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RAND EUROPE
OPEN EVIDENCE
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Digital Agenda for Europe

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Abbreviations and acronyms

ANOVA	analysis of variance
CATI	computer-assisted telephone interviewing
CAWI	computer-assisted web interviewing
DG CONNECT	Directorate-General for Communications Networks, Content and Technology
ECHI	European Community health indicators
EHR	Electronic Health Record
EMR	electronic medical record
EPR	electronic patient record
EU	European Union
GDPR	General Data Protection Regulation
GP	general practitioner
HFA-DB	Health for All database
HIE	Health Information Exchange
ICT	information and communication technology
MANOVA	multivariate analysis of variance
NHS	national health service
OECD	Organisation for Economic Co-operation and Development
PHR	Personal Health Record
RCT	randomised controlled trial
REA	rapid evidence assessment
UEMO	European Union of General Practitioners
WHO	World Health Organization
WONCA	World Organization of Family Doctors

Abstract

DG CONNECT commissioned RAND Europe, Open Evidence and BDI Research to undertake the third eHealth benchmarking study, which measured the availability and use of eHealth by general practitioners (GPs) in 27 EU member states, and compared the results to those of the second eHealth benchmarking study (2013). A random sample of 5,793 GPs was surveyed, and univariate and multivariate statistical analyses were conducted to analyse the collected data. The analyses showed that, overall, eHealth adoption in primary healthcare in the 27 EU member states has increased from 2013 to 2018, but that there are differences among the countries surveyed. In countries with the highest level of adoption (Denmark, Estonia, Finland, Spain, Sweden and the United Kingdom), the use of eHealth is routine among GPs, while in countries with the lowest level of adoption (Greece, Lithuania, Luxembourg, Malta, Romania and Slovakia), eHealth is currently not widespread. Electronic health records are widely available across all countries; health information exchange adoption is lower than electronic health record adoption; Telehealth adoption shows progress, but its availability and use are still low in most countries; and personal health record adoption is, overall, low.

Résumé

La DG CONNECT a confié à RAND Europe, à Open Evidence et à BDI Research la réalisation de la troisième étude comparative sur l'eSanté, destinée à mesurer la disponibilité de l'eSanté parmi les médecins généralistes et l'usage qui en est fait dans 27 États membres de l'UE, et à confronter ces résultats à ceux de la deuxième étude comparative sur l'eSanté (2013). Des données ont été recueillies auprès d'un échantillon aléatoire de 5 793 généralistes et ont fait l'objet d'analyses statistiques univariées et multivariées. Les résultats suggèrent que, d'une manière générale, l'adoption de l'eSanté dans le cadre de la médecine générale a augmenté dans les 27 États membres entre 2013 et 2018. Des différences existent néanmoins entre les pays étudiés. Dans les pays présentant le degré d'adoption le plus élevé (au Danemark, en Estonie, en Finlande, en Espagne, en Suède et au Royaume-Uni), l'utilisation de l'eSanté est chose courante parmi les généralistes ; au contraire, dans les pays où l'adoption est faible (en Grèce, en Lituanie, au Luxembourg, à Malte, en Roumanie et en Slovaquie), l'eSanté n'est pas très répandue à l'heure actuelle. Le dossier médical informatisé est largement disponible dans tous les pays ; l'adoption de l'échange d'informations de santé est moindre que celle du dossier médical informatisé ; l'adoption de la télémédecine progresse, mais elle n'est que peu disponible et peu utilisée dans la plupart des pays ; et, globalement, l'adoption du dossier médical partagé reste faible.

Executive summary

Introduction and background

The European Commission seeks to understand and measure the current use of information and communication technology (ICT) and eHealth applications by general practitioners (GPs) in the European Union (EU), as well as changes in uptake over time. Two studies benchmarking the use of eHealth by GPs in Europe had been conducted to date: Dobrev et al. (2008) and Codagnone and Lupiáñez-Villanueva (2013b). RAND Europe, together with Open Evidence and BDI Research, were commissioned by DG CONNECT to undertake the third benchmarking study, which aimed to: (1) measure the use of ICT and eHealth applications by GPs in 27 EU member states[1] since 2013, (2) analyse the main drivers of and barriers to eHealth adoption in primary healthcare, and (3) compare how the levels of adoption, drivers and barriers have evolved since 2013 (Codagnone and Lupiáñez-Villanueva 2013a, 2013b).

Study design and analysis

This mixed-methods study consisted of two main elements:

- A **literature review** on factors influencing the adoption and use of ICT in primary care.
- A **survey of GPs** in 27 EU countries.

The literature review followed a rapid evidence assessment approach and aimed to provide an update to the literature review findings presented in the second eHealth benchmarking study, as well as to identify whether the questions on the drivers, impacts and barriers to eHealth included in the questionnaire are still valid or, instead, require an update.

For the survey of GPs, we used the same approach and the same questionnaire as were used for the second eHealth benchmarking study. The questionnaire covers socio-demographics and general characteristics of surveyed GPs, as well as the availability and use of eHealth functionalities, and it addresses attitudes to, perceived barriers to and perceived impacts of ICT adoption. Questions on availability and use of eHealth functionalities are divided into four categories of ICT in healthcare, as defined by the Organisation for Economic Co-operation and Development (OECD) (OECD 2015): Electronic Health Records (EHRs), Health Information Exchange (HIE), Telehealth and Personal Health Records (PHRs) .

The survey was conducted between January and June 2018. Across the 27 EU countries analysed, a final sample of 5,793 GPs was randomly selected, with an overall sampling error of ±1.30%. Univariate and multivariate statistical analysis were conducted to analyse the survey data. To gain a better understanding of the difference between availability and use of the different eHealth functionalities, we created new variables, which are general measures of how well a functionality is adopted. These variables combine answers to questions on the availability and use of a functionality on a scale of 0 to 4 (0 = not aware ('do not know' answers), 1 = do not have it, 2 = have it and do not use it, 3 = use it occasionally, 4 = use it routinely). We used these variables to develop composite indicators for each of the four eHealth categories to show the adoption of each category, as well as a composite index[2] to show the overall adoption of eHealth, which combines the results of the four composite indicators.

Finally, we analysed responses to questions on perceived impacts of and barriers to eHealth,

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[1] All 28 member states as of 2018, except for the Netherlands. The Nationaal ICT Instituut in de Zorg (shortened to Nictiz), the national centre of expertise for eHealth in the Netherlands, was conducting an official monitoring eHealth survey during the same period covered by this study. Access to the GPs in this country was restricted by the Dutch authorities to avoid interference with the national survey.

[2] A composite index is formed when individual indicators are compiled into a single index on the basis of an underlying conceptual model with the support of the empirical exploration of the dataset.

using a non-hierarchical cluster analysis. We used these two sets of variables (i.e. impacts and barriers) to develop a typology of four GP attitudinal profiles: Realist, Enthusiast, Indifferent and Reluctant.

Main findings

Descriptive findings

General characteristics

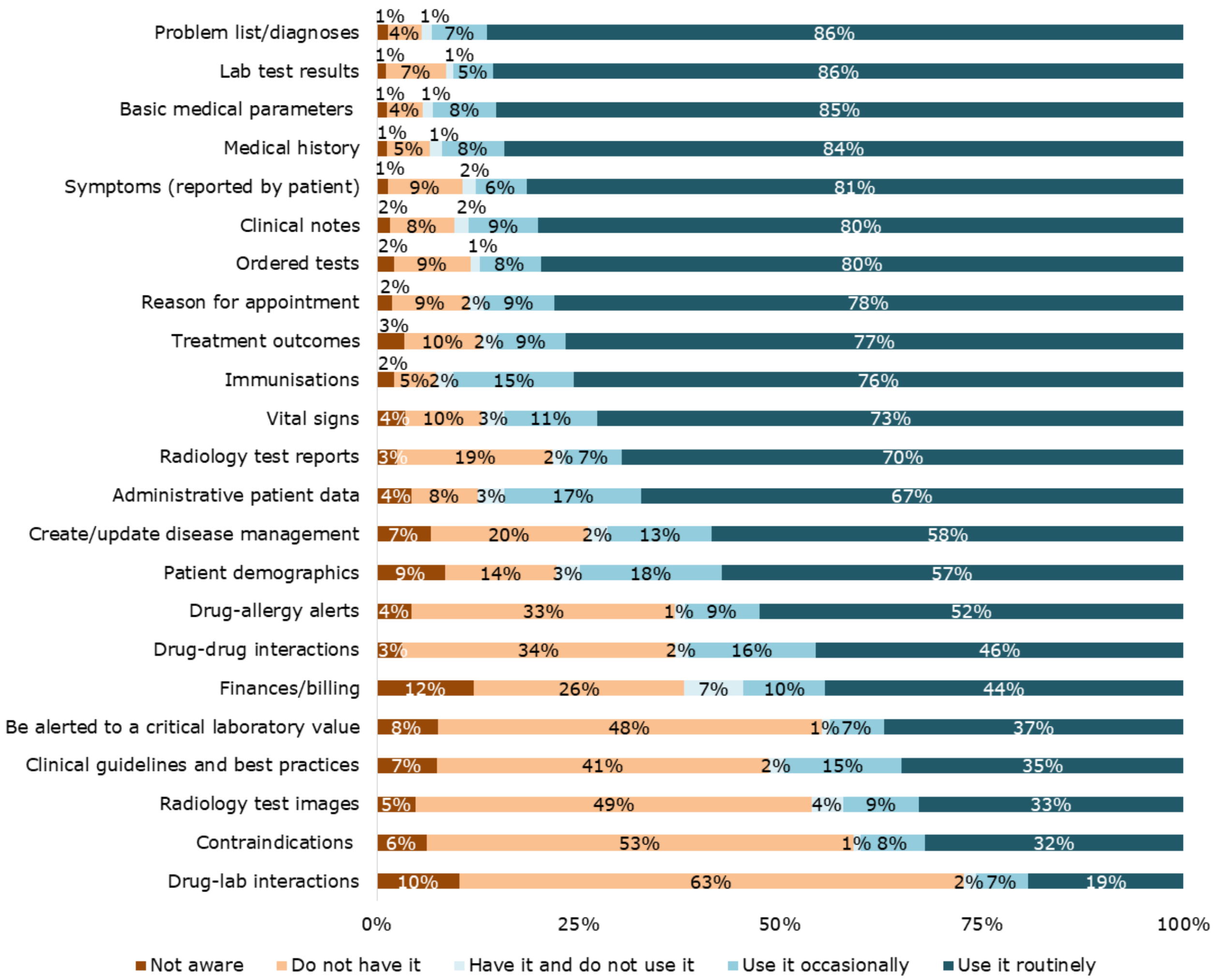
Across the 27 EU countries analysed, a final sample of 5,793 GPs was selected:

- 50% of respondents are male and 50% female.
- 45% of respondents are 55 years of age or older, 27% between 46 and 55 years, 18% between 36 and 45 years and 10% are 35 years or younger.
- 39% of respondents are self-employed working alone in a practice, 30% work as a salaried GP in a health centre and 22% are self-employed working in a group practice.
- 37% of respondents work in large cities, 36% in rural towns and 27% in medium- to small-sized cities.

Electronic health records

Figure 1 shows the adoption of the 25 EHR functionalities presented in the survey. There are no significant differences compared with 2013.

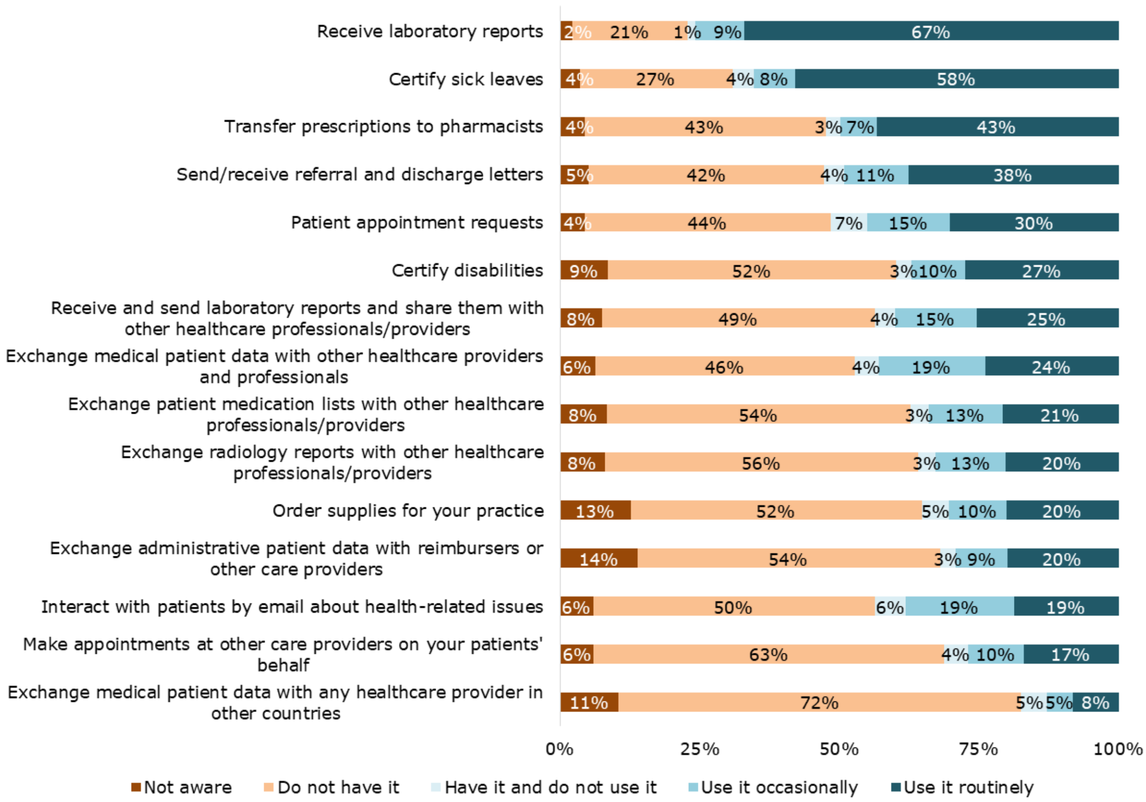
Figure 1 EHR awareness and use



Health information exchange

Figure 2 shows the adoption of 15 HIE functionalities presented in the survey. Routine use of certifying sick leaves has increased from 47% in 2013 to 58% in 2018, and routine use of transferring prescriptions to pharmacists has increased from 24% in 2013 to 43% in 2018.

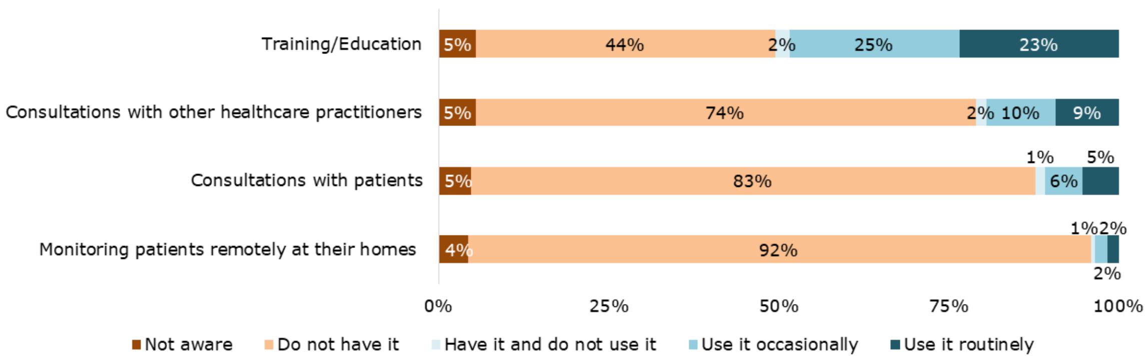
Figure 2 HIE awareness and use



Telehealth

Figure 3 shows the adoption of the HIE functionalities presented in the survey. There are no significant differences compared with 2013.

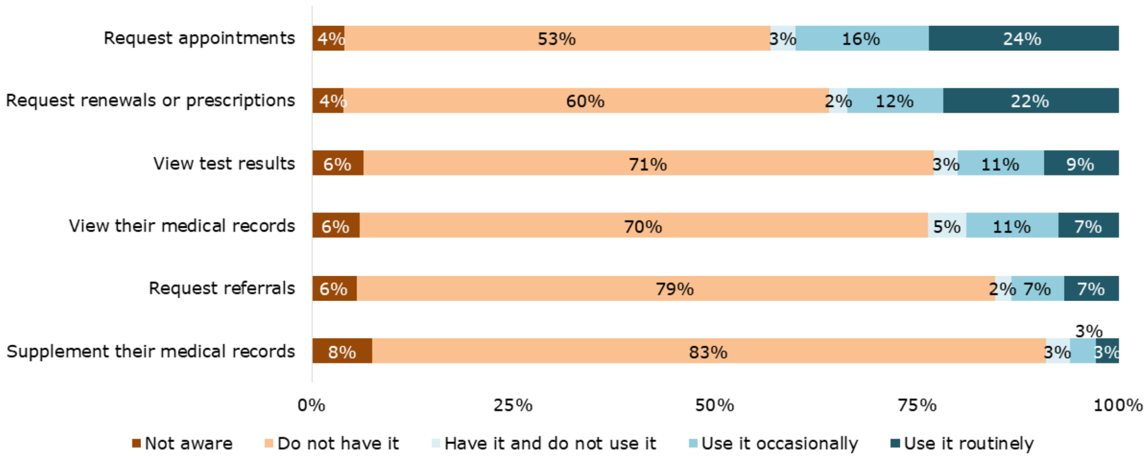
Figure 3 Telehealth awareness and use



Personal health records

Figure 4 shows the adoption of the PHR functionalities presented in the survey. Changes compared with 2013 were found for the functions to request appointments (2018: 24%, 2013: 13%) and to request renewals or prescriptions (2018: 22%, 2013: 13%).

Figure 4 PHR awareness and use



eHealth adoption

Electronic health record adoption

The EHR composite indicator combines 23 functionalities across five subdimensions. The EHR composite indicator shows that EHRs are fully available across the 27 EU countries; in some countries there is almost full adoption. The EHR composite indicator score for the EU in 2018 is 3.196,[3] which is an increase compared with the 2013 score of 2.989.

While we found increases in the adoption of EHRs since 2013 across all member states,[4] the extent of the increase varied. The largest increase was found for Lithuania, where the EHR composite indicator score increased by 0.790 points, from 1.393 in 2013 to 2.183 in 2018 (however, despite this increase, Lithuania still has the lowest EHR adoption score among all analysed countries).

Health information exchange adoption

The HIE composite indicator combines 13 functionalities into three subdimensions. The HIE composite indicator suggests that its adoption is lower than the adoption of EHR. The EU average score in 2018 is 2.070, which is an increase compared with the 2013 score of 1.884.

While we found increases in the adoption of HIE since 2013 across all member states, the extent of the increase varied. The largest increases were found for Croatia (2013: 1.692, 2018: 2.286) and Slovenia (2013: 1.318, 2018: 1.872).

Telehealth adoption

The Telehealth composite indicator is composed of two subdimensions covering four different functionalities. The Telehealth composite indicator shows an increase in Telehealth adoption from 2013 to 2018. The EU average score in 2018 is 1.639, while in 2013 it was 1.383.

While we found increases in the adoption of Telehealth since 2013 across all member states, the extent of the increase varied. The largest increase was found for Croatia, where the Telehealth composite indicator score increased from 1.260 in 2013 to 1.824 in 2018.

[3] The EU average for the EHR, HIE, Telehealth and PHR composite indicator was weighted based on the number of GPs in each country.

[4] Except for Bulgaria, where the 2013 EHR composite indicator score was 2.746, which means a decrease of 0.001 points, to 2.745, in 2018; however, given the margin error of the sample, this decrease is not statistically significant.

Personal health record adoption

The PHR composite indicator combines six different functionalities into two subdimensions. The PHR composite indicator shows a large discrepancy between high- and low-performing countries. The EU average score in 2018 is 1.568, which is higher than in 2013, when it was 1.319.

While we found increases in the adoption of PHRs since 2013 across all countries,[5] the extent of the increase varied. The largest increase was found for Finland, where the PHR composite indicator score increased by 1.334 points, from 1.242 in 2013 to 2.576 in 2018. Similarly, the United Kingdom (2013: 1.597, 2018: 2.428) and Sweden (2013: 1.555, 2018: 2.354) had substantial increases.

eHealth composite index of adoption

The overall eHealth adoption average score – the eHealth composite index of adoption – combines results for the four eHealth composite indicators. In 2018, the composite index EU average is 2.131, which indicates an increase since 2013, when the EU average was 1.876.

eHealth adoption in context

We analysed the organisational- and system-level differences for the composite index and the four composite indicators to show differences by practice type and health system type. On average, eHealth adoption is higher among national health service (NHS) system countries as compared with social insurance and transition countries. Overall, transition countries have lower levels of adoption compared with NHS and social insurance countries, with the exception of Estonia: it is not only ranked among the top five countries across all four eHealth categories and in the overall adoption of eHealth (second highest composite index score), but also had the highest increase in the level of adoption since 2013. In addition, the analysis showed that GPs working in health centres and group practices have higher adoption levels than those working in solo practices or under other arrangements (i.e. freelance and others).

GP profiles

We conducted a cluster analysis using the data on the perceived impacts of and barriers to ICT adoption in primary care to develop a typology of four GP attitudinal profiles: Realist, Enthusiast, Indifferent and Reluctant.

A cluster analysis using data on the perceived impacts of and barriers to ICT adoption showed that the **Realists** are the largest group among the GPs surveyed: 36% of GPs represented in the cluster analysis consider both the barriers and impacts as relevant and important when it concerns the adoption of eHealth functionalities. The second largest group are the **Enthusiasts**: 27% of the GPs in the cluster analysis extol the impacts and disregard the barriers. GPs in the cluster **Indifferent** (23% of the classified GPs) report that they do not care about either the impacts or the barriers. The smallest group are **Reluctant** GPs, who place more importance on barriers than on impacts (14% of the classified GPs, 12% of our sample).

We observed some changes between the 2013 and 2018 results. In 2013, 33% of GPs in the classified sample were **Indifferent**, while in 2018, 23% were in this group. Conversely, **Enthusiasts** increased from 13% to 27% between 2013 and 2018. This suggests that a large proportion of the GPs became more positive about the drivers and less negative about the barriers in the past five years.

[5] Except for Romania, where the 2013 PHR composite indicator score was 1.232, which means a decrease of 0.046 points, to 1.186, in 2018; however, given the margin error of the sample, this decrease is not statistically significant.

Note de synthèse

Introduction et contexte

La Commission européenne cherche à comprendre et à mesurer l'utilisation actuelle des technologies de l'information et de la communication (TIC) et des applications d'eSanté par les médecins généralistes de l'Union européenne (UE), ainsi que l'évolution de leur adoption avec le temps. Deux états des lieux de l'utilisation de l'eSanté par les généralistes européens ont été dressés jusqu'à présent : Dobrev et al. (2008) et Codagnone et Lupiáñez-Villanueva (2013b). C'est à RAND Europe, en collaboration avec Open Evidence et BDI Research, que la direction générale des réseaux de communication, du contenu et des technologies (DG CONNECT) a commandité la réalisation de la troisième étude comparative, dont les objectifs sont les suivants : (1) mesurer l'utilisation des TIC et des applications d'eSanté parmi les généralistes de 27 États membres de l'UE[6] depuis 2013, (2) analyser les principaux facteurs favorisant l'adoption de l'eSanté en médecine générale ou, au contraire, y faisant obstacle, et (3) déterminer l'évolution du degré d'adoption, et de l'impact des différents facteurs depuis 2013 (Codagnone and Lupiáñez-Villanueva 2013a, 2013b).

Conception de l'étude et analyse

Cette étude à la méthodologie mixte s'organise en deux volets principaux :

- une **revue de la littérature** concernant les facteurs d'influence dans le cadre de l'adoption et de l'usage des TIC en médecine générale ;
- et une **enquête auprès de généralistes** de 27 pays de l'UE.

La revue de la littérature suivait une analyse documentaire dite « évaluation rapide des données probantes » et avait pour but de dégager une perspective actualisée des conclusions tirées de l'examen de la littérature présentées dans la deuxième étude comparative sur l'eSanté, ainsi que de déterminer si les facteurs énumérés dans le questionnaire comme ayant un impact (quel qu'il soit) en matière d'eSanté étaient encore valides ou devaient, au contraire, être révisés.

Pour l'enquête auprès des généralistes, nous avons utilisé la même approche et le même questionnaire que lors de la deuxième étude comparative. Le questionnaire s'intéresse aux informations sociodémographiques et aux autres caractéristiques générales des médecins interrogés, à la disponibilité et à l'usage de fonctionnalités d'eSanté, aux attitudes vis-à-vis de l'adoption des TIC, et à la perception des obstacles à cette adoption et des conséquences de celle-ci. Les questions concernant la disponibilité et l'utilisation des fonctionnalités d'eSanté se subdivisent en quatre catégories, suivant les quatre TIC mises en œuvre dans le domaine de la santé, telles que définies par l'Organisation de coopération et de développement économiques (OCDE) : le dossier médical informatisé (DMI), l'échange d'informations de santé (EIS), la télémédecine, et le dossier médical partagé (DMP) (OECD 2015).

L'enquête s'est déroulée de janvier à juin 2018. Dans les 27 pays de l'UE étudiés, un échantillon final de 5 793 médecins généralistes a été sélectionné au hasard, l'erreur d'échantillonnage globale étant estimée à ± 1,30 %. Des analyses statistiques univariées et multivariées ont été réalisées pour étudier les données issues de l'enquête. Pour mieux saisir la différence entre la disponibilité et l'usage des diverses fonctionnalités d'eSanté, nous avons créé de nouvelles variables destinées à établir, de manière générale, dans quelle mesure une fonctionnalité est adoptée. Ces variables combinent les réponses aux questions sur la

[6] Tous les États membres depuis 2018, à l'exception des Pays-Bas. Le Nationaal ICT Instituut in de Zorg (ou « Nictiz »), centre national d'expertise en matière d'eSanté aux Pays-Bas, effectuait sa propre enquête officielle de suivi de l'eSanté pendant la période couverte par la présente étude. L'accès aux généralistes de ce pays a donc été limité par les autorités néerlandaises pour éviter toute interférence avec l'enquête menée au niveau national.

disponibilité et sur l'utilisation d'une fonctionnalité, sur une échelle de 0 à 4, où 0 = aucune connaissance (réponse « Je ne sais pas »), 1 = non disponible, 2 = disponible mais non utilisée, 3 = usage occasionnel, et 4 = usage courant. Nous avons utilisé ces variables pour développer des indicateurs composites mettant en lumière l'adoption de chaque catégorie d'eSanté, et un indice composite[7] destiné à révéler l'adoption globale de l'eSanté, combinant les résultats des quatre indicateurs précités.

Pour finir, nous avons analysé la perception des participants sur les conséquences de l'eSanté et les obstacles à son adoption, par le biais d'une analyse typologique non hiérarchique. Nous avons utilisé deux ensembles de variables (les conséquences et les obstacles) pour développer une typologie de quatre profils de médecins généralistes : les Réalistes, les Enthousiastes, les Indifférents et les Réticents.

Résultats principaux

Résultats descriptifs

Caractéristiques générales

Dans les 27 pays de l'UE à l'étude, un échantillon final de 5 793 médecins généralistes a été sélectionné. Il comprenait :

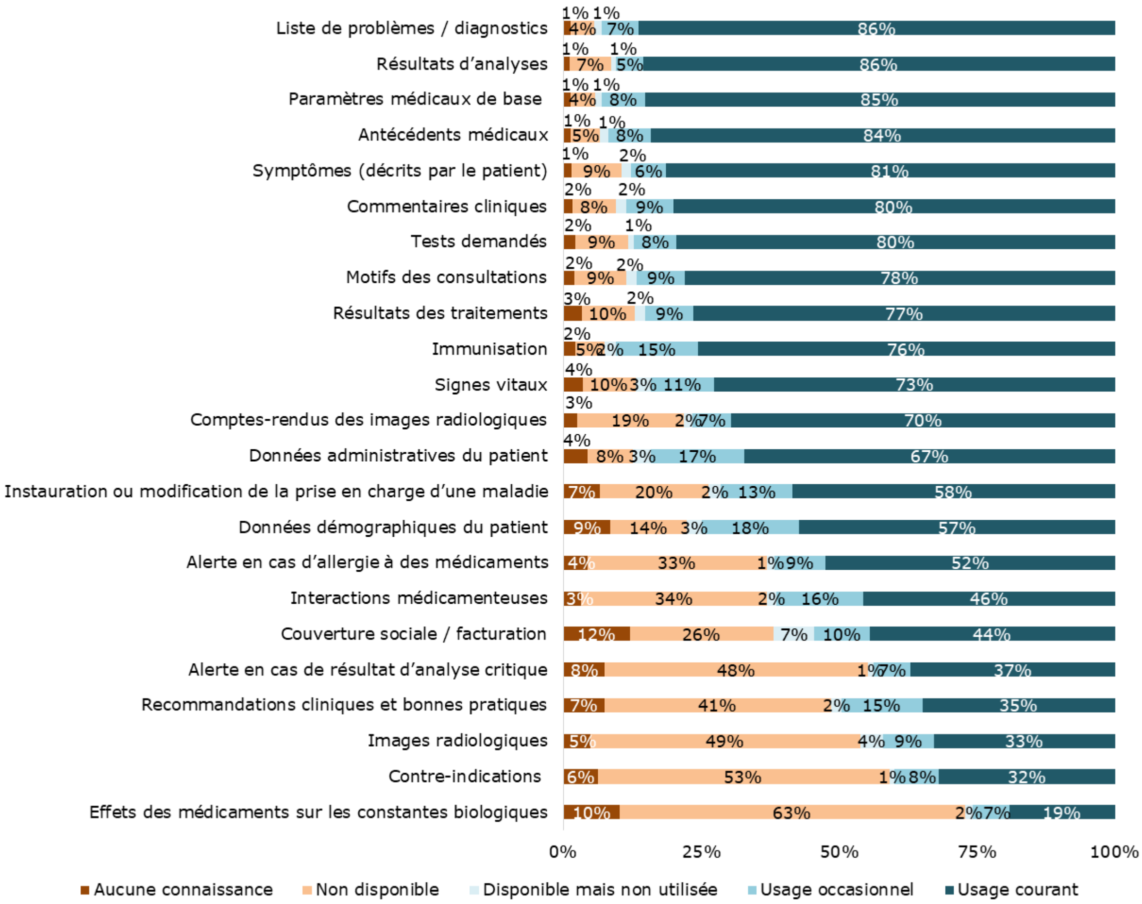
- 50 % d'hommes et 50 % de femmes ;
- 45 % de participants de 55 ans ou plus, 27 % entre 46 et 55 ans, 18 % entre 36 et 45 ans, et 10 % de 35 ans ou moins ;
- 39 % de médecins libéraux travaillant seuls à leur cabinet, 30 % de médecins salariés d'un établissement de santé, et 22 % de médecins libéraux en cabinet de groupe ;
- 37 % de participants exerçant dans des grandes villes, 36 % dans des communes rurales, et 27 % dans des petites villes ou des villes moyennes.

Dossier médical informatisé

Le Figure 5 illustre l'adoption des 25 fonctionnalités du DMI répertoriées dans l'enquête. Il n'y a pas de différence significative avec les données de 2013.

[7] Un indice composite est formé par la compilation de plusieurs indicateurs individuels en un indice unique, en fonction d'un modèle conceptuel sous-jacent étayé par l'étude empirique des données.

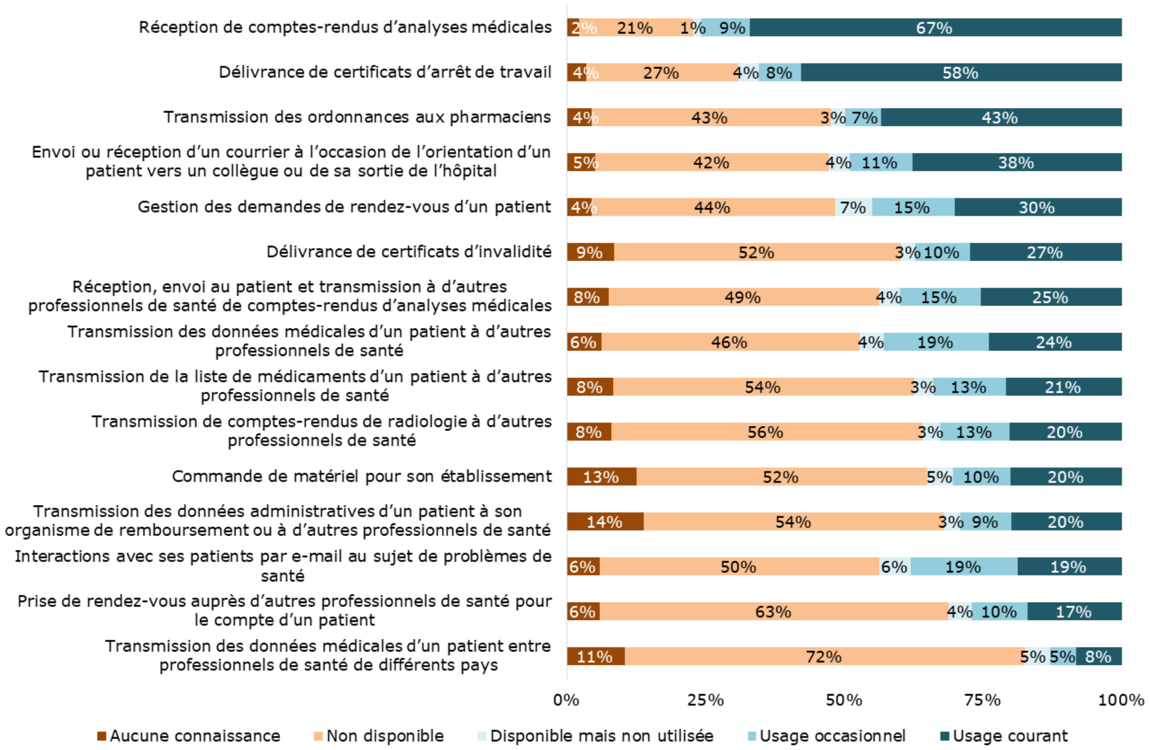
Figure 5 Connaissance et usage du DMI



Échange d'informations de santé

Le Figure 6 illustre l'adoption des 15 fonctionnalités d'EIS répertoriées dans l'enquête. L'usage systématique de certificats d'arrêt de travail a augmenté, passant de 47 % en 2013 à 58 % en 2018. Une augmentation de la transmission d'ordonnances directement aux pharmaciens est également à constater, passant de 24 % en 2013 à 43 % en 2018.

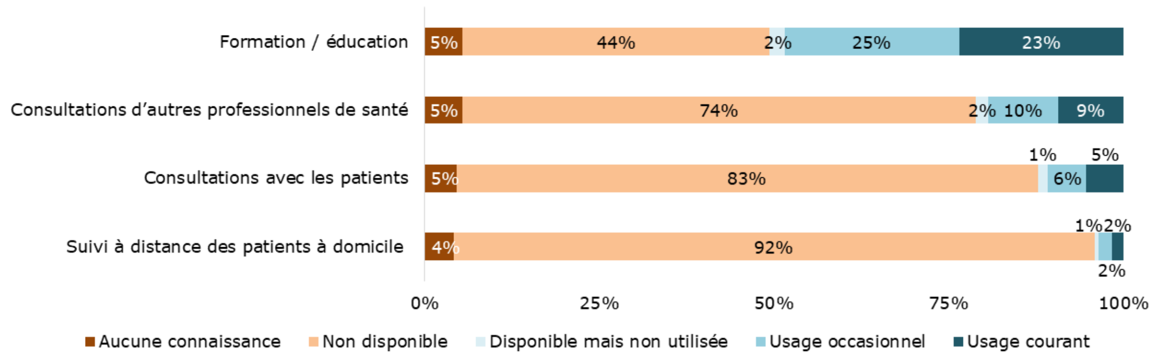
Figure 6 Connaissance et usage de l’EIS



Télémédecine

Le Figure 7 illustre l’adoption des fonctionnalités de télémédecine répertoriées dans l’enquête. Il n’y a pas de différence significative avec les données de 2013.

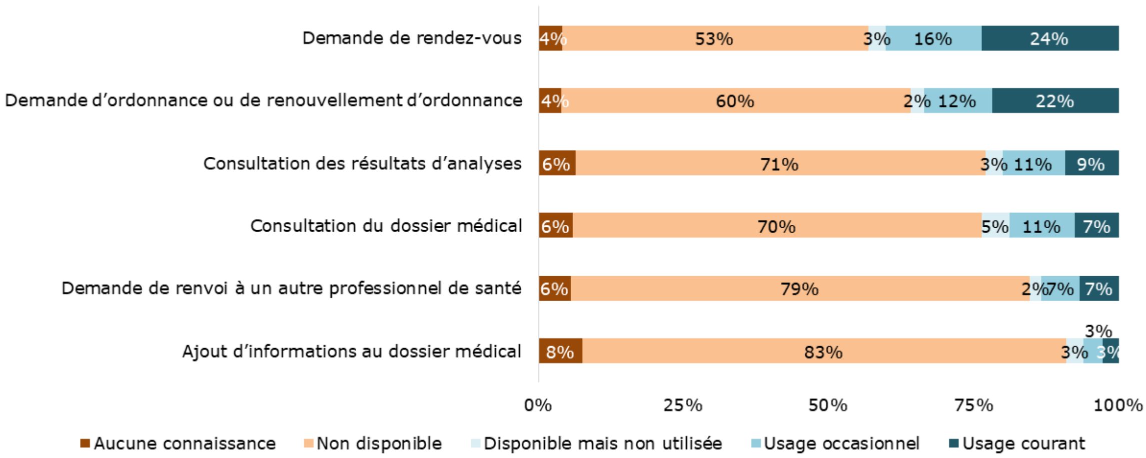
Figure 7 Connaissance et usage de la télémédecine



Dossier médical partagé

Le Figure 8 illustre l’adoption des fonctionnalités du DMP répertoriées dans l’enquête. Par rapport aux données de 2013, des changements apparaissent au niveau des fonctions de demande de rendez-vous (2018 : 24 % ; 2013 : 13 %) et de demande d’ordonnance ou de renouvellement d’ordonnance (2018 : 22 % ; 2013 : 13 %).

