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From clicks to care: Exploring the digital strategies of Italian health authorities in communicating 'General Practitioner Selection' service

Alessandro Vinci [a,*], Luca Pirrotta [a], Giulia Venturi [b], Milena Vainieri [a]

[a] Management and Healthcare Laboratory, Institute of Management, Sant'Anna School of Advanced Studies, Piazza Martiri della Libertà, 33, 56127, Pisa, Italy
[b] Italian Natural Language Processing Laboratory (ItaliaNLP Lab), Institute of Computational Linguistics "A. Zampolli" (ILC-CNR), Via G. Moruzzi, 1, 56124, Pisa, Italy

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ABSTRACT

The prioritization of digitalization is crucial to the agendas of nations worldwide. While substantial funds have been allocated to foster it, there remains a scarcity of tools dedicated to systematically monitoring the performance of the digital transformation. This work describes the level of digitalization and information of a fundamental primary care service: the "General Practitioner (GP) selection". The analysis was conducted by consulting websites of Italian Local Health Authorities (LHAs). First, we explored the digitalization levels of 105 websites through the Primary Care Digital Information (PCDI) composite index. It comprises four dimensions: informativeness, accessibility, inclusiveness, and adaptability, scoring on a five-point scale (low-high digitalization). Second, we conducted a readability analysis, employing three validated measures. We found an average level of digitalization and information, although dimensions perform differently. The best-performing dimension was adaptability, while the worst was inclusiveness. Half of the LHAs provided several digital alternatives to GP selection, while the remaining provided limited or no options. Regarding readability, just 29% of the LHA's websites were found easy to read. Overall, our findings depict that Italian LHAs have different approaches. This study highlights that, despite best practices, several areas require monitoring and intervention. Moreover, some barriers characterize Italian health communication strategies, notably the variability of information across and within regions and on average low website readability.

1. Introduction

Over the past few decades, the rise of e-government has made public services a prominent topic on the political and research agenda [1–3]. Until recently, this concept was primarily associated with the private sector. As public administrations digitize their processes, they now offer a wide range of services electronically [4].

In accordance with scholarly definitions, e-government pertains to the facilitation of government information and services to the public through digital mediums, such as the Internet [3,5]. Beyond this technical delineation, an additional conceptualization underlines the significance of e-government as a governance tool. Specifically, e-government, as a collection of methodologies, stands as a crucial impetus for the advancement of the public sector. As a practice, e-government entails the utilization of Information and Communication Technology (ICT) to conceive novel or revamp existing information processing and communication strategies. Its primary aim is to optimize governmental operations, particularly focusing on the efficient delivery of electronic services to both businesses and citizens [6–9].

Moreover, the concept of e-government is shifting to a more mature one. Rather than simply moving traditional analog and paper-based activities to the internet, "digital government" calls for a fundamental change in the way processes and interactions are designed and executed [10,11].

In the past decade, e-government has evolved into a more sophisticated concept, capable of addressing the complex digital environment. Digital Transformation (DT) is a "process that aims to improve an entity by triggering significant changes to its properties through combinations of information, computing, communication, and connectivity technologies" [12,13]. Service digitalization contributes to creating public value [14] by enhancing the functionality of traditional services and promoting transparency, which leads to increased accountability and citizen involvement in public administration [6,15]. Additionally, DT enhances efficiency by simplifying access to information [16]. These impacts are evident across various sectors, including public healthcare, but it's important to consider the cultural, physical, and institutional

* Corresponding author at: Piazza Martiri della Libertà, 33, 56127 Pisa, PI, Italy.
E-mail address: alessandro.vinci@santannapisa.it (A. Vinci).

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aspects of the system [17]. However, the introduction of digital solutions also presents challenges, requiring improvements in care quality and operational efficiency to effectively address various operational obstacles [18,19].

This transformation highlights the necessity of extensive engagement with stakeholders to facilitate the shift towards a new era that aptly addresses the dynamic requirements of its users [12,14,18].

Although digitalization is a necessary phenomenon, the challenges that are associated are constantly changing [20]. This dynamic nature of challenges is particularly evident when considering the profound impact of the recent COVID-19 pandemic, which has irrevocably transformed and reshaped our global landscape. Amidst the benefits brought forth by digitalization, one of the key risks lies in the proliferation of diverse experiences and applications, potentially leading to the fragmentation of a concept that was intended to foster closer connections among individuals. Most research has, indeed, underlined relevant heterogeneities across different countries at both national and subnational levels, highlighting how a wide range of social, political, and economic factors drive the speed and breadth of digital innovation experiences [21,22].

