personal and psychological factors affecting the onset of LBP that are job related. It consists of questions on demographics (age, sex, body weight and height, marital status, number of children, smoking, consumption of alcohol), general employment questions (department, shifts, tasks, years in position, lifts of patient/equipment, standing/seating positions, repetitive movements), general questions on daily life (daily habits, driving to work, walking, exercise, sports) and questions

regarding possible LBP problems (location/duration/intensity of pain, means of relieving it, leave of absence). The questionnaire, distributed in different envelope for each ward/clinic, was answered in the working environment, having received a verbal consent, and was collected three days later.

Statistical analysis

Statistical analysis was performed using descriptive statistics (mean, median) to describe the general characteristics of the nursing personnel and their LBP. Further on logistic regression models were used to estimate the association between LBP and various variables that were considered as scientifically relevant (work related factors, age, gender, familial characteristics, leisure time activities, smoking, daily consumption of cigarettes, health complains).

Results

Sample

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Discussion

When studying the above results, one can see that nurses in the particular hospital are in their late thirties (mean=38.39 years old) and with more than ten years of working experience (78%). Having in mind, that nursing profession causes great physical/mental stress, as it is necessary a close contact with people in need, and that 90% of the sample had low back pain incidents during the previous year, it is obvious that nursing personnel should be enriched with new nurses. Worldwide a lot of research studies have focused on the relationship between LBP and working department. It has been found that working in intensive care unit, operating room, orthopaedics, geriatrics and medical ward increases the risk of LBP incidents (Yip, 2001, Smith et al, 2003a). However, in our research there was no statistically significant difference between working department and LBP incidents, maybe because the sample from those wards was limited. Ando et al (2000) and Karahan & Bayraktar (2004) came to the same conclusion.

Sixty four percent of nurses are working in shifts (morning, afternoon and night). In other studies it was found that having to work the night shift, is in correlation with LBP (Josephson et al, 1997, Eriksen et al, 2004). Night shift relates to less sleeping hours and bad quality of sleep. A hypothesis explaining this correlation is that sleep abnormalities increase muscle tension and this way increase pain perception in the lumbar area. Despite these, there was no statistically significance in our study.

Two out of five nurses remain seated <1 hour during their shift. Karahan & Bayraktar (2004) in Turkey reported that 58.9% of nursing personnel are standing more than six hours a day. Standing workstations increase back strain, and if this body part is already affected, it is get worse. The absence of significance, is probably due to the fact that nurses intermittently have a short break "for a smoke" (smokers have 7 cigarettes a day). By all means, those breaks rest lumbar area from constant strain but they aggravate other tracts of the human anatomy!

Other researchers implicate offspring as a personal factor affecting the onset of LBP (Feyer et al, 2000, Yip, 2001, Hoogendoorn et al, 2002). Probably because during pregnancy body weight increases and body posture changes aggravating the lumbar area. Furthermore, children, particular very young ones, need manual handling and cuddling, increasing the load in lumbar area.

It is a wonder that there was no significance between LBP and nurses' body characteristics (age, height, weight and BMI), despite the different findings of foreign researchers (Ozguler

et al, 2000, Engkvist, 2006) and despite the fact that BMI is quite high and in the minimum of overweight range (25.11Kg/m²). The relationship between BMI and load in the lumbar area is obvious: heavier subjects-higher L5-S1 torques due to increased upper body weight (de Looze et al, 1998). Ozguler et al (2000) in France found that LBP prevalence increases as BMI increases. Smedley et al (2003) in two English hospitals found that LBP incidents were higher in nurses with BMI >30Kg/m². This is due to the fact that researchers focused on nursing personnel from specific wards, such as intensive care unit, operating room and orthopaedics. In a previous study of Smedley & Cooper (1997), in Southampton, there was no significance found between body weight or BMI and LBP. Ando et al (2000) concluded in the same negative conclusion, during a study of nursing personnel in a University hospital in Japan.

In our study there was a positive correlation between LBP and lifting/carrying load up to 5Kg (for example a tray of surgical instruments, a dialysate container, two PD exchange bags or five bags for intravenous infusion). As one can imagine, during their shift nurses in a ward with 30 beds (mean beds in each ward in our hospital) will perform the above nursing activities more than once. According to the literature, carrying loads is the main factor affecting the onset of LBP (Ozguler et al, 2000, Yip, 2001, Eriksen et al, 2004). In a large university hospital in Athens, Greece, 25% of nurses reported that they lift loads >15kg at least six times during their eight hour shift (Vasiliadou et al, 1995).

A lot of researchers believe that bad working postures (turning movements of the upper body, as well as repetitive and sudden movements) are responsible for back problems in nursing personnel (Ando et al, 2000, Yip, 2004). Our results are in order with that. On many occasions, nurses do not use their body mechanics. Bed care (turning, lifting and bed making), venepuncture for haemodialysis or nursing interventions in the operating room, usually are not performed with ergonomic criteria. When these daily duties are not performed correctly, it is most possible that LBP incidents will increase. In a study conducted by Lee & Chiou (1995) it was found that stress in the spine is greater when the bed is lower than iliacus ruga (approximately 90cm). The American National Institute for Occupational Safety and Health (NIOSH) has found that body postures during 17% of daily nursing interventions cause forces greater than allowed (Lee & Chiou, 1995). Direct nursing care is accompanied by static and awkward positions, with forward bending, kneeling and asymmetric load (patient) lifting.

Prevention and Coping with Low Back Pain

It has been a while, that global nursing community has recognised manual patient handling as a true occupational hazard. Several nursing associations across the world have taken initiative, often in cooperation with governments, to present guidelines concerning manual patient handling. United Kingdom and Australia are pioneers in this campaign

and have published strict guidelines (Royal College of Nursing, 2002, Australian Nursing Federation, 2004). The main tendency of these guidelines is to eliminate manual handling in all situations, except in the life-threatening ones.

Each hospitals' policy on manual handling, guidelines on the body's biomechanical limits as well as proper patient

handling should be distributed and posted on the wall on every hospital ward (Yip, 2001, Brown, 2003, de Castro, 2004, Fergusson et al, 2005).

Team Lifting should be applied when the requirements of the tasks are beyond the lifting capacity of a single health professional or when mechanical assistance is not available or practical (Barrett & Dennis, 2005). The Team's ability to lift and move is greater than an individuals', and total load and effort is divided equally between its' members.

Exercise, on a regular basis, increases muscle and tissue strength, blood circulation, flexibility, muscle endurance and reduces stress (Blue, 1996). De Looze et al (1998) propose endurance programs for back, trunk and lumbar area muscles. According to Yip (2004) thirty minutes of exercise or modest physical activity more than 3 days a week can prevent LBP. Proper diet and rest/sleep, as well as exercise, can help a nurse fulfill his/hers duties (Lee & Chiou, 1995, McHugh & Schaller, 1997).

Nowadays, it is common to piece together different approaches in order to face LBP, as a lot of risk factors attribute to its onset. Proper body posture and body mechanics should be included in undergraduate nursing education, as well as in orientation education (McHugh & Schaller, 1997, Hui et al, 2001, Radovanovic & Alexander, 2004). Alexandre et al (2001) described an educational program consisting of general advice, specific ergonomic orientation, patient handling, self-exercise program (strength and flexibility exercises) and relaxation methods.

Ward and work organizing is the key element to minimize and prevent risk factors (Hellsing et al, 1993). Desk,

chair, computer screen and keyboard should be designed in order to promote professionals health. Electric beds and dialysis chairs prevent LBP, as they reduce heavy body labor; patients lifting and moving and awkward body postures during nursing care. Cost can be a strain for the purchase of such equipment (Walls, 2001). Nevertheless, a cost-benefit analysis is necessary (McHugh & Schaller, 1997, Smedley & Cooper, 1997, Hildebrandt et al, 2001).

Mechanical aids (lifts, sliding boards, lifting belts) should be the main way of prevention, as it has been shown that the use of such devices reduce LBP incidents (Smedley & Cooper, 1997, de Looze et al, 1998, Hui et al, 2001, Brown, 2003, Hignett, 2003, de Castro 2004).

A very popular way of coping with LBP is visiting a specialized doctor (orthopaedic surgeon or neurologist). Forty one percent of Turkish nurses visited a doctor for managing LBP (Karahan & Bayraktar, 2004). More than one third of nurses in Yip's study (2001) were under medical advice.

Physiotherapy is personalized according to patients' special needs (Cooper et al, 1996). During the acute phase rest with periods of controlled movements, manipulation and traction are recommended. For strengthening the abdominal muscles, as stem stabilizers, as well as for increasing muscle endurance abdominal exercises are suggested, initially one minute duration going up to three minutes. For strengthening the lumbar muscles, as stem stabilizers, and for increasing muscle endurance rachidial exercises are recommended (Kisner & Colby, 1999).

Limitations

The current study found some of the factors affecting the onset of LBP incidents in nurses. Further studies, with more subjects are needed in order to generalise. In addition, a comparison between different hospitals would be of benefit.

Nonetheless, the present study will help to fill a void in this area. It is hoped that it will arouse interest on the theme in Greece.

Conclusion

The research team would like to emphasise that ergonomic planning of workplace environment cannot solve all problems, but it can improve daily nursing practice. A nurse, having undergone ergonomic training, can identify and solve possible problems in the workplace (patient or equipment transfer).

Finally, ergonomic designed working stations (beds, desks, chairs, dialysis chairs) can decrease repetitive movements and bad body postures as well as increase productivity while decreasing pain (an obstacle in delivering nursing care).

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Tables

Table 1. Questionnaire return per ward.

Hospital Wards	Empty	Filled	n
Surgical	5	7	12
Operating Theatre	4	8	12
Nurse Managers	0	2	2
Haemodialysis Unit	1	17	18
Peritoneal Dialysis	1	6	7
Medical	3	11	14
Urology	1	11	12
Orthopaedics	6	7	13
Neurology	8	4	12
Renal	2	4	6
Coronary Unit	6	6	12
Intensive Care Unit	4	4	8
Cardiology	7	5	12
Infectious Disease Department	0	1	1
Emergency Unit	5	3	8
Anaesthetics	1	5	6

Table 2. Sample's characteristics

Body Weight	69.20 Kg	46-140 Kg
Body Height	1.66 m	150-192 m
Body Mass Index (BMI)	25.11 Kg/m ²	20.44-37.97 Kg/m ²

Table 3. Load lift and move.

Movements	Positive answers
Lifting weight of 5kg >1 a day	39
Pushing weight of 5kg >1 a day	35
Moving weight of 5kg >1 a day	36
Lifting weight of 20kg >1 a day	25
Pushing weight of 20kg >1 a day	29
Moving weight of 20kg >1 a day	30

Table 4. Onset of low back pain (LBP) during last year.

LBP per hospital ward personnel	Yes	No
1. Urology ward	10	1
2. Nursing managers	2	0
3. Surgical Ward	6	1
4. Renal Ward	3	1
5. Peritoneal Dialysis Unit	6	1
6. Orthopaedics Ward	7	0
7. Operating Theatre	6	2
8. Neurology Ward	3	1
9. Infectious Diseases Department	0	1
10. Medical Ward	10	1
11. Intensive Care Unit	2	0
12. Haemodialysis Unit	16	1
13. Emergency Department	3	0
14. Coronary Unit	6	0
15. Cardiology Ward	6	0
16. Anaesthetics Department	4	0

Table 5. Low Back Pain (LBP) frequency.

Frequency	Positive answers
Once a day	6
Once a week	9
Once a year	5
Several times a week	13
Several times a month	19
Several times a year	19
After lifting or moving weights	44

Table 6. Type of pain.

Type of pain	Positive answers
Sharp, localized pain	43
Sharp, spread pain	20
Numbness of lumbar area	28
Numbness & burning of foot	29
Chronic pain	13

Table 7. Ways of coping with low back pain (LBP).

Coping mechanisms	Positive answers
I don't do anything	23
Painkillers	47
Rest	31
Back belt	11
Reduce movements at work	7
Reduce movements at home	26
Heat (locally)	20
Musculerelaxants	27
Exercise	7

Efficiency: Concepts, Empirical Investigation and Applications in Greek Hospitals

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Abstract

In this paper the concepts of technical efficiency, distributional efficiency and scale efficiency are presented. Following a brief note on the empirical estimation issues, there is a discussion on the implementation of these concepts in health units and a brief presentation of the main conclusions of the empirical studies on the efficiency of Greek hospitals.

Key - words: technical efficiency, allocative efficiency, scale efficiency, efficiency of Greek hospitals

Introduction

The concept of efficiency is widely used in economics and refers to the optimum use of resources in a productive process. In other words, a production process (or production unit) is effective when is organized in a way that given the production goals set there is no alternative procedure to produce greater benefit when all costs are taken into account (Shubik, 1978).

