A Set of Criteria for the Assessment of the Suitability of a Building to be Converted for Use as a Healthcare Facility

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Abstract. The COVID-19 pandemic highlighted the structural criticality of health systems at the international level and acted as a catalyst for their transformation. In Italy, under Mission 6 - Health, the NRRP envisages the strengthening of territorial healthcare by constructing two types of facilities: Community Homes Facilities (CHFs) and Community Hospitals (CHFs). The regulations allow these healthcare facilities to be built from scratch or by reusing existing buildings, an option that fits into a circular economy framework that favors urban regeneration processes and limits land consumption. The selection of buildings suitable for conversion is a complex decision-making process that requires a rigorous methodological approach capable of integrating both the intrinsic characteristics of the buildings and the extrinsic characteristics of the territorial context. This research, through a systematic review of the literature and regulatory frameworks, proposes five evaluation criteria to assess the degree of suitability of a building to undergo a re-functionalization process in favor of CHFs. The adoption of this methodological framework provides evidence-based support to policymakers and urban planners, facilitating informed site selection and contributing to an effective and sustainable reorganization of territorial healthcare.

Keywords: Healthcare facilities · Site selection · reuse of the building · Evaluation criteria · CHFs

1 Introduction

The public health emergency caused by COVID-19 (C19) in 2020 has posed significant challenges to healthcare facilities worldwide, affecting their operational, managerial and care delivery capacities. In the European context, National Health Systems (NHS) have been forced to address critical issues related to the scarcity of financial resources, the inadequacy of health infrastructures, the lack of appropriate technological equipment and the shortage of health workers. In Italy, the pandemic has been one of the most significant health crises that the country has faced in recent history: hospitals have had

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to deal with overcrowding in intensive care units and the reduction in their capacity to provide routine health services, with direct consequences for the management of non-C19-related diseases [1].

The systemic and structural criticalities that emerged during the pandemic spread are the direct implication of the policies carried out by the government over time [2]. The Italian NHS was established in 1978, ensuring universal healthcare coverage as a fundamental right for all citizens, regardless of individual financial capacity [3]. Despite the remarkable goal the NHS has faced growing economic crises. Since the 1990s, several reforms have been introduced to improve the efficiency and sustainability of the system. The most significant has been the decentralization of the NHS, shifting financial, managerial, and healthcare delivery responsibilities from the central government to the regions [4]. Under this model, the role of the government has been redefined as a regulatory and supervisory body, primarily for establishing the Essential Levels of Care (LEA) that each region must ensure for its population. While the primary objective of the reform was to strengthen the financial sustainability of the healthcare network, the outcomes of decentralization have been different and heterogeneous. Significant demographic, economic, and administrative disparities among regions, associated with variations in infrastructural resources, have exacerbated regional inequalities in healthcare service efficiency and expenditure levels. In particular, southern Italy regions have faced greater challenges in maintaining financial stability, leading to substantial budget deficits [5]. Consequently, the central government has intervened by implementing financial recovery plans aimed at containing healthcare expenditure in deficit-stricken regions [6, 7]. These policies have had the effect of progressively weakening the NHS and its structural limitations have become particularly evident during the health emergency. The pandemic has highlighted the need for the NHS to undergo a process of transformation in order to adequately manage potential health crises and respond effectively to ongoing demographic and epidemiological changes [8–11].

In this context, the European Union (EU) introduced the Next Generation EU, a temporary (2021–2027) financial instrument to rebuild Europe and mitigate the economic and social damage caused by C19. In order to access these funds, Italy developed the National Recovery and Resilience Plan (NRRP), which is structured into 7 missions, each representing a thematic area with a package of measures to be adopted [12, 13]. Mission 6, titled "Healthcare," focuses on strategies to modernize, digitalize, and enhance the inclusivity of healthcare infrastructures, ensuring equitable access to care and strengthening territorial healthcare services. One of the government's key objectives is to restructure community-based healthcare by establishing "Proximity Networks," i.e. facilities providing primary and intermediate healthcare services. These networks aim to solve the minimal healthcare communities' needs, alleviating pressure on hospitals [14]. Under the NRRP, the government initially has planned to establish 1350 community health facilities (CHF), 400 community hospitals (CH), and 600 local operating centers (LOC) by 2026. However, both the increase in raw material prices and the rise in energy prices in 2022 led to a significant increase in construction costs, which inevitably compromised the original NRRP targets. In response, on 7 August 2023, the European Commission has approved a revised version of the NRRP submitted by the Italian government to adjust and scale down the original objectives. Specifically, the revised targets

include the establishment of 1038 CHFs (−Δ 312), 307 CHs (−Δ 97), and 400 LOCs (−Δ 200) [15].

To facilitate the planning phases of these new healthcare infrastructures, the National Agency for Regional Healthcare Services (AGENAS), in collaboration with the Department of Architecture, Built Environment and Construction Engineering (ABC) and the Design & Health Lab of the Polytechnic of Milan, has developed the *"Documento di indirizzo per il metaprogetto della Casa di Comunità"* [16] and the *"Documento di indirizzo per il metaprogetto dell'Ospedale di Comunità"* [17]. The purpose of these documents is to provide operational guidelines, based on the current legislative framework and community needs, to technical offices and designers involved in planning and designing CHFs and CHs. A fundamental aspect emphasized in these guidelines is the necessity of conducting preliminary analyses at both territorial and local scales to inform the decision-making process regarding the localization of these new healthcare facilities. To ensure fair and widespread access to CHFs and CHs, site selection should be based on strategic criteria that consider territorial specificities, rather than merely relying on quantitative criteria such as the population catchment area defined by sector regulations [18]. Indeed, localization plays a crucial role in the success of the new community-based healthcare model, but in the absence of adequate decision-support tools, the site selection is often handled on a case-by-case basis, leading to discretionary choices that risk making territorial inequalities greater [19].

Furthermore, the sector regulations provide two options for establishing CHFs and CHs: the construction of new buildings or the repurposing of disused structures. The latter option, following the principles of the circular economy, represents an opportunity to optimize financial resources and reduce the environmental impact of new infrastructure projects [20]. The reuse of disused buildings offers multiple benefits, including urban regeneration, reduction of consumption of natural land, and improvement of energy efficiency. The repurposing of existing structures is a particularly suitable solution for CHFs, as these facilities have relatively low architectural and technological complexity and moderate size requirements, making them easier to integrate into buildings originally designed for other functions.

