

Research article

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National health models and the adoption of eHealth and ePrescribing in primary care – new evidence from Europe

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ABSTRACT

Objective Recent research from the European Commission (EC) suggests that the development and adoption of eHealth in primary care is significantly influenced by the context of the national health model in operation. This research identified three national health models in Europe at this time – the National Health Service (NHS) model, the social insurance system (SIS) model and the transition country (TC) model, and found a strong correlation between the NHS model and high adoption rates for eHealth. The objective of this study is to establish if there is a similar correlation in one specific application area – electronic prescribing (ePrescribing) in primary care.

Methods A review of published literature from 2000 to 2014 was undertaken covering the relevant official publications of the European Union and national government as well as the academic literature. An analysis of the development and adoption of ePrescribing in Europe was extracted from these data.

Results The adoption of ePrescribing in primary care has increased significantly in recent years and is now practised by approximately 32% of European general practitioners. National ePrescribing services are now firmly established in 11 countries, with pilot projects underway in most others. The highest adoption rates are in countries with the NHS model, concentrated in the Nordic area. The electronic transmission of prescriptions continues to pose a significant challenge, especially in SIS countries and TCs.

Conclusions There is a strong correlation between the NHS model and high adoption rates for ePrescribing similar to the EC findings on the adoption of eHealth. It may be some time before many SIS countries and TCs reach the same adoption levels for ePrescribing and eHealth in primary care as most NHS countries.

Keywords: eHealth, ePrescribing, electronic health records (EHRs), Europe, health information systems, national health service (NHS), primary health care

INTRODUCTION

Adoption of eHealth in Europe is an area of interest to many stakeholders. The European Union (EU), through its executive body the European Commission (EC), has been a very active stakeholder in promoting the digital agenda in health in recent decades.^{1,2} Since 1989, the EC has invested over €1 billion in over 450 eHealth projects.² The work includes action plans for eHealth,³ directives and guidelines related to eHealth,^{4,5} sponsored eHealth projects,^{6–8} benchmarking activities⁹ and commissioned research^{10–14} (see Appendix 1 for a sample list of recent eHealth reports).

The primary care sector has been a particular focus of interest as it is where most patients have their routine encounters with the health system and where the greatest volume of health services are provided.¹⁵ The EC commissioned three major surveys into the adoption of eHealth in primary care in 2002,⁹ 2007¹⁶ and 2013¹⁰ in 15, 29 and 31 countries, respectively. Taken together, this qualitative and quantitative research paints a rich and complex picture of the development and adoption of eHealth in Europe over the past two decades. It is clear from this work and other related literature^{17–27} that many contextual factors influence the development and adoption of eHealth across all countries.

One such factor is the underlying national health model in operation. The EC noted this factor in the 2013 survey¹⁰ and presented the findings in light of the different types of health system models. Three different models were identified in the

report – the NHS, the social insurance system (SIS) and the transition countries (TCs).

The NHS group comprises countries with an NHS model funded primarily by taxation, often referred to as the Beveridge model. The SIS group comprises countries where the health system is organised and funded through social insurance schemes, often called the Bismarck model. The TC group comprises former Eastern Bloc countries that have gained independence in recent decades and joined the EU, where their health systems are now in transition. These groups are shown in Table 1, and a map of these groups is shown in Figure 1.

Table 1 National health model groups¹⁰

NHS	SIS	TCs
Cyprus	Austria	Bulgaria
Denmark	Belgium	Croatia
Finland	France	Czech Republic
Greece	Germany	Estonia
Iceland	Ireland	Hungary
Italy	Luxembourg	Latvia
Malta	Netherlands	Lithuania
Norway	Turkey	Poland
Portugal		Romania
Spain		Slovakia
Sweden		Slovenia
United Kingdom		