According to Farrell (1957), efficiency comprises two components: technical efficiency and allocative efficiency. These two elements together make up the overall efficiency. Further, taking into mind the scale of the production process

and the form of returns (fixed or variable) that the technology has we come up with the concept of scale efficiency, which refers to selecting the optimal scale of production. These concepts are linked, and indeed, it is often confusing to use (Rutkauskas and Paulavičius, 2005; Shubik, 1978). However, they are widely used to assess the economic units in general and health units in particular. In this paper we analyze these concepts and indicate their relationship diagrammatically. We also make a note on the empirical measurement of efficiency, with emphasis on three empirical research of evaluating of health units and services in Greece.

2. Types of efficiency

2.1. Technical efficiency

In general, technical efficiency refers to the possibility of an economic unit to produce the best possible product from a given basket of inputs and given technology. Alternatively, technical efficiency is defined as the ability to produce a given quantity of product with the least possible amount of inputs. Therefore, there is inherent an element of comparison in the definition of technical efficiency. In order to decide whether a production process is technically efficient, it compares the actual with the optimal inputs and outputs. Usually this comparison takes the form of a ratio:

Y/Y^* , where Y is the actual product obtained and Y^* is the maximum product obtained with a given input vector X

or

X^*/X , where X is the actual inputs and X^* are the minimum inputs to produce a given output Y

These expressions imply that when an economic unit is technically efficient then it operates on the production frontier, which is defined as the potential production function. This function has the form

$$f(x) = \max\{y: y \in P(x)\} = \max\{x: x \in L(y)\}$$

Where $x = (x_1, x_2, \dots, x_n) \in R_+^n$ is a vector input, $y = (y_1, y_2, \dots, y_m) \in R_+^m$ is a vector of outputs, $P(x)$ is total output and $L(y)$ is the set of inputs (Silberberg, 1978; Varian, 1992).

On this basis, the measurement of technical efficiency of an economic unit has to do with measuring the distance of the combination of actual inputs and outputs of the unit from the potential production function. To measure this distance we use the so-called distance functions (Shephard, 1953), which may be defined with respect to either the inputs or the outputs.

The input distance function is defined as (Shephard, 1953; Lovell, 1993; Färe and Primont, 1995; Kumbakhar and Lovell, 2000):

$$D_i(x, y) = \max\left\{\lambda: \frac{x}{\lambda} \in L(y)\right\}$$

The parameter λ (with $\lambda \geq 1$), refers to technical efficiency. If $\lambda = 1$ then we have technical efficiency, while if $\lambda > 1$ then we have technical inefficiency. Thus, subtracting 1 from λ we have the degree of technical inefficiency and therefore the distance to have a technically efficient production unit.

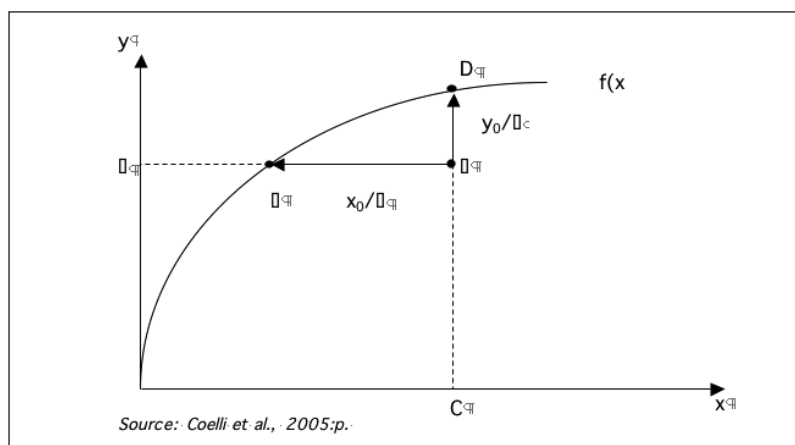
The output distance function is defined as (Färe and Primont, 1995; Kumbakhar and Lovell, 2000):

$$D_o(x, y) = \min \left\{ \mu : \frac{y}{\mu} \in P(x) \right\}$$

The parameter μ (with $\mu \leq 1$), refers to technical efficiency. If $\mu = 1$ then we have technical efficiency, whereas if $\mu < 1$ we have technical inefficiency.

In Diagram 1 we have a production function for one input and one output. Output y_0 is produced with input x_0 , but may also be produced with a smaller quantity x_1 , i.e. a quantity x_0/λ . Therefore, there is a distance from the technically efficient production. Conversely, x_0 can produce output y_0 , but can also produce greater output y_1 , i.e. a quantity y_0/μ . Therefore, there is a distance from the technically efficient production.

Diagram 1. Output and input technical efficiency



Output technical efficiency is given by the ratio CA/CD and input technical efficiency is given by the ratio EB/EA. As A approaches D the distance AD diminishes and the ratio CA/CD tends to unity and thus production becomes technically efficient in terms of output. Similarly, as A approaches B the distance AB diminishes and the ratio EB/EA tends to unity and thus production becomes technically efficient in terms of inputs. We see therefore that the technical efficiency with respect to either inputs or outputs takes values between zero and one. Fully technically

efficient production has the value of one.

The aforementioned refer to the very simple case of a production process which has one input and one output. Diagram 2 shows the measurement of output technical efficiency when one input x is used to produce two outputs y_1 and y_2 . The ratio OA/OB is equal to the degree of technical efficiency, in other words, the distance AB is the technical inefficiency, i.e. whether it could increase output without using a larger quantity of input.

Diagram 2. Measuring technical efficiency in outputs (one input, two outputs)

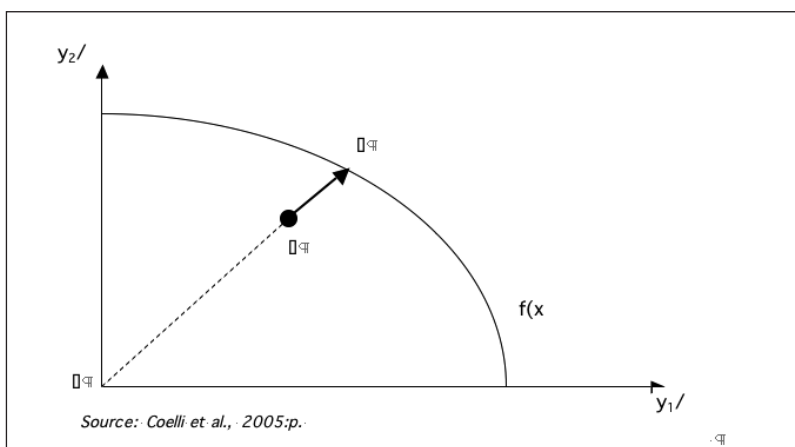
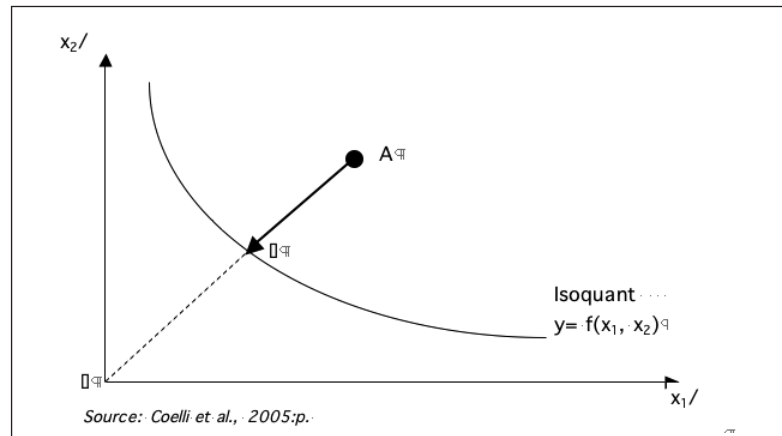


Diagram 3 shows the measurement of input technical efficiency in the case of a production process where two inputs x_1 and x_2 produce one output y .

The ratio OB/OA is equal to the degree of technical

efficiency, in other words, the distance AB is the technical inefficiency, i.e. by how much inputs could be proportionately reduced without reducing the quantity of output produced.

Diagram 3. Measuring technical efficiency in inputs (two inputs, one output)

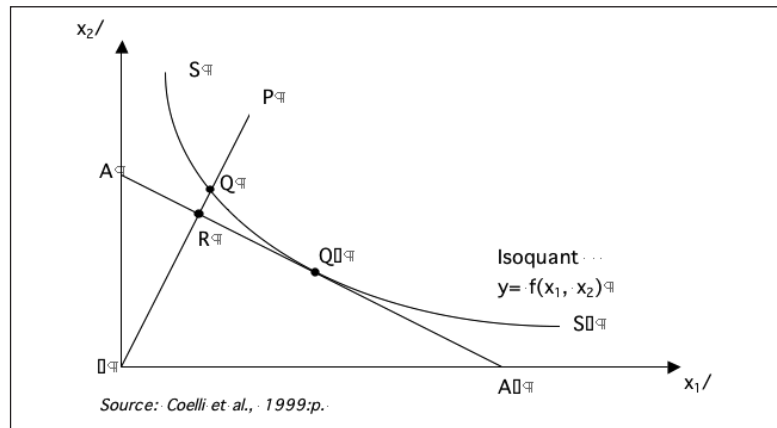


2.2. Allocative efficiency

The allocative efficiency, or price efficiency according to Farrell (1957), refers to the ability of an economic unit to use the optimal amounts and ratios of inputs given their cost. In other words, we have allocative efficiency when given the input prices an economic unit produces outputs that maximize revenue, or when the mix of inputs minimizes cost

(Farrell, 1957). Diagram 4 shows a production process with two inputs x_1 and x_2 which produce an output y . Line AA' is the ratio of input prices, while isoquant $y = f(x_1, x_2)$ derives from the production function and represents all possible combinations of inputs x_1 and x_2 in order to produce a given output level.

Diagram 4. Distributional efficiency



All points along the isoquant are technically efficient, as, by default, it represents production of the highest possible product from the inputs. Points to the right of the isoquant are technically inefficient. For example, at point P we have technical inefficiency which is reflected in the distance PQ. At point Q, however,

although we have technical efficiency, we have allocative inefficiency because we can produce the same quantity of product with less cost at point Q. The distance RQ is the reduction in costs we would have if production was at the allocatively efficient point Q (Lovell, 1993; Colli et al., 2005).

2.3. Total efficiency

The combination of technical and allocative efficiency gives us the overall efficiency. In terms of Diagram 4, the overall efficiency is the ratio OR/OP , whereas the cost that can be

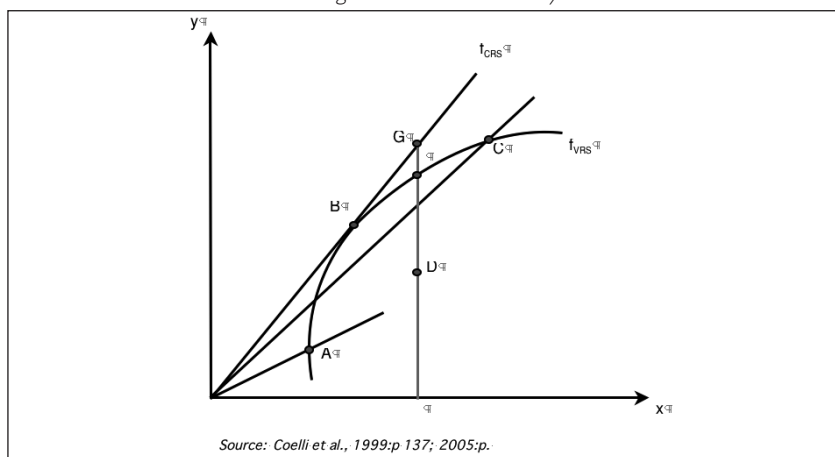
saved is given by the distance RP. As the point of production moves from P to Q, more cost is saved.

2.4. Scale efficiency

A production unit could operate at a small scale, where the production function exhibits increasing returns or at a large scale, where the production function exhibits decreasing returns. Efficiency can be improved in both cases if the scale of

productions changes (Hannesson, 2005). Diagram 5 shows a production technology (production function) with constant returns to scale fCRS and a production technology with variable returns to scale fVRS.

Diagram 5. Scale efficiency



Source: Coelli et al., 1999:p 137; 2005:p.

