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To cite this article: Sabina De Rosis & Milena Vainieri (2016): Incentivizing ICT in healthcare: A comparative analysis of incentive schemes in Italian Regions, International Journal of Healthcare Management, DOI: [10.1080/20479700.2016.1219808](https://doi.org/10.1080/20479700.2016.1219808)

To link to this article: <http://dx.doi.org/10.1080/20479700.2016.1219808>



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Published online: 19 Sep 2016.



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Incentivizing ICT in healthcare: A comparative analysis of incentive schemes in Italian Regions

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Abstract

Background: The use of Information and Communication Technologies (ICTs) in healthcare has been presented as a potential solution to the current challenges that healthcare systems have to face. The introduction of ICTs may need initial investments and, moreover, may produce changes in the routine practice of the healthcare system. Financial incentives are expected to be an effective managerial tool to communicate a strategic vision and a mandate, to improve the adherence to the strategy and to promote a consistent individual behaviour. In this perspective, financial incentives are assumed to accelerate the ICTs adoption and use in healthcare. The aim of this study was to investigate whether and how Italian Regional healthcare systems use the Chief Executive Officers' (CEOs) reward scheme to stimulate the implementation of ICT in healthcare.

Materials and methods: A content analysis was conducted on the Italian Regional acts on healthcare CEOs incentive schemes, that were approved in the period 2010–2012 and with a legal validity that ranged from 1 to 4 years (until 2014). The acts cover around 60% of the Italian Regions. ICT goals were identified, categorized, and compared using descriptive statistics.

Results: This study identified two areas on which financial incentives related to ICTs were mainly focused: (i) ICT infrastructure and architecture; (ii) flows and processing of economic and financial data. The use of technology to better store and process medical data (i.e. EHR-like systems) were only marginally present. Use of e-Health and m-Health solutions for providing healthcare services, valorization of 'health big data' in a community care perspective, more advanced applications of technology for monitoring or preventing diseases were not incentivized for CEOs in Italy.

Conclusion: The use of ICTs in healthcare appears to be of general interest in Italy: a great number of Italian Regions introduced specific goals into CEOs financial schemes. Efforts in this field seem to be not linked to the objectives of better care at sustainable cost, while it appears important to ensure a better and wider presence of enabling environments and to implement ICT-based control systems.

Keywords: ICT, Financial incentives, Incentive scheme, Healthcare CEO, Italy, Regions

Introduction

A widespread adoption of Information and Communication Technologies (ICTs) is expected to improve healthcare, while allowing for significant savings.^{1–3} In fact, there is growing scientific evidence on the potentiality of ICT adoption and use in healthcare, regarding appropriate services, as well as high quality and efficient care.^{4–10} The use of ICT in healthcare may produce positive impacts on the performance of the healthcare system or organization, regarding both the financial aspects and the healthcare outcomes.⁹

ICT in healthcare generally refers to a broad range of healthcare interventions⁹ based on tools and services using information and communication technology, for providing prevention, diagnosis, treatment, monitoring, management of diseases, and patients empowerment.¹¹ The use of ICT in healthcare is generally indicated with the term e-Health. There is not a consensus on the definition of e-Health, in the literature. Eysenbach defined e-Health as the 'intersection of medical informatics, public health and business, referring to health

services and information delivered or enhanced through the Internet and related technologies'.¹² While this definition includes primarily Internet-based solutions; commonly the term e-Health indicates a wider range of ICT-based health-related interventions. Similarly, the terms Tele-Health, Tele-HealthCare, and Tele-Medicine were used for indicating a way to ubiquitously provide, respectively, healthcare, social care, and clinical services related to the hospital setting utilizing telecom technologies.¹³ However, the distinction based on the typology of technology is blurred, due to a convergence of digital media. Actually, these words are used interchangeably¹⁴ and are increasingly seen as sub-domains of e-Health.

By constructing the categorization of e-Health solutions according to different purposes as anticipated, it is difficult to reach a unique definition too.¹⁵ Depending on the scope, several different healthcare settings may be involved in an e-Health solution or system: hospital care; primary care; home care; community care; welfare; and social care.

Independently on how it is defined, the term e-Health is increasingly used for indicating an increasingly variety of interventions implemented in healthcare organizations:⁹ just for exemplifying, from the Health Information System (HIS), to the Electronic Health Records (EHR) and EHR-like systems; to at-a-distance monitoring of vital signs; to ICT-supported rehabilitation; to health and well-being applications for smartphones and tablets; to health-related big data.¹⁶ According to a recent systematic review,¹⁷ e-Health technologies are categorized as following: (i) technologies that allow to store, manage, and transmit data; (ii) technologies that allow the use of data, information, and knowledge for supporting decision-making; and (3) technologies that facilitate the remote care.

ICT solutions are increasingly available also without great investments. In several countries, this has facilitated the introduction of policies and incentives aimed at promoting a rapid adoption of ICT in healthcare.^{9,10,18}

A growing number of countries all over the world have experienced the adoption of several ICT solutions, from basic ICT applications to more advanced and interactive tools.¹⁰ However, a wider number of countries remains in the first stages of information systems development and computerization of healthcare functions.