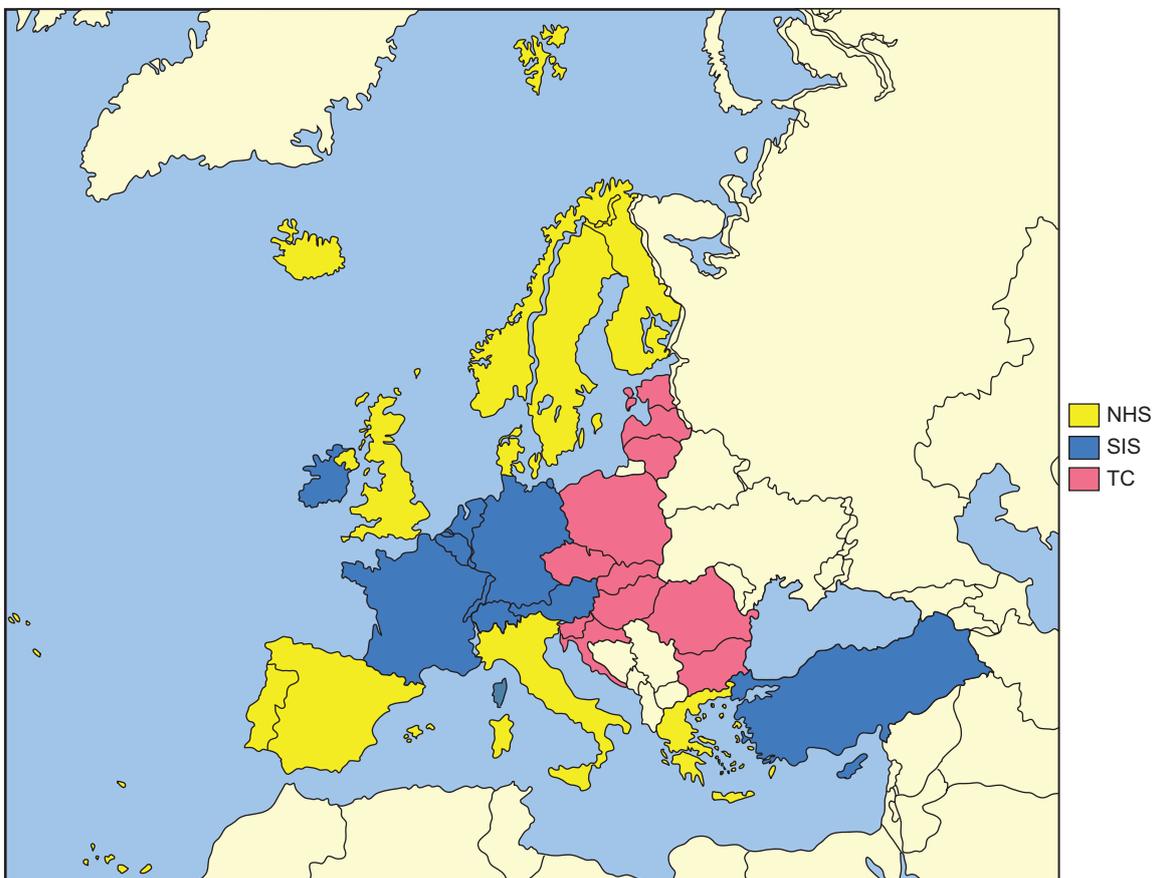


Figure 1 The map of NHS models

The 2013 EC survey studied general practitioners (GPs) in the primary care setting, which the report defined as ‘physicians working in outpatient establishments in specialties such as general practice, family doctor, internal medicine and general medicine’.¹⁰ The survey study took 18 months, and 9196 GPs (2%) from 31 European countries were surveyed in detail about the adoption of eHealth in primary care using four measures: electronic health records (EHRs), personal health records, health information exchange and telehealth. The study found that the adoption of eHealth was highest in NHS countries. As Figure 2 shows, eight of the top ten countries employ the NHS model, and the average score for NHS is higher than that for SIS or TC. It is clear from this research that the adoption of eHealth is higher in NHS countries across all four measures.

Is the situation similar for specific applications such as electronic prescribing (ePrescribing)? A survey of community pharmacy associations of the 27 EU members in 2010²⁸ concluded that the nationwide use of ePrescriptions was ‘not more common than in 2002’ and the adoption of ePrescribing was proceeding very slowly. Has this situation changed in the last four years?

DEFINITIONS AND METHODS

ePrescribing has been defined as a prescriber’s ability to electronically send an accurate, error-free and understandable prescription directly to a pharmacy from the point of care.²⁹ This definition was used in this study and explicitly includes the electronic transfer of prescription (ETP) as an integral part of the ePrescribing process.

