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NEXT GENERATION HOSPITAL

Executive summary

In the present days, hospitals worldwide are grappling with multiple issues due to the majority of facilities being outdated and ill-equipped, and Italy is no exception. Hospitals are complex ecosystems and involve several stakeholders, from the design phase to daily operativity. Currently, Italy lacks unified regulation for the whole sector; there is no common ground among professionals and experts in various disciplines. Regional approaches are often conflicting and inconsistent with each other. Lack of common regulations results in misunderstanding and lack of cooperation between parties, ultimately leading to inefficiency, increased cost, and the lowering and inhomogeneous quality of the infrastructures nation-wide.

Developed by an interdisciplinary group of eight Master students, the project provides the basis for the new Norma Terminologica UNI , the Italian national industrial terminology standard on healthcare design.

The aim of the project is to allow experts, professionals, and institutions to use on a daily basis the mentioned toolset: the UNI Terminology Standard and, subsequently, UNI Standard. The project uses multiple methodologies to achieve the goal. The strategy of composing the terminology standard is divided into two phases: the research and selection of terms, and the matching definition. The first part was conducted with the close collaboration of JRP-HI committee and expert members: their feedback was gathered through meetings and targeted surveys, resulting in a process of constant iteration and mutual exchange between scientific research and industrial experts' opinion. The terms were sourced through different approaches: a scoping review of scientific literature, the Piano-Veronesi Meta-project review (MD 12/12/2000), and the comparison between international healthcare legal regulations. The group also attended PhD and Master lectures, took an active part in JRP-HI meetings and other conferences and visited in firts person some hospitals known to be best practices in Europe. The innovative method for selection of the terms allowed to start from an initial count of 1041 words, then filtered until 499, divided into 15 macro-areas for organizational purpose.

The project and its resulting glossary, that will pave the way for improved communication among experts, is the starting point for the future UNI Terminology Standard and shall not be considered as a mere collection of words, but rather a methodological example for other research works alike, characterised by continuous dialogue between scholars and field professionals.

Key Words

hospital | next generation hospital | healthcare design | terminology standard | evidence-based design

Selection of words in Hospital Design by frequency

SPAZIO POLMONE MODULARITA' USER CENTERDNESS
OSPEDALI DI COMUNITA'
CASE DI COMUNITA'
LAYOUT DISTRIBUTIVO
SICUREZZ
ADATTABILITA'
NG GARDEN WAY FINDING PREVENZIONE
HA
SOSTENIBILITA
GREEN DESIGN
RESILIENZA INTELIGENZA ARTIFICIALE TRIAGE

Project description written by the Principal Academic Tutor

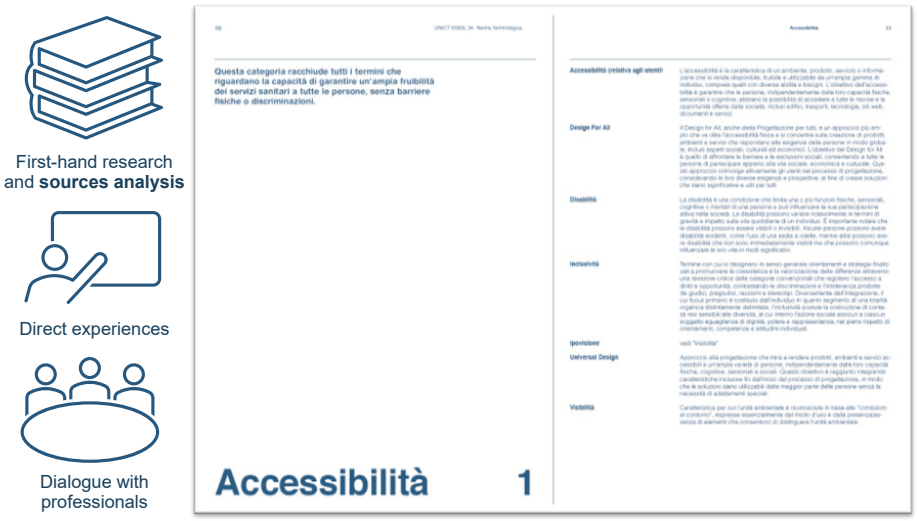
Access to healthcare is deeply conditioned by several social factors such as health policies and economic conditions but, undoubtedly, especially after the recent pandemic experience, healthcare facilities are recognized worldwide as the symbol of the healthcare system in its maximum complexity and they are services that will never decay. Since their origins, they represent the social community and, in the socio-cultural context, the original values of interdependence and solidarity. They embody the permeability and availability of entertainment and cultural activities in order to respond to the community's needs.

Starting from the evolution of hospital design, currently architectures for health are spaces for care but they also host research and education areas, workplaces, public spaces, etc. As healing places, they require specific considerations in the project design and planning to mitigate the sense of isolation and disorientation, to ease concerns and promote health.

