FEP WORKING PAPERS
FEP WORKING PAPERS

Research Work in Progress

n. 275, May 2008

ICTs and Family Physicians Human Capital Upgrading. Delightful Chimera or Harsh Reality?

Teresa Dieguez*
Aurora A.C. Teixeira**

* MIETE, Faculdade de Engenharia, Universidade do Porto

** INESC Porto, CEMPRE, Faculdade de Economia, Universidade do Porto

U.PORTO
FEP FACULDADE DE ECONOMIA UNIVERSIDADE DO PORTO

ICTs and Family Physicians Human Capital Upgrading. Delightful Chimera or Harsh Reality?

Teresa Dieguez
(teresadieguez@gmail.pt)
MIETE, Faculdade de Engenharia
Universidade do Porto

Aurora A.C. Teixeira ♣
(ateixeira@fep.up.pt)
INESC Porto; CEMPRE; Faculdade de Economia
Universidade do Porto

Abstract

In the present paper we provide a quantitative assessment of ICTs role in Family Physicians/General Practitioners (GPs) medical daily practice and scientific performance. It focus on the Portuguese underexplored context, where the Health Sector has been under pressure for wide and profound reforms. These reforms have been extensively relying on ICTs, namely on the Internet. Based on the responses of 342 GPs, we concluded that 94% uses the Internet and 57% agrees that the Internet is essential to their medical daily practice. This is a slightly lower percentage than that observed for other European physicians (62%). GPs tend to use the Internet mainly for professional purposes. On average, they spend 10 hours/week on the Internet for professional purposes. Further data shows that to have or to be enrolled in advanced training fosters the use of the Internet for professional purposes, which in its turn, tends to grant GPs access to more and up-to-date information and knowledge on these matters. A worrisome evidence is that at the workplace, a substantial proportion of GPs (over 70%) do not use the Internet or other related ICTs, namely Telemedicine. Although Electronic Prescription is used by roughly 60% of the respondent GPs, for all other activities – teleconsultation, telediagnosis, and telemonitoring – only a meagre percentage of physicians (10%) claim to use such technologies. Thus, Telemedicine at the workplace is still a chimera. Notwithstanding such dishearten scenario, our data shows that the Internet for the respondent GPs has a critical role on updating and improving their professional knowledge basis. They recognise, however, that the vast majority of GPs lack specific and general training in ICT-related technologies. In fact, half of them agree that they need to attend specific training actions on ICTs. A large percentage of GPs admitted that in the previous year they did not take any professional training targeting ICTs and those who did undertook rather short-term (less than one week) courses: Because of that, such training handicap uncovers that a large part of Portuguese GPs may be unable to reap the benefits of ICTs in their daily medical practice.

Keywords: GPs; Human Capital; Information and Communication Technologies (ICTs)

♣ Corresponding author: ateixeira@fep.up.pt; Faculdade de Economia do Porto Rua Dr Roberto Frias, 4200-464 Porto, Portugal.

1. Introduction

General Practice/Family Medicine is an academic and scientific discipline with its own educational content, research, evidence base and clinical activity as well as a clinical specialty orientated towards primary care (WONCA, 2002). General Practitioners/Family Doctors (GPs) should have special communication skills since he/she has to inform patients of their diseases and treatment options in a way that is adjusted to each individual patient who is part of a community. This interrelationship, full of responsibility, commitment and know-how, should guide and be reflected in the development of related agendas for teaching, research and quality improvement. This is a consequence of the impact and crucial role played by these professionals in the economy and subsequent welfare. GPs invest considerable personal commitment and energy in a wide spectrum of interventions (De Maesener and De Sutter, 2004).

Research and up-to-date knowledge of GPs are crucial (Seufer and Seufer, 2000) as they have to up live up, not only to their patients' expectations, but also to their peers'. Fulfilling this goal, however, is rather complex. Any research in this domain must consider several dimensions and foci and bear in mind the specificities of the General Practice. The framework presented by De Maesener and De Sutter in the Annals of Family Medicine (May/June 2004) describes quite interestingly the different research questions where factors such as basic knowledge, problem-solving approach, practice implementation, policy context and education can cross through dimensions like structure, process and outcome.

ICTs in general, and the Internet in particular, have been recognized for many years as an important, albeit also worrying, mechanism for the transformation of medical care (Kassirer, 1995; Silberg et al., 1997; Gingrich and Magaziner, 2000; National Research Council Networking, 2000; Purcell et al., 2002; Blumenthal, 2002; Clark, 2006). While questions remain about its limitations (Kleinke, 2000), concerns regarding misinformation (Impicciatore et al., 1997; Culver et al. 1997; Pealer and Dorman, 1997; Wyatt, 1997; Griffiths and Christiansen, 2000; Purcell et al., 2002; Meric et al., 2002) and potential difficulties with the confidentiality of personal information (Pennbridge et al., 1999; Fox et al., 2000), the Internet appears promising as a means to disseminate information about health and health care, to enhance communication and facilitate a wide range of interactions between patients and the health care delivery system. Therefore, continuing efforts to maximize this tool's potential could be of great value (Baker et al., 2003). The Internet can provide other means of

disseminating information such as practice guidelines to physicians in different specialities caring for patients with similar medical problems as well as possibly reduce practice differences (Eitel et al., 1998). It can provide immediate access to clinical protocols, authoritative textbooks (Kassirer, 1995) and peer-reviewed medical journals, consultation with specialists and continuing medical education (Ellenberger, 1995).

Notwithstanding, few data concerning Internet users is available in the medical literature to provide guidance on this medium's development for physicians (Eitel et al., 1998). As more physicians gain familiarity with the Internet, it is expected that they will integrate it into their clinical practices (Eitel et al., 1998). For these reasons, it is crucial to carry on a study focused on the relation between the use of such technologies and the scientific and daily medical activity performance by GPs. In fact, that might enable them to devise adequate policy responses as far as training is concerned.

Therefore, this paper aims at providing a quantitative assessment on the role of the Internet in GPs medical daily practice and scientific performance. It focuses on the Portuguese underexplored context, where the Health Sector has been under pressure for wide and profound reforms, namely at the base of the system – Health Centres – with GPs representing the bulk of the medical staff. Such reforms have been extensively relying on ICTs in general and the Internet in particular. Thus, it is timely and pertinent to carry out an objective assessment on GPs' behalf on the usefulness of such technologies for their medical daily practice and scientific performance. At the same time, it should focus on the problems they eventually face regarding the use of these technologies and potential span for training actions at this level.

In the following section, a comprehensive overview of the literature is provided on the role of ICTs for human capital upgrading, focusing particularly on GPs. After a methodological section (Section 3) where we detail the procedures for implementing data gathering and describe some demographic characteristics of the respondent sample (Section 4), we provide a quantitative assessment of the importance of ICTs for the Portuguese GPs as well the reasons for the Internet usage. In Section 5, the heterogeneity of GPs profiles according to the Internet perception and use is put forward. Finally, in Conclusions we underline the main results of the research underlying the need for ICTs related training actions in the medical area.

2. The role of ICTs for human capital upgrading. The specific case of GPs

The Information and Communication Technologies (ICTs) tools are developing and changing rules at a very fast pace. Because of this, there's a growing need for new ways of doing and learning (Zussman, 2002). Nowadays ICTs are used for work and leisure, to gather information, to communicate, to shop, in banks and for a myriad of other everyday tasks. Its increasing importance in our everyday lives has led to speculation about the effects of living in a world where so much is available through computers (Coget et al., 2002).

Highly endowed human capital individuals may profit more from ICTs as they may represent a powerful instrument to acquire, disseminate, manage and exchange information and experiences (McKenna and Bargh, 2000; Jakobsson, 2006). When tastes and technologies are changing rapidly, requiring a high rate of labour turnover across industries and occupations, adaptability is crucial in order to keep labour and capital employed and maintain competitiveness (Progetto, 1997). Beyond that, people who acquire skills make capital equipment more productive (Orlikowsk and Yates, 1994). They make more effective use of the machines they work with and they enable managers to introduce more sophisticated and productive machines. Without a workforce that is continuously acquiring new skills, it would be difficult to reap more most of the returns from technological progress (Boothe and Snower, 1996).

Internet worked human capital raises challenges and opportunities for all business, including the health sector (DOT Force, 2001). Upgrading/obsolescence of human capital lies at the heart of the economic challenge that the economies face: to realize the transformation towards a knowledge-based society through a lifelong learning (EC, 2006). Jones and Newman (1995) admit that technical progress tends to destroy the economy's accumulated informational capital. For these reasons, they argue, while innovation results of a potential increase in the yield of the new economic activities that it makes possible, it reduces the yield of existing activities at the same time (Carillo and Zazzaro, 2000).

Society and trends are changing, new technologies and sub-consequent skills are needed, flexibility and empowerment are more than ever required, continuous learning and skills updating are indubitably crucial for good performances and especially for self-recognition. In the challenging case of General Practitioners/Family doctors (GPs), these questions are particularly relevant.

The provision of health care involves putting together a considerable number of resource inputs to deliver an extraordinary array of different service outputs (WHO, 2002). Few, if any, manufacturing processes match the variety and the change rate of production possibilities in health. Figure 1 identifies three principal health system inputs: human resources, physical capital and consumables. It also shows how the financial resources to purchase these inputs are both a capital investment of a recurrent character. As in other industries, investment decisions in health are critical because they are generally irreversible: they commit large amounts of money to places and activities which are difficult or even impossible to cancel, close or scale down (WHO, 2002).

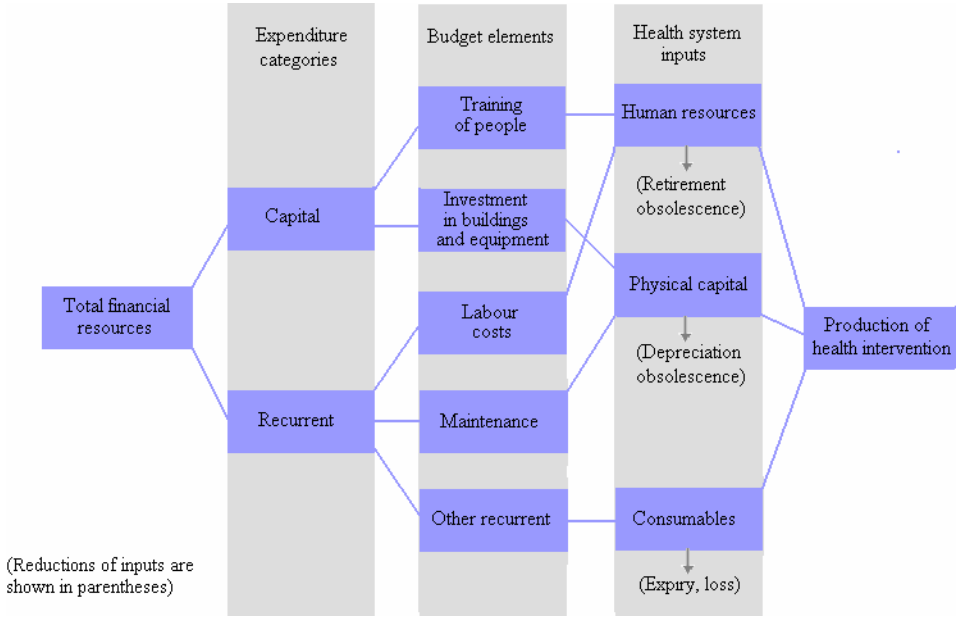

Figure 1: Health system inputs: from financial resources to health interventions

Source: The World Health Report 2000.

Human capital can be treated conceptually in the same way as physical capital, with education and training as the key investment tools to adjust the human capital stock and determine the available knowledge and skills (Becker, 1993). Unlike material capital, knowledge does not deteriorate with use. However, like equipment, old skills become obsolete with the advent of new technologies and human capital needs to be maintained too. Continuing education and on-the-job training are required to keep existing skills in line with technological progress and new knowledge.

The performance of health care systems depends ultimately on the knowledge, skills and motivation of the people responsible for rendering services. Health systems are labour intensive and require qualified and experienced staff in order to function properly (WHO,

2002). In Health, information is also vital, particularly to clinical decisions. Recent empirical evidences show that applications related to ICT originate improvements in save-timings, efficiency and quality in the handled services (Ortiz and Clancy, 2003).