Figure 8 Connaissance et usage du DMP



Adoption de l'eSanté

Adoption du dossier médical informatisé

L'indicateur composite du DMI combine 23 fonctionnalités regroupées en cinq dimensions. Cet indicateur révèle que le DMI est complètement disponible dans les 27 États membres de l'UE étudiés ; dans certains pays, son adoption est presque totale. Le score de l'indicateur composite du DMI en UE en 2018 est de 3,196,[8] en augmentation par rapport à un score de 2,989 en 2013.

Si les résultats témoignent d'une adoption en hausse du DMI dans tous les États membres depuis 2013,[9] l'ampleur de cette augmentation est variable. C'est en Lituanie qu'a été constatée la croissance la plus importante, le score de l'indicateur composite du DMI y a augmenté de 0,790 points, passant de 1,393 en 2013 à 2,183 en 2018. (Cependant, malgré cette augmentation, la Lituanie conserve le score d'adoption du DMI le plus faible parmi tous les pays analysés.)

Adoption de l'échange d'informations de santé

L'indicateur composite de l'EIS combine 13 fonctionnalités regroupées en trois dimensions. Cet indicateur suggère une adoption plus faible que celle du DMI. Le score européen moyen en 2018 est de 2,070, en augmentation par rapport au score de 1,884 en 2013.

Si les résultats témoignent d'une adoption en hausse de l'EIS dans tous les États membres depuis 2013, c'est une augmentation à géométrie variable entre les pays. Les augmentations les plus fortes sont celles enregistrées en Croatie (2013 : 1,692 ; 2018 : 2,286) et en Slovénie (2013 : 1,318 ; 2018 : 1,872).

Adoption de la télémédecine

L'indicateur composite de la télémédecine comporte deux dimensions couvrant quatre fonctionnalités différentes. Cet indicateur révèle une hausse de son adoption entre 2013 et 2018. Le score européen moyen est de 1,639 en 2018, tandis qu'il était de 1,383 en 2013.

Si les résultats témoignent d'une adoption en hausse de la télémédecine dans tous les États membres depuis 2013, cette augmentation varie entre les pays. La hausse la plus importante

[8] La moyenne européenne de l'indicateur composite englobant le DMI, l'EIS, la télémédecine et le DMP a été pondérée en fonction du nombre de généralistes interrogés dans chaque pays.

[9] À l'exception de la Bulgarie, où le score de l'indicateur composite du DMI était de 2,746 en 2013, accusant donc une diminution de 0,001 points en passant à 2,745 en 2018 ; toutefois, compte tenu de la marge d'erreur de l'échantillon, cette réduction n'est pas statistiquement significative.

est celle de la Croatie, où le score de l'indicateur composite de la télémédecine est passé de 1,260 en 2013 à 1,824 en 2018.

Adoption du dossier médical partagé

L'indicateur composite du DMP combine six fonctionnalités différentes en deux dimensions. Cet indicateur montre une grande disparité entre des pays à la performance élevée et d'autres ayant une performance faible. Le score européen moyen en 2018 est de 1,568, plus haut que celui de 1,319 datant de 2013.

Si les résultats attestent d'une adoption en hausse du DMP dans tous les pays depuis 2013,[10] l'ampleur de cette augmentation est variable. La hausse la plus importante est celle de la Finlande, où le score de l'indicateur composite du DMP a augmenté de 1,334 points, passant de 1,242 en 2013 à 2,576 en 2018. De même, on constate une augmentation considérable au Royaume-Uni (2013 : 1,597 ; 2018 : 2,428) et en Suède (2013 : 1,555 ; 2018 : 2,354).

Indice composite d'adoption de l'eSanté

Le score global moyen d'adoption de l'eSanté, ou « indice composite d'adoption de l'eSanté », combine les résultats des quatre indices composites de l'eSanté. En 2018, la moyenne européenne de l'indice composite est de 2,131, ce qui indique une augmentation depuis 2013, la moyenne s'élevant alors à 1,876.

L'adoption de l'eSanté en contexte

Nous avons analysé les différences organisationnelles et systémiques de l'indice composite et des quatre indicateurs composites, pour mettre en exergue le lien entre ces différences et le type d'établissement ou de système de santé en présence. En moyenne, l'adoption de l'eSanté est plus importante dans les pays disposant d'un service national de santé que dans ceux qui fonctionnent selon un système de sécurité sociale ou que dans les pays en transition. Globalement, les pays en transition montrent un degré d'adoption moindre que les pays ayant un service national de santé ou un système de sécurité sociale, à l'exception de l'Estonie : non seulement celle-ci se classe parmi les cinq premiers pays à avoir largement mis en œuvre les quatre catégories d'eSanté et l'eSanté en général (avec le deuxième score le plus élevé sur l'indice composite), mais elle a également connu la plus forte augmentation du niveau d'adoption depuis 2013. En outre, l'analyse a montré une adoption plus élevée parmi les généralistes travaillant au sein d'établissements de santé et de cabinets de groupe que parmi ceux pratiquant dans des cabinets individuels ou selon d'autres modalités (travailleurs indépendants ou autres).

Adoption de l'eSanté

Nous avons réalisé une analyse typologique à partir des données sur la perception des conséquences de l'adoption des TIC et des obstacles à cette adoption en médecine générale, pour développer une typologie des praticiens en quatre profils : les Réalistes, les Enthousiastes, les Indifférents et les Réticents.

Selon cette analyse, la majorité des généralistes interrogés font partie du groupe des **Réalistes** : 36 % des répondants considéraient les obstacles et les conséquences comme pertinents et importants pour l'adoption des fonctionnalités d'eSanté. Le deuxième groupe le plus important est celui des **Enthousiastes** : 27 % des généralistes inclus dans l'analyse exagéraient les conséquences et considéraient les obstacles comme négligeables. Les généralistes du groupe des **Indifférents** (23 % des médecins classés) déclaraient ne se soucier ni des conséquences de l'eSanté, ni des obstacles à son adoption. Enfin, le groupe le

[10] À l'exception de la Roumanie, où le score de l'indicateur composite du DMP était de 1,232 en 2013, montrant donc une diminution de 0,046 points en passant à 1,186 en 2018 ; toutefois, compte tenu de la marge d'erreur de l'échantillon, cette réduction n'est pas statistiquement significative.

plus réduit est celui des **Réticents**, qui accordent une plus grande importance aux obstacles à l'adoption de l'eSanté qu'à ses conséquences (14 % des généralistes classés, 12 % de notre échantillon).

Nous avons observé des changements entre les résultats de 2013 et ceux de 2018. En 2013, 33 % des généralistes de l'échantillon étudié étaient **Indifférents**, tandis qu'en 2018, 23 % correspondaient à ce profil. À l'inverse, le pourcentage d'**Enthousiastes** a augmenté, passant de 13 % à 27 % entre 2013 et 2018. Ces données suggèrent qu'au cours des cinq dernières années, une large proportion des généralistes a adopté une attitude plus positive concernant les facteurs favorables à l'eSanté, et moins négative à propos de ses obstacles.

1 Introduction and background

The European Commission seeks to understand and measure the current use of information and communication technology (ICT) and eHealth applications by general practitioners (GPs) in the European Union (EU), as well as changes in uptake over time. Two studies benchmarking the use of ICT in health and eHealth technologies by GPs in Europe had been conducted to date. The first, commissioned by the Directorate-General for Communications Networks, Content and Technology (DG CONNECT)[11] in 2008, covered 27 EU member states,[12] Croatia and Turkey during the period 2002 to 2007 (Dobrev et al. 2008). The second eHealth benchmarking study analysed the use of eHealth applications by GPs between 2008 and 2013 in the same 27 EU member states, as well as Croatia, Iceland, Norway and Turkey, to identify changes compared with the previous five-year period (Codagnone and Lupiáñez-Villanueva 2013b). RAND Europe, together with Open Evidence and BDI Research, have been commissioned by DG CONNECT to undertake the third eHealth benchmarking study, which measures the use of eHealth by GPs in 27 EU member states[13] and analyses changes since the second eHealth benchmarking study.

Specifically, this study aimed to:

- Measure the use of ICT and eHealth applications by GPs in the EU since 2013.
- Analyse the main drivers of and barriers to eHealth adoption in primary healthcare.
- Compare how the levels of adoption, drivers and barriers have evolved since 2013, following the same methodology used in the second eHealth benchmarking study (Codagnone and Lupiáñez-Villanueva 2013a, 2013b).

This document is the final report of this study. It is organised in seven chapters and six appendices:

- Chapter 1 presents the background to the study, including an overview of the policy context, the role and structure of primary healthcare in Europe and a brief description of the study design and methods.
- Chapter 2 describes factors influencing the adoption and use of eHealth technologies identified in the literature.
- Chapter 3 reports the descriptive findings about the characteristics of the GPs surveyed and the availability and use of the eHealth functionalities. These functionalities were grouped into four categories of eHealth applications, as defined by the Organisation for Economic Co-operation and Development (OECD) (OECD 2015): Electronic Health Records (EHRs), Health Information Exchange (HIE), Telehealth and Personal Health Records (PHRs).
- Chapter 4 presents eHealth adoption composite indicators[14] covering the four eHealth categories' as well as the composite index[15] showing the overall adoption of eHealth.

[11] Formerly the Directorate-General for Information, Society and Media.

[12] Austria, Belgium, Bulgaria, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden and the United Kingdom.

[13] All 28 member states as of 2018, except for the Netherlands. The Nationaal ICT Instituut in de Zorg (shortened to Nictiz), the national centre of expertise for eHealth in the Netherlands, was conducting an official monitoring eHealth survey during the same period covered by this study. Access to the GPs in this country was restricted by the Dutch authorities to avoid interference with the national survey.

[14] I.e. indicators for each of the four eHealth categories, which show the overall adoption of functionalities in each category.

[15] The composite index combined the results of the composite indicators of the four eHealth categories into an overall indicator.

- Chapter 5 describes the factors that can enhance or inhibit the use of eHealth within primary healthcare, considering health system, organisational characteristics and individual characteristics.
- Chapter 6 presents the conclusions of the study.
- Appendix 8.1 presents the study design and methodological approach used for this study.
- Appendix 8.3 presents results for the subdimensions of the four categories of eHealth applications by health system type and country.
- Appendix 8.4 provides details of the cluster analysis on perceived impacts and barriers.

This report is accompanied by country profiles for each member state surveyed.

As this research is a follow-up and builds on and compares with the second eHealth benchmarking study (Codagnone and Lupiáñez-Villanueva 2013a, 2013b) – including the use of the same survey methodology and questions asked in the survey of GPs – some of the wording in this report is similar or identical to the wording used in the reports of the 2013 study.

1.1 Policy context

1.1.1 Overview of EU policies and actions

In their Action Plan on eHealth for the period 2012 to 2020, the European Commission defines eHealth as 'the use of ICT in health products, services and processes combined with organisational change in healthcare systems and new skills, in order to improve health of citizens, efficiency and productivity in healthcare delivery, and the economic and social value of health' (European Commission 2012, 3). Similarly, the World Health Organization (WHO) describes eHealth as 'the use of information and communication technologies (ICT) for health' (WHO 2017).

The use of ICT in healthcare has been an important policy focus in the EU since 1999, when the European Commission published its first digital agenda report, *eEurope – An Information Society for All* (Commission of the European Communities 1999). The primary objective of the eEurope strategy was to ensure that EU member states and their citizens make use of and fully benefit from ICTs in all sectors. The strategy emphasised the need to embed ICT in the healthcare sector with the aim to improve treatment for all EU citizens as well as the efficiency of health services provided (Commission of the European Communities 1999). In 2004, eEurope was followed by the EU's first Action Plan on ICT and health (Commission of the European Communities 2004), which proposed several actions that EU member states should take in the area of health, such as establishing health information networks, introducing EHRs and online health portals, enabling electronic prescriptions or facilitating standardised health insurance cards for the unambiguous identification of individuals (Commission of the European Communities 2004).

In May 2010, the European Commission launched the Digital Agenda for Europe (European Commission 2010) for 2010 to 2020, which emphasises the need to work towards a digital single market in the EU and 'to boost Europe's social and economic performance' (European Commission 2010, 6–7). In the area of health, the agenda again specifically highlights the need to provide ICT in healthcare, and it outlines related actions and objectives for member states, including protecting citizens' data, enabling citizens to securely access their medical data online, and creating EU-wide standards for electronic patient records (European Commission 2010).

Directive 2011/24/EU,[16] which was adopted in 2011 and came into force in October 2013,

[16] 'Directive 2011/24/EU of the European Parliament and of the Council of 9 March 2011 on the application of patients' rights in cross-border healthcare'.

includes further guidelines for the implementation of eHealth services, such as the facilitation of a voluntary eHealth network among member states. The Directive provides the operational basis for the EU's second Action Plan for eHealth, for the period 2012 to 2020 (European Commission 2012). The objectives outlined in the Action Plan include promoting wider interoperability of eHealth services; providing support to research and innovation in order to study and develop eHealth ICT; supporting the wider uptake and implementation of eHealth services; and enabling and supporting eHealth efforts and dialogues at EU and wider policy level (European Commission 2012, 6).

An interim evaluation of the second Action Plan for eHealth (Wauters et al. 2014) highlighted overall limited awareness of the Action Plan among consulted stakeholders (from the public and private sectors, civil society and academia), which included individuals who have been directly involved in actions set out by the plan. While the evaluation found that stakeholders considered the actions of the plan to be relevant, views regarding the efficiency and effectiveness of the actions were mixed. The evaluation recommended an implementing mechanism to ensure the Action Plan's relevance, such as integrating it into the general EU and member states policy cycle; emphasised the need to provide clarity about the governance structure; and highlighted the need to take actions to increase awareness of the Action Plan (Wauters et al. 2014).

In May 2017, the European Commission published the *Mid-Term Review of the Digital Single Market* (European Commission 2017a). In the area of healthcare, the review emphasises the European Commission's intention to adopt a Communication focusing on three key elements for the digital transformation of health and care: (1) supporting citizens' secure access to their EHR and enabling them to use it in other EU countries, including e-prescriptions; (2) supporting data infrastructure necessary for research and disease prevention purposes and allow for personalised health and care; and (3) strengthening interactions between patients and healthcare providers and supporting patient empowerment (European Commission 2017a).

The European Commission launched a public consultation titled *Transformation of Health and Care in the Digital Single Market* in July 2017 (European Commission 2017b), with the aim to collect views on future actions to improve citizens' health and care from a wide range of stakeholders, including citizens, health professionals, healthcare providers, providers of eHealth solutions, data experts, public authorities, researchers and patient organisations. Some of the challenges identified in the consultation are difficulties in accessing health data, the heterogeneity of EHRs, a lack of interoperability between different systems, and privacy and cybersecurity risks that could arise from sharing health data. Participants indicated that the EU should focus on interoperability and on setting EU standards for EHRs and for data quality, reliability and cybersecurity (European Commission 2018).

Following this public consultation and responding to *Council Conclusions on Health in the Digital Society,* published in December 2017 (Council of the European Union 2017), the European Commission issued a *Communication on Enabling the Digital Transformation of Health and Care in the Digital Single Market,* in April 2018 (European Commission 2018). The Communication outlines several actions to address issues highlighted in the consultation and the Council conclusions, including adopting a Commission Recommendation on technical specifications for a European EHR exchange format. These specifications should consider the access of patients to such records and the protection of patients' data in line with the General Data Protection Regulation (GDPR). The European Commission also indicated that it will support the establishment of specifications for sharing health data among EU countries for research and that it is willing to launch pilot actions to demonstrate the effects of sharing data and resources across countries on research, disease prevention, personalised care, etc. Moreover, it highlighted the intention to increase citizens', patients' and health and care professionals' awareness, knowledge and skills to use digital health solutions (European

Commission 2018).

1.1.2 Healthcare system challenges in the EU

Recent EU policies have highlighted several challenges that healthcare systems across Europe have been facing or are expected to be facing in the future. Key challenges in European health and care systems include:

- **Ageing population:** Life expectancy at birth has grown steadily in most developed countries in the past 60 years. At the current pace, life expectancy at birth in the EU is expected to increase, from 78.3 years in 2016 to 86.1 years in 2060 for men and from 83.7 to 90.3 years for women. As a result, the proportion of EU citizens aged over 65 is expected to rise from 19% in 2016 to 29% by 2070 (Directorate-General for Economic and Financial Affairs 2018).
- **Shrinking workforce:** Related to changes in the age of the EU population, the old-age dependency ratio (the ratio between people aged over 65 and those aged 15 to 64 years) is expected to increase from 29.6% to 51.2% between 2016 and 2070. This increase means a decline from 3.3 to 2 working-age people to every citizen aged over 65 during the same period. This change is expected to compound the existing shortage in the workforce that provides health and care, and this shortage is likely to become an even bigger challenge given EU citizens' growing demand for health and long-term care (Directorate-General for Economic and Financial Affairs 2018; Eurostat 2016; OECD 2008, 2009).
- **Increase in healthcare consumerism:** Although attitudes towards health and long-term care differ between countries, overall demand for healthcare services in Europe is increasing and is expected to increase at a greater rate. This includes demand for at-home care, access to healthcare, higher quality healthcare and patient empowerment (Directorate-General for Health and Food Safety 2018; Economist Intelligence Unit 2011; Eurobarometer 2007; Health Consumer Powerhouse 2009; Przywara 2010).
- **Need for integrated care and ICT:** Changes in demographics are also related to an increase in both chronic and complex conditions (including increasing multimorbidity), which will require a shift towards more integrated and personalised healthcare (Directorate-General for Health and Food Safety 2017). ICTs are considered to be important for supporting such integrated healthcare services (Atun 2004; Greß et al. 2009).
- **Increase in public health expenditure:** Related to the challenges outlined above, public health expenditure in EU countries has steadily increased over the past 30 years and is expected to grow even more in the next decades. As highlighted in the eHealth Action Plan for 2012 to 2020, EU member states[17] spent on average 5.9% of GDP on public health in 1990. In 2010, expenditure was on average 7.2% of GDP,[18] and in 2015 it was on average 9.9% of GDP. In 2012, the European Commission expected the average expenditure to reach 8.5% of GDP by 2060. This proportion was exceeded in 2015. In 2017, the Commission expected expenditure to increase by around 2% of GDP between 2015 and 2060. Some EU member states are expected to have even greater increases, of up to 6.8% of GDP[19] (European Commission 2012, 2017c).[20]

[17] 27 EU member states as of 2012, i.e. excluding Croatia, which joined the EU in 2013.

[18] 27 EU member states as of 2012, i.e. excluding Croatia, which joined the EU in 2013.

[19] Austria, Belgium, the Czech Republic, Finland, Germany, Luxembourg, Malta, the Netherlands, Slovakia and Slovenia.

[20] Across all 28 EU member states as of 2015 (including Croatia).

1.2 Primary healthcare in the EU

The Declaration of Alma-Ata (1978) considers primary healthcare systems to be an integral part of a country's health system; it is the 'first level of contact of individuals, the family and community with the national health system bringing health care as close as possible to where people live and work, and constitutes the first element of a continuing health care process' ('Declaration of Alma-Ata' 1978, 2). Moreover, the Declaration notes that primary healthcare not only provides services to address health problems; it should also educate citizens about prevailing health problems and how to prevent them, as well as about nutrition, family planning, etc. The primary healthcare workforce and how it is constituted can vary greatly; nevertheless, GPs or family doctors are the most prominent providers of primary healthcare in European countries (OECD and European Union 2016).

The World Organization of Family Doctors (WONCA) Europe defines GPs in European countries as specialist physicians trained in the specialty of primary care who 'exercise their professional role by promoting health, preventing disease and providing cure, care, palliation and promoting patient empowerment and self-management' (WONCA Europe 2011, 9). Similarly, the OECD's definition states that GPs 'assume responsibility for the provision of continuing and comprehensive medical care to individuals, families and communities' (OECD 2018b, 2). This definition includes the following roles: 'District medical doctors – therapists, Family medical practitioners ("family doctors") [and] Medical interns (specialising in general practice)'. It excludes the following roles: 'Paediatricians [and] Other generalist (non-specialist) medical practitioners' (OECD 2018b, 2).

While national governments across developed countries are involved in the provision, structuring and/or funding of healthcare, their direct involvement can vary widely. Two main models of healthcare system prevail in European countries (Boerma 2003; Codagnone and Lupiáñez-Villanueva 2013a; Saltman, Busse, and Figueras 2004):

1. The **national health service (NHS) model**, which is predominantly funded by taxes and is government-led (found in Cyprus, Denmark, Finland, Greece, Iceland, Italy, Malta, Norway, Portugal, Spain, Sweden, the United Kingdom).
2. The **social insurance model**, whereby citizens typically join or are assigned to one or more compulsory health insurance plans and pay for these with part of their income from employment (found in Austria, Belgium, France, Germany, Ireland, Luxembourg, the Netherlands, Switzerland).

Some European countries have neither an NHS nor a social insurance system,[21] or are transitioning towards one or the other system. These are Bulgaria, Croatia, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia and Slovenia (Boerma 2003; Codagnone and Lupiáñez-Villanueva 2013a; Saltman, Busse, and Figueras 2004).

The organisation of primary care in the EU within these two models is heterogeneous (Macinko, Starfield, and Shi 2003). Primary healthcare physicians are the first point of contact in 15 EU member states, where they function as gatekeepers to specialist physicians. In six EU member states, primary care physicians do not use any referral systems to secondary care. In seven EU member states, patients may directly access secondary care without requesting any referral, but the systems offer financial incentives for patients requesting referrals.

In addition, there are two predominant modes of primary care provision, namely, solo practice and group practice, and there are several different forms of payment. Among the 28 EU

[21] E.g. countries that had so-called Semashko systems, which were common in communist countries; in Semashko systems, healthcare is centrally and hierarchically organised and run by the government (Lukášová 2018, 2).

member states, the most frequent forms of payment are fee-for-service[22] and capitation,[23] although combinations of different forms of payment are increasing (OECD and European Union 2016). Other forms of payment used in healthcare systems in EU member states are pay-for-performance, i.e. 'value-based payment, [which] comprises payment models that attach financial incentives/disincentives to provider performance' (NEJM Catalyst 2018) and global budgets, i.e. '"one-line" budget for facilities for a fixed period of time (typically one year) for some specified population or service use' (Langenbrunner and Liu 2004, 10).

Table 1 summarises the main characteristics of the primary care systems in the 28 EU member states.

[22] Practitioners are paid a fee for each individual service delivered (Langenbrunner and Liu 2004, 6).

[23] Under this type of payment agreement, doctors are paid a fixed amount per patient registered at their practice, no matter if the patient seeks care or not (Langenbrunner and Liu 2004, 11).

Table 1 Mode of provision, mode of remuneration and role of primary healthcare in EU member states

EU member state	Health system model	Primary healthcare physicians' role in controlling access to secondary care and incentives for referrals	Requirement of or incentives for patients to register with a primary healthcare physician or practice	Predominant type of practice	Type of payment for primary healthcare
Austria (AT)	Social insurance	No referral needed and no incentives to obtain referrals	Registration not required and incentives to register are not offered	Solo practice	Fee-for-service
Belgium (BE)	Social insurance	Financial incentives for patients to obtain referrals, but direct access is possible	Registration not required, but financial incentives to register are available	Solo practice	Capitation, fee-for-service, other
Bulgaria (BG)	Transition	Referral is required	No incentives and no obligation to register	Solo practice	Capitation, fee-for-service
Croatia (HR)	Transition	Referral is required	Registration required	Solo practice	Capitation, fee-for-service, pay-for-performance
Cyprus (CY)	NHS	No need and no incentives to obtain referrals	Registration not required and incentives to register are not offered	Group practice	Fee-for-service
Czech Republic (CZ)	Transition	No need and no incentives to obtain referrals	Registration not required and incentives to register are not offered	Solo practice	Capitation, fee-for-service, pay-for-performance
Denmark (DK)	NHS	Financial incentives for patients to obtain referrals, but direct access is possible	Registration not required, but financial incentives to register are available	Solo practice	Capitation, fee-for-service
Estonia (EE)	Transition	Referral is required	Registration required	Solo practice	Capitation, fee-for-service, pay-for-performance, other
Finland (FI)	NHS	Referral is required	Registration required	Group practice	Global budget
France (FR)	Social insurance	Financial incentives for patients to obtain referrals, but direct access is possible	Registration not required, but financial incentives to register are available	Group practice	Fee-for-service, pay-for-performance, other
Germany (DE)	Social insurance	No need and no incentives to obtain referrals	Registration not required, but financial incentives to register are available	Solo practice	Fee-for-service
Greece (EL)	NHS	No need and no incentives to obtain referral	Registration not required and incentives to register are not offered	Group practice	Global budget
Hungary (HU)	Transition	Referral is required	Registration not required and incentives to register are not offered	Solo practice	Capitation, pay-for-performance, global budget
Ireland (IE)	Social insurance	Referral is required	Registration not required and incentives to register are not offered	Group practice	Capitation, fee-for-service
Italy (IT)	NHS	Referral is required	Registration required	Group practice	Capitation

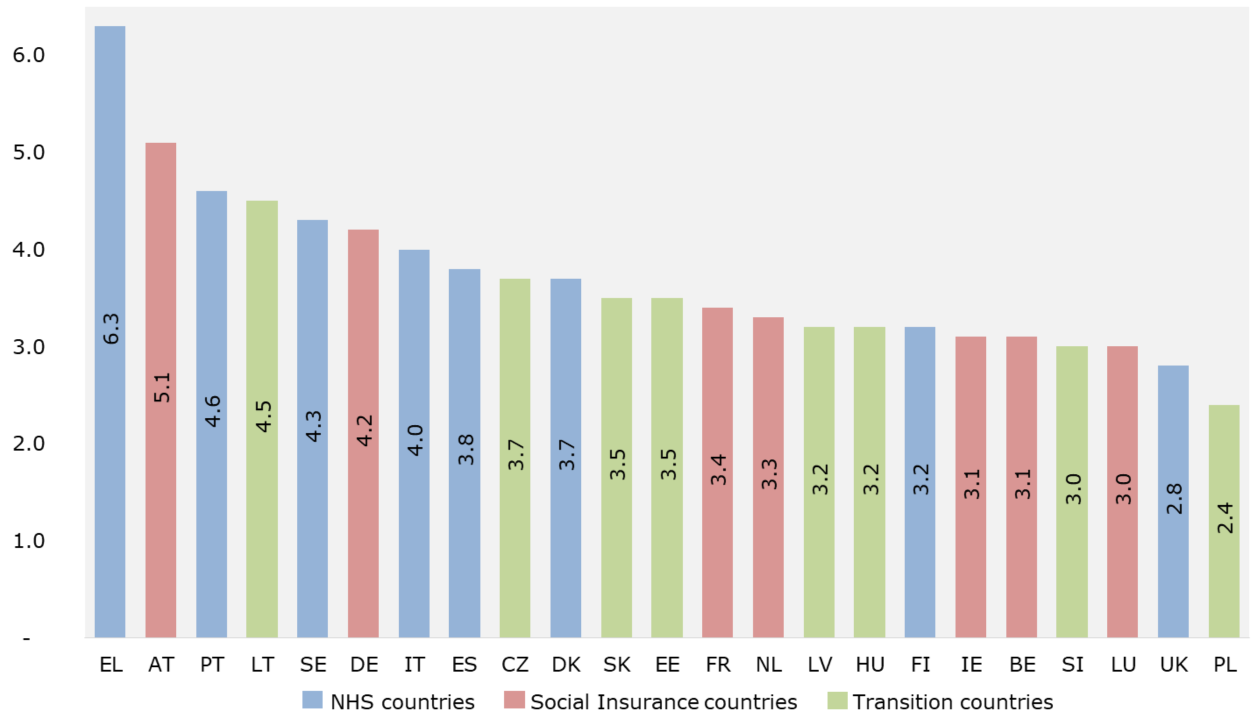
EU member state	Health system model	Primary healthcare physicians' role in controlling access to secondary care and incentives for referrals	Requirement of or incentives for patients to register with a primary healthcare physician or practice	Predominant type of practice	Type of payment for primary healthcare
Latvia (LV)	Transition	Financial incentives for patients to obtain referrals, but direct access is possible	Registration required	Group practice	Fee-for-service, capitation, fixed payments, pay-for-performance
Lithuania (LT)	Transition	Referral is required	Registration required	Group practice	Capitation, fee-for-service, pay-for-performance, global budget
Luxembourg (LU)	Social insurance	No need and no incentives to obtain referrals	Registration not required and incentives to register are not offered	Solo practice	Fee-for-service, capitation
Malta (MT)	NHS	Financial incentives for patients to obtain referrals, but direct access is possible	Registration not required and incentives to register are not offered	Solo practice	Fee-for-service
Netherlands (NL)	Social insurance	Referral is required	Registration not required and incentives to register are not offered	Group practice	Capitation, fee-for-service, pay-for-performance
Poland (PL)	Transition	Referral is required	Registration not required and incentives to register are not offered	Group practice	Capitation, fee-for-service
Portugal (PT)	NHS	Referral is required	Registration required	Group practice	Capitation, pay-for-performance, global budget
Romania (RO)	Transition	Financial incentives for patients to obtain referrals, but direct access is possible	Registration required	Solo practice	Capitation, fee-for-service
Slovakia (SK)	Transition	Financial incentives for patients to obtain referrals, but direct access is possible	Registration required	Solo practice	Capitation, fee-for-service, other
Slovenia (SL)	Transition	Referral is required	Registration required	Group practice	Capitation, fee-for-service
Spain (ES)	NHS	Referral is required	Registration required	Group practice	Capitation, pay-for-performance, global budget
Sweden (SE)	NHS	Referral is required	Registration not required and incentives to register are not offered	Group practice	Capitation, fee-for-service
United Kingdom (UK)	NHS	Referrals are typically used to access secondary care, but patients can also refer themselves to secondary care without consulting a GP	Registration not required and incentives to register are not offered	Group practice	Capitation, fee-for-service, pay-for-performance

Source: OECD and European Union (2016, 40)

Health systems in EU member states vary not only by health system model, GPs' gatekeeper role, modes of primary care provision and forms of payments, but also by other factors, including the number of doctors per capita and the geographic dispersion and socio-demographic characteristics of doctors.

Recent OECD data (2017, 2018a) indicate that the number of practicing doctors[24] per 1,000 inhabitants varies greatly across member states. For example, Greece has 6.3 and Austria 5.1 practicing doctors per 1,000 inhabitants, while the United Kingdom has 2.8 and Poland has 2.4 (Figure 9). Even within countries, access to doctors is not evenly distributed: in urban areas, the number of practicing doctors per capita tends to be higher and access is overall better compared with rural areas (Kringos et al. 2015; OECD 2017; Steinhaeuser et al. 2014). Moreover, within the EU, healthcare professionals tend to move between member states more often than do practitioners in any other regulated profession – and they move mostly from lower-income to higher-income countries (e.g. to the United Kingdom, Germany, Sweden and Belgium) (Hervey 2017). For instance, half of Romanian doctors moved to other countries between 2009 and 2015, and a quarter of Slovakian doctors have applied to positions in other countries since the country became an EU member state in 2004 (Hervey 2017).

Figure 9 Practicing doctors per 1,000 inhabitants in EU member states



Notes: Data from 2017 or latest available; data for Bulgaria, Croatia, Cyprus, Malta and Romania not available.
Sources: OECD (2017, 151, 2018a)

There are also variations in age and gender balance across EU member states (Figure 10): for

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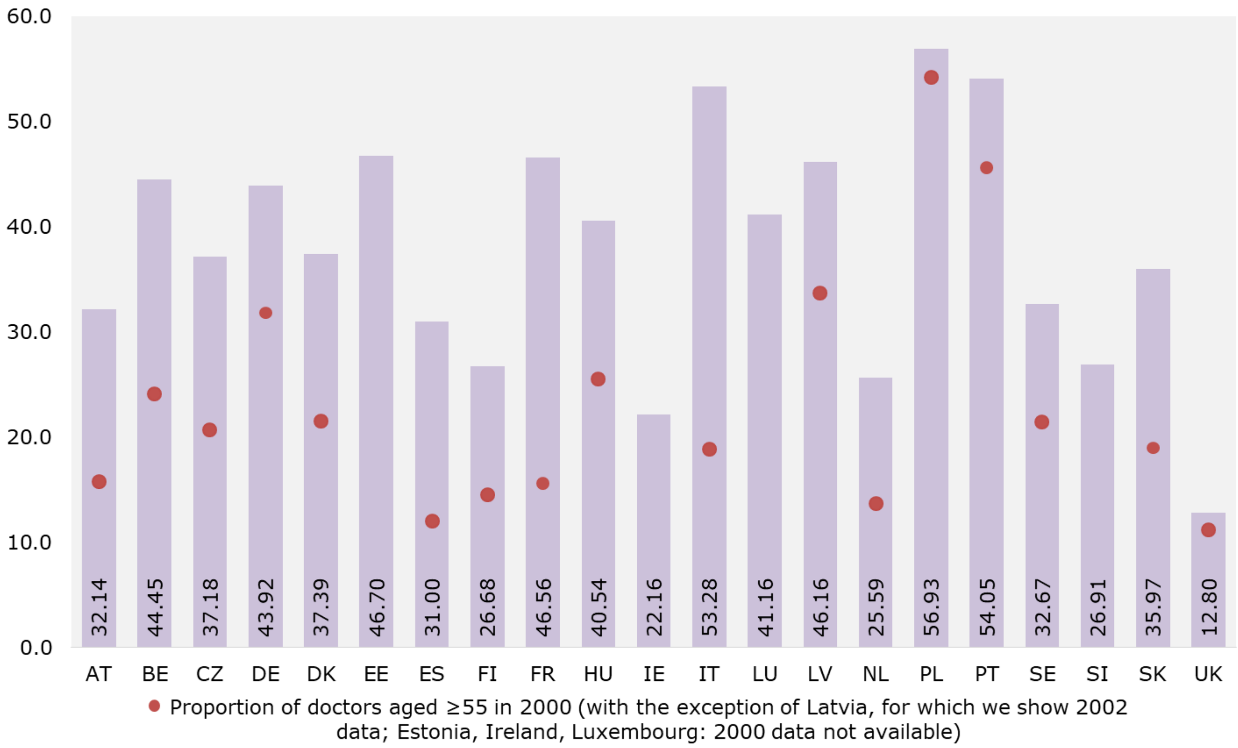
[24] The OECD regularly collects data on the geographic dispersion of doctors. It defines practicing doctors as 'doctors providing direct care to patients. However for some countries […], due to lack of comparable data, the figures correspond to "professionally active" doctors, including doctors working in the health sector as managers, educators, researchers, etc. (adding another 5-10% of doctors). Doctors are usually generalists who assume responsibility for the provision of continuing care to individuals and families, or specialists such as paediatricians, obstetricians/gynaecologists, psychiatrists, medical specialists and surgical specialists' (OECD 2018a).

example, 53.3% of Italian doctors were 55 or over in 2015, while only 12.8% of doctors in the United Kingdom were in this age group. The proportion of doctors aged 55 or over has substantially increased in some countries within 15 years: in Italy the proportion increased from approximately 20% in 2000 to 53.3% in 2015, and in France the proportion almost tripled, from 15.6% in 2000 to 46.6% in 2015 (Figure 10). Although the number of doctors in EU member states has steadily increased over time (in both total numbers and per capita), it is uncertain if the next generation of doctors will be able to replace the high number of doctors aged 55 and over, who are expected to retire in the next decade. The changing and increasing demand for health and care makes these concerns even greater (Directorate-General for Economic and Financial Affairs 2018; Eurostat 2016; OECD 2008, 2009, 2017).

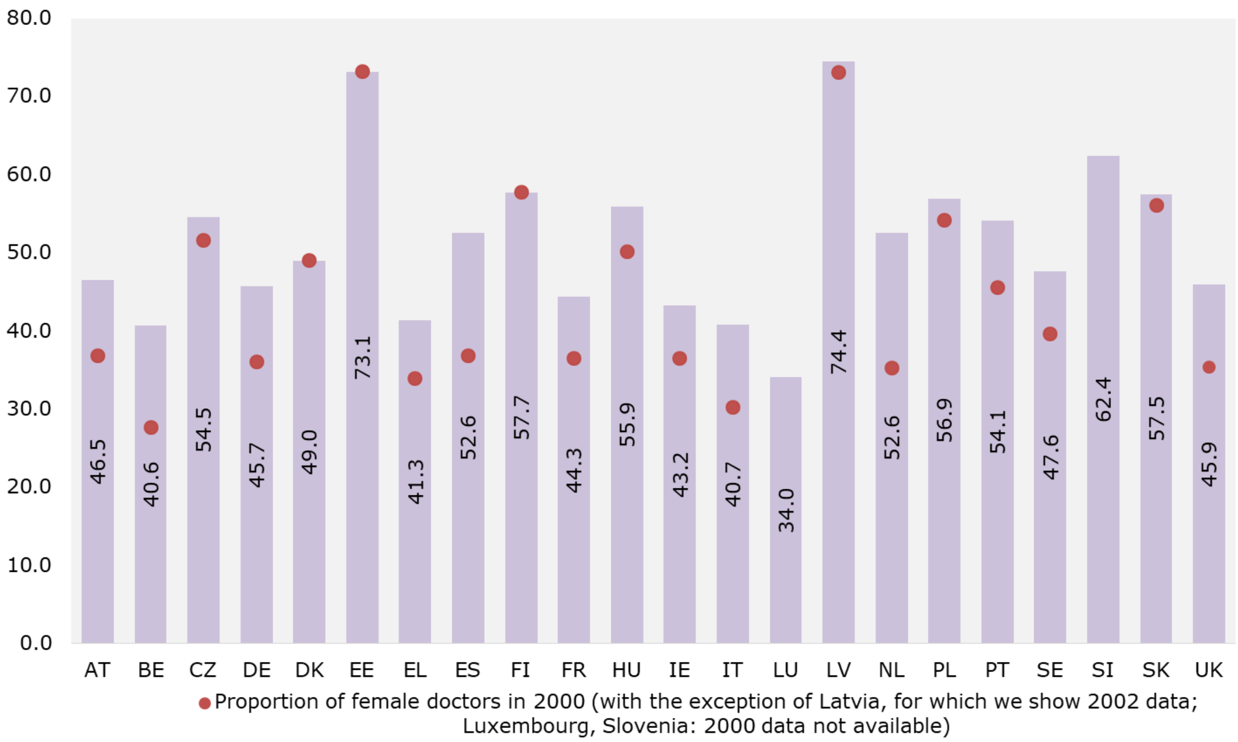
Figure 10 Proportion of doctors aged 55 or over in EU member states (per cent)



Notes: Data from 2017 or latest available; 2017 data for Bulgaria, Croatia, Cyprus, Greece, Lithuania, Malta, Poland, Portugal and Romania not available.
Source: OECD (2017, 153)

Similarly, the proportion of female doctors varies widely across member states: for example, in 2015 the proportion of female doctors was 74.4% in Latvia, compared with 34.0% in Luxembourg. However, an overall increase in the proportion of female doctors can be observed in most member states since 2000: the highest increase was found in the Netherlands, where the proportion grew from 35.3% in 2000 to 52.6% in 2015 (Figure 11). The increase in female doctors is expected to have an impact on general access to primary care, and in particular in rural areas, as female doctors more often work in group practices and in urban areas (Boerma 2003).