Points A, B, C and E, which are on the function f_{VRS} are technically efficient, in contrast to point D, which displays technical inefficiency equal to the distance DE. Points A, B and C have different average product which is equal to y_A/x_A , y_B/x_B and y_C/x_C , respectively. The average product can also be measured by the slope of the ray passing through each point. The difference in the average cost at these points is due to the existence of economies of scale. In point A we have increasing returns to scale and average product may

increase as we move to point B. The opposite is true in point C, where we have decreasing returns to scale and average product can be increased if we decrease the scale of production to point B. Therefore, Point B corresponds to the maximum average product and is the point of optimal production scale. The production function with constant returns to scale is identical to the radius through point B and is essentially the tangent of the production function with variable returns to scale.

3. Methods of empirically estimating efficiency

In the empirical research there are two main approaches to estimate efficiency, as shown in Diagram 6 (Fried et al. 2008; Greene, 2008; Thanassoulis et al., 2008; Färe et al., 2008).

The main feature of the parametric and econometric methods is the use of stochastic equations, which separate the effect of random error and inefficiency (Fried et al., 2008). On the other hand, non-parametric methods help to avoid confusion between specification errors and inefficiency (Fried et al., 2008). The non-parametric methods include the Data Envelopment Analysis (DEA), developed by Charnes, Cooper and Rhodes (1978) and the Free Disposal Hull method (FHD), developed by Deprins, Simar and Tulkens (1984).

4. Efficiency in health units

The literature of empirical studies on efficiency is very extensive and covers all sectors of the economy. Specifically in health, these studies started in the decade of 1960 (Lave and Lave, 1970), while in the last two decades are multiplied at an increasing rate. Hollingsworth (2003) presents a review of 188 relevant studies up to 2002, most of which refer to the estimation of technical efficiency using non-parametric methods. In a previous review, about five years ago (Hollingsworth et al., 1999), the number of studies reviewed was less than half. Both these reviews highlight the difficulties concerning the nature of the data and in

Understandably, a question arises as to which method is best and whether the results would be different if the same set of data is used with the parametric and non-parametric method. Several empirical studies have raised this question; the answer is that the better and more complete the datasets the closer are the results of both methods (Fried et al., 2008). For example, in a study of U.S. banks (Bauer et al. 1998), a very high degree of correlation was found between the results of two alternative parametric methods and between two alternative non-parametric methods, while a relatively high degree of correlation was found between the results of parametric and non-parametric methods.

particular the difficulty of measuring actual outcome, as well as an increased likelihood of severe bias due to omission of variables. Most studies are dealing with the efficiency of hospital units and use as inputs the number of physicians, the number of nurses, the number of beds and the cost of medicine and sanitary materials, whereas as outputs they use the length of stay in the hospital and the number of hospitalized patients. Quite common is the use of dummy variables to characterize the legal status of the hospital (private or public), the location (urban or regional), size, etc.

4.1. Empirical studies on the efficiency of hospitals in Greece

Most studies on the efficiency of hospitals in Greece are using the method of DEA, while some use the econometric - parametric approach (Table I). There are studies that

generally referred to hospitals and others that focus on some particular departments, e.g. nephrology, cardiology, etc. (Economou et al., 2007).

It is perhaps worth noting at this point some limitations of the analysis. First, the results of the studies are hardly comparable across countries, as not only the methodologies are different from country to country, but also the type of hospitals and the broader institutional framework. It should also be noted that because of the difficulty of measuring the actual effect of treatment, which is to improve the health

status of citizens, it is common practice to use proxies such as the number of incidents, diagnostic checks, etc. The same happens with the inputs, with commonly used proxies the number of doctors, nurses, etc. This of course does not include factors of quality of service, which is critical in achieving health outcomes for the patient and in general for the efficiency of the hospital.

5. Conclusion

The measurement of efficiency as a component of economic evaluation is increasingly widespread application in health economics worldwide, especially in light of the increasing health costs that create fiscal problems in all countries and bring forth the requirement to all stakeholders and the society at large to know whether the resources allocated ensure the achievement of optimal results.

The analysis of efficiency is a necessity for Greece, where there are gaps and significant cost inefficiencies, as shown by studies of individual researchers at academic level. Public health

authorities at the central government level but also management authorities of health units should incorporate the relevant measurements on a regular basis in their daily operation, and to adopt practices of economic evaluation for health programs and the various alternative therapies. This will provide valuable tools in both the management of health units to make rational decisions, and central government to effectively exercise their supervising role, leading ultimately to the efficient functioning of the health system and enhance the services provided to the citizens.

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Table 1. Empirical studies of efficiency of Greek hospitals

Study	Methodology	Number of hospitals	Time period	Main results
Aletras et al., 2007	DEA Inputs: number of physicians, number of other staff, number of beds Outputs: number of inpatients, number of outpatients, number of operations	51 NHS hospitals	Years 2000 and 2003	Technical efficiency and scale efficiency are reduced after the NHS reforms introduced by Law 2889/2001
Athanassopoulos et al., 1999	DEA Inputs: number of pathologists, surgeons, microbiologists, nursing and administrative staff number of beds Outputs: number of patients, number of diagnostic tests, number of clinical tests	98 NHS hospitals	1992	It is possible to improve both technical and cost efficiency
Athanassopoulos and Gounaris, 2001	DEA Inputs: number of physicians, number of nursing and administrative staff, administration costs, cost of medicines Outputs: number of patients, number of diagnostic tests, number of clinical tests	98 NHS hospitals	1992	Significant inefficiencies in the system that cost about 100 million Ecu in 1992, prices
Giokas, 2001	DEA and econometric estimation of cost functions	91 public hospitals	1992	Around 20% of the cost can be saved, while the inefficient hospitals can provide the same services at a reduced daily per patient cost by 2.6%. Also, 4,1% of health expenditure as a percentage of GDP is due to inefficient functioning of the hospitals
Kontodimopoulos et al., 2007	DEA Inputs: number of physicians, number of nursing and administrative staff Outputs: number of patients, number of diagnostic tests	133 NHS health centers and 118 IKA clinics	2004	The IKA clinics have higher technical and scale efficiency than the health centers. About 75% of the units operate with increasing returns to scale
Economou and Giomo, 2009	DEA	Health system	1990 – 2006	The Greek health system form the 3rd position in 1990 among the OECD countries fell in the 12th place in 2006 in terms of efficiency
Polyzos, 2002	Econometric estimation of two equations with dependent variable the average length of stay and cost of treatment per patient. Number of observations 104,688 people	22 hospitals (average length of stay equation) 127 NHS hospitals (per patient cost of treatment equation) 133 IKA clinics	1995 and 1993 for the two equations respectively	Hospitals with 250 – 400 beds are the most efficient while the main factors affecting the average length of stay are hospital size and type, number of specialists, access to outpatient clinics, age, sex and family status of the patient etc.
Zavras et al., 2002	DEA Inputs: number of staff by category, population covered Output: annual number of visits	133 IKA clinics	1998 – 1999	Clinics which have diagnostic equipment are more efficient, as well as those that cover 10,000 to 50,000 people

Nursing Personnel as a Must-be Quality Characteristic in a Public Hospital

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Abstract

Nursing care covers the whole range of hospital services. In many surveys, patient satisfaction from nurse care has been identified as the most important factor influencing overall patient satisfaction. This paper refers to a part of a wider survey aiming to categorize services provided by a public hospital on the three levels of quality, according to Kano's model. Based on the model, the quality characteristics are grouped on three distinctive levels: expected quality (characteristics deemed as given/basic), desired quality (characteristics whose performance affects satisfaction) and attractive quality (characteristics which create added value and can bring high levels of satisfaction). The paper analyzes the results of the survey on citizen satisfaction from the local public hospital and categorizes the characteristics on the three aforementioned quality levels. One of the parameters examined was personnel, further analyzed in medical and nursing personnel as well as other supporting personnel. The results show that the personnel in general and the nursing personnel in particular is a must-be quality characteristic, and thus it constitutes a major component of the services provided by a public hospital.

Keywords: quality in health services, nursing personnel, Kano's model

I. Introduction

The significant cost of health services and the increased needs of patients have resulted in laying more emphasis on measuring the quality of health services and patient satisfaction (Bond and Thomas, 1992; Fitzpatrick, 1991). In many countries, mainly USA and Great Britain, both quality measurement of health services and participation of patients in improving the quality of health care are regulated by law.

Although patient satisfaction from health services is a concept easily understood by common sense, no generally accepted conceptual definition may be found (Bond and Thomas, 1992). The concepts of patient satisfaction and patient perceptions on quality are often used alternatively, while according to Oberst (1984) there is a difference between the two terms. Petersen (1988) claimed that satisfaction is the patient's general perception of how healthcare is provided, where patient is not totally aware of the results or appropriateness of healthcare. According to Smith (1992), patient satisfaction is a combination of perceived needs, expectations and experience from healthcare.

Within the framework of investigating patient satisfaction from the public hospital of the town of Chania, a survey was carried out aiming to measure the satisfaction of citizens (year 2003). The presented research is based on the satisfaction data collected in the aforementioned survey in order to classify the hospital characteristics in connection with the three levels of quality proposed by Kano (Kano, 1984). A special questionnaire is developed for the purpose of this survey, while the assessment of the satisfaction criteria is based on the principles of multicriteria analysis forming a consistent family of decision criteria (Jacquet-Lagrèze & Siskos, 2001). Moreover, the management of the hospital have been also involved in this assessment process. It should be noted that the survey aims to determine the opinion of citizens for the public hospital which was moved in a new building in September 2000.

The survey questionnaire includes questions targeting the personal opinion of participants either as in-patients or out-patients or finally as visitors/persons accompanying patients. In

particular, the survey was carried out with a simple yet properly structured questionnaire, which includes six criteria: hospital location, facilities and infrastructure, hygiene, personnel, service and additional services. Each dimension of the satisfaction survey was analyzed into a number of subcriteria. In particular, the personnel criterion included three dimensions: medical and nursing personnel and other supporting personnel. International bibliography extensively refers to the correlation of patient satisfaction, particularly in regard of hospital medical and nursing personnel.

It follows from the demographical characteristics of the sample (N=177) that 59% are men and 41% women. Also, 99% of the sample has formed an opinion on the new hospital either as in-patients (20%), or as out-patients, or finally as

2. Kano's model

Customer satisfaction in most cases is related to perceived quality. The higher the quality, the higher the customer satisfaction and vice versa. However, fulfilling the individual product/service requirements to a great extent does not necessarily imply a high level of customer satisfaction. For example, when a pen writes the user is not highly satisfied but when it doesn't the user is completely dissatisfied (Vavra, 1997).

On the other hand, when somebody usually waits in a bank queue for ten minutes if on any given day he/she is served earlier, this unexpected event becomes a satisfaction situation. Kano's model proposes three types of product/service requirements (Fig. 1), which, when met, affect customer satisfaction in different ways.

Based on this model, customer satisfaction is not a one-dimensional concept. The three types of product/service requirements in Kano's model are:

1. Must-be requirements. These are basic characteristics of a product/service. If these requirements are not fulfilled, the customer is completely dissatisfied while on the contrary if they are fulfilled they do not affect satisfaction. The customer regards these characteristics of a product/service as prerequisites and does not ask for them. Usually, these requirements are obvious, not-expressed, implied or self-evident. For example, when a customer buys a pen it is implied that it can write. The 'must-be', as they are called, attributes constitute the 'expected quality' of a product/service.

2. One-dimensional requirements. The one-dimensional requirements, when fulfilled, affect satisfaction in an analogous way. The higher the level of fulfilment the higher

3. Methodological framework

The presented methodological framework is based on the comparative examination of the relationship between the derived importance of two target groups: satisfied and non-satisfied customers. The main idea of the approach is based on the fact that the importance level of a quality characteristic is not fixed, yet it depends on its performance, as expressed by the customer satisfaction level. Accordingly, we examine separately the opinions of satisfied and dissatisfied citizens.

In the first stage we collect data regarding the opinions of citizens, as expressed on the specially formulated

visitors/persons accompanying patients. The age distribution of the sample is: 27% up to 25 years old, 20% from 26-35, 20% from 36-45, 12% from 46-55 and 21% over 55 years old.

The MUSA, multicriteria satisfaction analysis, method (Grigoroudis et al., 2002) is used to analyze the survey data, while the satisfaction or non-satisfaction expressed by citizens was used to classify the criteria and subcriteria according to Kano's model.

In section 2 there is a brief presentation of the Kano's model. The methodological framework is presented briefly in section 3, which includes the derived importance assessment through the MUSA method and the Dual-Importance diagram. The application is presented in section 4, focusing on the results concerning the personnel.

the satisfaction level and vice versa. Usually, these attributes of a product/service are explicitly demanded by the customer and constitute what is called as 'desired quality'.