According to a recent research (2006) conducted by Manhattan Research (Taking the Pulse® Europe), European physicians (more rigorously, a selected sample of those from France, Italy, Germany, Spain and the United Kingdom) have embraced the Internet for professional purposes and are generally positive about the value of the Internet as a professional and educational resource. In fact, 62% of 'all' European physicians reported the Internet is essential for their practice today. Furthermore, the study found that 94% of all 'European' physicians reported that they have used the Internet for professional purposes in the past 12 months. Clearly, the Internet has become more than a mere "diversion". In fact, to some extent, the Internet has become an accepted information, education and communication channel for almost every practicing physician in Europe.

Understanding physician use of ICTs and physician attitudes towards the use of ICTs can provide insights into the potential pace of physician adoption of ICTs that can substantially improve patient safety and quality of care (Miller et al., 2002). Moreover, if we understand the differences in physician types, ICT users can provide managers, ICT vendors and private/public policymakers with additional insights (Rogers, 1995). Such heterogeneity has implications for the likely pace of ICTs implementation, the pace of efficiency and quality gains that can be reaped from ICTs as well as policies required to increase that pace (Miller et al., 2002).

Despite the ICTs' enormous potential in the management health area, so far there has been scarce evidence for the Portuguese case. An exception is a study carried out by Teixeira and Brochado (2005) which shows that ICTs have a non negligible impact in health organization, generating time-savings, increasing satisfaction among users and health professionals.

3. Methodological considerations and some descriptive statistics

Like most European systems, the Portuguese National Health-Care Sector (NHS) is a mix of public and private financing. It is predominantly funded through general taxation,[1] and in 1998 it was the second largest employer in the public sector, with 19% of the total public workforce.[2] Nowadays, the NHS employs 123962 people - 24% of these professionals

[1] In 2004, the main source of finance (71.9%) comes from the public sector (Source: Portal da Saúde, 2007).
[2] European Observatory on Health Care Systems, 1999.

physicians (Portugal – Ministério da Saúde). GPs represent the largest fraction of the Portuguese medical class – out of the almost 24 thousand medical professionals, one quarter are GPs (Martins et al., 2003). Thus, the total number of Portuguese GPs sums up to approximately 6000.[3]

The large amount and regional dispersion of GPs makes it difficult to implement on a large scale any research works which consider this important medical class. Because we are aware of this difficulty, we undertook a pragmatic approach. APMCG (*Associação Portuguesa dos Médicos de Clínica Geral*) is the Portuguese Association of General and Familiar Practitioners which congregates half of the Portuguese professionals of this class. In a first stage, we contacted the APMCG and with the collaboration of its President, Dr. Eduardo Mendes, we were able to establish a research plan and sign a protocol, which turned the survey underlying the research plan feasible. Using its web site and a direct mailing to its associate members, APMCG publicized our questionnaire. Also, during its 24th Meeting a wide coverage was given to our survey in order to try to increase the response rate for our survey. Through these joint efforts, we gathered around 250 responses. In a second phase, we complemented the first strategy with a wide (1500) direct mailing (funded by CEMPRE-FEP) to GPs enrolled in the Portuguese Northern Medical Association (*Ordem dos Médicos da Região do Norte*). Although this second attempt did not succeed very well also, we were able to increase the response rate approximately 11% (342 valid responses).

The questionnaire was developed and pre-tested during the first semester of 2007. The questionnaire was divided into five main parts: 1) General data (age, gender, education, workplace, professional category, type of labour contract and workplace location); 2) Level and intensity of usage of ICTs/Internet by the Portuguese GPs; 3) Training and sources for knowledge updating; 4) Activities related with GPs daily practice (number of patients seen; number of medical prescriptions; hours that were dedicated to managing/bureaucratic issues); and 5) GPs scientific practice and performance (participation in conferences and publications in journals).

The survey was implemented through an online questionnaire with the support of the Computing Services of FEP.[4] This necessarily conveyed a bias toward those GPs that (or at

[3] Primary health care in the public sector is mostly delivered through publicly funded and managed Health Centres (HCs). Most primary health care is delivered by GPs at the health centre. The number of Physicians in the total HCs (Continental) represents nearly 29% of the total HC Employees (IGIF, 2004). In fact, GPs are the most important players (85% of the total) in this context.

[4] Available in http://www.fep.up.pt/mgfportugal.

home or at the workplace) have minima conditions for ICTs/Internet usage (computer and web availability). Nevertheless, this matter did not hinder our main research goals: to characterize Portuguese GPs ICTs/Internet usage and to assess the perception of GPs on whether the Internet fostered or prevented GPs' human capital upgrading.

To the best of our knowledge, there is no study in Portugal focusing these questions. At an international level, some studies (e.g., Drezner, 1998; Andrews et al., 2006; Lowrey and Anderseon, 2006, Manhattan Research, 2006) have already focused the issue of Internet use, its reasons and determinants, although they did not relate it with the GPs profiles and its potential for human capital upgrading or obsolescence.

Most of the Portuguese surveyed GPs (approximately 80%) are aged 40 years or older. The mode group, that is, the one representing the bigger quote (51%) is the one with ages between 50 and 60 years old. According to data available in UEMO - European Union of General Practitioners - the average age of Portuguese GPs /Family doctors is 40 years old.[5] This number is similar to the one presented by the 2001 Portuguese Global Social Balance (Portugal, Ministério da Saúde, 2001).

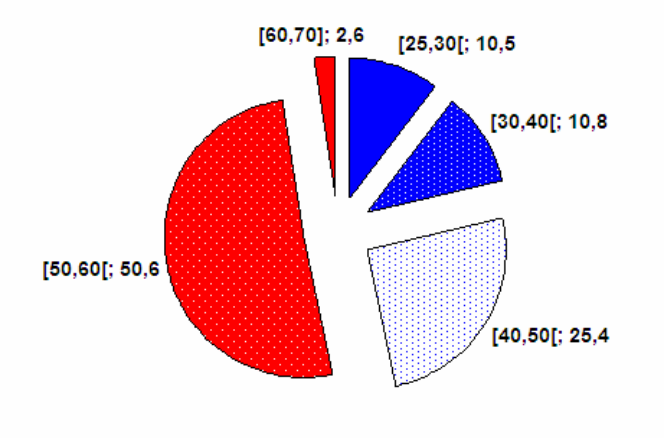

Figure 2: GPs distribution by Age

GPs are almost equally distributed by gender, with a slight advantage for male GPs. According to UEMO, there are more males GPs (56%) than females (44%) and a similar conclusion was reached in the Marques et al.'s (2005) study, referring the 51.2% respective percentage. The majority of GPs (52%) are Graduate Assistants. Broadly, the Assistant category comprises around 70% of total inquired GPs. The top category – Service Chief – comprises only 15% of the sample.

[5] http://www.uemo.org/, accessed on August 2007.

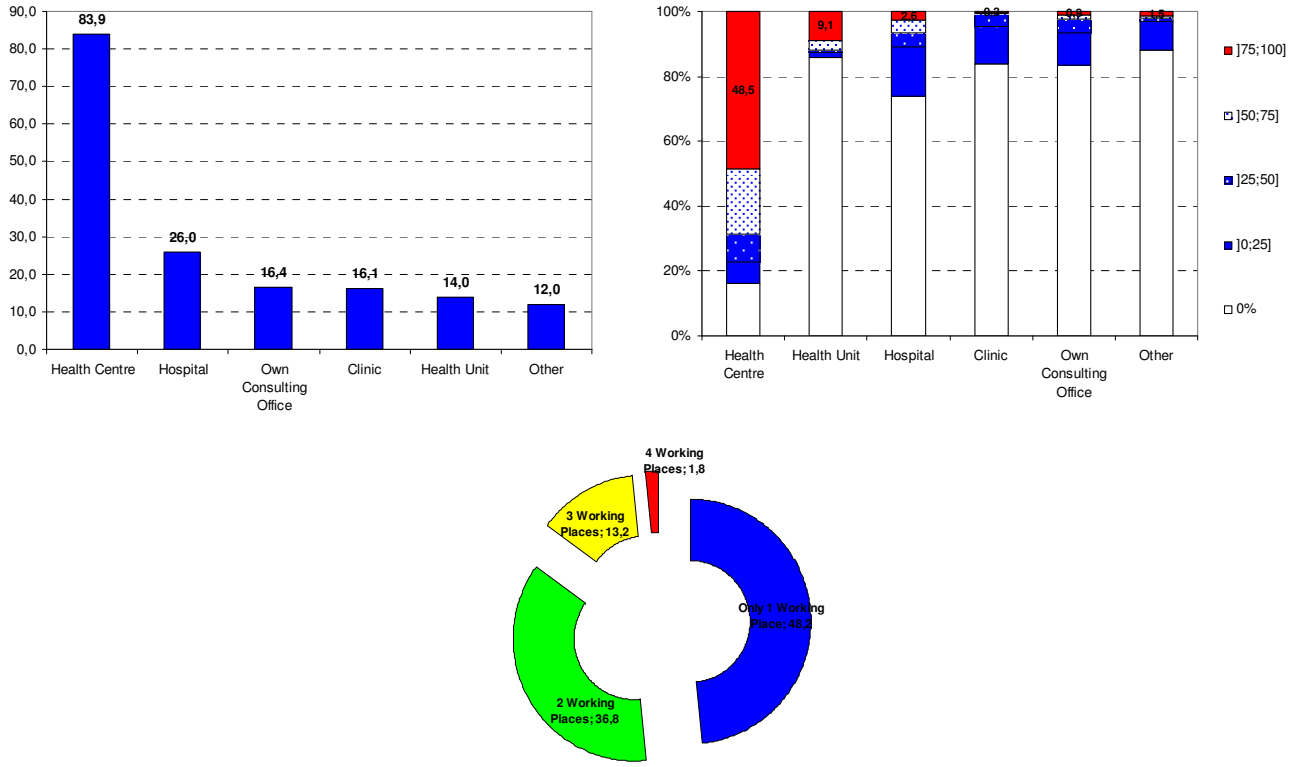

Figure 3: GPs distribution by type of workplace and time devoted to each type of workplace

Around half of GPs have long-term (effective/permanent) contracts while one quarter has short-term contracts. Over eighty per cent of the Portuguese GPs work (exclusively or in partial time) in Health Centres – the vast majority of these dedicated fifty per cent or more of their working time to this workplace (Figure 3). A less expressive figure (28%) emerges in the case of Hospitals with a rather negligible percentage for those working full-time. It should be highlighted that the majority of GPs work in more than one place – 37% combine two workplaces, 13% combine three and amazingly 2% manage to cope with 4 different workplaces. Such evidence cast serious doubts on the quality of services provided and the GPs availability to be enrolled in training activities targeting ICTs (but not only).

A small number of GPs possess post graduation courses (including those that grant a degree - master and PhD). The bulk of GPs (70%) took their undergraduate course more than 20 years ago, which in part is reflected in their age profile. This nevertheless raises serious concerns to these professionals' capability to absorb and use ICTs in general and the Internet in particular.

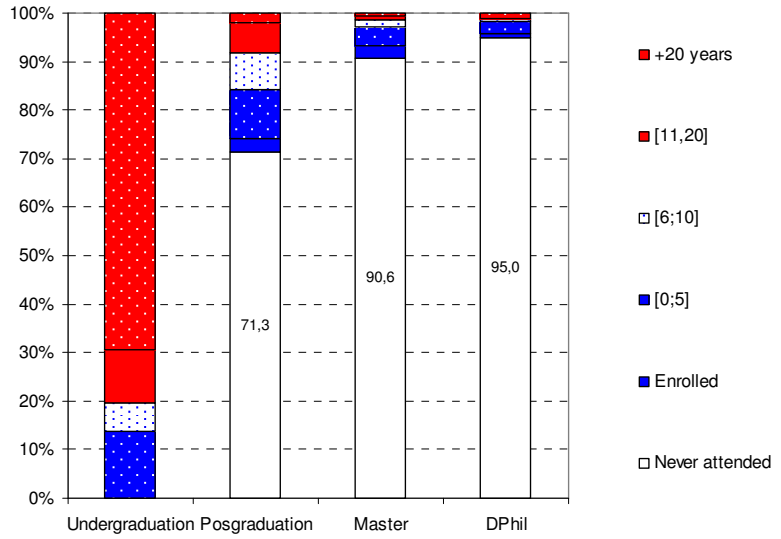

Figure 4: GPs formal education – distribution according to education's tenure

Over 70% of the sample is not even enrolled in any kind of degree. Although this does not exclude the possibility that these GPs might be (or were) enrolled in other type of training, such magnitude uncovers an effective risk that a large part of Portuguese GPs may be unable to reap the benefits of TICs. Moreover, a large percentage (42%) of GPs admitted that in the previous year they did not take any professional training targeting ICTs. Those who did undertook rather short-term (less than one week) courses.