Among several actors, the European Union (EU) has emerged as a frontrunner in the global arena for embracing digitalization as a pivotal instrument of governance [23]. Notably, the Digital Agenda for Europe has stood out as a key policy framework employed by the EU since 2010, actively implementing and enacting the principles of e-government and, subsequently, digital governance [24]. Additionally, Europe has been among the pioneering entities to systematically monitor the progression of digitalization within the public sector through the Digital Economy and Society Index (DESI). The European Commission has actively monitored the digital advancement of Member States through the systematic publication of DESI reports since 2014. As of 2023, in alignment with the Digital Decade Policy Programme 2030 [23], DESI has been seamlessly integrated into the State of the Digital Decade report, playing a pivotal role in the continuous monitoring of progress towards predefined digital objectives [25]. The four dimensions that constitute DESI, including Human Capital, Connectivity, Integration of digital technologies, and Digital public services, serve as the fundamental pillars of the composite index. These dimensions provide an overview of the primary trends shaping the digital landscape in Europe, offering insights into the progression of digitalization across the Region. The monitoring of digitalization holds particular significance for Europe, especially considering the profound impact experienced by the region during the pandemic crisis. Digital preparedness remains and will continue to be imperative in effectively navigating future challenges, whether related to pandemics or other critical events [26].

Among EU countries, Italy faced significant difficulties during the pandemic [27], and although it responded admirably and showed resilience, it still had to deal with the severe consequences of the crisis. Specifically, Italy lacked adequate preparation for the shift toward digitalization that occurred in response to the crisis. A more detailed analysis of the most recent Digital Economy and Society Index [25] highlights Italy's challenges, placing it in the 18th spot out of 27 EU member states. Significantly, in the areas of Human Capital and Digital Public Services, Italy falls below the EU average.

The main challenges, yet, not only included the quick and necessary transition to digital healthcare delivery methods, revealing significant regional differences [28]. Particularly, special attention was placed on the communication of digital information, which, during the pandemic period, made a crucial difference in achieving or not achieving population health outcomes [29]. Especially after COVID-19, effective communication and transparency play pivotal roles in mitigating citizens' hesitancy toward the utilization of health services [30]. To enhance access to healthcare, health-related information should be tailored to be easily understandable and readable for all citizens. This emphasis on clear and accessible health communication is crucial for fostering inclusivity and ensuring that healthcare services are readily comprehensible to a diverse range of individuals [31].

Given that individuals with lower educational levels exhibit a higher likelihood of utilizing the Internet as a source for health-related information [32], the Internet emerges as a crucial avenue for citizen education. When disseminating public performance information, it is imperative to ensure that information, intended to be beneficial, aids citizens in their decision-making processes [33]. The adequacy of online health information has been investigated in the Italian context, revealing that a lack of clarity in the information provided can hinder the effectiveness of efforts to inform and engage the public in utilizing health services [34]. Scholars assert that providing comprehensible information is of paramount importance to mitigate the risks of misinterpretation, making the information published unusable for healthcare choices [35].

The relevance of these aspects should be considered when communicating through different channels, particularly catering to individuals with lower literacy skills in a very specialized context like healthcare. On one hand, studies on the readability of health-related information on the Italian official websites, such as materials related to informed consent or health services like vaccines, underscores the persistent challenge of maintaining a high quality of written information [29,36,37]. On the other hand, a study showed that information reported on the websites for waiting times are not always coherent with their usability for booking purposes or benchmarking initiatives [34]. A recent study examining the access and utilization of digital health services from the perspective of the elderly underscores the importance of facilitating communication to support the use of digital health services. Specifically, it appears that in the healthcare sector, there exists a dual gap or divide: i) the digital gap, arising from varying levels of digital competencies, and ii) the digital health gap, associated with challenges in utilizing digital services for health-related purposes [38]. This highlights the importance that the digital transition should not only focus on empowering individuals with digital competencies but also on adopting more effective methods to inform and communicate with users on websites intended to reach populations with varying socio-economic and educational statuses. Clarity and readability on these websites are essential elements for enabling and guiding users in accessing digital services. In this perspective, the DESI index that helps countries understand their overall level of digitization is not enough to support how to improve this transition for specific services.

This study delves into an examination of the digitalization efforts and the quality of information available on the websites of Local Health Authorities (LHAs) in Italy for enabling access to primary care services through the "General Practitioner (GP) Selection". We chose to focus on the "GP selection" service as the focus of our study for several important reasons. First, GPs are often the primary point of contact for individuals regarding their health, acting as gatekeepers for secondary and specialist services and representing a key actor in the health system [39]. Their role in delivering primary care is fundamental, making the ease of accessing GP-related services crucial for citizens. Secondly, the GP selection itself represents, at least in Italy, one of the most essential public healthcare services, as it provides access to the physician who will manage long-term and routine healthcare needs. Ensuring that this service is available and easily accessible to the population, especially through digital means [40], aligns with the broader objective of promoting universal healthcare accessibility [41]. Moreover, the ability to perform online actions related to a service as foundational as GP selection can serve as a proxy for other essential digital services, both within healthcare and in other public sectors, where similar digitization efforts could improve service delivery and accessibility.

Finally, as its primary output, this paper introduces an index that explores and assesses various dimensions of the service under analysis. It serves as an example of a composite measure designed to support healthcare managers and policymakers in developing targeted strategies for effective and specific digital health implementation.

