

Virtual Subject Innovation Platform: A New Operational Pattern for Comprehensive Hospital

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Abstract This is a study that describes the prevalence and patterns of constructing virtual subject in hospital in China. It is a high risk for hospital to invest greatly for innovation of hospital disciplines, so we want to establish some new comprehensive platforms which based on some informational systems that involve diseases treatment, medical research, diseases recoveries, prevent diseases and medicine developments. But the virtual subject platform could afford a superior chance for cooperation between interior and exterior medical organizations. This article discusses the subject's structure, the construction's principles, cooperation advantages and clarifies that the platform could boost the efficiency of hospital to do some medical research.

Keywords Virtual subject · Creativity · Hospital

Introduction

In recent years, With China's medical and health reform deepens, the competition in health care market is increasing. Hospital medical innovations are facing more and more technical problems in terms of the technology's comprehensive and clustering. In the meantime, the uncertain factors of technology innovation are increasing, too. Even some large comprehensive hospitals in China also encounter the shortages of technology's resources. The individual hospital only relies on one subject to develop some new technologies become more and more difficult. When the medical innovation required capability exceed the capability

of one subject, even the whole hospital, we need a joint interdisciplinary research to technological innovation. However, the establishment of virtual subject could afford a platform for this pattern of joint [1]. At the same time, it also provides a creative concept for hospitals and even the whole medical system, which could enable various disciplines to more fully develop their own advantages.

Method and discussion

We have chosen five large scale comprehensive hospitals in one city of China. And we conducted a questionnaire survey to 150 doctors who belonging to the subjects (such as Department of Respiration, department of Radiotherapy, department of oncology and so on) that have the chance to establish the virtual subject platform. As Table 1, the results are not satisfactory.

Definition and background

Virtual subject means some independent hospital departments or some exterior health organizations join together to establish a temporary, dynamic and web-based organization which the purpose is to help doctors to research, diagnosis and cure some special disease. The Forms of organization should include cooperation agreements, outsourcing, strategic alliance and something else. The new organization should builds on the basis of information technology and promises all partners to meet common economic and social benefits.

With the social and economic development, people's medical needs will be diversified and personalized. Especially, Chronic non-communicable diseases, lifestyle diseases, environmental diseases and some other major public health events (outbreak of SARS, avian flu, H1N1, etc) had caused

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Table 1 Demographics of respondents

| | Have known the virtual subject (%) | Have not the known virtual subject (%) | Total number (N) |
|-------------------------------|--|--|------------------------|
| Gender | | | |
| Male | 34.0(N=33) | 66.0(N=64) | 97 |
| Female | 20.8(N=11) | 79.2(N=42) | 53 |
| Age | | | |
| 20-29 | 47.5(N=19) | 52.5(N=21) | 40 |
| 30-39 | 36.1(N=22) | 63.9(N=39) | 61 |
| 40-49 | 21.2(N=7) | 78.8(N=24) | 33 |
| ≥50 | 18.7(N=3) | 81.3(N=13) | 16 |
| Education | | | |
| Bachelor | 27.4(N=14) | 72.6(N=37) | 51 |
| Master | 54.2(N=38) | 45.8(N=32) | 70 |
| PHD | 65.5(N=19) | 34.5(N=10) | 29 |
| Professional title | | | |
| Attending physician | 23.4(N=18) | 76.6(N=59) | 77 |
| Associate chief physicians | 25.6(N=10) | 74.4(N=29) | 39 |
| Chief physicians | 41.1(N=14) | 58.9(N=20) | 34 |

significant damage to population health. In the meantime, China is in the social transition period, the regulations of food safety, water pollution control, occupational disease prevention and some natural disasters had posed a severe challenge to subject set of modern hospital. How to meet the changes of environment and the needs of patients are not only the objective requirements, but also the long strategic needs for Chinese hospitals. So the modern hospital must implement a new agile strategy in order to response to the rapidly changing of patients' needs and medical market. The new pattern asks the hospital to integrate the originally distributed resources such as technology resources, human resources and management resources. The virtual subject, as a new dynamic organization, came into being.

On the other hand, development of information technology also provides the technical basis for the establishment of some new organizational forms. Since the nineties the twentieth century, the boom of optical fiber communication technology, computer network technology had created a communication form for organization beyond the time and region, which eliminate all the barriers to information exchange, significantly changed the communication methods between different organizations. This current also made a profound impact on hospital, which provided a chance for the deepen information exchanging and sharing became a reality [2]. This rapidly changed communication forms and information technology provided not only the convenient conditions for different hospital cooperation, but also accelerate the speed of exterior environment of hospital subjects. It is also an objective

requirement that the emergence of new organizational forms to adapt to this change

Characteristics of virtual subject

Virtual subject platform has break the boundaries and forms of traditional research institutions, which breakthrough the restrict of subjects, region, time and knowledge. It makes the medical research to optimize the various resources at a broader and richer range in order to reduce the organization operating cost. Virtual subject has following characteristics compared with traditional medical research center.

