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*Research paper*

# A COMPARATIVE CODING FRAMEWORK FOR ADAPTIVE REUSE OF HISTORIC HOSPITAL BUILDINGS AND COMPLEXES

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**Abstract**

*Historic hospital buildings and complexes represent a specific category of built heritage whose obsolescence is related not only to medical function, but also to inherited spatial organisation, layout form, technical requirements and urban position. Although many no longer meet contemporary healthcare standards, they often retain significant architectural, urban and heritage value.*

*The objective of this paper is to develop a comparative coding framework for analysing adaptive reuse of historic hospital buildings and complexes. The research is based on 43 international examples of former healthcare buildings and complexes converted predominantly to non-medical functions. Each case is coded according to current use, original healthcare function, hospital layout form, urban position, construction period, architectural style, heritage status and data reliability. The database is analysed through descriptive statistics, cross-tabulation, exploratory association testing and interpretative pattern analysis.*

*The results show that cultural, hotel and residential functions are the most frequent reuse directions. Older and highly valuable hospital buildings are more often associated with cultural or museum reuse, while later, larger and more spatially adaptable complexes tend to support hotel, residential or mixed-use transformation. The framework provides a structured basis for comparing inherited hospital characteristics and contemporary programme selection.*

**Key words:** *adaptive reuse, hospital heritage, coding framework, hospital layout form, built heritage*

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## 1. INTRODUCTION

Historic hospital buildings and complexes represent a distinctive category of built heritage whose adaptive reuse cannot be understood solely as functional replacement. Their transformation is shaped by inherited spatial organisation, urban position, architectural character, heritage significance and the capacity of existing layouts to accommodate contemporary programmes.

Unlike many other historic building types, hospitals were designed according to specific medical, institutional and organisational principles. Wards, pavilions, courtyards, circulation systems, service zones and plot structures reflected healthcare regimes rather than generic architectural requirements. When medical use becomes obsolete, these inherited spatial characteristics may either facilitate or constrain future reuse, influencing the suitability of cultural, residential, hotel, educational or mixed-use programmes.

Consequently, adaptive reuse of historic hospital buildings and complexes should be analysed not only through heritage conservation and sustainability, but also through the relationship between inherited spatial configuration and future functional compatibility.

General studies of adaptive reuse emphasise extending building life cycles, reducing demolition, preserving embodied resources and maintaining cultural continuity [1–6]. In healthcare architecture, the reuse of obsolete facilities is linked to changing medical standards and regulatory requirements [7,8], while heritage conservation frames reuse as a way to keep historic buildings active while preserving authenticity and social value [9–12]. However, a compact comparative coding tool that relates inherited hospital layout form to new programme selection is still lacking.

The objective of this paper is to develop a comparative coding framework for investigating the relationship between inherited hospital layout form, heritage characteristics and contemporary reuse outcomes. Rather than serving only as a descriptive classification, the framework establishes a transferable analytical structure for comparing otherwise diverse hospital reuse cases.

## 2. ADAPTIVE REUSE OF HOSPITAL HERITAGE

Within built heritage, adaptive reuse extends building life and maintains cultural continuity while keeping historically significant buildings active through compatible new functions [1–12, 18]. In former hospitals, reuse is specifically conditioned by ward structures, circulation systems, courtyards, service areas and relationships between functional units. These inherited arrangements often differ from contemporary non-medical requirements, making spatial configuration a key factor in reuse potential.

Previous studies have examined adaptive reuse primarily through sustainability, conservation and economic feasibility [1–12], while healthcare-related research has focused on changing medical standards, hospital planning and patient environments [7,8,13]. Studies dealing with hospital morphology show that layout characteristics, spatial hierarchy, complexity and relationships between functional units provide a

useful basis for comparing healthcare buildings across different historical periods [15–17].

Urban position also affects reuse potential. Earlier hospitals were often established on generous peripheral sites that later became integrated into expanding urban areas, while more recent healthcare planning increasingly considered landscape quality, orientation and therapeutic environmental conditions [14]. Together with layout form, these contextual characteristics influence the range of functions that can be accommodated after medical use has ceased.

These observations provide the conceptual foundation for the comparative coding framework developed in this study. The framework treats layout form, urban context and inherited organisational structure as key analytical variables for interpreting the relationship between historic hospital characteristics and contemporary reuse outcomes.

