The warranty-based healthcare system: An innovative approach in public health for the "new normal scenario"

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Health protection is a goal that every State pursues. The WHO defines health as "a state of physical, spiritual, mental, and social well-being and not the mere absence of disease". Public healthcare systems are mainly financed through taxation, and they often overspends. For this reason, these systems are being reformed to increase efficiency while maintaining high effectiveness. Private healthcare systems make patients cover their health expenditure, which may be challenging. The warranty-based healthcare system is suggested as a new, innovative model that is activated as a public healthcare system but investigates individual responsibility for the disease so patients may be asked to share part of the expense. This paper aims to show that this model is suited to the post Covid-19 pandemics "new normal scenario" and can achieve greater economic sustainability than the Italian SSN and the Beveridge healthcare models. This work aims to contribute to previous literature by introducing new perspectives in an increasingly topical public health debate.

Keywords: Healthcare Systems, Public Health, Health Responsibility, New Normal, Financial Sustainability.

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1. Introduction

The health emergency of 2020 brought healthcare system models back to the attention of scholars. Regarding the Italian case, the debate focuses on the reform of Title V of the Constitution, which re-designed the relationship between central government, Regions, and other entities not only at a managerial level but also at an economic and financial one.

Like any public healthcare system, the Italian healthcare system (henceforth the Italian NHS) is characterised by financial unsustainability because expenditures are more than funds. From 2012 to 2020, the Italian healthcare system registered a deficit of 10.874,3€ million with an average year deficit of 1.208,34€ million. Despite multiple reforms, especially the 1992 and 1993 ones, which started the man-

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agerialisation process (Borgonovi, 2008, 2013; Anselmi, 2014), aiming to improve efficiency and effectiveness, the Italian NHS still presents a criticality in its financial dimension.

During the Covid-19 pandemic, the Italian NHS and even the most performing (Razavi *et al.*, 2020) healthcare systems worldwide were put under a great degree of stress (Lal *et al.*, 2021) and failed their primary objective of protecting the community's health, highlighting gaps in health infrastructure, thus creating fertile ground for research and challenging policymakers and healthcare managers in evolving healthcare systems towards a more integrated perspective (Armitage *et al.*, 2009; Evans *et al.*, 2014; Shortell, 1988; Strandberg-Larsen & Krasnik, 2008; Suter *et al.*, 2009; de Meijer *et al.*, 2013). Moreover, the pandemic highlighted the financial sustainability of public health models, challenging scholars, managers and professionals to discover new solutions and strategies for making public healthcare more financially sustainable. During the years, several attempts were made. More effective and efficient prevention programs (Hagenaars & Klazinga, 2021) and increased taxation on dangerous products (Gravelle & Zimmermann, 1994) are examples of scholars' attempts to propose systems to help healthcare become more financially sustainable. In these directions, our conceptual healthcare system model has practical implications since it can help regulators and policymakers discuss the best way to assess the financial sustainability of the Italian NHS by proposing a new model to deliver healthcare and satisfy patient-user health needs. In this way, we propose a more financially sustainable healthcare system than the Italian NHS, considering it as the possible or inevitable evolution of the public model of the healthcare system.

This paper describes the Warranty-based healthcare system, a hybrid and conceptual healthcare system model that shares characteristics with public and private healthcare systems. Like public healthcare systems, the warranty-based system protects health as a right of the individual and the community. This element ensures that the warranty-based system is activated to treat needy individuals without distinction.

The characteristic in common with private healthcare systems is the attribution of responsibility for health to the individual. This element coincides with an anti-paternalistic vision of the State and the healthcare systems.

Because of its better financial sustainability than Beveridge-based healthcare systems, moral persuasion, and peculiar and distinctive characteristics, this healthcare system could effectively prevent and heal. The better financial sustainability of the warranty-based healthcare system concerning the Italian NHS is represented in this paper by a simulation of lung cancer treatment. The case is first proposed to highlight the difference between the NHS and the warranty-based healthcare system in allocating the cost of the healthcare treatment needed for lung cancer. Then, different scenarios are proposed in which the percentage of "responsible" patients varies, aiming to show how health expenditure is divided. The scenarios are also proposed in comparison with the Italian NHS.

Although we are aware of the ethical and bioethical implications of such research,

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we opted to focus only on the financial dimension, keeping the ethical and bioethical considerations for further research.
The warranty-based healthcare system is based on health responsibility attributed to the individual. When a person needs healthcare treatments, the hospital analyses their clinical situation and if the hospital finds the patient responsible for their bad health conditions because of the individuation of one or more modifiable risk factors, a part of the health expenditure is distributed to the patient.
This paper presents multiple contributions and elements of originality. First, it introduces the warranty-based healthcare system as an alternative to the three well-established models, proposing the warranty principle instead of the insurance one, usually adopted in other systems. Second, the perspective of individual responsibility differs from that of private healthcare systems. In the warranty-based healthcare system, individual responsibility is strictly related to a specific action and its consequences on the individual's health. Thus, the responsibility does not consider a person's overall health as in the private models. Moreover, this paper can contribute to filling the gap in the scientific literature about the financial sustainability of healthcare systems, with particular attention to public healthcare models and individual behaviours. In fact, while in the literature exist works about the impact of financial tools on particular risky behaviours for health (DeCicca *et al.*, 2008; Cawley & Rhum, 2011; Chaloupka *et al.*, 2012) or isolated case studies, to the best of our knowledge there are no contributions about a healthcare system (so proposing a systemic perspective instead of individual) which is based on individual health responsibility and which, starting from that, can pursue financial sustainability through responsibility on health.
Finally, it contributes to the literature on health responsibility by suggesting the warranty-based healthcare system as a tool that promotes prevention through moral suasion. Attributing a proportion of the cost of the treatment is an economic incentive that can increase the number of healthy choices made by individuals. The cost of unhealthy actions is not distributed in society, and it limits opportunistic behaviours. Finally, this research presents a healthcare system model that is more financially sustainable than Beveridge-based models. Introducing a variable percentage to attribute the treatment costs incurred to the patient translates into a decrease in the overall expenditure incurred by the healthcare system, which will be more sustainable. In the case of non-existing unhealthy behaviour, the warranty-based healthcare system covers all expenses but ensures financial sustainability. On the one hand, fewer treatments are requested due to fewer illnesses; on the other hand, it reaches the best-case scenario of prevention.
The paper follows this structure. The following section presents the framework, which is about the concept of health and responsibility for health. The third section focuses on the financing and sustainability of national public healthcare systems, highlighting the financial sustainability issue. The fourth section will present an in-depth description of the warranty-based healthcare system. The methodology is illustrated in the fifth section. Results, discussion, and conclusion are illustrated in the last two paragraphs.

