L’ospedale universitario come centro di eccellenza per la produzione e la diffusione della cultura biomedica avanzata

Romano Del Nord, Centro TESIS, Università degli Studi di Firenze, Italia

Abstract. Gli ospedali pol clinici universitari si connotano per la compresenza di funzioni assistenziali, di ricerca e di formazione e per la vocazione al perseguimento di risultati di eccellenza nelle prestazioni sanitarie erogate. Tali attività, che fanno capo rispettivamente alle Aziende Ospedaliere e alle Istituzioni Universitarie di Medicina, raggiungono il loro massimo livello di efficacia qualora programmate e gestite con principi di massima integrazione e sinergia in termini organizzativi, funzionali e, non ultimo, fisico-spaziali. Sulla base di tale consapevolezza, un gruppo di ricercatori del Centro Interuniversitario TESIS ha sviluppato una ricerca PRIN – della quale il presente articolo sintetizza i contenuti – ed i risultati- finalizzati a definire i principi di orientamento progettuale secondo cui elaborare soluzioni innovative da sperimentare nella realizzazione delle Città della Salute, degli IRCCS e degli Ospedali di eccellenza.

Parole chiave: Ospedale universitario, Ricerca biomedica, Didattica e formazione, Cultura della salute, Innovazione tecnologica

La ricerca

La complessa questione dell’elaborazione di contributi conoscitivi e operativi utili a una prefigurazione rinnovata dei connotati fisico-spaziali, funzionali e organizzativi delle strutture ospedaliere universitarie che si pongono come riferimenti avanzati per la produzione e l’implementazione di nuovi modelli clinico-assistenziali, oltre che per la diffusione della cultura biomedico-scientifica, è stata sviluppata nell’ambito di un programma di ricerca di rilevante interesse nazionale (PRIN), cofinanziato dal MIUR, dal titolo Le nuove dimensioni strategiche delle strutture sanitarie per l’assistenza, la formazione e la ricerca scientifica di eccellenza: criteri di concezione e modelli di organizzazione dell’ospedale universitario ad elevata intensità di cura, coordinato a livello nazionale dal direttore del Centro TESIS, Prof. Romano Del Nord. All’attuazione del programma di ricerca hanno contribuito varie unità operative dislocate presso l’Università degli Studi di Firenze, l’Università degli Studi di Roma «La Sapienza», il Politecnico di Milano e l’Università degli Studi di Pavia.

I presupposti della ricerca

La ricerca si è inserita nell’ampia tematica della definizione delle caratteristiche tipologiche, organizzative e gestionali di ospedali ad alta tecnologia e assistenza che perseguono obiettivi di qualità ed efficienza e nei quali si esprimono i principi della ricerca e della formazione, a partire dal decalogo per l’ospedale del futuro redatto secondo le indicazioni dell’ex Ministro Veronesi e mediante il quale Renzo Piano aveva definito, all’inizio del nuovo millennio, il modello di ospedale ad alto contenuto assistenziale e tecnologico. La consapevolezza dell’importanza di una stretta interrelazione tra le attività clinico-assistenziali, quelle inerenti alla ricerca (e al conseguente trasferimento tecnologico) e quelle relative alla formazione è stata uno dei presupposti di partenza. Un’altra questione fondamentale ha riguardato la considerazione della rilevanza strategica di una produzione di ricerca scientifica che anticipi le conoscenze in campo biomedico e di una formazione aggiornata e continua dei medici e degli operatori sanitari.

The university hospital as centre of excellence for the production and dissemination of the advanced biomedical culture

The research

The complex issue of developing knowledge and operational proposals for a renewed prefiguration of the physical-spatial, functional and organizational characteristics of university hospital facilities that serve as advanced benchmarks for the production and implementation of new clinical-care models, as well as for the diffusion of the biomedical-scientific culture, was developed as part of a research programme of national interest (PRIN), co-financed by MIUR, entitled The new strategic dimensions of healthcare facilities for care, training and scientific research of excellence: design criteria and organization models of the university hospital with high-intensity care, coordinated at national level by the director of the Centro TESIS, Prof. Romano del Nord. Various operating units of the University of Florence, «La Sapienza» University of Rome, Milan Polytechnic and the University of Pavia helped to implement the research programme. Of these, the Florentine university unit developed a study entitled The university hospital as a centre of excellence for the production and dissemination of the advanced biomedical culture, the results of which were explained during several talks at national and international conferences and summarized in an encompassing volume (Del Nord, 2011). In keeping with the objectives proposed, the research explored the topic of the more substantial changes that the performance of training and research activ-
Le funzioni oggetto dell’integrazione organizzativa e funzionale alle diverse scale di intervento
The functions subject to organizational and functional integration at the different intervention scales