## 3. RESEARCH DESIGN AND CODING METHODOLOGY

This study adopts an exploratory comparative design to investigate adaptive reuse in historic hospital buildings and complexes. It uses a structured corpus of 43 international examples of former healthcare buildings or complexes converted to predominantly non-medical uses. Rather than seeking statistical representativeness, the study aims to identify recurring relationships between inherited spatial characteristics and reuse outcomes through systematic comparison.

The unit of analysis is a historic hospital building or complex, understood as a former healthcare building, group of buildings, hospital estate or urban block with discontinued or transformed medical function and architectural, urban, typological, social or heritage significance. The term is not limited to legally protected monuments; later twentieth-century complexes are included when their scale, morphology or urban role is relevant for adaptive reuse analysis.

The analysed examples were selected according to five criteria: identifiable original healthcare function; completed adaptive reuse or defined non-medical function; sufficient information on current use, layout form, urban position and heritage status; contribution to layout-form diversity; and illustration of a relevant reuse direction. The corpus was assembled from academic literature, institutional sources and documented redevelopment projects. It is a purposive comparative sample designed to maximise analytical diversity rather than a systematic global inventory.

The research methodology follows three sequential stages: (1) case selection and data collection, (2) coding using predefined analytical categories and (3) comparative analysis of the coded dataset. During database development, academic literature, institutional reports, architectural documentation, site plans and floor plans were examined to identify the inherited spatial organisation of each hospital building or complex. Particular attention was devoted to hospital layout form, the principal analytical variable of the proposed framework (Figure 1). Each case was then transformed into a standardised analytical record covering current use, original

healthcare function, hospital layout form, urban position, construction period, architectural style, heritage status and data reliability.

The coded database was analysed using descriptive statistics, cross-tabulation and interpretative pattern analysis. Frequency distributions and percentages were used to describe the structure of the sample, while cross-tabulations examined relationships between current use, hospital layout form and construction period. Because of the limited and purposively selected sample, inferential statistics were used only in an exploratory manner. An exploratory chi-square test and Cramer's V were applied to the full HLF × CU table, while Fisher exact tests were used for selected planned comparisons with small expected frequencies. The aim was not to establish statistically representative global models, but to identify recurring tendencies within the selected comparative corpus.

## 4. CODING CATEGORIES

The proposed coding framework transforms heterogeneous hospital reuse projects into a standardised analytical dataset suitable for systematic comparison. Each case was coded using eight categories: current use, original healthcare function, hospital layout form, urban position, construction period, architectural style, heritage status and data reliability.

Current use (CU) records the dominant post-medical function, while original healthcare function (OHF) identifies the principal historical medical purpose. Hospital layout form (HLF), the central analytical variable, records the dominant inherited spatial configuration relevant to adaptive reuse. Four aggregated layout forms were identified: hospital village, pavilion, block and campus (Figure 1). Hospital village denotes a layered ensemble of interconnected buildings, courtyards and functional units; pavilion refers to separate or semi-separated ward buildings in open or landscaped sites; block describes compact buildings organised as wings, courtyards or urban blocks; and campus refers to larger hospital estates with multiple buildings and open spaces. These categories describe spatial organisation rather than historical medical planning concepts.

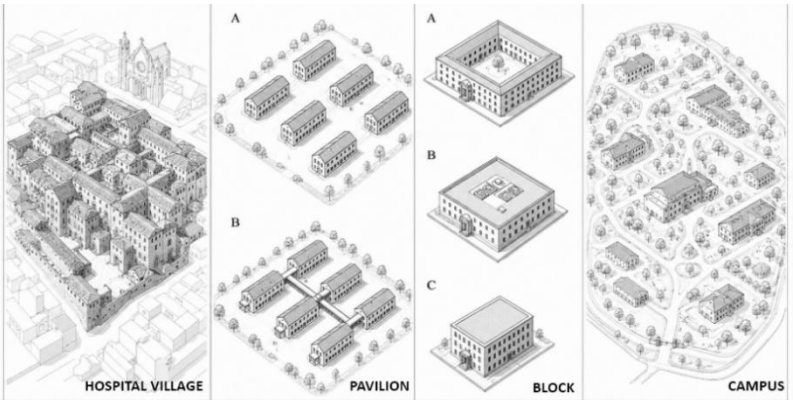



*Figure 1. Schematic interpretation of hospital layout forms used in coding. Source: authors*

Urban position (UP) records the relationship between the hospital and its surrounding context, while construction period, architectural style and heritage status describe historical and conservation characteristics. Data reliability (DR) indicates the quality and consistency of available comparative information.