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2. Framework: rights and responsibility in healthcare

The concept of health is often associated with ethics, bioethics and law. If the link with the firsts appears to be obvious, the link with the law is due to the fact we live in a regulated reality and laws are necessary for protecting the rights of the community.

In countries that adopt public health models, health is conceived as a right because it refers to an extended principle of fairness and equality (Sen, 2002). These countries usually have strong welfare systems, conceived as a set of tools, strategies, and programs that can protect people. Without any distinction, they would eventually need assistance (Pasini, 1998). In Italy, the right to health is ensured and protected by Article 32 of the Constitution, which states that the Italian Republic protects health as a fundamental right of the individual and an interest of the community. According to this vision, health is not simply a desirable condition for themselves, but it is like a common good which assumes crucial characteristics for satisfying the interests of the whole community (Callahan, 2000; Sen, 2002) and is a tool which can be used for eliminating inequalities not only under the medical but also under the socio-economic aspect (Pasini, 1998).

If countries with a strong social state adopt solidaristic and universalistic healthcare models, conceiving health as a right of the community, there are other realities which consider it a good disposable for the purchase on the free market and, consequently, propose private healthcare systems. The principle behind this concept is that people should be free to choose how much health provides for themselves, according to their purchasing power (Engelhardt, 1997).

Considering health as a right or as a good has implications on the responsibility of health.

Responsibility can be defined as the concept that embeds all the procedures, behaviours, and measures with which someone justifies their choices and accepts the consequences (Emanuel & Emanuel, 1996). Starting from private healthcare models, it is clear that the responsibility of health is individual, meaning that each individual should be aware of the potential consequences of their choices on their health. Individual responsibility for health leads to the victim-blaming concept, which in health finds justifications in the high cost of medical services and in how people consider risk and take actions and decisions which could have consequences on their health (Crawford, 1977; Knowles, 1977). More precisely, Knowles (1977) sustains that public health systems incentivise opportunistic behaviours, which lead to an increase in medical expenses (which are paid by the community). Making them responsible for their health should make them more aware of the consequences of their choices, and they should act by adopting less risky choices and decisions.

At the same time, individual responsibility for health could pose a freedom issue. In fact, even if attributing the responsibility for health to individuals explicitly aims to protect individual freedom (Callahan, 2000), buying it as good may be difficult for some people, who would find themselves dependent on their financial resources instead of being free to choose to buy

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the desired or needed level of health.
Countries which consider health as a right are more likely to socialise not only it but also the responsibility for health. As written above, Article 32 of the Italian Constitution considers health as a right and as an interest of the community, and when an individual gets sick, the whole community sustain the cost of their treatments. Socialising the responsibility for health makes it possible to achieve crucial objectives such as a good prevention campaign (Whitehead, 2004). Considering the definition of health (WHO, 1948), it is clear that the protection of everyone's right to health cannot be developed by individuals because of their intrinsic diversity, but it must be carried out by the central State through the healthcare system.
Socialising the responsibility for health has consequences for people. In the first instance, the sharing of medical expenses could make people less sensible about the costs often generated by their own choices and behaviours (Knowles, 1977), while at the same time, it contributes to eliminating both financial and access to health inequalities.
The collective responsibility for health has also other implications. Article 32 embeds a shared collective ethics (Turoldo, 2009), which balances the right to health and the freedom of choice, giving priority to the protection of the right, highlighting the solidaristic principle which lies behind the Italian NHS. This means that in extraordinary or particular situations, protecting the right to health could limit individual freedom and other fundamental rights, obliging people to adopt particular behaviours or avoid others. This is the case with some vaccination campaigns (Gardini, 2020), which oblige some people to receive sanitary treatment against their will because of the protection of the health of the community.
Responsibility for health, collective or individual, has its advantages and disadvantages, with several implications on the ethical, bioethical and economic dimensions. The decision on the attribution depends on several variables, including the driving values of the community.

3. Financing and sustainability of public healthcare systems

Financing a healthcare system is one of the actions that allow the entire system to function and protect the community's health. A distinctive element distinguishes between the different healthcare system models (Böhm *et al.*, 2013).
Since its foundation, the Italian NHS has faced critical issues regarding financial sustainability.
To address these problems, the Italian government issued two legislative decrees (number 502/1992 and 517/1993), which started the healthcare managerialisation process that "*indicates the need to apply the principles of rationality in the use of (limited) resources to produce (useful) performances and services. Therefore, it indicates the "instrumentality" concerning the ends that can be multiple and varied*" (Borgonovi, 2008, p. 11; Borgonovi, 2013)[1].
The introduction of the principles of business economics in the Italian

[1] Translated from the Italian: "Indica la necessità di applicare principi di razionalità nell'uso delle risorse (limitate) per produrre performance (utili). Indica la strumentalità rispetto ai fini che possono essere molteplici e vari".

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healthcare system has allowed the affirmation of the private market. Therefore, the Italian NHS funding system has a double dimension: one public and one private (Capano & Gualmini, 2011; Fabbri & Monfardini, 2003; Mapelli, 2012A; Mapelli, 2012B).

However, two dimensions are not equivalent: public funding is 78.8%, and out-of-pocket funding is 17.8%. A further 0.9% is represented by forms of supplementary private insurance (Ferré *et al.*, 2014).

Although the reforms contributed to lowering the deficit, the Italian NHS persists in identifying the financing subsystem as one main criticality (Balboni, 2001; Balduzzi & Carpani, 2013; Carè, 2016; Catelani, 2010; Cilione, 2005; Del Vecchio, 2004; Di Girolamo, 2007; Giorgetti, 2016; Guiducci, 1999; Jommi, 2000; Jommi & Del Vecchio, 2004; Salvatore, 2004).

Table 1 illustrates funding and healthcare expenses from 2010 to 2020.

Data illustrates that although funding has increased over time, the excellent performance of some Regions is not sufficient to close the balance positively, confirming funding as a critical component of the SSN.

Although the managerialisation process is still underway, more than current financing methods are needed to procure the economic resources necessary to meet the demand for healthcare services.

To keep the NHS functioning despite the deficits, "*the State can finance the NHS by resorting to the deficit and the credit system: it can resort to issuing government bonds or requesting long-term loans from banks*" (Mapelli, 2012B, p. 102).

The sustainability of healthcare systems is linked to insufficient funding for the obligations undertaken and must be observed in fiscal and economic dimensions (Carè, 2016). "*From an economic point of view, health expenditure is defined as sustainable as long as the social cost of health expenditure exceeds the value produced by this expenditure*" (Carè, 2016, p. 35)[2].