- Communication pattern cyberization—Virtual subject platform is the new organization, which greatly rely on the application of informational platform, which uses advanced platform technology and information system as basic structure, put different regions, different departments, and talent resources of different disciplines into a virtual entirety quickly through modern video, audio, network and mobile medium to work together for a common goal. At the same time, discipline members chat and share information with each other through web could achieve efficient information sharing purposes.
- Work pattern parallelization—Subject members could realize a new work pattern that the spread in space, but parallel in time through virtual subject platform. This parallel work pattern could changes the traditional chronological research approach, which greatly reduces the development time, thereby, catch the fleeting opportunities for innovation
- Organization size dynamics—The organizational structure of the virtual subject platform is not unchanged. We could continue to adjust its scope and scale to meets the different members to join and exit at anytime and anywhere due to the simple procedure. This unfixed structure could reduces the obstructions from human, at the same time, it could make agile organizational change to exterior environment fluctuation in order to reduces the flexible cost and realizes the best allocation of resources.
- Staff composition echelon—The establishment of virtual subject platform provides a diversity and non-discrimination environment for hospital researches. It bring the talents with different profession, different background and different age spectrum join together, We want to organically bring three generation doctors(veteran doctor, senior doctor and junior doctor) together to maximize their potential, cultivate key talents in order to reserve the “next generation talent” for the development of subject.
- Organization structure flattening—The structure of virtual subject changes from traditional pyramid structure to web structure, from control structure to

coordination structure, which not only reduces the excessive levels of traditional organization, shorten the information access, accelerates the speed of decision-making, but also benefits to the horizontal transfer of information in order to make use of information more timely and adequate.

- **Property information fuzziness**—The virtual subject platform could consists of hospitals, independent research institutes, colleges or some other organizations. The obvious advantage is no individual need to bear the whole risk itself. However, it also produces some problems during the research period such as Intellectual Property belonging problem, especially, it is difficult that to determine the proportion of every member to enjoy the result of subject revenue. And this shows the ambiguity of property rights [2].

Construction principles

- **Objective integration principle**—The purpose of virtual subject is promoting the react ability to new medical technology, which could keep the leading position in competition in the development of the subject. Therefore, the core of virtual subject is creative organization, cultivate high quality human resources and rapid integration of resources.
- **"People first" principle**—Virtual subject belongs to the organization of knowledge, and the human is the dynamic carrier of knowledge. So the main manage functions of virtual subject are not to person's supervision and inspection, but the constant motivation, training and integration.
- **Creativity and coordination principle**—Virtual subject is a net organization, which could continually change its organization's structure. This innovative platform should be conducive to the internal co-ordination and information exchange among the members. In the meantime, well communication environment also conduces to the rapid reorganization between different subject members.
- **Technology advanced organizational effectiveness and economy principle**—According to the organizational objectives and requirements of virtual subjects, we should integrate the resources priority to the discipline related to high social concern or some acute disease. But no matter what kind of organizational model is a process that change input to output. So it determines the virtual subject's main task is curing disease effectively. At the same time, economy is also one factor should be considered to formation of the virtual subject.
- **Idea sharing principle**—It is more important to make a bigger cake than sharing a big part of a small cake. In the

same way, it is most important for virtual subject to hold the development opportunities, cultivate the common scientific idea in the long-term. But shared interests and undertook common risk is an indivisible whole.

- **Responsibilities constraints principle**—The various members of virtual subject only could complete the research, diagnosis, treatment and rehabilitation activities of a disease under the strict constraints of process and balance of interests. So virtual subject platform should has its own constraint mechanism.
- **Intellectual property protection and confidentiality principle**—There is a special competition and cooperation relationship between virtual subject members. The subject property is independent from each other. So virtual subject's Intellectual property protection and confidentiality is an important principle for each member. And we should make a strict definition at the beginning of the establishment.