3. Attractive requirements. The attractive requirements have the greatest influence on satisfaction. They are neither explicitly expressed nor expected by the customer. Fulfilling these requirements leads more than an analogous increase of satisfaction, as is the case of the unexpected earlier service than the usual time spent on a bank queue. On the contrary, if these requirements are not met, they do not imply dissatisfaction. The characteristics of a product/service which cause delight to customers represent the 'attractive quality'.

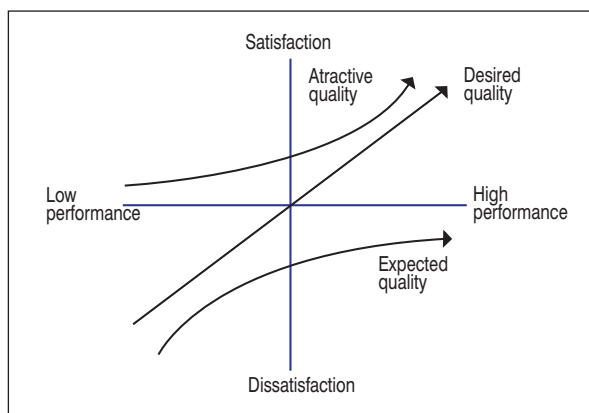


Figure 1. The three quality levels of Kano's model

questionnaire of the satisfaction survey. With this questionnaire, the citizens are asked to express their satisfaction using questions such as: 'How satisfied are you from ...?'. The answers were given on a 5-point qualitative scale ranging from 'completely satisfied' to 'completely dissatisfied'. In the second stage, we separate the answers of satisfied and dissatisfied citizens for each criterion/subcriterion of the survey and we apply the MUSA multicriteria methodology to estimate the importance of each characteristic per group of citizens. MUSA is used to estimate the weights for both

satisfied and dissatisfied citizens, and the dual importance diagram is plotted accordingly (Fig. 3), which categorizes the characteristics of the hospital on the three quality levels of Kano's model. For the methodological framework see Fig 2.

Quadrants I and III include the characteristics which are of the same importance for either satisfied or dissatisfied citizens (see Fig. 3). The coincidence of views between satisfied and dissatisfied customers highlights attributes for which customers do not attach high importance when satisfied, while on the contrary they consider them to be important when not satisfied. According to Kano's model, desired quality is related to the characteristics of a product/service whose low performance creates dissatisfaction while high performance creates satisfaction, therefore we could say that quadrants I and III include the one-dimensional characteristics. An improvement in the quality of these characteristics will apparently result in the proportional increase of satisfaction in both groups of satisfied and dissatisfied citizens, taking into consideration that satisfaction is associated with importance.

In quadrants II and IV the derived importance between satisfied and dissatisfied citizens is diversified. In particular, quadrant II contains the characteristics for which dissatisfied citizens attach higher importance compared to satisfied citizens. In this case, these characteristics seem to affect dissatisfaction to a higher degree compared to satisfaction. When the importance of a characteristic is connected to satisfaction we get the must-be characteristics of expected quality: if their performance is high citizens are satisfied yet they do not express such satisfaction, but if their performance is low citizens express clear dissatisfaction. In quadrant IV it's the exact opposite. Dissatisfied citizens attach lower importance to these characteristics and it appears that their dissatisfaction is not due to their possibly low performance. It is true that if a characteristic is of a given low performance and this does not affect satisfaction, then any sudden

improvement in its performance would cause unexpected satisfaction. In this sense, the characteristics of quadrant IV are those of attractive quality.

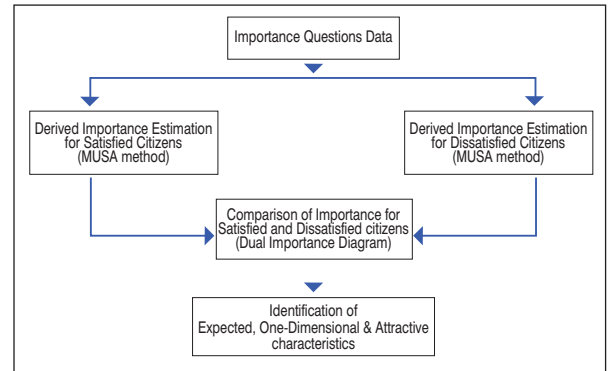


Figure 2. Methodological framework

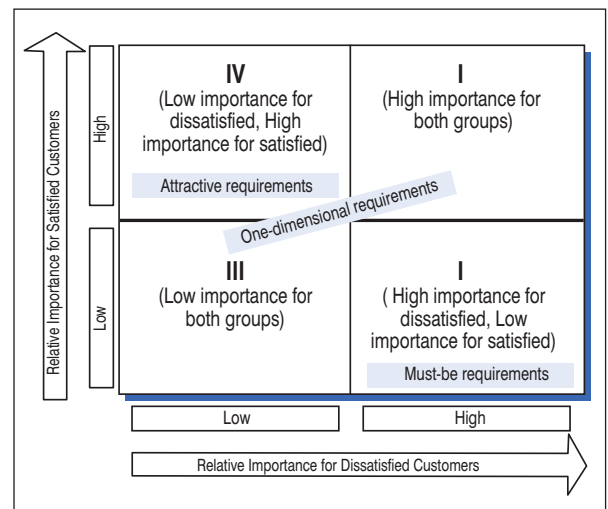


Figure 3. Dual-Importance Diagram (Better-Worse Diagram)

4. Results for personnel

It follows from the results of the proposed approach that personnel belongs to domain II of the must-be quality characteristics. Therefore, personnel as a satisfaction measurement criterion has high importance for dissatisfied citizens and of low importance for satisfied citizens, respectively. Namely, it appears that the personnel criterion affects to a higher degree dissatisfied citizens which, partly, justifies the dissatisfaction expressed.

The question is why. The analysis on the three separate parameters of personnel (physicians, nurses, other personnel) showed that nurses belong to the same quadrant II of the satisfaction-dissatisfaction diagram. Therefore, citizens consider personnel as a must-be quality characteristic, which is directly linked to nurses. Namely, the nursing personnel as a must-be characteristic of expected quality generally explains the citizens' opinion of the hospital personnel. The citizens' opinion of personnel is linked to nursing care which, when sufficient, does not cause satisfaction, yet when insufficient causes high

dissatisfaction. Within this meaning, citizens consider the performance of nursing care as granted, therefore it is not demanded yet implied. It is deemed to be given, existent and available. Therefore, it should be stressed that the nursing personnel as a key quality factor of the hospital is expected to be available, while at the same time it determines certain levels of acceptance on the part of citizens. The high performance of the nursing care does not bring satisfaction but it simply eliminates the dissatisfaction of citizens.

This approach showed that particular importance must be attached to the nursing personnel in a public hospital, in the sense that it affects to a higher degree the dissatisfaction of citizens and it is identified with the people's view of personnel in general. This practically means that the nurses' shortcomings or any other relevant inadequacies affect dissatisfaction to a high degree.

With regard to the other two subcriteria of personnel, physicians were included in quadrant IV of the attractive

characteristics while the other personnel, as expected, was included in quadrant III of the one-dimensional quality characteristics, respectively. The inclusion of physicians in quadrant IV means that if, for some unexpected reason, citizens have a better opinion of the medical personnel, this can dramatically affect their satisfaction. Namely, the citizens' opinion for the medical personnel does not create dissatisfaction or does not affect their satisfaction. If, however,

citizens have a better opinion of the medical personnel, then this will unexpectedly result in high satisfaction. In practice, this can result from an increase in the number of the medical personnel, the coverage of vacant specialties, the operation of units which were not operative or fully operative, etc. In respect of the hospital's personnel of remaining specialties, it appears that the improved performance relatively affects citizen satisfaction.

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Recorded Cases at the Emergency Department of the General Hospital of Lamia Town during the Year 2005 in Association with Helio-geomagnetic Activity.

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Abstract

Background: The terrestrial life owes its existence to the sun which is a source of electromagnetic radiation, light and heat. The adverse effects of eruptive solar phenomena on biosphere and especially on human health became of interest during the last twenty years (heliobiology), while their influences on terrestrial and space technological instrumentation is already well known. Although several studies over the world have been performed and possible mechanisms have been proposed; this issue remains under scrutiny.

Objective: We aimed to study the increase or not of the emergency cases arrival at the Emergency Department of the General Hospital at the city of Lamia during 2005, in order to examine the possible effects of geomagnetic storms on human health, physically and psychologically, resulting in possible increased demand of Health Services.

Method and material: The sample of our study included all patients of any age that attended the Medical and Surgical Sections of the Emergency Department at General Hospital of Lamia from 1/1/2005 to 31/12/2005. We used patients' records to collect data. Anonymity and confidentiality were always kept. There were 37.513 recorded cases. Data was encoded according to diagnosis and stored electronically. Microsoft Office Excel 2003 program was used. Data was then associated, according to time, with the geomagnetic index Dst; Dst is utilized to assess and depict geomagnetic storms evolution, the number of flares and CMEs (Coronal Mass Ejections) as well as solar wind parameters. All previous information was extracted from space observations after proper processing. Microsoft Office Excel 2003 and Origin 7 were also used.

Results: The helio-geomagnetic activity (non-photic effect) seems to affect human health since there was an increased number of cases that arrived at the Emergency Department of Lamia's General Hospital during periods of increased geomagnetic activity as well as intense flares. It appears that there is a time coincidence with the helio-geomagnetic activity. The influence is more evident on cardiological, oncological, neurological, orthopedical and, partially, on pathological cases. For these categories of patients, higher incidence was recorded generally on January (a month with extraordinary helio-geomagnetic activity), March (a month of maximum occurrence of flares in the last 12 years), May and August (months with strong geomagnetic storms).

Conclusions: The present conclusions add to the existing international literature, strengthening the estimated situation of the middle latitudes and especially Greece where little research has been conducted.

Implications for clinical practice: This study could contribute to adequate staffing as a prognostic index and play a role in the preparation of Health Services.

Key words: helio-geomagnetic activity, geomagnetic storms, solar activity, solar-terrestrial relations, health, cardiological cases, oncological cases, neurological cases, orthopedical cases.

I. Introduction

Space weather is the sum of all conditions in Sun, solar wind, magnetosphere, ionosphere and thermosphere that influence the work and credibility of space and terrestrial technological systems as well as may endanger human life and health (NOAA, Space weather Center). Space weather also influences biosphere. All sorts of this kind of influence on various biological and physiological systems are very important. The issue of solar phenomena during solar activity (non-photoc effects) and their consequences on terrestrial magnetosphere phenomena that influence human health is under discussion over the last decades. Moreover, there is a new scientific branch called heliobiology that studies these phenomena. Large studies all over the world have suggested probable mechanisms through which a number of solar and geophysical parameters can influence human health.

During solar activity, which appears with sunspots increase, unforeseen intense solar eruptive events can be observed; flares and coronal mass ejections (CMEs) which set free enormous amounts of energy and mass (solar plasma). Those born waves, particles, especially of high energy (electrons and protons) and radiation from radio to X and Gamma rays arrive on Earth's magnetosphere and ionosphere through the solar wind. The solar wind is the continuous solar plasma flux into the interplanetary space (Kivelson, 1995). Serious disturbances in the magnetosphere (terrestrial magnetic field), the ionosphere (electric currents), the upper atmosphere and the atmospheric electric current are observed. These disturbances are called magnetic storms. The arrival time of these particles or electromagnetic radiation resulting from solar phenomena (flares and CMEs) (not necessarily at the same time), is about 8 min for radiation (X and gamma rays, radio bursts etc.), a few hours for cosmic rays and high energy particles and 2-3 days for CMEs (fast magnetic solar plasma).

When the terrestrial geomagnetic environment is disturbed, a direct or indirect influence on human physiology

is normal to occur. A person is associated with the external environment (e.g. temperature) and is dependent of its fluctuations. However, the environment is not only about the atmosphere and the visual radiation. It also encompasses the electromagnetic field, the acoustic waves, the earthquakes etc. Not being able to see these events (e.g. the ultraviolet radiation) does not mean they don't exist. This is the case for the electromagnetic field.

The idea that these phenomena can have an influence on people was faced with skepticism at first. However, the last twenty years studies add up to the conclusion that the association between helio-geomagnetic disturbances (geomagnetic storms) and human health has true biophysical grounds. Among other studies (Palmer et al, 2006), researches in the middle latitudes similar to Greece, i.e. Israel (Stoupelet et al, 1994), Italy, (Gavryuseva et al, 2002), Bulgaria, (Dimitrova, 2006), Mexico and Cuba (Mendoza et al, 2004), suggested such an influence.

The objective of this pilot study is to investigate the fluctuation of emergency arrivals at the Emergency Department of the General Hospital of Lamia during 2005 in order to assess any time association between geomagnetic storms and human health, physically and psychologically, resulting in increased demand of Health Services.