From a fiscal point of view, the healthcare system is only sustainable if the income is sufficient to cover the expenses. It can, therefore, be said that if, on the one hand, NHS is sustainable because the non-repair of the state of health of patients would generate a higher (social) cost than the expense that is made to treat them, on the other it is not so as the costs exceed revenues.

This problem of financial sustainability concerns approximately all public healthcare systems and presents itself as a problem generated by multiple economic and social factors.

According to Borgonovi (2013), the theme of sustainability originates from a paradox articulated in the double dimension of technological progress (which increases life expectancy) and ageing (with a longer life expectancy, the elderly increase, requiring more resources for care in the face of a reduced production capacity if at all).

However, the "ageing" element as a factor of financial unsustainability of public healthcare is debated among scholars who sustain there is no correlation between ageing and per capita medical expenditure (Hoover *et al.*, 2002; Lowenfels *et al.*, 1997; Lubitz & Riley, 1993; Spillman & Lubitz, 2000;

[2] Translated from the Italian "Da un punto di vista economico, la spesa sanitaria si definisce sostenibile fino al livello in cui il costo sociale della spesa sanitaria supera il valore prodotto da tale spesa".

Tab. 1 – Regional healthcare systems' performance (Authors' elaboration)

REGION	YEARS	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Abruzzo	EXPENSES	2,331.20	2,303.10	2,348.60	2,316	2,374.20	2,347.40	2,411.10	2,463.60	2,471.10	2,485.50	2,594.80
	INCOME	2,324	2,366	2,346	2,352	2,387	2,358	2,389	2,415	2,431	2,432	2,524
	RESULT	-7.30	63.10	-2.12	36.04	12.60	11.07	-22.15	-48.18	-39.83	-53.60	-70.32
Basilicata	EXPENSES	1,056.40	1,059.60	1,030.30	1,022.10	1,029	1,033.60	1,035.40	1,069.20	1,059.90	1,051.50	1,083.40
	INCOME	1,021	1,022	1,042	1,030	1,041	1,037	1,052	1,077	1,062	1,051	1,092
	RESULT	-35.90	-37.80	12.08	7.62	12.24	2.93	16.21	8.18	1.65	-0.47	9.09
Calabria	EXPENSES	3,447.10	3,371.30	3,360.40	3,312.30	3,369.20	3,358.90	3,427.20	3,416.40	3,514.20	3,538	3,619
	INCOME	3,260	3,275	3,304	3,263	3,306	3,291	3,344	3,353	3,331	3,397	3,539
	RESULT	-187.50	-96.00	-56.13	-49.56	-63.00	-67.54	-83.61	-63.38	-183.09	-140.81	-80.18
Campania	EXPENSES	9,995.60	9,819	9,710.60	9,579.90	9,796.80	9,872.10	10,011.20	10,158.70	10,301.80	10,395.10	10,859.20
	INCOME	9,499	9,669	9,730	9,644	10,049	10,052	10,150	10,272	10,359	10,435	10,945
	RESULT	-496.20	-149.70	19.06	64.45	251.76	179.90	139.04	113.36	57.36	39.80	85.79
Emilia Romagna	EXPENSES	8,480.90	8,494.30	8,801.30	8,617.60	8,654.50	8,748.10	8,854.30	9,035	9,157.40	9,227.40	10,089.30
	INCOME	8,306	8,416	8,827	8,743	8,849	8,835	8,944	9,115	9,205	9,265	10,128
	RESULT	-174.90	-78.10	25.60	125.00	194.30	86.65	89.71	79.92	47.30	37.66	39.13
Friuli Venezia Giulia	EXPENSES	2,442.80	2,494.80	2,511.60	2,468.90	2,374	2,333.70	2,368	2,434.20	2,496	2,567.20	2622
	INCOME	2,365	2,430	2,455	2,455	2,450	2,358	2,379	2,375	2,406	2,439	2,515
	RESULT	-78.10	-65.30	-56.26	-13.48	76.25	24.32	10.66	-58.82	-90.31	-127.87	-106.88
Lazio	EXPENSES	11,054.70	10,892.60	10,853.60	10,628.20	10,662.30	10,712.70	10,701.60	10,698.30	10,713	10,791.30	11,592.50
	INCOME	10,063	10,199	10,306	10,015	10,371	10,448	10,625	10,682	10,733	10,912	11,614
	RESULT	-991.90	-693.80	-547.91	-612.92	-291.51	-264.92	-77.07	-16.03	20.00	120.42	21.99
Liguria	EXPENSES	3,240.40	3,232.30	3,147.40	3,122.40	3159	3,175.60	3,184.70	3,209.80	3,227.10	3,251.50	3,376
	INCOME	3,155	3,102	3,104	3,059	3,107	3,108	3,136	3,160	3,158	3,177	3,313
	RESULT	-85.40	-130.50	-43.76	-63.07	-51.58	-67.54	-48.40	-49.37	-68.79	-74.25	-63.20
Lombardia	EXPENSES	17,816.60	18,123.60	18,154.10	18,293.40	18,789.90	18,847.70	18,936.40	19,437.60	19,845.70	20,057.10	21,075
	INCOME	17,773	18,138	18,390	18,359	18,804	18,858	18,987	19,447	19,789	19,959	21,083
	RESULT	-44.10	14.00	235.42	66.01	14.55	10.62	50.54	9.28	-56.70	-98.15	7.87
Marche	EXPENSES	2,799.10	2,794.70	2,749.30	2,713.30	2,736	2,739.20	2,791.90	2,825.50	2,583.40	2,891.10	3,004.50
	INCOME	2,794	2,820	2,825	2,811	2,854	2,851	2,869	2,868	2,857	2,906	3,064
	RESULT	-5.20	25.50	75.94	97.49	118.26	111.89	77.52	42.97	273.52	14.40	59.59
Molise	EXPENSES	660.60	648.1	663.5	696.4	662.8	642.5	660.7	650.3	645.5	742.1	679.6
	INCOME	599	613	610	602	606	600	641	628	609	608	650
	RESULT	-62.00	-35.30	-53.24	-94.00	-56.69	-42.42	-19.98	-22.58	-36.64	-134.08	-29.44
Piemonte	EXPENSES	8,467.10	8,418.40	8,393.70	8,192.10	8,188.60	8,097.20	8,241.70	8,304.30	8,389.90	8,534	9,014.60
	INCOME	8,068	8,161	8,343	8,207	8,320	8,198	8,361	8,400	8,425	8,529	8,949
	RESULT	-398.80	-257.70	-50.24	14.44	131.65	100.37	119.79	96.18	35.27	-5.44	-65.55
Provincia autonoma di Bolzano	EXPENSES	1,099	1,108.80	1152	1160.9	1,145.40	1,174.80	1,199.10	1,249.70	1,265.80	1,277.50	1,408.10
	INCOME	869	886	890	935	975	958	969	978	1,007	1,048	1,096
	RESULT	-229.80	-222.70	-261.83	-225.71	-170.30	-216.77	-230.26	-272.14	-258.65	-229.53	-312.48
Provincia autonoma di Trento	EXPENSES	1,096.10	1,131.60	1,157.80	1,150.70	1,152.70	1,128.40	1,148.40	1,194.20	1,198.90	1,213.10	1,305.80
	INCOME	886	899	911	926	937	1,140	1,155	996	1,022	1,054	1,099
	RESULT	-210.60	-232.40	-246.50	-224.86	-215.54	11.79	6.35	-198.42	-177.04	-158.93	-206.71
Puglia	EXPENSES	7,227.20	7,051.20	6,906.30	6,931	7,047.70	7,092.60	7,231	7,262.70	7,376.10	7,462.20	7,704.40
	INCOME	6,895	6,953	6,996	6,933	7,130	7,144	7,238	7,298	7,365	7,436	7,752
	RESULT	-332.70	-98.10	89.73	1.90	82.32	50.96	6.96	35.79	-11.21	-26.27	47.39
Sardegna	EXPENSES	3,125.70	3,179.60	3,225.30	3,183.70	3,238	3,238.60	3,293.20	3,215.40	3,262.90	3,302.40	3,482.40
	INCOME	2,842	2,870	2,890	2,866	2,931	2,928	2,989	3,002	3,069	3,134	3,250
	RESULT	-283.60	-309.50	-334.97	-317.30	-307.32	-311.07	-303.74	-212.93	-193.91	-168.55	-232.65
Sicilia	EXPENSES	8,506.20	8,499.90	8,514.80	8,530.40	8,644.90	8,658.10	8,842.50	9,052	9,210.90	9,184.70	9,690.70
	INCOME	8,471	8,561	8,592	8,585	8,797	8,828	8,920	9,066	9,142	9,212	9,645
	RESULT	-35.30	61.20	77.63	54.28	152.50	169.99	77.35	13.55	-69.19	26.93	-45.70
Toscana	EXPENSES	7,082	7,131.20	7,120.10	6,948.10	7,113.80	7,197.80	7,277.80	7,446.90	7,396.60	7,505.50	8,037.40
	INCOME	7,014	7,041	7,181	7,057	7,240	7,246	7,312	7,433	7,452	7,547	8,032
	RESULT	-67.80	-90.30	61.24	108.62	126.64	48.42	33.86	-14.20	55.71	41.06	-5.13
Umbria	EXPENSES	1,623.50	1,634	1,643.80	1,645.60	1,637.90	1,651.70	1,672.60	1,716.30	1,743.10	1,719.80	1,836.20
	INCOME	1,636	1,653	1,669	1,669	1,702	1,689	1,708	1,751	1,756	1,737	1,821
	RESULT	12.80	18.90	25.37	23.30	64.55	37.23	35.79	34.71	12.77	16.87	-15.33
Valle d'Aosta	EXPENSES	277.8	278.5	278.8	271.2	260.5	261.8	256.5	254.5	256.5	262.2	287.1
	INCOME	219	231	230	224	230	237	232	234	241	248	267
	RESULT	-58.60	-47.30	-48.36	-47.08	-30.37	-25.24	-24.98	-20.81	-15.80	-13.81	-19.70
Veneto	EXPENSES	8,784	8,748.10	8,713.30	8,699.20	8,777.20	8,834.50	8,980.10	9,244.90	9,327.40	9,468.90	10,107.80
	INCOME	8,778	8,907	8,967	8,960	9,158	9,074	9,227	9,455	9,564	9,710	10,193
	RESULT	-6.10	158.60	253.41	261.13	380.66	239.45	247.16	210.29	236.80	241.42	85.00