By adopting the European e-Health Action Plans and the European Digital Agenda, the European Commission promotes policy development and deployment at country level regarding the adoption of ICT in healthcare.^{18-20,39} In particular, European

policies encourage the adoption of interoperable information systems, the wisely use of medical health data, the adoption of mobile health initiatives, and the focus on the patients' empowerment.¹⁹⁻²¹ European funding programmes have incentivized the adoption of technologies in this sector.^{9,18} The ICT use in healthcare has been also promoted by the World Health Organization, applauding the introduction of e-Health, Tele-Medicine, and social media in healthcare sector.²²

Given the general consensus, both from researchers and decision-makers, on the potential impact of ICT use on the efficiency and efficacy of healthcare services, the aim of this research was to explore if and how the healthcare organizations are strategically oriented in the achievement of their annual goals with the support of ICT solutions. In particular, this paper detects the Italian Regional strategical orientation using the CEO's financial incentive schemes.

Background

Incentive systems have been widely adopted in healthcare system as levers to improve the healthcare organizations performance. Generally, incentives are used as tools for aligning individual behaviours with organizational goals.²³ The focus of this research study is on monetary or financial incentives, widely studied in the field of pay for performance (P4P). P4P models are aimed at directing managers' behaviour, by using financial incentives. The basic assumption of P4P models is that monetary bonuses can motivate people to achieve performance targets. It is expected to improve quality, efficiency, and productivity, as well as to stimulate organizational innovation.²⁴ By paying more for obtained results or actions, P4P incentives can reduce the individual barriers to change.

P4P incentives can be applied at three different levels:²⁵ the healthcare national or regional system (i.e. the health plan; the regional health act); the healthcare services provider, organization, or institution; the individual. The literature about P4P incentives is generally focused on the individual level, exploring mainly the impact of these mechanisms on the doctors.^{25,26}

Despite this large interest on impact of incentive mechanisms in healthcare, there are still few evidence on the financial incentive schemes for top managers. A recent review found robust evidence on the positive association between the financial performance of the healthcare organization and the payment of the Chief Executive Officers (CEOs).²⁷ On the contrary, inconsistent results

emerged regarding the association of CEOs recompenses and the health outcomes or performance of the organization.²⁷ In Italy, Regions are increasing the number of performance indicators into CEO rewards schemes, which were found to have a positive influence on performance improvement. Yet, some Regions do not follow all management control suggestions (e.g. clarity, use of quantitative indicators). As a consequence, they are not able to differentiate the performance-related pay between their CEOs thus weakening the P4P strategy as a governance tool.²⁸

The incoherent results of P4P models on non-financial performance of the healthcare organization may be explained referring to: (i) the lack of integration of the reward and control systems; (ii) the definition of a control system mainly referred to financial goals; and (iii) the assessment of goals based on qualitative measures, or inconsistent and problematic indicators.

In the Italian context, the regional mechanisms of governance are often not integrated, in particular with regard to the integration between systems for incentivizing and rewarding, and systems for performance measurement in healthcare organizations.²⁹ The lack of consistency and integration may impede sharing and achieving organizational goals and performance improvement. In the incentive schemes, often regional strategies are not translated into measurable goals; while these latter are based on measures related to efficiency and volume of provided services, rather than to healthcare outcomes.³⁰

In contrast, content and intensity of goals are extremely important.³¹ In the goal setting theory, the definition of goals must be adherent to quantitative methods, to assure goals' efficacy and appropriateness.³² The goals content should be clear, specific, and challenging, but realizable. The intensity of goals refers to mechanisms of feedback and participation, which are also important in changing behaviour.³³ The process planning *per se* has assumed an increasing importance in this field, both in the early stage of design of the incentive mechanisms, and in the ongoing phases of measurement, monitoring, and evaluation. The interactive processes based on engagement are recognized as crucial in the highly professional systems, such as healthcare.³⁴ With regard to this, accountability and transparent public ranking can promote mechanisms of peer review and pressure, which contribute in achieving the incentive mechanism goals.

The present study aims to contribute providing an in-depth analysis on the use of incentive systems for the ICT in healthcare, by comparing incentive schemes currently implemented in Italy for CEO of

public healthcare institutions. The research investigates if the decentralized healthcare governments in Italy apply managerial approach to promote the implementation of ICT in healthcare.

Aims

This research work analyses the following aspects the design of effective goals, according to the literature, by identifying characteristics of transparency, clarity, and specificity. In particular, the use of quantitative targets indicated a more transparent and comprehensible system, due to the non-subjective interpretation of their content. The presence of sub-goals indicates a higher specificity of the incentive system, because it allows for a direct and clear identification of the requested results and of the ways to achieve them. The indication of the goals' weight make explicit and clear the incentive mechanisms, by indicating what is strategic for the healthcare organization in the goals' achievement. The analysis is also aimed at outlining the local variation in CEOs reward scheme to stimuli the implementation of ICT in healthcare, by comparing number and weight of goals among Regions.