2. Materials and methods

2.1. Study setting

Supported by public taxes, the Italian National Health System (NHS) is a universal healthcare model based on the Beveridge principles [42]. Its two Autonomous Provinces (APs) and nineteen Regions all contribute significantly to its decentralized governance. The three levels of this complex system – national, regional, and local – all play a part in providing all-encompassing healthcare services. To guarantee equal access across the country, the government is in charge of defining essential healthcare benefits at the national level [43]. It also distributes funds around the regions, which helps to create a unified system of healthcare delivery. In their role as supervisors, regional authorities plan and direct the delivery of healthcare services inside their purview. Primary, secondary, and tertiary healthcare services are provided directly to individuals at the local level.

This study focused on the analysis of GPs' information gathered from the LHAs' websites. The list of websites was taken from the Italian Ministry of Health [44]. A total of 105 LHAs' websites were analyzed considering the aspects cited by the Italian national guidelines for the "Design for Websites and Digital Services of Public Administration – Guideline Section 4.3" [45]: i) adopt a people-oriented approach; ii) explicitly define and assess; iii) conduct user research activities; iv) map users scenarios and functionality; v) consider the results of users research; vi) conducts usability tests; vii) used controlled vocabularies; viii) utilize language suitable for the target users; ix) ensure easy findability of published information. The complete table is available in the appendix.

Similarly to other studies in this field [29,34,46],we mapped the websites' information and the possibility of using a checklist for different dimensions adding specific analyses for the readability dimension.

In the context of the first aspect, this analysis aimed to explore four dimensions related to the online communication of Italian health institutions: accessibility, informativeness, adaptability, and inclusiveness of information. From a citizen's perspective, the investigation focused on confirming the presence of accurate information regarding the online GP selection service, assessing its accessibility, and determining the feasibility of making a visit reservation based on the provided information. Simultaneously, the second aspect involved an evaluation of the readability of textual information on the LHAs' website related to GP selection service.

2.2. Digitalization and informational dimensions

For digitalization, the dimensions analyzed were: accessibility, informativeness, inclusiveness and adaptability of information. In Table 1, the rationale for each of the four analyzed dimensions is presented.

These dimensions were conceptualized in an iterative process based on the literature and practical evidence as reported in the table above.

These domains were organized in a common grid comprised of fifteen variables as presented in Table 2A (see appendix). For the compilation of the evaluation grid, we employed the "simulated clients" or "mystery shopper" technique [53–55]. Mystery shopping constitutes a variant of "participant observation" wherein researchers assume the role of customers or potential customers. This methodological approach involves the systematic observation of processes and procedures employed in the delivery of a service [56]. This technique is rooted in the principle of simulating the viewpoint and experience of common users, ensuring that the evaluation grid reflects the comprehension and expectations of individuals who might interact with the healthcare system without specialized medical knowledge. Although traditionally associated with the private sector, recent research advocates for the extension of mystery shopping to other industries, particularly in healthcare service evaluation [57–59]. Moreover, mystery shopping, in the latest literature review, is also considered to be an appropriate tool to measure public service delivery, analyzing specifically its use in the public sector [60].

Table 1
Service digitalization dimensions under study.

Dimensions	Objective	Key Aspects
Accessibility [47, 48]	*To evaluate the extent to which the websites provide comprehensive information about the GP selection service.*	*Involves determining whether users can choose or change their GP and if information about appointment booking is available.*
Informativeness [49]	*To assess the ease of accessing essential information about GPs on the websites.*	*Involves checking the presence of a list of GPs, real-time availability, contact details (telephone and email), clinic locations, and reception hours.*
Inclusiveness [50,51]	*To examine the inclusivity of the websites, addressing the needs of both residents and, especially, non-residents citizens.*	*Focuses on providing information about GP choice for non-residents citizens and directing users to relevant information for non-Italian citizens.*
Adaptability [52]	*To assess the adaptability of the websites to different devices and the ease of accessing relevant services.*	*Involves checking if the GP reference is on the Home Page, determining the number of clicks to get to the actual service, assessing mobile/tablet accessibility and the existence of a dedicated app for GP services.*

This expansion aims to capture the perspective and experiences of potential healthcare service users, emphasizing the significance of their viewpoint and fostering engagement [58].

In our study, we selected three researchers outside the medical domain. The aim was to capture the experiences of a diverse user base and avoid any biases that might arise from a more specialized perspective. The entire process of grid compilation, spanning from October to December 2022, underwent supervision and validation by the authors through a series of alignment meetings during the same period of compilation. Every researcher was assigned one-third of the total 105 observations. The researchers also extracted text for the readability analysis in the same proportion as mentioned above. For each text related to the service under investigation, each researcher had to copy the text into a Word document and format it as plain text. In the end, the researchers and the authors conducted a final cross-check on the variables compiled in the common grid. The authors also reviewed the extracted text, removing acronyms (e.g., ASL, MMG, PLS) and any reference to norms and laws under the form of an acronym (e.g., LR, DGR, etc.) to analyze the text only in relation to its syntactical and lexical simplicity and correctness.