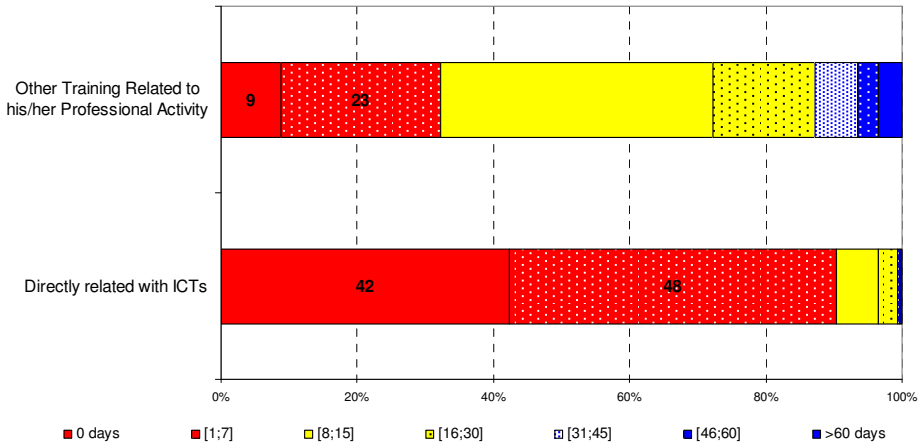

Figure 5: GPs training attendance and intensity (number of days)

4. The use of ICTs by Portuguese GPs. A quantitative assessment

According to the "Green Paper Living and Working in the Information Society: People First" (EC, 1996), the use of computers and computer-based patient records for primary care and in hospitals has increased quickly over the past 10 years in countries such as the UK, where 90%

of general practitioners (GPs) own a PC and 79% use electronic healthcare records; Denmark, where 65% of GPs own PCs and use electronic health records; and the Netherlands, where the numbers are 80% and 40% respectively. In other countries, however, progress was much slower. Great effort has been spent on standardisation of the patients' electronic records and smartcards in the Telematic Applications RTD Programme since the beginning of the 1990s. As a result, communication between hospitals, general practitioners and laboratories has improved greatly in quality of care, efficiency and cost effectiveness.

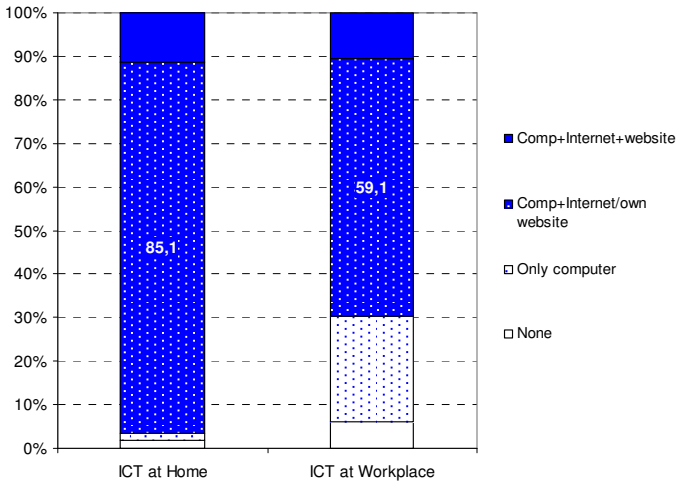

Figure 6: ICTs facilities at home and at the workplace

The eventual lack of ICT use cannot (in the present Portuguese GPs' sample) be attributed to the absence of physical means (computers). The vast majority of GPs possess computers with Internet access both at home (over 90%) and at the workplace (almost 70%). Nevertheless, it is interesting to notice that workplaces are relatively less equipped than GPs' houses.

The majority (57%) of GPs agree (or totally) agree that the Internet is essential to their medical daily practice. Although that percentage is lower, it is not very different from that observed for other European countries – 62%, according to Manhattan Research (2006). Notwithstanding, there is a reasonable percentage (25%) that disagree with the above-referred statement, which may raise some concerns in such an Information Society paradigm that many argue we live in.

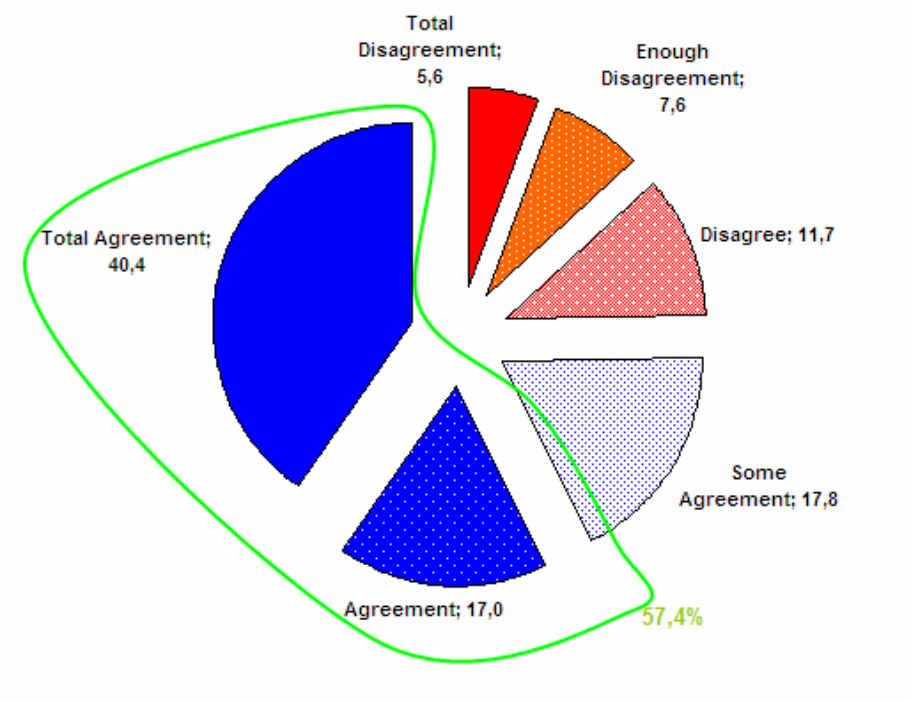

Figure 7: "The Internet is essential for my medical daily practice" – percentage of GPs by degree of agreement

GPs tend to use Internet to a large extent for professional purposes rather than other (Figure 8). The noticeable exception is for the youngest age group (GPs aged 25-30 years old) who use the Internet in similar degree. It is interesting to notice that GPs aged 50-60 years old spend, on average, 12h/week (more than 2h per working day) on the Internet for professional purposes, whereas for those aged 30-40 years old the corresponding figure is 9h a week.

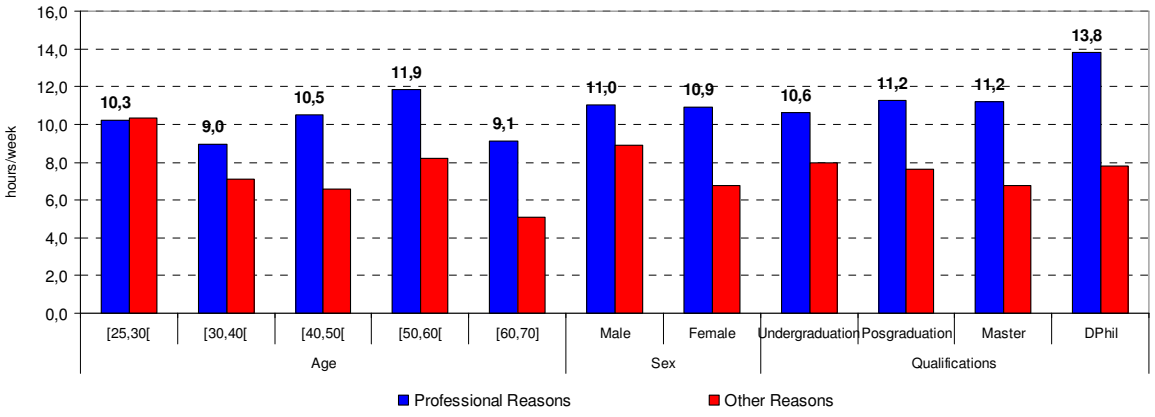

Figure 8: Weekly average hours of Internet usage for professional and other purposes, by age, gender and education

There seems to be no difference between genders when it comes to Internet use for professional reasons – on average, male and female spend 11h/week on the Internet for these purposes.

There is a positive relation between the amount of hours spent on the Internet for professional reasons and the maximum level of formal education achieved – GPs with or enrolled in a PhD spend, on average, 3 hours a week more on the Internet than a colleague who only has a graduation course. Thus, at a first glance, to posses or to be enrolled in advanced training fosters the use of the Internet for professional purposes, which in its turn tends to grant individuals the access to more and up-to-date information and knowledge on these matters.

According to INE (2006) data, during the first trimester of 2006, 45.6% of the Portuguese families owned computers at home, even if the Internet and ADSL only represented percentages of 35.2% and 24% respectively. It further shows that, similarly to GPs, consumers with higher educational levels are precisely the consumers who use the ICTs more frequently (with 91% for computers and 86.9% for the Internet).

Corroborating the previously mentioned result which associates the Internet use with the possession or enrolment in advanced training, Table 1 shows that the major motivation for using the Internet is to 'Search information concerned with professional activity/investigation'. 'Send and receiving email' and 'Search for information on goods and services' are also important reasons that GPs justify for using the Internet.

According to UMIC (2003), the most widespread use of the Internet among the Portuguese population aged 15-65 years old is sending and receiving e-mails (76%), ten points below the figure obtained for GPs. This alludes to the role Internet gained in the social contacts dimension (either on a personal or on an institutional perspective). The same report (UMIC, 2003) observes that the other Internet uses are more self-oriented. Thus, it is possible to identify different trends such as *leisure* (downloading music, games and videos, 54%; reading and downloading online newspapers and magazines, 43%; using chat sites, 33%), *comfort* (obtaining information from public authorities' websites, 47%; searching information about goods and services, 42%; Internet banking, 28%) and *convenience* (work-related activities, 51%; study and learning activities, 49%). In these latter two activities, we observe that almost 70% of the respondent GPs claim to often or always use the Internet in order to search information related to their professional activity, whereas the corresponding figure for

developing activities of formal education is about 21% (although 60% claim to use the Internet for such purpose).

Table 1: Reasons for using the Internet [degree of use – 0 (no use) … 5 (always), and percentage of GPs in that says 'never' and 'often/always']

		Average (0-5)	Never	Often/Always
Communication	Send/Receive e-mail	3,76	3,5	**65,8**
	Telephone via Internet/videoconference	0,86	60,5	7,6
	Develop a blog	0,29	85,7	2,3
	Other (acess to chats, etc.)	1,40	43,9	14,0
	Average	**1,58**		
Serach for Information and Use of on-line Services	Search information on goods and services	3,26	2,9	47,1
	Use of Services Related to Travels and Lodgements	2,63	12,0	33,6
	Listen Radio / Watch TV through Internet	1,04	50,9	7,6
	Play or Download Games, Images or Music	1,08	47,4	9,6
	Read / Download Journals / Magazines on-line	2,28	19,3	27,8
	Software Download (except Games, Images or Music)	1,49	36,0	14,0
	Search for a Job or Send Candidatures / CV	0,36	78,7	1,8
	Average	**1,73**		
Education / Training	Search Information concerned to his/her Professional Activity / Investigation	3,86	2,0	**68,4**
	Develop Activities of Formal Education /School, University, etc.)	1,73	40,1	20,8
	Perform Courses of Post-Formal Education (Out of the Official Educational System)	0,98	59,9	10,2
	Perform Courses Specifically Related to Job Opportunities	0,32	83,3	2,6
	Average	**1,72**		

It is also important to highlight the high percentage of Internet users among GPs recurring to Internet banking websites and visiting public authorities' websites in order to obtain information (Figure 9), namely for taxes purposes (IRS). This is seems to be in line with the Portuguese Government's goal (UMIC, 2003) for the widespread diffusion of Internet usage, aiming at a simplification of the interaction between citizens and institutions, public entities in particular.