Figure 11 Proportion of female doctors in EU member states (per cent)



Notes: Data from 2017 or latest available; 2017 data for Bulgaria, Croatia, Cyprus, Lithuania, Malta and Romania not available.
Source: OECD (2017, 153)

As a main component of a functioning healthcare system, primary healthcare systems are particularly affected by the wide range of health and care system challenges outlined in Section 1.1.2 (Directorate-General for Health and Food Safety 2018). These challenges have already led to higher workloads for primary healthcare professionals and to shifts in the way healthcare is provided and requested (e.g. individuals using healthcare services more often). This in turn has created challenges related to recruiting and retaining primary care personnel, particularly in relation to GPs (Kringos et al. 2015).

As highlighted by Macinko, Starfield and Shi (2003), the strength of a country's primary care system – that is, the provision of appropriate funding, system organisation, and delivery – is positively associated with health outcomes, for example decreasing all-cause mortality, all-cause premature mortality, and cause-specific premature mortality from major respiratory and cardiovascular diseases (Macinko, Starfield, and Shi 2003) as well as less frequent hospitalisation and declining use of specialist and emergency care (Atun 2004). The importance of strong primary care systems is also highlighted in the context of responding to the healthcare needs of ageing populations and the increasing burden of chronic diseases, and such systems are also seen as being able to contribute to reducing social inequalities (OECD and European Union 2016). The use and adoption of eHealth applications is considered to be key in strengthening healthcare systems and in mitigating against and overcoming challenges facing European healthcare systems (Atun 2004; Greß et al. 2009).

1.3 Study design and analysis

This section provides an overview of the methodological approach of this study. A detailed description is reported in Annex 9.1. Firstly, we undertook a rapid evidence assessment (REA) of the literature published since 2013 on the factors influencing the adoption and use of ICT in primary care. The aims of this review were to provide an update to the literature review findings presented in the second eHealth benchmarking study (Codagnone and Lupiáñez-Villanueva 2013a, 2013b) and to identify whether the questions on the drivers, impacts and barriers to eHealth included in the questionnaire – which were based on findings from the 2013 literature review – are still valid or, instead, require an update. Findings of the literature review are presented in Chapter 2.

In order to allow comparison between the results of the 2013 survey and those of the 2018 survey, the study team used the same methodological approach, including the questionnaire, as was used in 2013. The fieldwork process was conducted between January and June 2018. The following table shows the information related to the universe, the sample, margin errors, and the methods used in each country to recruit participants and collect the data. Respondents were recruited online, by telephone, by postal letter or face-to-face. The questionnaire was completed using computer-assisted telephone interviewing (CATI) or computer-assisted web interviewing (CAWI), except in the case of Bulgaria, where data was collected face-to-face.

The European Union of General Practitioners (UEMO)[25] supported the data collection process.

Table 2 Universe size, sample size, margin error and fieldwork methods

Country	Universe[26]	Sample	Margin error	Recruitment method	Data collection method
Austria	12,979	215	±6.76	Online	CAWI
Belgium	12,262	282	±5.89	Online + telephone	CAWI
Bulgaria	4,786	240	±6.29	Face-to-Face	Face-to-Face
Croatia	2,960	172	±7.40	Online	CAWI
Cyprus	345	51	±12.95	Telephone	CAWI
Czechia	7,332	246	±6.27	Online	CAWI
Denmark	3,735	62	±12.60	Telephone	CAWI
Estonia	1,148	50	±13.84	Online	CATI
Finland	5,453	134	±8.53	Online	CAWI
France	104,225	412	±4.92	Online + telephone	CAWI
Germany	53,719	400	±4.98	Online	CAWI
Greece	3,060	248	±6.09	Telephone	CAWI + CATI
Hungary	6,559	183	±7.29	Online	CAWI
Ireland	2,449	126	±8.68	Online	CAWI
Italy	46,661	335	±5.44	Online + telephone	CATI + CAWI
Latvia	1,315	163	±7.33	Telephone	CATI
Lithuania	2,288	101	±9.73	Online + telephone	CAWI
Luxembourg	392	52	±12.93	Telephone	CATI + CAWI
Malta	286	50	±12.87	Postal letter	CATI + CAWI

[25] UEMO is an organisation of the European countries' national, non-governmental, independent organisations representing GPs and specialists in family medicine.

[26] The 'universe' is a statistical population, i.e. the overall number of GPs in the country.

Country	Universe[26]	Sample	Margin error	Recruitment method	Data collection method
Poland	6,619	332	±5.35	Telephone	CATI + CAWI
Portugal	20,221	346	±5.33	Online	CAWI
Romania	27,418	324	±5.52	Online	CATI + CAWI
Slovakia	2,236	165	±7.49	Telephone	CATI + CAWI
Slovenia	1,012	121	±8.53	Online	CAWI
Spain	33,349	414	±4.88	Online + telephone	CAWI
Sweden	5,487	248	±6.21	Online	CAWI
United Kingdom	48,543	321	±5.56	Online	CAWI
TOTAL	**425,622**	**5,793**	**±1.30**		

Notes: CATI = computer-assisted telephone interviewing; CAWI = computer-assisted web interviewing

The results of this study shall be considered with caution. While the margin error for the data collected at EU level is rather low, the margin error is significantly higher in countries where the number of target respondents and/or the GP population are small (e.g. Cyprus, Luxembourg and Malta). This does not allow for comparisons among countries or analyses of the evolution between 2013 and 2018 at country level.

The number of functionalities and variables gathered using the questionnaire created in 2013 makes this study suitable for the use of composite indicators. This technique facilitates the summary of multidimensional issues (e.g. eHealth adoption) for decision makers, providing messages that are easier to interpret and that might attract public interest. However, the study does not aim at oversimplifying the issues at stake and should not be used to oversimplify.

It is important to emphasise that, despite the limitations of the survey, this is the only updated and transparent information about the deployment of eHealth among GP covering the European Union and facilitating the comparison with 2013 exercise. Therefore, the use of this data and analysis can support decision makers at regional, national and EU level to design informed, evidence-based policies. Transparent and replicable composite indicators provide clear input ready to use for policy consumption.

2 Factors influencing the adoption and use of eHealth

This chapter presents the findings of an REA covering publications from the period January 2013 to July 2018 on the factors influencing the adoption and use of ICT in primary care. The findings of the REA are organised in the following seven main categories:

- Design and availability of applications
- Motivations, attitudes and intentions
- Perceived benefits, barriers and impacts
- Institutional settings
- Organisational settings
- Community demands
- Individual characteristics, social influence and networks.

2.1 Design and availability of applications

This sub-section summarises findings on factors related to the design and availability of infrastructure, technical concerns, and training and education.

Design and availability of infrastructure

The design of an ICT system was commonly identified as either facilitating or prohibiting ICT adoption (Atherton et al. 2018, 2018; Choi et al. 2018; Gagnon et al. 2014; Hickson et al. 2015; Irwin, Stokes, and Marshall 2015; Kooienga 2018; Lau et al. 2015; Li et al. 2013; Palabindala, Pamarthy, and Jonnalagadda 2016; Ross et al. 2016; Young and Nesbitt 2017). Professionals are less likely to use an ICT system if it is difficult to use, it does not connect with other electronic systems, data handling is difficult, there is a lack of reliability and/or its use leads to frequent downtime/slow connectivity (Atherton et al. 2018; Choi et al. 2018). For example, a survey included in a review of eVisits (i.e. virtual/electronic visits) showed that many GPs found eVisit technologies unintuitive and inflexible (Hickson et al. 2015). On the other hand, sometimes access to EHR data supports virtual consultations as this access allows professionals to access their patients' data during consultations and, in the case of virtual consultations between two healthcare professionals, both individuals can access the data at the same time (Aller et al. 2017).

The benefits of ICTs need to be perceived to outweigh non-technology-based methods, as suggested in a review of telehealth by Bashshur et al. (2016). In their review of academic and grey literature on EU health systems, Brennan et al. (2015) report that ePrescriptions could not be used due to infrastructure and legal issues and that GPs had to resort to manually producing prescriptions. GPs found that ePrescriptions hold no advantage over traditional prescriptions (Brennan, McElligott, and Power 2015).

The ability to rapidly and effectively exchange information between different eHealth systems, both between and within health centres, substantially influences adoption (Alami et al. 2017, 2017; Aller et al. 2017; Choi et al. 2018; de la Torre-Diez, Gonzalez, and Lopez-Coronado 2013; Gagnon et al. 2014; Ross et al. 2016; Young and Nesbitt 2017). If patient information is easy to exchange between providers, both within and across centres, then EHRs are more likely to be used (Aller et al. 2017; de la Torre-Diez, Gonzalez, and Lopez-Coronado 2013; Gagnon et al. 2014). This is associated with both the extra time taken and the associated costs (Krog et al. 2018). For example, a randomised controlled trial (RCT) of patients using a triage-based email system for primary care found that transferring email content to EHRs led to increasing costs and workload, as email communication did not substitute for, but was, rather, an 'add on' to, traditional consultations (Hickson et al. 2015). For certain applications, such as patient portals, it also requires both the patient and the doctor to have access to the technology (Young and Nesbitt 2017).

A number of studies identified strategies to increase uptake, which include:

- Involving professionals who would use the system in the design and implementation of a health ICT (Gagnon et al. 2014; Li et al. 2013; Ross et al. 2016): several studies found that staff involvement resulted in the end product being more user friendly and staff having a basic understanding of the layout and how it is used.
- Use of standardised templates to streamline the use of eHealth applications (Hickson et al. 2015): some authors reported that the inclusion of free-text options was required to provide some flexibility in use.
- Inclusion of computerised reminders, alerts and advice (Gagnon et al. 2014; Irwin, Stokes, and Marshall 2015; Lau et al. 2015): this can become a barrier if there are too many alerts or if they are not relevant (Gagnon et al. 2014).
- Detailed assessment and planning for eHealth implementation (Ross et al. 2016).
- Slower pace of implementation: this can allow users to adjust to the new technology, whereas a sudden introduction can hinder adoption (Ross et al. 2016).

Technical concerns

Concerns regarding technical errors, reliability and dependability of ICT systems were frequently highlighted in publications reviewed by Gagnon et al. (2014) and Palabindala et al. (2016). These concerns may prevent uptake due to GPs' fears of potentially losing data or the system going down. In addition, the cost associated with supporting a secure system for data transfer was also raised as a barrier (Bashshur et al. 2016).

The layout of EHRs can also be a barrier to their usage if they are not considered to be user friendly, as shown in studies reviewed by Aller et al. (2017).

Training and education

A lack of ICT skills and training is cited as a major barrier to eHealth adoption: studies suggest that individuals who lack experience with computer technology are less likely to use eHealth systems (Alami et al. 2017; Atherton et al. 2018; Kooienga 2018; Li et al. 2013; Ross et al. 2016). This may be due to both perceived and real lack of familiarity with ICT. Introducing support, training and educational materials can help overcome these issues and facilitate adoption; this includes ongoing professional development to ensure that staff stay up to date on changes to the system (Atherton et al. 2018; Gagnon et al. 2014; Li et al. 2013; Ross et al. 2016).

Such initiatives as educational outreach programmes or meetings can contribute to improving staff skills (Lau et al. 2015). However, these programmes tend to require a lot of time if training is to be provided to all members of staff (Alami et al. 2017; Ross et al. 2016). Farr et al. (2018) suggest that implementing systems that require little training can influence adoption positively, as it is easier to introduce them and provide staff with the required skills, and they thus can be less expensive. Moreover, Krog et al. (2018) found that the similarity of an eHealth application to a system it is intended to complement or replace can support adoption. In their study, the transition from a paper-based method to an electronic system was facilitated by healthcare professionals' ability to use them interchangeably (Krog et al. 2018).

2.2 Motivation, attitudes and intentions

This sub-section summarises findings on factors related to motivations, attitudes and intentions of GPs, which include the familiarity with ICT, research evidence and evaluation, and financial incentives.

Familiarity with ICT

A GP's experience with technology and perceptions about its use in healthcare can be major drivers or barriers. Familiarity with and general interest in technology, such as EHR or telehealth, can improve adoption (Choi et al. 2018; Gagnon et al. 2014), while a lack of awareness of the system's range of uses can become a barrier to use (Hensel et al. 2018). Moreover, if GP practices are already using other eHealth services, they tend to be more open to using new ones (Jetty et al. 2018).

Research evidence and evaluation

Some studies included in the analysed reviews suggested that there is a lack of rigorous evaluation of eHealth systems, which means that the performance, efficiency and patient outcomes have not been sufficiently identified (Antoun 2016). Although there are some high-quality studies on the effectiveness and benefits of eHealth services, including RCTs, many of those score poorly on quality assessment checklists of the reviews' authors (Akiyama and Yoo 2016; Downes et al. 2017; Totten et al. 2016). This can be a barrier to adoption, as practitioners might not be able to clearly see the benefits of eHealth (Gagnon et al. 2014; Ross et al. 2016).

Financial incentives

Financial incentives for GPs to adopt eHealth are a frequently cited influencer of adoption. Lack of reimbursement (or even a lack of awareness that financial reimbursement is available (Jetty et al. 2018)) is one of the issues that may lead to staff not using health ICT (Antoun 2016; Kooienga 2018; Li et al. 2013). However, some studies suggested that a lack of financial reimbursement has only modest and variable effects (Lau et al. 2015; Young and Nesbitt 2017).

In response to this concern, reimbursement models for time spent on eHealth have been developed. For example, in Denmark, use of email communication by healthcare professionals is encouraged and reimbursed by the national health service provider (Antoun 2016).

A study reviewed by Hickson et al. (2015) suggested that eHealth services, such as eVisits, should include a functioning billing process for reimbursements from insurers. Lack of such processes can lead to uncertainties among GPs, and can lead some GPs to restrict their services to patients paying for themselves. An anonymous survey of patients reviewed by Hickson et al. (2015), which focused on patient willingness to communicate with their GP via email, found that only 42% of respondents would pay for this service without reimbursement.

De Lusignan et al. (2014) also found that having a fee-for-service system in place can have a positive impact on physicians' uptake of eHealth services. The authors note that fee-for-service approaches are not yet widespread, although there have been some larger organisations in European countries working with fees for eHealth services (e.g. in Norway) (de Lusignan et al. 2014).

2.3 Perceived benefits, impacts and barriers

This sub-section summarises findings on factors related to GPs' perceptions of the general benefits of eHealth, of the actual eHealth technologies, of health ICTs' impact on the management and organisation of healthcare professionals' day-to-day working, and GPs' views of patient perspectives.

Perception of the benefits

Several reviewed studies suggest that an individual GP's perceptions of disadvantages of eHealth technologies – regardless of whether the disadvantages actually exist – can themselves act as barriers to adoption. Similarly, if physicians have positive attitudes towards eHealth and are convinced of the benefits, they can positively influence adoption in their practice (Antoun 2016; Gagnon et al. 2014; Li et al. 2013).

The perceived benefits to patients are also important; professionals who believe eHealth is more likely to reduce the risk of complications and help improve a patient's quality of life are more likely to use it (Bassi and Lau 2013). Negative perceptions regarding health ICTs' impact on patients are more likely to act as barriers (Atherton et al. 2018; Li et al. 2013; Ross et al. 2016). Negative perceptions include views that health ICTs require more time; increase workload; have a negative impact on the doctor-patient relationship (e.g. making it less personal and having an impact because patients may not want to share sensitive information online); and could also increase the loneliness and isolation of some patient groups, such as the elderly (Davis et al. 2014; Li et al. 2013). Antoun (2016) also reports on healthcare professionals' concerns regarding miscommunication and the absence of non-verbal cues, as well as fears regarding medical errors resulting from electronic communication – errors which are less likely to be missed in a face-to-face setting.

If eHealth technologies are perceived to bring advantages, then this can support adoption. Perceived benefits include views that a new health ICT system will be better than the one already in place, is easy to use, improves healthcare and the doctor-patient relationship, decreases medical errors, does not affect the professional's autonomy and enhances job performance (Aller et al. 2017; Atherton et al. 2018; de la Torre-Diez, Gonzalez, and Lopez-Coronado 2013; Emani et al. 2017; Farr et al. 2018; Gagnon et al. 2014; Hanley et al. 2018; Jetty et al. 2018; Li et al. 2013). For example, the study by Atherton et al. (2018) showed that GPs found non-face-to-face consultations (e.g. emails) useful, as they allow more flexibility than face-to-face consultations, and Hanley et al. (2018) report that GPs who use telemonitoring found that they are able to reduce the level of supervision of patients and contact with them without introducing adverse effects.

There is also some evidence suggesting that individuals with different primary care profession roles also have different perceptions about the benefits of and need for eHealth (Davis et al. 2014; Hensel et al. 2018). For instance, Davis et al. (2014) report that nurses perceive telehealth as a greater benefit than do GPs: some nurses think that it can improve patient care, contribute to their own career development and give them more autonomy and improved responsibility (Davis et al. 2014).

Perception of the technology

Li et al. (2013) discuss the idea that the perceptions that health professionals have about the actual technology and its design also influence adoption. As well as the professionals' actual ICT skills, negative perceptions of their skills and knowledge regarding ICT can act as a barrier; individuals who demonstrate computer anxiety or believe they lack technical skills are less likely to use eHealth systems. If professionals believe that ICT infrastructure and technical support are both available to them, and that the external ICT services can be trusted, adoption can be increased (Li et al. 2013). The perception that medical staff will easily be able to exchange patient data also facilitates adoption (Aller et al. 2017). There may also be perceived concerns about the security of patient data; if such data is seen as having a lack of protection, then professionals are less likely to use eHealth services (Li et al. 2013). Perceptions of the volume of information required to be entered into EHR systems can also cause concern regarding how meaningful the data really is – especially when it varies in quality – or whether it can be retrieved properly (Emani et al. 2017; Farr et al. 2018; Kooienga 2018).

Perception of the organisation/management

Health professionals often have specific perceptions related to the management and organisational factors of health ICTs. Staff perceptions of the impact eHealth may have on their day-to-day working life can be a major driver of or barrier to adoption (Li et al. 2013; Ross et al. 2016). Professionals may also have financial concerns, such as the view that implementing eHealth systems is expensive and that the practice does not have the resources to pay, as well as the view that eHealth systems do not provide a return on investment. These financial factors can impede eHealth adoption as practices become reluctant to make the initial investment for implementation. There may also be concerns and uncertainties about (potential) new roles and responsibilities, role loss, or dissatisfaction with restructured responsibilities (Kooienga 2018; Ross et al. 2016).

Concerns from health professionals about greater workloads and time constraints, including during system implementation, are often highlighted in the literature as creating a barrier to adoption (Atherton et al. 2018; Davis et al. 2014; Farr et al. 2018; Gagnon et al. 2014; Hanley et al. 2018; Jetty et al. 2018; Young and Nesbitt 2017). For instance, it was found that GPs are often concerned about information overload as well as patient demands, that may have an impact on their day-to-day work. There are also concerns that for certain services, such as online consultations, there is a lack of staff and time to monitor the incoming information (Davis et al. 2014; Hanley et al. 2018), or that turnover of staff will lead to a loss of expertise (Alami et al. 2017). Additionally, if technologies are not seen as saving time by reducing workload, then this acts as a barrier. For instance, Young and Nesbitt (2017) identified that telehealth consultations were seen as increasing workload, for example, through patients being required to have a face-to-face appointment after the initial electronic appointment.

Although many studies suggest that physicians perceive an increase in workload with eHealth, a review by Antoun (2016) found that doctors indicating overall satisfaction with electronic communication with patients (e.g. by email) also reported that this type of communication saves them time and contributes to delivering better care. Hickson et al. (2015) identified studies suggesting that electronic care did not lead to an increase in the time needed to care for patients overall and that, rather, electronic communication is more time efficient than other types of communication; for instance, such technologies as telehealth may save physicians time by them not having to travel to patients' homes (Davis et al. 2014).

Physician views of patient perspectives

Health professionals often have their own ideas regarding what they believe patients think about eHealth. If health professionals believe that patients want them to use eHealth, then they are more likely to do so, and vice versa (Farr et al. 2018; Li et al. 2013; Ross et al. 2016). Patients who are perceived as 'sensible' generally encourage GP confidence in providing consultations via eHealth methods, such as telephone or email (Atherton et al. 2018). Studies found that, because some eHealth technologies reduce face-to-face interactions between GPs and patients, GPs may be concerned that some of their patients may not be literate enough to assess when and how they should use an eHealth service (Hickson et al. 2015). This may include such issues as patients accessing their records without being able to interpret the presented information correctly, which, in turn, could lead to patients being more anxious and concerned (de Lusignan et al. 2014; Hanley et al. 2018). In addition, Antoun (2016) found that many doctors think that electronic consultations are not in demand and that their patients prefer or only want face-to-face consultations. However, Antoun (2016) and Atherton et al. (2018) also report that there is evidence that patients are willing to use these technologies.

2.4 Institutional settings

This sub-section summarises findings on institutional-level factors, including costs, the type of healthcare model, legal issues and ethical issues related to privacy and security.

Costs

The costs of implementing and maintaining the technology can be major institutional barriers to adoption. If the set-up and maintenance costs are high, health centres are less likely to want to introduce the technology, or perhaps will not have the financial capabilities to do so, for example, if they are a smaller practice (Jetty et al. 2018; Ross et al. 2016). GPs also showed concerns about the the direct monetary costs and who is responsible for paying them (Alami et al. 2017; Palabindala, Pamarthy, and Jonnalagadda 2016). This may result in delayed implementation until decisions have been made about who is responsible for the initial investment as well as the ongoing maintenance costs. Farr et al. (2018) report that enabling practices to take part in pilots where they could test a system without having to pay for it in the first instance can help overcome this issue: such pilots enable practices to explore a new system and its impact on their work and healthcare before (financially) committing to it (Farr et al. 2018).

Cost-effectiveness of eHealth is also controversial and has yet to be clearly defined. For example, emerging models of financing that focus on value-based purchasing and shared risk with provider organisations are predicted to accelerate the adoption and use of telemedicine in the primary care setting (Bashshur et al. 2015). These models present an opportunity for coordinated care that offers benefits at a population-health-management level, rather than only from an individual patient perspective. However, the cost-evaluation evidence for value-based financial models is still in its infancy and requires further investigation (Totten et al. 2016). Calculating the cost-effectiveness of eHealth versus conventional healthcare is also important; this calculation should take into account costs, such as travel and consultation time of physicians (Akiyama and Yoo 2016).

Type of healthcare model

The type of healthcare model a country uses can also act as an institutional setting barrier to eHealth adoption. Countries with NHS systems have been associated with higher uptake of eHealth. For example, Brennan et al. (2015) found that higher uptake occurred specifically for ePrescribing, and the authors suggest that this was possibly facilitated by the fact that NHS systems are managed by a small number of institutes compared with social health insurance systems. The authors found that countries with social health insurance systems or with models transitioning to such a system were associated with a lower uptake of ePrescribing (Brennan, McElligott, and Power 2015).

Studies also suggest that policy initiatives offering incentives or financial support for the implementation of eHealth services can be a key driver of adoption (Antoun 2016; Atherton et al. 2018; Jetty et al. 2018; Kooienga 2018; Lau et al. 2015; Li et al. 2013; Young and Nesbitt 2017). Similarly, Choi et al. (2018) and Jetty et al. (2018) found that lack of national support or restrictive regulations can be a barrier to implementation.

Legal issues

The type, or absence, of policies and other legal guidelines can impact on eHealth adoption. For example, if there are no guidelines or legal documents on the legal protection of professionals and/or their organisations (for instance, in cases of disputes with patients or insurers), professionals may be deterred from using eHealth technologies (Li et al. 2013). While there are several EU Directives and initiatives on eHealth in general, there appears to be a lack of policies on the actual use of eHealth in the EU and on liability (Antoun 2016; Ross et al. 2016). Moreover, many EU policies are perceived to be either general (i.e. do not specifically focus on eHealth) or, if they do focus on eHealth, incomplete, in that they focus on only one specific eHealth type (e.g. telemedicine), whereas policies on some other types, such as online/electronic communication, are absent (Antoun 2016).

Existing policies and guidelines can also be confusing and can differ within countries. For example, in Spain, all regions govern their own healthcare policies and decision making, while in other countries, this is done centrally. Although the use of most eHealth technologies in Spain and related processes – e.g. how primary and secondary care organisations should use ICTs to coordinate among each other – is based on the same standards, the policy autonomy also led to variations among the individual regions (Aller et al. 2017; de la Torre-Diez, Gonzalez, and Lopez-Coronado 2013).

There can also be issues regarding keeping medical and healthcare staff up to date with changes in policies and guidelines, such as changes to who is responsible for the accuracy of the systems and how to appropriately use an eHealth service (Davis et al. 2014; Jetty et al. 2018; McPhee 2014). Palabindala et al. (2016) suggest that without clarity, staff may 'blindly' rely on eHealth services, which can result in medical errors. Concerns and lack of clarity regarding liability may also lead to professionals not adopting eHealth technologies at all, as they may fear breaking confidentiality/privacy laws (Palabindala, Pamarthy, and Jonnalagadda 2016). However, concerns regarding liability were only found in a review by Palabindala et al. (2016) and a study by Jetty et al. (2018), both of which focused on the US healthcare system. Liability concerns may be less common in Europe.

Alami et al. (2017) suggest that changes in policy focus can also influence the uptake of or decline in eHealth usage. For example, Norway has seen a decline in telehealth usage since 2013, and this is thought to be associated with a move in policy focus to other eHealth technologies (Alami et al. 2017).

To overcome some of these legal issues, government support and efforts, such as the development of guidelines, are crucial for the advancement of eHealth. Antoun (2016) refers to Denmark, which is highly ranked in the European eHealth consumer trends survey in the area of patients using the Internet for healthcare purposes (e.g. for communication with healthcare professionals). According to the author, this could be a result of the Danish government actively encouraging electronic/online communication in healthcare (Antoun 2016).

In addition, some studies analysed in reviews suggest that audits and feedback of eHealth systems act as a driver of adoption (Irwin, Stokes, and Marshall 2015; Lau et al. 2015). Hickson et al. (2015) suggest that some eHealth technologies can also provide more legal certainty: for instance, as electronic consultations provide clear documentation of each interaction between a physician and a patient, this can help protect physicians (as well as patients) if legal disputes arise (Hickson et al. 2015).

Ethical issues related to privacy and security

Common barriers often cited in the literature on eHealth relate to ethical concerns. Confidentiality and privacy issues frequently arise, especially with regards to individuals accessing data and the ability to send patient data to other institutions without a patient's permission or knowledge. These concerns are often voiced by both staff and patients, and authors assume that such concerns may prevent patients from wanting to use eHealth technologies. Patient concerns can then lead to health professionals not adopting the technologies because they do not see the need for them. Alternatively, health professionals may be deterred from adopting eHealth systems as they do not want patient data to be at risk (de la Torre-Diez, Gonzalez, and Lopez-Coronado 2013; Gagnon et al. 2014; Young and Nesbitt 2017).

A particular area where privacy has been highlighted as an issue is electronic communication between patients and physicians. Antoun (2016) identified many of these concerns. For instance, a reviewed study showed that some health professionals think that patients have a stronger sense of personal security if online communication is offered, while other studies suggested that health professionals are concerned about potential related risks, such as receiving spam emails, cyberattacks or viruses. In addition, some practitioners also feared that patients may not receive emails at all or that interoperability with other systems used in the practices (e.g. EHR) is not given. Other physicians, however, shared concerns regarding the costs and technical procedures necessary to implement a system offering encrypted messages (Antoun 2016). Some studies reviewed by Antoun (2016) indicated that some healthcare staff are worried about the suitability of electronic communication if there is an urgent matter, a new symptom or a sensitive issue (e.g. mental health problems) that should be discussed.

Fears over privacy extend to other forms of eHealth technology, such as exchanging confidential information during eVisits (Hickson et al. 2015). According to Atherton (2013), however, such issues are not limited to online communication, but also occur with other consultation methods (e.g. telephone). Hickson et al. (2015) suggest that patients may find electronic communication more secure than face-to-face interactions, and thus may be more willing to share information about their conditions. However, these authors also assume that this could lead to patients requesting consultations more often, as well as requesting consultations for issues for which they would not consult a physician at all if only face-to-face services are offered (Hickson et al. 2015).

Young and Nesbitt (2017) suggest that patient concerns regarding ethical issues may be reduced through targeted patient education. In addition, offering encrypted messaging could help overcome fears (Antoun 2016). However, de Lusignan et al. (2014) also note that in order to limit ethical concerns, the introduction of an eHealth service needs to be considered in overall business processes of a healthcare organisation, as well as in contracts with employees (e.g. required skills and training). Moreover, organisations need to ensure that their infrastructure provides data security (de Lusignan et al. 2014).

2.5 Organisational settings

This sub-section summarises findings on institutional-level factors, including factors related to the planning of eHealth technology implementation and practice characteristics.

Planning implementation

A lack of a detailed plan when implementing eHealth technologies can act as a barrier to adoption (Alami et al. 2017; Gagnon et al. 2014), while providing straightforward plans for implementation is seen to be an enabler (Atherton 2013, editorial; Farr et al. 2018). Moreover, if an eHealth technology is designed or implemented in such a way that it can be integrated into existing services, adoption is more likely (Hensel et al. 2018; Hickson et al. 2015; Ross et al. 2016).

This extends to the restructuring of staff roles and responsibilities. Clearly defining which members of staff will be responsible for which aspect of the technology makes adoption more likely, for example, forming teams to liaise with the technology vendor (Lau et al. 2015; Palabindala, Pamarthy, and Jonnalagadda 2016). However, redefining roles and changing responsibilities can lead to disputes within the practice, which can hamper adoption and/or result in delays in implementation (Gagnon et al. 2014).

Especially in cases where healthcare staff are reluctant to change, 'champions' can help overcome concerns and drive adoption. Champions are usually healthcare staff within a centre or a practice who raise awareness of a new technology, introduce their colleagues to it and may also teach them how to use it, support staff in adopting it, and thus can increase their colleagues' knowledge and understanding of the technology (or eHealth in general) and its potential benefits (Ross et al. 2016).

Practice characteristics

Certain features of primary care practices can have an effect on eHealth adoption. The following can all increase the likelihood of adoption: large practices with more than 11 GPs, practices that see a large number of people daily, practices with an affiliation to an academic institution, practices that are located in an urban environment, practices that include a range of specialities and practices that have few competing priorities (Antoun 2016; Kooienga 2018; Li et al. 2013; Young and Nesbitt 2017). This may be due to a range of factors, such as that larger, urban and more diverse speciality practices have a greater need for eHealth, as well as a greater financial capability to implement it (Li et al. 2013). However, the nationally representative randomly sampled survey of US GPs by Jetty et al. (2018) found that rural physicians are twice as likely to use telehealth technologies than urban physicians because their patients tend to have poorer access to healthcare due to longer travel distances to see healthcare professionals than people living in urban areas (Jetty et al. 2018).

However, as reported by Jetty et al. (2018), adoption of health ICTs may be lower among practitioners working in smaller practices, as they are often not able to afford the implementation of new ICTs (Jetty et al. 2018).

2.6 Community demands

This sub-section summarises findings on factors relating to patient demographics and patient perceptions that healthcare professionals believe patients have.

Patient demographics

Certain patient demographics were found to act as a barrier to eHealth adoption. For example, those who are elderly or from disadvantaged socioeconomic backgrounds are more likely to not use eHealth technologies due to lack of knowledge or Internet access, which is needed for certain types of eHealth (Antoun 2016; Farr et al. 2018; Young and Nesbitt 2017). In addition, patients who have disabilities or certain physical conditions may also be unable to access or use the required technology, for instance, if their disability or condition affects their reading or typing abilities (Antoun 2016; Downes et al. 2017). Certain ethnicities have also been associated with lower use of eHealth services, such as Asian and black women; however, the three cited studies which found an association between ethnicities and lower eHealth uptake all focused on the United States, and these issues might not be present in an EU context (Antoun 2016). Younger, healthier and more highly educated patients, as well as those with higher incomes, were found to have better access to and use eHealth options more often than older, less healthy and less wealthy people, i.e. those who generally require healthcare more often and would thus benefit from eHealth services (Antoun 2016). Hickson et al. (2015), however, found that middle-aged people are more likely than younger patients to use eVisit technologies – contrary to the studies reviewed by Antoun (2016). Moreover, the former authors identified studies suggesting that women use eVisit technologies more often than do men (Hickson et al. 2015).

Patient perceptions

Perceptions that patients have, or perceptions that healthcare professionals believe patients have, can affect the adoption of eHealth. There is a disparity between public endorsement for, and public understanding of, the benefits of eHealth technologies, such as shared medical records: the way a patient interacts with the health system may affect their understanding of the benefits and problems of an eHealth intervention. For example, rural populations may be less aware of the availability of new interventions (Bashshur et al. 2016). This may affect the speed of service uptake, even by those more familiar with ICT (Atherton et al. 2018; Bashshur et al. 2016).

2.7 Individual characteristics, social influence and networks

This sub-section summarises findings on such factors as GPs' individual characteristics, leadership and stakeholder engagement, attitudes of colleagues and organisations, and the perceived impact of eHealth on the doctor-patient relationship.

Individual characteristics

The characteristics of individual GPs can influence whether they choose to use eHealth systems or not. Certain demographic factors can mean a GP is less likely to adopt eHealth, such as being older or female (Li et al. 2013). Additionally, the stage of career the GP is in may affect their drive to adopt eHealth technologies. Those later in their career, and thus closer to retirement, may not see the benefit in investing time and money in training, as they think they will not use it for a sufficiently long period (Li et al. 2013). This may be a problem in practices dominated by primarily older GPs, as the practice as a whole might not adopt eHealth technologies, despite younger colleagues who are lower in the hierarchy being willing to implement or use them.

Additionally, physicians who were among the earlier adopters of such eHealth services as online communication with patients were found to be more enthusiastic and less concerned about potential time pressures than those who introduced eHealth services later or have not yet done so (Antoun 2016).

Leadership/stakeholder engagement

Management and organisational factors can have an effect on eHealth adoption. For example, if an eHealth system is implemented by an authority figure within a healthcare organisation who directly works with the introduced technology, then adoption and use by the medical staff is more likely (Li et al. 2013; Ross et al. 2016). On the other hand, a lack of leadership engagement with eHealth can act as a barrier (Ross et al. 2016). This may be for multiple reasons, for example, management may choose not to implement eHealth technology, enforce its use by staff, or use it themselves. Negative attitudes from management may cause physicians to have the same view. Conversely, if management views eHealth as providing the practice or healthcare organisation with an advantage over other medical organisations, or if a competing practice has adopted a technology, then this can act as a driver for professionals to adopt it themselves (Li et al. 2013).

Attitudes of colleagues and organisations

Ross et al. (2016) highlight that the attitudes of colleagues can influence a professional's perception, and thus adoption, of eHealth; those whose colleagues are more negative towards eHealth are less likely to view the technologies as beneficial themselves.

Problems have also been identified regarding the attitudes of some professional bodies towards eHealth. Although many policymakers show enthusiasm for eHealth, there are professional bodies and organisations (e.g. representative organisations of primary care practitioners) in the EU, e.g. in the United Kingdom, that do not take the initiative at all to support the uptake of eHealth technologies or that even take a negative stance towards them (Antoun 2016; Atherton 2013, editorial). Atherton (2013) assumes that lack of support from professional bodies and organisations has an impact on the overall uptake of eHealth services by GPs.

Impact on doctor-patient relationship

Although some professionals perceive that eHealth technologies will improve care, others worry that they could worsen it due to changes in the doctor-patient relationship; for example, some physicians think that fewer face-to-face interactions can cause a lack of context for problems (Antoun 2016; Davis et al. 2014; Hanley et al. 2018). Those who believe that the doctor-patient relationship should be more distant in general were found to be more likely to use eHealth (Li et al. 2013).

2.8 Conclusions on factors influencing the adoption and use of eHealth and implications for the survey

The findings of this review highlight that there is a wide range of factors that can drive or hinder the uptake and use of ICTs in health, ranging from individual-level factors (e.g. the ability to work with eHealth technologies, perceptions of eHealth, and wider motivations of and incentives for staff) to organisational and country-specific factors (e.g. budget availability within organisations, wider system support or policy support).

The study team did not identify any additional factors influencing the adoption and use of eHealth in primary care compared with the factors identified in the second eHealth benchmarking study (Codagnone and Lupiáñez-Villanueva 2013a, 2013b).

Based on these findings, we decided to use the same questions on drivers, impacts and barriers to eHealth for the 2018 survey as were used for the 2013 survey.

Findings resulting from the analysis of these questions are presented in Section 5.2; wherever applicable, we provide insights from the literature review in Section 5.2, highlighting any similarities or differences between the survey results and the literature.