R. Del Nord

comprendenti al loro interno sia attività di natura assistenziale, di gestione operativo della struttura ospedaliera universitaria e nizzative Dipartimentali), ordinariamente costituenti il modello istituzioni compresenti e coesistenti nelle SOD (Strutture Organizzative, organizzative, logistiche, finanziarie espresse dalle istituzioni, intraprendendo un ruolo generale di coordinamento, aderente costantemente alle richieste di adeguamento e supportare il raggiungimento degli auspicati obiettivi di eccellenza. Per effetto dell’importanza delle innovazioni tecnologiche e bio-mediche e del ruolo della ricerca e della formazione, all’interno delle SOD (Strutture Organizzative), possono essere evidenziate significative ricadute sulla definizione architettonica dell’organismo ospedaliero, con la concomitanza di caratteristiche spaziali e tipologiche in grado di supportare il raggiungimento degli auspicati obiettivi di eccellenza, assecondando costantemente le richieste di adeguamento e adattazione ai mutamenti introdotti dagli avanzamenti tecnologici e terapeutici negli approccioni e nelle prassi clinico-terapeutiche. Tra le maggiori criticità rilevate è emersa la necessità di realizzare una sinergia efficace ed efficiente tra le attività, ospedaliere e universitaria, nell’esigenza di conciliare le diverse logiche gestionali, organizzative, logistiche, finanziarie espresse dalle istituzioni compresenti e coesistenti nelle SOD (Strutture Organizzative Dipartimentali), ordinariamente costituenti il modello di gestione operativo della struttura ospedaliera universitaria e comprensente al loro interno sia attività di natura assistenziale, sia attività formative e di ricerca. Per la definizione di un efficace modello spaziale, funzionale e gestionale sì è presentata la necessità di considerare le interazioni reciproche tra tali tipologie di attività, anche in questo caso con la finalità di assecondare le eventuali richieste di flessibilità determinate dalle diverse evoluzioni strategiche. Le relazioni spaziali, funzionali e gestionali regolatrici delle integrazioni delle diverse SOD afferenti a un medesimo DAI (Dipartimento Assistenziale Integrato) richiedono infatti specifiche definizioni in termini tecnici e progettuali, anche in rapporto al soddisfacimento di determinati requisiti di flessibilità e di assetto dello stesso DAI sulla base di obiettivi programmatici espressi da parte dell’azienda ospedaliera universitaria.

Le analisi svolte
Partendo da tali presupposti, la ricerca ha elaborato un sistema di orientamenti operativi i cui contenuti sono stati definiti sulla base di analisi condotte mediante risorse bibliografiche e scientifiche, su casi di studio nazionali e internazionali, mediante la partecipazione a seminari e convegni oltre che con colloqui con opinion leader e referenti qualificati delle singole strutture indagate. Rispetto agli obiettivi prefissati, vari sono stati i campi di indagine, a partire da una definizione rigorosa del significato e degli effetti connessi all’interdipendenza delle funzioni clinico assistenziali con quelle formativo-didattiche e della ricerca biomedica, prefigurando la morfologia di spazi e di modelli per l’integrazione, in rapporto alle diverse scale di intervento (a livello territoriale, di singolo edificio o di specifiche aree funzionali) (Fig. 1).

Per ben inquadrate le misure in cui si attuano le politiche tecniche per la programmazione e la realizzazione del sistema infrastrutturale dei servizi sanitari sul territorio, è stata svolta,

**The concentration of all functions in one area: a key feature**

**The effects of the integration**
university hospitals and IRCCSs that represent the most suitable facilities for both the development and use of the most innovative technologies as well as for the application of operating procedures and models that generate fundamental changes in clinical medical practice, in which medicine is understood and in the approach to health. Due to the importance of technological and biomedical innovations and the role of research and training, in these contexts significant impacts on the architectural design of the hospital were observed, with the definition of spatial and typological characteristics capable of supporting the achievement of the desired objectives of excellence, constantly accommodating requests for adaptive adjustments to the changes introduced by technological and therapeutic advances in the clinical-therapeutic approaches and practices. The most critical issues detected brought to light the need to create an effective and efficient synergy between hospitals and universities in view of the need to reconcile the different managerial, organizational, logistical and financial logics of the institutions simultaneously present and co-existing in the SODs (Departmental Organizational Structures), ordinarily constituting the operational management model of the university hospital facility and incorporating care, training and research activities within them. In order to define an effective spatial, functional and managerial model it was therefore necessary to consider the reciprocal interactions between activity types, in this case too with the aim of accommodating any requests for flexibility determined by the different strategic developments. The spatial, functional and managerial relationships that control integration between the various SODs pertaining to the same DAI (Integrated Care Department) in fact require specific definitions in technical and design terms, also in relation to the fulfillment of certain requirements concerning flexibility in the arrangement of the DAI itself based on programming objectives communicate by the university hospital.