A literature review was carried out to capture the spread of ePrescribing in Europe from 2000 to 2014. An online search for journal articles related to the subject of national ePrescribing between the years 2000 and 2014 was carried out using PubMed, Medline, Web of Science, Academic Search Premier, Business Source Premier and Google Scholar. This search found that a significant body of research has been published on many aspects of ePrescribing in recent years.^{1,30–59} For example, a qualitative review of 108 systematic reviews on the impact of eHealth interventions in 2011⁶⁰ found that ePrescribing was the most commonly studied intervention in a study that included picture archive communication systems (PACS), EHR systems, computerised provider order entry systems and computerised decision support systems. Many published research papers, conference papers and reports on national ePrescribing projects were also included in this study.

The EC has undertaken extensive research into the adoption of eHealth in European countries in the last decade, and this material was used in the study. This included surveys of eHealth in primary care in 2002,⁹ 2007¹⁶ and 2013,¹⁰ surveys of eHealth in acute hospitals in 2010¹² and 2013,¹⁴ and a review of national eHealth strategies in 2011.⁶¹ Independent reports have also been published about the European health systems, including eHealth and ePrescribing indices in 2009,⁶² 2012⁶³ and 2013,⁶⁴ and this research was included. The European Patient Smart Open Services (EPSOS) project was an EU-funded project (2008–2014) to promote the transfer of patient summaries and ePrescriptions between European countries, and published reports and other data from this project were also included.^{6,65}

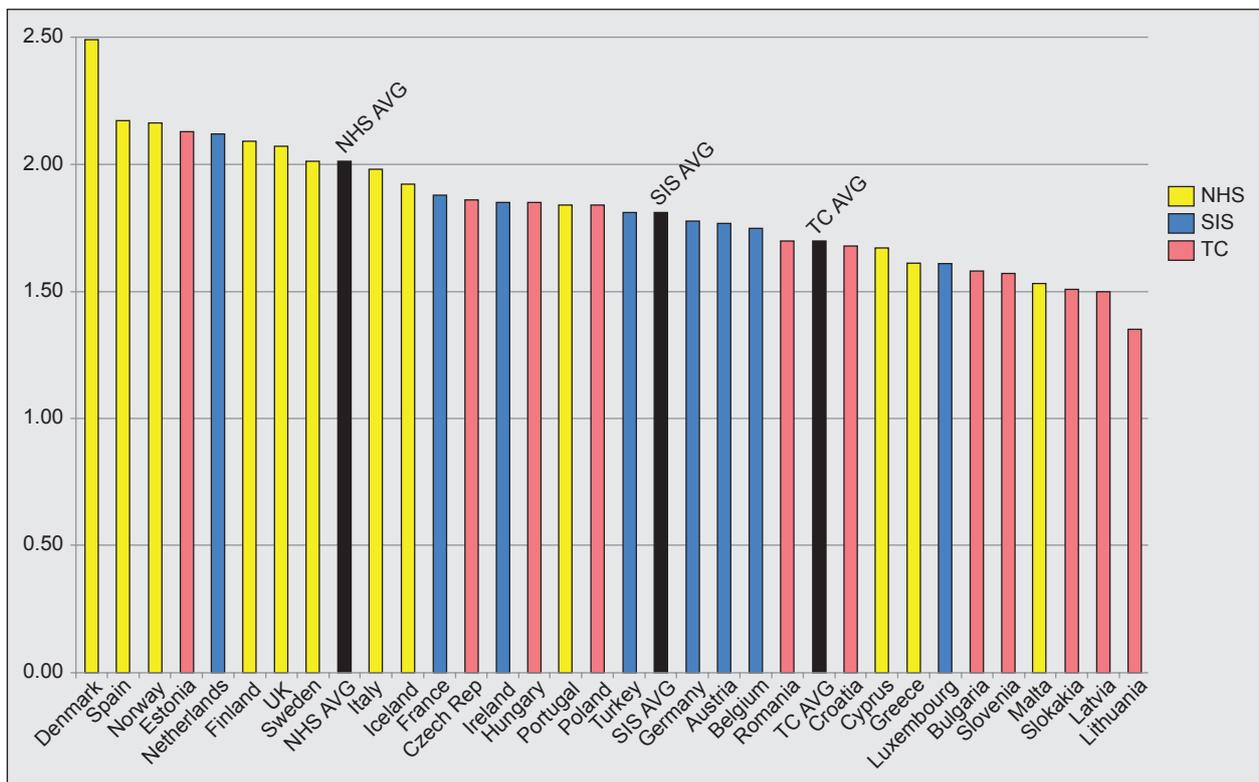


Figure 2 The adoption of eHealth by the national health model

Data were gathered and verified on the adoption of ePrescribing in both primary and secondary care in the 28 EU countries and three other countries where comparable data on ePrescribing were published – Iceland, Norway and Turkey. All of this literature was reviewed and analysed to identify trends in ePrescribing in Europe at this time in the following six thematic areas:

1. General eHealth adoption in primary care
2. ePrescribing in primary care
3. ePrescribing in secondary and tertiary care
4. National ePrescribing strategies and projects
5. Recent European ePrescribing indices
6. An EU-funded ePrescribing project EPSOS (2008–2014).