2 Aim

The planning of CHFs and CHs represents a multidimensional decision-making issue that involves multiple disciplines and a wide range of stakeholders. Addressing this complexity requires the adoption of evaluation tools that integrate both qualitative and quantitative variables, thereby enabling a comprehensive representation of the decision-making problem while considering the specific constraints of the territorial context in which the assessment is developed. Furthermore, it is essential to ensure a balanced representation of the interests of the various stakeholders involved in the operation, including the state, regional authorities, local health agencies and the local population [19].

This study is part of the outlined framework. The objective is to propose a set of criteria to assess the suitability of existing buildings for conversion into healthcare facilities. In particular, the research aims to develop a structured criteria abacus to support

decision-making processes concerning the functional repurposing of disused buildings for the establishment of CHFs.

The identification of the evaluation criteria set has been conducted in two stages. Firstly, a thorough review of sectoral regulations has been carried out, identifying the organizational, qualitative and technological standards for territorial healthcare structures. This ensured the inclusion of assessment criteria that met legislative requirements. In the second step, a comprehensive review of national and international academic literature on the localization of various types of healthcare facilities has been performed. This analysis aimed to determine established evaluation strategies that could serve as a foundation, adaptable to the specific context of CHFs.

In this sense, the goal of the present study is to identify the key evaluation criteria, systematically classified into categories (building-related, socio-demographic, epidemiological, economic, and territorial), to verify the feasibility of repurposing disused buildings within a valorization and functional transformation strategy. The methodological approach implemented in this research integrates regulatory aspects, empirical evidence and findings from previous studies aligned with the same objective, to provide Decision-Makers (DMs) with a practical support tool.

The results of the review process are presented in Sect. 3 of the paper. The obtained outputs led to the selection of five criteria, which are further detailed into sub-criteria that address critical issues in the planning phase of healthcare interventions aimed at the functional reconversion of degraded or unused buildings into CHFs. Finally, Sect. 4 outlines the study's conclusions and potential future research developments.

3 Identification of Criteria for Functional Reconversion of a Disused Building into a CHFs

Investment decisions regarding healthcare facility planning require extensive consideration, as the outcome of these choices can significantly impact the quality and effectiveness of healthcare services [21, 22]. In the context of the reorganization of territorial healthcare in Italy, Ministerial Decree No. 77 of 2022 defines CHFs as "physical and easily identifiable facilities where citizens can access healthcare and social-healthcare services with a healthcare focus" [23]. The regulation thus emphasizes the role of CHFs as recognizable territorial healthcare hubs, designed to become a reference point for the community ensuring widespread and accessible healthcare services. In order to achieve these objectives adequately, DMs have to identify a suitable localization for these facilities within the urban context, to guarantee that CHFs are easily accessible and rationally distributed across the national context. Beyond the issue of siting, it is also necessary to assess whether CHFs should be the result of an ex-novo project or integrated into existing buildings. The second approach (i.e. the reconversion of an existing asset for health use) could potentially expedite intervention implementation timelines and reduce land consumption, thereby promoting the regeneration of the built environment.

In this context, DMs need to adopt a structured methodological approach that facilitates a rational choice process for the planning of healthcare facilities (in general) and CHFs (in particular). The analyses should support both the identification of an appropriate localization for these facilities and the assessment of the feasibility of repurposing

disused buildings for the new function. From this perspective, this research aims to develop a set of evaluation criteria to guide this decision-making process.

A narrative review of academic literature and sector-specific regulations has been carried out. The analysis of national and international empirical evidence is aimed at identifying criteria already used to address the challenges of siting healthcare facilities and repurposing disused real estate assets. The review has included studies on various types of healthcare facilities, with the objective of selecting a broad set of criteria that can be adapted to the evaluations of specific CHFs. The analysis has highlighted that the siting of newly built healthcare facilities has been extensively studied, whereas the repurposing of existing buildings for healthcare purposes remains an underexplored topic. To address this knowledge gap, the review has also included articles analyzing adaptive reuse in general, selecting from them only those criteria applicable to the planning of CHFs. The literature investigation has been conducted consulting major academic databases, i.e. Scopus, Google Scholar and PubMed, using keywords such as "siting healthcare facilities," "community healthcare facilities," "hospital site selection," and "adaptive reuse of buildings". The review has included only English-language articles that explicitly identified evaluation criteria in consistency with the research objectives. Furthermore, related articles and their bibliographies have been examined. This process of review ultimately has resulted in the selection of 40 scientific papers.

Concurrently, an analysis of the regulatory framework has been undertaken, with particular emphasis on Ministerial Decree No. 77 of 2022 [23] and the guidelines for the meta-project [16]. A qualitative analysis of regulatory documents has been developed to extract evaluation criteria that would be useful for the planning phase of CHFs.

The methodological approach adopted, in conjunction with the processing of the obtained results, has allowed the identification of five evaluation criteria, which have been further articulated into sub-criteria measurable through specific indicators. The criteria are intended to be adopted by public administration, policymakers and designers in the planning of CHFs, with the scope of ensuring decision-making based on a systematic and multidimensional approach.

The criteria identified are described below: i) Territorial context characteristics, ii) Site area (in the case of new constructions) and building characteristics (in the case of the refurbishment of disused buildings), iii) Sociodemographic characteristics, iv) Epidemiological aspects and v) Economic issues (see Fig. 1).

The **"Territorial context characteristics"** criterion comprises sub-criteria that allow the analysis of the specific features of the urban context in which a healthcare facility is planned to be included. The examination has highlighted that accessibility to healthcare facilities is an essential requirement to ensure equitable access to healthcare services and to reduce territorial inequalities. Homogeneous distribution of facilities enables an effective response to the growing healthcare needs of the population [24, 25]. In addition to the dimension of physical accessibility, further evaluation fields include the environmental quality of the urban context and the analysis of the pre-existing healthcare network.