Ethical considerations: The authors obtained permission from the administration of the General Hospital of Lamia town. Data collection was based on patients' records. Anonymity and confidentiality were kept at all times.

Sample: Our sample included all recorded cases of any age, at the Emergency Department of General Hospital of Lamia town who attended Medical and Surgical Sections from 1/1/2005 to 31/12/2005.

2. Data selection and analysis

2.1. Data selection from the Emergency Department

At first, the selection of Emergency specialties was necessary since emergency cases of different diagnosis arrive in this Department every day. As a consequence, a triage according to diagnosis is made. The increased incidence of diseases was associated with seasonal variations (weather, climate), as well as with increased or not

helio-geomagnetic activity (space weather).

Data was collected from the Emergency Department's registry (medical and surgical sections, table I). Demographic characteristics (age and sex), arrival date and time, nursing details and diagnosis were recorded. The sample consisted of 21.872 and 15.641 cases from the Surgical and Medical section respectively.

Cases	Medical section %	Surgical section %
n	15641	21872
Male	7872	11904
Female	7769	9969
Adolescents		
<20 YEARS	1071	4367
Young adults		
20-40	3488	6445
Middle aged		
40-60	3457	4664
Older adults		
60-80	5580	4839
Overaged >80	1722	1303
Without age entry	323	254

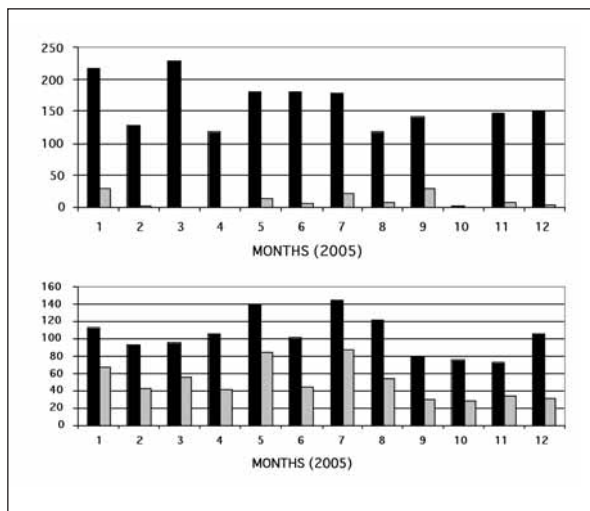


Table 1: Recorded cases in two Emergency Department's sections at Lamia General Hospital, during 2005, according to section, gender and age.

Data collection was performed under a specific protocol for retrieving info from patients' records by using digital cameras, taking into account anonymity and confidentiality. Then, data was encoded and inserted in a PC for analysis. Microsoft Office Excel 2003 was employed. Results are presented in tables, graphs with monthly and daily distributions. Figure 1: Distribution of eruptive solar activity, flares and CMEs during 2005. Major flares and CMEs are presented in gray color.

2.2. Solar and Geomagnetic Activity during 2005

Solar activity is reported according to sunspots number observed on the solar disk and appears in almost eleven year cycles (solar cycle). The 23rd solar cycle started in 1996 with low sunspots number (solar minimum), peaked (high sunspots number) in 2000-2001 (solar maximum) and ended in 2007 with low sunspots number (solar minimum). Many and intense solar eruptive events (flares and CMEs) are generally observed during the solar maximum periods triggering geomagnetic storms. However, some extraordinary, intense solar eruptive events can be observed during solar minimum.

During 2005 (solar minimum), this happened especially on January and it is the reason why we selected this particular year in our pilot study.

The monthly flares and CMEs numbers (eruptive events) are indicative of the extreme solar activity (Figure 1). From solar eruptive events, which are randomly emitted to interplanetary space, apart from electromagnetic radiation, high energy particles (mainly protons) called solar particle events (SEP) are also emitted, with usual energy levels >30 MeV per nucleon. Also, solar cosmic rays (energy of GeV) called Ground Level Events (GLE) arrive on Earth surface in extreme conditions. Only 69 GLEs are reported since 1942. The last two were observed on 17th and 20th of January 2005. Moreover, a high flare number (230!) was recorded on March 2005, which is way over solar maximum. On the contrary, the absence of flares characterized October 2005.

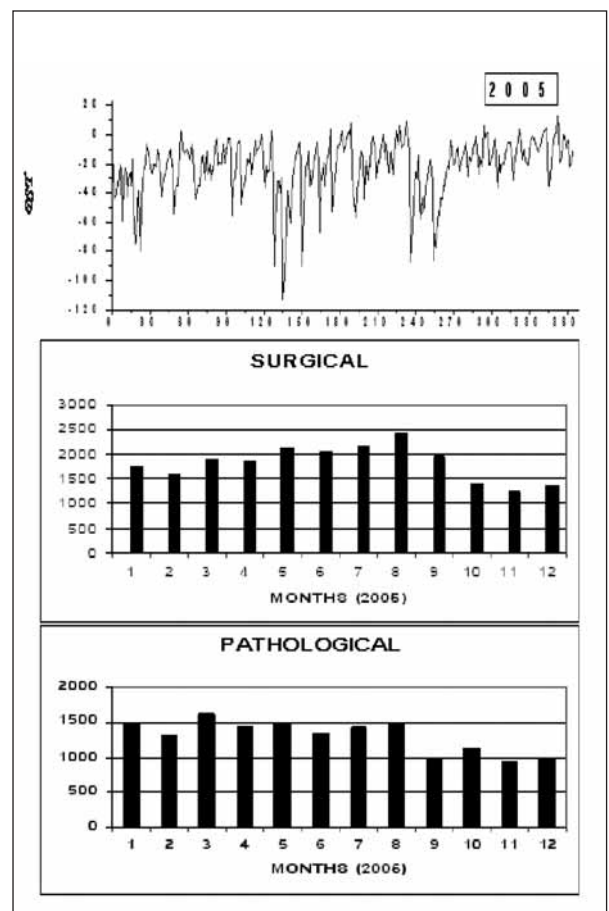


Figure 2
Upper graph: Dst geomagnetic index depicting the sequence of magnetic storms during 2005. Values under -40nT indicate magnetic storms, while, values under -100nT indicate very strong magnetic storms.
Middle-Lower graphs: volume of recorded cases by month at surgical (middle) and medical (lower) sections of E.D.

Finally, strong geomagnetic storms were recorded on May until September (the most intense on May and August) and a sequence of magnetic storms followed the solar extreme events on January (Figure 2, upper part). Absence of solar and geomagnetic activity was observed after September. We used Dst index, which is the world average value of equatorial geomagnetic field disturbance, to estimate and depict the evolution of geomagnetic storms. Values smaller than -40 nT present geomagnetic storms, while values smaller than -100 nT indicate intense geomagnetic storms. Thus, three periods with different helio-geomagnetic characteristics are observed (Figure 2):

1) **January–April:** On January, extreme solar activity with high flares number; 2 GLE- SEP (17-20th of January) as well as a sequence of geomagnetic activity is observed. This activity decreases until April. However, on March the highest monthly flares number (230 flares) of the 23rd solar cycle was recorded.

2) **May–September:** Strong geomagnetic storms which peaked on May, with a decreasing rate until July. A second sequence of strong geomagnetic storms followed on August–September.

3. Results

3.1. Monthly distribution of Emergency cases during 2005

Dst geomagnetic index and monthly recorded cases of Emergency Department (Medical and Surgical sections) for the year 2005 are presented in figure 2. There is an evident increase in cases on May until August; a period with strong geomagnetic storms. On the contrary, a reduction in cases was recorded after September which is the period of absence of helio-geomagnetic activity. Moreover, an increase of cases appeared on March; a month characterized by the maximum number of flares of the 23rd solar cycle. Especially in medical section, increased number of cases was reported on January, March, May and August.

In surgical section patient arrivals (58%) is higher than in medical section (42%) (table I). Also, there is an increased number of males in surgical section (54%) while there is almost no difference between genders at medical section. With regard to age, rates differ between the two sections. Thirty percent of surgical section's cases fall between the age of 20-40, while 36% of medical section's cases were between 60-80 years of age. Patients of 40-60 years of age visited both sections equally (21-22%). Patients under 20 visited mainly the surgical section, while, patients over 80 mainly visited the medical section. A monthly cases' analysis according to diagnosis follows.

3.1.1. Emergency cases and seasonal variations

Monthly distribution of cases for Medical and Surgical section according to diagnosis (pathological, gastrointestinal, otorhinolaryngological (ENT), pneumonological, dermatological and ophthalmological cases) is presented in Figures 3 and 4. Increased number of cases was recorded in spring and summer time.

Pathological cases: Increased number of cases appeared

3) **October–December:** Absence of geomagnetic storms. Also, on October (and only during that month) no flares were observed.

2.3. Data Analysis

Based on the above description, monthly and daily associations between emergency cases number and flares number; CMEs number; solar wind parameters and geomagnetic storms (Dst index), were examined. Data from the Emergency Department's registry was encoded and inserted in a PC. It was classified according to diagnosis. Tables, monthly and daily graphs are presented.

The increased or not helio-geomagnetic activity is expressed by the geomagnetic index Dst, number of flares, CMEs number and solar wind parameters (velocity, density, temperature and magnetic field). These data was obtained by space observations (GOES and SOHO satellites) and OMNI DATA BASE. Tables and graphs derived using appropriate calculations.

An association between spatial data and collected data from patients' records was attempted, taking into account seasonal factors.

on March to August at medical section with three peaks appearing on January (extreme helio-geomagnetic activity), on March (solar flares maximum) and May (strongest geomagnetic storms) for patients at surgical section. In summary, increased number of cases was recorded in spring and summer time. However, there is a time coincidence between the number of recorded cases and helio-geomagnetic activity at surgical section.

Gastrointestinal cases: There was an increased number of cases at medical section on March, May and July, while the maximum number of cases appeared on January. For the surgical section, increased number of cases was recorded on May–September with maximum reached on July –August, March and January. This shows that increased number of cases was reported in spring and summer time as well as on January.

Pneumonological cases: In medical section, there was an increase from February to May with maximum on March. In surgical section, increased number of cases was reported on February to April with maximum on April, that is, increased number of cases was recorded in spring time.

ENT cases: There was an increase in medical section on January to April with maximum on March. In surgical section there was an increase from January to March and May to August, with maximum on August. There is a different distribution of cases between the recordings of two sections. In surgical section increased number of cases was reported in summer time while in medical section increased number of cases was reported in spring time as well as in winter.

Ophthalmological cases: A higher number of cases was reported in medical section on May and July–August, while, in surgical section on March, May–June and August–September, which means that that increased number of

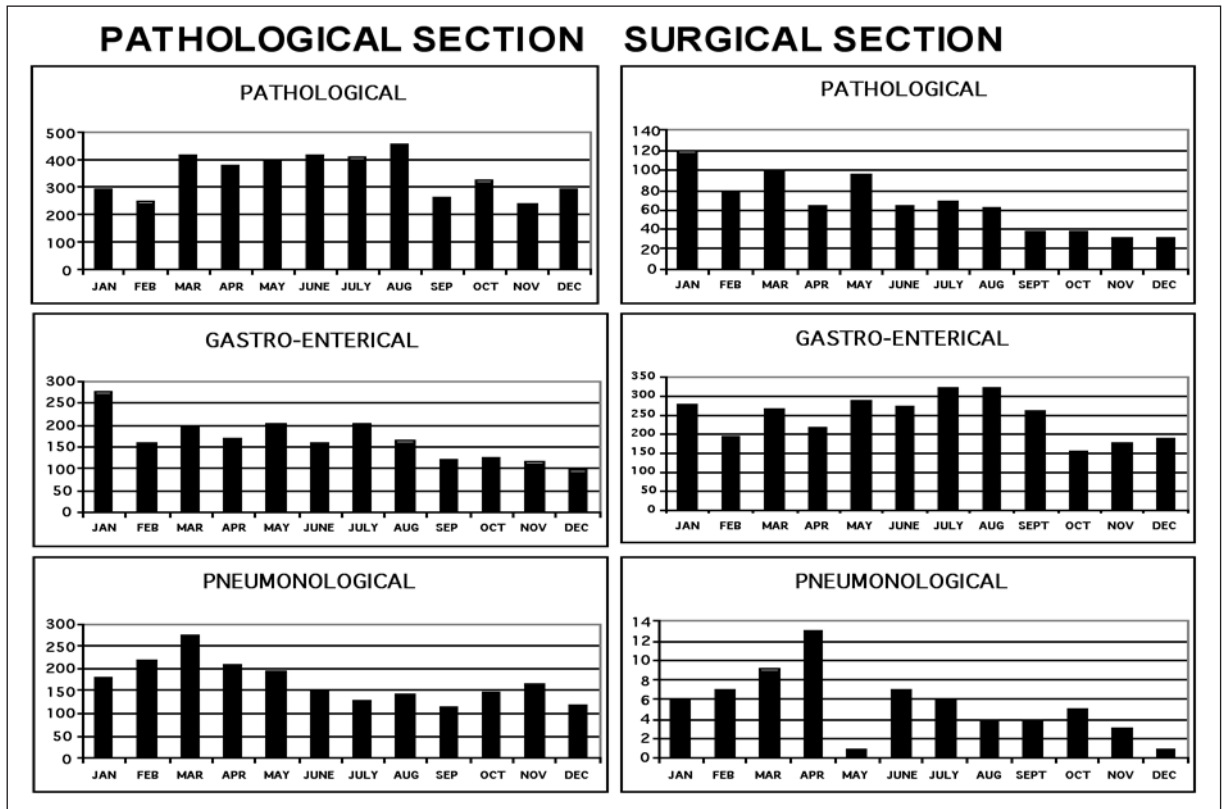


Figure 3: Monthly distribution of recorded cases at Lamia's General Hospital.