It was clear from the research data that ePrescribing in primary care is a very different proposition than ePrescribing in secondary or tertiary care.

In primary care, a wide range of routine services are provided by a number of different professionals (GPs, dentists, pharmacists, physiotherapists, public health nurses and so forth) in a variety of different outpatient settings,⁶⁶ which vary from country to country.^{15,67,68} Because of the geographically widespread and fragmented nature of primary care, ePrescribing in this environment explicitly demands the transmission of prescriptions electronically from GPs and other prescribers to community pharmacists over national networks using ETP infrastructures, and in turn community pharmacists transmit dispensed medication records electronically to GPs and other prescribers, and also to national reimbursement services or national medication registries.

On the other hand, secondary or tertiary care is generally provided by specialists in hospitals⁶⁶ (often referred to by a professional in primary care) and ePrescribing in hospitals is a different challenge, with special requirements (medication is prescribed to be directly administered), technologies and regulations. It usually takes place within a single institution or campus in a secure private network, with a different degree of complex interoperability and data regulation than that required in the primary care sector, but with a more urgent medical need and a higher risk factor. Because the ETP challenges in hospitals are not as great as those encountered in the primary sector, hospitals are more likely to attain 'the gold standard', which is 'a closed-loop medication administration system that may include medication reconciliation and adverse drug event monitoring'.^{12,69} In the interest of clarity, ePrescribing in hospitals was excluded from this study, and the focus was exclusively on ePrescribing in primary care.

RESULTS

ePrescribing systems have been gradually developing in many countries in recent decades from stand-alone systems used by prescribers to create and print prescriptions to point-to-point systems from prescriber to pharmacy using

ETP infrastructures and to regional and national projects managed and supported by national health authorities and government initiatives. ePrescribing is now beginning to gain broad acceptance in both the primary and acute sectors similar to the acceptance of PACS in radiology in recent decades.^{70,71} Interest and activity in ePrescribing is increasing across many countries in recent years, and many national ePrescribing projects are underway. For example, in the USA, reports in 2012⁷² and 2014⁷³ on the adoption of ePrescribing indicate that in 2008, 10% of office-based physicians in primary care were actively ePrescribing, but this increased to 58% by 2011 and 73% by 2013. The reports also highlighted that 1.04 billion ePrescriptions were transmitted electronically in 2013, accounting for 58% of all primary care prescriptions.

In Europe, according to the most recent data on eHealth in primary care,^{1,10,56–58} approximately 97% of GPs have access to the Internet and use a computer during consultations and 83% use these systems for recording clinical data such as prescriptions. Using the inclusion criteria that explicitly include ETP as an integral part of ePrescribing, it was estimated that approximately 2% of European GPs were actively ePrescribing in 2002, but by 2013 this had increased to 32%,^{10,16} as shown in Figure 3.

These data were extracted from the EC studies, and were verified and triangulated by reference to academic studies and published reports within each country. Further analysis of this internal country data indicates that most GPs still print and sign prescriptions, as it is simply not possible to transmit prescriptions electronically in many countries. There are several reasons for this – the infrastructure for ETP in primary care is not yet established, and complex legal, regulatory and technical issues must be resolved before ETP can commence. This suggests that ETP is the key challenge in most countries. The growth of ePrescribing across Europe is illustrated by country in Figure 4, which shows data from the EC studies in 2002,⁹ 2007¹⁶ and 2013.¹⁰

As Figure 4 shows, in 2002, only Denmark, Sweden and the Netherlands reported ePrescribing rates above 10%, and this was approaching 100% in these countries by 2007, but the picture in the remaining countries had not changed in this period. However, the increase in ePrescribing since 2007 is evident in Figure 4, where adoption in the top 11 countries is now higher than 50%. Of the remaining 20 countries, 14 still report ePrescribing rates of less than 10%. The 2013 data also reveal that 27 (87%) out of 31 countries have a national strategy for ePrescribing, while 24 (77%) were involved in the EPSOS project. Most of the countries that have a national ePrescribing strategy also participated in the EPSOS project with three exceptions (Cyprus, Iceland and Lithuania), while Hungary and Malta participated in EPSOS, but do not have a national strategy. Ireland neither participated in EPSOS nor has a national ePrescribing strategy.

