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eHealth, ICT and its relationship with self-reported health outcomes in the EU countries

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ABSTRACT

This work contributes to the discussion on the relationship between ICT and ehealth solutions in primary care, and self-reported health and health status in the European Union. The method used is an ordinary least squares linear model. The results show that there is no significant relation between self-reported health outcomes and ICT and ehealth indexes, except for self-reported chronic health problems. The more advanced that countries are in ICT, the larger is the share of people reporting a chronic health problem. This provides evidence on the existence of a link between chronic patients and ICT development.

1. Introduction

1.1. Background

Health systems are expected to improve population health and implicitly to provide the population with high quality health care that is also affordable [1]. Nowadays, health systems face two main challenges [2,3]. First challenge, there are limited health budgets and increasing health costs (met by the public and private sectors). While costs have been rising at a faster rate than GDP growth [4], but not as fast in recent years [5], health budgets are limited and do not rise at the same rate. This financial constraint raises several problems for governments because it forces the reallocation of resources in favor of health and to the detriment of other social areas. Second challenge, medicine is changing to become more continuous over a person's lifetime, and individually focused. The emergence of this trend can be explained firstly, by the generalization of chronic diseases as a health issue in modern industrialized societies, that demands continuous monitoring for the sake of treatment efficiency. A second factor is that of population aging, which creates a demand for long-term and continuous care.

eHealth has been offering some answers to these challenges by exploiting Information and Communication Technologies (ICT) to the full and creating new services [2].

As a matter of fact, there has been concern for the development of ehealth in Europe for some years now. The most recent and relevant initiative by the European Commission is the eHealth Action Plan 2012–2020 [44,45]. This plan provides a roadmap to empower patients and healthcare workers, link up devices and technologies, and invest in research into the personalized medicine of the future, to provide smarter, safer and patient-centered health services.

The definition of ehealth has been discussed in the literature (a review on the concept is done by Pagliari, [6], this work looks at the European Union proposal. The EU definition [7] states that ehealth concerns those tools and services using Information and Communication Technologies that can improve prevention, diagnosis, treatment, monitoring and management, to the benefit of the entire community by improving access and quality of care and by making the health sector more efficient.

The benefits of ehealth have been listed and discussed at length [8], such as increasing the quality of care and efficiency, reducing the operating costs of clinical services, reducing administrative costs and enabling entirely new modes of care [9–11].

The improved quality and the new modes of health care are seen in better access to diagnostic services, more coordination between providers, improved patient management, helping to overcome physical distances between patients and providers and engaging patients in their own health and well-being [12].

Emerging modes of health care place patients at the centre of the

Abbreviations: ICT, information and communication technology; OLS, ordinary least squares; UnMetNe, percentage of respondents who self-reported unmet needs for medical care; HealthGVG, percentage of respondents who self-perceived health good or very good; ChrHealthProb, percentage of respondents who self-reporting a chronic or long-standing health problem; IDI, Information and Communication Technologies Development index; eHI, eHealth index in primary care; PHE, Public health expenditure; BSEdu, share of population with basic secondary education; GDP pcap, gross domestic product per capita

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decision. This health care approach is sustained by an ehealth framework which allows individuals to manage their health and the health of their community. Patient centered modes of health care offer individuals the possibility of gaining considerable expertise in preventing and managing illness, as well as the opportunity to make health more affordable and increase patient satisfaction [1,13], as set out in the final objectives of health systems [1].

1.2. Aim

The general aim of this work is to contribute to the scant research on the relation between ICT development, ehealth technology and health outcomes in the European Union (EU).

The particular aim of this work is to describe the ehealth and ICT indicators prevailing in the set of 28 EU countries, and to test if health outcomes are correlated with ehealth at primary care level and with ICT development.

1.3. Literature review

Studies that focus on the relationship between ICT, ehealth and health outcomes are few. Cross-country empirical studies use population health indicators. Mithas et al., Wu and Raghupathi and Raghupathi and Raghupathi [14–16] find a positive relation between information technology (IT) and life expectancy. While Mithas et al. use a sample of 61 countries, the other two works have a sample of 200 countries. Moreover, these latter authors also study the possible relation between ICT and the mortality rate, fertility rate and tuberculosis detection, across countries with different levels of development. Recently, Irawan and Koesoema [17] have also found a positive effect between ICT, ehealth, and child mortality and maternal health, mostly in developing countries. Finally, it is worth mentioning the work by Ahangama and Poo [18], who found evidence for the moderator role of ehealth in the improvement of infant survival rate for a sample of 55 countries.