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Stearns & Norton, 2004) and those who support Borgonovi's position (Breyer & Felder, 2006; Scarcella *et al.*, 2007; Schulz *et al.*, 2004; Wickstrøm *et al.*, 2002; de Meijer *et al.*, 2013).

According to Berwick & Hackbarth (2012), the conditions for achieving the sustainability of public healthcare are the reduction of waste, the reduction of corruption, and the increase in the overall quality of services offered by healthcare systems.

Other scholars focus on the link between the resources used in healthcare systems and the outcomes achieved (Anand & Bärnighausen, 2004; Martin *et al.*, 2008; Nixon & Ulmann, 2006; Nolte *et al.*, 2005; Or, 2001), introducing the theme of performance as an element for achieving sustainability.

Therefore, the long-term challenge for the Italian NHS and public healthcare systems is to ensure greater financial sustainability, which provides sufficient financial resources to guarantee adequate and quality health coverage (Rebba, 2013).

Some incentive or disincentive tools for certain behaviours are often introduced to increase sustainability, reduce unhealthy behaviours and counter opportunism.

A cost-sharing tool, the ticket (Rebba & Rizzi, 2013), with an exemption for income and pathology, is used in the NHS to redistribute wealth and discourage opportunistic behaviours. The tool is presented as a tax people must pay to demand healthcare services.

In their study, Grossman *et al.* (1993) and Gravelle and Zimmerman (1994) analyse US President Clinton's choice to apply a surcharge on cigarettes with the dual purpose of discouraging the purchase and consumption of cigarettes by raising their price on the market and finance healthcare costs to treat patients who became sick due to smoking.

This program was designed to be permanent, creating a sustainability problem. The decrease in the use of cigarettes would reduce the tax funding necessary to treat diseases caused by smoking, while the cost of these is independent of the amount of funding.

The warranty-based healthcare system reduces health expenditure according to individual health responsibility. Every patient recognised as responsible for his illness will sustain a share of the expense, increasing the healthcare system's financial sustainability and making it more financially sustainable than Beveridge-based healthcare systems.

The warranty-based healthcare system differs from the surcharges on harmful products because it does not intervene on the market price of the goods but instead spreads a cost already established on various social actors.

The eventuality that all individuals adopt healthy and preventive behaviours for their health would imply that the totality of health expenditure is borne by the warranty-based healthcare system, which would operate as a Beveridge-based one. However, in the face of this unlikely scenario, on the one hand, the healthcare system would not be more financially sustainable; on the other hand, there would be a drastic reduction in the number of health treatments provided for adverse conditions favoured by modifiable risk

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factors. This would mean having achieved a high level of individual and collective health protection and realising the fundamental objective of a public healthcare system.