When the results from the analysis of ePrescribing were compared with those from the national health model groups (see Table 1), it became clear that the NHS countries are

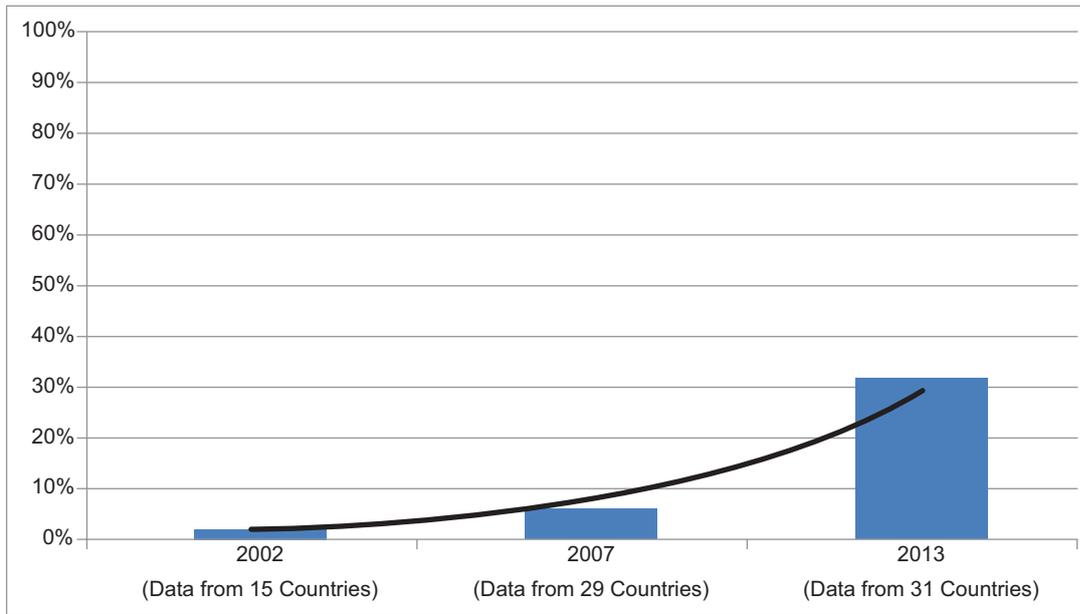


Figure 3 Rate of ePrescribing in primary care in Europe from 2002 to 2013

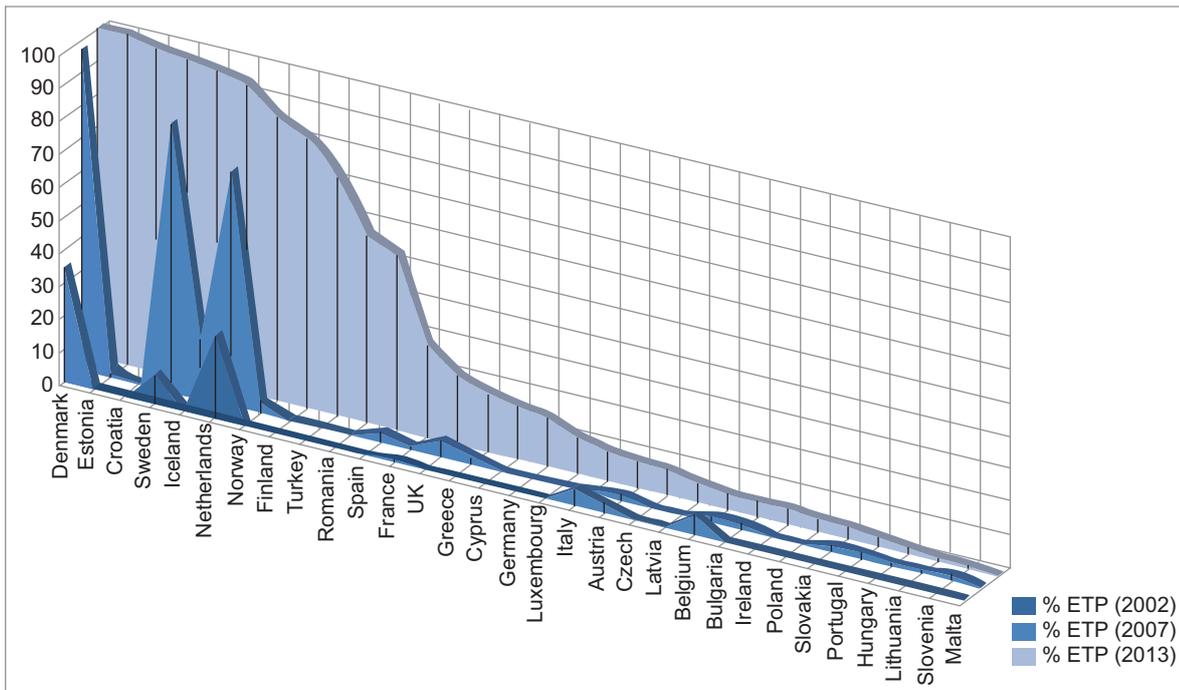


Figure 4 The growth of ePrescribing in primary care in Europe from 2002 to 2013

the most prominent among the ePrescribing leaders, as illustrated in Figure 5. The NHS model shows the highest average adoption rate and five of the top ten are NHS countries. The SIS and TC averages are very similar, with most of these countries in the middle and lower ranks (with some outliers). This analysis suggests that the highest adoption of ePrescribing is in NHS countries, which is consistent with the findings for the broader adoption of eHealth in Europe, where the NHS countries scored the highest on the overall index.¹⁰

DISCUSSION

Adoption

Why do most NHS countries have higher adoption rates than SIS countries or TCs? The EC report noted the following: ‘...on average, NHS countries have higher adoption levels on all dimensions, suggesting that institutional settings, funding of healthcare, the entailed structure of incentives and command chain are more favourable to eHealth adoption than, for instance, the social insurance model.’