*Table 1. Coding categories used in the comparative analysis*

| Code group | Codes | Meaning |
|---|---|---|
| Current use (CU) | CU1–CU6 | CU1 culture/museum; CU2 hotel/tourism; CU3 housing; CU4 mixed use; CU5 office/public administration; CU6 university/education |
| Original healthcare function (OHF) | OHF1–OHF7 | OHF1 general hospital; OHF2 sanatorium; OHF3 military hospital; OHF4 psychiatric hospital; OHF5 children's hospital; OHF6 specialised hospital; OHF7 other healthcare use |
| Hospital layout form (HLF) | HLF1–HLF4 | HLF1 hospital village; HLF2 pavilion; HLF3 block; HLF4 campus |
| Urban position (UP) | UP1–UP5 | UP1 central urban; UP2 inner urban; UP3 peripheral/suburban; UP4 parkland/landscape; UP5 isolated/specific |
| Construction period (CP) | CP1–CP5 | CP1 pre-1800; CP2 1800-1899; CP3 1900-1945; CP4 post-1945; CP5 unknown |
| Architectural style (AS) | AS1–AS13 | AS1 Medieval/Gothic; AS2 Renaissance; AS3 Baroque; AS4 Classical; AS5 Historicist; AS6 Romanesque; AS7 Beaux-Arts; AS8 Arts and Crafts; AS9 Art Deco; AS10 Modernist; AS11 Regional Revival; AS12 Mixed/layered; AS13 Other |
| Heritage status (HS) | HS1–HS5 | HS1 confirmed protection; HS2 partial protection; HS3 contextual protection; HS4 no confirmed protection; HS5 unknown/insufficient data |
| Data reliability (DR) | DR1–DR3 | DR1 high; DR2 medium; DR3 low reliability of available comparative data |

Table 1 summarises the coding categories and their associated codes, while Table 2 illustrates their application to selected examples from the comparative database. The database consists of 43 coded cases; due to the page limit, only selected examples are presented here, while the complete coded database is available from the authors upon request.

*Table 2. Example of coded cases from the comparative database*

| Case | Country | Constr. period | Current function | CU | OHF | HLF | UP | HS | AS | DR |
|---|---|---|---|---|---|---|---|---|---|---|
| Santa Maria della Scala, Siena | Italy | pre-1800 | cultural / museum use | CU1 | OHF1 | HLF1 | UP1 | HS1 | AS12 | DR1 |
| Hôtel-Dieu de Marseille | France | 1800–1899 | hotel / tourism | CU2 | OHF1 | HLF3 | UP1 | HS1 | AS4 | DR1 |
| Bristol General Hospital | United Kingdom | 1800–1899 | residential reuse | CU3 | OHF1 | HLF3 | UP2 | HS1 | AS5 | DR1 |
| Sant Pau, Barcelona | Spain | 1900–1945 | cultural / museum use | CU1 | OHF1 | HLF2 | UP2 | HS1 | AS5 | DR1 |
| Genesee Hospital | USA | 1900–1945 | mixed use | CU4 | OHF1 | HLF4 | UP3 | HS4 | AS5 | DR2 |

*Note: The table shows selected coded cases only; code meanings are defined in Table 1.*

## 5. COMPARATIVE RESULTS

The coded database enables comparison between cases through shared analytical variables and reveals recurring relationships between inherited spatial characteristics and contemporary reuse outcomes. The analysis identifies three dominant adaptive reuse directions within the selected corpus: cultural and museum functions, hotel and tourism development, and residential conversion. Together, these categories account for more than 85% of the analysed cases, indicating that historic hospital buildings are most frequently transformed into programmes capable of accommodating existing spatial structures while preserving their architectural identity (Table 3).

*Table 3. Distribution of analysed cases by current use*

| Current use category | Number of cases | Share |
|---|---|---|
| Culture / museum / cultural function | 14 | 32.6% |
| Hotel / tourism | 12 | 27.9% |
| Housing / residential | 11 | 25.6% |
| Mixed use | 3 | 7.0% |
| Office / public administration | 2 | 4.7% |
| University / education | 1 | 2.3% |

Table 4 summarises both the distribution of hospital layout forms and their relationship with current use. Block configurations constitute the largest group within the dataset, followed by hospital villages, campuses and pavilion systems. This distribution reflects the diversity of historic hospital development and the different levels of spatial complexity present in the analysed corpus. More importantly, the cross-tabulation indicates that reuse outcomes are not evenly distributed across layout forms. Although these relationships should not be interpreted as deterministic, they reveal recurring tendencies and suggest that hospital layout form is an important analytical variable for evaluating adaptive reuse potential.