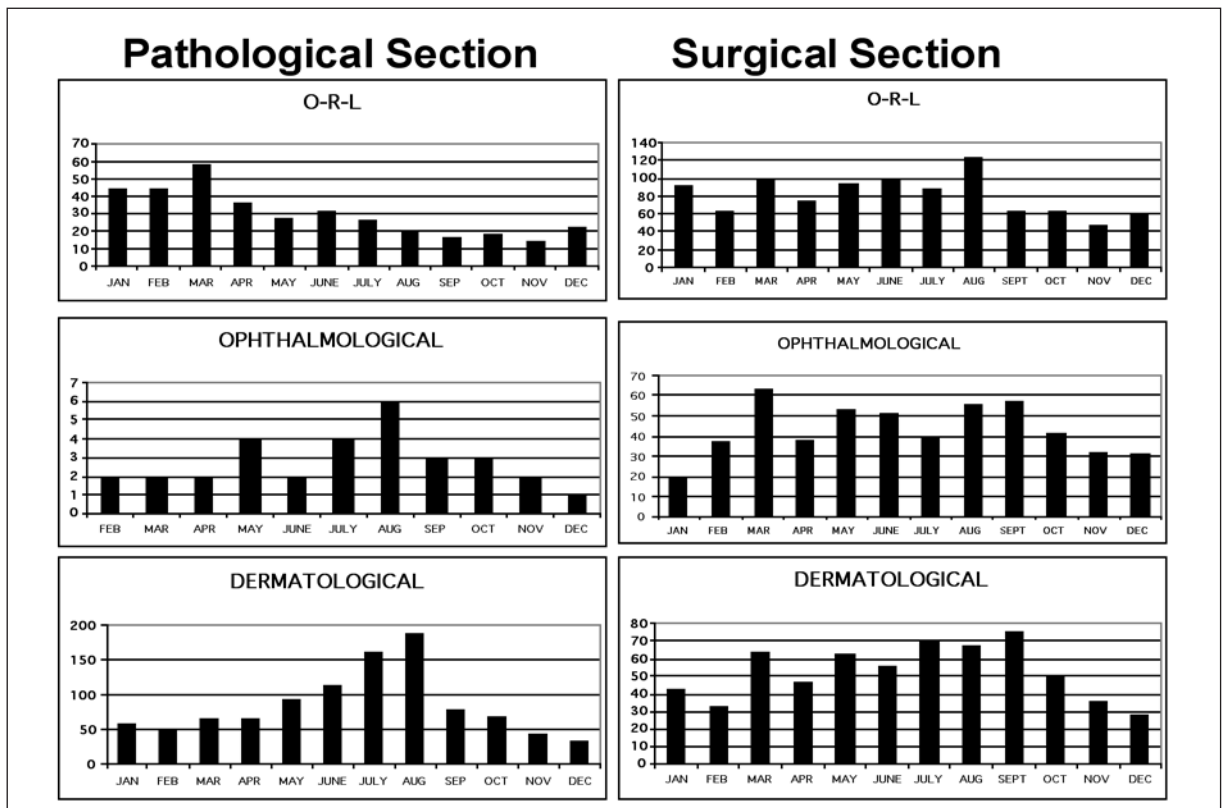


Figure 4: Monthly distribution of recorded cases at Lamia's General Hospital.

cases was recorded in summer time and on March.

Dermatological cases: In medical section there were more cases on June, July and August with maximum on August. In surgical section there were more cases on March, May and July-September; that is, an increase appears in summer time and spring.

3.1.2. Emergency cases and space weather

The increased number of cardiological, oncological, neurological and orthopedical cases (Figures 5, 6 and 7) coincides with the three helio-geomagnetic periods.

Cardiological cases (Figure 5): In medical section there was an increased number of cases during the first months of the year (January- May) with a maximum on January (extreme helio-geomagnetic activity). In surgical section there were more cases on March (solar flares maximum) as well as on May and August (months with strong geomagnetic storms). Unfortunately, there is a lack of data on January in surgical section's recordings. A small increase in medical section's cases was also recorded on August.

Oncological cases (Figure 6): We noticed an increased number of cases in medical section from January to March with a maximum on March (solar flares maximum). Also, evident peaks appeared on May and August (months with strong geomagnetic storms). Cases decreased after September, a period which is characterized by absence of helio-geomagnetic activity. A similar distribution appears in surgical section's cases. Increased number of cases is reported from April to September (with peaks on May, July

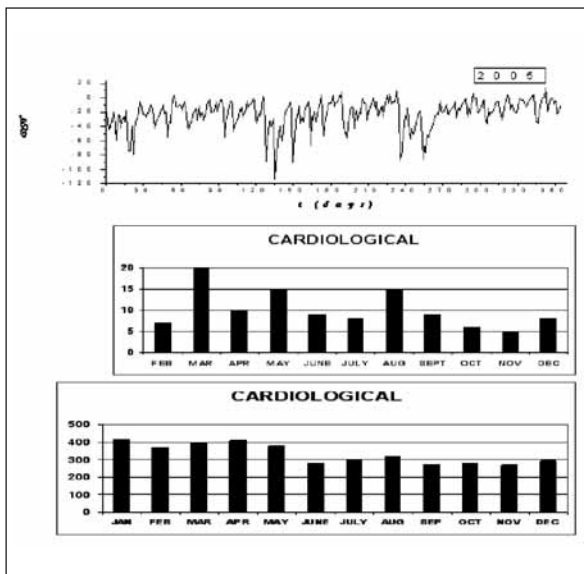


Figure 5: Monthly distribution of cardiological cases in surgical (middle) and medical (lower) sections. Dst geomagnetic index appears on top.

and September), a period characterized by geomagnetic storms. A decrease of cases appeared after September (absence of geomagnetic storms).

Orthopedical cases (Figure 6): Increased cases were reported on January-February (extreme solar activity) in medical section, while, in surgical section there was an increase

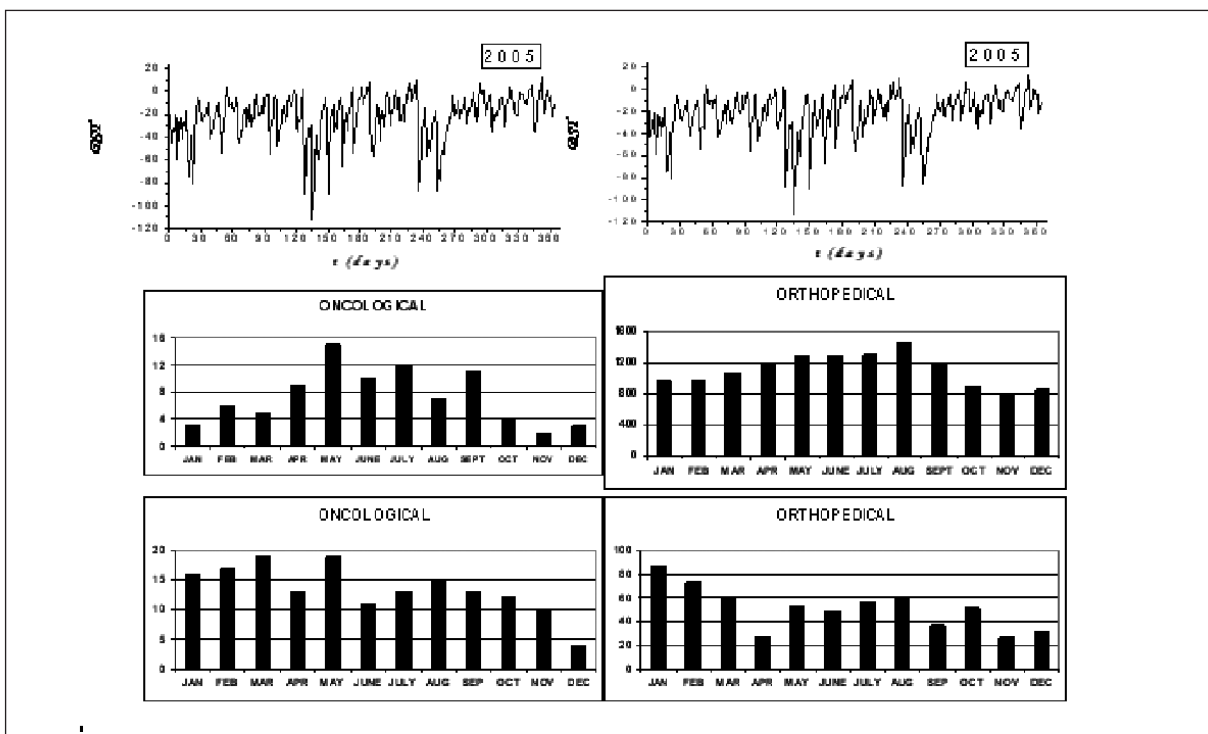


Figure 6: Monthly distribution of oncological and orthopedical patients in surgical (middle) and medical (lower) section. Dst geomagnetic index appears on top.

from April to September with a peak on August (strong geomagnetic storms). There is a difference between medical and surgical cases' distribution, although there is also an increase of cases in medical section in August. Notably, there was a decrease in cases after September. The small increase in medical section on October may be the result of increased traffic accidents (autumn rains). However, there is a difference (Medical section) in distribution during winter months. There is a peak on January-February and a minimum on November-December. Winter months account for more traffic accidents caused by bad weather conditions. Also, more people travel during Christmas Holidays and near Lamia town there is a dangerous road section where many accidents occur. We note that there is an increase of cases on January (after Christmas Holidays) while a decrease of cases is reported on December (before Christmas Holidays). Keep in mind that there was an absence of geomagnetic storms after September.

Neurological cases (Figure 7): There was an increase of patients in medical section from April to August (a period with geomagnetic storms). A decrease of cases appeared after September except a small increase on December. Similar decrease was also recorded after September in the surgical section cases. It is not unusual to have more neurological cases near Holidays (Christmas Holidays and Easter Holidays). Indeed, there was a small increase on December and January as well as on March-April (Easter date 1/5/2005). Also, there

was an increase in surgical section cases reported on May and August (strong geomagnetic storms) as well as on February (a few days after the period of extreme solar activity). Moreover, increase of psychiatric cases was recorded on February, following the extreme solar activity of January. Considering that battering cases may be associated with neurological system in conjunction with the fact that there was a great number of such recorded cases, battering was examined separately. Increase of cases was also reported on May and August-September; months with strong geomagnetic storms.

3.2. January 2005: Emergency cases distribution on daily base.

We examined in detail this month because of the extreme helio-geomagnetic activity with rare characteristics (Figure 8): a sequence of geomagnetic storms (especially after 15 January), high number of solar flares (with peak of 34 flares /day at 12-15th of January) and two GLE, a rare event (paragraph 2.2) during three days (17 and 20th of January). We focused on cardiological, oncological, neurological and orthopedical cases as well as in pathological cases since, according to the above, there appears to be a time coincidence between increased number of cases of these categories and helio-geomagnetic activity.