Upon finalizing the common grid assessment for all 105 LHAs' websites, we consolidated the outcomes across the four macro-areas to establish an indicator capable of evaluating the digitalization level of information regarding the GP selection service.

This indicator, termed the Primary Care Digital Information (PCDI) index, underwent refinement through multiple consensus meetings [61]. During these meetings, a decision was made to selectively use variables initially identified for each dimension definition. Specifically, after the initial list of variables was developed and conceptualized by the research team, with reference also to previous studies in this field [29, 34], the variables were presented during a preliminary consensus meeting held in November 2022 between the research team and representatives from the LHAs involved in the Interregional Performance Evaluation System (IRPES) [62]. During this meeting, the first proposal for aggregating the variables into the dimensions that compose the PCDI was also introduced. From the initial list of 25 variables (see Table 2A in the Appendix), only 13 were ultimately selected. It is important to

highlight that of the 25 initial variables, variables numbered 0, 1, 1. Notes, 2, 4.Notes, 5, 9.Notes, 11.Notes, and 15 were purely descriptive and did not have any scores assigned to them. Instead, variables 3, 11, and 14 were excluded following the consensus meeting. Specifically, variable 3 ("Is the site up and running?") applied positively to all observations in our dataset, and thus, it was agreed that its inclusion in the PCDI scoring would not be meaningful. As for variable 11 ("If online services are present, what modes of access do they offer?"), in almost all cases, access to services was available through multiple channels, including digital identity services (e.g., SPID, CNS, etc.). Therefore, this variable was also excluded from the composition of the index dimensions. Lastly, variable 14 ("Is there a mobile application that allows citizens to perform operations for the GP service?"), although it provided useful insights into app development, was not included in the analysis. This exclusion was based on the fact that mobile apps, while a natural extension of the services offered by LHAs, are external to the primary observational unit of this study, which remained the LHA's websites. Consequently, this variable was excluded from the PCDI dimensions, with further exploration of this topic left for future research.

The last version of the set of variables selected was presented in March 2023, and organized according to the PCDI dimensions (see Table 3A in the appendix) during a second consensus meeting with the same. This meeting provided final approval for all the included variables, as well as the weight assigned to each variable in the final score.

Each variable was aggregated under a specific dimension of the PCDI, aligned with the definition of each dimension as outlined in Table 1. Each dimension was designed to have a maximum score of 5 points, and the variables within each dimension were assigned a weight consistent with this objective. The four dimensions that comprise the PCDI can thus each reach a maximum score of 5 points, calculated as the sum of the variable scores within the dimension. The regional scores in this study are calculated as the average of the PCDI scores of each LHA within the region's jurisdiction. This also applies to the readability analysis.

Finally, the global PCDI score is determined by averaging the scores of each dimension, with a maximum possible score of 5 points.

A comprehensive summary of the variables, their respective scores, and weights is presented in Table 1A, available in the appendix.

An extensive readability analysis, based on the texts extracted from the LHAs' official websites, was conducted to assess the quality and linguistic complexity of the texts. Two well-known indexes, the Gulpease index [63], and the READ-IT index [64], were employed to gauge text quality. Additionally, the New Basic Italian Vocabulary (NBIV) was utilized to appraise lexical complexity [65].

The results of the PCDI and the readability analysis of the websites were presented at two public events in June 2023. The events were attended by various stakeholders of the health system, including practitioners, decision-makers, LHA representatives, and members of the academia. These results received final approval, upholding the principles of accountability and transparency, in line with the necessary guidelines for producing composite indicators that have a system-wide impact [66].

In Table 2, an overview of all three dimensions of our readability analysis is provided.

The results of both PCDI and readability analysis were also shared with the researchers who acted as "mystery shoppers."

2.3. Data Analysis

Both the PCDI and readability analysis were assessed using a score ranging from 0 to 5 in line with the assessment criteria applied in the IRPES that provides a comprehensive picture of the performance obtained by the health authorities of half of the Italian regions which is used by local and regional governments to assess their results and orient their behaviors [62]. IRPES assessment bands are excellent (5), good (4), average performance (3), poor (2), or very poor (1). These five evaluation tiers are associated with different colors, from dark green (excellent performance), to red (very poor) [62]. Applying IRPES methodology, we assessed the performance of all level governments in the Italian health systems: LHAs, Regions, and Central governments considering their nested structure (e.g., the regional level is the average of the assessment obtained by the LHAs settled in its territory).

Table 2
Readability dimensions under study.

Dimensions	Description
READ-IT	*Utilizes advanced Natural Language Processing (NLP) technologies to evaluate the level of difficulty of a text. Scores range from 0 to 100, with higher scores indicating greater difficulty. It screens various linguistic factors affecting readability* [36,64,67].
Gulpease	*Measures text readability with a scale from 0 to 100, where higher scores denote easier readability. A score above 80 suggests easy readability for less educated individuals (primary school), while a score below 40 indicates comprehension mainly by medium-high educated individuals (high school)* [63].
New Basic Italian Vocabulary (NBIV)	*Assesses lexical complexity by calculating the percentage of words adopted from the New Basic Italian Vocabulary (NBIV), which includes the most familiar Italian words. A percentage above 80% designates the text as easy to understand* [65].