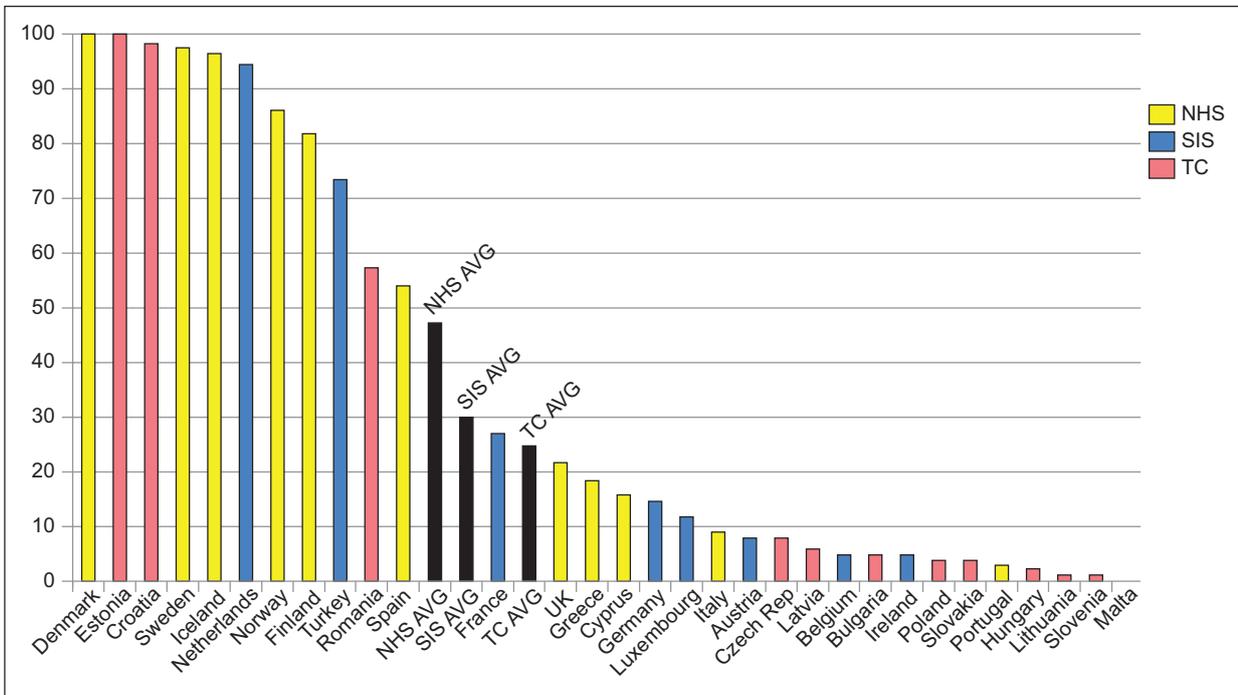


Figure 5 The adoption of ePrescribing by the national health model

If we take as correct the feedback from GPs stating that eHealth is becoming a mandatory obligation imposed for administrative purposes, then this is clearly more direct and effective in the NHS model where in relative terms hierarchy prevails over the market compared with the social insurance model'.¹⁰ Most NHS countries have a single authority or a small number of institutions responsible for the management of the NHS and the associated national health information systems, and this seems to be a key factor. This study compared the findings for the adoption of ePrescribing with both the national health models and the adoption categories popularised by Rogers.⁷⁴ This comparison is explored in the remainder of the discussion.

Pioneers

The evidence to support this research indicates that Sweden, Denmark and the Netherlands were the ePrescribing pioneers. Sweden developed the first ePrescription in Europe in 1983 and the tipping point in Sweden is now thought to have occurred in 2002, 20 years after the first ePrescribing pilot project.⁷⁵ Denmark has been making progress with ePrescribing since the early 1990s on a national basis,⁷⁶ while the Netherlands was also making progress at the same time on a regional basis and is now consolidating this progress on a national basis.^{47,77} Both Denmark and Sweden are leading NHS countries in the adoption of eHealth, while the Netherlands has the highest adoption rates for eHealth of any SIS country (see Figure 2).

Early adopters

The success of ePrescribing in Iceland (NHS) is the result of a seven-year project that commenced in the early 2000s and led to the national implementation of ePrescribing

in 2009.^{16,78} Estonia and Croatia are two unique TCs that have made very rapid progress in recent years, with national ePrescribing projects commencing in January 2010 and January 2011, respectively, and by 2012, over 80% of prescriptions were transferred electronically in each country.