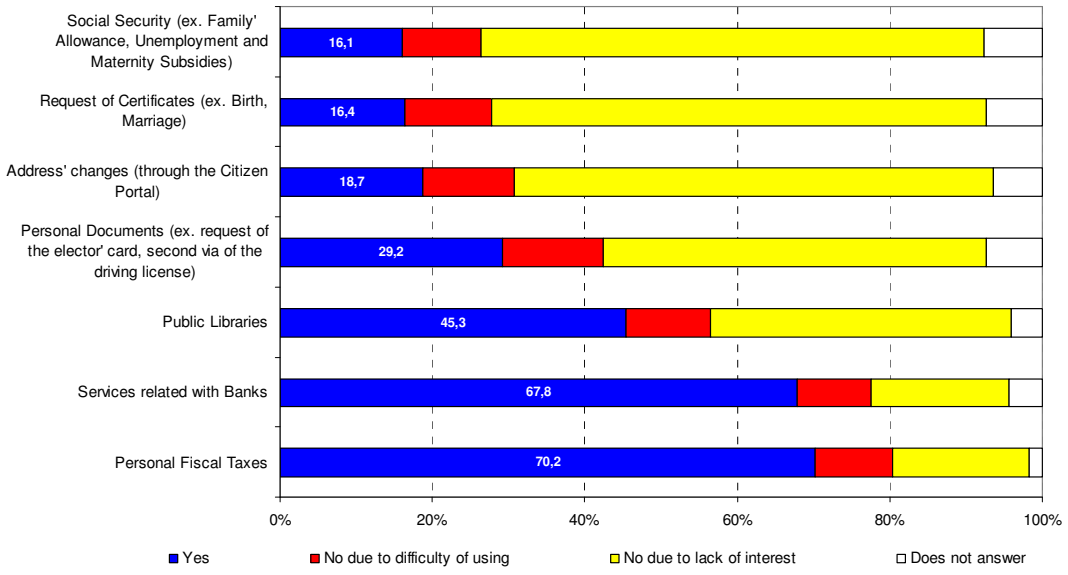

Figure 9: Use of the Internet for daily tasks (% of respondent GPs)

A substantial proportion of GPs (over 70 %) do not use the Internet or other related ICTs at their workplaces, namely for activities related with Telemedicine, exchanging files with other Hospitals/Health Units, external communication with citizens, training and consultation of provision catalogues. The most frequent activities for which GPs use the Internet are the search and gathering of information and access to databases.

Table 2: Activities performed at the workplace using ICTs/Internet

	Does not use	Uses Often/Always
Search and Gathering of Information / Documentation	27,8	**38,3**
Access to Data Bases	37,7	29,2
Internal Communication Between Services	48,2	21,1
Activities of Telemedicine	**72,2**	13,5
External Communication with Other Health Units	59,9	12,0
Exchange of Files with Other Hospital Units	**76,6**	6,1
External Communication with the Citizens	**71,6**	5,3
Training of Human Resources	**76,3**	3,2
Consultation of Provision Catalogues	**81,0**	2,0

The low use of telemedicine related activities is well depicted in the following figure.

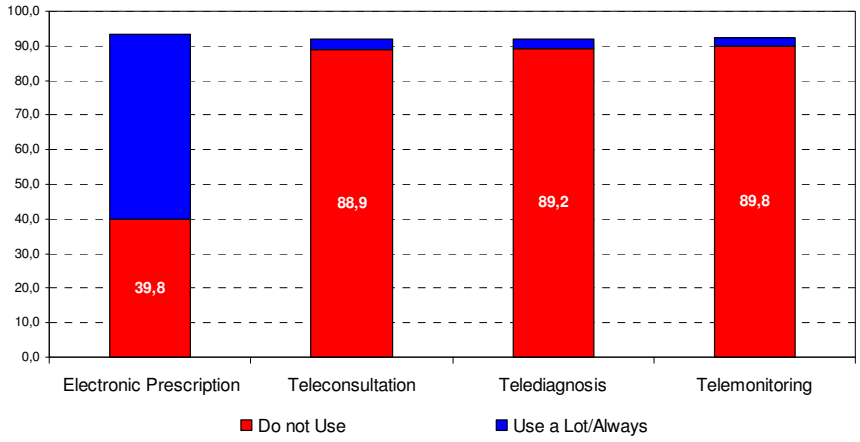

Figure 10: Telemedicine activities developed at the workplace (% of GPs)

Although Electronic Prescription is used by the majority (roughly 60 %) of the respondent GPs, only a meagre percentage of physicians (around 10%) claim to use such technologies for other activities, such as teleconsultation, telediagnosis and telemonitoring.

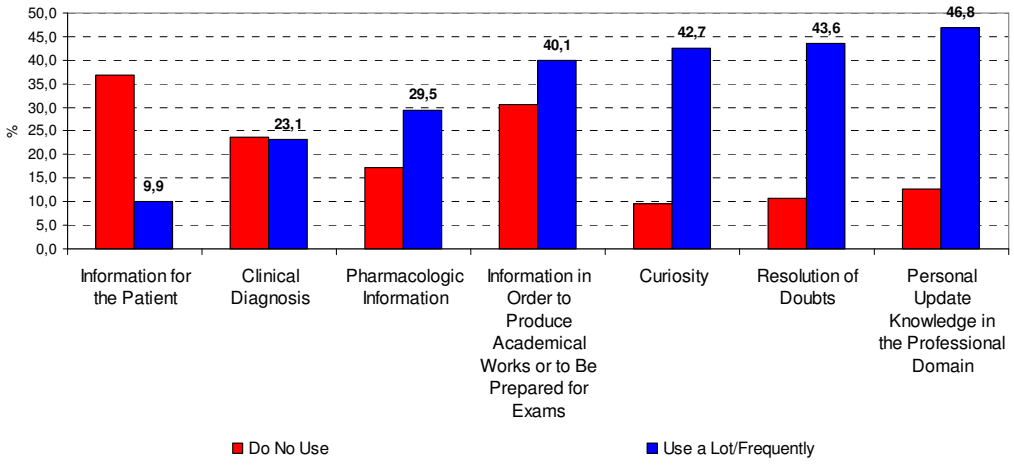

Figure 11: Use of the Internet for gathering information for daily medical practice

The most common purpose for Internet usage in the daily medical practice is for GPs to update their knowledge in their professional domain. In fact, 46.8% of the surveyed GPs claimed to use the Internet frequently or very frequently for those purposes (only a small percentage, around 10%, admitted not doing so). The Internet is also widely used for queries and performance of academic related activities. In this vein, we might conclude that the Internet for the respondent GPs has a critical role when it comes to updating and improving their professional knowledge basis.

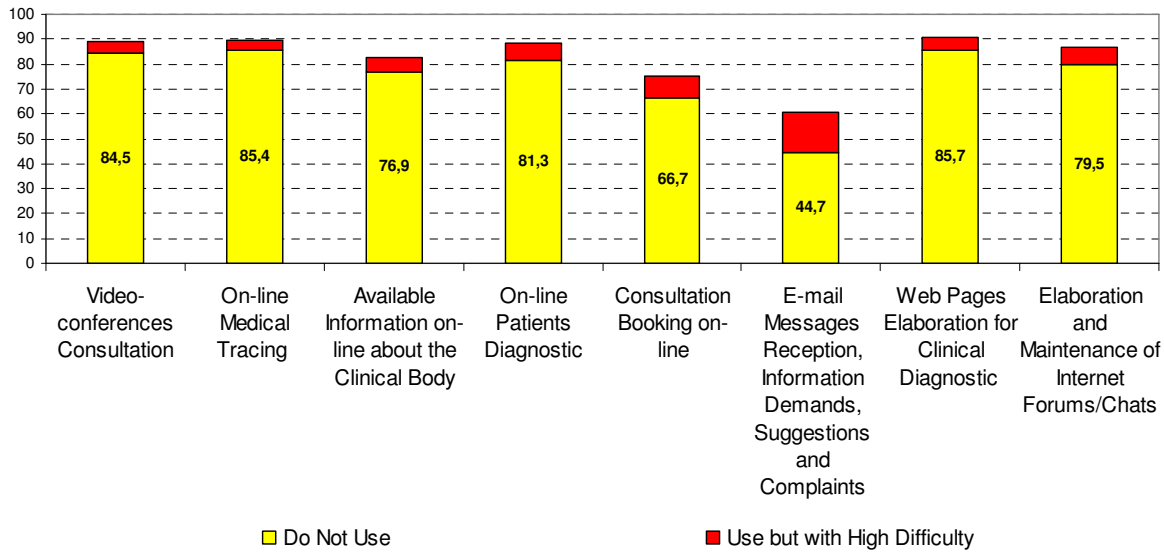

Figure 12: Use and degree of difficulty in using ICT related activities

Notwithstanding the importance of the Internet for information and knowledge update and upgrading (excluding emails), for the remaining activities listed in Figure 12 – web pages (86%), video conferences (85%), on-line medical tracing (85%), on-line patient diagnosis

(81%), chats/forums (80%), a huge percentage of GPs (over ¾) admit not using them. Moreover, despite a considerable proportion of GPs claiming to use emails, a non-negligible part of these latter consider that they face severe or considerable difficulties in performing such activity. We might speculate that the low percentage of GPs that claim to face difficulties in activities that are manifestly more complex than email management (e.g. creating web pages) derives from the fact that those few that use them are the ones that already have a good expertise in ICT-related activities.

As we mentioned above, the respondent GPs consider ICT related technologies, the Internet in particular, as important vehicles for knowledge updating and upgrading. It is important to uncover which are the main information sources that help GPs pursue their demanding daily practice.

The three most important scientific sources of information for Portuguese GPs are *Revista Portuguesa de Clínica Geral*, scientific and technical books, *Jornal Médico de Família* and *American Family Physician*.

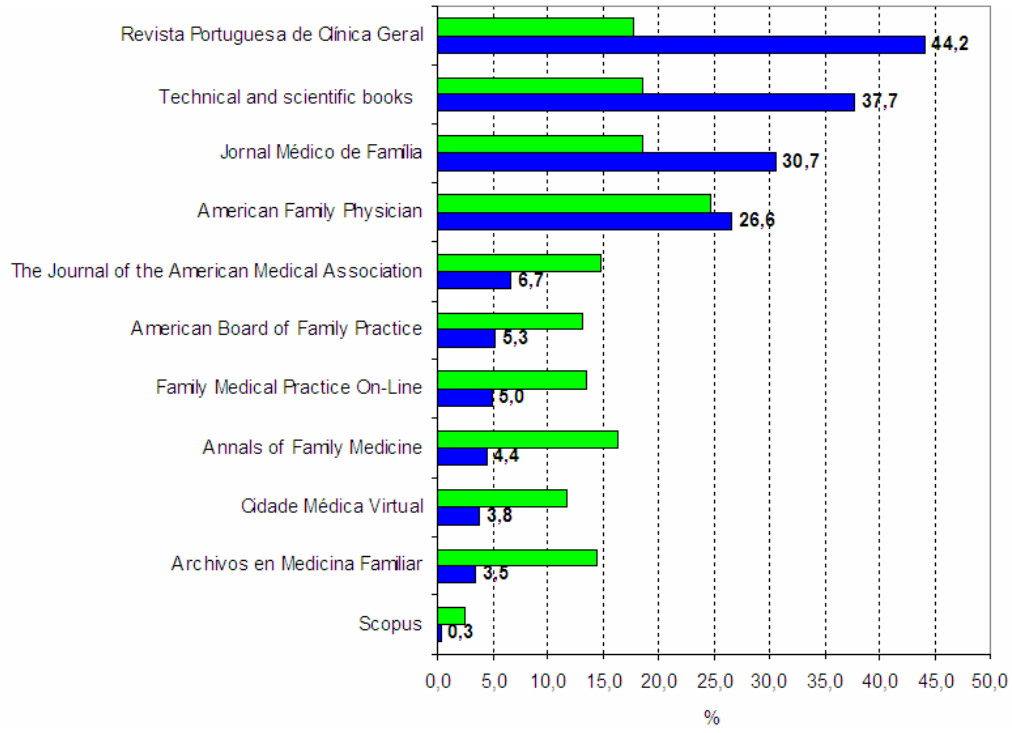

Figure 13: Most important sources of information for GPs' daily medical practice – scientific journals and books

Less than 20% reckon that the Internet is the preferred way/mean to read the above-mentioned journals/books. This could indicate that printing materials would be the preferred mean for GPs getting their information for knowledge upgrading and updating. However, this does not seem to be the case. In fact, when asked about the degree of importance attributed to a set of

ways of upgrading and complementing their knowledge (see Figure 14), the 'reading and searching on the Internet' was the item that collected the highest percentage. In fact, Portuguese GPs claim that it was a very important source to upgrade knowledge.