The analyses conducted
Taking these assumptions as a starting point, the research developed a system of operational approaches, the content of which was defined on the basis of analyses conducted through bibliographic and scientific resources, national and international case studies, participation in seminars
The effects of translational research in the biomedical sector, also in view of the importance accorded to the development of translational research, the need for/provision of a continuum of infrastructural support and close physical proximity to the clinical context of the hospital and laborato-

and conferences as well as interviews with opinion leaders and qualified representatives of the individual facilities studied. As regards the preset objectives there were various fields of investigation, starting with a strict definition of the meaning and the effects deriving from the interdependence between clinical-care and training-education functions as well as biomedical research, prefiguring the morphology of the spaces and integration models in relation to the different intervention scales (territorial, building level, or specific functional areas) (Fig. 1).

In order to define the context in which technical policies for the programming and creation of the infrastructural system of healthcare services throughout the country are implemented, as a priority a systematic analysis was made of the regulatory provisions underlying the healthcare system development process in Italy. Particular attention, through a comparative analysis of a broad sample, was given to the innovative features of the Corporate Act considered as an effective tool to boost inter-institutional integration. This cognitive and critical study also made it possible to highlight the heterogeneity that exists in the operational methods of approaching the question of integrating clinical care activities with those of research and training in the changing geographical and cultural contexts. A significant part of the research concerned the systematic definition of the methods used to carry out training in the biomedical sector, the organizational logistics used to develop research activities and the models used to translate the results into innovative products and processes. This examination made it possible to detect an increase in the types of training paths as well as the increasingly important role of continuous education, with the consequent diversification of spaces for teaching even physically connected to the operating units of the hospital. Ample space was given to an in-depth study of methods connected to the application of increasingly sophisticated and widespread techniques and technologies in the field of training such as those, for example, used in simulations for the use of highly sophisticated and versatile equipment (Figs. 2-3). For the research activities, also in view of the importance accorded to the development of translational research, the need for/provision of a continuum of infrastructural support and close physical proximity to the clinical context of the hospital and laborato-

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da Ospedaliero Universitaria di Careggi nel quale la risposta all’esigenza dell’integrazione è stata fornita mediante la proposizione di appositi modelli organizzativi, gestionali, di governance e infrastrutturali finalizzati all’incremento dell’efficienza e dell’efficacia dell’offerta sanitaria.

I risultati della ricerca

I risultati della ricerca, frutto peraltro di un’approfondita analisi comparata finalizzata a evidenziare costanti ripetitive e variabili nei casi di studio analizzati, hanno assunto una valenza marcatamente operativa attraverso la definizione di raccomandazioni per la progettazione. La lettura critica dei casi di studio ha consentito di fare emergere alcune convergenze di orientamenti progettuali che, per effetto dei positivi effetti riscontrati, potrebbero configurarsi come utili orientamenti per futuri programmi di intervento.

In merito all’integrazione funzionale, che da subito si è rivelata un connotato fondamentale dell’ospedale universitario di eccellenza, è generalmente emerso che le funzioni clinico-assistenziali, didattico-formative, di ricerca e innovazione trovano un fondamentale strumento di integrazione nella vicinanza fisica, a livello macro e di singolo organismo edilizio. A livello spaziale, i gradi di integrazione dipendono dai collegamenti fisici risposti progettualmente possibili tra le aree e dalla compresenza di più macrofunzioni all’interno dello stesso organismo edilizio. Uno dei principi ricorrenti riguarda la scelta di collocare, in prossimità e in reciproco collegamento orizzontale e verticale, funzioni tra loro in qualche modo collaboranti (Fig. 6). Per la sua importanza, la questione dell’integrazione funzionale è stata oggetto di specifica riflessione in riferimento alla dimensione del progetto, alla concezione di efficaci sistemi di relazione tra gli spazi mediante l’ottimizzazione di flussi e percorsi, alla facilità di orientamento, alla presenza di piattaforme tecnologiche condivisibili in ambiti multidisciplinari, alla disponibilità di servizi comuni (biblioteche, sale conferenze) e di luoghi di incontro informali, oltre che allo sviluppo adeguato dell’infrastruttura di rete per un utile superamento dei confini fisici delle strutture e un utilizzo migliore di tutte le risorse offerte dallo spazio fisico (Fig. 7).