As the Scientific Community demonstrated, nowadays the quality of spaces and the organizational issues play an important role in the medical processes, contributing both to improve the experience and comfort perceived by users and to improve the efficiency of staff. For this reason, hospital planners and stakeholders are called to act and to give rise to user-centred system in terms of comfort, efficiency, organizational and operational effectiveness, with an evidence based design approach.

Among the activities developed by Design & Health Lab and the Joint Research Partnership Healthcare Infrastructure, the ASP team developed an interesting project related to a gap that currently persists; in fact nowadays the stakeholders involved in the management and design of an hospital (i.e. managers, designers, healthcare professionals, etc.) have different backgrounds, knowledges, points of view, and sometimes they do not use the same terminologies, as well as they interpret an issue/topic in different ways. Therefore a tool, a vocabulary, a report, etc. which defines some "common" and daily terms related to healthcare design and the management of an architecture for health with unambiguous definitions become strategic.

Starting from an activity promoted by Italian unification body (UNI), the ASP team supports the definition of the methodology for defining the list of terminologies of the future norm on healthcare facilities.



Project Methodology (left), Final Report (right)

Team description by skill

The High-Quality Healthcare for Rethinking the Next Generation Hospital working group, or more briefly, the Next Generation Hospital (NGH) team, is composed of eight students from the XVIII cycle (Academic Years 2021-2023) of the Alta Scuola Politecnica (ASP), representing various technical disciplines. The team consists of four architects, namely Maria Maslova, Aleksandra Cichy, Salvatore Pinna Nossai, and Eugenio Lux, two building engineering and architecture students, Matteo Vitali and Riccardo Rivano, a biomedical engineer, Lucrezia Mulatero, who served as the Communication Coordinator in the latter part of the project, and a management engineer, Giorgio Micheli, who holds the role of Team Controller.

Goal

The problems of modern hospitals, magnified by the recent pandemic, highlight the urgent need to rethink existing healthcare systems. Overcrowding, limited resources, outdated infrastructure, technological complexities, changing patient expectations, and financial sustainability challenges all necessitate a comprehensive re-evaluation. By addressing these issues and implementing innovative solutions, hospitals can enhance patient care, improve outcomes, and create resilient healthcare systems capable of meeting the evolving needs of patients and society as a whole.

More specifically, The Next Generation Hospital (NGH) project aims to achieve the following objectives:

- **Establishment of a Common Vocabulary.** The project endeavours to create a shared vocabulary among medical professionals, managers, and designers working in the hospital field. This initiative will facilitate effective communication and comprehension among all stakeholders while minimizing potential ambiguities or misunderstandings.
- **Multidisciplinary Approach.** The project involves diverse expertise from various disciplines, including architecture, engineering, biomedical engineering, and management. Embracing a multidisciplinary approach ensures a comprehensive and integrated outlook for the design and management of the Next Generation Hospital.
- **Integration of Scientific Research.** The project is built upon the analysis and integration of scientific research, because this evidence-based and experiential approach will contribute to defining innovative and cutting-edge solutions.
- **Engagement of Stakeholders.** The NGH project engages various stakeholders, including companies operating within the hospital sector, the National Center for Hospital Engineering and Technical Operations (CNETO), UNI (Italian National Standardization Body), and public entities such as the Ministry of Health and AGENAS. This collaborative involvement ensures a broad and inclusive perspective, embracing diverse viewpoints and requirements.

Undestanding the problem

The recent experience of COVID-19 has highlighted the challenges faced by healthcare facilities in Italy and globally. In particular, Italian healthcare infrastructure has proven to be largely outdated, with approximately 70% of hospitals being over 50 years old, and 50% no longer meeting organizational, managerial, and healthcare needs. Additionally, about 75% of these buildings have significant deficiencies, particularly in the event of natural disasters such as strong earthquakes. The COVID-19 pandemic has also exposed the organizational and structural difficulties within healthcare organizations, revealing their lack of flexibility and inefficiency in responding to the unexpected surge in patients.

Adding to these challenges is the increasing average age of the population and the rise in chronic and degenerative diseases, resulting in a growing demand for healthcare services. Italy is projected to become the third OECD country in terms of its elderly population within less than thirty years.

Despite these challenges, there is a growing political demand for containing healthcare expenditure, with the healthcare spending-to-GDP ratio standing at 6.7% for the 2023 DEF, just above the minimum threshold defined by the World Health Organization.

Additionally, technological advancements have brought both opportunities and challenges for modern hospitals. While new medical technologies have enhanced diagnostics, treatments, and patient monitoring, their integration into healthcare systems can be complex. Issues such as interoperability, data security, and staff training need to be addressed to fully harness the potential benefits of technology while ensuring patient privacy and safety.

The changing expectations of patients and their desire for a more patient-centered approach also necessitate a rethinking of hospital practices. Patients now expect personalized care, seamless coordination between healthcare providers, and access to information and services through digital platforms. Hospitals must adapt

their processes and structures to meet these evolving patient needs and preferences. Furthermore, the financial sustainability of healthcare systems is a pressing concern. The rising cost of healthcare, limited healthcare budgets, and the need for cost-effective delivery of services require hospitals to optimize their operations and resource allocation. This involves streamlining processes, adopting innovative models of care delivery, and implementing efficient management practices.