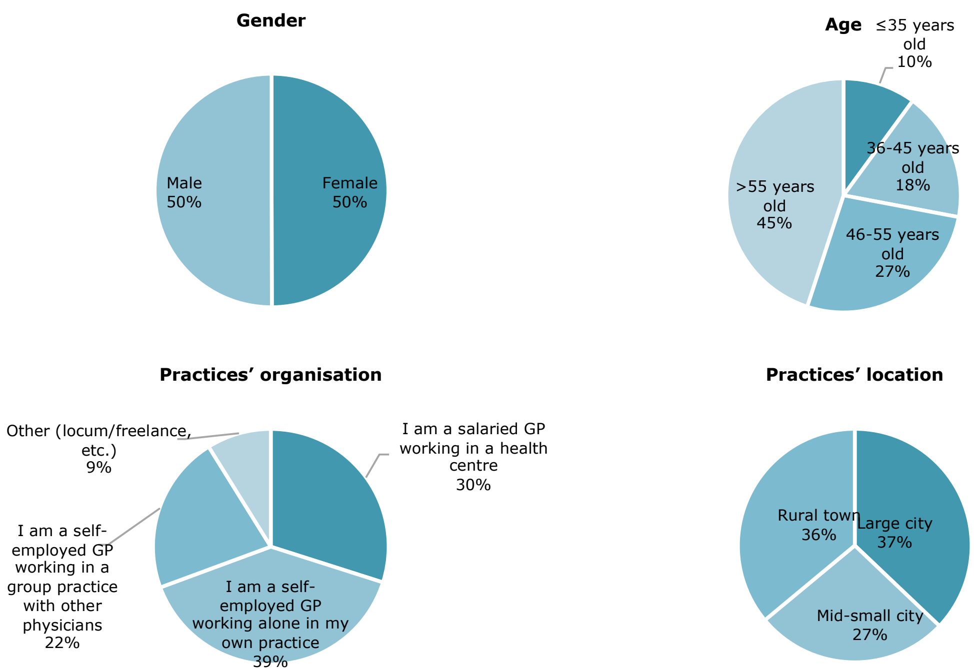
3 Descriptive findings

This chapter presents the descriptive findings of the GP survey. We first describe the general characteristics of the respondents to the survey, including socio-demographics (Section 3.1). In Sections 3.2 to 3.5 we provide findings on the availability and use of eHealth functionalities, categorised into the four eHealth categories: EHR, HIE, Telehealth and PHR.

3.1 General characteristics

Across the 27 EU countries analysed, a final sample of 5,793 GPs was selected; Figure 12 presents the general characteristics of this sample. There is an overall gender balance between male and female, which is comparable to the latest available EU data (data from 2015; OECD 2017) (see also Section 1.2).[27] Moreover, almost half of the GPs surveyed are 55 of age or older, which is higher than the latest available EU average of 38% (data from 2015; OECD 2017) (see also Section 1.2).[28] The organisational settings of surveyed GPs' practices reflect the characteristics of the overall population of GPs in Europe (see Table 1 in Section 1.2): 39% of the individuals reported being a self-employed GP working alone in their own practice, 30% indicated that they are working as a salaried GP in a health centre and 22% declared being self-employed working in a group practice with other physicians. Overall, 37% of the surveyed GPs work in large cities, 36% in rural towns and 27% in medium- to small-sized cities.[29]

Figure 12 General characteristics



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[27] The EU average is based on OECD data from 22 EU member states (Austria, Belgium, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Luxembourg, the Netherlands, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, the United Kingdom) (OECD 2017).

[28] The EU average is based on OECD data from 21 EU member states (Austria, Belgium, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Hungary, Ireland, Italy, Latvia, Luxembourg, the Netherlands, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden and the United Kingdom) (OECD 2017).

[29] Rural town: <20,000 inhabitants; medium- to small-sized city (mid-small city): 20,000 to 100,000 inhabitants; large city: >100,000 inhabitants.

3.2 Electronic health records

In order to determine the degree of access to EHRs in GP practices in the surveyed countries, GPs were provided with a list of 25 EHR functionalities and asked whether these are available to them. When respondents indicated that a functionality is available to them, they were asked about the actual use of those EHR functionalities in their practice. Table 3 shows the frequencies of the availability and use of these functionalities, sorted by availability.

Table 3 EHR functionalities: availability and use 2018

Functionality	Availability				Use			
	Yes	No	Don't know	N[30]	Yes, routinely	Yes, occasionally	No	N[31]
Prescriptions/medications	96%	3%	1%	5,297	96%	3%	0%	5,109
Medication list	96%	3%	1%	5,297	95%	4%	1%	5,081
Problem list/diagnoses	94%	4%	1%	5,297	91%	7%	1%	5,001
Basic medical parameters	94%	4%	1%	5,297	90%	8%	1%	4,996
Medical history	93%	5%	1%	5,297	90%	8%	2%	4,947
Immunisations	93%	5%	2%	5,297	82%	16%	2%	4,905
Lab test results	91%	7%	1%	5,297	94%	5%	1%	4,843
Clinical notes	90%	8%	2%	5,297	88%	10%	2%	4,790
Symptoms (reported by patient)	89%	9%	1%	5,297	91%	7%	2%	4,736
Reason for appointment	89%	9%	2%	5,297	88%	10%	2%	4,695
Ordered tests	88%	9%	2%	5,297	90%	9%	1%	4,680
Administrative patient data	87%	8%	4%	5,297	77%	19%	4%	4,630
Treatment outcomes	87%	10%	3%	5,297	88%	10%	2%	4,612
Vital signs	87%	10%	4%	5,297	84%	13%	3%	4,606
Radiology test reports	78%	19%	3%	5,297	89%	9%	2%	4,143
Patient demographics	78%	14%	9%	5,297	74%	23%	4%	4,116
Create/update disease management	74%	20%	7%	5,297	79%	18%	3%	3,909
Drug-drug interactions	63%	34%	3%	5,297	72%	25%	3%	3,342
Drug-allergy alerts	63%	33%	4%	5,297	83%	15%	2%	3,339
Finances/billing	62%	26%	12%	5,297	72%	16%	12%	3,277
Clinical guidelines and best practices	51%	41%	7%	5,297	68%	28%	4%	2,724
Radiology test images	46%	49%	5%	5,297	71%	20%	9%	2,443
Be alerted to a critical laboratory value	45%	48%	8%	5,297	83%	15%	2%	2,376
Contraindications	41%	53%	6%	5,297	78%	20%	2%	2,169
Drug-lab interactions	27%	63%	10%	5,297	70%	24%	6%	1,444

Note: Percentages have been rounded and may not sum to 100%.

[30] N=number of respondents.

[31] N=number of respondents; only GPs who responded 'Yes' to the question whether the functionalities were available were included.

More than 90% of respondents stated that, among all the functionalities listed, the following were available in their EHR systems (in order of prevalence):

- Medication list (96%)
- Prescriptions/medications (96%)
- Basic medical parameters (94%)
- Problem list/diagnoses (94%)
- Immunisations (93%)
- Medical history (93%)
- Lab test results (91%)
- Clinical notes (90%)

Availability was below 50% for the following EHR functionalities:

- Radiology test image (46%)
- Be alerted to a critical laboratory value (45%)
- Contraindications (41%)
- Drug-lab interactions (27%)

The availability of clinical guidelines in 2018 was 51%, an increase of 16% since 2013. The majority of GPs who have those features in their practice also use them. This means that the 'have/use' gaps are relatively small. The largest 'have/use' gaps are for 'finances/billing' and for 'radiology test images': 12% and 9% of GPs, respectively, who have these functionalities available to them are not using them.

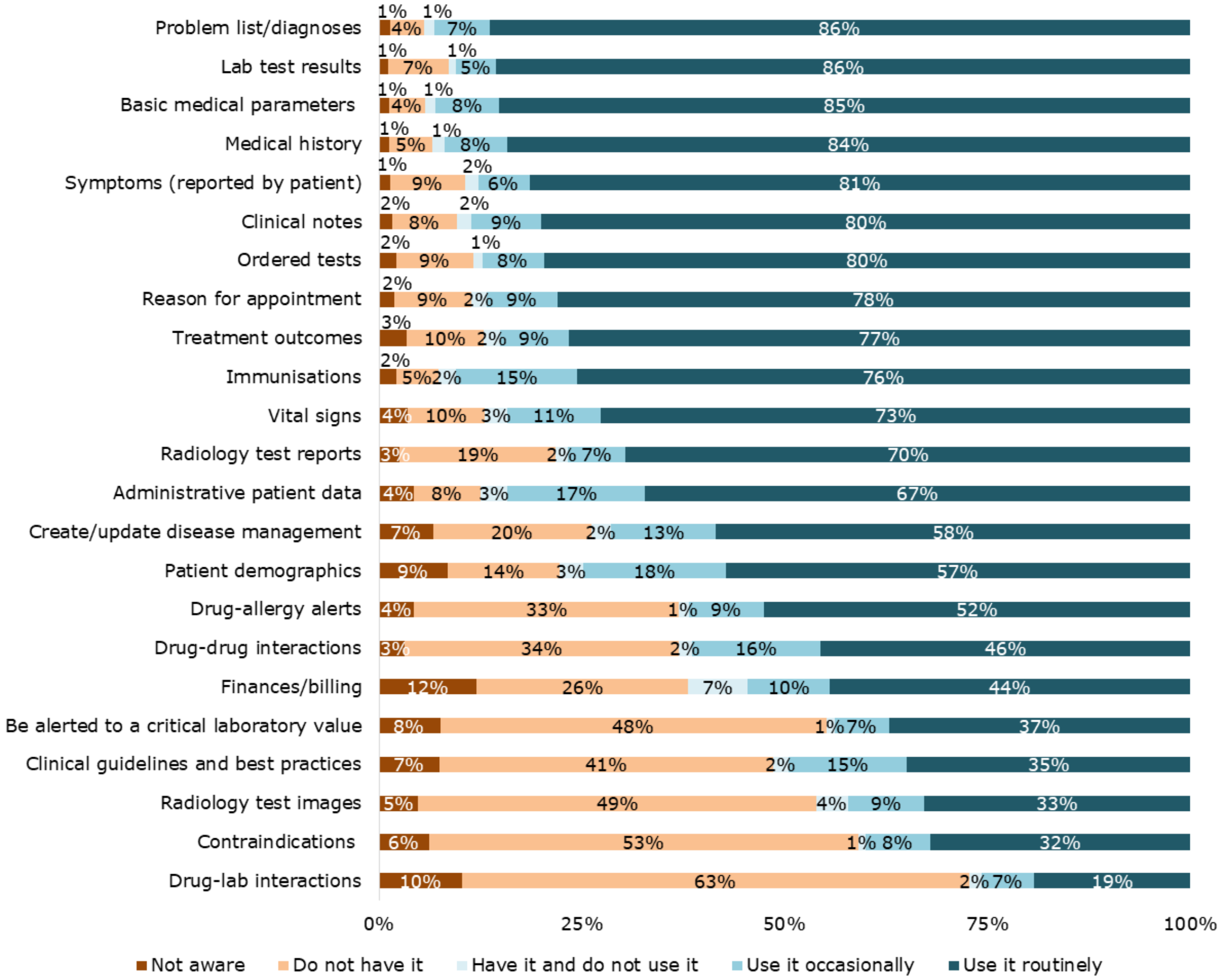
To gain a better understanding of the difference between availability and use of EHR functionalities, a new variable was created to assess the level of adoption (see methodological report of this study (Appendix 8.1) for more details on the approach used to create this variable). Figure 13 shows the adoption of the EHR functionalities.

More than 80% of all GPs surveyed routinely use the following functionalities:

- Problem list/diagnoses (86%)
- Lab test results (86%)
- Basic medical parameters (85%)
- Medical history (84%)
- Symptoms (81%)
- Clinical notes (80%)
- Ordered tests (80%)

All other functionalities are routinely used by at least 30% of GPs surveyed, except for the functionality 'drug-lab interactions' (used routinely by 19% of GPs surveyed); a majority (63%) of GPs surveyed does not have this functionality available to them.

Figure 13 EHR awareness and use



3.3 Health information exchange

In the category of HIE, GPs were asked to indicate whether their practice's ICT system allows them to transfer, share, enable or access patient data electronically for 15 different HIE functionalities. Table 4 presents the frequencies of availability and use of these functionalities, sorted by availability.

Table 4 HIE functionalities: availability and use 2018

Functionality	Availability				Use			
	Yes	No	Don't know	N[32]	Yes, routinely	Yes, occasionally	No	N[33]
Receive laboratory reports	77%	21%	2%	5,793	87%	11%	2%	4,472
Certify sick leaves	69%	27%	4%	5,793	84%	11%	5%	4,006
Send/receive referral and discharge letters	53%	42%	5%	5,793	71%	22%	7%	3,052
Transfer prescriptions to pharmacists	52%	43%	4%	5,793	83%	12%	5%	3,035
Patient appointment requests	52%	44%	4%	5,793	58%	29%	13%	2,987
Exchange medical patient data with other healthcare providers and professionals	47%	46%	6%	5,793	51%	40%	9%	2,741
Interact with patients by email about health-related issues	44%	50%	6%	5,793	43%	44%	13%	2,528
Receive and send laboratory reports and share them with other healthcare professionals/providers	44%	49%	8%	5,793	58%	33%	8%	2,528
Certify disabilities	40%	52%	9%	5,793	69%	25%	7%	2,307
Exchange patient medication lists with other healthcare professionals/ providers	37%	54%	8%	5,793	56%	35%	9%	2,163
Exchange radiology reports with other healthcare professionals/providers	36%	56%	8%	5,793	56%	35%	9%	2,080
Order supplies for your practice	35%	52%	13%	5,793	57%	30%	13%	2,038
Exchange administrative patient data with reimbursers or other care providers	32%	54%	14%	5,793	62%	29%	9%	1,852
Make appointments at other care providers on your patients' behalf	31%	63%	6%	5,793	54%	32%	13%	1,806
Exchange medical patient data with any healthcare provider in other countries	17%	72%	11%	5,793	47%	27%	26%	1,011

Note: Percentages have been rounded and may not sum to 100%.

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[32] N=number of respondents.

[33] N=Number of respondents; only GPs who responded 'Yes' to the question whether the functionalities were available were included.

From the 15 HIE functionalities provided in the survey, none are available to more than 90% of GPs, and only one is available to more than 70% of GPs:

- Receive laboratory reports (77%)

By contrast, ten HIE functionalities are available to less than 50% of GPs:

- Exchange medical patient data with other healthcare providers and professionals (47%)
- Certify disabilities (40%)
- Interact with patients by email about health-related issues (44%)
- Receive and send laboratory reports and share them with other healthcare professionals/providers (44%)
- Certify disabilities (40%)
- Exchange patient medication lists with other healthcare professionals/providers (37%)
- Exchange radiology reports with other healthcare professionals/providers (36%)
- Order supplies for your practice (35%)
- Exchange administrative patient data with reimbursers or other care providers (32%)
- Make appointments at other care providers on your patients' behalf (31%)
- Exchange medical patient data with any healthcare provider in other countries (17%)

The availability of the function to transfer prescriptions to pharmacists has increased from 36% in 2013 to 52% in 2018.

Overall, there are larger 'have/use' gaps for HIE functionalities than for EHR functionalities. Compared with 2013, there has been an increase in the 'have/use' gaps for some of the HIE functionalities. The gaps are particularly large for the following functionalities:

- Exchange medical patient data with any healthcare provider in other countries (26%)
- Patient appointment requests (13%)
- Interact with patients by email about health-related issues (13%)
- Order supplies for your practice (13%)
- Make appointments at other care providers on your patients' behalf (13%)

Following the same process described to measure adoption of EHR functionalities, a similar variable was derived to assess the HIE level of use. Findings are shown in Figure 14.

Only two HIE functionalities are routinely used by more than half of the surveyed GPs:

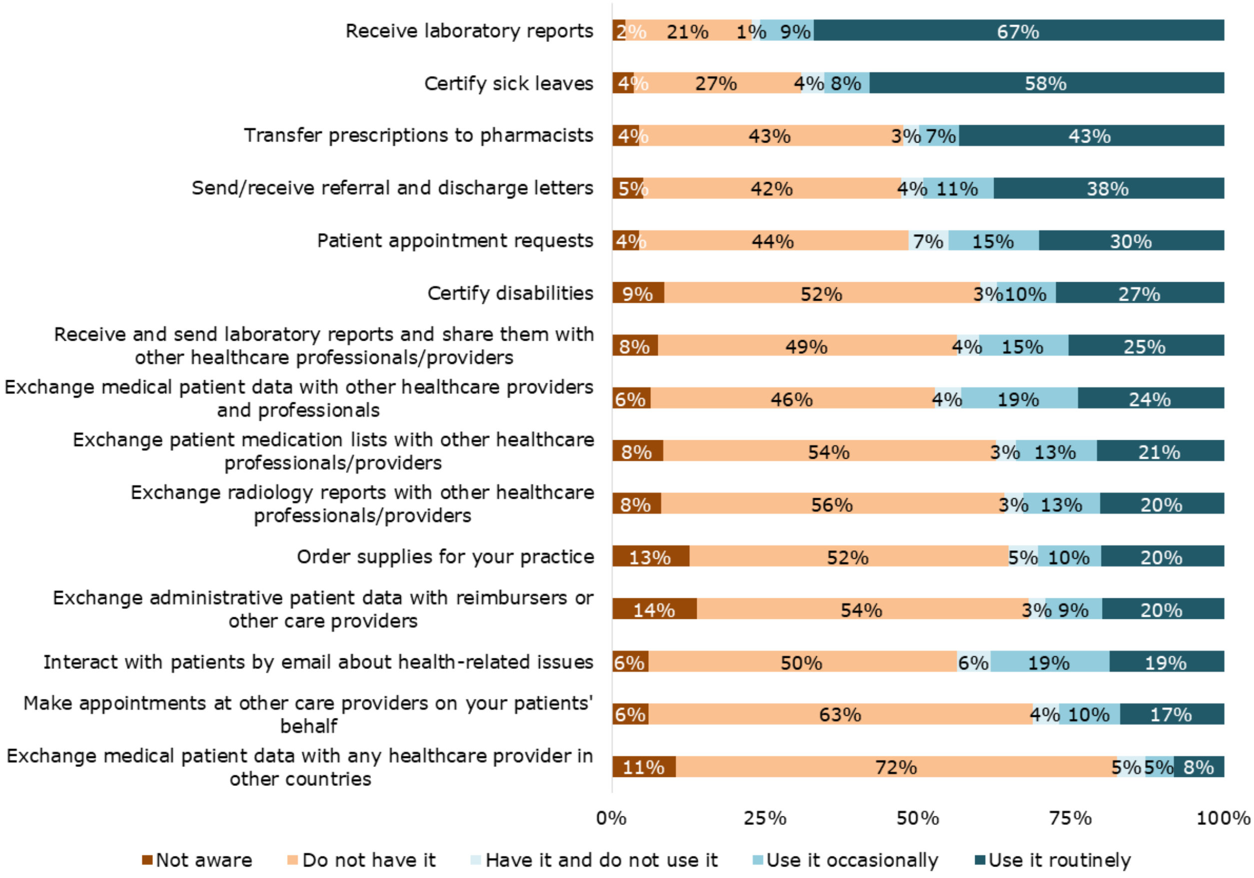
- Receive laboratory reports (67%)
- Certify sick leaves (58%)

The majority of HIE functionalities are not used routinely by a large percentage of the surveyed GPs. Routine use was especially low for the following functionalities (below 30%):

- Certify disabilities (27%)
- Receive and send laboratory reports and share them with other healthcare professionals/providers (25%)
- Exchange medical patient data with other healthcare providers and professionals (24%)
- Exchange patient medication lists with other healthcare professionals/providers (21%)
- Exchange radiology reports with other healthcare professionals/providers (20%)
- Order supplies for your practice (20%)
- Exchange administrative patient data with reimbursers or other care providers (20%)
- Make appointments at other care providers on your patients' behalf (17%)
- Exchange medical patient data with any healthcare provider in other countries (8%)

Routine use of certifying sick leaves has increased from 47% in 2013 to 58% in 2018, and routine use of transferring prescriptions to pharmacists has increased from 24% in 2013 to 43% in 2018.

Figure 14 HIE awareness and use



3.4 Telehealth

Surveyed GPs were provided with four different Telehealth functionalities and asked about the availability and use of them in their practice. Table 5 shows the frequencies of availability and use of these functionalities, sorted by availability.

Table 5 Telehealth functionalities: availability and use 2018

Functionality	Availability				Use			
	Yes	No	Don't know	N[34]	Yes, routinely	Yes, occasionally	No	N[35]
Training/Education	51%	44%	5%	5,793	46%	49%	4%	2,931
Consultations with other professionals	21%	74%	5%	5,793	44%	48%	8%	1,220
Consultations with patients	12%	83%	5%	5,793	43%	45%	12%	708
Monitoring patients remotely at their homes (i.e. 'telemonitoring')	4%	92%	4%	5,793	41%	44%	16%	239

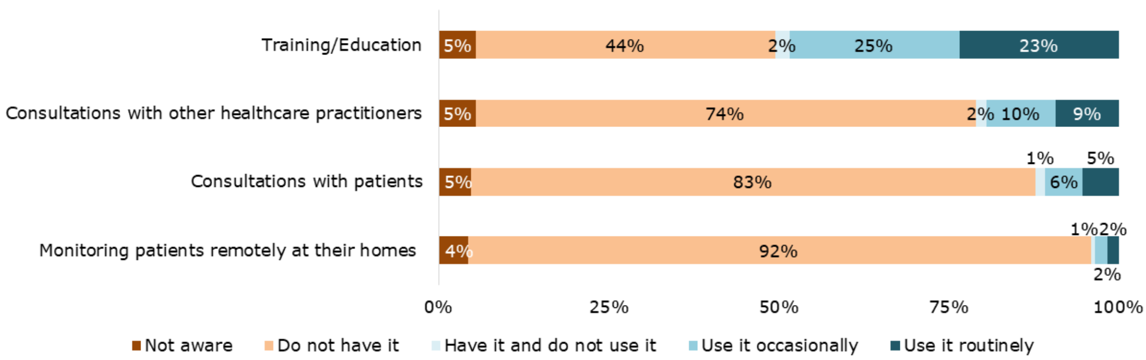
Note: Percentages have been rounded and may not sum to 100%.

None of the presented Telehealth functionalities are available to more than 90% of GPs, and only one functionality is available to more than 50% of GPs: training and education. However, there has been a marked increase in the availability of training and education compared with 2013: in the previous eHealth benchmarking survey, only 36% of respondents indicated that 'training/education' was available to them.

The largest 'have/use' gaps were found for monitoring patients remotely and for consultations with patients. The gap for monitoring patients remotely is 16% in 2018, a decrease compared with 2013 (26%). The gap for consultations with patients is 12%, a decrease compared with 2013 (14%).

Following the same process described for EHR and HIE, we derived a variable to assess the level of Telehealth adoption. Findings are summarised in Figure 15. Training and education is the only functionality that is used routinely by more than 10% of all GPs surveyed: 23% of GPs routinely use it.

Figure 15 Telehealth awareness and use



[34] N=number of respondents.

[35] N=Number of respondents; only GPs who responded 'Yes' to the question whether the functionalities were available were included.

3.5 Personal health records

GPs were asked whether their ICT systems allow their patients to access six different types of PHR functionality. Table 6 presents the frequencies of availability and use of these functionalities, sorted by availability.

Table 6 PHR functionalities: availability and use 2018

Functionality	Availability				Use			
	Yes	No	Don't know	N[36]	Yes, routinely	Yes, occasionally	No	N[37]
Request appointments	43%	53%	4%	5,793	55%	38%	7%	2,499
Request renewals or prescriptions	36%	60%	4%	5,793	61%	33%	6%	2,078
View their medical records	24%	70%	6%	5,793	32%	48%	20%	1,372
View test results	23%	71%	6%	5,793	41%	46%	13%	1,327
Request referrals	15%	79%	6%	5,793	44%	42%	13%	890
Supplement their medical records	9%	83%	8%	5,793	31%	36%	33%	521

Note: Percentages have been rounded and may not sum to 100%.

The results suggest that the availability of these functionalities is limited: availability for all is below 50%. However, overall availability of PHR functionalities has increased compared with 2013. Requesting appointments is available to 43% of GPs (2013: 30%), requesting renewals or prescriptions to 36% of GPs (2013: 25%), viewing medical records to 24% of GPs (2013: 8%), viewing test results to 23% of GPs (2013: 10%), requesting referrals to 15% of GPs (2013: 10%) and supplementing their medical records to 9% of GPs (2013: 7%).

The 'have/use' gaps are the largest for supplementing medical records (33%) and viewing medical records (20%).

Following the same process as for EHR, HIE and Telehealth, we derived a variable to assess the level of adoption for PHR functionalities. Findings are presented in Figure 16. The results show that just under a quarter of patients use functions to request appointments (2018: 24%, 2013: 13%) and request renewals or prescriptions (2018: 22%, 2013: 13%).

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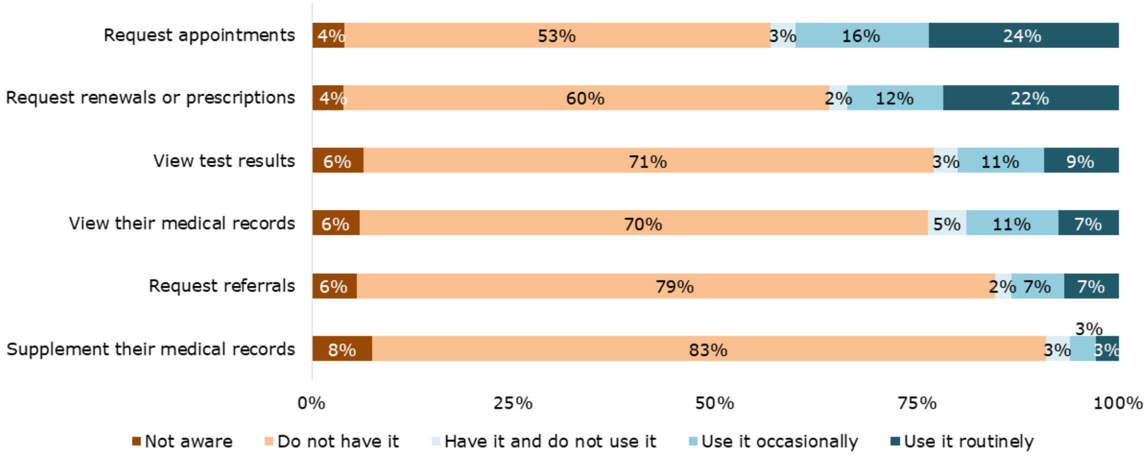
[36] N=number of respondents.

[37] N=Number of respondents; only GPs who responded 'Yes' to the question whether the functionalities were available were included.

Figure 16 PHR awareness and use



4 eHealth adoption

This chapter provides the composite indicators for each of the four eHealth categories (EHR, HIE, Telehealth and PHR) to show the overall adoption of the four categories in 2018. Findings relating to the four eHealth categories are provided in Sections 4.1 to 4.4. Section 4.5 presents the composite index for 2018, which combines the results of the composite indicators of the four eHealth categories and shows the overall eHealth adoption among GPs.

Each composite indicator consists of two to five subdimensions, which group the functionalities into broader categories. The grouping of functionalities into subdimension followed the same approach used in the previous eHealth benchmarking study (Codagnone and Lupiáñez-Villanueva 2013b).

4.1 Electronic health record adoption

The EHR composite indicator combines 23 functionalities across five subdimensions. Table 7 shows how the different functionalities were grouped.

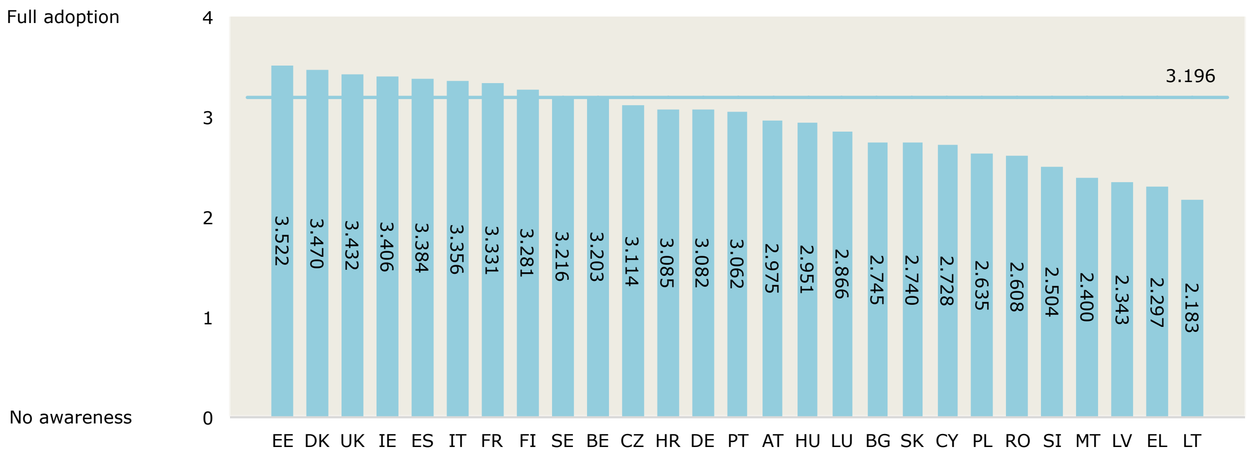
Table 7 EHR overview: subdimensions and functionalities

Subdimension	Functionalities
Health Info and Data	Symptoms
	Reason for appointment
	Clinical notes
	Vital signs
	Treatment outcomes
	Medical history
	Basic medical parameters (e.g. allergies)
	Problem list/diagnoses
Clinical Decision Support System	Contraindications
	Drug-drug interactions
	Drug-lab interactions
	Drug-allergy alerts
	Clinical guidelines and best practices
	Be alerted to a critical laboratory value
Order-Entry and Result Management	Medication list
	Prescriptions/medications
	Immunisations
	Lab test results
	Ordered tests
Image	Radiology test images
	Radiology test reports
Administrative	Finances/billing
	Administrative patient data

The EHR composite indicator shows that EHRs are fully available across the 27 EU countries; in some countries there is almost full adoption. The EHR composite indicator score for the EU in

2018 is 3.196,[38] which is an increase compared with the 2013 score of 2.989. Estonia, Denmark, the United Kingdom, Ireland and Spain are ranked at the top (scores between 3.384 and 3.522), while Lithuania, Greece, Latvia, Malta and Slovenia have the lowest scores (between 2.183 and 2.504) (Figure 17).

Figure 17 EHR composite indicator of adoption

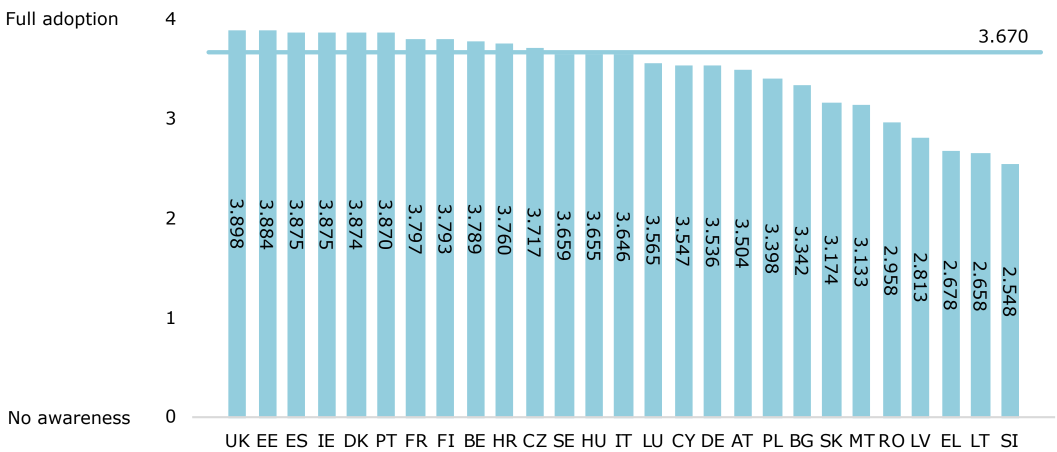


While we found increases in the adoption of EHRs since 2013 across all member states,[39] the extent of the increase varied. The largest increase was found for Lithuania, where the EHR composite indicator score increased by 0.790 points, from 1.393 in 2013 to 2.183 in 2018.

Figure 18 to Figure 22 present the composite indicator results for the five different subdimensions shown in Table 7.[40]

The **Health Info and Data** EU average score indicates that the core components of EHRs – i.e. to provide information and key health data – are widely adopted. In 2018, this subdimension scored 3.670, while it was 3.176 in 2013. The United Kingdom, Estonia, Spain, Ireland and Denmark are the top five performers, with almost full adoption, while Slovenia, Lithuania, Greece, Latvia and Romania have the lowest scores (Figure 18).

Figure 18 EHR subdimension *Health Info and Data*



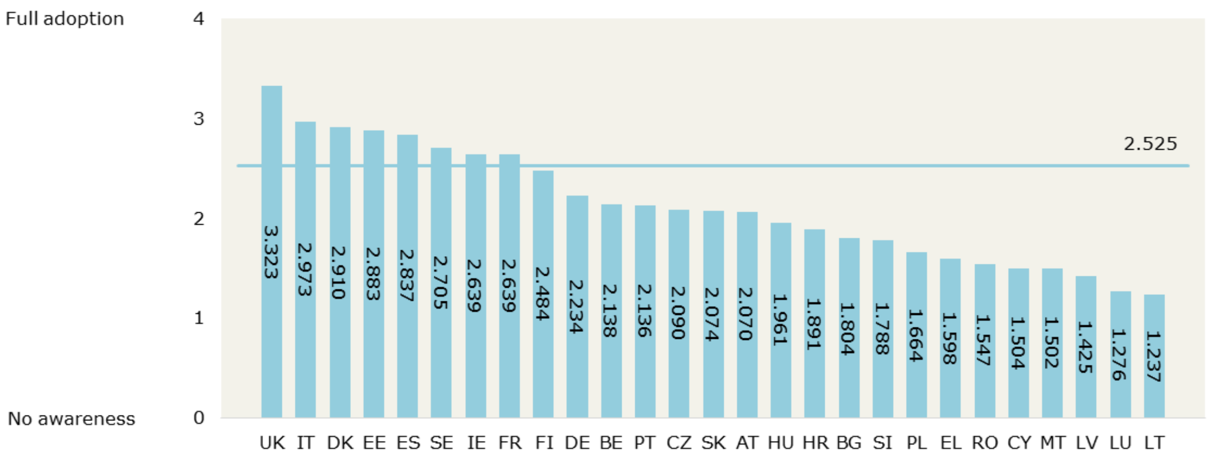
[38] The EU average was weighted based on the number of GPs in each country.

[39] Except for Bulgaria, where the 2013 EHR composite indicator score was 2.746, which means a decrease of 0.001 points, to 2.745, in 2018; however, given the margin error of the sample, this decrease is not statistically significant.

[40] EU averages shown in each figure are weighted averages based on the number of GPs in each country.

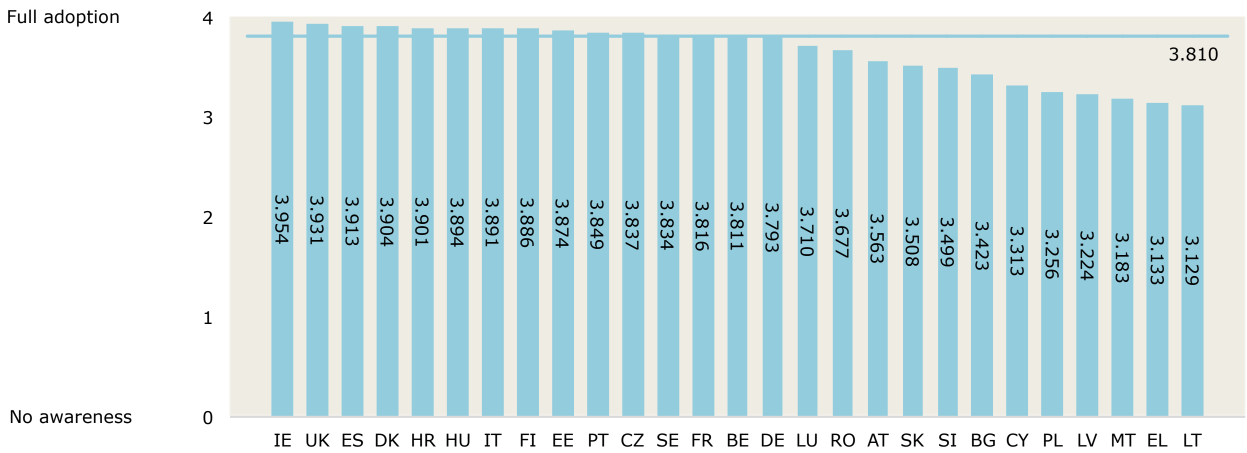
The **Clinical Decision Support System** EU average score is lower than that of the Health Info and Data subdimension. The EU average score has remained almost constant between 2018 (2.525) and 2013 (2.513). The United Kingdom, Italy, Denmark, Estonia and Spain are the top five performers among all 27 countries, while Latvia, Luxembourg, Latvia, Malta and Cyprus have the lowest scores (Figure 19).

Figure 19 EHR subdimension *Clinical Decision Support System*



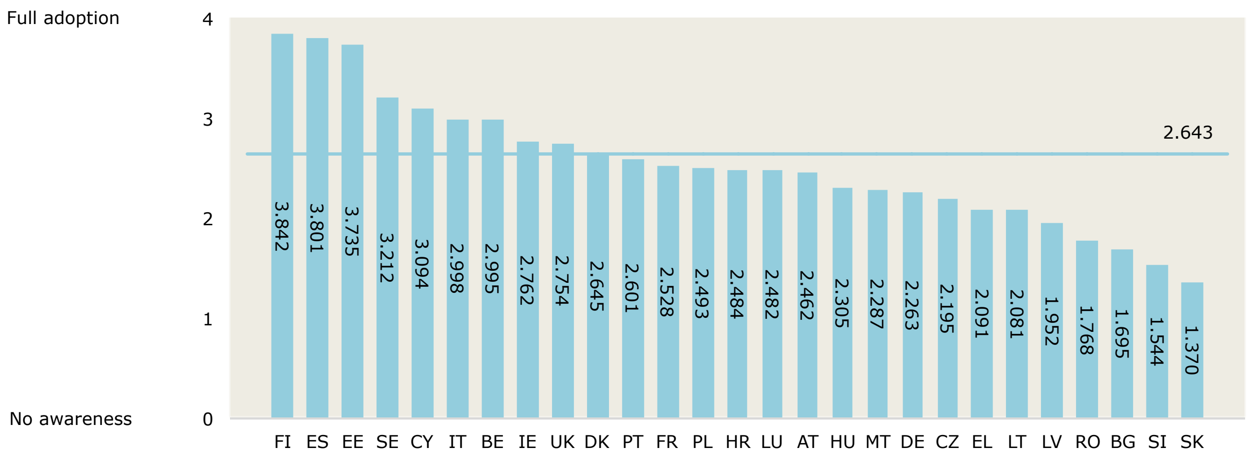
Similar to the Clinical Decision Support System subdimension, there is no relevant variation between the 2018 EU average score (3.810) and the 2013 EU average score (3.748) of the **Order-Entry and Result Management** subdimension. Ireland, the United Kingdom, Spain, Denmark and Croatia have the highest scores, while Lithuania, Greece, Malta, Latvia and Poland have the lowest scores (Figure 20).