The **"Site Area and Building Characteristics"** criterion incorporates sub-criteria designed to evaluate the physical characteristics of the building to be functionally transformed. Given that the majority of the selected articles focus on the construction of new

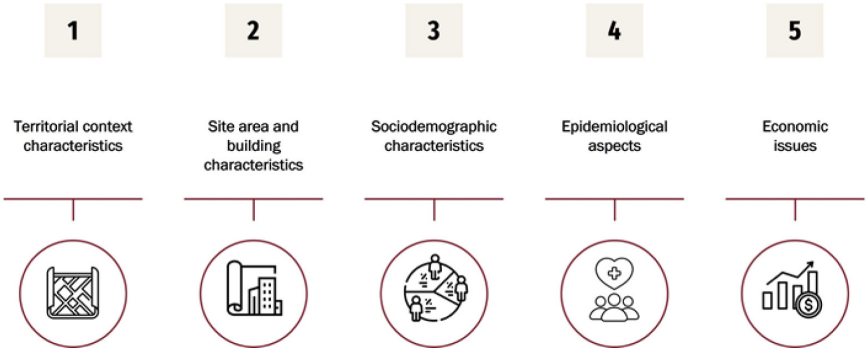

Fig. 1. Criteria for assessing the suitability of disused buildings for repurposing into healthcare use.

healthcare facilities, additional sub-criteria have been included to assess the suitability of the site for new developments.

Two further fundamental criteria for guiding investment decisions related to the establishment of healthcare facilities concern the analysis of the **"Sociodemographic characteristics"** and **"Epidemiological aspects"** of the target population (catchment area). By assessing these aspects, it is possible to understand the composition and distribution of the population that will benefit from the intervention.

Finally, the assessment of the economic and financial feasibility of a project concerns the analysis of the **"Economic issues"** associated with the initiative. The cost of the intervention, the level of community support and the modalities of funding are key factors in determining the economic sustainability of the project.

The criteria described are further divided into sub-criteria, each of which can be measured by indicators. In order to ensure a systematic presentation of the results of the narrative review, five tables have been elaborated (one for each criterion). Each table shows: i) the sub-criteria identified for the assessment of the criterion, ii) the indicators used to measure the sub-criteria, and iii) the bibliographic sources from which the systematized information is derived. It should be noted that the terminology used in the tables reflects the results of the review carried out in this research and, where possible, similar concepts have been grouped under a single definition.

3.1 Territorial Context Characteristics

The identification of the most suitable localization site for a healthcare facility must be based on a thorough analysis, both at the territorial and local levels. It is essential to adopt an assessment approach that makes it possible to examine the characteristics of an urban area in terms of potential and possible critical points in order to select the site that best meets the operational and functional needs of a health facility. The NRRP promotes the concept of 'proximity to healthcare', which requires that CHFs are planned taking into account the characteristics of the urban context, urban infrastructures, environmental quality and integration with the existing healthcare network.

Table 1 summarizes the findings related to this criterion from the review of academic literature and sector regulations. Specifically, from the analysis 15 measurable sub-criteria through quantitative and qualitative indicators have been identified.

Accessibility is the most important requirement to be considered in health facility planning operations. Soltani et al. [30] define accessibility as the ease with which a service can be reached within a reasonable time and at a reasonable cost. One of the first aspects to be analyzed is therefore the infrastructure efficiency of the reference urban area, assessed by the presence and distance of bus, tram, metro stops and railway stations from the structure. In addition to public transport, many studies analyze the efficiency of the road network linking residential areas to the health facility. In this context, Vahidnia et al. [52] use GIS systems to analyze road networks and calculate the length and average travel time (based on traffic information) to reach the facility. This type of data is particularly relevant for planning emergency services, for which it is essential to minimize the travel time to reach them. The assessment of major roads is also essential for the planning of community health centers, especially if they are to serve areas without public transport.

Another aspect to be taken into account is the existing and planned hospital network in the urban context. Ministerial Decree No. 77 of 2022 emphasizes the importance of integrating the functions of CHFs with the other care sectors, in order to ensure the cohesion of health services and the sharing of knowledge between professionals. Empirical evidence shows that the analysis of the existing health network is carried out using indicators such as the number and/or presence of health facilities in the urban context being evaluated. However, to guarantee a more accurate and comprehensive analysis, the consideration of other indicators, such as the type of facilities included in the area (hospitals, clinics, outpatient clinics) and their mode of financing (private, public, mixed) should be carried out. An analysis of this type makes it possible to characterize the range of services on the reference territory, to avoid duplication of services and compensate for any shortcomings [27]. Environmental quality is another field examined by empirical evidence. The concentration of air pollutants (e.g. PM10, O3, NO2), which is particularly high in urban areas, and noise pollution can have an impact on the well-being of patients during hospitalization. For this reason, several studies suggest avoiding proximity to (polluting and noisy) industrial activities that reduce the environmental quality of the urban context. In addition to being affected by environmental conditions, healthcare facilities also have an impact on the ecosystem. For example, the management of hospital wastewater is a major issue: the existence of an adequate sewerage network is essential [46]. Moreover, hydrogeological risk plays a crucial role in the choices processes related to the health facilities interventions. The distance from rivers and canals is used as an indicator to assess the risk of flooding, which could affect operational management and patient safety [56].

3.2 Site Area and Building Characteristics

The ‘Site and building characteristics’ criterion is structured into 17 sub-criteria, as shown in Table 2. These sub-criteria fall into two main categories: i) the assessment of the specific characteristics of a building undergoing functional change, and ii) the analysis of the site designated for the construction of a new healthcare facility.

Table 1. Sub-criteria and indicators of territorial context characteristics.