Finally, legislative references for healthcare architecture in Italy are limited and outdated currently. They primarily focus on minimum requirements for specific healthcare functions, often overlooking the diversity of existing facilities and their various, complex roles. This situation is further complicated by regional management, which has led to the issuance of specific provisions lacking comprehensive consistency in guidance.

Exploring opportunities

To address the intricate challenges within the healthcare broad universe, a meticulous examination of various information sources had offered invaluable guidance and insights.

1. **The Metaprogetto by Piano and Veronesi:** This architectural and organisational project, aptly named after its creators, provided a holistic blueprint for the design of the high complexity hospital but serves as a clear guide also for other healthcare infrastructures. By subjecting this source to rigorous analysis, it was uncovered a treasure trove of best practices and avant-garde design principles that not only enhanced the patient experience but also streamlined workflows and maximized resource efficiency. The Metaprogetto might have introduced concepts such as modular designs, adaptability, and seamless technology integration, all innovations that could be particularly effective in mitigating challenges like overcrowding, antiquated infrastructure, and resource constraints.

2. **Scoping Review on Post-COVID-19 Best Practices and Guidelines for Hospitals:** A scoping review systematically synthesizes existing literature on a specific subject. A meticulous evaluation of this review enabled to pinpoint emerging best practices and guidelines tailored for hospitals in the post-pandemic era. These guidelines could encompass recommendations on infection control, telemedicine implementation, digital health solutions, data interoperability, and remote patient monitoring. The adoption of these practices equips healthcare institutions to respond more effectively to crises, enhance patient outcomes, and elevate overall healthcare delivery.

3. **European Legal Standards in Healthcare Design:** An examination of European legal standards provides valuable insights into successful healthcare design strategies adopted across diverse countries. These standards encompass architectural, technical, and safety requirements, ensuring that healthcare facilities are purposefully designed to deliver top-tier care. Through a meticulous review of a selected number of these standards, commonalities and distinctions were identified and could determine which elements can be suitably integrated or customized to address specific healthcare challenges within a given context.

4. **Visits to Prominent European Hospitals:** Conducting on-site visits and conducting in-depth analyses of leading European hospitals offered a first-hand opportunity to observe successful operational practices. These visits yielded insights into the efficacy of workflow systems, patient-centric care models, staff engagement methodologies, and innovative healthcare delivery approaches. By studying and adapting these practices, healthcare facilities could aspire to enhance patient outcomes, optimize resource allocation, and elevate the overall quality of care.

In addition to these sources, fostering a collaborative environment enriched by expert-led lectures within the healthcare domain, dedicated workgroups for in-depth discussions on research findings, thesis projects, and internships in the healthcare field has provided each of us with an exceptional opportunity to expand our knowledge and expertise within the healthcare landscape. This holistic approach, which combines research, practical experience, and expert insights, holds the potential to reshape healthcare delivery and elevate the quality of patient care.

Generating a solution

Starting from the analysis of the state of the art on hospital construction in Italy and abroad, and from discussions with experts (whether they be designers, hospital users or suppliers of medical equipment), what emerges more and more is the need for a common language, thanks to which these experts can confront each other unambiguously. In order to support innovative and effective progress in hospital design, it is indeed crucial that, at the basis of a 'Tower of Babel' such as the healthcare infrastructure, there is a common vocabulary able to allow the players to communicate seamlessly and coherently.

Hence the desire to develop a UNI terminology standard to reimagining what the new generation of hospitals will look like. This, at the basis of the following building standard, essentially represents the proposed solution by the working group to address the previously mentioned issues. The future UNI technical standard will provide clear guidelines for various components of a healthcare facility. It will address essential aspects of hospital design, including the facility's location and accessibility, general design criteria, architectural quality, the organization of functional areas (both healthcare and non-healthcare), structural characteristics, technological aspects, ventilation systems, air quality, materials, furnishings, and more. This standard will also benefit from the lessons learned from the COVID-19 pandemic and offer valuable insights for the future development of healthcare infrastructure with a focus on emergency response.

A UNI terminological standard is a technical document that defines the terms, concepts, and specific definitions used in a particular sector or field of activity. The primary goal of a terminological standard is to ensure harmonization and consistency in communication and information exchange within a specific sector. This standard provides clear and precise definitions of technical terms, reducing ambiguity and ensuring correct understanding and interpretation of concepts. Additionally, the UNI terminological standard may include recommendations for the proper use of terms and naming conventions to follow.

The adoption and application of UNI terminological standards promote coherence, efficiency, and clarity in technical communication within the relevant field, facilitating the sharing of knowledge and interoperability among different organizations and professionals. Therefore, the effectiveness of a standard is closely related to the comprehensibility of the language used for its formalization. Standards primarily use specialized languages, which are linguistic subsystems aimed at unambiguous communication in a predefined domain through the use of terminology and other linguistic tools. Hence, it is essential for technical terms belonging to a specialized language to be recognized by convention.

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