Methods

The present study is part of a larger project commissioned by the Italian Ministry of Health, aimed at analysing whether if and how Italian Regions define goals and indicators for incentivizing healthcare CEOs. The analysis was performed in the 2012, on the last available and legally valid regional acts on healthcare CEOs reward systems. Results of the whole research project were shared with Regional policy makers in July 2015, for checking and discussion. They confirmed that the findings captured the ongoing status of their Regions.

Study and policy context

Italy has a public healthcare system, which ensures universal coverage and is financed by general taxation and largely free of charge. After the devolution process of the 1990s, Italian Regions are responsible for organizing and delivering health services. Each Regional healthcare system is managed by Local Health Authorities (LHA) that are composed by hospitals, prevention departments, and healthcare districts.

Italy presents 20 Regions, one of which is an Autonomous Region (RA). In the Region of Trentino-Alto Adige, the two Autonomous Provinces (PAs) of Bolzano and Trento have healthcare responsibilities. Thus, those PA were considered authorities as the other Regions.

Each Regional Governments can approve political and administrative decisions, by formalizing them into official juridical Acts (e.g. Decree and Deliberations). The regional systems of financial incentives for managers of healthcare organizations are ratified into Regional Acts.

The analysis of incentivized ICT goals was based on a documental analysis of official Regional Acts, which covers 14 Italian Regions and Provinces. We included in the analysis the following Regions: Basilicata, PA Bolzano, Emilia-Romagna, RA Friuli Venezia-Giulia, Lazio, Liguria, Lombardy, Marche, Piedmont, Sardinia, Tuscany, PA Trento, Veneto, Umbria. These Regions represent the 65% of the whole territory of Italy.

The object of the analysis: acts, goals, and sub-goals

The analysis was performed on the last available Regional Acts related to the incentive scheme for healthcare CEOs. Official Regional Acts were gathered by performing a search on the official regional healthcare websites and the main Internet browsers was performed, specific keywords ('number of the regional acts',³⁵ 'name of the Region', 'year', 'CEO', 'objective*', 'goal*', 'incentiv*', 'compensation'; the asterisk indicates that the research regarded any word that began with the part of the word truncated by the asterisk). We checked with the Regional Healthcare Departments and the Ministry of Health whether if we collected the last available Regional Acts. If not, the last Acts were directly provided by them.

By following these criteria, we were able to cover 14 (out of 20) Italian Regions for a total of 17

Regional Acts. The number of Act is greater than the number of analysed Regions, because some Regional Governments approved two legal Acts for the adoption of the financial incentive schemes in the healthcare sector: one Act for the establishment of the scheme and another Act for the technical details. The Regional Acts included into the analysis were approved in the period 2010–2012 and with a legal validity that ranged from one to four years (till 2014). The details related to the Acts for each Region and Province (e.g. year of approval and period of validity) are summarized in Table 1.

The analysis was focused on the goals for CEOs of the following healthcare organizations: (LHA, Hospitals, and Teaching Hospitals). Thus, the analysis regarded only the sections of the Regional Acts that were about incentive schemes for these categories of CEOs.

In the CEOs financial reward schemes adopted by Italian regional health systems, the financial-economic reward (the additional compensation) is related to the achievement of specific goals. Sometimes goals are drill down into more specific goals, which we defined 'sub-goals'. Thus, the distinction between goal and sub-goals was identified in terms of level of specificity of the target. The goal is mostly related to a general field for intervention (i.e. a plan) or a generic target (i.e. health promotion); the sub-goal expresses the specific way to achieve the main goal and the related measures (i.e. respectively: working package 'x'; maternal healthcare pathway).

An indicator was associated to each sub-goal (or goal if there is not a more specific level). The

Table 1 Details of Regions included in the analysis, year of approval of the relative act, and name of the act

Region	Year	Validity	Document
Basilicata	2012	2012–2013	DGR 298 (14.03.2012) 'Obiettivi 2012'
PA Bolzano	2011	2011–2012	BSC 2011 Del. 682 (21.04.2011)
Emilia-Romagna	2010	2010–2012	Dgr. 234 (08/02/2010)
		2010–2012	Dgr. 1544 (18/10/2010)
RA Friuli Venezia-Giulia	2012	2012–2013	Del. n. 1021 (2012)
Lazio	2010	2010–2014	Decree 104 (2010) - 'Criteri valutazione e obiettivi DG'
Liguria	2012	2012–2013	Del. Reg. 873 (13.07.2012)
Lombardy	2011	2011–2012	Del. N° IX/1283 e 1284 - Session 01.02.2011
Marche	2012	2012–2013	Del. n. 606 (02.05.2012)
Piedmont	2011	2011–2012	Dgr. 15/02557 (05.09.2011)
Sardinia	2011	2011–2012	DGR 30/60 (12.07.2011)
Tuscany	2012	2012–2013	DGRT. 116 (20.02.2012) - 'Obiettivi SdS 2012'
		2012–2013	Del. GR122 (02.2012)
PA Trento	2010	2010–2011	Del. n. 2501 (2010)
		2010–2011	Del. n. 1332 (2010)
Umbria	2011	2011–2012	DGR. n. 1274 (28.10.2011)
Veneto	2010	2010–2012	DGR n. 3140 (14.12.2010) - 'Assegnazione obiettivi 2011–2012'

indicator expresses how the achievement of a goal is measured. Indicators were categorized into qualitative and quantitative, according to the following criteria: (i) presences of concrete indications on how to achieve the related goal; (ii) measurable or non-measurable; (iii) with or without indication of the expected results.