^{46,79} Two other national projects also went live in 2010 and 2011 in Finland and Norway,^{57,80} and now both of these NHS countries also report over 80% of primary care ePrescriptions transmitted through their national networks. For example, in Norway, in the first month, 300,000 ePrescriptions were recorded in the national system.⁸¹ In all of these countries, national ePrescribing projects have been in development for several years, with various pilot projects and legislation changes introduced to accommodate national ePrescribing.⁸²

Early majority

Turkey and France (both SISs), Romania (TC), and Spain, Greece and the UK (all NHSs) are currently progressing towards the national adoption of ePrescribing in primary care. In both Turkey and Romania, large national pilot projects in progress since 2012 became mandatory in January 2013.^{83–85} In the Andalucía region of Spain, a very robust ePrescribing system has been in use for the last decade, with almost 100% adoption,⁸⁶ and there are plans to extend this project to the whole country. National pilot projects are underway and have been making progress for several years in France.⁸² In the UK, the English national project (National Program for IT/Connecting for Health) has been making steady progress since 2002, but many prescriptions are still printed as barcodes, and ETP continues to be the key challenge.^{38,87,88} In more recent years, Northern Ireland and Wales have both implemented

national projects also based on printed barcoded prescriptions, while a national ETP project (ePharmacy) was widely adopted in Scotland⁸².

In an unusual development, an instruction for the mandatory use of ePrescribing in 2011 was contained in the memorandum of understandings issued by the Troika responsible for the fiscal reorganisation of Greece and Portugal, respectively.^{89,90} Greece has already a national project underway, following pilot projects from 2006 to 2008,¹² and this mandatory ePrescribing instruction seems to have accelerated the adoption in primary care in Greece, but not to the same degree in Portugal, which ranks among the laggards.