Figure 20 EHR subdimension *Order-Entry and Result Management*



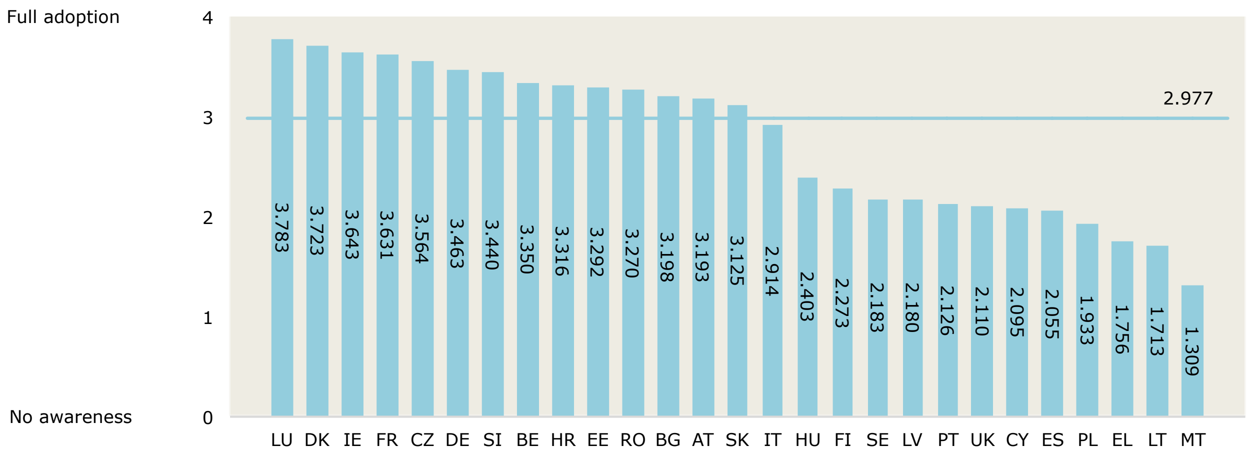
The **Image** subdimension shows a similar level of adoption as the Order-Entry and Result Management subdimension. The 2018 EU average score is 2.643, which is an increase compared with the 2013 score of 2.483. Finland, Spain, Estonia, Sweden and Cyprus are the top five performers, while Slovakia, Slovenia, Bulgaria, Romania and Latvia have the lowest scores (Figure 21).

Figure 21 EHR subdimension *Image*



The **Administrative** subdimension EU average score remained almost the same between 2013 (2.861) and 2018 (2.977). Luxembourg, Denmark, Ireland, France and the Czech Republic are the top five performers, while Malta, Lithuania, Greece, Poland and Spain have the lowest scores (Figure 22).

Figure 22 EHR subdimension *Administrative*



4.2 Health information exchange adoption

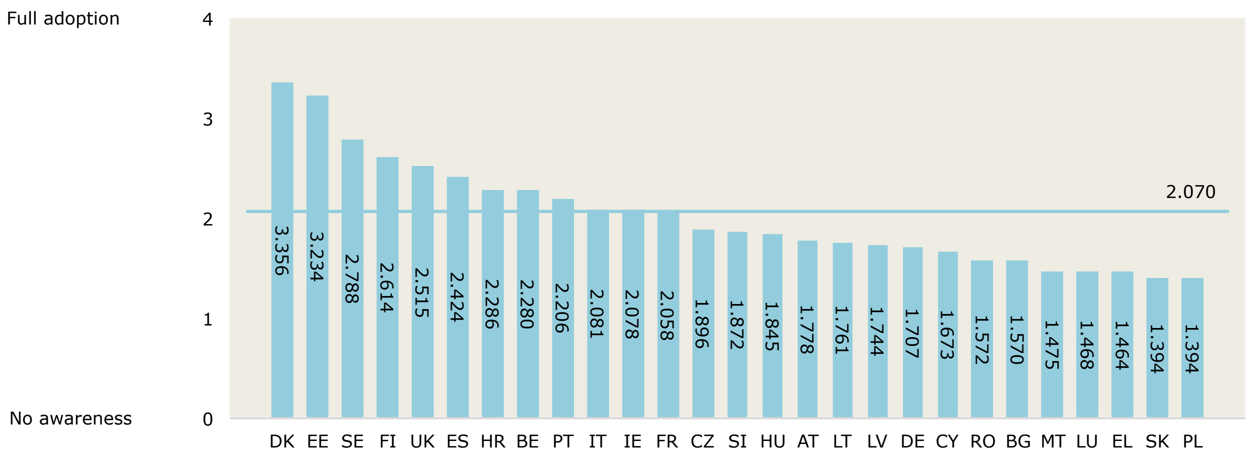
The HIE composite indicator combines 13 functionalities into three subdimensions. Table 8 shows how the different functionalities were grouped.

Table 8 HIE overview: subdimensions and functionalities

Subdimension	Functionalities
Clinical Data	Exchange patient medication lists with other healthcare professionals/providers
	Exchange radiology reports with other healthcare professionals/providers
	Exchange medical patient data with other healthcare professionals/providers
	Receive and send laboratory reports and share them with other healthcare professionals/providers
	Send/receive referral and discharge letters
	Make appointments at other care providers on your patients' behalf
	Exchange medical patient data with any healthcare provider in other countries
	Transfer prescriptions to pharmacists
Patient Administration	Certify sick leaves
	Certify disabilities
	Patient appointment requests
Management	Exchange administrative patient data with reimbursers or other care providers
	Order supplies for your practice

The HIE composite indicator suggests that its adoption is lower than the adoption of EHR. The EU average score[41] in 2018 is 2.070, which is an increase compared with the 2013 score of 1.884. Denmark, Estonia, Sweden, Finland and the United Kingdom have the highest scores (between 2.515 and 3.356) among all 27 EU countries, while Poland, Slovakia, Greece, Luxembourg and Malta have the lowest scores (between 1.394 and 1.475) (Figure 23).

Figure 23 HIE composite indicator of adoption



While we found increases in the adoption of HIE since 2013 across all member states, the extent of the increase varied. The largest increases were found for Croatia and Slovenia: in Croatia, the HIE composite indicator score increased by 0.594 points, from 1.692 in 2013 to 2.286 in 2018, and in Slovenia it increased by 0.554 points, from 1.318 to 1.872.

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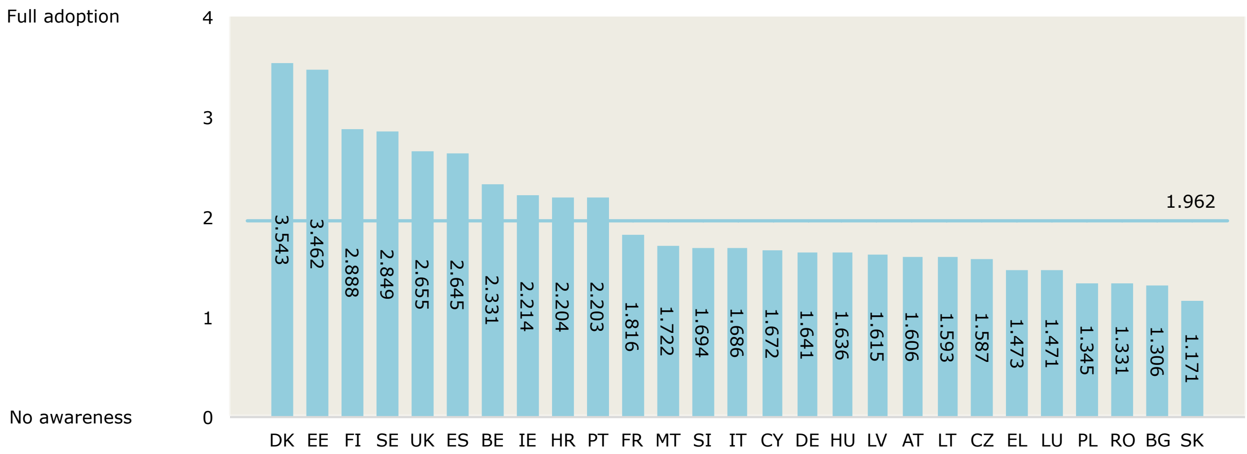
[41] The EU average was weighted based on the number of GPs in each country.

Figure 24, Figure 25 and Figure 26 present the composite indicator results for the three different subdimensions shown in Table 8.[42]

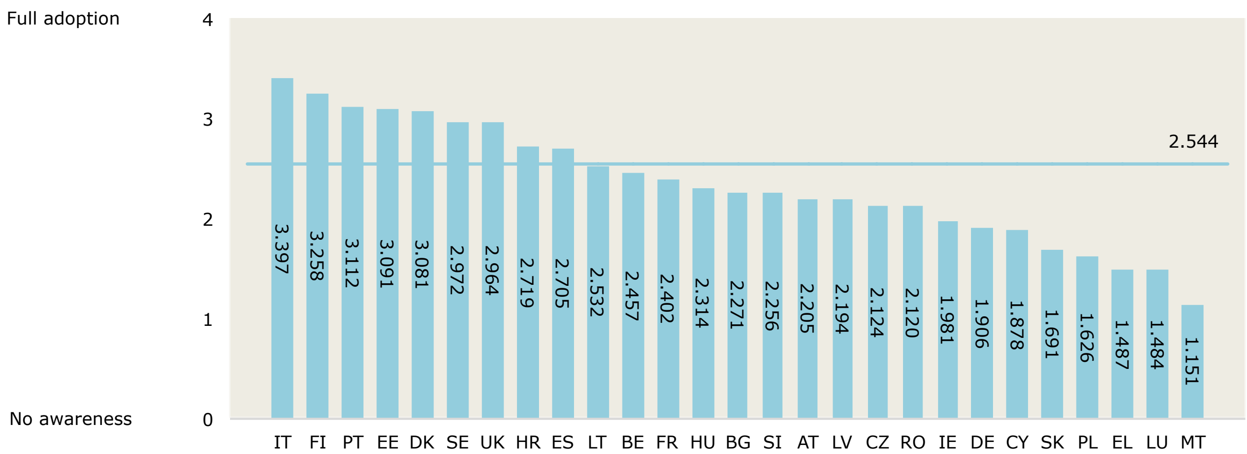
The **Clinical Data** subdimension EU average score in 2018 is 1.962, which represents an increase from the 2013 score of 1.785. Denmark, Estonia, Sweden, Finland and the United Kingdom are the highest ranked countries among all 27 EU member states, while Poland, Slovakia, Greece, Luxembourg and Malta have the lowest scores (Figure 24).

Figure 24 HIE subdimension *Clinical Data*



The **Patient administration** subdimension EU average score in 2018 is 2.544; in 2013, this subdimension had an average score of 2.225. Italy, Finland, Portugal, Estonia and Denmark have the highest scores, while Malta, Luxembourg, Greece, Poland and Slovakia have the lowest values. This subdimension has the highest values within the HIE dimension (Figure 25).

Figure 25 HIE subdimension *Patient Administration*



The **Management** subdimension EU average score in 2018 is 1.794. The 2018 average score is similar to the 2013 score of 1.753, indicating that the level of adoption remains low. Denmark, Estonia, the Czech Republic, Sweden and France have the highest scores, while Finland, Portugal, Malta, Poland and Greece have the lowest scores (Figure 26).

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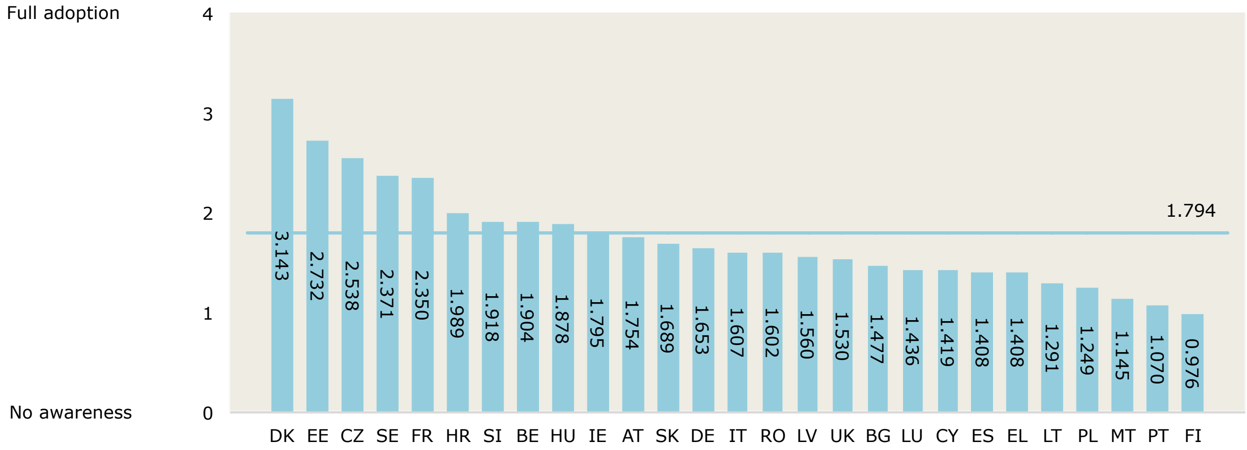
[42] EU averages shown in each figure are weighted averages based on the number of GPs in each country.

Figure 26 HIE subdimension *Management*



4.3 Telehealth adoption

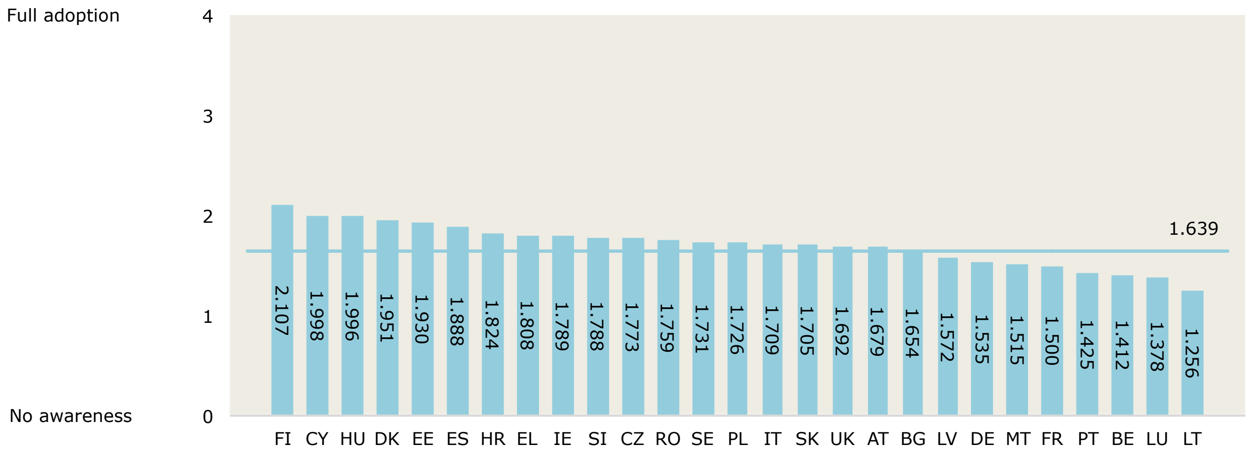
The Telehealth composite indicator adoption is composed of two subdimensions covering four different functionalities. Table 9 shows how the different functionalities were grouped.

Table 9 Telehealth overview: subdimensions and functionalities

Subdimension	Functionalities
Clinical Practice	Monitoring patients remotely at their homes
	Consultations with patients
Training	Training/Education
	Consultations with other healthcare practitioners

The Telehealth composite indicator shows an increase in Telehealth adoption from 2013 to 2018. The EU average score[43] in 2018 is 1.639, while in 2013 it was 1.383. Finland, Cyprus, Hungary, Denmark and Estonia have the highest scores (between 1.930 and 2.107), while Lithuania, Luxembourg, Belgium, Portugal and France show the lowest level of adoption among all 27 EU countries (scores between 1.256 and 1.500) (Figure 27).

Figure 27 Telehealth composite indicator of adoption



While we found increases in the adoption of Telehealth since 2013 across all member states, the extent of the increase varied. The largest increase was found for Croatia, where the Telehealth composite indicator score increased by 0.564 points, from 1.260 in 2013 to 1.824 in 2018.

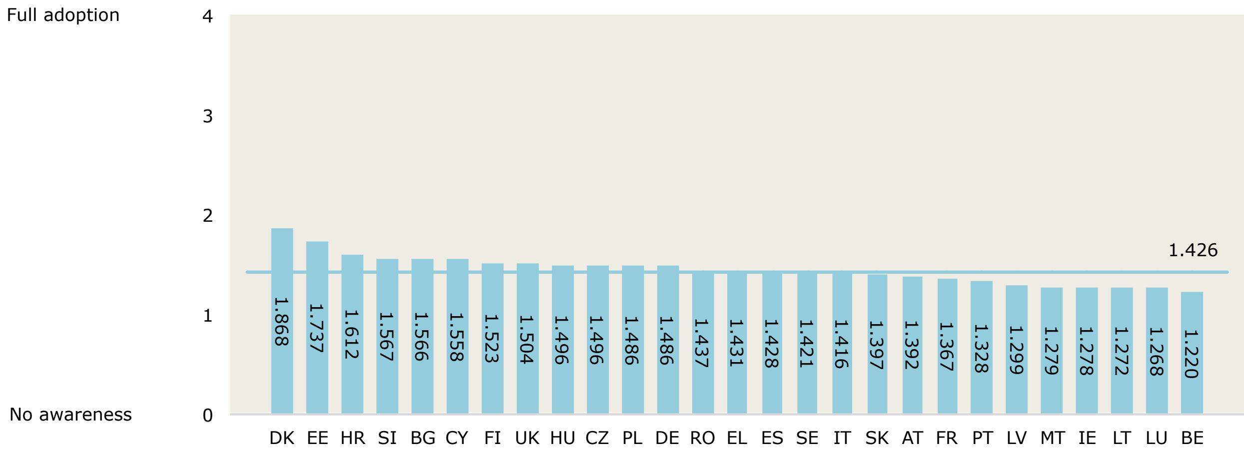
Figure 28 and Figure 29 present the composite indicators for the two different subdimensions shown in Table 9.[44]

The **Clinical Practice** subdimension EU average score, comprising digital services between professionals and patients, is 1.426 in 2018, which is an increase compared with the 2013 score of 1.093. Denmark, Estonia, Croatia, Slovenia and Bulgaria have the highest scores among all countries covered in the study, while Belgium, Luxembourg, Lithuania, Ireland and Malta have the lowest scores (Figure 28).

[43] The EU average was weighted based on the number of GPs in each country.

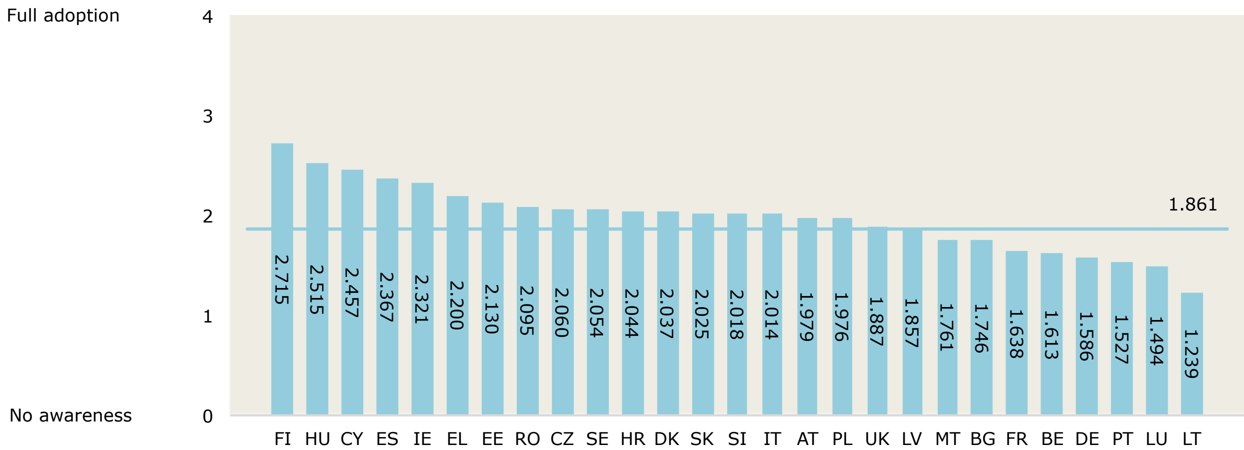
[44] EU averages shown in each figure are weighted averages based on the number of GPs in each country.

Figure 28 Telehealth subdimension *Clinical Practice*



The **Training** subdimension EU average score is higher than the average of the Clinical Practice subdimension, indicating that professional-to-professional digital services have a higher level of adoption than professional-to-patient services. The EU average score in 2018 is 1.861, which is higher than the 2013 score of 1.686. Finland, Hungary, Cyprus, Spain and Ireland have the highest scores, while Lithuania, Luxembourg, Portugal, Denmark and Belgium have the lowest scores (Figure 29).

Figure 29 Telehealth subdimension *Training*



4.4 Personal health record adoption

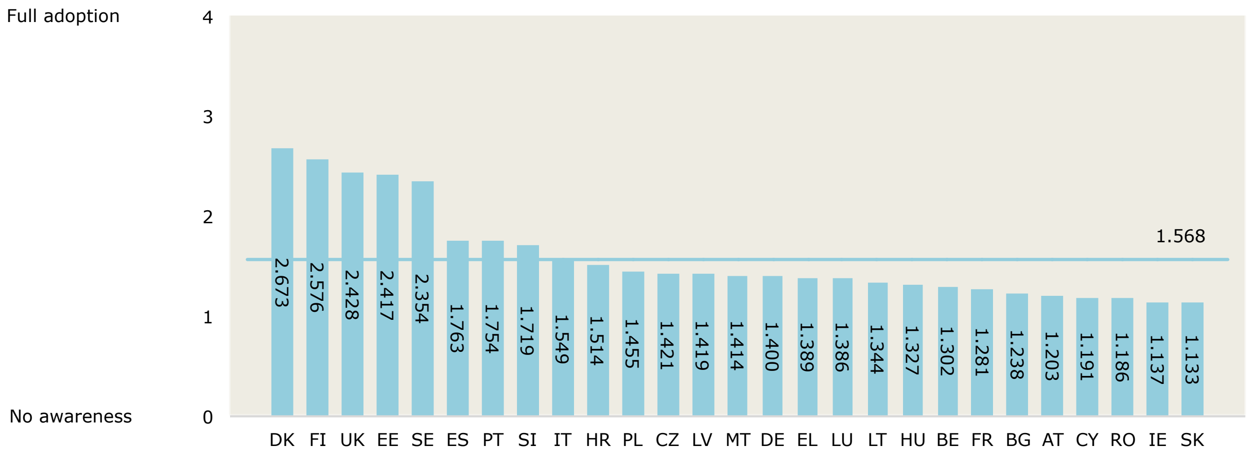
The PHR composite indicator combines six different functionalities into two subdimensions. Table 10 shows how the different functionalities were grouped.

Table 10 PHR overview: subdimensions and functionalities

Subdimension	Functionalities
Clinical Information	View their medical records
	Supplement their medical records
	View test results
Requests	Request referrals
	Request appointments
	Request renewals or prescriptions

The PHR composite indicator shows a large discrepancy between high- and low-performing countries. The EU average score[45] in 2018 is 1.568, which is higher than the 2013 score of 1.319. Denmark, Finland, the United Kingdom, Estonia and Sweden have the highest scores among all 27 EU countries (between 2.354 and 2.673), while Slovakia, Ireland, Romania, Cyprus and Austria have the lowest scores (between 1.133 and 1.203) (Figure 30).

Figure 30 PHR composite indicator of adoption



While we found increases in the adoption of PHRs since 2013 across all member states,[46] the extent of the increase varied. The largest increase was found for Finland, where the PHR composite indicator score increased by 1.334 points, from 1.242 in 2013 to 2.576 in 2018. Similarly, the United Kingdom and Sweden had substantial increases, of more than 0.7 points, and in the United Kingdom, the PHR composite indicator score increased by 0.831, from 1.597 to 2.428, and in Sweden it increased by 0.799 points, from 1.555 to 2.354.

Figure 31 and Figure 32 present the composite indicator for the two different subdimensions shown in Table 10.[47]

The **Clinical Information** subdimension EU average score in 2018 is 1.309; the score has

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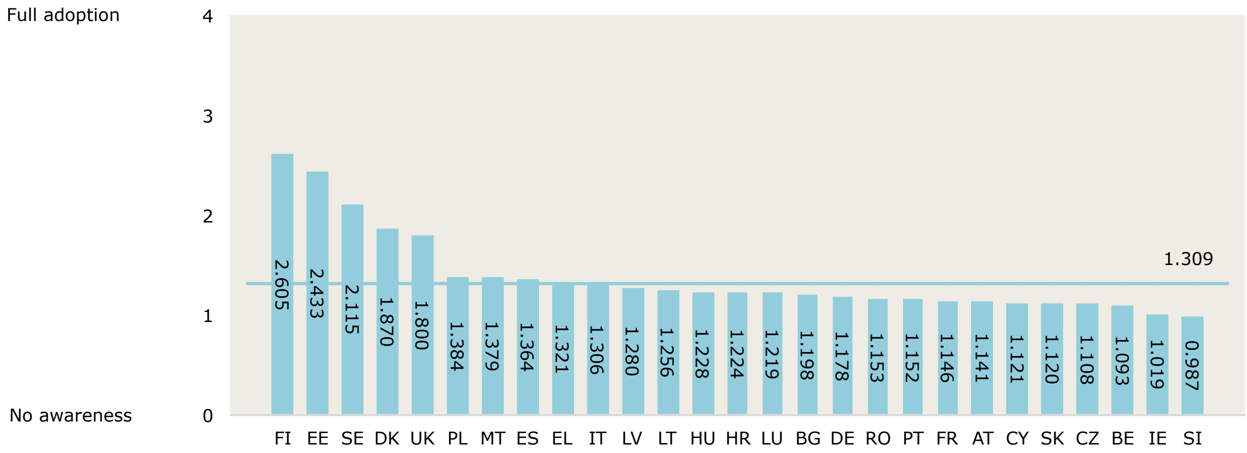
[45] The EU average was weighted based on the number of GPs in each country.

[46] Except for Romania, where the 2013 PHR composite indicator score was 1.232, which means a decrease of 0.046 points, to 1.186, in 2018; however, given the margin error of the sample, this decrease is not statistically significant.

[47] EU averages in each figure are weighted averages based on the number of GPs in each country.

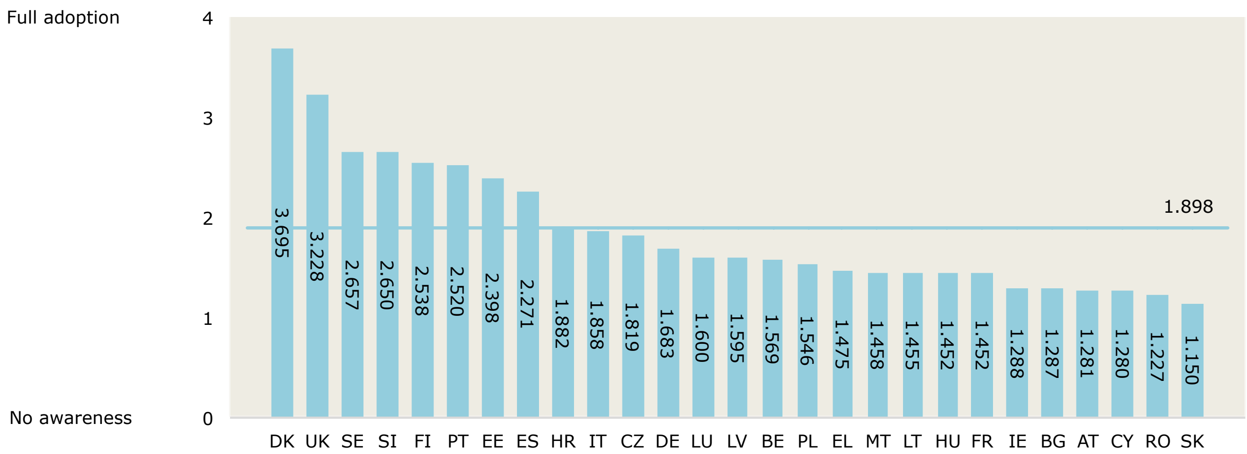
increased since 2013, when the average score was 1.098. Finland, Estonia, Sweden, Denmark and the United Kingdom have the highest scores, while Slovenia, Ireland, Belgium, the Czech Republic and Slovakia have the lowest scores (Figure 31).

Figure 31 PHR subdimension *Clinical Information*



The **Request** subdimension EU average score is 1.898 in 2018, which is higher than the 2013 score of 1.601. Denmark, the United Kingdom, Sweden, Slovenia and Finland have the highest scores, while Slovakia, Romania, Cyprus, Austria and Bulgaria have the lowest scores (Figure 32).

Figure 32 PHR subdimension *Requests*

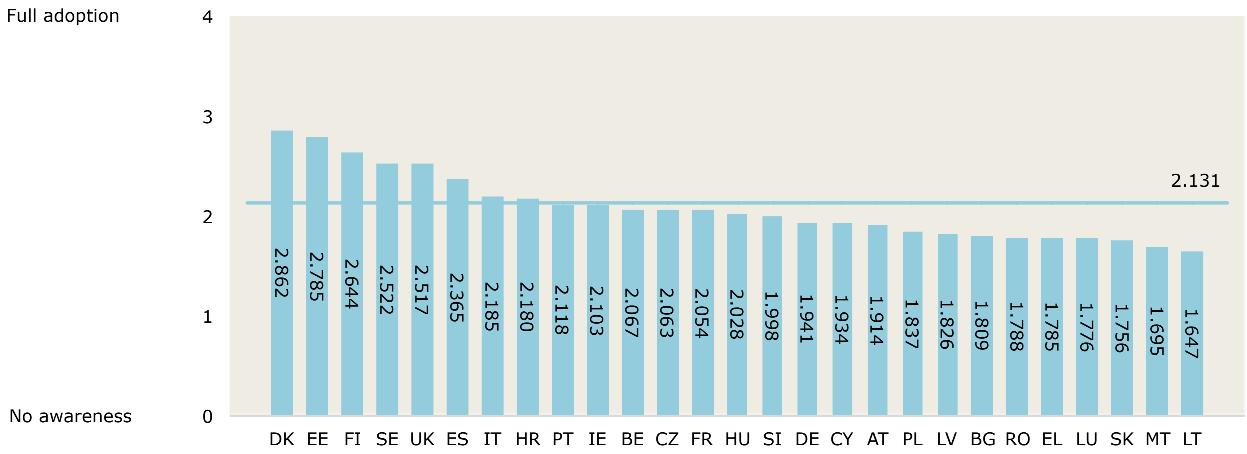


4.5 eHealth composite index of adoption

The overall eHealth adoption average score – the eHealth composite index of adoption – was based on the four composite indicators described in the previous sections (EHR, HIE, Telehealth and PHR). The composite index uses equal weights for each dimension. Therefore, it balances the high adoption of EHR and HIE with the low adoption of Telehealth and PHR (see methodological report of this study (Appendix 8.1) for more details on the approach used).

In 2018, the composite index EU average is 2.131, which indicates an increase since 2013, when the EU average score was 1.876. The countries with the highest level of eHealth adoption are Denmark, Estonia, Finland, Sweden and the United Kingdom (scores between 2.517 and 2.862), while Lithuania, Malta, Slovakia, Luxembourg and Greece have the lowest level of adoption (scores between 1.647 and 1.785) (Figure 33).

Figure 33 eHealth adoption



As shown in the previous sections, all composite indicator EU averages, as well as the composite index EU average, increased between 2013 and 2018. The largest increases in the EU averages were found for the Telehealth composite indicator (2013: 1.383, 2018: 1.639; i.e. an increase of 0.256 points), the PHR composite indicator (2013: 1.319, 2018: 1.568; i.e. an increase of 0.249 points) and the eHealth composite index (2013: 1.876, 2018: 2.131; i.e. an increase of 0.255 points).

We also found that between 2013 and 2018 the composite index scores of all individual EU member states surveyed increased; however, the extent of the increase varied across member states, as shown in Table 11.

Table 11 Changes to the eHealth composite indices between 2013 and 2018

EU member state	Composite index 2013	Composite index 2018	Change from 2013 to 2018
Estonia	1.478	2.417	+0.939
Finland	2.087	2.644	+0.557
Sweden	2.010	2.522	+0.512
Croatia	1.684	2.18	+0.496
United Kingdom	2.071	2.517	+0.446
Slovenia	1.577	1.998	+0.421
Denmark	2.308	2.673	+0.365
Latvia	1.497	1.826	+0.329
Belgium	1.752	2.067	+0.315
Lithuania	1.346	1.647	+0.301
Poland	1.540	1.837	+0.297
Portugal	1.844	2.118	+0.274
Cyprus	1.674	1.934	+0.260
Ireland	1.851	2.103	+0.252
Slovakia	1.517	1.756	+0.239
Bulgaria	1.582	1.809	+0.227
Austria	1.914	2.131	+0.217
Italy	1.972	2.185	+0.213
Czech Republic	1.857	2.063	+0.206
Spain	2.167	2.365	+0.198
Greece	1.605	1.785	+0.180
Hungary	1.848	2.028	+0.180
France	1.876	2.054	+0.178
Luxembourg	1.614	1.776	+0.162
Germany	1.781	1.941	+0.160
Romania	1.695	1.788	+0.093

The largest increase was found for Estonia: the composite index score increased by 0.939 points, from 1.478 in 2013 to 2.417 in 2018. Five member states had comparably large increases of more than 0.4 points: Finland (an increase of 0.557 points), Sweden (an increase of 0.512 points), Croatia (an increase of 0.496 points), the United Kingdom (an increase of 0.446 points) and Slovenia (an increase of 0.446 points). All five member states with increases larger than 0.4 points are either NHS or transition countries.

The composite index scores of other member states, by contrast, increased by less than 0.2 points: Romania (an increase of 0.093 points), Germany (an increase of 0.160 points), Luxembourg (an increase of 0.162 points), France (an increase of 0.178 points), Hungary (an increase of 0.180 points), Greece (an increase of 0.180 points) and Spain (an increase of 0.198 points). The member states with increases lower than 0.2 points are a mix of NHS, transition and social insurance countries. However, overall, we found larger increases among NHS and transition countries compared with social insurance countries.

5 eHealth adoption in context

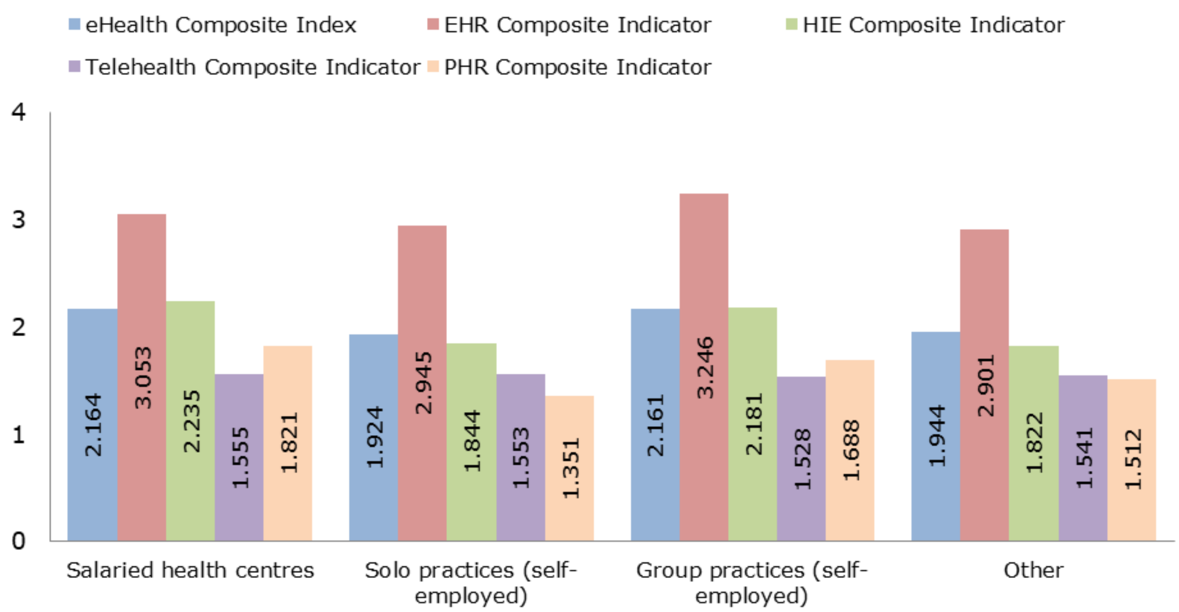
This chapter provides insights into the differences in eHealth adoption across different health system and GP practice types (Section 5.1) and presents findings on the perceived impacts of, drivers of and barriers to eHealth adoption (Section 5.2). In Section 5.3 we provide findings related to the typology of four different attitudinal profiles of GPs developed for this study.

5.1 Organisational- and system-level differences in adoption

Using Univariate ANOVA and MANOVA, we analysed the organisational- and system-level differences for the composite index and the four composite indicators. These analyses showed that the differences were statistically significant ($p<0.05$).

As shown in Figure 34, self-employed GPs working in solo practices have a lower level of adoption than GPs working in salaried health centres, group practices (as self-employed GPs) or other practice types (e.g. freelance GPs). The only exception is in the area of Telehealth, where self-employed GPs working in solo practices have a higher level of adoption than self-employed GPs working in group practices and other types of practices. Overall, eHealth adoption is higher among GPs working in health centres or in group practices. Compared with the organisational-level findings of 2013, eHealth adoption has increased for GPs working in all four different types of practices (increases of 0.088 to 0.232 points). The largest increases were found for GPs working in salaried health centres (increase of 0.232 points), while the scores for self-employed GPs working in solo practices changed from 1.836 in 2013 to 1.924 in 2018 (increase of 0.088 points). These results reflect findings from the literature reviewed for this study: larger practices are more likely to adopt health ICTs, while GPs working in smaller practices are often not able to afford the implementation of such technology (Antoun 2016; Jetty et al. 2018; Kooienga 2018; Li et al. 2013; Young and Nesbitt 2017).