*Table 4. Relationship between hospital layout form and current use*

| Layout form | Culture | Hotel | Housing | Mixed | Office | Univ. | Total |
|---|---|---|---|---|---|---|---|
| Hospital village | 7 | 1 | 0 | 0 | 0 | 0 | 8 (18.6%) |
| Pavilion | 2 | 1 | 2 | 0 | 1 | 0 | 6 (14.0%) |
| Block | 4 | 8 | 7 | 2 | 1 | 0 | 22 (51.2%) |
| Campus | 1 | 2 | 2 | 1 | 0 | 1 | 7 (16.3%) |

An exploratory chi-square test of the full HLF × CU table suggested a possible moderate association, $\chi^2(15, N = 43) = 22.95$, $p = 0.085$, Cramer's $V = 0.42$. Since several expected frequencies were small, two planned Fisher exact tests were applied. Hospital village forms were associated with cultural/museum reuse (7/8 vs. 7/35; $p = 0.0007$), while block forms were associated with hotel, residential and mixed-use redevelopment (17/22 vs. 9/21; $p = 0.031$). These exploratory results support the interpretation that inherited layout form is related to reuse direction.

### 5.1. Cultural and museum reuse

Cultural and museum reuse is the most frequent category in the analysed sample. It is often associated with buildings that have strong architectural, historical or symbolic value, where the former hospital history and spatial organisation become part of the cultural narrative. Courtyards, chapels, wards and historic interiors can support museum, gallery, archive or public cultural functions. Examples include Santa Maria della Scala in Siena and the Recinte Modernista Sant Pau in Barcelona.

### 5.2. Hotel and tourism reuse

Hotel and tourism reuse is another frequent direction. Former hospitals in central urban areas, historic districts or visually prominent locations can become attractive for hospitality because their architectural identity contributes to the experience of place [19]. This pattern is illustrated by the Hôtel-Dieu de Marseille and St. Vincent's Hospital in Santa Fe, both converted into hotels while retaining a recognisable historical identity.

The coding suggests that hotel reuse is often connected with location value and recognisable architectural character. Compact historic hospitals can be adapted for hospitality when room organisation, service circulation and public areas can be inserted without excessive loss of heritage character.

### 5.3. Residential reuse

Residential reuse is strongly connected with the capacity of the building or site to support subdivision into dwelling units. Former hospitals with repeated spatial modules, large floor areas, separate wings or significant open space may be suitable for housing. Examples include Bristol General Hospital, converted into The General as a heritage-led residential scheme with mixed-use elements.

Residential reuse is often linked to broader site transformation, including new open spaces, additional buildings or phased development. In larger former hospital complexes, this process may also contribute to the transformation of the surrounding urban area by introducing new housing, public space, commercial uses and improved connectivity. Smaller urban hospitals, by contrast, depend more on the internal adaptability of the existing structure.

### 5.4. Mixed, institutional and educational reuse

Mixed-use reuse appears in fewer cases, but it demonstrates the capacity of hospital complexes to become part of broader urban regeneration. Large hospital sites or urban blocks may not be adequately reused through a single programme; combinations of housing, hotel, cultural, commercial and public functions may better respond to their spatial complexity. Mixed-use reuse is illustrated by Cook County Hospital in Chicago, while educational reuse is represented by the former hospital in Lecco, transformed into a university campus.

Institutional reuse, including public administration and education, shows another form of continuity: although the medical function is lost, the building remains part of civic or institutional infrastructure. Former wards, administrative zones and service areas may be adapted into offices, classrooms or public service spaces.

## 5.5. Secondary patterns in the coded corpus

Geographical variation was also observed. In the selected corpus, examples from the United States are more often linked to hotel, residential and mixed-use redevelopment, the United Kingdom to residential conversion, Italy to cultural reuse, Spain to cultural and public functions, and France to hotel and cultural programmes. These are indicative tendencies within the analysed sample rather than representative national models.