The PCDI was already expressed in a five scale as the mean of the score of the four dimensions, as detailed in the appendix.

This process was discussed and validated by the representatives of the regions included in the IRPES as well, and it was also discussed and positively commented by representatives of Italian associations and government working in digital health in specific meetings, as stated in the previous paragraph. The three readability indexes are quantified on a scale ranging from 0 to 100. For the NBIV and Gulp-ease, a score of 0 indicates poor readability while a score of 100 signifies excellent readability. Conversely, for the READ-IT, the scoring is inverted, where 0 represents excellent readability and 100 indicates poor readability.

The three readability indexes were assessed by applying the IRPES criterion based on the average value of all the units analyzed and then transformed and aggregated into a "Readability Index", assessed on a five-point scale to be used as all the other indicators in the IRPES. Both the PCDI and readability analysis assessment bands are calculated based on the distribution of observed values.

In the data collection phase, Microsoft Excel (Microsoft Inc., Redmond, Washington, USA) was employed to systematically gather information based on the common grid (see Appendix). The subsequent graphical representation of the collected data was executed using PowerBI, another tool from Microsoft Inc. In this way, the recipients of this study (the regional and local managers) can have a tool able to drill down as a cascade all the information collected to understand which aspect needs to be improved. Variability analysis (ANOVA, t-test, chi2) among different regions in Italy was conducted to discern patterns and differences.

For the readability analysis, the text extracted from the websites was evaluated through an Automatic Readability Assessment algorithm [64], which employs Machine Learning methodologies, specifically Support Vector Machines through LIBSVM (Library for Support Vector Machines) [56]. This computational model, developed from a training corpus, extracts and analyzes features that model linguistic complexity, as demonstrated in the literature, to assess lexical and syntactic factors potentially impacting patient comprehensibility of websites [68].

3. Results

3.1. Primary Care Digital Information (PDCI) Index

Results report a nationwide mean score of 2.48 out of 5 for the PCDI.

On a national scale, adaptability emerged as the most commendable dimension (mean 3.89, SD 1.28), whereas inclusiveness lagged as the least satisfactory (mean 1.10, SD 1.57).

We found a statistically significant difference between and within regions ($p<0.001$), with northern Regions generally performing better than central and southern Regions. The autonomous province of Trento has the highest PCDI, reaching 4, followed by Umbria (mean 3.63, SD 0.13), while the worst score is recorded by Sardinia (mean 0.7, SD 0.82) and Molise (mean 0.75).

Fig. 1 reports a complete view of the results. The table on the left reports the regional means score of PDCI and of the four dimensions included to assess it. The map on the right reflects the national fragmentation of the service, representing LHAs' results.

More specifically, approximately 70% of the analyzed websites feature a reference to the General Practitioner (GP) service on their homepage, facilitating easier access to information. Among these, 78% provide a detailed list of GPs within the page, offering citizens all the necessary details for contact.

Concerning the GP service accessibility, the situation appears more fragmented. Overall, about 35% of websites do not offer the choice or change of the GP service directly on the web portal. Among these, 9.52% provide information on how to avail of the service by calling the National Health Service, while just under 25% of sites do not mention the service at all.

The situation is critical for non-resident citizens, as approximately 70% of LHAs' websites do not provide specific information about the service, while 17% provide information but without the option to use the service online. Only 12.38% of LHAs' websites present the option to perform the service of selecting/changing the General Practitioner online.

Overall, nationwide, on average, it takes 2.52 clicks to access the service starting from the Home Page. Lastly, among LHAs, 14 mobile applications dedicated to GP services were found.

3.2. *Readability Analysis*

In terms of readability of the collected texts, the national average stood at 2.51, graded on a scale of 0 to 5, indicating that, overall, texts related to GP service' were found to be difficult to read.

As for READ-IT, the national average was 48.78, graded on a scale of 0 to 100 (indicating good to bad readability). Regionally, the READ-IT index ranged from a minimum score of 32 to a maximum of 62 (see Fig. 1A in the Appendix).

The national mean percentage of words belonging to the NBIV is 70.52%, ranging from 76.27% to 59.33% (Fig. 2A in the Appendix).

The Gulpease Index (Fig. 3A in the Appendix), the only index directly related to the individual educational level, reported a national average score of 44.61. At a regional level, the lowest score was obtained by Umbria (mean 39.84), while the easiest texts were found by Calabria LHAs (mean 50.7). Gulpease index results confirm that texts are very difficult to read or incomprehensible by less educated people, while people with high school diplomas should find them easier to read.

Fig. 2 presents the results for all italian regions, showing the NBIV, Gulpease and READ-IT indexes, along with the global readability index, calculated for every region.