Territorial context characteristics		
Sub-criteria	Indicators	Source
Urban development center	Dummy (presence/absence)	[26, 27]
Potential of the area to become an attractive center	Dummy (presence/absence)	[19, 27–29]
Accessibility	Public, private, and soft mobility and number of parking spaces (availability; distance)	[19, 27–42]
	Bus stops (no.; distance)	[26, 43–46]
	Subway stops (no.; distance)	[43–45]
	Tram stops (no.; distance)	[43, 45]
	Taxi stops (no.; distance)	[46]
	Railway station (distance)	[43, 45, 47–50]
	Arterial roads and main roads (distance)	[26, 28, 30, 32, 33, 36, 40, 44, 45–55, 57, 58]
	Average annual daily traffic of roads leading to the facility (no. vehicles/year)	[32, 40, 43, 45]
	Travel time to the facility (minutes)	[30, 32, 35, 42, 52, 53, 57]
Existing healthcare facilities	Healthcare facilities (no.)	[19, 26, 27, 31, 33, 35, 40, 45, 59]
	Healthcare facility (distance)	[30, 31, 34–36, 44–49, 51, 53–55, 57]
	Frequency of visitation for health services, Healthcare spending and health insurance payment (%)	[43]

(*continued*)

Table 1. (*continued*)

Territorial context characteristics		
	Types of healthcare services provided, size, clientele and funding mechanism	[43, 59]
	Health market growth rate (%)	[31, 40, 59]
	Capacity/availability of healthcare facilities (ratio between no. beds/inhabitants)	[31, 33, 35, 39, 40, 45]
	Equity of access to health services	[57]
Services	Services present within a defined distance from the site (no.)	[19, 28, 29, 60]
	Offices (distance)	[44]
	Banks/ Post Offices (distance)	[27, 29, 44]
	Schools (distance)	[26, 27, 37, 44, 45, 47]
	Shopping centers/shops (distance)	[26, 37, 40, 41, 51, 57, 61]
	Place of cult (distance)	[26, 37, 44]
	Fire station (distance)	[18, 37, 44, 53, 54]
Sewerage system	Dummy (presence/absence)	[19, 26, 29, 30, 32, 43, 44, 46, 61]
Wastewater treatment system	Dummy (presence/absence)	[45]
Green areas	Parks/gardens (presence, distance)	[19, 26, 27, 30, 34, 38, 44, 45, 48, 54, 57, 60]
Hydrogeological/hydraulic instability	Rivers and canals (presence/absence)	[18, 26, 37, 44]

(*continued*)

Table 1. (*continued*)

Territorial context characteristics		
	Rivers and canals (distance)	[46, 49–51, 53, 55, 56, 58]
Natural disaster risk zones	Faults, volcanoes (distance)	[39, 40, 42, 44, 54, 56]
Air pollution	Contraction of specific pollutants (PM10, O3, NO2)	[18, 19, 26–30, 33, 38–40, 48, 52]
Noise pollution	Sound pressure level (Leq, Lden, dB)	[18, 19, 26–30, 32, 38–40, 46]
Water pollution	Contraction of specific pollutants (microbiological and chemical contamination, physic-chemical parameters)	[38–40]
Unhealthy industries	Industrial activities (presence/absence)	[18, 26, 45, 48, 53, 57]
Residential area	City center or densely populated areas (distance)	[30, 32, 33, 44, 47, 49, 50, 54, 55, 58]

In this sense, it should be recalled that, although the primary objective of this research is to identify criteria for assessing the suitability of a disused building for conversion into a healthcare facility, empirical evidence suggests that most studies focus on newly constructed projects. Therefore, to ensure a comprehensive review and to avoid overlooking potentially relevant factors, the study also includes criteria for evaluating site localization.

The construction of a new health facility involves significant costs, making the renovation of an existing building a potentially advantageous alternative [65]. However, this is not always the "best" solution and it is essential to analyze the potential criticalities associated with a renovation project, such as: i) the lack of suitable properties for conversion within the identified territorial context, ii) the excessive renovation costs due to the state of maintenance of the property, and iii) the disagreements among the stakeholders involved in the operation [66]. A thorough analysis of these aspects is fundamental to ensure the technical and economic feasibility of the interventions and to prevent any potential problems from compromising the success of the initiative.

The first aspect to consider in the redevelopment of disused real estate assets concerns the maintenance condition of the building, as severely deteriorated states of preservation may entail significant investment costs, thereby reducing the economic viability

Table 2. Sub-criteria and indicators of building and area characteristics.

Site area and building characteristics		
Sub-criteria	Indicators	Source
Area suitability	Contaminated area (dummy)	[19, 26, 27, 37, 40, 41, 45, 46, 50, 52, 56–58, 61]
Size and shape of the land	The ratio of site area to square meters of health facility (no.)	[19, 26–30, 46, 53]
Historical and artistic constraints	Constrained building (dummy)	[60]
Land use	Compatibility with the land-use plan: presence of urban constraints (dummy)	[19, 26, 27, 30, 32, 35, 38, 46, 47, 50, 56–59]
Site slope	Slope index (%)	[30, 45, 48, 56, 58]
Area flexibility	Possibility for future expansion (residual buildability index)	[28–30, 35, 37, 39–42, 46, 48, 61]
Water and electricity	Existence and functioning of water and electricity connections (dummy, qualitative assessment)	[30, 32, 33, 35, 37, 40, 41, 43, 45, 61]
Property size	m^2	[60]
Building Condition and Maintenance Status	Qualitative assessment of elements (floors, walls and ceilings, fixtures, electrical system, water system and sanitation, heating system, common areas)	[62–64]
Compliance with fire prevention regulations	Presence of compartmentalization systems with REI characteristics (dummy)	[60]
Compliance with seismic regulations	Seismic vulnerability index; compliance with current regulations (dummy)	[60]

(*continued*)

Table 2. (*continued*)

Site area and building characteristics		
Sub-criteria	Indicators	Source
Economic obsolescence	Estimated cost of refurbishment (€/m^2)	[63]
Physical obsolescence	Age of the building (years)	[63]
Functional adequacy	Layout flexibility: modular structural system (dummy)	[60, 63, 64]
Energy efficiency	Thermal transmittance; roof insulation; ground connection; energy certification; carbon footprint ($kgCO_2e/m^2$/year)	[60, 63]
Presence and adequacy of technical systems	Compliance and functionality of Heating, Ventilation & Air Conditioning, water supply, sanitary, and electrical systems (%)	[60]

of the intervention. In this context, Diana L., et al. [62] propose a qualitative assessment approach for the criterion *"building condition and maintenance status"*, based on the evaluation of specific functional components such as floors, walls and ceilings, fixtures, installations and common areas. These elements are rated on a scale ranging from "mediocre" to "poor." Notably, a building lacking electrical and plumbing systems is classified as being in critical condition. Similarly, Langstone C. et al. [63] introduce the concept of *"physical obsolescence"* to assess the condition of a building, a parameter primarily determined by the age of the structure and the lack of regular maintenance. Another fundamental aspect to be examined is *"functional adequacy"*: a modular supporting structure facilitates any building intervention necessary to adapt it to new functional requirements. In addition, the guidance documents for the meta-project of CHFs [16, 60] emphasize that healthcare facilities must comply with current fire prevention and structural safety regulations. In particular, buildings must be constructed with a structure and compartmentalization systems with REI characteristics, as specified by the legislative references, to limit the potential spread of fire.