4. The warranty-based healthcare system

The warranty-based healthcare system, considering health as a right, is triggered as a Beveridge-based healthcare system, restoring the best possible level of health to any individual who needs access to care without any exclusion based on income or other elements of discrimination.

As Beveridge-based systems, the financing of this theoretical system occurs mainly through taxation (Boslaugh, 2013; Mapelli, 2012A).

The distinctive element of this healthcare system (and based on which it is named) is the health warranty, conceived in the same way the manufacturer applies to his goods at the time of sale.

A warranty is an after-sales tool with which the manufacturer takes responsibility for any damage the good may report within a period. The only condition is an appropriate use of the good. The warranty expires if the good is damaged due to incorrect or improper use, and the consumer pays for the repair costs. The warranty on health acts in the same way. Improper or incorrect use is the adoption of unhealthy behaviours, which involve risk factors for specific pathologies.

The onset of pathologies is an event often correlated to the interaction of one or more risk factors, which can be modifiable or non-modifiable (Broccolo, 2010; Lowenfels & Maisonneuve, 2002; Lowenfels *et al.*, 1997; Midha *et al.*, 2016). The first are those that cannot be varied, such as age, genetic makeup, gender, ethnicity, and others. Modifiable ones are more related to individuals' choices and behaviours.

Some pathologies are defined as "lifestyle diseases" (Cappelen & Norheim, 2006) and are attributable to the often-prolonged adoption of unhealthy behaviours by individuals. These concretise modifiable risk factors for some pathologies (Lamotte, 2016; Lowenfels *et al.*, 1997; Midha *et al.*, 2016).

Regarding patients who become ill because of modifiable risk factors, the warranty-based healthcare system divides between itself and these patients the medical expense incurred for providing healthcare and treatments necessary to re-establish patients' good health conditions.

Often, modifiable risk factors result from unhealthy choices made by individuals who are not sufficiently informed about the possible consequences of their behaviours. Furthermore, some of these unhealthy behaviours lead to addictions. Two examples are cigarette smoking and the consumption of alcohol. As diseases, addictions require targeted intervention.

The warranty-based healthcare system, which attributes the responsibility for health to individuals by discriminating on modifiable risk factors, in the case of addictions, faces two adverse health events:

- A modifiable risk factor causes the disease.
- Addiction results from unhealthy behaviour.

In this eventuality, the warranty-based healthcare system would distribute

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part of the expense for treating the disease caused by the modifiable risk factor on the patient. At the same time, the health warranty would cover the dependence and then be wholly treated at the expense of the healthcare system.
The adverse health event is analysed to determine the amount of health expenditure the patient would bear, and the impact of the modifiable risk factor on it is determined. Determining the incidence of a modifiable risk factor can be done based on guidelines issued by the healthcare system to which all entities and people involved in the healthcare environment must comply. In the Italian SSN, the guidelines are developed following a six-step process (Burrai *et al.*, 2021).
It starts with a literature review aiming to synthesise the best scientific evidence available (Sala *et al.*, 2006) and ends with the finalisation and publication of the guideline.
The modifiable risk factor's impact on the manifestation of the adverse health event is the percentage value of health expenditure that will be attributed to the patient because of the responsibility for his health.
If it is impossible to determine if certain conduct, however unhealthy, is a modifiable risk factor for the sickness the healthcare system is helping, healthcare costs are entirely borne by the system, as in the case of public healthcare systems.
Figure 1 illustrates how the warranty-based healthcare system works. When someone contracts a disease or an adverse health condition and requires medical assistance, they become a patient.
The warranty-based healthcare system acts like a Beveridge system: it takes care of the patient, treats him, and discharges him.
At the same time, the warranty-based healthcare system investigates the possible influence of modifiable risk factors on the sickness that occurred.
After this process, two options are possible:

1) No modifiable risk factors were found. In this case, the warranty-based healthcare system bears all the expenses necessary for the patient's recovery.
2) At least one modifiable risk factor is identified. In this case, the health warranty expires exclusively regarding the sickness under treatment, and further investigation is carried out to quantify the incidence that the modifiable risk factor may have had as a trigger of the sickness. The patient bears a share of health expenditure equal to the incidence rate of the modifiable risk factor of his sickness.

This system of distribution of health costs allows a warranty-based healthcare system to act as a more financially sustainable solution than a Beveridge healthcare system, which, in any eventuality, bears all the medical expenditures.
The sustainability of the theoretical model is linked to the will of the individual. The more people adopt virtuous behaviours oriented to prevention, the lower the chances that a modifiable risk factor will affect the overturning of an adverse health event. The warranty-based healthcare system will then behave like the Beveridge healthcare system.

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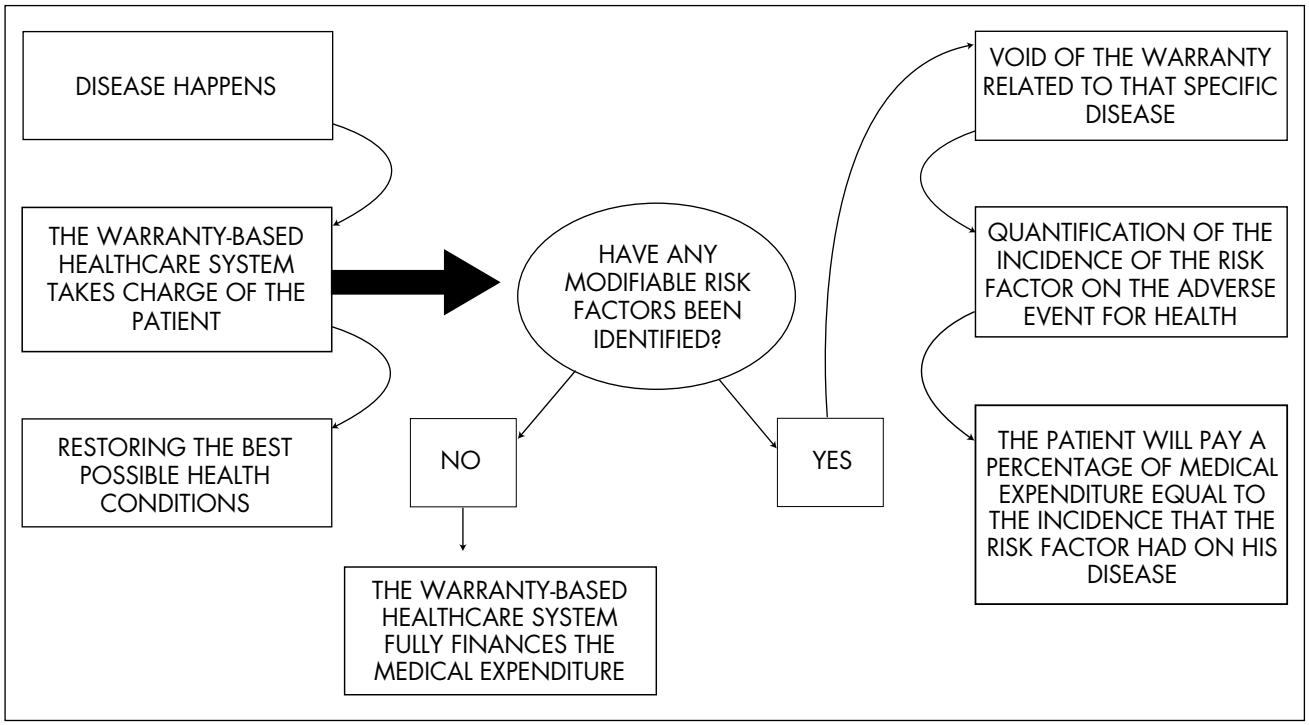