Overall, the analysis of readability indicates that the examined texts, despite containing a substantial percentage of words from the NBIV category, exhibit intricate linguistic features. These include the presence of numerous subclauses, intricate structures in verbal predicates, sentence constituents arranged in non-standard orders, and embedded sequences of subordinate clauses.

4. Discussions

The findings of this study reveal substantial disparities in the digitalization levels of primary care services throughout Italy. The PCDI scores elucidate a fragmented landscape, indicating that the adoption of digital transformation in LHAs is not uniform across the country. Certain LHAs exhibit more effective embraces of digitalization than others, emphasizing the necessity for a cohesive and consistent approach to healthcare digitalization. These disparities not only impact user experience but also influence the overall efficiency of primary care service delivery. Addressing these variations is crucial for achieving a higher standard of healthcare accessibility and quality as well as the implementation of health information technologies [69–71].

Regions	Accessibility	Informativeness	Adaptability	Inclusivness	PC Digital Index
ABRUZZO	2,00	1,00	3,50	0,00	1,63
AOSTA VALLEY	5,00	3,50	5,00	0,00	3,38
APULIA	3,00	3,50	4,00	0,00	2,63
BASILICATA	4,00	0,00	2,50	0,50	1,75
BOLZANO	5,00	2,50	5,00	1,00	3,38
CALABRIA	0,50	3,00	3,00	1,25	1,94
CAMPANIA	1,57	0,64	4,43	1,43	2,02
EMILIA ROMAGNA	2,00	2,75	4,00	1,13	2,47
FRIULI VENEZIA GIULIA	1,67	3,67	3,33	1,67	2,58
LAZIO	0,90	1,00	4,40	1,10	1,85
LIGURIA	3,20	4,50	5,00	1,00	3,43
LOMBARDY	4,25	3,31	4,00	0,56	3,03
MARCHE	1,00	5,00	4,00	0,00	2,50
MOLISE	0,00	2,00	1,00	0,00	0,75
PIEDMONT	3,75	2,33	3,75	1,88	2,93
SARDINIA	0,38	1,06	1,38	0,00	0,70
SICILY	1,67	2,17	4,67	1,06	2,39
TRENTO	5,00	3,50	5,00	2,50	4,00
TUSCANY	3,00	3,50	4,67	3,17	3,58
UMBRIA	3,00	3,50	4,50	3,50	3,63
VENETO	4,56	3,61	4,22	1,44	3,46

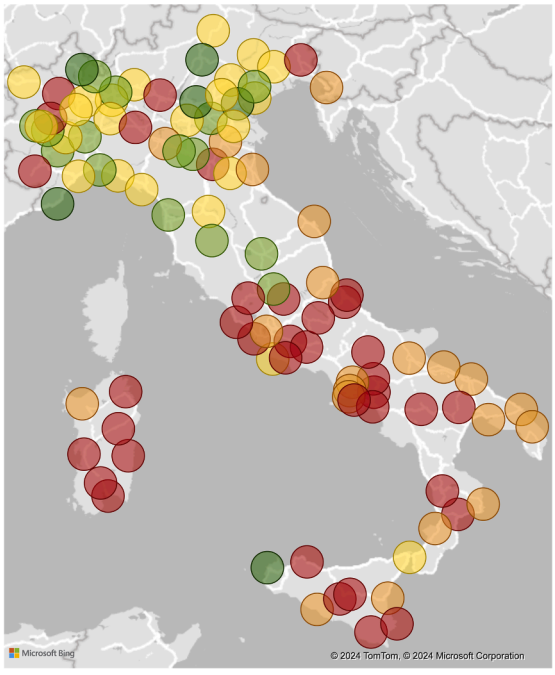

Fig. 1. Regional and Local PCDI results. Regional scores are reported as a mean of the scores of the LHAs populating the Region.

Regions	NBIV	GULPEASE	READ-IT	Readibility index
ABRUZZO	66,83	46,95	58,12	2,10
AOUSTA VALLEY	62,78	42,65	57,01	2,35
APULIA	73,46	45,44	62,92	1,63
BASILICATA	55,92	37,46	45,95	2,85
BOLZANO	69,62	44,46	41,67	2,98
CALABRIA	73,47	44,85	53,51	2,49
CAMPANIA	73,01	43,66	46,86	2,51
EMILIAROMAGNA	55,61	41,44	50,34	2,66
FRIULI VENEZIA GIULIA	69,73	45,28	47,76	2,64
LAZIO	70,54	43,29	43,06	2,59
LIGURIA	71,27	42,90	48,91	2,57
LOMBARDY	67,49	42,67	56,46	2,10
MARCHE	70,69	44,24	34,63	3,20
MOLISE	71,33	45,28	45,62	2,88
PIEDMONT	69,41	45,46	48,60	2,60
SARDINIA	66,10	42,35	44,23	3,03
SICILY	74,61	46,67	48,26	2,97
TRENTO	67,93	45,69	53,71	2,50
TUSCANY	67,78	43,77	47,15	2,55
UMBRIA	72,53	41,93	51,63	1,99
VENETO	74,21	43,17	50,09	2,71