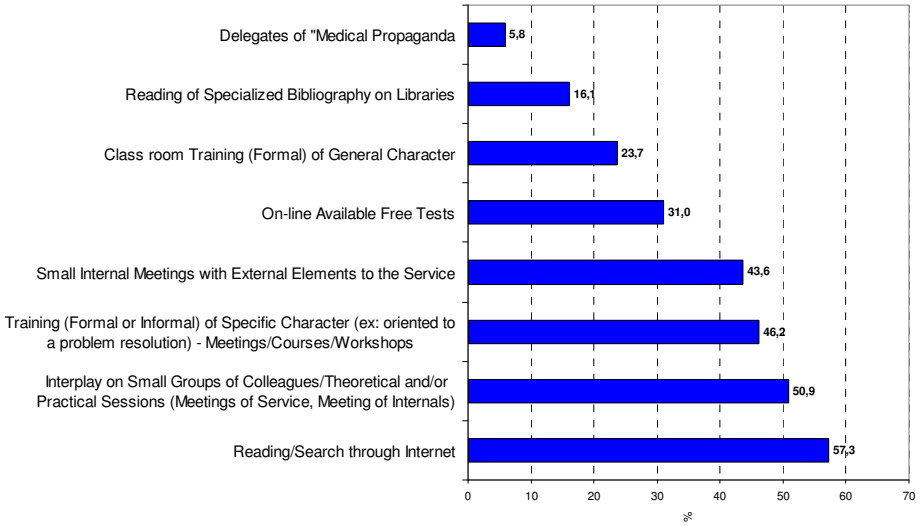

Figure 14: Ways of upgrading/complementing knowledge (% of GPs that answered 'important' and 'very important')

The low percentage (less than 7%) that consider 'Medical Information Delegates' as an important or very important source of information and knowledge for their daily medical practice is quite surprising. In fact, and according to Granja (2005), the frequency at which Portuguese physicians (especially family physicians) contact with pharmaceutical sales representatives is higher than the frequency reported in countries where there are available studies (namely Canada and the United States of America). So, one would expect that these professionals would be an important source of information and knowledge (namely in pharmaceutical related issues) for GPs' daily medical practice.

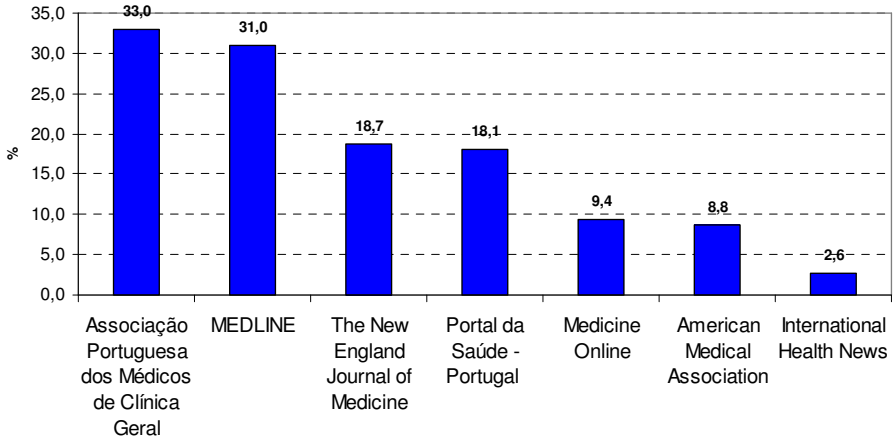

Figure 15: Most important sources of information for GPs' daily medical practice – web pages

The most important web pages, in terms of frequency of use, are *Associação Portuguesa dos Médicos de Clínica Geral* and *Medline.* One third of GPs claim that they consult these pages on a regular basis. On the other hand, *The New England Journal of Medicine* and *Portal da Saúde* – Portugal, register an 18% percentage.

Only 10% of Portuguese GPs agree that the "The ICTs contribute for an increasing obsolescence of GPs' knowledge base", while 70% absolutely disagree with such statement. This means that for these GPs, ICTs and the Internet in particular, are seen as a vehicle for knowledge upgrading and updating.

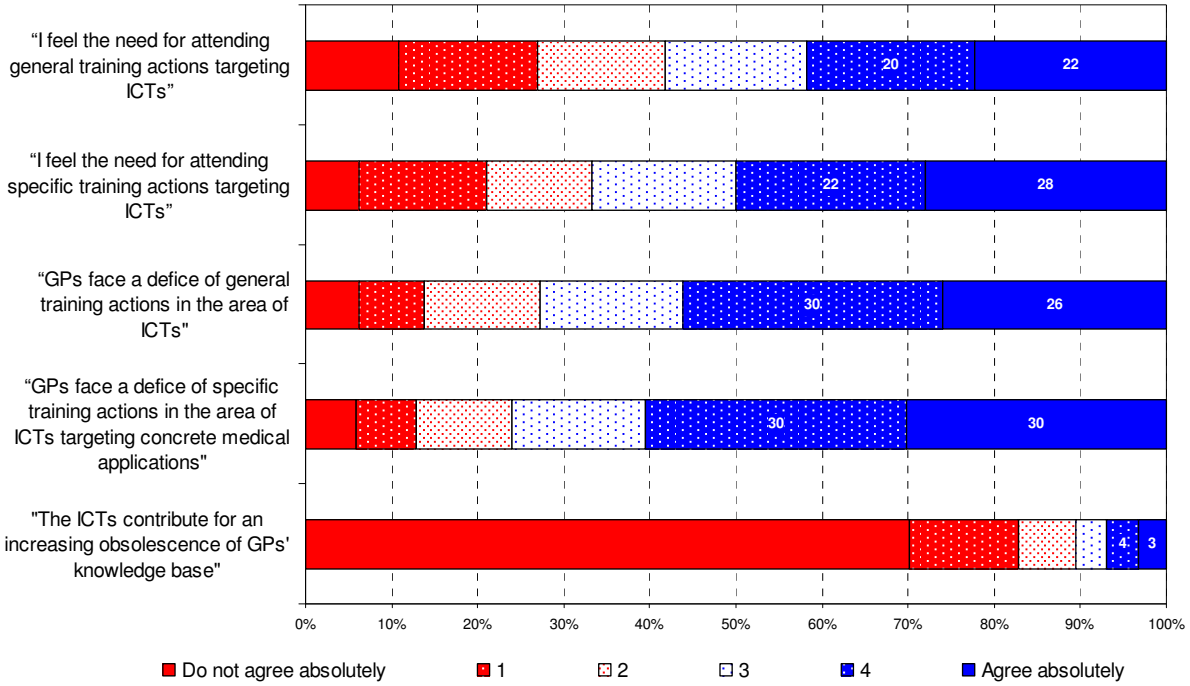

Figure 16: Degree of Agreement with the Statements (% of GPs)

Nevertheless, the Portuguese GPs recognise that the vast majority of GPs lack specific and general training on ICT related technologies and 50% agree (22%) or absolutely agree (28%) that they need to attend specific training actions on ICTs. As we have shown earlier, a large percentage (42%) of GPs admitted that in the last year (2006) they did not take any professional training targeting ICTs. Those who did undertook rather short-term (less than one week) courses.

Such a disheartening scenario uncovers an effective risk that a large part of Portuguese GPs may be unable to reap the benefits of ICTs in general and the Internet in particular.

5. GPs heterogeneity in Internet use, medical and scientific performance

In order to provide a general, although simple, overview of the descriptive statistics of the relevant variables and whether their means significantly differ in statistical terms in some perspectives – opinion on the Internet utility, Internet use, medical and scientific practice performance of GPs – we compute and analyse non-parametric independent group comparisons using the Kruskal-Wallis Test. This is a simple and useful non-parametric test (distribution-free) used to compare two or more independent groups of sampled data.[6] The hypotheses for the comparison of two independent groups are: H_0: the samples come from identical populations *versus* H_1: the samples come from different populations.[7] When the asymptotic significance is less that 0.10 (indicated with grey areas in the appendix tables), we reject the H_0 that the samples are identical for the item in analysis.

Given the aim of the present research, we analyse four groups of variables:

1) GPs that agree with the statement "The Internet is essential for my daily medical practice" versus those who don't agree with it;

2) GPs that use the Internet for medical practice above the average versus the remaining GPs;

3) GPs that present a medical daily practice performance above the average versus the remaining GPs;

4) GPs that present a scientific performance above the average versus the remaining.

The grouping variables were computed based on the responses gathered in our survey. Concerning the first variable – **'agree that the Internet is essential'** – we compute a dummy variable that assumes the value 1 when GPs responded 4 (I agree very much) or 5 (I absolutely agree) and 0 otherwise.

[6] Unlike the parametric independent group ANOVA (one way ANOVA), this non-parametric test makes no assumptions about the distribution of the data (e.g., normality). Thus, this test is an alternative to the independent group ANOVA, when the assumption of normality or equality of variance is not met. This, like many non-parametric tests, uses the ranks of the data rather than their raw values to calculate the statistic. Since this test does not make a distributional assumption, it is not as powerful as the ANOVA.

[7] It should be noticed that the hypothesis makes no assumptions about the distribution of the populations. These hypotheses are also sometimes written as testing the equality of the central tendency of the populations. The test statistic for the Kruskal-Wallis test is H. This value is compared to a table of critical values for U based on the each group's sample size. If H exceeds the critical value for H at some significance level (usually 0.10) it means that there is evidence to reject the null hypothesis in favour of the alternative hypothesis. When sample sizes are small in each group (< 5) and the number of groups is less than 4 a tabled value for the Kruskal-Wallis should be compared to the H statistic to determine the significance level. Otherwise, as in our case (see Tables 3-6), a Chi-square with k-1 (the number of groups-1) degrees of freedom can be used to approximate the significance level for the test.

The second variable – **use Internet for medical practice** above the average – is also a dummy variable that assumes the value 1 when the index, computed as the sum of the degree of use (0 - no use; …; 5 - use always) of activities listed in Question 11 of the questionnaire, is above the average and 0 otherwise.

Medical daily practice performance is a dummy variable computed as an index which sums up three indexes - number of consultations, number of prescriptions and number of hours spent in bureaucratic/managerial work related to the health unit. Again, if the index is above the average, the dummy variable assumes the value 1 and 0 otherwise.

Finally, **scientific performance** is computed in a similar, albeit more complex, way. It averages two indicators of performance ($0,3\times Perf\_Conf + 0,7\times Perf\_Journals$), one related to the scientific performance associated with congresses/conferences ($0,1\times n^{o}\ talks + 0,3\times n^{o}\ papers\ at\ national\ conferences + 0,6\times n^{o}\ papers\ at\ international\ conferences$) and other related to publications in scientific journals ($0,4\times n^{o}\ publications\ at\ national\ journals + 0,6\times n^{o}\ publications\ at\ international\ journals$); the dummy assumes once more the value 1 for GPs that present the index with a figure above the corresponding mean and 0 otherwise.[8]

Comparing the group of GPs that argues that "Internet is essential for their daily medical practice" with those who don't (Table A1), Kruskal Wallis Test indicates that they are younger, they tend to work at hospitals to a large extent, they use the Internet more intensively, they admit to experience difficulties using ICT related technologies on a higher degree, they had longer periods of ICT related training, they present lower medical daily practice performance and higher scientific performance.