Pathological cases (Figure 8): An increase of cases after Christmas Holidays is expected. However, the increase of January 12 coincides with solar activity increase (solar flares

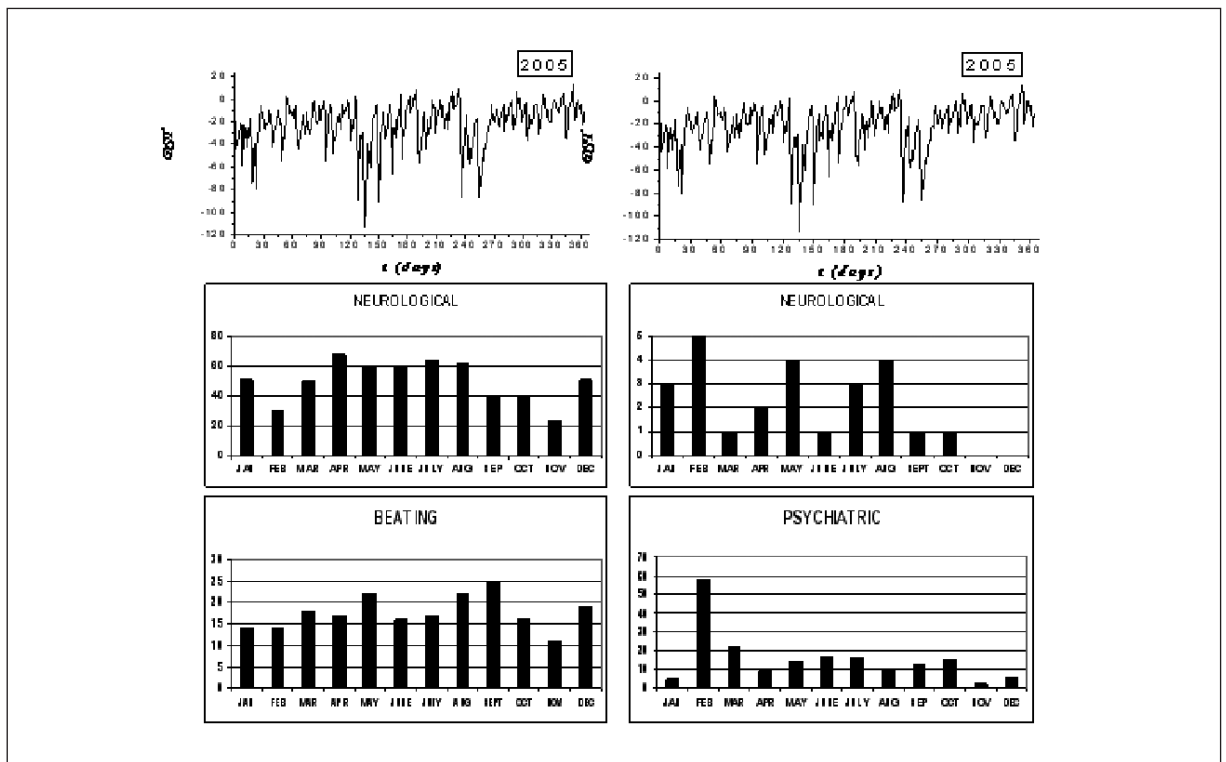


Figure 7: Monthly distribution of neurological cases in surgical (middle right) and medical section (middle left), psychiatric cases (lower right) and battering incidents (lower left). Dst geomagnetic index appears on top.

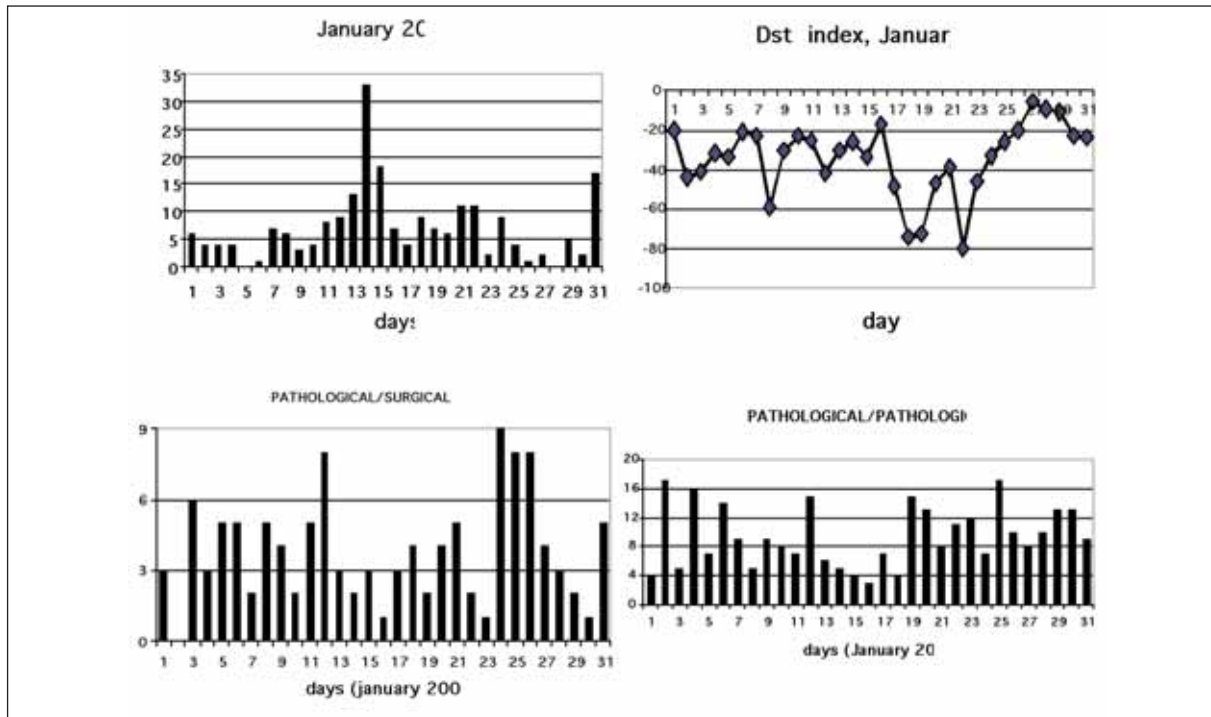


Figure 8: Daily distribution of solar flares (upper left), Dst index (upper right). Recorded cases of pathological cases in medical (lower left) and surgical (lower right) sections at the Emergency Department of Lamia's General Hospital.

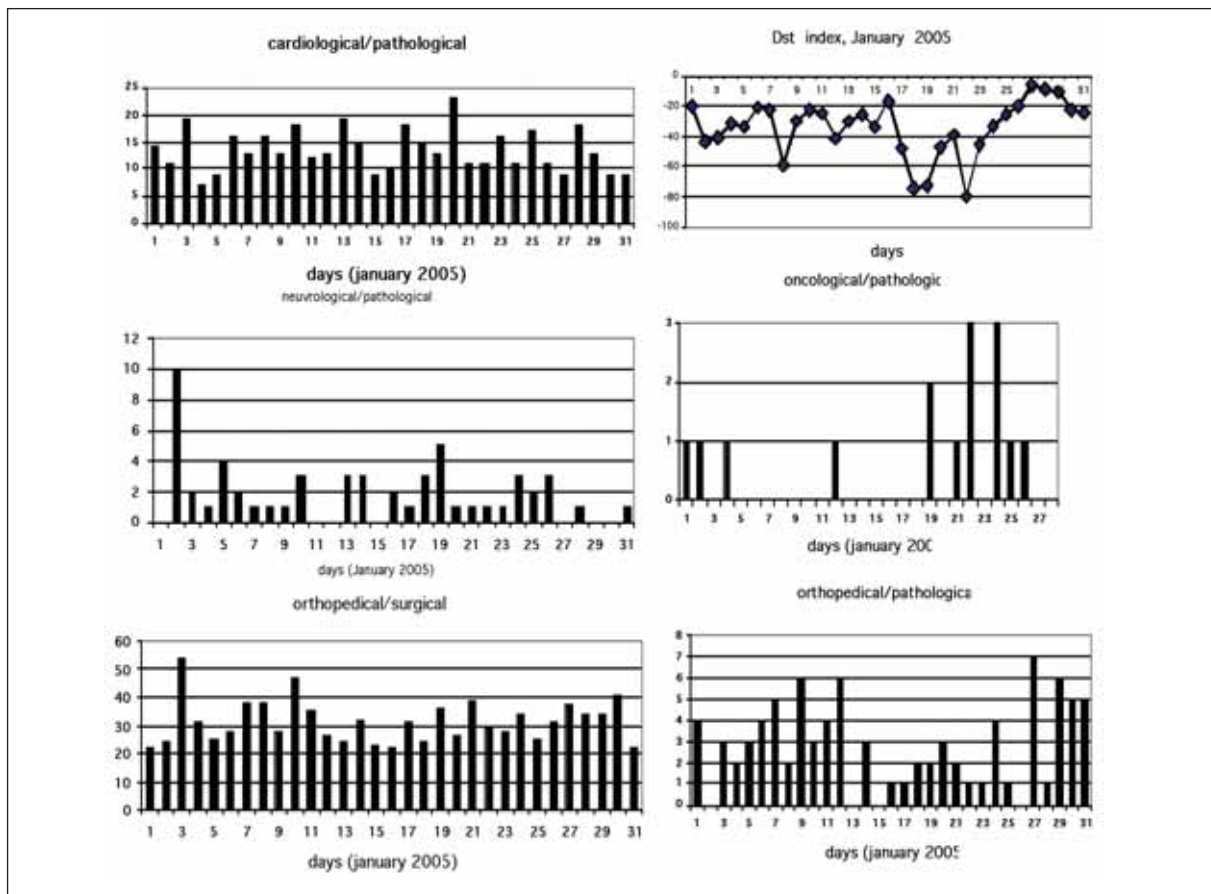


Figure 9: Daily distribution of cases at E.D. in January. Dst index appears on top right.

increase). Moreover, the significant increase of cases appeared after the 19th (Medical Section) and 24th (Surgical Section) of January, during the sequence of geomagnetic storms. Notably, the majority of cases in surgical section during 2005 was recorded on January.

Orthopedical cases (Figure 9): Although we observed an increase of patients in surgical section during this month, in medical section there are two periods of increased volume of patients; after Christmas Holidays (until January 12) and the last days of the month (after January 27). The later coincides with the recovery phase of geomagnetic storms.

Cardiological cases (Figure 9): Notably, the major increase in cases all over the year 2005 was recorded on January and the day with the highest number of arrivals all over the year 2005 that was recorded in medical section, is the 20th of January. The rare GLEs and the strongest one over the last 20 years was recorded on the 20th of January too. Unfortunately, data from surgical section is missing for this period of time.

4. Conclusions

In this pilot study we examined the association between the monthly distribution of emergency cases according to diagnosis with the helio-geomagnetic factors (space weather). Medical data that covered year 2005 was obtained from the Emergency Department of the General Hospital of Lamia town. We conclude that the helio-geomagnetic activity (non-photic effects) seems to influence human health as we observed an increase of emergency cases during the periods of geomagnetic storms as well as most of and during intense solar flares. There is a time coincidence between the increase of emergency cases and the helio-geomagnetic activity.

This influence is more clear in the cardiological, oncological, neurological and orthopedical cases and partially in pathological cases. Generally, the major increase of these cases is recorded on January (extreme solar activity (GLEs) along with a sequence of geomagnetic storms), March (highest number of solar flares in the last 12 years), May and August (months with strong geomagnetic activity). On the contrary, increase of pneumological, otorhinolaryngological, gastrointestinal, ophthalmological and dermatological

5. Discussion

Our conclusions add to the existing international literature providing useful information about the situation in the middle latitudes countries and especially Greece where very little work has been done on this subject so far (Petropoulos et al., 2006 & 2007). An increased arrival of patients with cardiac problems in the Emergency Department has been demonstrated by our findings. This is supported by the study of Breus et al (1989), where there had been a significant number of ambulance calls in Moscow during a three years period of increased solar activity (1979-1981) and found a positive correlation between myocardial infarction (M.I) and geomagnetic activity. Cornelissen et al (2002), claim that the incidence of mortality due to M.I increases in Minnesota,

Oncological cases (Figure 9): Medical section's recordings include only 16 cases. However, 11 of them were recorded after January 19. Surgical section's recordings include only three cases on the 7, 18 and 21st of January. The increased number of cases coincide with the period of extreme helio-geomagnetic activity (15 to 28th of January) and the major increase in cases was recorded during the period of two GLEs (17 and 20th of January) or a few days later (1-4 days).

Neurological cases (Figure 9): There was an increase in medical section on the 2nd of January (Christmas Holidays), while another small increase was noted on the 19th of January. Surgical Section recordings include only three cases on the 13th, 21st and 22nd of January. However, these dates coincide with the solar flares increase date as well as the dates of helio-geomagnetic activity; especially with the GLEs dates. We note that there is an increase in surgical section in the following month of February (Figure 7). Moreover, a major increase of psychiatric cases (Figure 7) is recorded on February after January's extreme helio-geomagnetic activity.

recordings appear in spring and summer time (seasonal variations, weather effects).