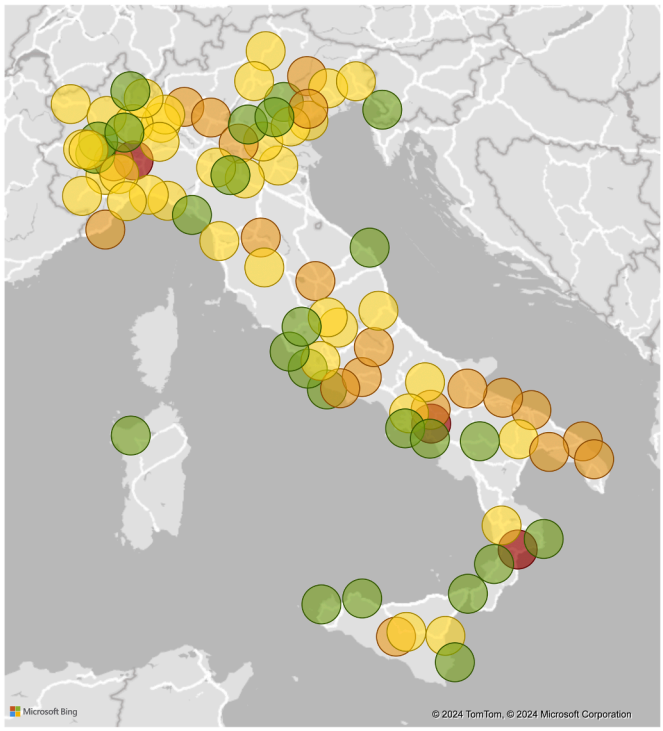

Fig. 2. Regional and Local Readability analysis results. Regional scores are reported as a mean of the scores of the LHAs populating the Region.

5. Limitations and future research

Our study presents some limitations: a) dimensional focus: the study's scope is delimited by the dimensions selected for evaluating the PCDI Index, potentially constraining the breadth of inquiry. While these dimensions offer valuable insights, a comprehensive understanding of other dimensions might be required; b) snapshot in time: the study provides a snapshot of a specific moment, scrutinizing LHAs' websites. Rapid changes in website content pose a limitation, as the dynamic nature of online platforms could influence the analysis over time. Continuous monitoring and periodic reassessment would offer a more dynamic perspective; c) contextual specificity: The findings are intricately tied to the Italian healthcare landscape, limiting immediate generalizability. Whilst the methodology holds promise for replication in diverse public sectors and countries, caution is warranted in extending the study's outcomes beyond the Italian context.

Moreover, as some academics have pointed out, there are certain limits to the mystery shopper approach, especially about the findings' external validity and generalizability [60,72]. These assessments typically have small sample sizes, which calls into question whether the findings are truly representative [72]. However, the main goal is to present a "snapshot" of service encounters at a specific time rather than to represent the experiences of the entire population [60]. This study, while acknowledging the limitations of the methodology, aims to evaluate the usability of LHA websites at predetermined intervals. Furthermore, we acknowledge the subjective aspect of the mystery shopper's assessment, as factors like misremembered details, one's own look, or prior experiences could influence the conclusion [73]. Even though a structured assessment grid was employed, it is crucial to remember that this instrument might not fully capture the relationship dynamics of the service [74]. To obtain a more comprehensive understanding, future research could benefit from a mixed-methods strategy that combines the mystery shopper technique with other methodologies, like customer satisfaction surveys [75].

Taking into account the limitations mentioned previously, there are potential future research areas to consider. In this paper, we focused on a specific access channel. Future research should examine broader, macro-level factors that could impact service accessibility and usability. While our analysis focused on the website as the primary access channel, we recognize that other important factors could significantly influence overall service effectiveness. Additionally, procedural barriers were not explored in this study. Future studies should consider these factors to gain a more comprehensive understanding of the digitalization of healthcare services and their integration within the broader healthcare framework.

Another aspect to explore involves gaining a better understanding of the factors contributing to the disparity that we have found according to LHAs websites' specific information for non-residents, which could greatly benefit from the GP selection service. For example, correlating the results with immigration rates in each of the Regions analyzed could help identify which areas may require greater investment, giving higher immigration rates or other collateral factors influencing it.

6. Conclusions

Our study represents a pioneering empirical effort to assess and measure the digitalization and actionability of information in public services and, specifically, in primary care through the introduction of the Primary Care Digital Information (PCDI) index together with the readability domain.

The PCDI index introduces an innovative approach to assessing digital health services, distinguished by its versatile application across multiple governance strata. Such adaptability is significant, addressing the prevalent issue where national-level performance metrics are often too generalized, impeding policymakers' ability to address particular problems [15,76]. This research highlights significant practical implications in the context of digital information regarding the selection of GPs in Italy. For GP services' information, significant regional differences emerge, with northern Regions outperforming most of the central and southern ones. The Autonomous Province of Trento and Umbria Region demonstrate exemplary practices, providing learning opportunities for other regions. The identified disparities highlighted by our study emphasize the need for a unified national digitalization strategy, fostering collaboration to elevate the standard of digital services and

using performance indicators guiding the implementation stage.