The content analysis

The Regional Acts were used as data source and analysed using the methodology of document analysis.^{36,37} We previously identified both the object of analysis (ICT incentives for healthcare CEOs) and defined the theoretical framework (P4P models). For extracting data from Regional Acts on incentive schemes, we selected a set of keywords related to the ICT field. The keywords were selected according to different definitions and characteristics of all the variations of ICT in healthcare, such as e-Health, m-Health, and Tele-Health, still presented in the Introduction. Thus, the keywords used for the search in English were: 'ICT', 'information system', 'HIS', 'informatic*', 'informativ*', 'flow', 'record', 'dossier', 'EHR', 'EMR', 'internet', 'web', 'e-*', 'tele-*', 'm-*', 'electronic', 'SMS', 'mobile'. We also performed the search using the same keywords in Italian. After the selection of incentives of interest (related to ICT and to defined CEOs' categories), we refined the analysis by defining a grid, where the following data were reported for each incentive: text of the specific goal; target population (e.g. Hospital CEO); typology of target (e.g. sub-goal); text of the indicator; typology of indicator (e.g. qualitative). Data were grouped per Act and Region. A quantitative content analysis was performed on the gathered data, based on a direct method using existing theory on P4P models.³⁸ Descriptive statistical analyses were conducted on data collected from the documental analysis, using Excel and Stata 12.

Results

One third of Regions did not promote the achievement of goals on ICT using economic incentives to healthcare CEOs: Emilia-Romagna, Lombardy, Sardinia, and Veneto. Some of these Regions, such as Emilia-Romagna, indicated targets related to health ICT without measures, indicators, or weight. Thus, this kind of goals did not contribute to the evaluation of CEOs and to the allocation of additional compensation.

The remaining 10 Regions encouraged the achievement of goals related to or connected to ICT. The first analysis conducted on regional and

provincial acts included in this study showed variability in the definition of the main goal related to ICT. Six Regions had a single reference target: Basilicata, Friuli Venezia-Giulia, Liguria, Piedmont, PA Trento, Umbria.

The incentive system for the Basilicata Region pertains to different areas of results, and is organized differently depending on whether the goal was for all the LHAs, the Teaching Hospital of 'San Carlo', and the Institute for Treatment and Research (IRCSS)-CROB. The goal related to ICT was placed between the strategic interest objectives at regional level for all the entities above.

The RA Friuli Venezia-Giulia assigned incentives related to ICT through the Local Implementation Plan, which is a medium-term strategic plan. The implementation of this plan is the main goal, which presents two sub-goals related to ICT. The latter were indicated as criteria for reward for CEOs of: LHAs 2, 3, and 4; the Teaching Hospital 'Ospedali Riuniti' of Trieste; the Teaching Hospital 'S. Maria della Misericordia' of Udine; the Teaching Hospital 'S. Maria degli Angeli' of Pordenone; and the 'National Cancer Institute' of Aviano.

The Piedmont Region incentivized regional healthcare CEOs on the base of the achievement of four goals, included in a unique project (the main goal) aimed at improving the management of reservations and streamline waiting lists through direct communication with patients (i.e. via SMS and e-mail).

The act of the Liguria Region is the only one having a main goal related to the ICT, called 'Informatics.' It presented several sub-goals related to ICT, for the evaluation and reward of all the healthcare CEOs with the exception of those working at the Paediatric Hospital 'Gaslini' of Genoa. The latter were evaluated on three of the four goals for this area, because the adoption of a specific EHR for new-borns was excluded.

The PA of Trento had a goal on ICT in dental care services, in particular with control and management purposes.

In the act of Umbria Region, the ICT goals were related to activities aimed at containing the waiting time in the delivery of community and hospital healthcare services.

In the incentive acts of PA Bolzano, Lazio, Marche, and Tuscany, the ICT topic was tackled in different thematic areas of goals, or within several macro-indicators, because functional to the achievement of different kinds of purposes. Thus, in the acts of these Regions, ICT was incentivized only through sub-goals.