Concerning the group of GPs that "use the Internet (above the average) for daily medical practice" versus those that present below average values (Table A2), the former tend to work in a narrower set of workplaces, reckon that the Internet is an essential tool for their daily medical practice and present a higher global scientific performance.

Those GPs that present above average medical performance are older, they present above average Internet use and lower scientific performance (Table A3). It seems clear that in the case of Portuguese GPs, daily medical practice and scientific activities are not complementary tasks. In fact, above average scientific performance GPs present lower daily medical practice

[8] These averages are weighted with weights reflecting the higher importance of journals relatively to conferences in global scientific performance and within each partial scientific indicator the higher importance of international relative to national conferences/journals. For that case, we take instead simple average results that did not change significantly.

(Table A4), they are younger and have attained higher education levels. At the same time, they present a higher use of ICTs related to activities (excluding creating a blog and listening radio/watching TV on the Internet) and consider that the Internet is essential.

6. Conclusions

Information and Communication Technologies (ICTs) in general and the Internet in particular, have been recognized for many years as an important, albeit also worrying mechanism for the transformation of medical care. The Internet appears promising as a means to disseminate information about health and health care, to enhance communication and facilitate a wide range of interactions between patients and the health care delivery system. As more physicians gain familiarity with the Internet, it is expect they will integrate it into their clinical practices. Notwithstanding, few empirical evidence concerning Internet use and users are available in the medical literature.

With this research we were able to provide a quantitative assessment on the role of the Internet in General Practitioners (GPs) medical daily practice and scientific performance. It focuses on the Portuguese underexplored context, where the Health Sector has been under pressure for wide and profound reforms, which have been extensively relying on ICTs, namely on the Internet.

Based on the responses of 342 GPs, we concluded that 94 % uses the Internet and the majority (57 %) of GPs agree that the Internet is essential to their medical daily practice. This is a slightly lower percentage than the one (62%) observed in other European countries. GPs tend to use Internet mainly for professional purposes. On average, they spend 10 hours per week on the Internet for professional purposes, a figure well above that of the European physicians (4 hours per week). Thus, although the percentage of Portuguese GPs claiming to use the internet (for professional or other purpose) is slightly lower to that of the European physicians, the intensity of use is quite higher.

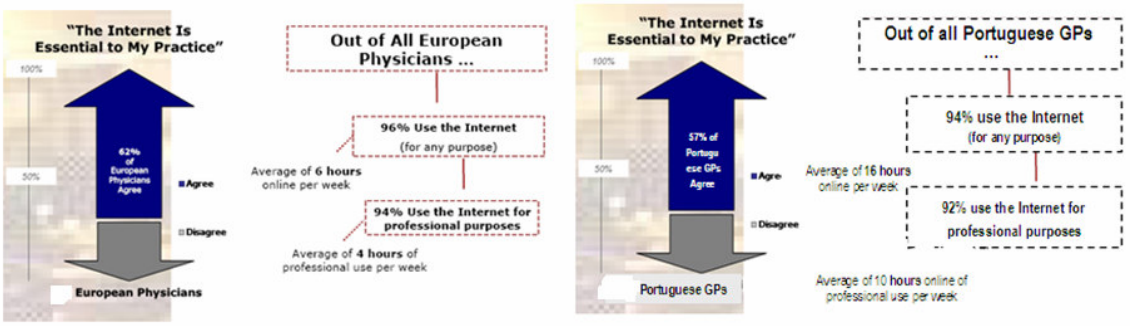

Figure 17: Level of Agreement the Internet is Essential, Frequency of Access

Source: Adapted from Manhattan Research (2006)

The use of ICTs in general and the Internet in particular reveal distinct GPs profiles, namely a 'medical' and a 'scientific' profile. These later tend to be relatively young, highly educated (reaching master and PhD courses). At the same time, they tend to spend a considerable amount of time on the Internet for professional purposes, using a wide range of ICTs related activities. Contrary to GPs with 'medical' profile, GPs with 'scientific' profile consider the Internet as an essential tool for their daily medical practice. Additionally, as we observe in Table 3, those who consider the internet as an essential tool, are not only more aware of the difficulties in using ICTs, but also the ones with longer periods of ICT related training, higher medical and scientific performances. This seems to convey a virtuous (vicious) cycle of higher (lower) perceived importance of the internet – higher (lower) levels of ICT training – higher (lower) performances and thus a demand for ICTs related training actions if one wants to prevent some kind of medical digital divide.

Descriptive data show that to posses or to be enrolled in advanced training fosters the use of the Internet for professional purposes, which in its turn tends to grant GPs the access to more and up-to-date information and knowledge on these matters. The three most important scientific sources of information for Portuguese GPs are *Revista Portuguesa de Clínica Geral*, scientific and technical books, *Jornal Médico de Família*, and *American Family Physician*, whereas the most important web pages, in terms of frequency of use, are *Associação Portuguesa dos Médicos de Clínica Geral* and *Medlin*, followed by *The New England Journal of Medicine* and *Portal da Saúde* – Portugal. In fact, one third of GPs claim that they frequently consult these pages.

Corroborating the result which associates the Internet use with the possession or enrolment in advanced training, data shows that the largest motivation factor to use the Internet is to 'Search information concerned with professional activity/investigation'.

Table 3: Main traits of GPs that …

	… argue that **"Internet is essential for their daily medical practice"**	… "**use the Internet** (above the average) for **daily medical practice**"	… present above the average **medical performance**	… present above the average **scientific performance**
Age	Younger	0	Older	Younger
Education	0	0	0	Attained **higher education** levels
Internet use	Use the Internet **more intensively**		Use the Internet **more intensively**	Use the Internet **more intensively** and present **higher** use of ICTs related activities
Internet usefulness		Consider (to a larger extent) that the **Internet is an essential tool** for their daily medical practice	0	Consider (to a larger extent) that the **Internet is essential**
ICT difficulties	Admit (to a higher degree) experiencing **difficulties** using ICTs	0	0	0
ICT Training	Had **longer periods** of ICT related training	0	0	0
Scientific performance	Present **higher** scientific performance	Present **higher** scientific performance.	Present **lower** scientific performance	
Medical daily practice performance	Present **lower** medical daily practice performance	0		Present **higher** medical performance
Number of workplaces	Work at **hospitals** (to a large extent)	Work in a **narrower** set of places	0	0

Nota: 0 – differences are not statistically significant

A worrisome evidence is that at the workplace, a substantial proportion of GPs (over 70 %) do not use the Internet or other related ICTs, namely for activities related with Telemedicine, exchanging files with other Hospitals/Health Units, external communication with citizens, training and consultation of provision catalogues. Although Electronic Prescription is used by the majority (roughly 60 %) of the respondent GPs, for all the other activities – teleconsultation, telediagnosis, and telemonitoring – only a meagre percentage of physicians (around 10%) claim that they use such technologies. Telemedicine at the workplace is still a chimera, at least for Portuguese GPs.

Notwithstanding such dishearten scenario, our data shows that the Internet for the respondent GPs has a crucial role in updating and improving their professional knowledge basis. In fact, the most common purpose of using the Internet in the daily medical practice is to update

knowledge in the professional domain. It is also used for queries and performance of academic related activities. Indeed, 70 % of Portuguese GPs absolutely disagree with the statement that the "The ICTs contribute for an increasing obsolescence in their knowledge base". Nevertheless, GPs recognise that the vast majority of them lack specific and general training on ICTs related technologies. In fact, half of them agree that they need to attend specific training actions on ICTs. Because of that large percentage (42%) of GPs who admitted not having pursued professional training targeting ICTs in the previous year, and those who did undertook rather short-term (less than one week) courses, such a disheartening scenario uncovers an effective risk that a large part of Portuguese GPs may be unable to reap the benefits of ICTs in general and the Internet in particular.

References

Andrews, J., Pearce, K., Ireson, C. and Love, M., (2006), "Information-seeking behaviors of practitioners in a primary care practice-based research network (PBRN*)", J Med Libr Assoc*, 93(2), April.

Baker, L., Wagner T., Singer S. and Bundorf, M. (2003), "Use of the Internet and E-mail for Health Care Information Results from a National Survey", *JAMA*, 289:2400-2406, in www.jama.com, accessed on August, 2007

Becker G. (1993), *Human capital. A theorical and empirical analysis with special reference to education*, 3rd edition. Chicago, The University of Chicago Press.

Blumenthal, D. (2002), "Doctors in a wired world", *Milbank Q*., 80:525-546.

Booth, A. and Snower D. (1996), *Acquiring skills. Market failures, their symptoms and policy responses,* Centre for Economic Policy Research, Great Britain: Cambridge University Press.

Carillo, M. and Zazzaro, A. (2000). "Innovation, Human capital Destruction and Firm's Investment in Training", *The Manchester School*, 68 (3), June..

Clark, J. (2006), "The impact of ICT on health, health care and nursing in the next 20 years", Paper presented to *NI2006*, Seoul, Korea, June.

Coget et al. (2002), "The Internet, social networks and Loneliness", *IT & Society,* 1: 1, summer180-201.

Culver, J., Gerr, F. and Frumkin, H., (1997), "Medical information on the Internet: a study of an electronic bulletin board". *J Gen Intern Med,* 12: 466-470.

De Maeseneer, J. and De Sutter, A. (2004), "Why Research in Family Medicine ? A Superflous Question", *Annals of Family Medicine,* 2 (2), May/June.

DOT Force (2001), "Digital Opportunities for All: Meeting the Challenge", Report of the *Digital Opportunity Task Force* (DOT Force) including a proposal for a Genoa Plan of Action, 11 May.

Drezner, J. (1998), "A Study of Internet Use by Physicians Treating HIV Patients - Clinical Care Options for HIV", *Medscape HIV/AIDS eJournal* 4(3).

EC (2006), "*Technology for Innovation / Information & Communication Technologies and E-business. ICT Standardisation. Work Programme 2006", in*. http://ec.europa.eu/enterprise/ict/policy/standards/ict_index_en.htm, accessed on June 2006.

Eitel, D., Yankowitz, J. and Ely JW., (1998), Use of Internet Technology by Obstetricians and Family Physicians", *JAMA*, October , 280 (15).

Ellenberger, H. (1995), Beyond the Unconscious: Essays of Henri F. Ellenberger in the History of Psychiatry, ed. and intro. Mark S. Micale, trans. Françoise Dubor and Mark S. Micale, 1993, reviewed: 1995, 69: 329-31.

Fox, S., Rainie, L., Horrigan, J., Amanda, L., Spooner, T., Burke M., Lewis, O. and Carter, C. (2000), "The Online Health Care Revolution: How the Web Helps Americans Take Better Care of Themselves.", *Washington, DC:* Pew Internet and American Life Project; November 26.

Gingrich, N. and Magaziner, I. (2000), "Two old hands and the new thing", *Health Aff*, (Millwood). 19:33-40.

Granja, M. (2005), "Ligações Perigosas. Os Médicos e os Delegados de Informação Médica", *Acta Med Port* 2005; 18: 61-68

Griffiths, K. and Christiansen, H. (2000), "Quality of Web based information on treatment of depression: cross sectional survey",. *BMJ,* 321:1511-1515.

Impicciatore, P., Violante, A. and Bonati, M.., (1997), "Reliability of health information for the public on the World Wide Web"., *BMJ*, 314:1875-1879.

INE – Instituto Nacional de Estatística (2006), "Inquérito à Utilização de Tecnologias da Informação e da Comunicação pelas Famílias 2006".

Jakobsson, M. (2006), "Virtual Worlds & Social Interaction Design", Department of Informatics, Umeå University, RR-06.02, ISSN 1401-4572, ISBN 91-7264-053-7.

Jones, R. and Newman, G. (1995). "Adaptive capital, Information and Schumpeterian Growth", *Economic Journal,* July, 105: 897-915.

Kassirer JP. (1995), "The next transformation in the delivery of health care." *N Engl J Med*; 332: 52-54.

Kleinke, J. (2000), "Vaporware.com: the failed promise of the health care Internet". *Health Aff (Millwood),* 19:57-71.

Lowrey, W. and Anderson, W. (2006), "The impact of the Internet use on the Public perception of Physicians: A perspective from the Sociology of Professions Literature", *Health Communication*, 19 (2): 125-131.

Manhattan Research (2006), "Taking the pulse ® Europe White Paper - Opportunities for Physician Marketing in the Networked European Economy", June 2006.