Late majority

Cyprus and Italy (both NHSs); Austria, Belgium, Germany and Luxembourg (all SISs); and the Czech Republic and Latvia (both TCs) all have lower than average rates of ePrescribing in primary care.^{57,91} All of these countries were members of the EPSOS project (except Cyprus and Latvia), and each has a national strategy for ePrescribing (except Luxembourg). Most have national projects and pilots underway but delays in these projects have been the common experience due to legal, organisational and technical problems.^{61,82,92} Scalability has also been a challenge, for example, in Italy where progress has been steady in the Lombardy region with a project that started in 2000,⁴² and plans are now in train to scale this project to the national level. One interesting finding from some countries in this group is the suggestion that 'participation in the EPSOS project might help to overcome these challenges'.⁸²

Laggards

At the bottom of the scale is a group of countries where there is little evidence of ePrescribing in the primary sector and it appears that ePrescribing has not yet reached their respective national eHealth agendas. These countries are Ireland (SIS), Portugal and Malta (both NHSs), and Bulgaria, Hungary, Lithuania, Poland, Slovakia and Slovenia (all TCs). There are no national plans for ePrescribing in Ireland, Hungary or Malta, while Bulgaria, Ireland and Lithuania were not members of the EPSOS project. Within this group, Poland seems to be making the most progress with pilot projects and the Polish government has established a national website for ePrescribing for both the medical community and the public.⁹³

CONCLUSIONS

ePrescribing in primary care is spreading in Europe. The pioneers – Sweden and Denmark (both NHSs) and the Netherlands (SIS) – have been joined in recent years by NHS countries such as Iceland, Finland and Norway, where long-term national projects are now making an impact. Early adopters from the TC and SIS groups include Estonia,

Croatia, Romania and Turkey – all of whom have also made progress in recent years in the implementation and adoption of mandatory national ePrescribing services.

In many other countries, the research suggests that GPs record prescriptions in computer systems during consultations, but are unable to transmit ePrescriptions to pharmacies because of legal, regulatory or technical reasons in their national health models. ETP seems to be the greatest challenge in most SIS countries and TCs where GPs still print and sign paper prescriptions.

There is a strong correlation between NHS countries and high adoption rates for ePrescribing. This is consistent with the finding on the adoption of eHealth in the recent EC research and this finding was confirmed in this study. Another interesting finding was that most NHS countries have undertaken national pilot ePrescribing projects for many years, in contrast to many SIS countries and TCs that are beginning the journey. A single health authority with a clear hierarchical structure seems to be a key factor in explaining why NHS countries have the highest adoption rates. Other factors specific to each country also play a key role, such as the organisation, legislation and regulation of national eHealth services, and stakeholder engagement in the health domain, but a thorough investigation of these factors requires further study.

In conclusion, ePrescribing is increasing but it is still not widespread in most of Europe. Although adoption rates exceed 50% in 11 countries in Europe at this time, the spread of ePrescribing is uneven with notable variations between the national health model groups. This research suggests that the context of the national health model in operation in a country is a key factor in the adoption of ePrescribing. It may be some time before most of the SIS countries and TC reach the same adoption levels as most NHS countries for ePrescribing and eHealth in primary care.

Limitations of the study

This study was limited by the availability of comparable data for 31 countries and by material in the English language. Other European countries in the Balkan area (Serbia, Montenegro, Macedonia, Albania and Bosnia–Herzegovina), Eastern Europe (Moldova, Ukraine, Belarus and Russian Federation) and Switzerland were not included in the study. It is probable that some countries have made further progress since their data were published, and the adoption rates in these countries may be higher than those reported in this study.

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Appendix 1

Sample of European Commission Reports on eHealth 2007–2014

Year	Report
2014	Overview of the national laws on electronic health records (EHRs) in the EU member states and their interaction with the provision of cross-border eHealth services: final report and recommendations
2013	Benchmarking deployment of eHealth among general practitioners (GPs)
2013	European Hospital Survey: benchmarking deployment of eHealth services
2012	eHealth Action Plan 2012–2020 – innovative healthcare for the 21st century
2011	European countries on their journey towards national eHealth infrastructures
2011	A composite index for the benchmarking of eHealth deployment in European acute hospitals
2011	eHealth Benchmarking III
2010	Interoperable eHealth is Worth it
2009	eHealth in action: good practice in European countries
2009	The socioeconomic impact of interoperable EHR and ePrescribing systems in Europe and beyond
2009	The socioeconomic impact of Diraya, the regional EHR and ePrescribing system of Andalucía's public health service
2009	The European files: eHealth in Europe
2009	eHealth Benchmarking II
2008	Benchmarking ICT use among GPs in Europe
2007	Pilot on eHealth indicators: country profiles

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