*Table 5. Relationship between construction period and current use (count; row %)*

| Period | Culture | Hotel | Housing | Mixed | Office | Univ. | Total |
|---|---|---|---|---|---|---|---|
| Pre-1800 | 11 (73.3%) | 3 (20.0%) | 0 (0.0%) | 0 (0.0%) | 1 (6.7%) | 0 (0.0%) | 15 |
| 1800–1899 | 1 (8.3%) | 5 (41.7%) | 4 (33.3%) | 1 (8.3%) | 0 (0.0%) | 1 (8.3%) | 12 |
| 1900–1945 | 2 (14.3%) | 3 (21.4%) | 6 (42.9%) | 2 (14.3%) | 1 (7.1%) | 0 (0.0%) | 14 |
| Post-1945 | 0 (0.0%) | 1 (50.0%) | 1 (50.0%) | 0 (0.0%) | 0 (0.0%) | 0 (0.0%) | 2 |
| Total | 14 (32.6%) | 12 (27.9%) | 11 (25.6%) | 3 (7.0%) | 2 (4.7%) | 1 (2.3%) | 43 |

The second pattern concerns construction period (Table 5). Earlier hospital buildings, especially those constructed before 1800, are strongly associated with cultural and museum reuse, reflecting exceptional heritage significance and symbolic value. Nineteenth-century hospitals demonstrate a more balanced distribution between hotel and residential conversion, whereas twentieth-century examples more often accommodate residential, hotel and mixed-use redevelopment. Construction period does not determine adaptive reuse outcomes, but it contributes to understanding relationships between historical development, inherited spatial organisation and programme selection.

## 6. DISCUSSION

The comparative coding framework demonstrates that systematic coding can provide insights that remain less evident in descriptive case-based studies. By transforming diverse hospital buildings and complexes into a common analytical structure, the framework enables comparison of adaptive reuse projects according to consistent spatial, historical and contextual variables rather than through isolated examples.

The findings suggest that adaptive reuse outcomes are influenced by the interaction of multiple inherited characteristics rather than by any single determinant. The original healthcare function alone does not sufficiently explain later reuse outcomes. Instead, hospital layout form, urban position, construction period, architectural character and heritage status appear to shape the range of programmes that can be accommodated.

Among the analysed variables, hospital layout form emerges as a particularly informative comparative parameter. Rather than representing a historical typological classification, it functions as an organisational descriptor of inherited spatial structure that links architectural morphology with functional adaptability. The observed relationships between layout form and reuse direction indicate that spatial configuration should be considered during the earliest stages of adaptive reuse

evaluation. The geographical and chronological patterns identified within the corpus should be interpreted cautiously. They do not represent statistically representative national or historical models, but they nevertheless suggest that adaptive reuse reflects broader cultural, planning, economic and conservation contexts.

The principal limitation of the research lies in the simplification required by comparative coding. Complex hospital sites frequently comprise multiple construction phases, layered heritage values and mixed redevelopment programmes that cannot be fully represented through categorical variables alone. Nevertheless, such abstraction is necessary to enable systematic comparison across a heterogeneous international corpus.

## 7. CONCLUSION

This paper has presented a comparative coding framework for analysing adaptive reuse of historic hospital buildings and complexes. By integrating information on original healthcare function, current use, hospital layout form, urban position, construction period, architectural style, heritage status and data reliability into a common analytical structure, the framework enables systematic comparison between otherwise heterogeneous international case studies.

The application of the framework to a corpus of 43 adaptive reuse projects demonstrates that cultural and museum functions, hotel and tourism development, and residential conversion represent the dominant reuse strategies within the analysed sample. The results further indicate that adaptive reuse outcomes are associated not only with heritage significance or former medical function, but also with inherited spatial organisation and contextual characteristics. In particular, hospital layout form appears to be a valuable comparative variable for interpreting recurring reuse tendencies across different geographical and historical contexts.

The principal contribution of this research is a transferable comparative framework that organises complex architectural information into a consistent coding structure. In the early design stages, it can support preliminary evaluation of adaptive reuse potential and help identify programme and intervention strategies compatible with inherited spatial organisation, heritage constraints and urban context. It does not replace detailed architectural, conservation, technical or economic assessment, but structures the initial screening and prioritisation of alternatives. Future research may translate selected categories into indexed indicators of spatial flexibility, heritage significance, urban integration and functional compatibility.

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