Table 2 List of the incentive acts for Region, with the details of the specific act and the main goal (or reference area) for ICT incentivized targets

Region	Main goal
Basilicata	Achievement of regional strategic objectives – use of information flows
PA Bolzano	Continuity of care and integration primary-specialist care Extension and qualify improvement of the information system
Emilia-Romagna	–
RA Friuli Venezia-Giulia	PAO PAL (Local Implementation Plan) projects
Lazio	Reorganization of the network of hospitals and laboratories Control Economic-financial balance International healthcare mobility Pharmaceutical spending Informatics
Liguria	–
Lombardy	–
Marche	Prevention – prevention and health promotion of living and working environments Prevention – veterinary and food safety Pharmaceutical care
Piedmont	Activation of the RECALL function for bookings of performance for outpatient specialist care
Sardinia	–
Tuscany	– Consolidation and enhancement actions – waiting times Development and investments actions – chronic care model and development of primary care Development and investments actions – information systems and technologies
PA Trento	Specific objectives – Resolution no. 167 dated 4 February 2011 (point no. 3) – Approval of the Provincial 2011 activity program for health services, together with the statements and the directives 2011 of the Department of Health and Social Policies
Umbria	Waiting time containment
Veneto	–

An analysis of the act of the PA Bolzano showed that the achievement of specific ICT sub-goals, on the one hand, was aimed at ‘extending and improving quality of the provincial information system’, by unifying and making interoperable the existing systems, improving the knowledge management and the control of processes. On the other hand, ICT sub-goals were aimed at achieving general quality goals, such as: continuity of care, integration between primary and specialist care, and access to care (waiting lists).

In the act of the Lazio Region, the ICT in healthcare was instrumental to economic and financial control activities, as well as to the network management. Looking at the list of sub-goals related to ICT, the general purpose emerged is mainly the satisfaction of bureaucratic-administrative requirements.

The Marche Region placed the ICT sub-goals in two thematic areas. For achieving the goal of health prevention, the ICT sub-goals were related to the management of the ‘informative debts’ to the national government. Only CEOs of the Regional Health

Authorities (ASURs) had incentivized to achieve the latter goal. Moreover, ICT sub-goals were incentivized for the control of pharmaceutical expenditure, in this case for CEOs of ASURs, the Hospital, and the National Institute of Elderly Care (INRCA).

In the Region of Tuscany act, ICT sub-goals were among ‘development and investments actions’, in an area related only to information systems and technologies. Furthermore, the Tuscan act presented sub-goals of computerization and improving of the information flows, considered among the actions of ‘consolidation and strengthening’ relating to waiting lists.

The detail of the main goal (or reference area), in which the specific sub-goals related to ICT have been placed, can be found in Table 2.

Within each reference area or main goals, it is possible to find one or more sub-goals related to ICT and encouraged by the intensive mechanism. Among Regions or Provinces that promoted ICT in healthcare, Basilicata, PA Bolzano, Lazio, Liguria, Marche, and Tuscany have more sub-goals per reference area (main goal).

In the case of the Basilicata, there are two closely related specific objectives. These sub-goals both treated information flows, but having different indicators for the achievement of the specific sub-goal, and different weights for the achievement of the main goal.

The PA Bolzano presented three sub-goals: a sub-goal related to online training activities for prevention and quality of services; another one regarding the computerization of the system of healthcare service booking; the third sub-goal linked to a project aimed at unifying the provincial HIS.

The Lazio Region had two sub-goals in the area of goals related to the 'Control.' They were instrumental to achievement and strengthening of the appropriateness of performance monitoring (i.e. using correct encoding and reporting), and of pharmaceutical and specialty spending (via the information system connected to the EHR). In the 'economic - financial balance' area of goals, there were two specific sub-goals, both related to the improvement of information flows in terms of timeliness and completeness.

In the act of the Liguria Region, the main goal 'Informatics' could be accomplished, by achieving four specific sub-goals related to: information flows, electronic prescriptions, and EHRs.

Tuscany Region represented a unique case in the Italian context: 13 ICT sub-goals within three main areas of reference were defined, covering each topic of the present work.

In the act of the other Regions and Provinces, the number of sub-goals is the same to that of the main goal. Their specific content, such as the implementation or a better use of ICT in the specific sector, can contribute to achieve the overall objective.

As shown by Table 3, most of the Regions had a single indicator for the assessment of the achievement for each sub-goal. Regions of Lazio, Marche, and Tuscany, instead, assessed each sub-goal on the basis of a plurality of indicators.

In the act of Lazio, went into detail, the evaluation of the specific sub-goals for economic and financial balance and pharmaceutical spending was performed through a set of specific indicators.

The sub-goals of the Marche Region appeared not specific, by grouping a series of targets, each of which achievable based on detailed indicators. For example, in the thematic area of 'prevention and promotion of health in living and working environments', a sub-goal had 11 indicators for evaluation, of which two related to ICT in healthcare.

The Tuscany Region had 16 specific ICT sub-goals, which included 12 for the main goal related

to 'information systems and technologies'. In this case, the achievement of each of the sub-goals was assessed through a number of indicators (38 in total and very specific).

In Table 3, indicators of achievement of ICT goals are distinguished between qualitative indicators and quantitative indicators. In general, the majority of indicators (more than 72%) presented a qualitative nature, therefore not measurable or lacking of a specific indication of the expected results in a quantitative form.

Finally, considering all the analysed acts, there are 41 sub-goals related to ICT (less than three per Region), with 71 indicators for their achievement evaluation.