Especially for January of 2005, we examined the daily distribution of the various categories of emergency cases. Two intense GLEs (17th and 20th of January) were observed on January, apart from the sequence of geomagnetic storms (extreme helio-geomagnetic activity). January's 20 GLEs are characterized as the most intense of the last twenty years.

The extreme helio-geomagnetic activity (15th to 28th of January) coincide in time coincident with the increase in emergency cardiological cases. Most of them (in monthly values) are recorded on January. The day with the highest number of cardiological cases is the 20th of January (simultaneous GLEs). Also, increase of emergency oncological and neurological cases (small number of cases) is reported 1-4 days after the 20th of January. The pathological cases of both Sections and the orthopedical cases of surgical section, increase after January 19th and during the last days of the month, a period with a sequence of geomagnetic storms and especially in their recovery phase.

U.S.A, by 5% during years of maximal solar activity compared with years of minimum activity. Chermouss et al (2001), came to the same conclusions and they also noticed that sympathetic responders have a higher adaptive ability to changes in the geophysical environment. Stoupelet et al (1995), in a study which took place at Tel Aviv university hospital, Israel over a period of 180 months, supported that there is a positive correlation between solar activity and death from myocardial infarction.

Our study also indicated an increase of neurological cases arriving at the hospital from April to August which was the period of geomagnetic storms. From the daily analysis of the neurological cases during January, there was a significant

increase on days of solar magnetic activity and flares. The above finding is in agreement with the results of a study by Palmer et al (2006) according to which, 75% of geomagnetic storms is followed by an increase of 50% in hospital arrivals with cardiac and neurological problems (M.I., cardiological episodes, suicides)

In addition, in our study we found that increased hospital arrival of patients with orthopedical problems has been apparent during months with strong geomagnetic activity. Stoupel et al. (1995) presented evidence that accidents increase during periods of increased geomagnetic activity. Dorman et al., (2001) in their study in Moscow confirm the possible connection of space weather changes and train and car accidents.

In our study we also observed increase in mental cases on February after a solar storm. The above finding is in agreement with the results of the study by Kay (1994) which showed a statistically significant increase in male hospital admissions in the U.K., with a diagnosis of mental illness in the second week following a solar storm. Partonen et al (2004), claim that periods of time with predicted maximum risk of suicide coincide with those of maximum geomagnetic disturbance: spring and autumn. This is caused

by the seasonal change of Earth's magnetic field. Halberg et al (2005) show that suicides in Minnesota also exhibit a similar bi-modal distribution.

Our study could be used as a predictive index for calculating Emergency Department's personnel needs and as an additional factor in order to take all necessary measures (more nursing personnel, pharmacy, material and equipment, reception areas, etc).

Nursing considers people as bio-psycho-social entities. Sun and helio-geomagnetic activity influence these aspects. Nursing is also interested in those factors as well as any other factor that influences directly or indirectly human health. National accumulation of data from all Greek hospitals and the construction of an electronic data base could be accomplished with the participation of nursing personnel in order to study the problem of non-photic effects in human health more carefully.

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The Hellenic Journal of Nursing Science is the official journal of the Hellenic Regulatory Body of Nurses. It is a peer-reviewed, multidisciplinary journal that is intended to promote Nursing Science in Greece. Research reports, analysis and discussion articles, reviews of literature, theoretical articles, clinical applications, and analytical case studies are desired. Documents should be submitted in English.

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Arthur, D., Sohng, K.Y., Noh, C.H., Kim, S., 1998. The professional self concept of Korean hospital nurses. *International Journal of Nursing Studies* 35 (3), 155-162.

Barnes, B., Bloor, D., 1982. Relativism, rationalism and the sociology of knowledge. In: Hollis, M., Lukes, S. (Eds.), *Rationality and Relativism*. Basil Blackwell, Oxford, pp. 21-47.

Dijkstra, A., Buist, G., Dassen, Th.W.N., 1996. Nursing-care dependency: development and psychometric testing of the NCD-scale for demented and mentally handicapped inpatients. In: *Proceedings of the 8th Biennial Conference of the WENR, Research on Nursing throughout the Lifespan*, vol. I. Ekblad & Co, Vastervik, pp. 117-126.

Gower, B., 1997. *Scientific method: an historical and philosophical introduction*. Routledge, London.

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THE EPITOME OF USEFUL INFORMATION

INCORPORATION OF THE HELLENIC REGULATORY BODY OF NURSES

The Hellenic Regulatory Body of Nurses was constituted by the law 3252/2004 as a form of a Public Body and functions as the official professional body representing the nurses. The enrolment of all nurses is compulsory as is done in corresponding chambers overseeing other professions and functions as a regulatory body and the official counselor of the state (Pan-Hellenic Medical Association, Legal Association of Athens, Technical Chamber of Greece etc.)

MAIN GOALS OF HRBN

In an effort to make the reasons that all nurses should be subscribed to HRBN clear, shown below are the basic goals as presented by the law 3252/2004 and these should be implemented by HRBN:

- The promotion and development of nursing as an independent and autonomous science and art.
- The research, analysis and study of nursing matters and the formulation and submission of scientifically documented studies of the various nursing problems in the country.
- The construction of proposals on nursing matters.
- The continuous training and educating of nursing staff and the materialization and utilization of training programmes.
- The participation in materializing programmes which are funded by the European Union or other international organizations.
- The editing of certificates which are necessary for obtaining a license to practice the nursing profession.
- The evaluation of the nursing care provided.
- The representation of our country at international organizations regarding the nursing department.
- The publication of a journal, an informative bulletin, text books and leaflets so as to inform its members and the public.
- The study of Medicaid matters and the organization of scientific congresses that are independent or in cooperation with other bodies.
- The creation of an ethics committee for the nursing profession.
- The definition and cost assessment of nursing activities.
- The protection and enhancement of the level of health of the Greek population.

MEMBERS OF HRBN

It is compulsory for members of HRBN to be nurses, in other words they should be graduates of the following:

- a) University level nursing schools
- b) Technical level nursing schools
- c) Former higher school for nursing, visiting nurses belonging to the ministry of health, welfare and social security
- d) Former nursing school "KATEE"
- e) Foreign nursing schools with degrees that are accepted as equivalent to the corresponding Greek schools
- f) Military supreme nursing schools

STRUCTURE OF HRBN

HRBN is composed of a central administration, which is located in Athens, and seven peripheral sections, one in each health district of the country.

CENTRAL ADMINISTRATION

The central administration is made up of a 15 member executive council and has its central office in Athens. The address is 47 Vasilisis Sofias Avenue p.c. 10676, tel: 210 3648044-048 and fax: 2103617859 and 210 3648049. HRBN's website is www.enne.gr and email: info@enne.gr.

PERIPHERAL SECTIONS

The peripheral sections correspond to the number of health districts in the country and include:

1. 1st P.S. Attica: 47 Vasilisis Sofias Avenue, p.c. 10676, tel: 210 3648044-048 and fax: 2103617859 and 2103648049
2. 2nd P.S. Piraeus and Aegean: 47 Vasilisis Sofias Avenue, p.c. 10676, tel: 210 3648044-048 and fax: 2103617859 and 2103648049
3. 3rd P.S. Macedonia: Il Mavili St., Thessalonika p.c. 54630, tel: 2310 522229 and fax: 2310 522219
4. 4th P.S. Macedonia and Thrace: Il Mavili St., Thessalonika p.c. 54630, tel: 2310 522229 and fax: 2310 522219
5. 5th P.S. Thessaly and Mainland Greece: 2 Navarinou St., Larissa p.c. 41223 tel: 2410 284866 and fax: 2410 284871
6. 6th P.S. Peloponnese, Ionian Islands, Epirus, and Western Greece: I Ipatis and N.E.O Patra-Athens, Patra p.c. 26441 tel. and fax: 2610 423830
7. 7th P.S. Crete: Il6 Menelaou Parlama St., Irakleio p.c. 73105 tel: 2810 310366, 2810 311684 and fax: 2810 310014

MEMBER REGISTRATION AND SUBSCRIPTION

All nurses are obliged to apply for registration at the nearest peripheral section. The application form requires a certified copy of the nurse's degree and official identification, two coloured photographs, the receipt from the bank statement for the amount of 65 €, a simple copy of the license to practice the nursing profession and other titles that the applicant might have are optional (postgraduate degrees, certificates for foreign languages, social activities etc.).

All nurses are obliged to renew their subscription annually, in person or by post (not by fax) till the end of February, by handing in the appropriate statement to the nearest peripheral section. The statement should be handed in simultaneously with the annual subscription fee, which has been assigned to the amount of 45 € by the law 3252/2004.

All nurses who register or renew their subscription to HRBN are given a Nursing Identity Card.

LICENSE TO PRACTICE THE NURSING PROFESSION

The license to practice the nursing profession can be administered at the local prefecture by presenting the necessary documents and certification of registration at their HRBN peripheral section. When receiving the license to practice it is compulsory to present a copy to the peripheral section to which they belong.

According to the law 3252/2004, whoever practices the nursing profession without a license to practice will be prosecuted according to the article 458 of the Greek penal code.

Any individual of the peripheral council or the board of directors can file a complaint for illegal practice of the nursing profession and thereafter must notify the judiciary authorities.

In the case of a temporary disciplinary sentence or final disqualification from HRBN the license to practice is automatically suspended.

ADMINISTRATIVE BODIES

HRBN is administered by the assembly of representatives and the executive council. The peripheral sections are administered by the general assembly and the peripheral council.

HRBN'S INTERNATIONAL REPRESENTATION

HRBN is a member of FEPI and has one of the seven positions on the board of directors. England, Italy, Spain, Ireland, Poland, Croatia, Romania and Portugal participate in this European federation. France, Cyprus and Belgium are under consideration for participation. For more information the website is www.fepi.org.

SELECTION AND SERVICE OF ADMINISTRATIVE BODIES

HRBN's board of directors is elected by the assembly of representatives. The representatives are elected separately for each peripheral section by the members of the department's General Assembly. The peripheral councils are elected in a similar way by the members of the peripheral department's General Assembly.

These elections take place every 3 years and Nurses that take part are members in good standing (subscription paid).

DISCIPLINARY CHECK

The members of HRBN are initially submitted to a disciplinary check by the peripheral section, which also functions as a disciplinary council. The secondary disciplinary check, as well as the disciplinary check of the members of the board and the peripheral councils is executed by the supreme disciplinary council, whose president is the supreme court judge.

SCIENTIFIC JOURNAL

HRBN created the "Hellenic Journal of Nursing Science" in 2008 which is its official journal. It is a multidimensional journal with an editorial committee which aims at the promotion of the nursing science in Greece.

The "Hellenic Journal of the Nursing Science" is a reliable, modern, quarterly scientific journal which is published in Greek and English and is available in electronic and printed form. A nominal fee is offered to all interested researchers, university teaching staff, students and the entire nursing community in general as well as the tertiary university and technical level schools (Greek or foreign).

Simultaneously it offers young scientists easy access to knowledge and the chance for nursing to progress, as well as a scientific step for the nurses who work in the academic area and the clinical area to publish their work and undergo some constructive criticism. The journal publishes research studies, reviews, original dissertations and book reviews.

The papers that are published, are credited in a manner that is regulated and certified by the Greek legislation according to international standards.

INFORMATIVE JOURNAL

HRBN created a monthly informative journal in 2008 "Rhythm of Health – Ρυθμός της Υγείας", aiming at promoting and demonstrating each nurse as a unified psychosomatic and professional personality.

The nurses in Greece have the need to solve primary issues that concern their profession as well as the need to express themselves, to communicate, to enjoy themselves and to demonstrate the diverse aspects of their social purpose.

"Rhythm of Health - Ρυθμός της Υγείας" aims at uniting the voice of all nurses in the country and becoming an immediate and dependable form of communication, giving a chance to all voices of the professional community to be heard.

GOALS FOR THE FUTURE

With the collaboration of all its members HRBN aims at materializing and completing some important projects that are requested by the nursing community, some of which have already started being carried out:

- The definition and cost assessment of nursing activities.
- The creation of an open line of communication so as to record and solve the nursing problems.
- The enhancement of international relations between Greek nurses and organizations, for and international institutes.
- The creation of an electronic digital library which can be used free of charge by members of HRBN and to which the whole country will have access.
- Will offer specific training and postgraduate courses.
- The organizing of scientific congresses and day meetings with formal accreditation.
- The formation of specific project committees such as a training committee, a documentation committee, a foreign affairs committee and an informative committee.
- The creation of a network of experts on nursing issues and the provision of legal advice.
- The creation and function of specialization programmes.
- The certification of nursing specialties and nursing adequacy.

CONTACTS

Nurses can contact us :

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