Establish procedure

In general, a lot of members join virtual subject provide the necessary conditions for platform construction, but different members play different roles in it, so they have different importance. The virtual subject platform could apply two-layer organizational system, as Chart 1. Virtual subject platform consist of core layer and out layer. The core layer members play the critical role and other external partners constitute out layer. The number of core layer members does not need more, but everyone should have the prominent creative capability to realizes mutual complementary during the whole research period. The core layer is the leader of the whole platform whose benefit-sharing, risk sharing and has closer links with each other. Therefore, we

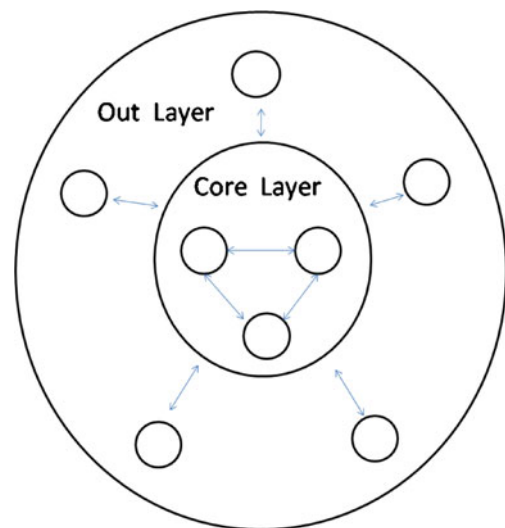


Chart 1 Virtual subject structure

should design a reasonable structure at the beginning and clear everyone's rights and responsibility [3].

The construction and process of virtual subject platform could divide into following seven steps.

The first step—The establishment of a virtual subject's standards. We should choose potential subject with different technical characteristic according to needs of different disease, such as whether in the same level of discipline, whether the structure of human resources could meet the different needs, whether the work cycle is consistent or experimental conditions are similar. All above could affect the future development of virtual subjects in terms of technology or management [4].

The second step—Identification the possible partners. At the beginning of establish virtual subject, core subject must designs an index system to identify the potential cooperators. This system could tests the potential subjects not only the technology capability but also the willing to join the research. But in practice, the core subject should change the inappropriate index according to different needs of special disease.

The third step—Agility Measurement. The successful operation of virtual subject must basis on the good agility, which means virtual subject have ability of dynamic flexibility and rapid response to face the continually changing spectrum of disease. For virtual subject, the more agile, the stronger competitive, so virtual disciplines must be pursued to maximize the agility as target [5].

The forth step—The establishment of virtual subject platform must considered two aspects (sustainable development and respond to actual needs). After the completion of the organizational design, virtual subject members sign contract that determine everyone's legal rights and obligations, especially, the input of resources, the share of risks and the distribution of benefits are the system foundation and legal guarantee to operate platform orderly.

The fifth step—The Elasticity management of virtual subject. The original goal of subject may be changed when national health department adjust its health policies or some Changes of disease spectrum. So it must establish some re-evaluate system to react to these changes. Re-evaluate system could be periodical or systematic which also could provides the data of research and progress of virtual subject to the director of core subject who could evaluate the progress at any time.

The sixth step—Focus on relationship management and task coordination. Partners' relationship management plays the key role in the subject which is a combo that consists of two or more independent research unit. First, we should cultivate a kind of cooperation and trust

organization culture. Second, we should do good dynamic management, this asks the director of core subject rule out the improper subject and absorb new subject according to the change of virtual subject's purpose [6]. Finally, we must properly handle the contradictions and conflicts between different members. On the other hand, virtual subject should formats the task module according to the core ability of different members, and assigns the proper research tasks to them. In the mean time, coordination is the core ability of virtual subject, only the effective coordination can exert the superiority of this organizational model, which obtains the competitive advantages compare with the traditional entity subject.

The seventh step—Strategic retreatment. It will be a big impact for development of virtual subject that releases the relationship unplanned and unfriendly, which will also reduces the social and economic benefit for each other. So we must make a perfect exit strategy at the beginning and record it in the contact [7]. Basically, the best retreat strategy for most members that is maintaining the existing condition, which includes merger exist subject's technical capital, absorb new subject to replace the old one and transfer the virtual subject's whole invisible capital to the third party, etc.

Operating model

Internal integration and outsourcing—Virtual subject platform just needs the support of hospital basic functions, such as treatment, research, teaching, funding, logistical, etc. Rather than the possession of these entities department with above functions. As long as the functions of these vectors consistent with the discipline required, which could promote the development of subject, improve the discipline standard, the purpose of virtual subject has reached.

The establishment of virtual subject could make hospital's core subject's operation more efficient than ever before. However, its cost maybe equal or less than now. And it also can save a number of significant investments, which could enable hospital agility response to the research news at the shortest time [8]. In this way, entity subject could virtualized some normal function, such as academic planning, target determine, logistics support, human resources training, even the Administrative, and financial management. For example, now many virtual subjects tend to outsource the logistics support to outer professional companies, which not only ensure the quality of logistics support, but also reduce the cost burden of the virtual subject.