In the analysed acts, the sub-goals were related almost exclusively to the HIS. From the analysis, it emerged that only two goals were related to more advanced applications of ICT in healthcare: one goal for e-Health area and one goal for the Tele-Health.

In fact, almost all the identified ICT goals encouraged the adoption of infrastructures, or technological components, or procedures for generating, organizing, and managing information about the regional health system, with the aim to achieve several general purposes represented by the main goals seen above.

As evident from Fig. 1, most of the sub-goals (23) are intended to encourage actions that affect the information flows. The main purpose of these actions is: (i) bridging the information debt of Regions and Provinces towards the national system; (ii) complying with legal obligations; or (iii) making the information system more timely, comprehensive or integrated.

There are goals (6) relating to the definition and implementation of the basic information system. 10 goals (24% of the targets) cover more advanced forms of access, collection, storage, and management of information: the electronic health card (CSE) (3), the EHRs (FSE) (4), the electronic system of services booking (e-CUP) (1), and the electronic medical prescription (2).

As anticipated, the two non-HIS related sub-goals are included in the category 'Other.' A goal incentivized the use of online training for employees of the healthcare organizations in the PA Bolzano. The other goal referred to the implementation of direct channel of communication with patients in the waiting list (e.g. e-mail, SMS), in the Piedmont Region.

Fig. 1 shows the areas of interventions that each Region and Province included in the own incentive scheme for healthcare CEOs.

Table 3 Number of ICT main goals and sub-goals, relative indicators, and typology of indicators per Region

Region	Main goal (reference area)	Sub-goals	Indicators	Quantitative indicators	Qualitative indicators
Basilicata	1	2	2	0	2
PA Bolzano	2	4	4	1	3
Emilia-Romagna	0	0	0	0	0
RA Friuli Venezia-Giulia	1	2	2	2	0
Lazio	5	7	13	6	7
Liguria	1	4	4	2	2
Lombardy	0	0	0	0	0
Marche	3	3	5	0	5
Piedmont	1	1	1	1	0
Sardinia	0	0	0	0	0
Tuscany	3	16	38	8	30
PA Trento	1	1	1	0	1
Umbria	1	1	1	0	1
Veneto	0	0	0	0	0
Average	1.36	2.93	5.07	1.43	3.64
Average considering only regions having ICT goals	1.9	4.1	7.1	2.00	5.10

The interest for activation or enhancement of information flows is almost a constant for all the Regions and Provinces analysed, with the two exceptions. The Piedmont Region included an incentivized goal in the project 'Recall', aimed at adopting tools of tele-communication with the patients. For this reason, it was considered related to the Tele-

Health field. The PA Trento only incentivized the definition a local information system, with particular reference to the dental care services.

In addition to the PA Trento, also PA Bolzano and Tuscany Region included the establishment and implementation of basic information system among the incentivized goals. The information