Another crucial factor is the energy efficiency of the building, in line with the objectives of the 2030 Agenda and the European Green Deal [67–69]. The need to launch a decarbonization process that includes the built environment is demonstrated by the fact that the building sector is responsible for 40% of the EU's energy consumption and 36% of its annual greenhouse gas emissions from the energy sector [70–72]. In

this context, academic literature and regulations propose various indicators to assess the energy efficiency of a building, including envelope transmittance, ground connection and roof insulation. In addition, the Energy Performance Certificate (EPC) provides a summarized classification of the building's efficiency, which can be used as part of the overall assessment of the property.

Beyond building-specific sub-criteria, the characteristics of the site in the case of new-build projects should be analyzed for an effective exam of the alternatives. In particular, a systematic analysis is required to verify the suitability of the site, in terms of soil compaction, potential contamination, land slope and the compatibility of the urban area with the hosting of a healthcare facility under urban planning regulations.

3.3 Sociodemographic Characteristics and Epidemiological Aspects

The socio-demographic characteristics and epidemiological aspects criteria are structured into sub-criteria, organized in Tables 3 and 4, which describe the reference social context.

The analysis of the demographic composition assumes a key role in defining the catchment area of a health facility and understanding the health needs of the communities [43]. Among the most commonly used indicators in empirical research, population density serves as a crucial parameter because it allows an estimate of the potential demand for healthcare that the facility will have to meet [30]. However, population density provides only an aggregate assessment, which requires further investigation to ensure effective planning of health services. An indicator in this regard is the age distribution of the population, with particular attention to the elderly population (>65 years), as they have a higher incidence of health conditions and consequently a greater need for medical use.

In addition to the demographic structure, the design of a health facility must take into account the epidemiological characteristics of the target area. The literature examines the prevalence of chronic and acute diseases in the population, as well as behavioral risk factors such as smoking prevalence, which can have a significant impact on healthcare demand and service delivery [43].

3.4 Economic Issues

Economic sustainability should be verified within the project assessment phase. It involves the analysis of a set of sub-criteria aimed at evaluating the economic-financial dimensions of the initiative. The literature review has allowed us to identify five sub-criteria, which are summarized in Table 5.

The literature reviewed mainly focuses on the cost of land purchase (in the case of an ex-novo project) and the total investment cost. A relevant aspect to be considered is the ownership of the land or building: if the land is publicly owned, the total cost of the intervention can be significantly reduced, as the burden of acquisition is avoided. For this reason, the legal nature of ownership is included in the indicators analyzed.

From a broader perspective of economic analysis, it is also crucial to consider the community support level for the project development.

Table 3. Sub-criteria and indicators of sociodemographic characteristics.

Sociodemographic characteristics		
Sub-criteria	Indicators	Source
Demographics	% of elderly (>65 years); age index	[32, 43, 46]
	Current population in the target area (no. of inhabitants)	[26, 27, 30–36, 39, 50, 58, 59]
	Estimated future population (% annual population growth rate)	[31, 32, 35, 39, 42]
	Population distribution by age groups (no.)	[26, 30, 31, 33–35, 40, 45, 59]
	Current population density (inhab./km^2)	[30–32, 34–37, 40–42, 44–46, 48, 50, 52, 53, 56, 58, 59, 61]
	Estimated future population density (inhab/km^2)	[30, 31]
	Net migration rate (%)	[32, 33]
Socio-economics	% of low-income families; per capita income (€/capita)	[30, 31, 33, 35, 37, 40, 41, 43, 45, 61]

Table 4. Sub-criteria and indicators of epidemiological aspects.

Epidemiological aspects		
Sub-criteria	Indicators	Source
Healthcare demand	Population aged (> 65 years) (no.)	[19, 27]
	Elderly with chronic diseases such as diabetes (%)	[43]
	Smokers (%)	[43]
	Physical activity rate (%)	[43]
	Community health status (% of population with disease)	[45]

Table 5. Sub-criteria and indicators of economic aspects.

Economic aspects		
Sub-criteria	Indicators	Source
Land ownership status	Public/private (%)	[19, 26, 27, 30, 37, 40–42, 45, 61]
Land cost	€/m^2	[19, 26, 27, 30–32, 34–37, 39, 40, 45, 46, 48, 52, 57, 59, 61]
Financial support	Source and availability of funds (descriptive analysis)	[30, 33, 39, 40, 42, 43, 45]
Community support	Participatory approach through surveys and focus groups (qualitative assessment)	[30, 43]
Investment cost	€/m^2	[28, 29, 31, 32, 34–37, 39–41, 43, 45, 59, 61]

4 Conclusions and Future Insights

Over time, Italy has favored a hospital-centered model, translating into the health services predominantly provided by hospitals. During the health crisis, this management model has not been able to adequately address the health needs of the population. The intervention strategies outlined by the government in the NRRP aim to reform the territorial healthcare system through the establishment of CHFs and CHs, which will provide respectively primary and intermediate care services. The regulations stipulate that these types of facilities can be established in existing, disused buildings through refunctionalization projects. Such interventions offer several advantages, including the

regeneration of the existing building stock and the reduction of natural land consumption [73, 74]. To maximize the benefits of the limited available financial resources, investment decisions related to the development of these facilities need to be supported by operational tools that effectively orient the decision-making process. The key tasks to be undertaken during the planning phase of community health facilities include the identification of a strategic localization and the assessment of the feasibility of repurposing abandoned buildings.