Figure 34 eHealth adoption by practice type



On average, the adoption of eHealth is higher among GPs working in NHS countries compared with social insurance and transition countries (Figure 35): NHS countries have higher scores than social insurance and transition countries in the overall eHealth adoption, but also for the EHR, HIE and PHR dimensions. This result resonates with findings from the literature reviewed for this study: as highlighted by studies reviewed by Brennan et al. (2015), eHealth adoption tends to be higher among countries with NHS systems. The highest adoption of Telehealth was found among transition countries.

Figure 35 eHealth adoption by health system type

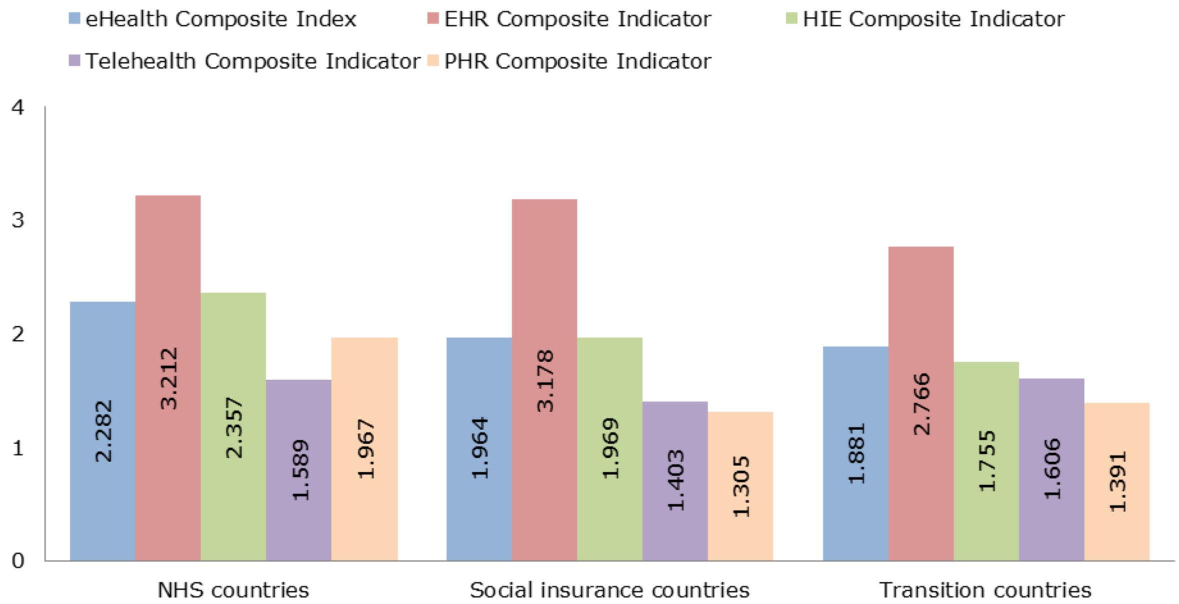


Figure 36 to Figure 40 report the values of the composite index and the four eHealth categories by health system type and country. Within some health system types, individual countries' scores vary strongly. Differences are especially great among NHS countries.

The fact that the eHealth adoption scores vary depending on the organisational setting (Figure 34) and the health system type (Figure 35) indicates that variation in eHealth adoption may be shaped not only by GPs' individual characteristics and attitudes, but also by contextual meso- (e.g. practice settings) and macro-level factors (e.g. health system type, country's eReadiness, societal demands and norms, etc.), as a hypothesis that was also highlighted in the literature reviewed for this study (see in particular Section 2.4, on institutional settings, such as costs of implementing and maintaining eHealth technologies and the relevance of the health system type, and Section 2.5, on practice characteristics).

Figure 36 eHealth adoption by health system type and country

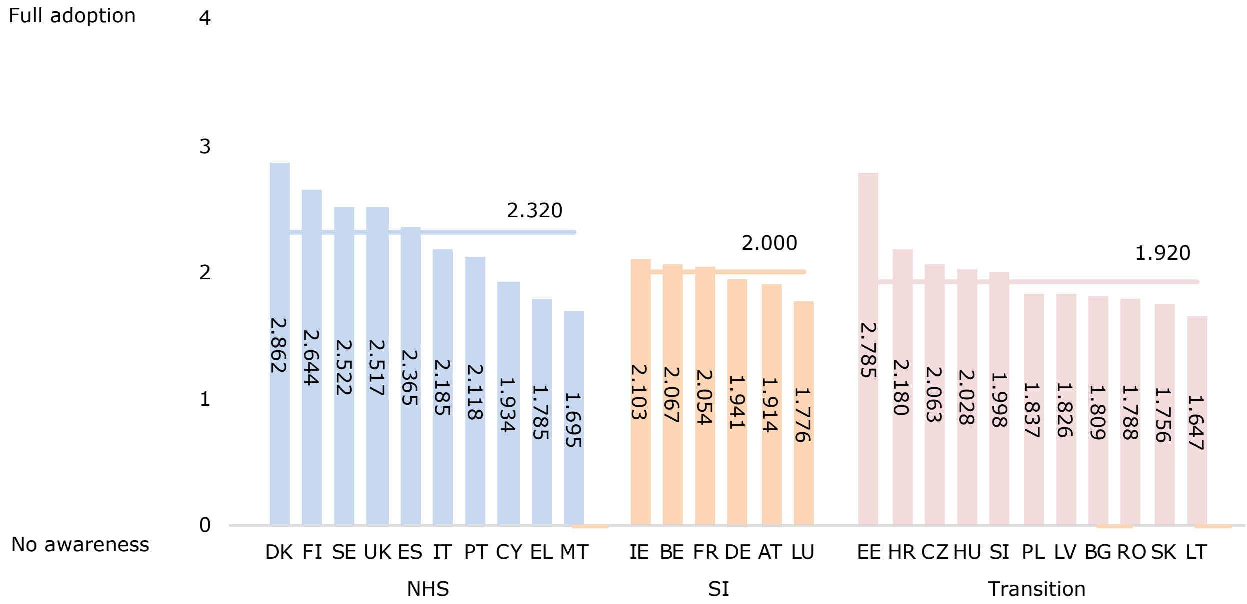


Figure 37 EHR composite indicator of adoption by health system type and country

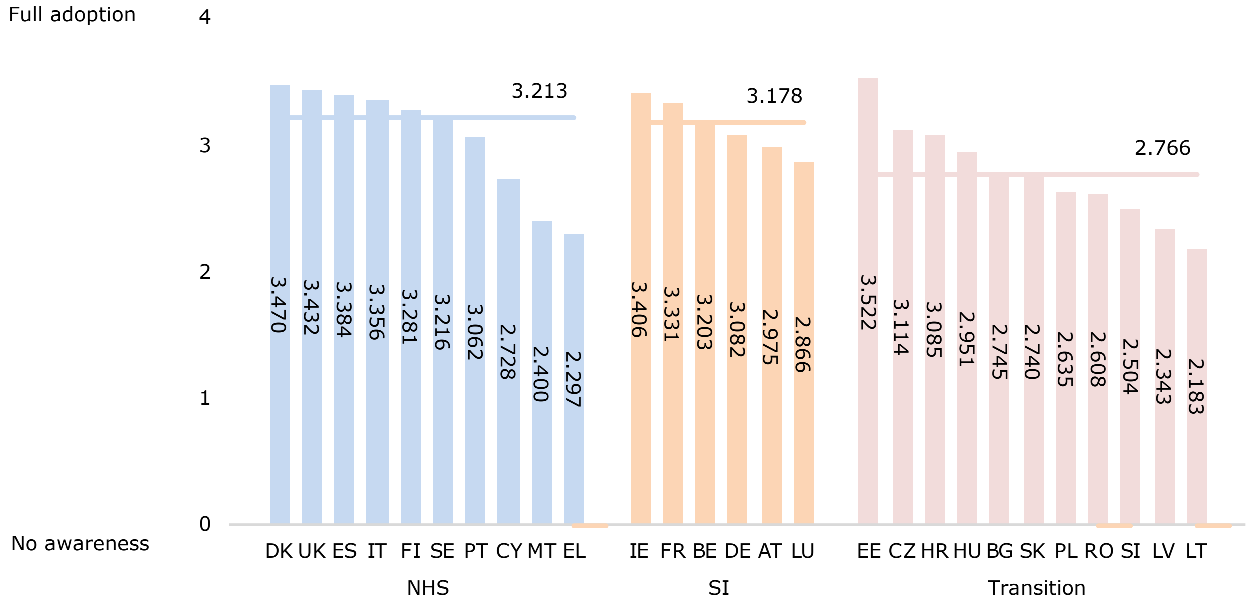


Figure 38 HIE composite indicator of adoption by health system type and country

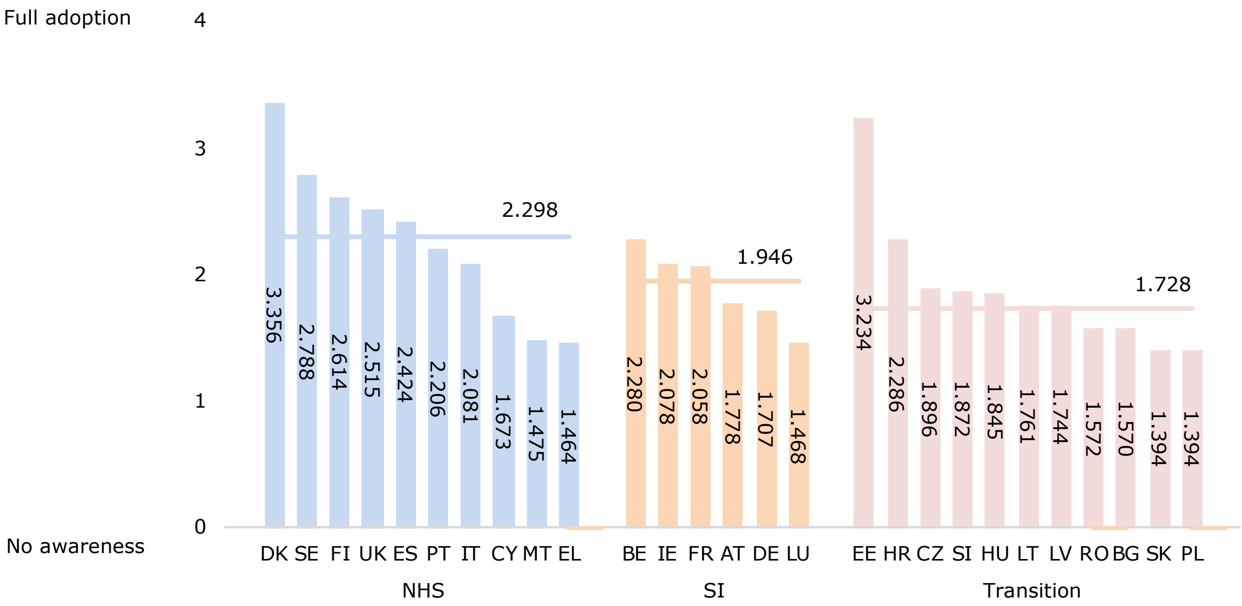


Figure 39 Telehealth composite indicator of adoption by health system type and country

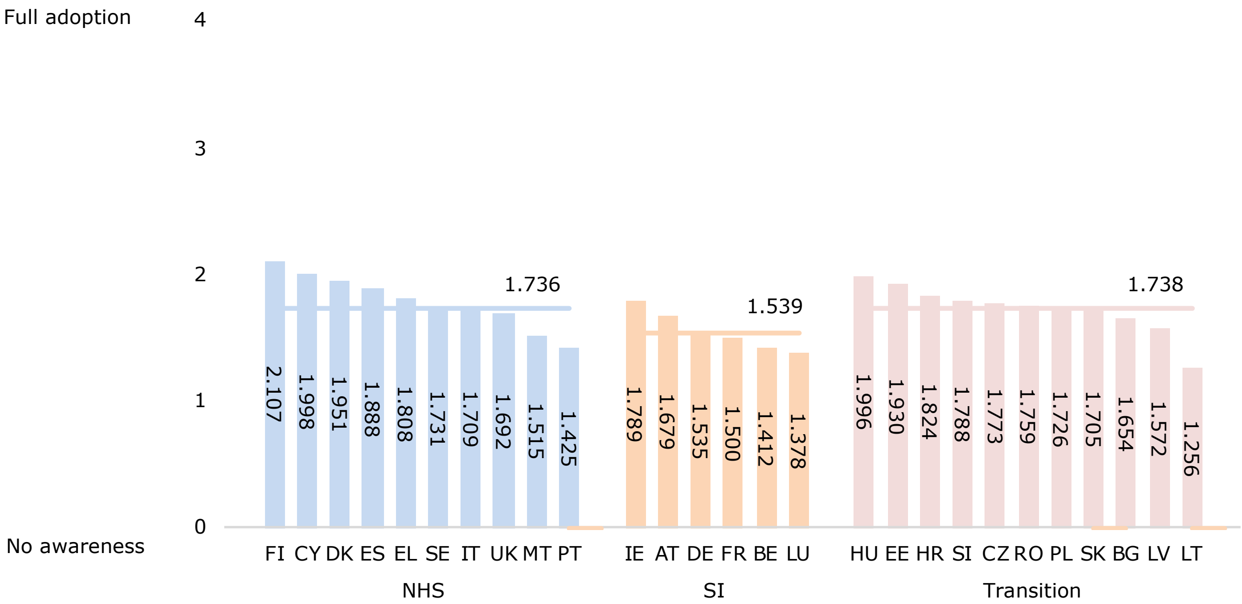
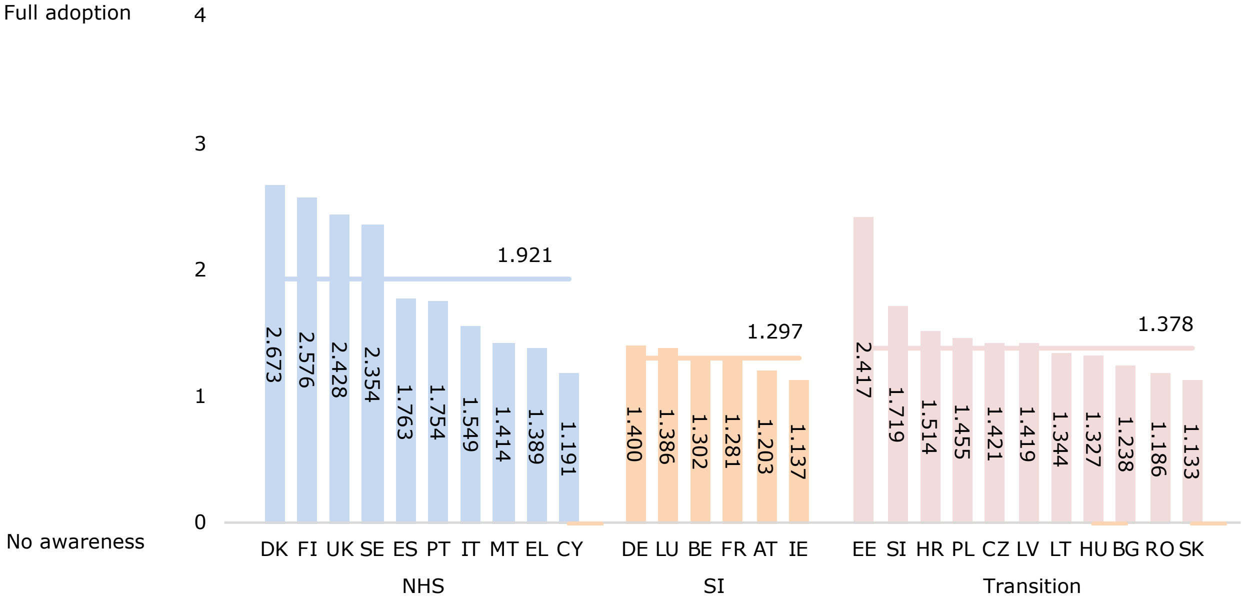


Figure 40 PHR composite indicator of adoption by health system type and country



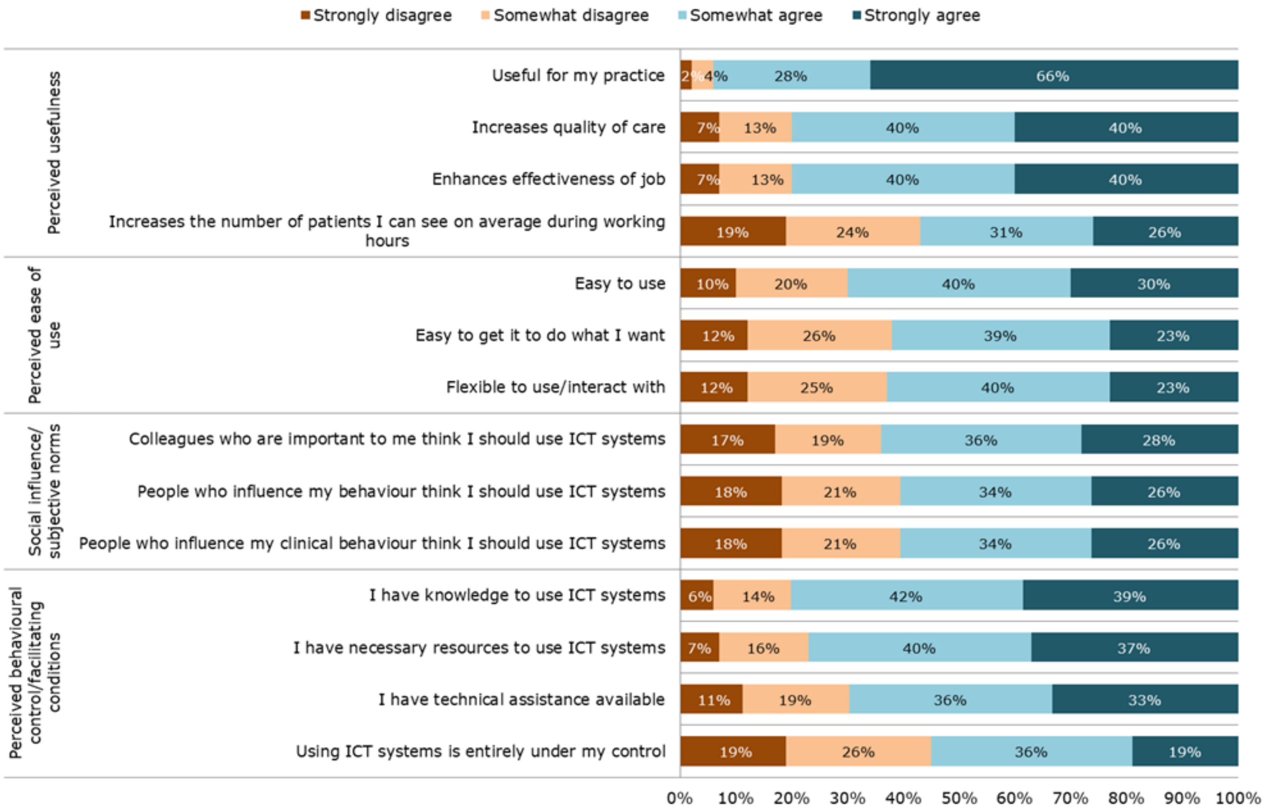
5.2 Drivers, impact and barriers

Following the same approach as in the 2013 eHealth benchmarking study (Codagnone and Lupiáñez-Villanueva 2013b), the survey included a set of questions asking GPs about factors that might drive or hinder the adoption of eHealth in their practices. Moreover, GPs were asked to indicate the extent to which they agree with statements related to the potential impact of eHealth on such areas as their day-to-day work, as well as the efficiency and quality of care. Sub-sections 5.2.1 to 5.2.3 report on the findings relating to the perceived drivers of, impact of and barriers to eHealth adoption.

5.2.1 Perceived drivers of eHealth adoption

GPs were asked about 14 different factors that might facilitate the adoption of ICTs in their practice. These factors were grouped into four different categories: perceived usefulness, perceived ease of use, social influence/subjective norms, and perceived behavioural control or facilitation conditions (Figure 41).

Figure 41 Perceived drivers of eHealth adoption



With regard to **perceived usefulness**, 66% of GPs surveyed strongly agree that the use of ICTs is generally useful for their practice. Furthermore, 40% of GPs strongly agree that ICTs increase the quality of care. Similarly, 40% indicated that they strongly agree that it enhances the effectiveness of their job. The statement that ICTs increase the number of patients GPs can see daily received higher disagreement than the other three statements in this category: 19% of GPs strongly disagree and 24% somewhat disagree, while 26% strongly agree and 31% somewhat agree.

All statements except for 'Enhances effectiveness of job' (the 2018 results for this statement are similar to the 2013 results) had stronger agreement compared with 2013. The greatest increase was found for the statement on the usefulness for GPs' practice: in 2013, 55% of GPs strongly agreed, and in 2018, 66% strongly agreed.

As shown in the literature reviewed for the second eHealth benchmarking study (Codagnone and Lupiáñez-Villanueva 2013b), as well as in the review conducted for this study (e.g. Aller et al. 2017; Gagnon et al. 2014; Li et al. 2013), **perceived ease of use** is a key factor influencing the adoption of eHealth technologies. In this area, we found, overall, less agreement with the individual statements compared with the statements on perceived usefulness: 30% of GPs strongly agree that ICTs for health are easy to use, 23% strongly agree that 'it is easy to get [ICTs] to do' what GPs want them to do, and 23% strongly agree that there is a degree of flexibility in the use of ICTs. There is no considerable difference compared with the 2013 results.

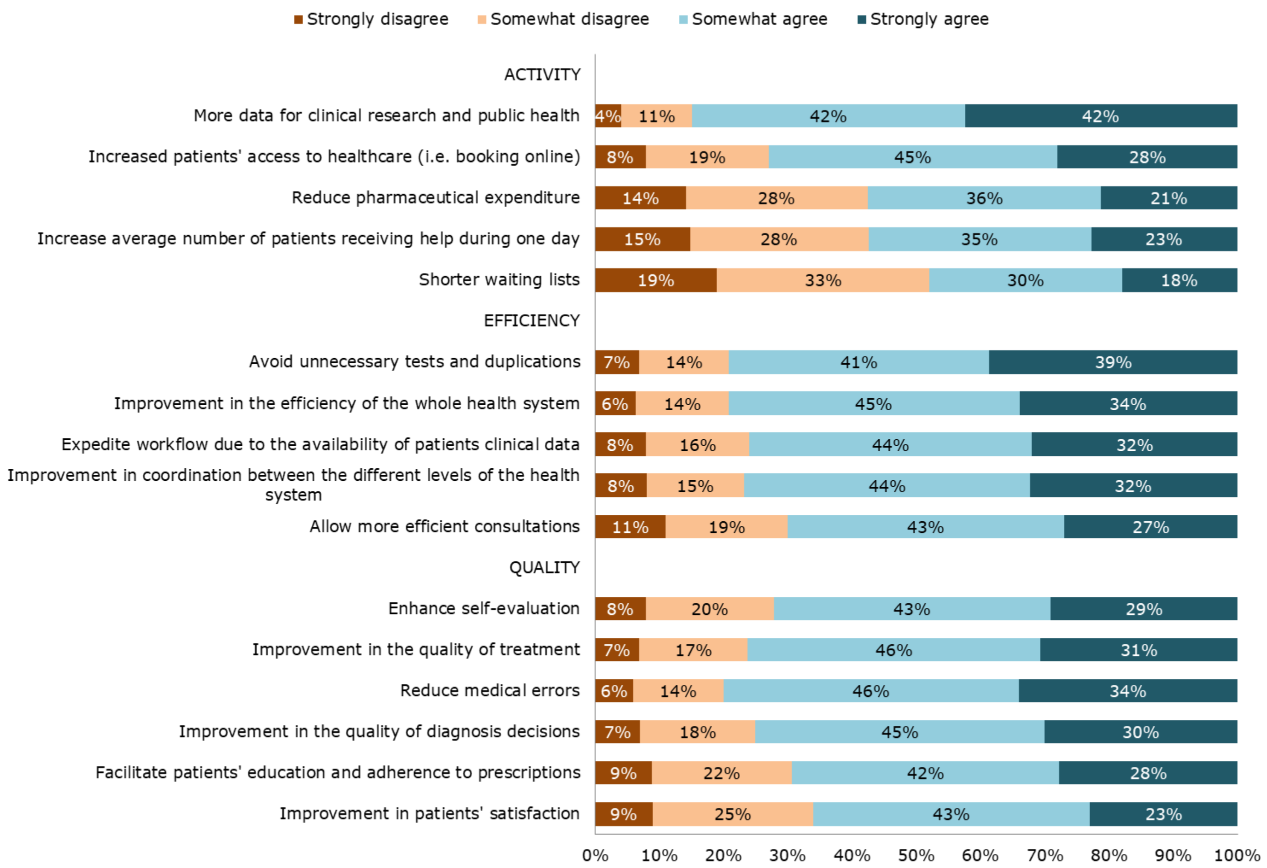
Statements in the category of **social influence/subjective norms** received a similar degree of strong agreement as the category of perceived ease of use. However, the statements in this category have less agreement compared with the statements in the other three categories. Overall, 28% of GPs strongly agree with the statement 'Colleagues who are important to me think that I should use ICT systems', while 17% strongly disagree with this statement. Similarly, 26% each also indicated strong agreement with the statements 'People who influence my behaviour think I should use ICT systems' and 'People who influence my clinical behaviour think that I should use ICT systems', while 18% of GPs strongly disagree with both statements. The degree of strong agreement with the statements in this category is similar to that in 2013, while the degree of strong disagreement decreased compared with 2013. These findings also reflect the findings in the literature reviewed, which indicates that familiarity with ICT can be a key driver of or barrier to adoption, by either the GPs themselves, their colleagues or their social environment, which includes a GP's experience with technology and their personal attitude towards ICT (Alami et al. 2017, see e.g.; Atherton et al. 2018; Choi et al. 2018; Gagnon et al. 2014; Jetty et al. 2018; Kooienga 2018; Li et al. 2013; Ross et al. 2016).

Overall, statements related to **perceived behavioural control/facilitating conditions** have a high degree of agreement ('strongly agree' and 'somewhat agree' combined). Of the surveyed GPs, 39% strongly agree and 42% somewhat agree that they know how to use ICT systems, 37% strongly agree and 40% somewhat agree that they have the necessary resources to use ICT systems, and 33% strongly agree and 36% somewhat agree that they have technical assistance available. A lower degree of agreement was found for the statement that using ICT systems is entirely under the control of the surveyed GPs: 19% strongly agree and 36% somewhat agree, while 26% somewhat disagree and 19% strongly disagree. Overall, the proportion of GPs indicating strong agreement with the statements in this category is higher than in 2013.

5.2.2 Perceived impact of information and communication technologies in health

Survey respondents were asked to indicate the extent to which they agree with statements related to health ICT impact. The statements were categorised into three areas: impact on activity, impact on efficiency and impact on quality (Figure 42).

Figure 42 Impact on activity, efficiency and quality



In the category **activity**, 84% of GPs surveyed (strongly or somewhat) agree that ICTs provide more data for clinical research and public health, 73% that they increase patients' access to healthcare, 57% that they reduce pharmaceutical expenditure, and 58% that they increase the average number of patients receiving help during one day. The lowest extent of agreement across all 15 statements was found for the statement on waiting times: 19% strongly disagree and 33% somewhat disagree that ICTs lead to shorter waiting times for patients. Indeed, as shown in the literature reviewed, if GPs think that ICTs are able to improve or increase patients' access to healthcare, this can be a key driver of adoption (Bassi and Lau 2013).

A high degree of agreement was also found for statements related to ICT impact on **efficiency**: between 70% and 80% (strongly or somewhat) agree that ICTs help avoid unnecessary tests and duplications (80%), contribute to the efficiency of the whole health system (79%), lead to expedited workflow due to the availability of patients' clinical data (76%), contribute to an improvement of the coordination between different levels in the health system (76%), and enable more efficient consultations (70%).

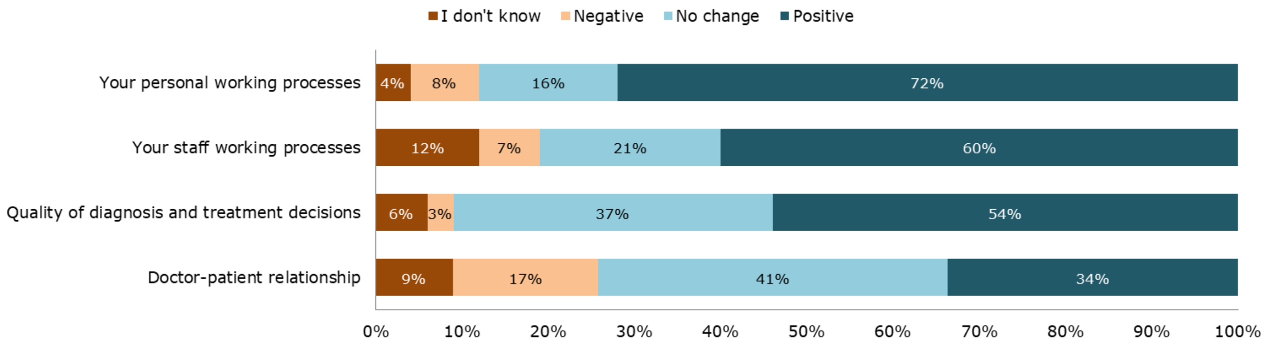
Overall, there was also a high degree of agreement with statements on the impact of ICTs on **quality**: between 70% and 80% of respondents (strongly or somewhat) agree that ICTs enhance self-evaluation (72%), improve the quality of treatment (77%), reduce medical errors (80%), improve the quality of diagnosis decisions (75%), and facilitate patient education and adherence to prescription (70%). The level of agreement is lower for the statement related to whether ICT improves patient satisfaction: 66% of respondents strongly or somewhat agree, while 25% somewhat disagree and 9% strongly disagree.

GPs were also asked whether eHealth has a positive or negative impact on working processes (Figure 43). The highest degree of positive impact was found in the area of personal working processes: 72% of respondents indicated that eHealth has a positive impact on GPs' personal working processes, while 8% reported that it has a negative impact; 16% think that ICTs do not lead to any change in this area, and 4% do not know.

More than half of respondents also think that eHealth has a positive impact on GP staff working processes (60% of respondents versus 12% who think that there is a negative impact) as well as the quality of diagnosis and treatment decisions (54% of respondents versus 3% who think that there is a negative impact).

By contrast, only 34% of GPs think that eHealth has a positive impact on the doctor-patient relationship, while 17% indicated that it has a negative impact on this relationship; however, 41% of respondents reported that eHealth does not lead to any change in this area, and 19% indicated that they do not know. This result is interesting in light of findings in the literature reviewed for this study, which indicate that doctors more often think that eHealth has a negative impact than a positive impact on their relationship with patients (Antoun 2016; Davis et al. 2014; Hanley et al. 2018).

Figure 43 Impact on working processes

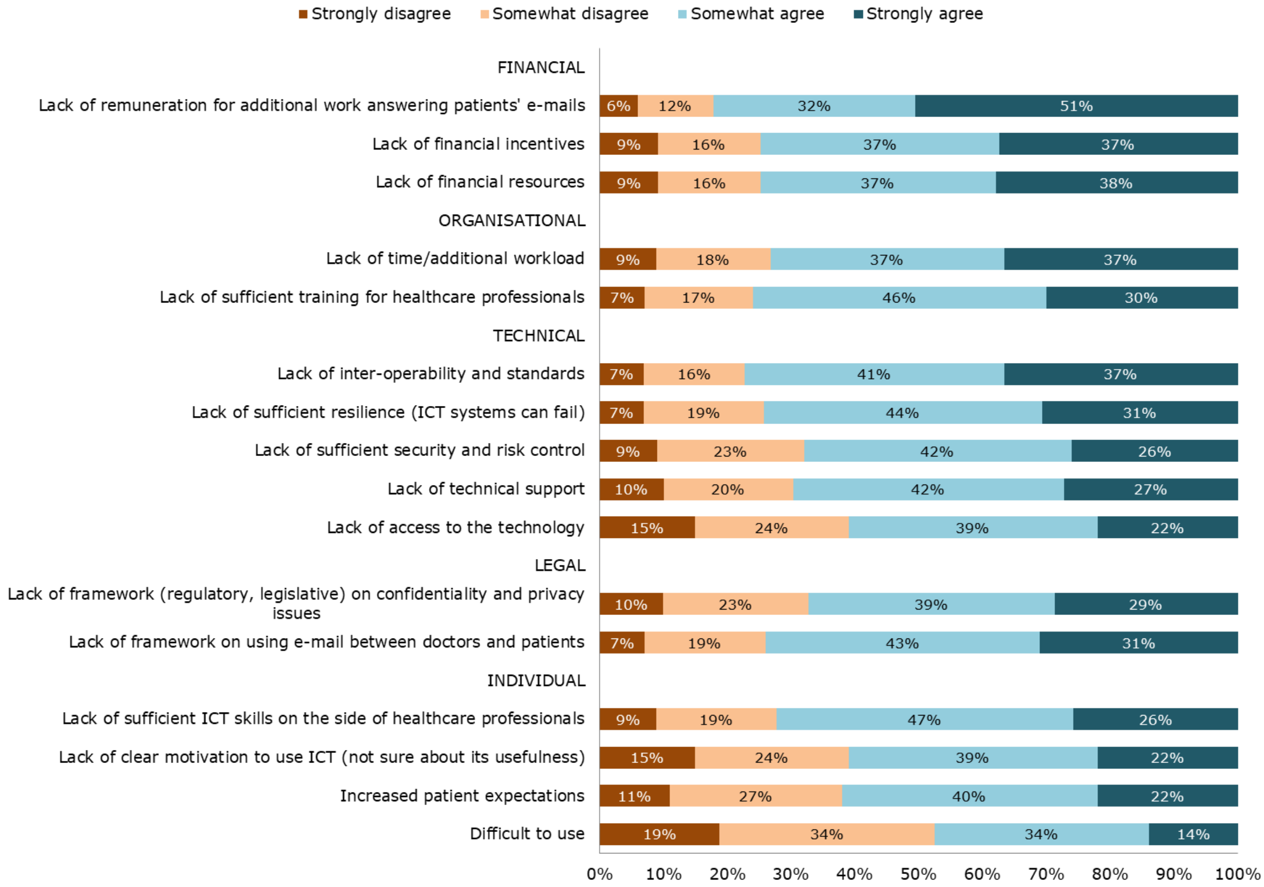


The results for the perceived impact of eHealth on the activity, efficiency, quality and working processes are similar to those of the 2013 study; we did not observe any relevant changes.

5.2.3 Perceived barriers to eHealth adoption

We also asked GPs to report on the barriers to the introduction and use of ICT systems in primary healthcare. These barriers were grouped into five different categories: financial, organisational, technical, legal, and individual (Figure 44).

Figure 44 Barriers



The highest degree of agreement was found in the category of **financial** barriers: 83% of respondents (strongly or somewhat) agree that lack of remuneration for additional work required to answer to patient emails is a barrier to adoption and use, 74% (strongly or somewhat) agree that lack of financial incentives is a hindrance, and 75% (strongly or somewhat) agree that lack of financial resources is a constraint. These results resonate with findings from the literature, which indicate that costs of eHealth technologies can be a key barrier to adoption (Jetty et al. 2018; Ross et al. 2016).

In the category of **organisational** barriers, 74% of GPs surveyed (strongly or somewhat) agree that lack of time or additional workload is a hindrance to adoption and use, and 76% (strongly or somewhat) agree that lack of sufficient training for healthcare professionals is an issue. Similar to the findings on the financial barriers, results relating to organisational barriers reflect what was found in the literature review: as highlighted by Davis et al. (2014) and Li et al. (2013), concerns that using eHealth technologies increases the workload can hinder adoption.

We found high agreement in the category of **technical** barriers, indicating that those are also relevant barriers to the introduction and use of eHealth: 78% of GPs surveyed (strongly or somewhat) agree that lack of interoperability and standards is a barrier, 75% reported that lack of sufficient resilience somewhat or strongly constrains adoption and use, 69% (strongly or somewhat) agree that lack of technical support is an issue, and 61% (strongly or somewhat) agree that lack of access to the technology is a barrier. Similarly, literature reviewed suggests that technical concerns can be key barriers to adoption and use (Antoun 2016; Gagnon et al. 2014; Palabindala, Pamarthy, and Jonnalagadda 2016).

In the category of **legal** barriers, 68% of GPs surveyed (strongly or somewhat) agree that the lack of a regulatory or legislative framework on confidentiality and privacy issues is a hindrance, and 74% (strongly or somewhat) agree that the lack of a framework on using email between doctors and patients is a barrier. Again, these results reflect findings from the literature, which suggest that the absence of policies and legal guidelines, as well as lack of clarity regarding privacy and security, can hinder adoption and use of eHealth technologies (see e.g. Aller et al. 2017; de la Torre-Diez, Gonzalez, and Lopez-Coronado 2013; Gagnon et al. 2014; Li et al. 2013; Young and Nesbitt 2017).

Compared with financial, technical and legal barriers, **individual** barriers presented in the survey are overall less often seen as hindrances, but the level of agreement is still overall high: 73% of GPs surveyed (strongly or somewhat) agree that healthcare professionals' lack of sufficient ICT skills is an issue, which strongly reflects findings from the literature (Alami et al. 2017; Atherton et al. 2018; Kooienga 2018; Li et al. 2013; Ross et al. 2016). Overall, 61% of respondents also think that lack of clear motivations to use ICT is a barrier to adoption and use (responses 'strongly agree' and 'somewhat agree' combined), and 62% (strongly or somewhat) agree that ICTs are difficult to use and that this is a hindrance.

We did not find any relevant changes compared with the 2013 results.

5.3 GP profiles

As described in the methodological report of this study (Appendix 8.1), we conducted a cluster analysis using the data on the perceived impacts of and barriers to ICT adoption in primary care to develop a typology of four GP attitudinal profiles: Realist, Enthusiast, Indifferent and Reluctant. The detailed cluster analysis results are presented in Appendix 8.4.

The cluster analysis showed that the **Realists** are the largest group among the GPs surveyed: 36% of GPs represented in the cluster analysis (31% of our sample) consider both the barriers and impacts as relevant and important when it concerns the adoption of eHealth functionalities. The second largest group are the **Enthusiasts**: 27% of the GPs in the cluster analysis (23% of our sample) extol the impacts and disregard the barriers. GPs in the cluster **Indifferent** (23% of the classified GPs, 19% of our sample) report that they care about neither the impacts nor the barriers. The smallest group are **Reluctant** GPs, who place more importance on barriers than on impacts (14% of the classified GPs, 12% of our sample).