All the empirical works use a pool sample of countries of different levels of development, which may create some bias and does not allow for any differentiation. The exceptions are found in Wu and Raghupathi [15] and Raghupathi and Raghupathi [16] who have isolated developed countries. Nevertheless, the positive correlation between ICT development and health outcomes is still present in general.

While Raghupathi and Raghupathi [16] have looked for associations between health indicators and ICT development, the other authors have preferred to use a linear regression approach, either cross-section or panel data, to test that relation.

The set of countries used in these studies is wide-ranging and very diversified. Some European countries may be included in these sets, but no work has defined an exclusive set of EU countries that are more similar to one another than to other non-European countries. Such a diversified sample of countries may oversimplify or bias the view about what is happening in the EU countries.

1.4. Contribution

This work contributes to the ongoing discussion and research about the relation between ICT, ehealth and health outcomes. It differs in two respects. Firstly, the focus is only on countries with a similar level of development, so the sample includes the 28 EU countries. Secondly, health outcomes are self-reported by individuals and not population health indicators such as mortality rate or life expectancy. The health outcomes considered are those that mostly reflect the individuals' view of their health, such as unmet medical needs, general health status and suffering from chronic diseases.

1.5. Conceptual models

The conceptual models supporting the analysis in this work have two fundamental sources. The first is the health production function, which describes the relationship between a combination of medical and non-medical inputs and a resulting output measuring the health status [19]. The production process depends, in part, on the health system and its resources, but also on the non-medical, social, economic and physical conditions [20]. This perspective is more often used at country level to assess the population health determinants.

The second source is the individual determinants of health proposed by Dahlgren and Whitehead [21]. This model considers that individual health is influenced by different factors in various layers of influence. Individual health determinants have individuals at the center with a set of fixed genes and around them are different factors that influence their health and that can be modified. The first layer is personal behavior and ways of living that can promote or damage health. The second layer is social and community influences. The third layer, a sort of umbrella layer, includes structural factors: housing, working conditions, access to services and provision of essential facilities. Formally modeling this view yields a sort of health production.

Therefore, the determinant factors of health outcomes include GDP per capita, public health expenditure, education, health system, and communication and information system. The empirical studies just reviewed have also focused their interest on similar explanatory factors [14–18].

The analysis presented here uses a simplified form of a health production function applied to aggregated statistics of individual self-reported health outcomes and uses indicators of ehealth and ICT development as inputs, as described in the methodology section. It is thus able to test the relationship between ehealth and ICT development, and health outcomes.

Linear regressions are commonly used in empirical work and they have been well described by Zweifel et al. (ch. 4) [22], who devoted an entire chapter of their book to analyzing empirical studies estimating health production functions.

2. Methodology

The first part of this analysis describes the two basic indexes used here: the ICT Development Index (IDI), measuring the development of ICT in the country, and the eHealth Index at General Practitioner level (eHI), measuring the level of adoption of ehealth in primary care. This description characterizes how countries are positioned in the ehealth and ICT framework.

The second part has a quantitative nature. It is based on linear regression analysis, and it tests the potential relation between ehealth adoption in the primary care and ICT development, the inputs, and health outcomes.

The dependent variables of the linear model are three different health outcomes for the year 2014 available at Eurostat database (2016):

i) Self-reported unmet needs for medical care (UnMetNe). This captures the share of the survey respondents perceiving an unmet need for medical examination or treatment for any of three reasons: could not afford it, waiting list, and too far to travel.
ii) Self-perceived health good or very good (HealthGVG). This shows the share of the respondents perceiving their health as good or very good, in general.
iii) People self-reporting a long-standing health problem (ChrHealthProb). This reflects the share of respondents who suffer from any longstanding (duration of at least six months) illness or chronic health problem.

These indicators are collected by Eurostat from the SILC survey[1]

[1] Information about the SILC- Survey in European Union Statistics on Income and Living Conditions (EU-SILC) available at http://ec.europa.eu/eurostat/web/microdata/european-union-statistics-on-income-and-living-conditions and information about the self-perceived health statistics is available at http://ec.europa.eu/eurostat/statistics-explained/index.php/Self-perceived_health_statistics.