In un contesto caratterizzato da incessanti cambiamenti come quello analizzato, un’altra questione individuata come prioritaria...


...to the impact of the positive effects detected, could be configured as useful guidelines for future intervention programmes. As for functional integration, which immediately proved to be a fundamental characteristic of the university hospital of excellence, it generally emerged that the clinical-care, teaching-training, and research and innovation functions find physical proximity to be a fundamental tool for integration at macro level and individual building level. In spatial terms, the degrees of integration depend on the physical connections between the areas made possible in the design and on the joint presence of several macro-functions within the same building. One of the recurring principles relates to the choice of locating functions that collaborate to some degree near to each other and in horizontal and vertical connection (Fig. 6). Due to its importance, the question of functional integration was specifically considered in reference to the extent of the project, the design of efficient spatial relation systems through the optimization of flows and routes, the ease of orientation, the presence of technological platforms that can be shared in multidisciplinary areas, the availability of communal services (libraries, conference rooms) and informal meeting places, as well as the proper development of the network infrastructure in order to usefully exceed the physical confines of the buildings and make better use of all the resources offered by the physical space (Fig. 7).

In a context characterized by incessant changes such as that analysed, another question identified as a priority concerns the management of functional and technological obsolescence in close connection with the characteristics of spatial flexibility and the possibility of adapting the designed works to the changes and reconfigurations of the organizational, structural and plant systems due to the effects introduced by continuous evolution, with the minimum inconvenience and alterations, in the transition phases, to the areas concerned. Appropriate choices, such as those concerning the positioning of the fixed architectural elements (for example vertical blocks for stairs and lifts) in peripheral positions and the fitting calculation of the load-bearing capacity of the floor structures can create large central spaces that can be reconfigured according to future needs. In laboratory areas too better possibilities of adapting to the changing needs of research activities can be offered by the presence of modular, open and continuous spaces. Of the principles supporting the management of obsolescence and adaptability the following are therefore highlighted: the adoption of modular solutions to create open systems that can be implemented; the provision of appropriate areas for expansion to support possible spatial growth requirements through lateral or vertical extensions; the presence of universal rooms, namely spaces that can potentially be used for a variety of different and alternative functions; the appropriate choice of construction and implementation techniques and strategies such as prefabricated systems as well as light and ‘dry’ construction solutions; the widespread installation of plants with the presence, among other things, of technical inter-floors, several shafts that are...
sempre maggiore al benessere generale del paziente. Ai fini della compatibilità ambientale e del risparmio energetico in genere si riscontra una diffusa attenzione per la realizzazione di microclimi sani e rigorosamente controllabili e regolabili, con la possibilità di utilizzare al meglio e al massimo l'illuminazione naturale mediante un corretto orientamento dei corpi di fabbrica e un adeguato proporzionamento di questi ultimi in rapporto alle superfici illuminanti. Adeguate soluzioni progettuali e tecnologiche vengono poi proposte per limitare il consumo energetico e favorire attività di manutenzione a basso costo mediante l’utilizzo di materiali ed energie eco-compatible (ad esempio, pannelli fotovoltaici, tetti giardino ad alta cobiettazione, sistemi di facciata a ‘doppia pelle’, sistemi di riutilizzo dell’acqua piovana, sistemi integrati di gestione telematica di tutte le fonti energetiche). Anche l’attenzione al benessere generale degli utenti si rivela come una questione prioritaria. In merito a questo aspetto si evidenzia, in particolare, l’esigenza di riuscire sempre più a conciliare la dimensione tecnologica con quella umana, concependo ambienti piacevoli, sicuri e salutari, a partire dalle zone di accesso e distribuzione. Proprio queste aree sono pertanto sempre più spesso connotate come spazi per l’informazione, la sosta e l’attesa di distribuzione. Appropriate design to the lit surfaces. Appropriate design and technological solutions are then proposed to limit energy consumption and encourage low cost maintenance activities through the use of eco-compatible materials and energies (for example photovoltaic panels, highly insulated roof gardens, “double skin” façade systems, rainwater collection and reuse systems, and integrated systems for the computerized management of all energy sources). Even attention to the general well-being of users proved to be a priority question. In relation to this aspect, the increasing need to reconcile the technological dimension with the human one by designing pleasant, safe and healthy environments, starting with the access and distribution areas, is highlighted in particular. These very areas are therefore increasingly often characterized as

### REFERENCES


spaces for information, stopping and waiting, documentation, restaurants and shopping, where there are actual opportunities to meet and real and authentic integration between all the numerous types of users that gravitate around the university hospital of excellence.