Marques, C., Nunes, G., Ribeira, T., Santos, Nuno and Teixeira, R. (2005), "Hábitos de sono em médico de família", *Rev. Port. Clin. Geral*, 21:555-61.

Martins, J., Biscaia, A., Conceição, C., Fronteira, I., Hipólito, F., Carrolo, M. and Ferrinho, P. (2003), "Caracterização dos profissionais de saúde em Portugal, Parte I – Quantos somos e quem somos", *Rev Port Clin Geral*, 19: 513-17.

Martins, J., Biscaia, A., Conceição, C., Fronteira, I., Hipólito, F., Carrolo, M. and Ferrinho, P. (2003), "Caracterização dos profissionais de saúde em Portugal, Parte II – Como estamos, onde estamos e como nos sentimos", *Rev Port Clin Geral*, 19: 627-35

McKenna, K and Bargh, J. (2000), "Plan 9 from Cyberspace: The Implications of the Internet for the Personality and Social Psychology", *Personality and Social Psychology Review*, 4 (15): 1, 57–75.

Meric, F., Bernstam, E., Mirza, N., Hunt, K. and Ames, F.(2002), "Breast cancer on the World Wide Web: cross sectional survey of quality of information and popularity of Websites.", *BM,* 324:577-581.

Miller, R., Hillman, J. and Given, R. (2002), "Physician Use of IT: Results from the Deloitte Research Survey", *Journal of Healthcare Information Management,* 18 (1).

National Research Council (2000), *Networking Health: Prescriptions for the Internet,* Washington, DC: National Academy Press; 2000.

Orlikowsk, W. and Yates, J. (1994), "Genre Reportoire: Norms and Forms for Work and Interaction", *MIT Sloan School*, Working Paper #3671-94, Center for Coordination Science Techincal Report #166 , March.

Ortiz, E. and Clancy, C. (2003), "Use of information technology to improve the quality of health care in the United States", *Health Serv Res,* Apr; 38(2):xi-xxii.

Pealer, L. and Dorman, S. (1997), "Evaluating health related Web sites",. *J Sch Health,* 67:232-235.

Pennbridge, J., Moya, R. and Rodrigues, L., (1999), "Questionnaire survey of California consumers' use and rating of sources of health care information including the Internet.", *West J Med,* 171:302-305.

Portugal, Ministério da Saúde (2001), Secretaria Geral, Estatísticas, in http://www.dmrs.min-saude.pt/recursos_dados_estatisticos_1.asp, accessed on February 2007.

Progetto, D. (1997), "Social partners' contribution to the Employment Summit", Paper presented by the European Trade Union Confederation, the Union of Industrial and Employer's Confederations Europe and the Europe Centre of Enterprises with Public Participation, 13 November 1997, in http://www.eurit.it/Eurplace/diana/ce97-partsoc.html, accessed on the 30th June 2006.

Purcell, G. et al., (2002), "The quality of health information on the Internet." *BMJ*. 2002;324: 557-558.

Seufer, S. and Seufer, A. (2000), "Towards the Continuously Learning Organization through Knowledge Networking - Case Swiss Re Group", Proceedings of the 33rd Hawaii International Conference on System Sciences.

Silberg, W. et al. (1997), "Assessing, controlling, and assuring the quality of medical information on the Internet". *JAMA*; 277: 1244-1245.

Teixeira, A.A.C. and Brochado, A. (2005), "Quando o SONHO se torna realidade...: avaliação estatística do impacto das tecnologias de informação nos serviços de consulta externa hospitalar", *Revista Portuguesa de Saúde Pública*, 23(1), Janeiro/Junho.

UMIC (2003), *Uma Nova Dimensão de Oportunidades. Plano de Acção para a Sociedade da Informação.* UMIC – Unidade de Missão, Inovação e Conhecimento.

WHO, 2002, *Health Systems: Improving Performance,* The World Health Report 2000, World Health Organization 2000,

WONCA Europe (2002), World Family Doctors Caring for People

Wyatt, J. (1997), "Measuring quality and impact of the World Wide Web.", *BMJ,* 314: 1879-1881.

Appendix

Table A1: Agrees that "the Internet is essential for medical daily practice" – Kruskal Wallis Test

			Agrees that "the Internet is essential for medical daily practice"		All	Chi-Square	Asymp. Sig.
			No	Yes			
Structural variables		Age	3,514	3,036	3,240	12,851	0,000
		Education	1,527	1,495	1,509	0,108	0,743
		Number of workplaces	1,712	1,663	1,684	0,124	0,725
		Hospital	0,212	0,296	0,260	3,028	0,082
Internet use		Number of hours/week (above the average) using the Internet	0,178	0,383	0,295	16,777	0,000
	Reasons for using the Internet	Send/receiving email	3,096	4,255	3,760	53,986	0,000
		Telephone via Internet	0,541	1,092	0,857	13,889	0,000
		Creating a blog	0,089	0,439	0,289	16,695	0,000
		Search information on goods and services	2,705	3,679	3,263	42,424	0,000
		Using travel and accommodation services	1,979	3,107	2,626	41,133	0,000
		Listening to the radio and watching TV on the Internet	0,596	1,372	1,041	27,111	0,000
		Playing and downloading games, images and music	0,801	1,281	1,076	12,376	0,000
		Reading and downloading online journals	1,651	2,750	2,281	37,385	0,000
		Downloading software (excluding games, images and music)	0,966	1,872	1,485	35,504	0,000
		Look for employment/sending applications, CVs	0,158	0,515	0,363	17,473	0,000
		Search for subjects related to scientific and professional activities	3,151	4,393	3,863	76,563	0,000
		Developing activities of formal education (school, university, etc.)	1,171	2,148	1,731	20,226	0,000
		Education Courses - extra formal education (outside the official system)	0,466	1,367	0,982	24,170	0,000
		Courses related specifically with job opportunities	0,116	0,474	0,322	13,939	0,000
	Activities developed at the workplace	Telemedicine activities	0,623	1,102	0,898	7,246	0,007
		Exchange files with other hospital units	0,356	0,791	0,605	4,328	0,037
		External communication with citizens	0,356	0,827	0,626	14,399	0,000
		External communication with other health units	0,808	1,291	1,085	7,725	0,005
		Internal communication between services	1,171	1,781	1,520	8,595	0,003
		Human resources training	0,329	0,694	0,538	8,289	0,004
		Consultation of provision catalogues	0,226	0,500	0,383	9,131	0,003
		Database access	1,377	2,439	1,985	24,143	0,000
		Search and gathering of information/documents	1,671	3,082	2,480	44,921	0,000
	Difficulty in performing these activities	Consultation by video conference	0,507	0,347	0,415	0,006	0,938
		Online medical tracing	0,404	0,352	0,374	0,331	0,565
		Online information available about medical issues	0,500	0,587	0,550	2,451	0,117
		Online diagnosis	0,459	0,541	0,506	2,491	0,115
		Register online consultations	0,589	0,929	0,784	8,960	0,003
		Receiving emails, requesting information, suggestions, complaints	0,979	1,628	1,351	13,537	0,000
		Creating web pages for medical diagnosis	0,336	0,454	0,404	4,028	0,045
		Maintenance of forums/chats in the Internet	0,418	0,643	0,547	7,449	0,006
Opinion		"The Internet is essential to my medical daily practice"	1,979	4,704	3,541	271,593	0,000
Training		Number of days of ICT related training	2,983	4,258	3,713	5,078	0,024
Performance		Medical daily practice	95,864	81,139	87,425	4,335	0,037
		Global scientific performance	0,186	0,347	0,278	27,337	0,000

Table A2: Use of the Internet (above the average) for medical practice – Kruskal Wallis Test

			Use of the Internet (above the average) for medical practice		All	Chi-Square	Asymp. Sig.
			No	Yes			
Structural variables		Age	3,294	3,166	3,240	1,142	0,285
		Education	1,497	1,524	1,509	0,082	0,775
		Number of workplaces	1,751	1,593	1,684	2,871	0,090
		Hospital	0,249	0,276	0,260	0,318	0,573
Internet use		Number of hours/week (above the average) using the Internet	0,213	0,407	0,295	15,014	0,000
	Reasons for using the Internet	Send/receive email	3,315	4,366	3,760	47,436	0,000
		Telephone via Internet	0,726	1,034	0,857	4,997	0,025
		Creating a blog	0,223	0,379	0,289	3,793	0,051
		Search information on goods and services	3,015	3,600	3,263	15,648	0,000
		Using travel and accommodation services	2,350	3,000	2,626	13,656	0,000
		Listening to the radio and watching TV on the Internet	0,939	1,179	1,041	5,412	0,020
		Playing and downloading games, images and music	0,919	1,290	1,076	11,337	0,001
		Reading and downloading online journals	1,914	2,779	2,281	23,669	0,000
		Downloading software (excluding games, images and music)	1,223	1,841	1,485	16,719	0,000
		Looking for employment or sending applications, CVs	0,315	0,428	0,363	1,867	0,172
		Search for subjects related to scientific and professional activities	3,477	4,386	3,863	40,916	0,000
		Developing activities of formal education (school, university, etc.)	1,355	2,241	1,731	19,039	0,000
		Education Courses - extra formal education (outside the official system)	0,675	1,400	0,982	21,564	0,000
		Courses related specifically with job opportunities	0,249	0,421	0,322	9,631	0,002
	Activities developed at the workplace	Telemedicine activities	0,289	1,724	0,898	61,819	0,000
		Exchange files with other hospital units	0,071	1,331	0,605	90,599	0,000
		External communication with citizens	0,122	1,310	0,626	87,159	0,000
		External communication with other health units	0,264	2,200	1,085	131,233	0,000
		Internal communication between services	0,472	2,945	1,520	144,774	0,000
		Human resources training	0,112	1,117	0,538	76,906	0,000
		Consultation of provision catalogues	0,051	0,834	0,383	72,802	0,000
		Database access	0,893	3,469	1,985	152,543	0,000
		Searching and gathering information/documents	1,437	3,897	2,480	136,130	0,000
	Difficulty in performing these activities	Consultation by video conference	0,355	0,497	0,415	5,653	0,017
		Online medical tracing	0,294	0,483	0,374	8,466	0,004
		Available online information about medical issues	0,335	0,841	0,550	27,008	0,000
		Online diagnosis	0,426	0,614	0,506	7,865	0,005
		Register online consultations	0,569	1,076	0,784	25,129	0,000
		Receiving email, requesting information, suggestions, complaints	1,036	1,779	1,351	25,182	0,000
		Creating web pages for medical diagnosis	0,264	0,593	0,404	8,363	0,004
		Making and maintaining forums/chats in the Internet	0,315	0,862	0,547	26,113	0,000