We observed some changes in the 2018 cluster analysis compared with the 2013 results. In 2013, 33% of GPs in the classified sample were **Indifferent**, while in 2018, 23% were in this group. Conversely, **Enthusiasts** increased from 13% to 27% between 2013 and 2018. This suggests that a large proportion of the GPs became more positive about the drivers and less negative about the barriers in the past five years.

Furthermore, we attempted to characterise the four profiles by mapping them against other variables and checking if they differed in statistically significant ways with respect to the latter. For instance, we took the eHealth composite index and the composite indicators (ranging on a scale from 0 to 4) and examined whether there are statistically significant differences for the composite index for the four profiles. We conducted the same analysis for each country and for some socio-demographic and organisational characteristics.[48]

Results in Table 12 are all statistically significant; in Table 13 and Table 14 an asterisk (*) indicates statistical significance of individual results. Table 12 shows that overall eHealth adoption is higher among the Enthusiast, Indifferent and Realist GPs compared with Reluctant GPs. These results resonate with the findings in the literature, where authors have found that GPs' perceptions of advantages of health ICTs can drive the actual adoption, while perceptions of disadvantages can hinder the uptake (Antoun 2016; Gagnon et al. 2014; Li et al. 2013)

[48] For continuous variables, such as the level of the composite index, we conducted a one-way analysis of variance (ANOVA), whereas for dichotomous (i.e. gender) or categorical (i.e. type of practice) variable analyses, we used a chi-square test to compare means.

Table 12 GP clusters by composite index and composite indicators

	Realists	Enthusiasts	Reluctant	Indifferent
Composite index	2.022	2.181	1.852	2.181
EHR adoption	3.030	3.154	2.872	3.158
HIE adoption	1.971	2.183	1.792	2.245
Telehealth adoption	1.545	1.702	1.362	1.589
PHR adoption	1.541	1.687	1.383	1.733

Notes: *Results are significant at p<0.001.
The number of GPs clustered is 4,884 (i.e. 84% of the total sample of 5,793); 909 GPs (16%) were not classified.

Table 13 shows the four profiles mapped against the variable 'country'. The results indicate that the Enthusiasts are more prevalent in countries that have higher adoption levels (statistically significant). The opposite was found for Reluctant GPs, who more often work in transition countries than in NHS or social insurance countries.

Table 13 GP clusters by country

	Realists (36%)[49]	Enthusiasts (27%)[50]	Reluctant (14%)[51]	Indifferent (23%)[52]
NHS countries				
Cyprus	29%	46%	5%	20%
Denmark	8%	22%	6%	64%
Finland	25%	19%	9%	47%
Greece	42%	43%	7%	8%
Italy	42%	41%	4%	13%
Malta	26%	45%	5%	24%
Portugal	35%	30%	10%	25%
Spain	40%	26%	5%	28%
Sweden	17%	15%	19%	49%
United Kingdom	37%	24%	8%	32%
Social insurance countries				
Austria	36%	17%	18%	30%
Belgium	30%	20%	21%	29%
France	46%	23%	12%	19%
Germany	29%	15%	26%	30%
Ireland	45%	29%	8%	18%
Luxembourg	22%	25%	17%	36%
Transition countries				
Bulgaria	34%	38%	5%	24%
Croatia	39%	20%	15%	26%

[49] 36% of the sample of GPs clustered (4,884 GPs) and 31% of the total sample of 5,793 GPs.
[50] 27% of the sample of GPs clustered (4,884 GPs) and 23% of the total sample of 5,793 GPs.
[51] 14% of the sample of GPs clustered (4,884 GPs) and 12% of the total sample of 5,793 GPs.
[52] 23% of the sample of GPs clustered (4,884 GPs) and 19% of the total sample of 5,793 GPs.

	Realists (36%)[49]	Enthusiasts (27%)[50]	Reluctant (14%)[51]	Indifferent (23%)[52]
Czech Republic	34%	22%	19%	26%
Estonia	31%	31%	6%	33%
Hungary	39%	33%	17%	11%
Latvia	42%	12%	41%	6%
Lithuania	22%	25%	17%	36%
Poland	39%	31%	9%	21%
Romania	39%	41%	11%	10%
Slovakia	50%	26%	17%	7%
Slovenia	38%	20%	28%	14%

Notes: *Results are significant at $p<0.001$.
The number of GPs clustered is 4,884 (i.e. 84% of the total sample of 5,793); 909 GPs (16%) were not classified.

Finally, we conducted the same analysis to examine differences with respect to a set of individual characteristics and organisational parameters (Table 14). We did not find any large differences between female and male GPs with regard to the four different clusters, although the small differences found are statistically significant. Females are more often **Realists** or **Reluctant** GPs, while males are more often **Indifferent** GPs and **Enthusiasts**. In addition, younger GPs tend to be more often among the **Enthusiasts** than older GPs. Self-employed GPs working in solo practices and GPs working in 'other' types of practices are more often **Realists** than GPs working self-employed in group practices or salaried health centres, whereas GPs working in salaried health centres are more often **Indifferent** GPs. We did not find any significant differences related to the size of GPs' practice locations (i.e. large cities, medium- to small-sized cities and rural towns).

Table 14 GP clusters by gender, age, professional status and location

	Realists (36%[53])	Enthusiasts (27%[54])	Reluctant (14%[55])	Indifferent (23%[56])
Gender				
Female	38%*	26%*	15%*	21%*
Male	35%	28%	13%	25%
Age				
Less than 36 years old	36%	33%*	9%	22%
36-45 years old	35%	28%	12%	25%
46-55 years old	37%	25%	15%	23%
More than 55 years old	36%	26%	15%	22%
Professional status				
Salaried GPs in health centres	35%	24%	13%	28%*
Self-employed, solo practice	38%*	27%	16%*	19%
Self-employed, group practice	35%	28%	11%	26%
Other	38%*	34%*	12%	16%
Location				
Large city	22%	28%	14%	22%
Mid-small city	24%	26%	13%	24%
Rural town	24%	27%	14%	24%

Notes: *Results are significant at $p<0.001$.
The number of GPs clustered is 4,884 (i.e. 84% of the total sample of 5,793); 909 GPs (16%) were not classified.

[53] 36% of the sample of GPs clustered (4,884 GPs) and 31% of the total sample of 5,793 GPs.

[54] 27% of the sample of GPs clustered (4,884 GPs) and 23% of the total sample of 5,793 GPs.

[55] 14% of the sample of GPs clustered (4,884 GPs) and 12% of the total sample of 5,793 GPs.

[56] 23% of the sample of GPs clustered (4,884 GPs) and 19% of the total sample of 5,793 GPs.

6 Conclusions

Overall, eHealth adoption in primary healthcare in Europe has increased from 2013 to 2018, but there are differences among the countries surveyed.

In countries with the highest level of adoption (Denmark, Estonia, Finland, Spain, Sweden and the United Kingdom), the use of eHealth is routine among GPs, while in countries with the lowest level of adoption (Greece, Lithuania, Luxembourg, Malta, Romania and Slovakia), eHealth is currently not widespread. Nevertheless, if we analyse these results by the different eHealth categories (EHR, HIE, Telehealth and PHR), we can identify several nuances:

- **EHR** is currently available across all analysed EU countries, and most GPs use it in their practice. Basic health data and information and order-entry functionalities are almost fully adopted in all countries, and in more than half of the countries most GPs are routinely using clinical decision support functionalities and administrative data.
- **HIE** adoption is lower than EHR adoption. The degree of exchange of clinical, administrative and management is still not very high across the analysed countries. However, since 2013 there has been a large increase in the adoption of certifying sick leaves and transferring prescriptions to pharmacists; these are the functionalities with the greatest increase.
- **Telehealth** shows progress, but its availability and use are still low in most analysed countries. Training and education functionalities are now available to half of GPs in the analysed countries, while they were available to only 36% of GPs surveyed in 2013. The availability of consultations with patients (12%) and telemonitoring (4%) are still low.
- **PHR** adoption shows a similar pattern to Telehealth. The availability of the functionalities to request appointments and prescriptions has increased, as have the functionalities that patients can view their medical records and test results. However, there are some countries (Denmark, Estonia, Finland, Sweden and the United Kingdom) where these functionalities are more often available than in the other countries.

The analysis of the **drivers and barriers** reported by the GPs showed that the **practice settings are correlated with adoption levels**.

On average, **eHealth adoption is higher among NHS system** countries as compared with social insurance and transition countries. Denmark, Finland and Sweden are the countries with the highest scores among NHS countries; Ireland, Belgium and France have the highest scores among social insurance countries; and Estonia, Croatia and the Czech Republic are leading among the transition countries. Overall, transition countries have lower levels of adoption compared with NHS and social insurance countries, with the exception of **Estonia: it is not only ranked among the top five countries** across all four eHealth categories and in the overall adoption of eHealth (second highest composite index score), and **it also had the highest increase in the level of adoption** since 2013.

In addition to the health system type, the **type of practice is also associated with overall eHealth adoption**. GPs working in health centres and group practices have higher adoption levels than those working in solo practices or under other arrangements (i.e. freelance and others).

The variation in eHealth adoption is shaped by **contextual meso- and macro-level factors**, not only by GPs' individual characteristics and attitudes. These results are similar to the 2013 study.

The analysis of **individual factors** identified results similar to those identified in 2013. The majority of GPs surveyed consider ICTs to be useful for their practice and think that their use increases the effectiveness of their practice and the quality of care. However, they are more sceptical about the positive impact on waiting lists, patient satisfaction and the efficiency of consultations.

GPs also reported that ICT systems are easy to use and that they have the necessary technical assistance and resources to use them as well as the necessary knowledge to do so; however, in practice, they may not be able to decide whether or not to use a specific ICT functionality (this may depend, for example, on decisions taken by the public authorities or the managers of the health organisation). Social influences and peers are perceived as drivers of eHealth adoption. However, GPs also claimed a lack of positive eHealth impact on the doctor-patient relationship. Furthermore, financial difficulties, inter-operability issues and lack of a legal framework on confidentiality and privacy are perceived as the main barriers to eHealth adoption.

Perceived impacts and barriers were used to identify **attitudinal profiles of GPs**. The cluster analysis showed that:

- **Realists** are the largest group among the GPs. They consider both the barriers and impacts as relevant and important when it concerns the adoption of eHealth functionalities.
- **Enthusiasts**, representing the second largest cluster in the sample, extol the impacts and disregard the barriers.
- **Indifferent** GPs tend not to care about either impacts or barriers.
- **Reluctant** GPs place more importance on barriers than on impacts.

Compared with the 2013 results, there is a 10% decrease in the Indifferent group, while the Enthusiast group has increased from 13% to 27% between 2013 and 2018. This suggests that a large proportion of the GPs became more positive about the drivers and less negative about the barriers in the past five years.

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8 Appendices

8.1 Methodological report

8.1.1 Literature review

We undertook a rapid evidence assessment (REA) of the literature published since 2013 on the factors influencing the adoption and use of ICT in primary care. The aims of this review were to provide an update to the literature review findings presented in the second eHealth benchmarking study (Codagnone and Lupiáñez-Villanueva 2013a, 2013b) and to identify whether the questions on the drivers, impacts and barriers to eHealth included in the questionnaire – which were based on findings from the 2013 literature review – are still valid or, instead, require an update.

REAs take a systematic approach, but the scope of the search and quality assessment may be restricted to allow a focused review within a limited timeframe. The REA was conducted in two phases. The first phase was undertaken at the inception phase of this study, in August 2017: the study team searched PubMed[57] and Google Scholar, including literature published between 1 January 2013 and 9 August 2017. The second phase followed in July 2018, when the study team searched for literature published on PubMed and Google Scholar between 10 August 2017 and 20 July 2018. The search in both REA phases was conducted in English using the search terms listed in Table 15. During the 2017 review, we also undertook forward citation searching of an early systematic review (Gagnon et al. 2009).

Table 15 Rapid evidence assessment search terms

Terms
"telemedicine"[Title/Abstract] OR "tele medicine"[Title/Abstract] OR "tele-medicine"[Title/Abstract] OR "telehealth"[Title/Abstract] OR "tele-health"[Title/Abstract] OR "tele health"[Title/Abstract] OR "ICT"[Title/Abstract] OR "information communication technology"[Title/Abstract] OR "electronic health"[Title/Abstract] OR "ehealth"[Title/Abstract] OR "e health"[Title/Abstract] OR "e-health"[Title/Abstract] OR "telecommunication"[Title/Abstract] OR "tele communication"[Title/Abstract] OR "tele-communication"[Title/Abstract] OR "electronic medical"[Title/Abstract] OR "EMR"[Title/Abstract] OR "computer*"[Title/Abstract] OR "electronic prescribing"[Title/Abstract] OR "eprescribing"[Title/Abstract] OR "e prescribing"[Title/Abstract] OR "e-prescribing"[Title/Abstract] OR "email"[Title/Abstract]
AND
"primary care" OR "general practice"

Publications were eligible for inclusion if they examined the barriers and facilitators to the adoption and use of any type of ICT intervention in primary care and if they reported on findings from high-income countries. Identified literature was screened based on the title or abstract against the inclusion criteria. Full papers of potentially relevant publications were retrieved, and a final judgement on eligibility was made. Based on the quantity of relevant literature identified in 2017, the scope of the REA was initially restricted to only include reviews.

Included publications were grouped into the OECD's four categories of ICT in healthcare (OECD 2015): EHR, HIE, Telehealth and PHR. We created a fifth category ('eHealth') for publications that reported on a range of different types of ICT interventions. Data were extracted into a standardised template, which covered the aims of the publication, a description of the interventions assessed, the practice-level enablers and barriers, the system-level enablers and barriers, and the authors' conclusions. We did not undertake any qualitative assessment of the

[57] See https://www.ncbi.nlm.nih.gov/pubmed

publications included in the REA.

Overall, 4,002 records across the databases searched were found. After initially screening titles and abstracts, we considered 224 references for full-text review. The 2017 search resulted in only 21 reviews eligible for inclusion, and the 2018 search did not result in any reviews eligible for inclusion. However, we identified 11 primary research non-review papers (e.g. mixed-methods studies, surveys, qualitative studies) published between 10 August 2017 and 20 July 2018 that included highly relevant and recent insights into drivers of and barriers to eHealth adoption in primary care. These 11 studies were reviewed and then included in the literature review. Overall, 32 publications were included in the review.

Findings across the five categories of ICT in healthcare were triangulated in a narrative synthesis, as the drivers and barriers were found to be similar across the different categories. Where differences between categories were identified, these are described in the text.

Insights from the literature were organised in seven key categories of drivers, impacts and barriers to eHealth that were identified in the second eHealth benchmarking study (Codagnone and Lupiáñez-Villanueva 2013a, 2013b):

- Design and availability of applications
- Motivations, attitudes and intentions
- Perceived benefits, barriers and impacts
- Institutional settings
- Organisational settings
- Community demands
- Individual characteristics, social influence and networks

There are a number of caveats to consider when interpreting the results of the literature review. First, although the REA followed a systematic approach, the search for relevant literature was restricted compared with a full systematic review (e.g. exclusion of literature published in languages other than English; focus on reviews rather than primary studies). This means that some publications relevant to this study may not have been identified. Second, we did not assess the quality of the reviewed publications, contrary to what is usually done in systematic reviews. Third, again contrary to what is usually done in systematic reviews, each publication was screened by only one researcher. To mitigate against possible differences in selection approaches and to ensure consistency, the study team regularly met to discuss and refine the approach.

Findings of the literature review are presented in Chapter 2.

8.1.2 Survey of GPs

Data collection

The definition of the statistical population – the universe – and the sampling strategy followed the approach used for the second eHealth benchmarking study (Codagnone and Lupiáñez-Villanueva 2013b). We used the OECD's definition of GPs, which states that GPs 'assume responsibility for the provision of continuing and comprehensive medical care to individuals, families and communities' (OECD 2018b, 2) (Section 1.2). The universe for each country was the overall number of GPs in each country. The overall population of GPs in each country was compiled from the following sources: the WHO Regional Office for Europe's European Health for All database (HFA-DB; numbers as of July 2011) (WHO 2018); OECD 2010 health data (OECD 2010); European Community health indicators (ECHI) from the European Commission's Directorate-General for Health and Food Safety (European Commission n.d.); and Eurostat (Eurostat 2017).

Table 16 provides the technical characteristics of the survey conducted between January and June 2018, including the universe, the sample, margin errors, and the methods used in each country to recruit participants and collect the data. Respondents were recruited online, by telephone, by postal letter or face-to-face. The questionnaire was completed using computer-assisted telephone interviewing (CATI) or computer-assisted web interviewing (CAWI), except in the case of Bulgaria, where data was collected face-to-face. The European Union of General Practitioners (UEMO)[58] supported the data collection process.

Across the 27 EU countries analysed,[59] a final sample of 5,793 GPs was randomly selected, with an overall sampling error of ±1.30%.

Table 16 Universe size, sample size, margin error and fieldwork methods

Country	Universe[60]	Sample	Margin error	Recruitment method	Data collection method
Austria	12,979	215	±6.76	Online	CAWI
Belgium	12,262	282	±5.89	Online + telephone	CAWI
Bulgaria	4,786	240	±6.29	Face-to-Face	Face-to-Face
Croatia	2,960	172	±7.40	Online	CAWI
Cyprus	345	51	±12.95	Telephone	CAWI
Czech Republic	7,332	246	±6.27	Online	CAWI
Denmark	3,735	62	±12.60	Telephone	CAWI
Estonia	1,148	50	±13.84	Online	CATI
Finland	5,453	134	±8.53	Online	CAWI
France	104,225	412	±4.92	Online + telephone	CAWI
Germany	53,719	400	±4.98	Online	CAWI
Greece	3,060	248	±6.09	Telephone	CAWI + CATI
Hungary	6,559	183	±7.29	Online	CAWI
Ireland	2,449	126	±8.68	Online	CAWI
Italy	46,661	335	±5.44	Online + telephone	CATI + CAWI
Latvia	1,315	163	±7.33	Telephone	CATI
Lithuania	2,288	101	±9.73	Online + telephone	CAWI
Luxembourg	392	52	±12.93	Telephone	CATI + CAWI
Malta	286	50	±12.87	Postal letter	CATI + CAWI
Poland	6,619	332	±5.35	Telephone	CATI + CAWI
Portugal	20,221	346	±5.33	Online	CAWI
Romania	27,418	324	±5.52	Online	CATI + CAWI
Slovakia	2,236	165	±7.49	Telephone	CATI + CAWI
Slovenia	1,012	121	±8.53	Online	CAWI
Spain	33,349	414	±4.88	Online + telephone	CAWI
Sweden	5,487	248	±6.21	Online	CAWI
United Kingdom	48,543	321	±5.56	Online	CAWI
TOTAL	**425,622**	**5,793**	**±1.30**		

Notes: CATI = computer-assisted telephone interviewing; CAWI = computer-assisted web interviewing

[58] UEMO is an organisation of the European countries' national, non-governmental, independent organisations representing GPs and specialists in family medicine.

[59] All EU member states as of 2018, except for the Netherlands (i.e. 27 EU member states minus the Netherlands).

[60] The 'universe' is a statistical population, i.e. the overall number of GPs in the country.

As in the 2013 survey, the study team followed a simple random sample procedure without *ex ante* stratification. In addition, weighting was applied *ex post* in order to ensure that the sample is representative for the interpretation of the overall data. The randomness in the responses was achieved through the random selection of the contacts available in each country regardless of the sources. If potential participants did not respond to the survey questionnaire after a reminder, they were replaced with another potential participant, also randomly selected.

In order to allow comparison between the results of the 2013 survey and those of the 2018 survey, the study team used the same questionnaire as was used in 2013 (see Appendix section 8.2). The questionnaire was developed using insights gained through a review of 20 different questionnaires used in surveys of ICT adoption in primary care, literature on ICT adoption in healthcare, sources related to institutional and organisational settings in primary care, and literature on the evaluation of eHealth tangible outcomes and impacts.[61] In addition, the 2013 benchmarking study team undertook consultation activities to inform the development of the questionnaire, including focus groups with 25 participants representing GPs of 20 European countries and consultations with representatives of national GP associations (Codagnone and Lupiáñez-Villanueva 2013b).

The questionnaire is divided into three sets of questions. The first set covers socio-demographics, organisational settings, practice location, description of tasks and workload. The second set of questions covers the measures of ICT availability and use within a GP practice. The questions in this second set are divided into four categories of ICT in healthcare as defined by the OECD – EHRs, HIE, Telehealth and PHRs (see Table 17 for more details). The third set of questions addresses attitudes to, perceived barriers to and perceived impacts of ICT adoption.

Table 17 OECD categories of information and communication technology in healthcare

ICT category	Definition
EHRs	Also known as electronic medical records (EMRs), provider-centric electronic records, or electronic patient records (EPRs), Electronic Health Records 'include systems that are used by healthcare professionals to store and manage patient health information and data, and include functionalities that directly support the care delivery process'.
HIE	Health Information Exchange 'refers to the process of electronically transferring, or aggregating and enabling access to, patient health information and data across provider organisations. Exchange may take place between different types of entities – for example, e-transfer of patient data between ambulatory care providers or e-transfer of data at the regional level'.
Telehealth	Telehealth is seen as comprising 'a broad set of technologies that support care between patients and providers, or among providers, who are not co-located. Telemedicine is often defined as synchronous video-mediated consultations between physicians and patients. However, it may also include applications such as remote home monitoring of patients, tele-ICUs[intensive care units], and teleradiology'.
PHRs	Also known as patient-centric electronic records or patient portals, Personal Health Records 'are typically used by patients and their families to access and manage their health information and organize their health care'.

Source: OECD (2015, 8)

Data analysis

Univariate and multivariate statistical analysis were conducted to analyse the data collected through the survey. The analysis was conducted in several stages. First, we constructed the

[61] See Codagnone & Lupiáñez-Villanueva (2013b, 13–14) for more details.

descriptive statistics of each country sample's general characteristics and the items related to the availably and use of ICT within GP practices. The overall EU results are presented in Chapter 3, and results for individual countries are provided in accompanying country reports. Findings were also compared with those from the 2013 benchmarking study (Codagnone and Lupiáñez-Villanueva 2013a, 2013b), and we have highlighted cases where we observed relevant changes.

Second, to gain a better understanding of the difference between availability and use of the different eHealth functionalities and to provide a basis for composite indicators – i.e. indicators for each of the four eHealth categories showing the overall adoption of functionalities of each category – we created new variables, which are general measures of how well a functionality is adopted. These new variables replace a two-pronged description of the functionality's adoption based on its availability and use. This new measure of adoption is a combination of the answers to questions on the availability and use of a functionality on a scale of 0 to 4:

- Not aware ('do not know' answers) = 0
- Do not have it = 1
- Have it and do not use it = 2
- Use it occasionally = 3
- Use it routinely = 4

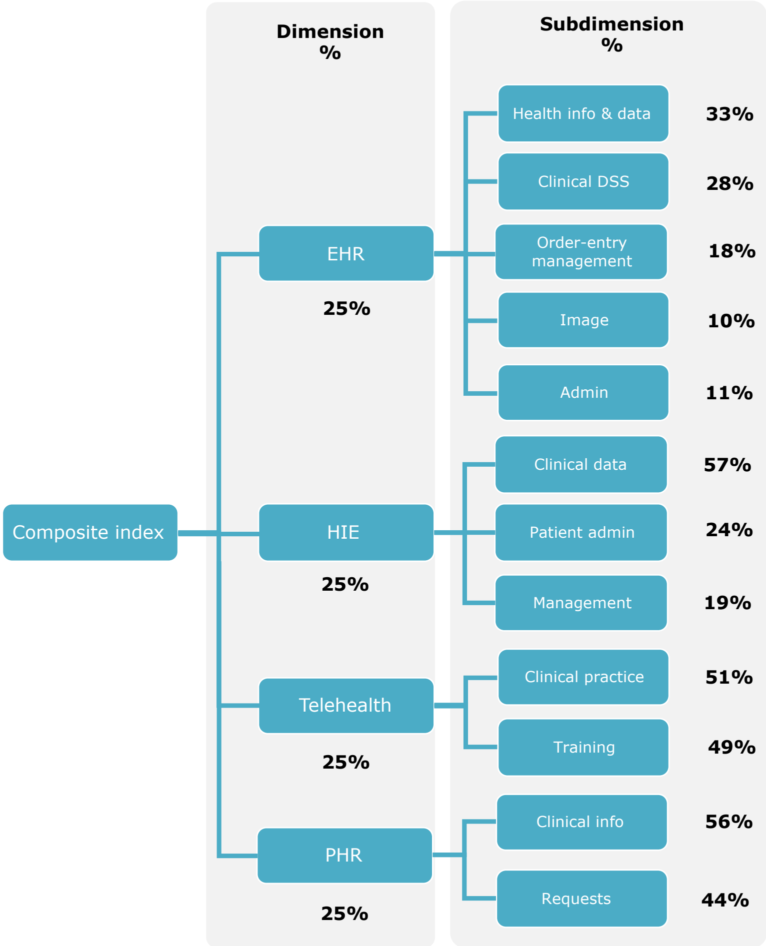
Third, we used these variables to develop the 2018 composite indicators for each of the four eHealth categories. We used the same weights that were used in 2013 to calculate the composite measures in the 2018 study, in order to enable comparisons between the two studies (Codagnone and Lupiáñez-Villanueva 2013a, 2013b). The weights were constructed in 2013 using multivariate statistics following the OECD/JRC Handbook on constructing composite indicators (OECD and JRC 2008). Figure 45 illustrates the four categories (dimensions), their subdimensions and their weights as reported in 2013.[62]

Fourth, a composite index[63] was formed to show the overall adoption of eHealth. This composite index combines the results of the four composite indicators. The combination of the individual composite indicators and their subdimensions followed the same approach used for the 2013 benchmarking study.

[62] For a detailed explanation, see Codagnone and Lupiáñez-Villanueva (2013b).

[63] A composite index is formed when individual indicators are compiled into a single index on the basis of an underlying conceptual model with the support of the empirical exploration of the dataset.

Figure 45 eHealth adoption dimensions and subdimensions



Differences between countries observed in the composite index and in the composite indicators were then analysed and compared by organisational setting (i.e. salaried doctors in health centres, self-employed doctors in solo practices, self-employed doctors in group practices and doctors in other types of practices) as well as by health system (NHS, social insurance and transition country models). We used univariate analysis of variance (ANOVA)[64] and multivariate analysis of variance (MANOVA)[65] for these analyses and comparisons. The composite indicators of the four eHealth categories and the eHealth adoption composite index are presented in Chapter 4.

Finally, we analysed the responses to the third set of questions of the survey, which focus on perceived impacts and barriers of eHealth, using a non-hierarchical cluster analysis. We used these two sets of variables (i.e. impacts and barriers) to develop a typology of four GP attitudinal profiles: Realists, Enthusiasts, Indifferent GPs and Reluctant GPs. To develop this typology, we first calculated the averages of the grouped items related to impact (i.e. the items presented in Q27 of the survey, which address health ICT impact on quality, efficiency and activity) and the averages of the grouped items related to barriers (i.e. items presented in Q26 of the survey, which include financial, organisational, technological and individual

[64] ANOVA is statistical test to determine whether there is a significant difference between two or more independent variables, of which one is a dependent variable (Research Optimus n.d.).

[65] MANOVA 'is used to determine whether there are any differences between independent groups on more than one continuous dependent variable' (unlike ANOVA, which considers only one dependent variable) (Laerd Statistics 2018).

barriers). Second, we conducted a factor analysis on these items within the two constructs (perceived barriers and perceived impacts) and used this factor analysis to conduct the non-hierarchical cluster analysis, resulting in the four attitudinal profiles. These four distinct profiles maximise the within-profile similarity and the between-profiles differences. Findings on the attitudinal profiles are presented in Section 5.3.

Limitations

The results of this study shall be considered with caution. While the margin error for the data collected at EU level is rather low, the margin error is significantly higher in countries where the number of target respondents and/or the GP population are small (e.g. Cyprus, Luxembourg and Malta). This does not allow for comparisons among countries or analyses of the evolution between 2013 and 2018 at country level.

The number of functionalities and variables gathered using the questionnaire created in 2013 makes this study suitable for the use of composite indicators. This technique facilitates the summary of multidimensional issues (e.g. eHealth adoption) for decision makers, providing messages that are easier to interpret and that might attract public interest. However, the study does not aim at oversimplifying the issues at stake and should not be used to oversimplify.

It is important to emphasise that, despite the limitations of the survey, this is the only updated and transparent information about the deployment of eHealth among GP covering the European Union and facilitating the comparison with 2013 exercise. Therefore, the use of this data and analysis can support decision makers at regional, national and EU level to design informed, evidence-based policies. Transparent and replicable composite indicators provide clear input ready to use for policy consumption.

8.2 Questionnaire

The questions that follow will be about your work in relation to the use of Information and Communication Technologies (also referred to as "ICT"). The use of ICT in healthcare is also referred to as "eHealth". Due to different understanding of the concept of "eHealth" in different contexts, we will use the more generic expression "ICT", but please bear in mind that we refer to **Information and Communication Technologies explicitly devised to support the provision of healthcare.**

A. GPs' socio-demographics, individual characteristics and tasks description

Q1. Gender:

1. Female
2. Male

Q2. Age:

____ years old [AGE SHOULD BE BETWEEN 23 AND 75 YEARS OLD; IF NOT, CLOSE]

Q3. Which of the following statements best reflects your professional status? [SINGLE ANSWER]

1. I am a salaried General Practitioner (GP) working in a Health Centre → ASK Q4
2. I am a self-employed GP working alone (with only administrative support staff) in my own practice → GO TO Q5
3. I am a self-employed GP working in a group practice with other physicians → ASK Q4
4. Other → ASK Q4

Q4. Approximately (estimate if you do not know exactly) how many physicians work at your health centre or private group practice, <u>including</u> yourself?

Number of GPs including yourself (or full-time equivalent): ____

Number of other physicians (or full-time equivalent): ____

Q5. Has the number of patients you treat decreased, remained stable, or increased over the past two (2) years? [SINGLE ANSWER]

1. Decreased
2. Remained stable
3. Increased
4. I don't know

Q6. Your work place is located in a...? [SINGLE ANSWER]

1. large city (more than 100,000 inhabitants)
2. mid-small city (between 20,000 to 100,000 inhabitants)
3. rural town (less than 20,000 inhabitants)

Q7. How many years have you spent in general practice?

____ years [GPs SHOULD HAVE AT LEAST 1 YEAR OF EXPERIENCE; IF NOT, CLOSE]

Q8. How many minutes per week do you have direct contact (either face-to-face or by phone) with...? [MULTIPLE ANSWER; MUST ANSWER AT LEAST 2 ITEMS]

1. Other General Practitioners approx. _______ minutes/week
2. Specialists approx. _______ minutes/week
3. Practice nurses approx. _______ minutes/week
4. Home care nurses approx. _______ minutes/week
5. Physiotherapists approx. _______ minutes/week
6. Social workers (including youth care) approx. _______ minutes/week

Q9. When your patient has been seen by a specialist or discharged by a hospital, how often does the following occur? [ONE ANSWER PER ITEM]

	Always	**Often**	**Sometimes**	**Rarely**	**Never**
You receive a report back from the specialist/hospital with all relevant health information					
The information you receive is timely, that is, received in a timely manner so that it is available when needed					

Q10. How do you usually receive or access this information (if at all)? [MULTIPLE ANSWER]

1. By fax
2. By mail or courier
3. By electronic mail (e-mail)
4. I have (electronic) remote access to it
5. The patient hands it to me
6. Other

B. Deployment and Usage of Information and Communication Technologies (ICT) Systems and Functionalities

Q11. Does your practice or department of general practice use computers? [SINGLE ANSWER]

1. Yes
2. No → EXPLAIN "DEPARTMENT" IF NECESSARY*; CLOSE & RECORD
3. I don't know → EXPLAIN "DEPARTMENT" IF NECESSARY*; CLOSE & RECORD

*NOTE: "department of general practice" means the unit you work for (in a health centre, polyclinic, hospital, etc.)

Q12a. Do you have access to a computer in the consultation room? [SINGLE ANSWER]

1. Yes → ASK Q12b
2. No → GO TO Q12d
3. I don't know → GO TO Q12d

Q12b. Do you use the computer during consultations? [SINGLE ANSWER]

1. Yes → ASK Q12c
2. No → GO TO Q12d & SKIP Q12g
3. I don't know → GO TO Q12d & SKIP Q12g

Q12c. Do you use the computer to show patients any health-related information during consultations? [SINGLE ANSWER]

1. Yes, routinely
2. Yes, occasionally
3. No
4. I don't know

Q12d. Does your practice or department of general practice have access to the Internet? [SINGLE ANSWER]

1. Yes → ASK Q12e
2. No → GO TO Q13
3. I don't know → GO TO Q13

Q12e. What type of connection to the Internet does your practice have? [MULTIPLE ANSWER IF VARIOUS CONNECTIONS]

1. Dial Modem
2. ISDN connection
3. DSL connection
4. Other broadband connection
5. Mobile Internet connection while on the move or outside the practice
6. I don't know

Q12f. What speed does the connection reach? [MULTIPLE ANSWER IF VARIOUS CONNECTIONS]

1. Less than or equal to 2 MBps (megabits per second)
2. Between 2 and 30 MBps (megabits per second)
3. Between 30 and 100 MBps (megabits per second)
4. More than 100 MBps (megabits per second)
5. I don't know

Q12g. Do you use the Internet during consultations? [SINGLE ANSWER]

1. Yes, routinely
2. Yes, occasionally
3. No, I do not use it
4. No, I do not have access to the Internet in the consultation room
5. I don't know

Q13. **<u>When you are working outside your office (i.e. visiting a patient)</u>, which of the following devices do you have at your disposal?**

[FOR ITEMS ANSWERED AS "YES"] **Do you use them <u>when you are working outside your office</u>?**

	HAVE IT			USE IT		
	Yes	**No**	**I don't know**	**Yes, routinely**	**Yes, occasionally**	**No, I don't use it**
A simple mobile phone (with no internet connection)						
A mobile phone with internet connection and e-mail (called "smartphone")						
A laptop with internet connection						
A laptop with no internet connection						
A tablet (e.g. iPad)						

Q14. **Does your office or health centre have its own website?** [SINGLE ANSWER]

1. Yes
2. No
3. I don't know

Q15. **Do the computers and other ICT systems in use at your office have any of the following security features?** [MULTIPLE ANSWER]

1. Electronic signature
2. Encryption of sent or received files and e-mails
3. Password protection of sent or received files
4. Password-protected access
5. I don't know

Q16. **How often do you encounter problems of compatibility when exchanging patient data electronically?** [SINGLE ANSWER]

1. Very often
2. Often
3. Sometimes
4. Seldom
5. I don't exchange patient data
6. I don't know

Q17. To which of the following organisations or persons is your office's ICT system connected electronically?

[Note: "ICT" stands for "Information and Communication Technologies"]

[FOR ITEMS ANSWERED AS "YES"] **Do you use the connections to the following organisations/persons?**

	CONNECTED			USE IT		
	Yes	**No**	**I don't know**	**Yes, routinely**	**Yes, occasionally**	**No, I don't use this connection**
Other GPs						
Specialist practices						
Hospitals						
Laboratories						
Pharmacies						
Care homes						
Patients' homes						
Health authorities						
Insurance companies						
Suppliers						
Others						

Q18. How are administrative and patient medical records stored at your office?

[SINGLE ANSWER]

1. All electronic
2. Mostly electronic
3. Combined electronic/paper
4. Mostly paper
5. All paper

Q19a. In your practice, do you record and store patients' medical and administrative data electronically? [SINGLE ANSWER]

1. Yes → GO TO Q20a
2. No → ASK Q19b
3. I don't know → GO TO Q20a

Q19b. [IF OFFICE HAS NO ELECTRONIC HEALTH RECORDS ACCORDING TO Q19a]

Why doesn't your office have these systems? [MULTIPLE ANSWER & SKIP TO Q21]

1. Too expensive
2. Not needed
3. Not useful
4. Too complicated
5. Still unsure about privacy and confidentiality issues
6. Other

Q20a. Does your ICT system allow you to record and store the following types of patient data electronically?

[Note: "ICT" stands for "Information and Communication Technologies"]

[FOR ITEMS ANSWERED AS "YES"] **Do you use them?**

	ALLOW IT			**USE IT**		
	Yes	**No**	**I don't know**	**Yes, routinely**	**Yes, occasionally**	**No, I don't use it**
Basic medical parameters (e.g. allergies)						
Vital signs						
Treatment outcomes						
Problem list/diagnoses						
Medication list						
Immunisations						
Medical history						
Patient demographics						
Lab test results						
Radiology test reports						
Radiology test images						
Symptoms (reported by patient)						
Reason for appointment						
Clinical notes						
Prescriptions/medications						
Ordered tests						
Create/update disease management/care plan (e.g. diabetes)						
Finances/billing						
Administrative patient data						

Q20b. Does your ICT system have any of the clinical decision support functionalities listed below (such as real-time alerts or prompts)?

[Note: "ICT" stands for "Information and Communication Technologies"]

[FOR ITEMS ANSWERED AS "YES"] **Do you use them?**

	HAVE IT			USE IT		
	Yes	**No**	**I don't know**	**Yes, routinely**	**Yes, occasionally**	**No, I don't use it**
Clinical guidelines and best practices (e.g. alerts, prompts)						
Drug-drug interactions						
Drug-allergy alerts						
Drug-lab interactions						
Contraindications (e.g. based on age, gender, pregnancy status)						
Be alerted to a critical laboratory value						

Q21. Does your ICT system allow you to transfer/share/enable/access patient data electronically, permitting you to engage in any of the following?

[Note: "ICT" stands for "Information and Communication Technologies"]

[FOR ITEMS ANSWERED AS "YES"] **Do you use them?**

	ALLOW IT			USE IT		
	Yes	**No**	**I don't know**	**Yes, routinely**	**Yes, occasionally**	**No, I don't use it**
Interact with patients by email about health-related issues						
Patient appointment requests						
Make appointments at other care providers on your patients' behalf						
Send/receive referral and discharge letters						
Order supplies for your practice						
Transfer prescriptions to pharmacists						
Exchange medical patient data with other healthcare providers and professionals						
Receive laboratory reports						

	ALLOW IT			USE IT		
	Yes	**No**	**I don't know**	**Yes, routinely**	**Yes, occasionally**	**No, I don't use it**
Receive and send laboratory reports and share them with other healthcare professionals/ providers						
Exchange patient medication lists with other healthcare professionals/ providers						
Exchange radiology reports with other healthcare professionals/providers						
Exchange medical patient data with any healthcare provider in other countries						
Certify sick leaves						
Certify disabilities						
Exchange administrative patient data with reimbursers or other care providers						

Q22. "Telehealth" is the use of broadband-based technological platforms for the purpose of providing health services, medical training and health education over a distance. Which of the following telehealth services do you currently have access to?