Fig. 1
How the warranty-based healthcare system works. Own elaboration

5. Methodology

Social sciences aim to allow the understanding of reality by suggesting what can be improved and how to do it (Roig-Tierno *et al.*, 2017).

The methodological tool chosen to carry out this research is the comparative analysis between the Italian NHS and the warranty-based healthcare system in managing a particular disease: lung cancer.

The comparison highlights the differences in the allocation of medical expenses between the two healthcare system models, aiming to analyse the results through the lenses of financial sustainability.

The usefulness of this tool in the investigation of central administrations is that immediate terms of reference often need to be present, raising the methodological problem of relative uniformity. This problem makes it necessary to look for comparison elements, often in other countries (Mussari, 2002).

This paper addresses tangible outcomes of the Italian NHS and the warranty-based healthcare system. Because the only difference between the two is the financing method, it is posited that the causal link is straightforward. In its theoretical elaboration, it is assumed that there are no differences at the organisational level between the two models. Such assumptions ensure that financial results are compared because other factors do not drive them.

Thus, the results are driven by the allocation of the costs.

The methodological process consists of a rigorous analysis of helpful scientific literature to identify the impact of modifiable risk factors on triggering the selected disease.

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The data relating to the patients and the services offered by the NHS for the treatment of the focus pathologies of this study were obtained by consulting national databases (Ministero della Salute, 2020).

Data gathering is completed by researching DRGs (Diagnosis Related Group), the systems through which the reimbursement that the State will have to pay to the various hospitals for the treatments provided to patients is established. The DRGs related to the pathologies considered to be the object of interest of the study were considered and studied.

Using this methodology avoids the main limitations of qualitative research. Bell and Bryman (2022) identify them as subjectivity, difficulty in replication, problems in generalisation, and the need for more transparency. Subjectivity derives from a scholar's different perceptions of what is essential, but using quantitative data on the healthcare system allows us to carry out analyses that do not depend on interpretation or perception. The study is easily replicable and transparent as it uses publicly available data. A critical factor is the correct understanding of the theoretical construction of the warranty-based healthcare system and its variations. The study's main limitation is the difficulty of observing the results in the real world. Many of the hypotheses must be tested in the practical analysis. Implementing the warranty-based system includes challenges and practical obstacles that are difficult to consider in this comparative analysis.

After the quantification of the amount of health expenditure for the pathology under study, it was possible to proceed with the comparative analysis between the NHS and the warranty-based healthcare system in its hypothetical application, aiming to demonstrate that this theoretical model is able, with the same assistance offered, to have a less incisive impact on public health expenditure for the treatment of the pathologies analysed.

People's behaviour is not fixed and static. Governments can encourage some virtuous behaviours (Benartzi *et al.*, 2017). Recent studies speculate that these strategies can lead governments to save hundreds of millions of euros (Halpern & Senders, 2016).

Therefore, the comparative analysis proposes the investigation of different scenarios in which the variable represented by the percentage of patients who have adopted unhealthy behaviours is allowed to express multiple values. The aim is to highlight the dynamism and the different impacts of people's choices on the behaviour of the theoretical system.

As above, the disease chosen for the comparative analysis between the warranty-based healthcare system and the Italian NHS is lung cancer.

This cancer was chosen because it is the most widespread in the world (Barta *et al.*, 2019; Corrales *et al.*, 2020; Fitzmaurice *et al.*, 2015; Sala *et al.*, 2006; Smoke & Smoking, 2004; Tanoue *et al.*, 2015) and is strongly favoured by a modifiable risk factor. The main risk factor is the smoke derived from the combustion of tobacco, for which the scientific literature estimates an incidence rate of 85-90% (Gallus & Lugo, 2019; Hecht, 1999; IARC, 2012; Jiménez *et al.*, 2007; Parkin *et al.*, 1994; Schabath & Cote, 2019; WCRF/AICR, 2007; de Groot *et al.*, 2018).

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Once defined, the incidence of the risk factor (90%) is the percentage of medical expenses that the warranty-based healthcare system would distribute to the smoker patient, which is also defined as 90%.
The following phase aims to quantify the medical expense necessary to treat such sickness in the Italian NHS. Before establishing the expense, it must be considered that tariff determination is delegated to the regions in Italy. The central State provides references to prevent significant differences between regional tariffs.
For this paper's analysis, the Lombardy Region was chosen as a reference for its tariffs.
Lombardian protocol used to treat lung cancer provides:

- DRG 82 "3".
- DRG 75 "*Major interventions on the chest*."
- Chemotherapy treatment.

This paper does not propose the protocol and related costs as a practice for the management of lung cancer. Numerous other variables must be considered to manage such a complex pathology. This study deliberately does not consider those variables because the objective differs from the specific nature of the expenditure but the functioning of the warranty-based healthcare system compared with the Italian NHS.
Therefore, a basic procedure was chosen to compare with reliable data. Any more specific analyses may be the subject of future research.