Nationally, the adaptability of web platforms surpasses other dimensions, indicating the presence of information on the Home Page of the websites and overall user-friendliness on various devices. However, accessibility challenges are evident, with approximately 35% of websites not offering online options for GP service selection, posing potential barriers for citizens who prefer online interactions. Additionally, the conspicuous absence of specific information for non-resident citizens on 70% of websites accentuates the pressing need for more inclusive information dissemination. This information gap is particularly significant in major university cities or areas with high internal immigration rates. In Italy, even if not mandatory, individuals relocating are often required to change their GP, making this service crucial. Consequently, large cities with a substantial influx of residents should prioritize and ensure high levels of inclusiveness in providing information about GP selection. This not only supports the diverse population but also aligns with the broader goals of public health, ensuring that individuals, including those who have recently relocated, can easily access and navigate essential healthcare services. The inclusivity of information becomes paramount in fostering a healthcare system that adapts to the dynamic demographics of urban centers with diverse and evolving healthcare needs. Empirical evidence within the scholarly literature [77–79] indicates that a considerable proportion of immigrant populations tend to directly seek medical attention from emergency departments or through hospital admissions. Providing information about fundamental healthcare services, such as those offered by GPs, constitutes a pivotal measure towards ensuring a more effective and efficient use of healthcare facilities and services.

In terms of readability, the national average READ-IT index of 48.78 suggests suboptimal readability, posing potential challenges for the public in understanding health information. The Gulpease Index confirms that texts may be challenging for less-educated individuals, emphasizing the importance of clear communication for diverse literacy levels. The relatively low overall educational attainment in Italy may contribute to the readability challenges observed. Yet, with ongoing educational opportunities and awareness initiatives, there is optimism for an improvement in Italians' general education levels. This enhancement in education could, in turn, boost overall health literacy, making health information more accessible and understandable for a broader audience.

Also, it is noteworthy that individuals with lower levels of education often turn to the Internet for health-related information [32]. Given this tendency, the challenges posed by suboptimal readability could disproportionately impact this demographic, hindering their ability to access and comprehend essential health information. Certainly, ineffective communication arising from inadequate harmonization and unclear information provision has the potential to compromise efforts aimed at engaging patients and directing them toward the appropriate utilization of services [80].

Enhancing the clarity and readability of online health information becomes not only a matter of improving overall health literacy but also a means of promoting equity in access to healthcare resources [31]. Policymakers and healthcare communicators should consider tailoring digital health content to be more accessible to individuals with varying educational backgrounds, ensuring that everyone can make informed decisions about their health. This approach aligns with the goal of fostering inclusivity and reducing disparities in health information access across different segments of the population.

In conclusion, our study underscores the importance of comprehensive digitalization in health communication and, generally, in public services. The dynamic nature of digitalization challenges necessitates continuous monitoring, and policymakers can use this study's findings to implement targeted interventions, addressing specific gaps in digital communication and readability. Collaborative research initiatives involving health authorities, academic institutions, and technology experts can contribute to evidence-based policies and practices.

Indeed, the study posits a research agenda. Some of them are referred to methodology, such as the idea to validate and adapt the approach of PCDI and readability to diverse countries for a broader generalizability. Others instead are related to the use of these dimensions to monitor and understand the improvement strategies put in place to bridge gaps in the various dimensions. Simultaneously, starting from the dimensions analyzed in our study, there is a call for investigating other measures of performance evaluation in digitalization, extending beyond healthcare to encompass public services more broadly. Addressing these gaps can contribute to a more cohesive and inclusive digital landscape. Moreover, this study spotlights a crucial concern regarding the readability of healthcare information on LHA websites, paving the way for future investigations. The analysis signals an opportunity to improve information accessibility. Future studies could explore innovative interventions to enhance readability, ensuring equitable access to vital health information. Simultaneously, examining the impact of enhanced readability on user decision-making and healthcare outcomes can provide valuable insights. While emphasizing the need for strategic investments in healthcare information readability, future research should pinpoint specific areas for effective interventions. Additionally, exploring the broader implications of readability enhancements on user experiences in the evolving digital landscape is crucial. Beyond healthcare, future studies should investigate alternative measures of performance evaluation in digitalization across public services, offering a comprehensive understanding of the digital transformation's impact.

CRediT authorship contribution statement

Alessandro Vinci: Writing – original draft, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Luca Pirrotta:** Writing – original draft, Investigation, Formal analysis, Conceptualization. **Giulia Venturi:** Writing – original draft, Formal analysis. **Milena Vainieri:** Writing – review & editing, Supervision, Methodology, Conceptualization.

Declaration of competing interest

The authors declare that they have no conflicts of interest.

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Supplementary materials

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