The present research has examined both national and international academic literature as well as current regulations regarding the planning of community-based healthcare facilities. The review has aimed to select evaluation criteria that can support both the choice of a suitable site for health hubs and the verification of the feasibility of disused buildings for their functional reconversion for health purposes. The systematization of the collected contributions has led to the identification of 5 main evaluation criteria, which analyze the characteristics of the urban context, demographic and epidemiological aspects, the economic issues of the project and the characteristics of the building to be converted.

The identified criteria do not focus on the specificities of CHFs. Therefore, future research developments may include expanding and refining the criteria set to better and specifically represent the functional, design and operational characteristics of community-based health facilities. In addition, based on the research findings, further insight can concern the development of a decision support system to guide public administrators in the planning and implementation of community health hubs. The design of these facilities is a multi-dimensional choice problem involving different disciplines and multiple stakeholders. In order to effectively address this complexity, the adoption of Multi-Criteria Analysis techniques is proposed [75, 76]. These methods allow the integration of both quantitative and qualitative variables, the consideration of specific territorial constraints and the balancing of the interests of different involved subjects. Furthermore, given the spatial nature of some of the relevant variables, the use of GIS-based systems is envisaged. The expected outcome is the definition of a practical and flexible tool to support strategic decision-making in the context of the territorial health reform promoted by the current funding measures.

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References

1. Bosa, I., Castelli, A., Castelli, M., Ciani, O., Compagni, A., Galizzi, M., Garofano, M., Ghislandi, S., Giannoni, M., Marini, G., Vainieri, M.: Response to COVID-19: was Italy (un) prepared? Health Econ. Policy Law. **17**(1), 1–13 (2022)
2. Mauro, M., Giancotti, M.: Italian responses to the COVID-19 emergency: overthrowing 30 years of health reforms? Health Policy. **125**(4), 548–552 (2021)

3. Ricciardi, W., Tarricone, R.: The evolution of the Italian national health service. Lancet. **398**(10317), 2193–2206 (2021)
4. Mauro, M., Maresso, A., Guglielmo, A.: Health decentralization at a dead-end: towards new recovery plans for Italian hospitals. Health Policy. **121**(6), 582–587 (2017)
5. Tediosi, F., Gabriele, S., Longo, F.: Governing decentralization in health care under tough budget constraint: what can we learn from the Italian experience? Health Policy. **90**(2–3), 303–312 (2009)
6. De Belvis, A.G., Ferrè, F., Specchia, M.L., Valerio, L., Fattore, G., Ricciardi, W.: The financial crisis in Italy: implications for the healthcare sector. Health Policy. **106**(1), 10–16 (2012)
7. Parlamento Italiano Homepage: https://leg16.camera.it/561?appro=94. Accessed 10 Mar 2025
8. De Belvis, A.G., Meregaglia, M., Morsella, A., Adduci, A., Perilli, A., Cascini, F., Scarpetti, G., et al.: Italy: health system review. Health Syst. Transit. **24**(4), 1–236 (2022)
9. Jazieh, A.R., Kozlakidis, Z.: Healthcare transformation in the post-coronavirus pandemic era. Front. Med. **7**, 429 (2020)
10. Bustacchini, S., Abbatecola, A.M., Bonfigli, A.R., Chiatti, C., Corsonello, A., Di Stefano, G., Lattanzio, F., et al.: The Report-AGE project: a permanent epidemiological observatory to identify clinical and biological markers of health outcomes in elderly hospitalized patients in Italy. Aging Clin. Exp. Res. **27**, 893–901 (2015)
11. Atella, V., Piano Mortari, A., Kopinska, J., Belotti, F., Lapi, F., Cricelli, C., Fontana, L.: Trends in age-related disease burden and healthcare utilization. Aging Cell. **18**(1), e12861 (2019)
12. European Commission: https://commission.europa.eu/strategy-and-policy/recovery-plan-europe_it. Accessed 2 Mar 2025
13. Italia Domani: https://www.italiadomani.gov.it/content/sogei-ng/it/it/home.html. Accessed 02 03 2025
14. Filippini, T., Vinceti, S.R.: Italian National Recovery and resilience plan: a healthcare renaissance after the COVID-19 crisis? Acta Biomed. **92**(6), e2021463 (2021)
15. Ministero della Salute: https://www.pnrr.salute.gov.it/portale/pnrrsalute/dettaglioContenutiPNRRSalute.jsp?lingua=italiano&id=5805&area=PNRR-Salute&menu=investimenti. Accessed 2 Mar 2025
16. AGENAS: https://www.agenas.gov.it/comunicazione/primo-piano/2127-documento-di-indirizzo-per-il-metaprogetto-della-casa-della-comunit%C3%A0. Accessed 02 Mar 2025
17. AGENAS: https://www.agenas.gov.it/comunicazione/primo-piano/2160-documento-di-indirizzo-per-il-metaprogetto-dell-ospedale-di-comunit%C3%A0. Accessed 2 Mar 2025
18. Gola, M., Fior, M., Arruzzoli, S., Galuzzi, P., Capolongo, S., Buffoli, M.: A research method for locating community healthcare facilities in Italy: how to guarantee healthcare for all. J. Integr. Care. **32**(1), 98–114 (2024)
19. Dell'Ovo, M., Oppio, A., Capolongo, S., Dell'Ovo, M., Oppio, A., Capolongo, S.: Approaching the location of healthcare facilities: how to model the decision problem. In: Decision Support System for the Location of Healthcare Facilities: SitHealth Evaluation Tool, pp. 53–79 (2020)
20. Tajani, F., Morano, P.: Concession and lease or sale? A model for the enhancement of public properties in disuse or underutilized. WSEAS Trans. Bus. Econ. **17**, 18 (2014)
21. Gul, M., Guneri, A.F.: Hospital location selection: a systematic literature review on methodologies and applications. Math. Probl. Eng. **2021**(1), 6682958 (2021)
22. Baran, E.: An innovative fuzzy TOPSIS method to determine the location of a new hospital. Int. J. Eng. Sci. Appl. **2**(4), 133–136 (2018)
23. Gazzetta ufficiale: https://www.gazzettaufficiale.it/eli/id/2022/06/22/22G00085/SG. Accessed 04 Mar 2025