6. Simulation and comparison

This chapter proposes using graphics to simulate how the costs are distributed in the warranty-based healthcare system for lung cancer treatment. Because the Italian NHS always bears all the medical expenses (with the eventual exception of the ticket, which is charged to the patient-user), it is not represented on the graphics, which show the repartition of costs with the hypothetically application of the warranty-based healthcare system. Thus, compared with the Italian NHS, it must be considered that the Italian NHS always has the red column – which represents the State's expenses - at its highest value.
The value in euros of DRG 75 and DRG 82 of the Lombardy Region is, respectively, € 10.972 and € 4.145 (Tariff of the Lombardy Region, 2015). The value of the chemotherapy treatment is € 30.000 instead.
The total cost for a single treatment is € 4145 + € 10972 + € 30000 = € 45117.
Fig. 2 shows the graph that compares expenditure distribution in the warranty-based healthcare system and the Italian NHS in a single treatment scenario. In the Italian NHS, the smoker patient does not contribute to the healthcare cost of € 45.117 (possibly he could pay the ticket worth € 22). The healthcare system bears all the costs. Using the warranty-based system, the smoker patient bears 90% of the costs for € 40.605,3. The healthcare system will support the remaining 10% of the expenditure, for € 4.511,7.
All subsequent graphs use the Italian situation recorded in 2019[3]. In that year, 42.500 cases of lung cancer were recorded[4]. The graphs propose different scenarios in which the percentage of confirmed smokers varies.

[3] Data available at www.salute.gov.it
[4] Although data for 2020 are available, they have not been chosen due to the pandemic emergency.

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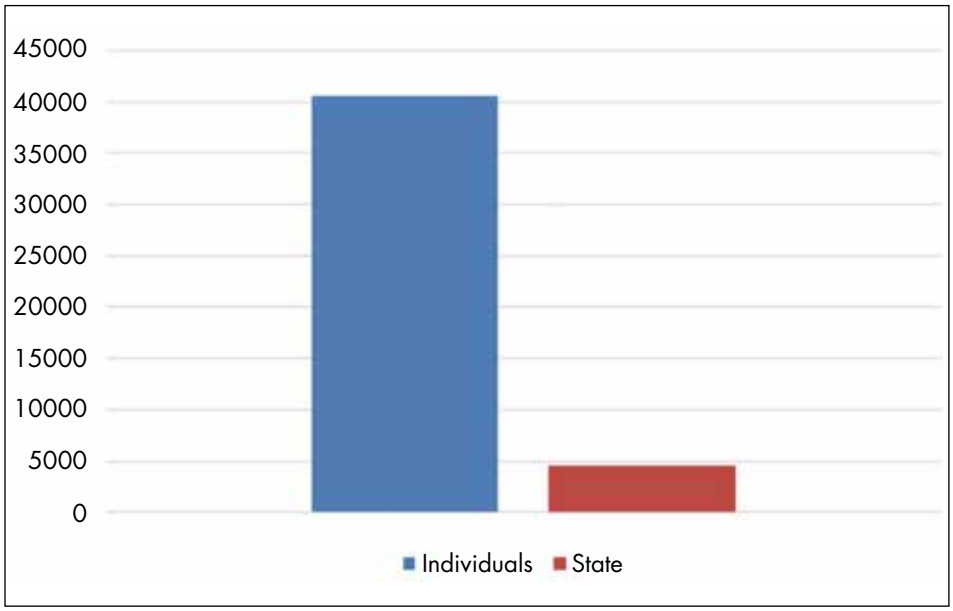

Fig. 2
Shows the distribution of a single treatment between the individual and the state

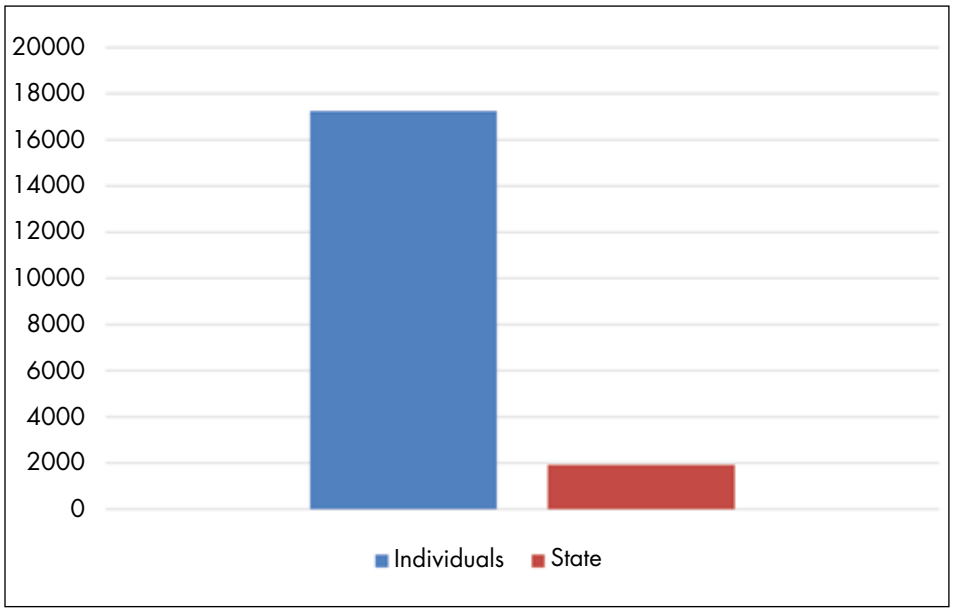

Fig. 3
The distribution of total costs between individuals and the state when 100% of the cases are reported on smokers

Fig. 3 illustrates the scenario where all reported lung cancer cases are found in smokers. The total expenditure of the Italian NHS is € 1.917.472.500. The warranty-based healthcare system is divided as follows: € 1.725.725.250 is the value of the expenditure incurred by patients, € 191.747.250 is the value of the expenditure that will support the healthcare system. The graphic shows that by applying the warranty-based healthcare system, the expenditure of the healthcare system is lower than that of patients. Compar-