[FOR ITEMS ANSWERED AS "YES"] **Do you use the following "telehealth" services?**

	ACCESS TO IT			USE IT		
	Yes	**No**	**I don't know**	**Yes, routinely**	**Yes, occasionally**	**No, I don't use it**
Training/Education						
Consultations with other healthcare practitioners						
Consultations with patients						
Monitoring patients remotely at their homes (i.e. "telemonitoring")						

Q23. [IF ANSWERED "YES" TO USAGE in Q22 "Monitoring patients remotely"]

You said that you provide telemonitoring service to patients at their homes. How is the service paid for? [MULTIPLE ANSWER]

1. I provide the service as part of my mandate and contract obligations (no additional payment/funding is required)
2. The service is fully reimbursed by the national health system or social insurance fund
3. The service is provided only for patients with a private insurance coverage
4. The service is partially reimbursed (by national health system or social health insurance or private insurance) and partially paid by patients
5. The service is entirely paid by patients and is not reimbursed
6. Other
7. I don't know

Q24a. Does your ICT system allow patients to have secure access to and manage their health information and/or other services such as referrals, appointments, etc.?

[Note: "ICT" stands for "Information and Communication Technologies"]

[SINGLE ANSWER]

1. Yes, they can both access and manage their information and data
2. Yes, they can view their information and data, but cannot manage it
3. No, neither access nor manage
4. I don't know

Q24b. Does your ICT system give patients online access to the following services?

[Note: "ICT" stands for "Information and Communication Technologies"]

[FOR ITEMS ANSWERED AS "YES"] **Do your patients use these services?**

	ALLOW IT			**USE IT**		
	Yes	**No**	**I don't know**	**Yes, routinely**	**Yes, occasionally**	**No, I don't use it**
Request referrals						
Request appointments						
Request renewals or prescriptions						
View their medical records						
Supplement their medical records						
View test results						

C. Barriers, Impact, Attitudes

Q25. To what extent do you agree/disagree with the following statements related to the use of Information and Communications Technologies (ICT) in your practice?

[Note: "ICT" stands for "Information and Communication Technologies"]

[ONE ANSWER PER ITEM]

	Strongly agree	Somewhat agree	Somewhat disagree	Strongly disagree	I don't know
Useful for my practice					
Increases the number of patients I can see on average during working hours					
Enhances effectiveness of job					
Increases quality of care					
Easy to use					
Easy to get it to do what I want					
Flexible to use/interact with					
Colleagues who are important to me think I should use ICT systems					
People who influence my behaviour think I should use ICT systems					
People who influence my clinical behaviour think I should use ICT systems					
I have necessary resources to use ICT systems					
I have knowledge to use ICT systems					
I have technical assistance available					
Using ICT systems is entirely under my control					

Q26. To what extent do you agree/disagree that the following items are <u>barriers</u> to the introduction and usage of ICT systems in primary care?
[Note: "ICT" stands for "Information and Communication Technologies"]
[ONE ANSWER PER ITEM]

	Strongly agree	**Somewhat agree**	**Somewhat disagree**	**Strongly disagree**	**I don't know**
Lack of financial incentives					
Lack of financial resources					
Lack of access to the technology					
Lack of technical support					
Lack of inter-operability and standards					
Lack of sufficient resilience (ICT systems can fail)					
Lack of sufficient security and risk control					
Lack of framework (regulatory, legislative, ethical) on confidentiality and privacy issues					
Lack of time/additional workload					
Lack of sufficient ICT skills on the side of healthcare professionals					
Lack of sufficient training for healthcare professionals					
Lack of clear motivation to use ICT (not sure about its usefulness)					
Increased patient expectations					
Lack of framework on using e-mail between doctors and patients (i.e. standards for response time)					
Lack of remuneration for additional work answering patients' e-mails					
Difficult to use					

Q27. To what extent do you agree/disagree that the following items are <u>positive effects</u> from the introduction of ICT systems in primary care?

[Note: "ICT" stands for "Information and Communication Technologies"]

[ONE ANSWER PER ITEM]

	Strongly agree	Somewhat agree	Somewhat disagree	Strongly disagree	I don't know
Reduce medical errors					
Improvement in the quality of diagnosis decisions					
Improvement in the quality of treatment					
Enhance self-evaluation					
More data for clinical research and public health					
Facilitate patients' education and adherence to prescriptions					
Improvement in patients' satisfaction					
Increased patients' access to healthcare (i.e. booking online appointment, viewing their data)					
Avoid unnecessary tests and duplications					
Increase average number of patients receiving help during one day					
Reduce pharmaceutical expenditure					
Shorter waiting lists					
Allow more efficient consultations					
Improvement in coordination between the different levels of the health system					
Expedite workflow due to the availability of patients clinical data					
Improvement in the efficiency of the whole health system					

Q28. In what ways has the use of Information and Communication Technologies (ICT) systems changed your work practice? Has it had a positive influence, a negative influence, or no change at all on it?

[ONE ANSWER PER ITEM]

	Positive	No change	Negative	I don't know
Your personal working processes				
Your staff working processes				
Quality of diagnosis and treatment decisions				
Doctor-patient relationship				

Q29. Some patients use the Internet to search information about their symptoms or conditions. How often do you encounter one of the following situations concerning health-related information your patients found online?

[ONE ANSWER PER ITEM]

	Often	Sometimes	Rarely	Never
Patients wanted to discuss the information they found online during consultation				
Patients misapplied or misunderstood the information they found online				
The information your patients found online was actually beneficial for them				
You recommended specific websites to your patients				
Chronically-ill patients told you that internet is helping them in the self-management of their illness				

Q30. Social networking sites, blogs, and other online tools are part of the so-called "Web 2.0". To what extent do you use any of these tools?

	Often	Sometimes	Rarely	Never
In your practice with patients				
In your practice with other healthcare professionals				
In your private life				

CLOSURE

You have successfully completed the online survey. Thank you very much for your time. Your feedback is very important.

For quality control purposes, we would appreciate it if you could give us the following information about yourself. Please note this information will be deleted after the study is finished.

Full Name: …………………………………………………

Phone Number: ……………………………………………

Region (please select your geographic area):

___ Area 1
___ Area 2
___ Area 3
___ Area 4
___ Area 5

8.3 Composite index dimensions and subdimensions by health system type and country

8.3.1 Electronic Health Record subdimensions by health system type and country

Figure 46 EHR subdimension *Health Info and Data* by health system type and country

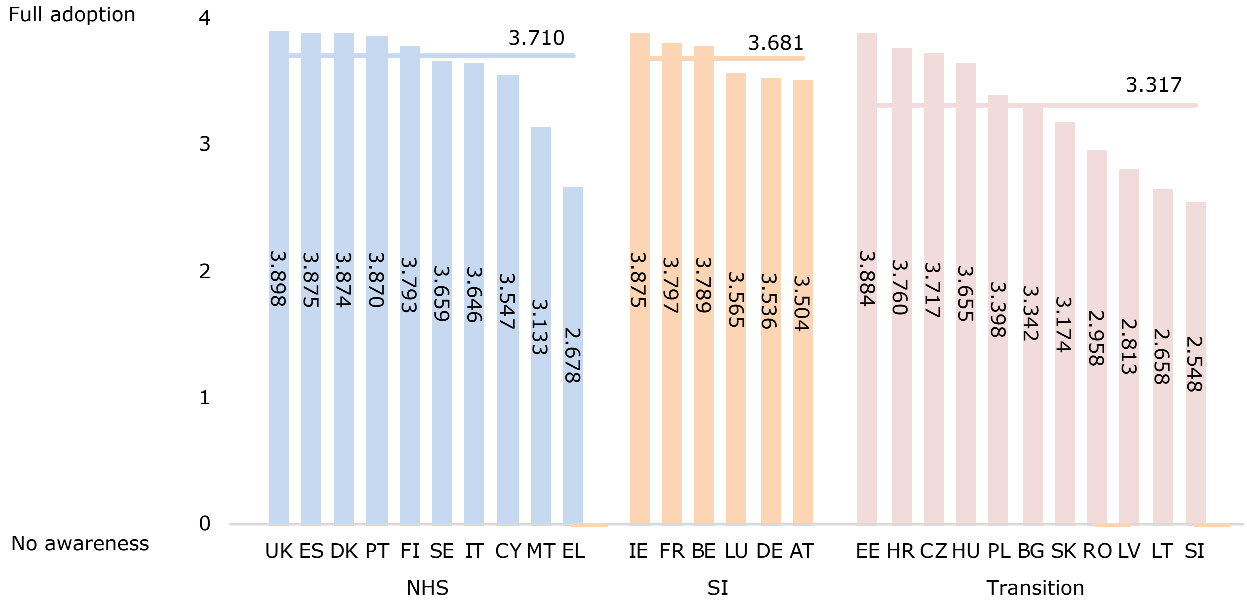


Figure 47 EHR subdimension *Clinical Decision Support System* by health system type and country

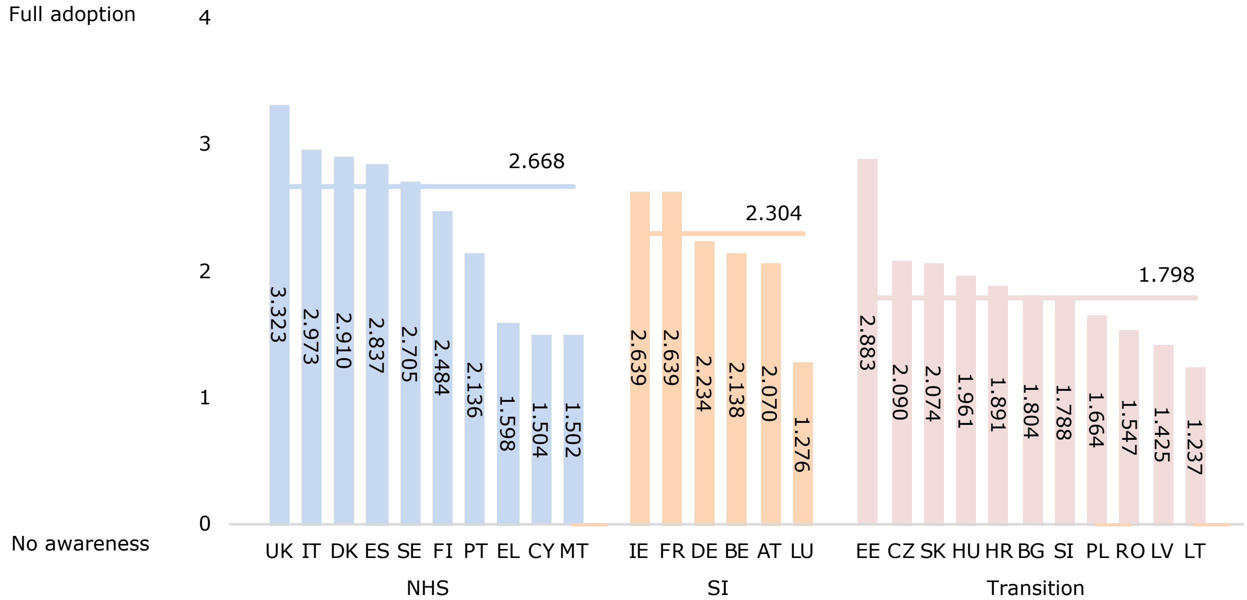


Figure 48 EHR subdimension *Order-Entry and Result Management* by health system type and country

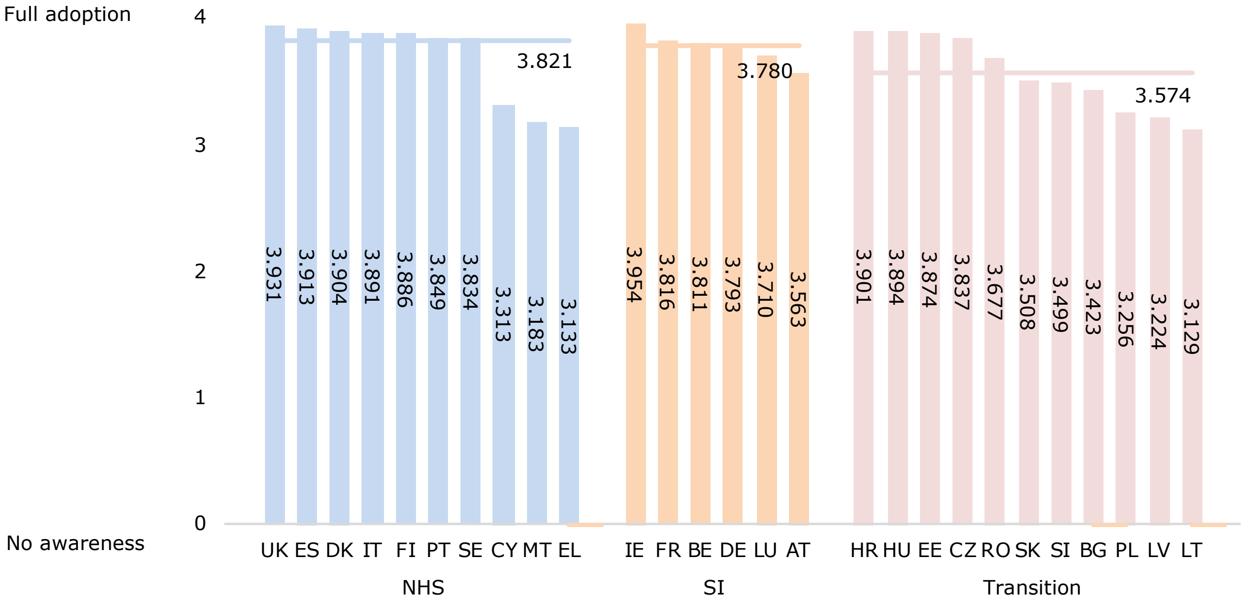


Figure 49 EHR subdimension *Image* by health system type and country

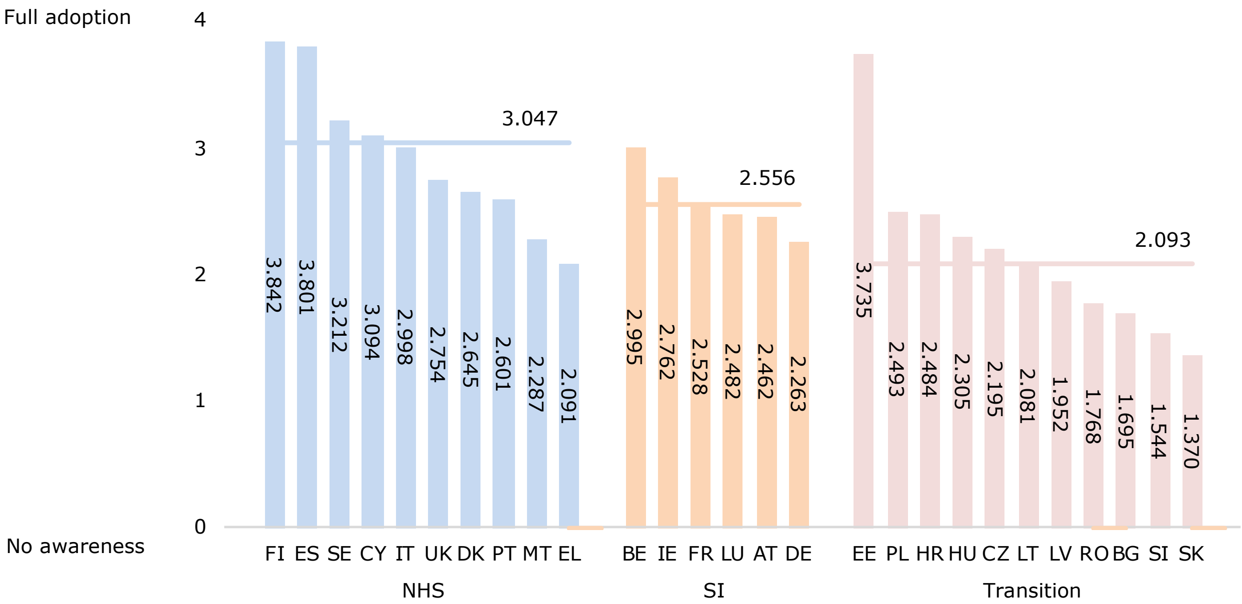
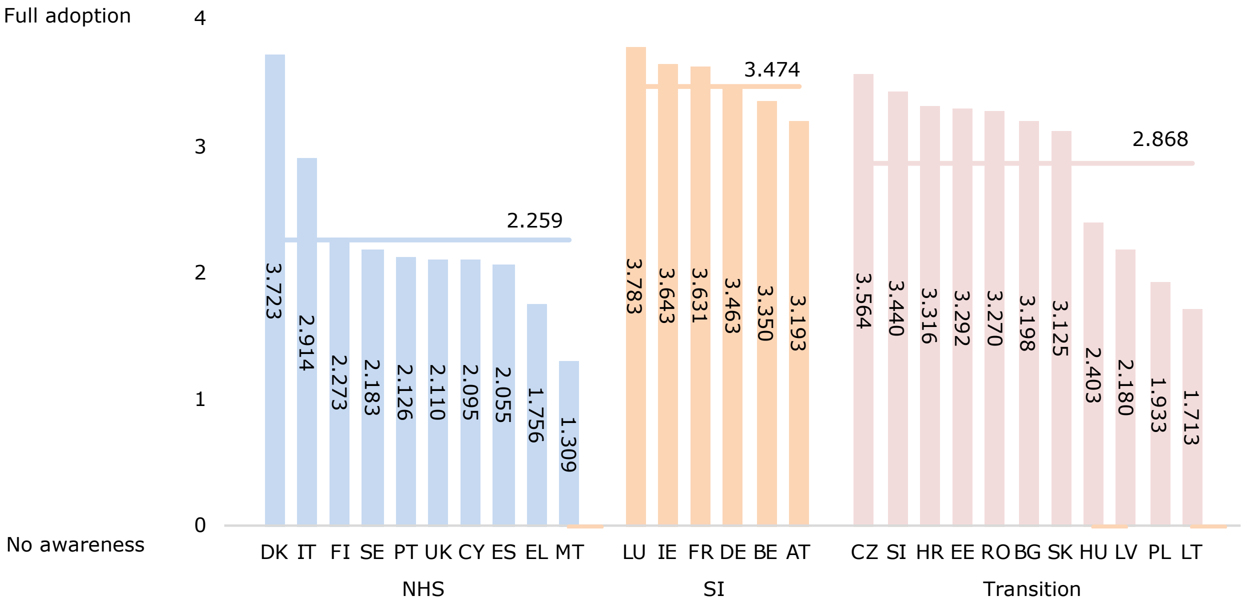


Figure 50 EHR subdimension *Administrative* by health system type and country



8.3.2 Health Information Exchange subdimensions by health system type and country

Figure 51 HIE subdimension *Clinical Data* by health system type and country

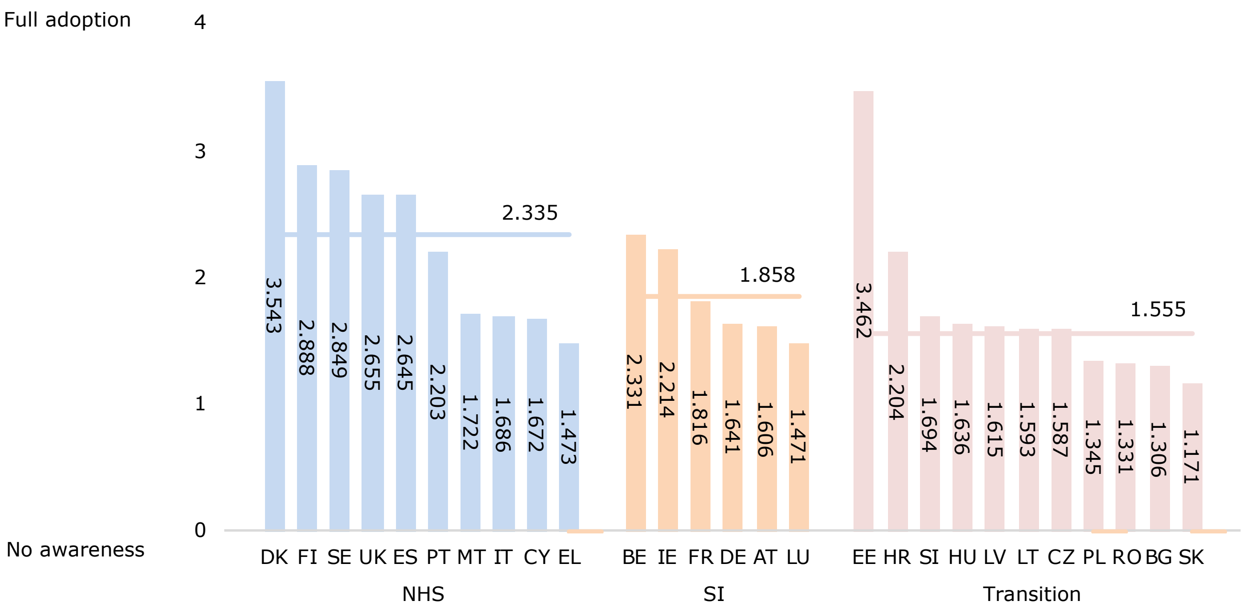


Figure 52 HIE subdimension *Patient Administration* by health system type and country

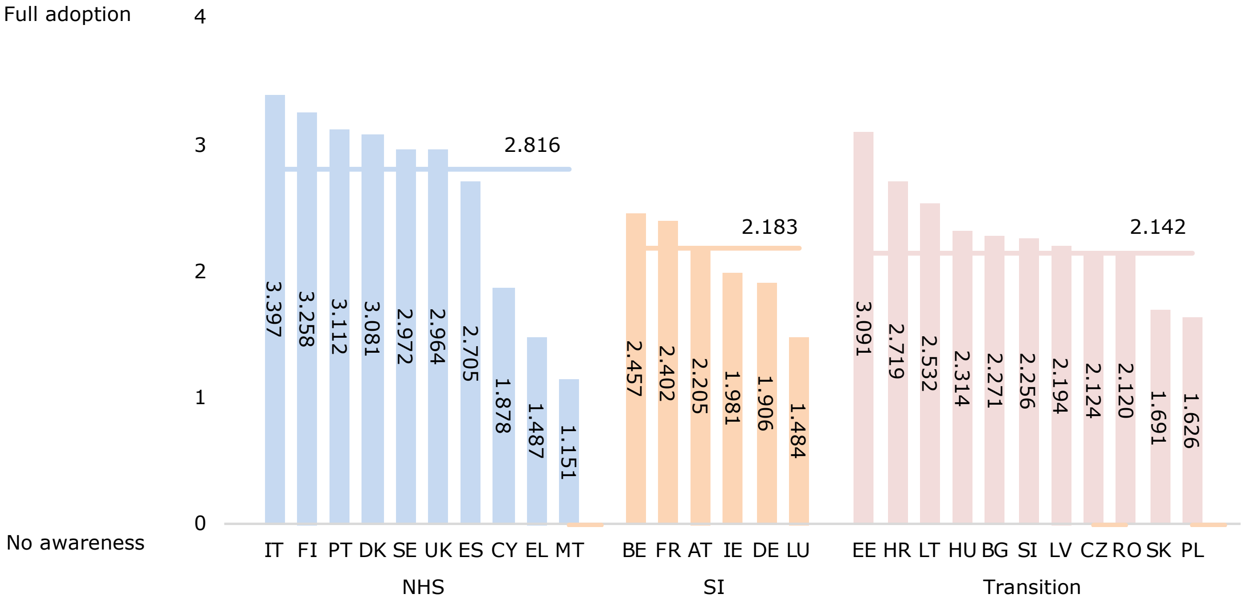
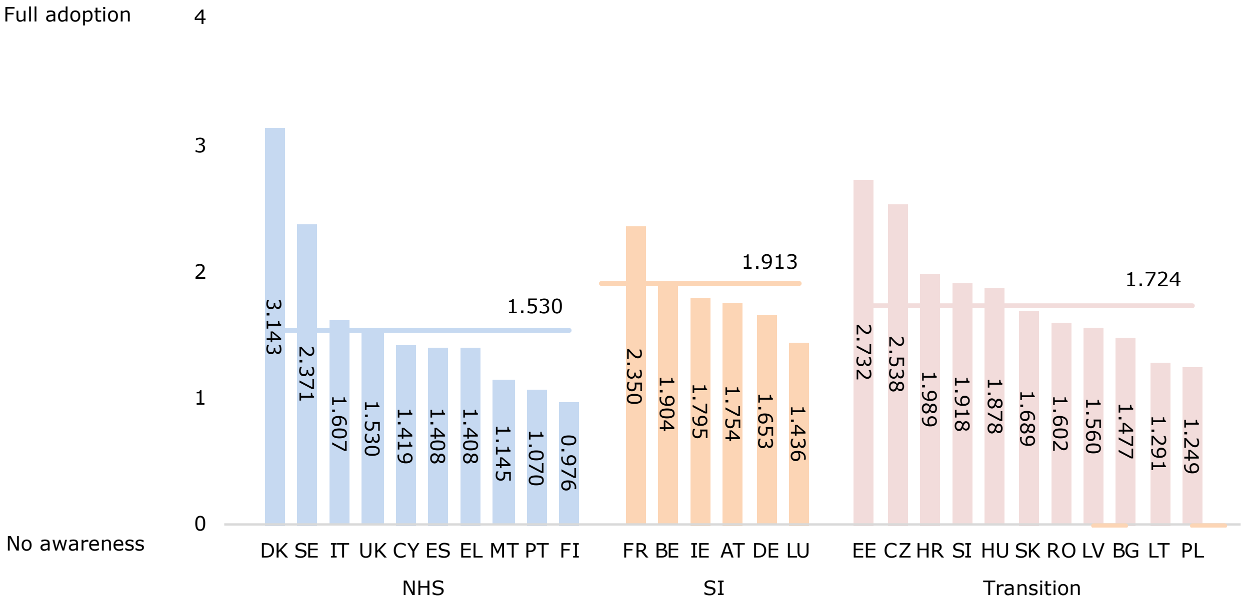


Figure 53 HIE subdimension *Management* by health system type and country



8.3.3 Telehealth subdimensions by health system type

Figure 54 Telehealth subdimension *Clinical Practice* by health system type and country

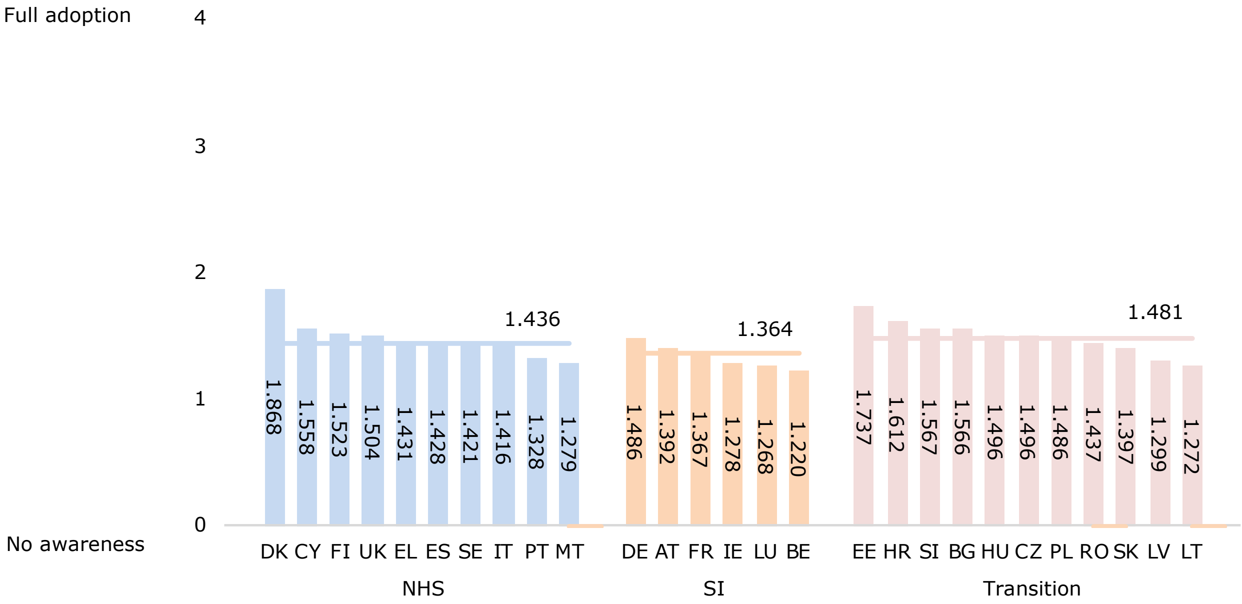
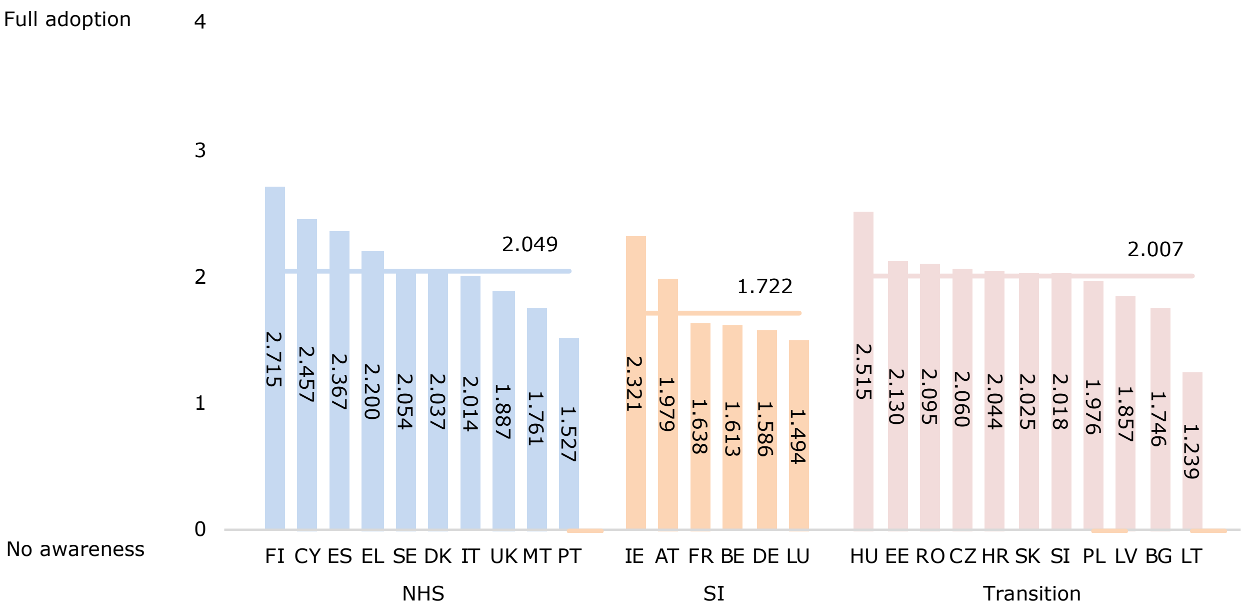


Figure 55 Telehealth subdimension *Training* by health system type and country



8.3.4 Personal Health Record subdimensions by health system type and country

Figure 56 PHR subdimension *Clinical Information* by health system type and country

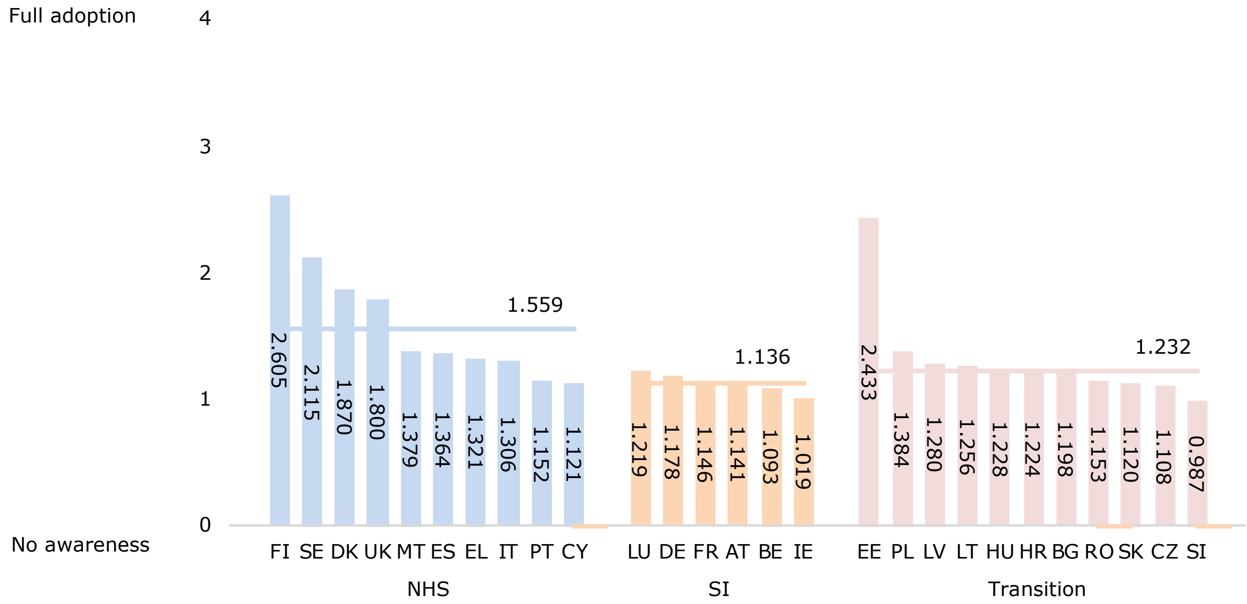
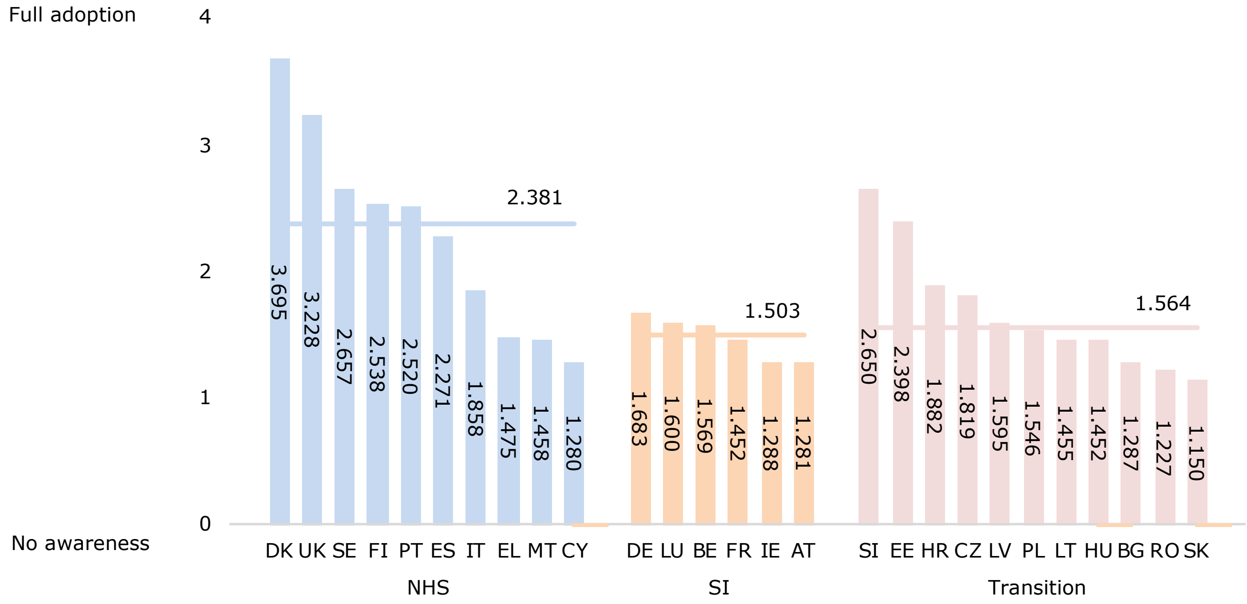


Figure 57 PHR subdimension *Requests* by health system type and country



8.4 Cluster analysis on perceived impacts and barriers

We report below the technical tables with the results of the application of a cluster analysis to our data for the identification of the four profiles of GPs presented in Section 5.3.

Table 18 Factor analysis: perceived impacts and barriers

Items	Perceived barriers (factor loadings)	Perceived impact (factor loadings)
Perceived barriers individual	0.798	
Perceived barriers technological	0.804	
Perceived barriers organisational	0.751	
Perceived barriers legal	0.790	
Perceived barriers financial	0.764	
Perceived impact efficiency		0.835
Perceived impact activity		0.803
Perceived impact quality		0.821
Expl. var.	3.597	2.412
% Expl. var.	0.450	0.300

Notes: Rotated component matrix; Extraction Method: Principal Component Analysis; Rotation Method: Varimax with Kaiser Normalisation 0.814; Bartlett's test of sphericity p=0.000; Rotation converged in 3 iterations; Minimum eigenvalue 1. Values below 0.45 are omitted; Expl. var. = variance explained by the factor; % Expl. var. = % variance explained by the factor.

Table 19 Cluster analysis: perceived impacts and barriers

Factors	Realistic (36%)[66]	Enthusiastic (27%)[67]	Reluctant (14%)[68]	Indifferent (23%)[69]	ANOVA
Factor 1: Barriers	2.243	2.045	2.158	1.107	1631.1*
Factor 2: Impacts	1.872	2.741	0.774	1.778	4551.9*
	n=1,772	n=1,312	n=676	n=1,124	

Notes: *Results are significant at p<0.001; results of K-means—quick cluster analysis; method of analysis: non-hierarchical cluster, final cluster centroids.
The number of GPs clustered is 4,884 (i.e. 84% of the total sample of 5,793); 909 GPs (16%) were not classified.

[66] 36% of the sample of GPs clustered (4,884 GPs) and 31% of the total sample of 5,793 GPs.

[67] 27% of the sample of GPs clustered (4,884 GPs) and 23% of the total sample of 5,793 GPs.

[68] 14% of the sample of GPs clustered (4,884 GPs) and 12% of the total sample of 5,793 GPs.

[69] 23% of the sample of GPs clustered (4,884 GPs) and 19% of the total sample of 5,793 GPs.

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