Table A3: Medical Performance above the average – Kruskal Wallis Test

			Medical Performance above the average		All	Chi-Square	Asymp. Sig.
			No	Yes			
	Structural variables	Age	3,092	3,467	3,240	8,337	0,004
		Education	1,454	1,593	1,509	2,215	0,137
		Number of workplaces	1,643	1,748	1,684	1,182	0,277
		Hospital	0,271	0,244	0,260	0,288	0,592
Internet use		Number of hours/week (above the average) using the Internet	0,256	0,356	0,295	3,877	0,049
	Reasons for using the Internet	Send/receive email	3,986	3,415	3,760	11,491	0,001
		Telephone via Internet	0,860	0,852	0,857	0,025	0,875
		Creating a blog	0,319	0,244	0,289	1,178	0,278
		Search information on goods and services	3,367	3,104	3,263	2,881	0,090
		Using travel and accommodation services	2,744	2,444	2,626	2,803	0,094
		Listening to the radio and watching TV on the Internet	1,034	1,052	1,041	0,009	0,924
		Playing and downloading games, images and music	1,121	1,007	1,076	2,101	0,147
		Reading and downloading online journals	2,401	2,096	2,281	3,137	0,077
		Downloading software (excluding games, images and music)	1,560	1,370	1,485	2,151	0,142
		Looking for employment/sending applications	0,411	0,289	0,363	1,120	0,290
		Search for subjects related to scientific and professional activities	4,000	3,652	3,863	7,134	0,008
		Developing activities of formal education (school, university, etc.)	1,802	1,622	1,731	0,741	0,389
		Education Courses - extra formal education (outside the official system)	1,048	0,881	0,982	0,414	0,520
		Courses related specifically with job opportunities	0,377	0,237	0,322	0,032	0,858
	Activities developed at the workplace	Telemedicine activities	0,952	0,815	0,898	1,357	0,244
		Exchange files with other hospital units	0,662	0,519	0,605	0,679	0,410
		External communication with citizens	0,638	0,607	0,626	0,560	0,454
		External communication with other health units	1,135	1,007	1,085	0,379	0,538
		Internal communication between services	1,517	1,526	1,520	0,004	0,952
		Human resources training	0,473	0,637	0,538	2,210	0,137
		Consultation of provision catalogues	0,386	0,378	0,383	0,073	0,787
		Database access	2,068	1,859	1,985	0,580	0,446
		Searching and gathering information/documents	2,512	2,430	2,480	0,124	0,725
	Difficulty in performing these activities	Consultation by video conference	0,367	0,489	0,415	0,444	0,505
		Online medical tracing	0,285	0,511	0,374	1,367	0,242
		Online information available about medical issues	0,498	0,630	0,550	0,969	0,325
		Online diagnosis	0,488	0,533	0,506	0,071	0,790
		Register online consultations	0,749	0,837	0,784	0,289	0,591
		Receiving email, requesting information, suggestions, complaints	1,353	1,348	1,351	0,056	0,813
		Creating web pages for medical diagnosis	0,377	0,444	0,404	1,155	0,283
		Maintaining forums/chats in the Internet	0,502	0,615	0,547	0,774	0,379
	Opinion	"The Internet is essential to my medical daily practice"	3,618	3,422	3,541	1,151	0,283
	Training	Number of days of ICT related training	3,862	3,485	3,713	0,001	0,972
	Performance	Medical daily practice	54,587	137,776	87,425	238,010	0,000
		Global scientific performance	0,307	0,234	0,278	18,532	0,000

Table A4: Scientific Performance above the average – Kruskal Wallis Test

			Scientific Performance above the average		All	Chi-Square	Asymp. Sig.
			No	Yes			
	Structural variables	Age	3,371	2,831	3,240	16,652	0,000
		Education	1,436	1,735	1,509	13,300	0,000
		Number of workplaces	1,699	1,639	1,684	0,244	0,621
		Hospital	0,251	0,289	0,260	0,475	0,491
Internet use		Number of hours/week (above the average) using the Internet	0,274	0,361	0,295	2,296	0,130
	Reasons for using the Internet	Send/receive email	3,560	4,386	3,760	19,561	0,000
		Telephone via Internet	0,757	1,169	0,857	5,657	0,017
		Creating a blog	0,290	0,289	0,289	0,079	0,778
		Search information on goods and services	3,158	3,590	3,263	5,729	0,017
		Using travel and accommodation services	2,417	3,277	2,626	17,479	0,000
		Listening to the radio and watching TV on the Internet	0,988	1,205	1,041	1,893	0,169
		Playing and downloading games, images and music	0,950	1,470	1,076	11,758	0,001
		Reading and downloading online journals	2,116	2,795	2,281	10,677	0,001
		Downloading software (excluding games, images and music)	1,336	1,952	1,485	11,335	0,001
		Looking for employment or sending applications, CVs	0,320	0,494	0,363	2,726	0,099
		Search for subjects related to scientific and professional activities	3,672	4,458	3,863	24,830	0,000
		Developing activities of formal education (school, university, etc.)	1,421	2,699	1,731	29,514	0,000
		Education Courses - extra formal education (outside the official system)	0,764	1,663	0,982	24,288	0,000
		Courses related specifically with job opportunities	0,243	0,566	0,322	4,953	0,026
	Activities developed at the workplace	Telemedicine activities	0,764	1,313	0,898	9,155	0,002
		Exchange files with other hospital units	0,490	0,964	0,605	11,788	0,001
		External communication with citizens	0,432	1,229	0,626	17,241	0,000
		External communication with other health units	0,992	1,373	1,085	1,913	0,167
		Internal communication between services	1,317	2,157	1,520	10,374	0,001
		Human resources training	0,340	1,157	0,538	35,316	0,000
		Consultation of provision catalogues	0,293	0,663	0,383	9,337	0,002
		Database access	1,776	2,639	1,985	12,719	0,000
		Searching and gathering of information/documents	2,278	3,108	2,480	11,524	0,001
	Difficulty in performing these activities	Consultation by video conference	0,394	0,482	0,415	2,774	0,096
		Online medical tracing	0,386	0,337	0,374	0,734	0,392
		Online information about medical issues	0,510	0,675	0,550	3,725	0,054
		Online diagnosis	0,479	0,590	0,506	3,471	0,062
		Register online consultations	0,799	0,735	0,784	1,211	0,271
		Receiving emails, requesting information, suggestions, complaints	1,359	1,325	1,351	0,413	0,521
		Creating web pages for medical diagnosis	0,386	0,458	0,404	2,748	0,097
		Maintaining forums/chats in the Internet	0,452	0,843	0,547	14,647	0,000
	Opinion	"The Internet is essential to my medical daily practice"	3,347	4,145	3,541	15,809	0,000
	Training	Number of days of ICT related training	3,797	3,452	3,713	0,134	0,715
	Performance	Medical daily practice	91,600	74,396	87,425	4,748	0,029
		Global scientific performance	0,050	0,992	0,278	203,743	0,000

Recent FEP Working Papers

Nº 274	Teresa M. Fernandes, João F. Proença and P.K. Kannan, "*The Relationships in Marketing: Contribution of a Historical Perspective"*, May 2008
Nº 273	Paulo Guimarães, Octávio Figueiredo and Douglas Woodward, "*Dartboard Tests for the Location Quotient"*, April 2008
Nº 272	Rui Leite and Óscar Afonso, "*Effects of learning-by-doing, technology-adoption costs and wage inequality"*, April 2008
Nº 271	Aurora A.C. Teixeira, "*National Systems of Innovation: a bibliometric appraisal"*, April 2008
Nº 270	Tiago Mata, "*An uncertain dollar: The Wall Street Journal, the New York Times and the monetary crisis of 1971 to 1973"*, April 2008
Nº 269	João Correia-da-Silva and Carlos Hervés-Beloso, "*General equilibrium with private state verification"*, March 2008
Nº 268	Carlos Brito, "*Relationship Marketing: From Its Origins to the Current Streams of Research"*, March 2008
Nº 267	Argentino Pessoa, "*Kuznets's Hypothesis and the Data Constraint"*, February 2008
Nº 266	Argentino Pessoa, "*Public-Private Sector Partnerships in Developing Countries: Are Infrastructures Responding to The New ODA Strategy"*, February 2008
Nº 265	Álvaro Aguiar and Ana Paula Ribeiro, "*Why Do Central Banks Push for Structural Reforms? The Case of a Reform in the Labor Market"*, February 2008
Nº 264	Jorge M. S. Valente and José Fernando Gonçalves, "*A genetic algorithm approach for the single machine scheduling problem with linear earliness and quadratic tardiness penalties"*, January 2008
Nº 263	Ana Oliveira-Brochado and Francisco Vitorino Martins, *"Determining the Number of Market Segments Using an Experimental Design"*, January 2008
Nº 262	Ana Oliveira-Brochado and Francisco Vitorino Martins, *"Segmentação de mercado e modelos mistura de regressão para variáveis normais"*, January 2008
Nº 261	Ana Oliveira-Brochado and Francisco Vitorino Martins, *"Aspectos Metodológicos da Segmentação de Mercado: Base de Segmentação e Métodos de Classificação"*, January 2008
Nº 260	João Correia-da-Silva, *"Agreeing to disagree in a countable space of equiprobable states"*, January 2008
Nº 259	Rui Cunha Marques and Ana Oliveira-Brochado, *"Comparing Airport regulation in Europe: Is there need for a European Regulator?"*, December 2007
Nº 258	Ana Oliveira-Brochado and Rui Cunha Marques, *"Comparing alternative instruments to measure service quality in higher education"*, December 2007
Nº 257	Sara C. Santos Cruz and Aurora A.C. Teixeira, *"A new look into the evolution of clusters literature. A bibliometric exercise"*, December 2007
Nº 256	Aurora A.C. Teixeira, *"Entrepreneurial potential in Business and Engineering courses … why worry now?"*, December 2007
Nº 255	Alexandre Almeida and Aurora A.C. Teixeira, *"Does Patenting negatively impact on R&D investment?An international panel data assessment"*, December 2007
Nº 254	Argentino Pessoa, *"Innovation and Economic Growth: What is the actual importance of R&D?"*, November 2007
Nº 253	Gabriel Leite Mota, *"Why Should Happiness Have a Role in Welfare Economics? Happiness versus Orthodoxy and Capabilities"*, November 2007
Nº 252	Manuel Mota Freitas Martins, *"Terá a política monetária do Banco Central Europeu sido adequada para Portugal (1999-2007)?"*, November 2007
Nº 251	Argentino Pessoa, *"FDI and Host Country Productivity: A Review"*, October 2007
Nº 250	Jorge M. S. Valente, *"Beam search heuristics for the single machine scheduling problem with linear earliness and quadratic tardiness costs"*, October 2007
Nº 249	T. Andrade, G. Faria, V. Leite, F. Verona, M. Viegas, O.Afonso and P.B. Vasconcelos, *"Numerical solution of linear models in economics: The SP-DG model revisited"*, October 2007

Nº 248	Mário Alexandre P. M. Silva, *"Aghion And Howitt's Basic Schumpeterian Model Of Growth Through Creative Destruction: A Geometric Interpretation"*, October 2007
Nº 247	Octávio Figueiredo, Paulo Guimarães and Douglas Woodward, *"Localization Economies and Establishment Scale: A Dartboard Approach"*, September 2007
Nº 246	Dalila B. M. M. Fontes, Luís Camões and Fernando A. C. C. Fontes, *"Real Options using Markov Chains: an application to Production Capacity Decisions"*, July 2007
Nº 245	Fernando A. C. C. Fontes and Dalila B. M. M. Fontes, *"Optimal investment timing using Markov jump price processes"*, July 2007
Nº 244	Rui Henrique Alves and Óscar Afonso, *"Fiscal Federalism in the European Union: How Far Are We?"*, July 2007
Nº 243	Dalila B. M. M. Fontes, *"Computational results for Constrained Minimum Spanning Trees in Flow Networks"*, June 2007
Nº 242	Álvaro Aguiar and Inês Drumond, *"Business Cycle and Bank Capital: Monetary Policy Transmission under the Basel Accords"*, June 2007
Nº 241	Sandra T. Silva, Jorge M. S. Valente and Aurora A. C. Teixeira, *"An evolutionary model of industry dynamics and firms' institutional behavior with job search, bargaining and matching"*, April 2007
Nº 240	António Miguel Martins and Ana Paula Serra, *"Market Impact of International Sporting and Cultural Events"*, April 2007
Nº 239	Patrícia Teixeira Lopes and Lúcia Lima Rodrigues, *"Accounting for financial instruments: A comparison of European companies' practices with IAS 32 and IAS 39"*, March 2007
Nº 238	Jorge M. S. Valente, *"An exact approach for single machine scheduling with quadratic earliness and tardiness penalties"*, February 2007
Nº 237	Álvaro Aguiar and Ana Paula Ribeiro, *"Monetary Policy and the Political Support for a Labor Market Reform"*, February 2007
Nº 236	Jorge M. S. Valente and Rui A. F. S. Alves, *"Heuristics for the single machine scheduling problem with quadratic earliness and tardiness penalties"*, February 2007
Nº 235	Manuela Magalhães and Ana Paula Africano, *"A Panel Analysis of the FDI Impact on International Trade"*, January 2007
Nº 234	Jorge M. S. Valente, *"Heuristics for the single machine scheduling problem with early and quadratic tardy penalties"*, December 2006

Editor: Sandra Silva (sandras@fep.up.pt)
Download available at:
http://www.fep.up.pt/investigacao/workingpapers/workingpapers.htm
also in http://ideas.repec.org/PaperSeries.html

www.fep.up.pt

Faculdade de Economia da Universidade do Porto
Rua Dr. Roberto Frias, 4200-464 Porto | Tel. 225 571 100
Tel. 225571100 | www.fep.up.pt