24. Jausovec, M., Korpnik, N., Gabrovec, B., Klemencic, V.S.: Siting of healthcare care facilities based on the purpose of their operation, demographic changes, environmental characteristics, and the impact on public health. Appl. Sci. **12**(1), 379 (2021)
25. McGrail, M.R., Humphreys, J.S.: Measuring spatial accessibility to primary care in rural areas: Improving the effectiveness of the two-step floating catchment area method. Appl. Geogr. **29**(4), 533–541 (2009)
26. Dell'Ovo, M., Capolongo, S., Oppio, A.: Combining spatial analysis with MCDA for the siting of healthcare facilities. Land Use Policy. **76**, 634–644 (2018)
27. Dell'Ovo, M., Frej, E.A., Oppio, A., Capolongo, S., Morais, D.C., de Almeida, A.T.: Multicriteria decision making for healthcare facilities location with visualization based on FITradeoff method. In: Decision Support Systems VII. Data, Information and Knowledge Visualization in Decision Support Systems: Third International Conference, ICDSST 2017, Namur, Belgium, May 29–31, 2017, Proceedings 3, pp. 32–44. Springer International Publishing (2017)
28. Sen, H.: Hospital location selection with ARAS-G. Eurasia Proc. Sci. Technol. Eng. Math. **1**, 359–365 (2017)
29. Şen, H., Demiral, M.F.: Hospital location selection with grey system theory. Eur. J. Econ. Bus. Stud. **2**(2), 66–79 (2016)
30. Soltani, A., Marandi, E.Z.: Hospital site selection using two-stage fuzzy multi-criteria decision-making process. J. Urban Environ. Eng. **5**(1), 32–43 (2011)
31. Al Mohamed, A.A., Al Mohamed, S., Zino, M.: Application of fuzzy multicriteria decision-making model in selecting pandemic hospital site. Future Bus. J. **9**(1), 14 (2023)
32. Miç, P., Antmen, Z.F.: A healthcare facility location selection problem with fuzzy TOPSIS method for a regional hospital. Eur. J. Sci. Technol.., Avrupa Bilim ve Teknoloji Dergisi. **16**, 750–757 (2019)
33. Şahin, T., Ocak, S., Top, M.: Analytic hierarchy process for hospital site selection. Health Policy Technol. **8**(1), 42–50 (2019)
34. Gazi, K.H., Momena, A.F., Salahshour, S., Mondal, S.P., Ghosh, A.: Synergistic strategy of sustainable hospital site selection in saudi arabia using spherical fuzzy mcdm methodology. J. Uncertain Syst. **17**(03), 2450004 (2024)
35. Senvar, O., Otay, I., Bolturk, E.: Hospital site selection via hesitant fuzzy TOPSIS. IFAC-PapersOnLine. **49**(12), 1140–1145 (2016)
36. Chiu, J.E., Tsai, H.H.: Applying analytic hierarchy process to select optimal expansion of hospital location: The case of a regional teaching hospital in Yunlin. In: 2013 10th International Conference on Service Systems and Service Management, pp. 603–606 (2013)
37. Chatterjee, D.: Can fuzzy extension of Delphi-analytical hierarchy process improve hospital site selection? Int. J. Intercult. Inf. Manag. **4**(2–3), 113–128 (2014)
38. Ahmed, A.H., Mahmoud, H., Aly, A.M.M.: Site suitability evaluation for sustainable distribution of hospital using spatial information technologies and AHP: a case study of upper Egypt, Aswan City. J. Geogr. Inf. Syst. **8**(05), 578 (2016)
39. Adalı, E.A., Tuş, A.: Hospital site selection with distance-based multi-criteria decision-making methods. Int. J. Healthc. Manag. **14**(2), 534–544 (2021)
40. Yılmaz, M., Atan, T.: Hospital site selection using fuzzy EDAS method: case study application for districts of Istanbul. J. Intell. Fuzzy Syst. **41**(2), 2591–2602 (2021)
41. Chatterjee, D., Mukherjee, B.: Potential hospital location selection using AHP: a study in rural India. Int. J. Comput. Appl. **71**(17), 1–7 (2013)
42. Jalaliyoon, N., Arastoo, A., Pirouti, A.: Land selection: using multiple criteria decisions making. Int. J. Acad. Res. Manag. (IJARM). **4**(1), 14–23 (2015)
43. Kim, J.I., Senaratna, D.M., Ruza, J., Kam, C., Ng, S.: Feasibility study on an evidence-based decision-support system for hospital site selection for an aging population. Sustainability. **7**(3), 2730–2744 (2015)