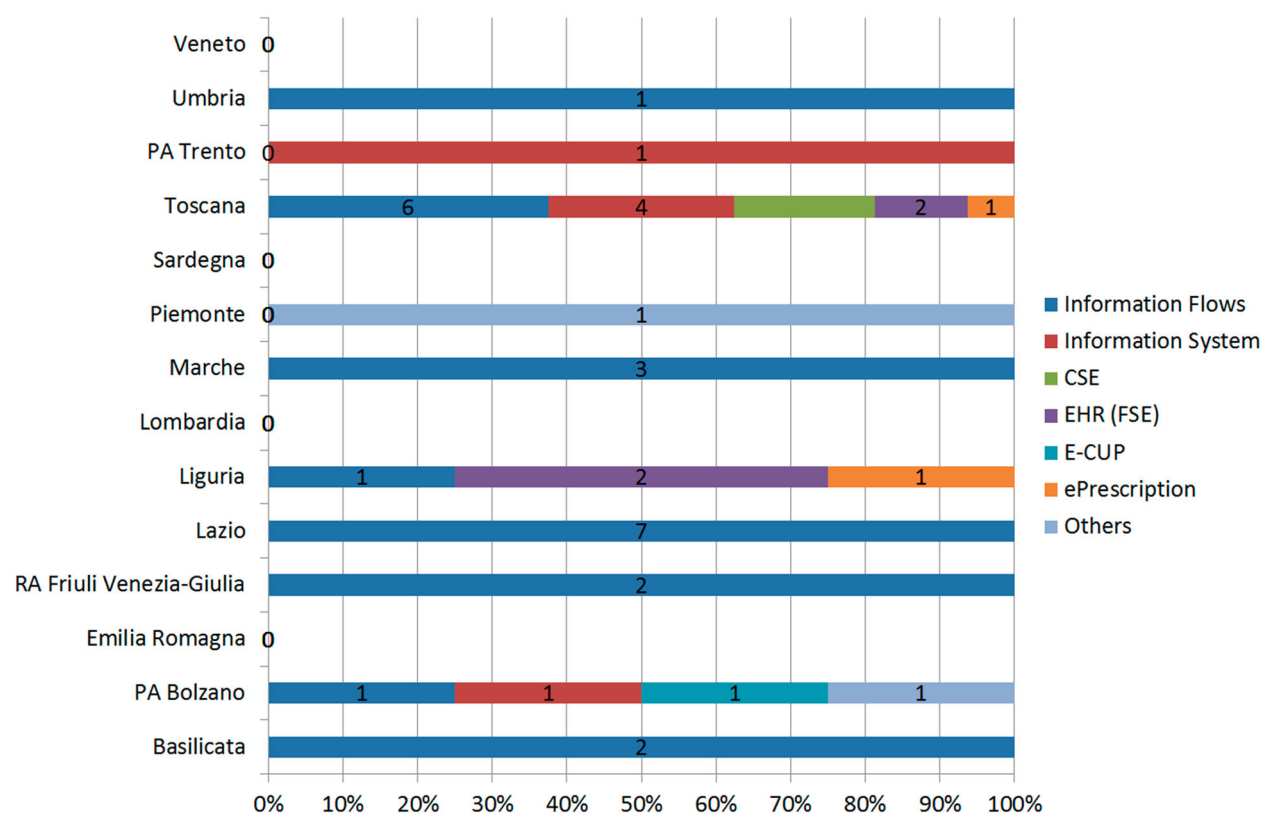


Figure 1 Areas of intervention of the specific sub-goals per Region/Province.

Table 4 Number and specific weight of ICT goals by Region/Province

Region	Sub-goals (N.)	Total weight (%)	Average weight per sub-goals (%)
Basilicata	2	4.00	2.00
PA s Bolzano	4	6.94	1.74
Emilia-Romagna	0	0.00	0.00
RA Friuli Venezia-Giulia	2	10.00	5.00
Lazio	7	18.28	2.61
Liguria	4	15.00	3.75
Lombardy	0	0.00	0.00
Marche	3	18.60	6.20
Piedmont	1	10.00	10.00
Sardinia	0	0.00	0.00
Tuscany	16	9.50	0.59
PA Trento	1	3.00	3.00
Umbria	1	4.00	4.00
Veneto	0	0.00	0.00
Average	2.93	7.09	2.78
Average (only considering Regions with ICT goals)	4.1	9.93	3.89

system is the base for most innovative applications, such as e-Health, which need platforms of data collection and management.

Tuscany is the only Region that included, among incentivized goals, targets about all the identified categories of interventions, with the only exception of e-CUP. Along with the Region of Liguria, Tuscany appeared more oriented towards a more advanced and interconnected HIS, based on the computerization of health records and medical prescriptions.

Table 4 shows the number of specific sub-goals related to ICT per Region or Province, specified with the assigned weight. It is worth pointing out that, as already mentioned, only goals assigned to CEOs of LHA and Hospitals were taken into account, in this work. In contrast, there are CEOs of other public entities, who are locally in charge for health ICT. There is, in fact, variation among Regions and Provinces with respect to the areas of competence and responsibility of CEOs. Tuscany Region, for example, identifies in the Regional (ex Local) Agency for Technical and Administrative Services (ESTAR-ESTAV) the institution with specific responsibility on ICT in healthcare.

Table 4 describes how much the achievement of ICT goals were rewarded in terms of percentage of the additional compensation for healthcare CEOs, per Region and Province.

The Region that incentivized more the ICT in healthcare was the Region of Marche, by assigning to the achievement of ICT goals the 18.6% of the value of the total additional compensation for CEOs. Lazio Region was the second in the ranking, by linking the 18.3% of the economic incentive for CEOs to the achievement of target in which the use of ICT is instrumental in fulfilling the various types of control activities. The Liguria Region allocated the 15% of the CEOs economic incentive in the domain of health ICT, by defining different types of goals connected with the ICTs. Friuli Venezia-Giulia and Piedmont Regions established a weight of 10% to the achievement of ICT goals.

The Tuscany Region emerged as the Region with the largest number of goals and indicators. This may explain the reason behind the lower total weight of the ICT goals in the Tuscan scheme of incentive (9.5 points, slightly below average of analysed Regions and Provinces). New paragraph: use this style when you need to begin a new paragraph.

Conclusions

The analysis of Regional or Provincial acts of the healthcare CEOs incentive schemes showed that attention of local governments to the ICT is mainly related to the implementation, adoption, and use of basic ICT in healthcare: definition of information infrastructure, digitization of data and procedures, data and information flows, integration, and interoperability. In the analysed acts, there are not goals aimed at encouraging actions or initiatives of introduction of technological innovations in the strict sense. For instance, the adoption and use of specific ICT-based services or the ICT-based delivery of usual services were not planned in the incentive schemes. Tele-Medicine, Tele-Health, and e-Health did not appear not issues of strategic interest to the Regions and Provinces. Their potential value was not translated in an economic value for incentivizing goals for healthcare CEOs.

Thus, the present study analysed almost exclusively goals related to the HIS and the associated tools and procedures for collecting, storing, analysing, and managing data and information.