Internal explore potential and external cooperation—With social progress and development of medical science. For patients, the contradiction between holistic medical care needs and sub-disciplines become apparent. So it is difficult that just rely on one subject to diagnosis disease alone, and the phenomenon of subject combination therapy became ubiquitous. The speed of application of new theories and new methods is accelerating, Interdisciplinary communication is often subject to the limitations of time and space. However, the virtual subject creates a new platform that could afford the physicians the cutting-edge theories and new methods, which could apply to clinical timely and accurately. The Specialist from different subjects joint together to checkup, discuss, research, exchange perspectives, and learn from each other, this method could solves the “precision” and “breadth” issue of disease research project. The establishment of virtual subject realizes the promotion of quality, but not the quantity [9].

Virtual platform could effectively utilizes the outside consultants or academic experts could expand the working range, promote research quality and efficiency, but not increase management people and levels [10]. For instance, a virtual subject could not to leave a position for vice-director, but to hire some outside management expert, who could cooperate with the primary director to manage the virtual subject. This method neither increases the number of clinicians, nor increases the number of management people of hospital, even the regular office are not fixed. However, the extent of its effective management has greatly increased

Internal and external coordination to form alliance—Nowadays, strategic alliance welcomed more by the medical organizations and has become a very common phenomenon. A growing number of medical institutions need to form a “learning alliance”, which could to share the knowledge and participation of both R & D activities. The Innovation Alliance should solve the core problem is the realization of effective organizational learning and improves performance within the union.

The main features of strategic alliance is that could rapid mix as an entirety to take part in the development of medical subject in order to achieve the common objective, when the common goal does not exist, the component units can be quickly dissolved, and not brings too much losses and risks. Strategic alliance could avoid a single hospital subject in medical market competition alone, which could reduce all kinds of research risks. The establishment of virtual subject platform is beneficial to follow the principle of “make the focal points standout, support features and make famous brand”. Realize the development strategy of “effective integration of health care resources, make the entity subject stronger, make the virtual subject bigger and promote the academic development” [11].

Conclusions

Perspectives and strategies for virtual subject are currently evolving, as emerging operative requirements would allow self-sustainable large scale exploitation while recent technological developments are available to support integrated and cost-effective solutions to such requirements. However, as far as we know few virtual subject researches have proceeded to large scale exploitation, even after successful technological demonstration phases. Main exploitation drawbacks, problems and deficiencies have been:

1. Partial solutions approach instead of integrated total approach to health care assistance needs.
2. Lack of economical drive and consequently no self-sustainability for large scale exploitation.
3. Insufficient medical operators and public citizens support.
4. Insufficient networking approach for medical operators and scientific/clinical structures.

We have investigated 100 senior medical staff, the professional subject to their advices that what subjects or diseases could form the virtual subjects. As Table 2.

Each respondent was asked to give more than one response, Total number of response was 400.

It is well known, that the happen of public health emergencies frequently than ever before. There are more challenges for human health, the medical resources of a hospital or a subject alone are difficult to achieve the purpose of safeguarding people’s health. How to respond to changes in demand for health care better, how to solve the medical problems more effective are the crucial issue of how to reform the modern medical model. The establishment of virtual subject platform provides the new creative solutions that how to promote the diagnosis efficiency, how

Table 2 Demographics of respondents

| Topics | Number of response | Percentage |
|------------------------------|--------------------|------------|
| Lung cancer | 102 | 25.5 |
| Digestive system cancer | 87 | 21.7 |
| Breast disease | 60 | 15 |
| Coronary heart disease | 53 | 13.2 |
| Lymphoma | 39 | 9.7 |
| Necrosis of the femoral head | 31 | 7.7 |
| Pain | 10 | 2.5 |
| Peripheral vascular disease | 9 | 2.2 |
| Obesity | 7 | 1.7 |
| Other | 2 | 0.5 |

to relief the patients' pain and how to avoid the unnecessary wastes of modern medical model. These could realize the optimization and integration of medical recourses, boost the hospital competition and beneficial to the sustainable development of the whole medical system and reduce the medical fare and resource waste.

Virtual subject platform is a creative organizational pattern. It has many advantages that reduce and decentralize the innovation costs and risks, achieve resource sharing beyond time and space, mutual complementarities, reduce creative time and accelerate the pace of science into product compare to the traditional pattern. Virtual subject platform forms the new brand of hospital and create the new developed point of subject. It will yields remarkable social and economic benefits [12].

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