44. Eldemir, F., Onden, I.: Geographical information systems and multicriteria decisions integration approach for hospital location selection. Int. J. Inf. Technol. Decis. Mak. **15**(05), 975–997 (2016)
45. Fardi, K., Ghanizadeh, G., Bahadori, M., Chaharbaghi, S., Shokouh, S.M.H.: Location selection criteria for field hospitals: a systematic review. Health Promot. Perspect. **12**(2), 131 (2022)
46. Abdullahi, S., Mahmud, A.R.B., Pradhan, B.: Spatial modelling of site suitability assessment for hospitals using geographical information system-based multicriteria approach at Qazvin city, Iran. Geocarto Int. **29**(2), 164–184 (2014)
47. Halder, B., Bandyopadhyay, J., Banik, P.: Assessment of hospital sites' suitability by spatial information technologies using AHP and GIS-based multi-criteria approach of Rajpur–Sonarpur Municipality. Model. Earth Syst. Environ. **6**, 2581–2596 (2020)
48. Tripathi, A.K., Agrawal, S., Gupta, R.D.: Comparison of GIS-based AHP and fuzzy AHP methods for hospital site selection: a case study for Prayagraj City, India. GeoJournal. **87**(5), 3507–3528 (2021)
49. Ajaj, Q.M., Shareef, M.A., Jasim, A.T., Hasan, S.F., Noori, A.M., Hassan, N.D.: An AHP-based GIS for a new hospital site selection in the Kirkuk Governorate. In: 2019 2nd International Conference on Electrical, Communication, Computer, Power and Control Engineering (ICECCPCE), pp. 176–181 (2019)
50. Almansi, K.Y., Shariff, A.R.M., Kalantar, B., Abdullah, A.F., Ismail, S.N.S., Ueda, N.: Performance evaluation of hospital site suitability using multilayer perceptron (MLP) and analytical hierarchy process (AHP) models in Malacca, Malaysia. Sustainability. **14**(7), 3731 (2022)
51. Sharmin, N., Neema, M.N.: A GIS-based multi-criteria analysis to site appropriate locations of hospitals in Dhaka City. Hospital. **8**(4), 8–12 (2013)
52. Vahidnia, M.H., Alesheikh, A.A., Alimohammadi, A.: Hospital site selection using fuzzy AHP and its derivatives. J. Environ. Manage. **90**(10), 3048–3056 (2009)
53. Rahimi, F., Goli, A., Rezaee, R.: Hospital location-allocation in Shiraz using geographical information system (GIS). Shiraz E Med. J. **18**(8), e57572 (2017)
54. Kaveh, M., Kaveh, M., Mesgari, M.S., Paland, R.S.: Multiple criteria decision-making for hospital location-allocation based on improved genetic algorithm. Appl. Geomat. **12**, 291–306 (2020)
55. Rezayee, M.: Hospital site selection in Iskandar Malaysia using GIS-multi criteria analysis. Int J Basic Sci Appl Comput. **2**(10), 8–15 (2020)
56. Yu, M., Hu, S.Y., Cai, J.M., Guo, P.N., Li, H.B., Xing, H.G.: A comprehensive evaluation method for the site selection of new healthcare facilities in geological hazard-prone areas. Front. Earth Sci. **11**, 1121690 (2023)
57. Beheshtifar, S., Alimoahmmadi, A.: A multiobjective optimization approach for location-allocation of clinics. Int. Trans. Oper. Res. **22**(2), 313–328 (2015)
58. Almansi, K.Y., Shariff, A.R.M., Abdullah, A.F., Syed Ismail, S.N.: Hospital site suitability assessment using three machine learning approaches: evidence from the gaza strip in Palestine. Appl. Sci. **11**(22), 11054 (2021)
59. Wu, C.R., Lin, C.T., Chen, H.C.: Optimal selection of location for Taiwanese hospitals to ensure a competitive advantage by using the analytic hierarchy process and sensitivity analysis. Build. Environ. **42**(3), 1431–1444 (2007)
60. Capolongo, S., Buffoli, M., Gola, M., Mangili, S., Brambilla, A., Brusamolin, E., Picco, M., et al.: Metaprogetto per Case della Comunità e Ospedali di Comunità. In: Criteri di progettazione architettonico-funzionale e organizzativi. [Meta 2 e 3 (2022)
61. Ramani, K.V., Mavalankar, D., Patel, A., Mehandiratta, S.: A GIS approach to plan and deliver healthcare services to urban poor: a public private partnership model for Ahmedabad City, India. Int. J. Pharm. Healthc. Mark. **1**(2), 159–173 (2007)

62. Diana, L., D'Auria, S., Acampa, G., Marino, G.: Assessment of disused public buildings: Strategies and tools for reuse of healthcare structures. Sustainability. **14**(4), 2361 (2022)
63. Langston, C., Wong, F.K., Hui, E.C., Shen, L.Y.: Strategic assessment of building adaptive reuse opportunities in Hong Kong. Build. Environ. **43**(10), 1709–1718 (2008)
64. Bullen, P., Love, P.: Factors influencing the adaptive re-use of buildings. J. Eng. Des. Technol. **9**(1), 32–46 (2011)
65. Elrod, J.K., Fortenberry, J.L.: Adaptive reuse in the healthcare industry: repurposing abandoned buildings to serve medical missions. BMC Health Serv. Res. **17**, 5–14 (2017)
66. Elrod, J.K., Fortenberry, J.L.: Advancing indigent healthcare services through adaptive reuse: repurposing abandoned buildings as medical clinics for disadvantaged populations. BMC Health Serv. Res. **17**, 5–14 (2017)
67. European Commission: European Green Deal. https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal_it. Accessed 24 Mar 2025
68. United Nations homepage: https://unric.org/it/agenda-2030/.Accessed 24 Mar 2025
69. Tajani, F., Anelli, D., Di Liddo, F., Morano, P.: An innovative methodology for the assessment of the social discount rate: an application to the European states for ensuring the goals of equitable growth. In: Smart and Sustainable Built Environment (2023)
70. Tajani, F., Sica, F., Morano, P., Locurcio, M., Roma, A.: An evaluation method of the building decarbonization process at the international level. In: International Conference on Computational Science and Its Applications, pp. 126–142. Springer Nature Switzerland, Cham (2024)
71. Sica, F., Tajani, F., Cerullo, G.: An evaluation model for an optimal decarbonization process in the built environment. Built Environ. Proj. Asset Manag. **15**(1), 51–66 (2025)
72. Tajani, F., Morano, P., Di Liddo, F., Doko, E.: A model for the assessment of the economic benefits associated with energy retrofit interventions: an application to existing buildings in the Italian territory. Appl. Sci. **12**(7), 3385 (2022)
73. Locurcio, M., Tajani, F., Anelli, D.: Sustainable urban planning models for new smart cities and effective management of land take dynamics. Land. **12**(3), 621 (2023)
74. Tajani, F., Morano, P., Di Liddo, F.: The optimal combinations of the eligible functions in multiple property assets enhancement. Land Use Policy. **99**, 105050 (2020)
75. Guarini, M.R., Battisti, F., Chiovitti, A.: A methodology for the selection of multi-criteria decision analysis methods in real estate and land management processes. Sustainability. **10**(2), 507 (2018)
76. Guarini, M.R., Sica, F., Tajani, F., Sabatelli, E., Anelli, D.: A strategic multidirectional approach for picking indicator systems of sustainability in urban areas. Urban Sci. **8**(3), 107 (2024)