Emilia-Romagna, Lombardy, and Sardinia Regions had no incentivized goals on health ICT issues, in the analysed acts. Among the other Regions and Provinces, only the Liguria Region presented a main goal related to the introduction of ICT. The other Regions and Provinces included ICT-related sub-goals in other areas of intervention, thus considering ICT an instrument for the achievement of other strategic goals more strictly related to

the health outcomes, control or financial balance. The regions of Basilicata and Tuscany stand out from the other Regions, by collocating the specific ICT sub-goals in strategic areas of intervention: the first, among regional strategic goals; the second, among development and investments actions. In general, the analysis showed that actions, initiatives, and activities involving the adoption, use or exploitation of ICT are functional to the achievement of other general targets, mostly related to improving the quality of healthcare services, or monitoring and controlling expenditure, as well as economic and financial balance.

The analysis showed that the ICT goals refer largely to actions related to information flows. Their aims are the improvement of their quality (for example, the completeness of the data) and the timeliness, for meeting legislative requirements and bridging informational debts towards the national system.

Furthermore, in several incentive acts (PA Bolzano, Tuscany, Trento), goals related to the definition of ICT architectures and infrastructures were included, as strategic objectives. This may be explained by the importance of information systems' definition and implementation, as mandatory platform for implementing and using interconnected ICT solutions. Tuscany Region incentivized ICT goals related to almost all the identified categories of goals. Liguria and Tuscany Regions appeared the most oriented towards a more advanced HIS, based on health records and electronic prescription.

In terms of strategic weight of ICT goals, the total weight in terms of additional contributions for CEOs varied from the 3 points of the PA Trento to the 18.6 points from the Marche Region. The weight of rewards, linked to the three ICT goals, established the Marche Region as the Italian local government that considered the ICT in healthcare more important rather than the other Regions.

However, it is worth to point out that there are Regions that actually invest on HIS, e-Health, and Tele-Health, but do not link ICT innovations adoption and implementation to the incentive mechanisms.

For instance, in Act n. 1544 of 2010, the Emilia-Romagna Region included 23 ICT goals, 19 of which related to the main goals 'Information System,' 'ICT Projects and Services,' 'Regional Information System and Information debts of the healthcare organizations.' This demonstrated a high level of attention from this Region to e-Health issues. However, the strategic importance of these goals was not measurable, because they were not associated to the economic incentives for healthcare CEOs.

In the DGR. 3140 dated 14.12.2010, the Veneto Region assigned the target for the years 2011 to 2012. In this act, 11 goals were related to IT infrastructure, information flows, and electronic medical prescription, but again without assigning them a weight in terms of economic incentive to CEOs.

Also the Basilicata Region listed a number of not incentivized goals regarding the introduction of technological innovations for providing services, information, and involvement of patients, and for collecting and managing of health information, in the 'Integrated Regional Plan for Health and Services to Individuals and Communities for the Years 2012-2015.'

There are also Regions that assigned a weight to strategic ICT goals, for incentivizing CEOs of different healthcare agencies or organizations. The Region of Tuscany, as already mentioned above, gave to the ESTAR-ESTAR institutions the responsibility for ICT. In fact, in the incentive act analysed in this study, ICT goals for ESTAR-ESTAV CEOs were incentivized and weighted nearly 30% more than the ICT goals for CEOs of other healthcare organizations.

For the present study, it seems to emerge a general strategic orientation for basic technologies rather than for more advanced technological innovation. Regions and Provinces show an interest in more advanced e-Health applications, represented by the presence of related goals in other strategic plans. Often this kind of solutions are seen as pilot projects or experimental, thus excluding this initiative from the annual acts assigning the strategic goals for CEOs. This misalignment could be counterproductive. In fact, the adoption of a new technology requires a number of changes in the organizations and personnel behaviour so that the introduction of this issue into the CEO's scheme could ease his/her commitment. This latter is recognized as one of the key factors of success of innovative changes within the system. Indeed, the absence of rewarded goals on ICT demonstrates that Italian regional healthcare systems are still laggards in this field. Efforts in health ICT field appear aimed at ensuring a better and wider presence of enabling environments, and at implementing ICT-based control systems, rather than at directly improving the quality and equity of care for patients. The use of e-Health and m-Health solutions for providing healthcare services, the valorization of 'health big data' in a population care perspective, as well as more advanced applications of ICT for monitoring or preventing diseases were not incentivized for CEOs in Italy, and therefore cannot be considered yet strategic.

Disclaimer statements

Contributors Both the authors participated in the study design and interpreted the results. SDR participated in acquiring the data, performed the analyses, and wrote results. MV wrote the literature review. SDR and MV wrote methods and conclusions of the manuscript. All authors read, revised, and approved the final manuscript.

Funding This work was supported by the Italian Ministry of Health. SDR is grateful to Telecom Italia that supported her PhD through the grant and the Telecom Joint White Lab of Pisa, Italy. The authors are grateful to the Management and Healthcare Laboratory (MeS) of the Sant'Anna School of Advanced Studies of Pisa, in particular of the professor Sabina Nuti, and to partners from Italian Regions, for their support and help.

Conflicts of interest The authors declare no conflict of interest.

Ethics approval No ethical approval required.

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