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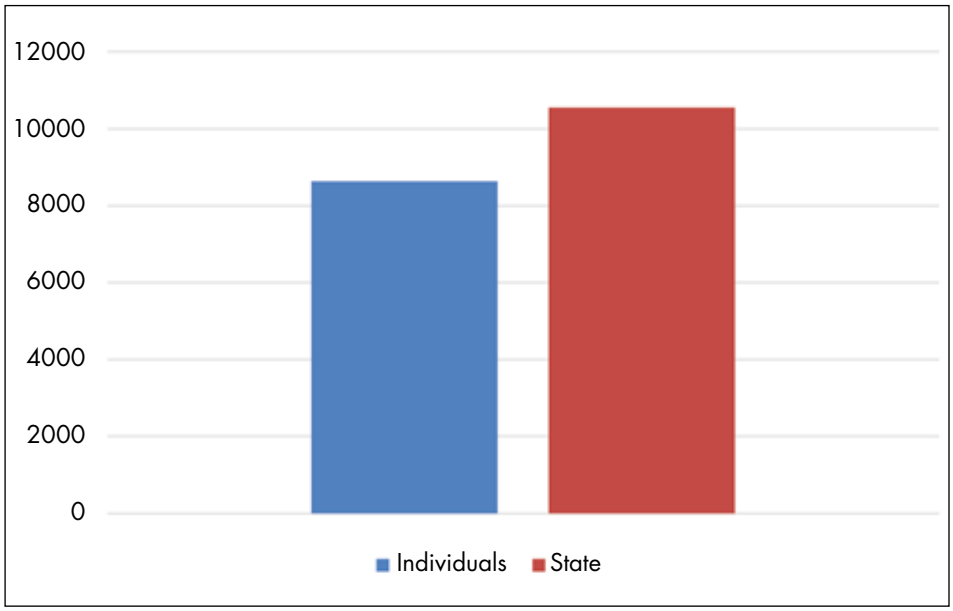

Fig. 4
The distribution of total costs between the individuals and the state when 50% of cases are reported on smokers

ing the State's expense in the theoretical model with the State's expense, for the same case, in the Italian NHS, it derives the State's expense in the warranty-based healthcare system is much lower than the NHS's.

Fig. 4 illustrates the scenario where smokers are 50% of the 42.500 cases registered in 2019. This scenario allows observing the "double payment" of the warranty-based healthcare system. The total expenditure is divided as follows: € 923.770.575 is the expenditure incurred by 22.750 smokers with lung cancer, € 102.641.175 is 10% of smokers' health expenditure supported by the warranty-based healthcare system. € 1.026.411.750 is the expense that the theoretical system bears for caring for 22.750 non-smoking patients and, therefore, fully covered by the guarantee. The total expenditure of the warranty-based healthcare system is equal to the sum between the expenditure of 50% of non-smoking patients and the 10% of smoking patients: € 1.026.411.750 + € 102.641.175 = = € 1.129.052.925. Comparing this value with the expenditure of the Italian NHS, it is shown that the warranty-based healthcare system still incurs a lower expenditure:

- SSN expenditure: € 1.917.472.500.
- Warranty-based healthcare system expenditure: € 1.129.052.925.

By subtracting the expense of the health care system from the NHS expenditure, money saved is highlighted:
€ 1.917.472.500 – € 1.129.052.925 = = € 788.419.575.
The last scenario is that no smokers were identified among the 42,500 cases of lung cancer registered in 2019. In this case, the expenses of a warranty-based healthcare system and the NHS would be equivalent.
However, this scenario would result in zeroing the choice of the smoking risk

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factor. Thus, it would concretise achieving the best possible outcome regarding prevention. Furthermore, considering the incidence of smoking as a risk factor, it is unlikely to have the same number of lung cancer cases in the absence of smokers.

This last simulation communicates supplementary information: the expenditure of the theoretical system is never higher than the NHS one but will always be lower in any scenario where the percentage of patients who have become ill because of a modifiable risk factor is less than 100% of registered cases.

7. Discussion and conclusion

This paper introduces the warranty-based healthcare system and its implication on health responsibility and the financial sustainability of healthcare systems.

In this theoretical system, individual health is compared to goods with warranty. The individual loses their warranty when he pursues unhealthy choices that damage health.

Regarding financial sustainability, using comparative analysis, the authors showed a net reduction in the financial needs of the social program derived from the expense borne by 'responsible' patients.

From a cultural point of view, it would be difficult for people to adapt to such a radical change in personal health. How people think about risky decisions depends not only on internal factors such as knowledge, information, ability, and experience but also on external factors such as the social environment, including laws, measures, and systems.

The warranty-based healthcare system charges the patients the expenses of pathologies resulting from a long period of unhealthy, risky choices and behaviours. The later the negative consequences of a behaviour or a choice are, the lower individuals perceive the risk (Bonini *et al.*, 2008). Patients would pay for choices adopted decades before penalising individuals who do not internalise the costs of such choices to discharge expenses on society. Introducing this kind of healthcare system in a society that used to have an NHS would require hard work to change cultural values and ways of thinking consolidated in time.

Beyond the cultural aspect, there are difficulties regarding acceptance by the population. In Italian public opinion, in public health, the collective interest is more important than the individual interest. Article 32 of the Italian Constitution defines healthcare as a right of the whole population. With the warranty-based healthcare system, the principle of solidarity is missing because of the individual responsibility for health. From a unique economic perspective, even if it appears correct to make people pay for the consequences of well-known bad choices, having a healthcare system as warranty-based would be a loss. The eventuality of sustaining a percentage of the medical expense because of individual behaviours is a limitation if applied to people with all the sanitary treatments they need without paying more than taxes.

Introducing such a new healthcare system model would challenge public administrators. As the Italian case suggests, implementing a significant change in a delicate dimension as healthcare requires time and incremental processes rather than radical

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ones. Furthermore, implementing a new healthcare system model would require adopting different managerial models with which the public and healthcare managers could work more effectively and efficiently. Because this theoretical model still has no practical application, thinking about the best-suited managerial models requires more effort from business economics, management and medicine scholars (including, in this last category, physicians).

The research acknowledges higher acceptance possibilities in countries with a private healthcare system or a prevalent private one. Applying the same individual economic principle, in a context in which insurance is a sort of obligation and people – also for culture – have to pay for every kind of illness, having a healthcare system funded by taxation in which the only way to overspend is to get sick because of their own choices, would make people accept it as a progression and an occasion to get more economic value from the management of their health.

By acknowledging such issues, the research aims to stimulate a debate on the possible evolution of the Italian NHS. In Italy, the private health expense for health was 29,34 in 2021, registering a rise of 20.7% compared to 2020 (MEF, 2022). Given the constant increase in private expenses, we suggest, provocatively, that such a transition is already happening as a united consequence of the financial issues of our healthcare system.

Because of the financing problem and the increasing private expenses, the warranty-based healthcare system can be considered not only a possible option for citizens to contain private expenses but also the inevitable evolution of the public healthcare systems of the future.

This research presents several limitations. First, it needs to investigate the potential implications from an organisational perspective. For example, there is no analysis regarding who inside the hospital is responsible for investigating the patients' behaviour and how the investigation should be pursued. Further research can clarify the guidelines for implementing the inquiry. Second, each clinical situation requests a dedicated treatment, which influences the related expenses. The necessity to create synergies with medical staff to understand and calculate properly the exact standard cost to treat every disease leaves the possibility for further investigations, as well as the choice of the best-suited managerial models for this healthcare system model.

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