

Health Post

A Sustainable Prototype for the Third World

Chizzoniti Domenico, Beggiora Klizia, Cattani Letizia, Moscatelli Monica

Abstract—This paper concerns the study of sustainable construction materials applied on the "Health Post", a prototype for the primary health care situated in alienated areas of the world. It's suitable for social and climatic Sub-Saharan context; however, it could be moved in other countries of the world with similar urgent needs. The idea is to create a Health Post with local construction materials that have a low environmental impact and promote the local workforce allowing reuse of traditional building techniques lowering production costs and transport. The aim of Primary Health Care Centre is to be a flexible and expandable structure identifying a modular form that can be repeated several times to expand its existing functions. In this way it could be not only a health care centre but also a socio-cultural facility.

Keywords—Low costs building, sustainable construction materials, green construction system, prototype, health care, emergency.

I. INTRODUCTION

THE importance of right to health has been affirmed after being cited in the Universal Declaration of Human Rights and has been confirmed as a human right following with declaration of the 30th World Health Assembly, "Health for All by the Year 2000", in 1977.

The studies showed that most of the people of the third world countries primarily need health care interventions at a rather basic level. These basic interventions are gathered under the name of "Primary Health Care" (PHC) whose principles were definitely stated in the Declaration of Alma-Ata, which was held in the Soviet Union in 1978, following the International Conference sponsored by the World Health Organization (WHO) and UNICEF.

After the Alma-Ata declaration, the Harare Conference was held in 1987 developing the program of "Selective Primary Health Care" as a response to the difficult implementation of PHC.

These conferences were a response to growing expectations for a new public health movement around the world, and thanks to them the importance of Primary Health Care was underlined and it was provided as an integral part of a country's health care system.

Chizzoniti Domenico, Senior Assistant Professor, is with the ADL Architectural Design Laboratory, ABC Department (Architectural, Built environment, Construction engineering), Italy (phone: +390223995734; mobile: +39 3887697349; e-mail: domenico.chizzoniti@polimi.it).

Beggiora Klizia, Cattani Letizia, and Moscatelli Monica, Research Assistants, are with the ADL Architectural Design Laboratory, ABC Department (Architectural, Built environment, Construction engineering), Italy (e-mail: klizia.beggiora@polimi.it, letizia.cattani@polimi.it, monica.moscatelli@polimi.it).

To implement the PHC systems the countries need to redirect their policies, strategies and resource allocation, and overcome the cultural and political barriers. As a result, they need to focus on rural areas and the most deprived urban ones, where the primary needs and pathologies of the poorest people are so diffused [1].

In most developing countries the health care has the task to increase in the community the awareness of the causes of disease. These may include domestic causes such as contaminated water, lack of services or sewerage, waste disposal, lack of attention to personal hygiene and preservation, processing and preparation of food.

Providing medical care can bring only limited progress if there isn't a program to improve housing conditions, prevention and health education. The health care in a developing country, particularly in rural areas, must carry out the task of education and leadership in the community.

Although health officials declare that their national priorities should be the improvement of hygienic conditions, infection control and primary health care in rural areas, much of their money seems to go always more frequently in major urban hospitals [2].

The role of PHC is different from that of the "district hospitals" since they don't function to lighten the burden of the main hospital, not because it is cheaper to have the first contact at the peripheral level, but because the patient, in a properly working system, is often better cared for at the primary level. The hospital is often overload with primary care work, so involvement of the hospital in primary care activities results in a lower quality of care, so there are tasks for which the health centre is better suited than the city hospital or the district hospital.

II. LOCATING THE HEALTH CENTRE

The location of a health care facility is chosen mainly on the basis of physical elements, it is necessary to consider factors like population density, water supply, sanitation and waste disposal and access to public transport. The zones with worst situations are those that should receive priority in interventions.

Cultural characteristics and resources of the population have to be considered in locating a health centre as well. Resources are not only money or materials but also technologies and people's skills. In the third world countries the health centre facilities usually face with financial problems due to the fact that they are often scattered in the country and have difficult links with the decisional centres. If the Health Centre can't connect properly with the population it will face

with a quick obsolescence and low efficiency [3].

This implies that the centre should be planned considering different cultural factors and in such a way to be able to grow.

To induce people to approach the health care services, we must have ideas about their potentialities and how they can be involved in strategic planning proposals to increase outcomes.

To consider the most practicable location of health centers in rural context, we have to assume that a large number of people should reach the centre by foot. Therefore it is really important that health centers are within easy reach and that they work mainly with outpatients.

III. HEALTH POST STRATEGY

The health service of a country in the developing world, particularly in rural areas, must accomplish the task of education and leadership in the community. It's certain that the more efficiently it will perform its duties in diagnosis and treatment, the sooner the community to which it addresses will evolve.

The cooperation between community and health post could increase the quality of life of rural communities. The attention must be focused on *community development* rather than considering individuals, favoring a substantial increase in the number of health care in the villages and health centers linked to larger hospitals.

In rural areas, the first unit of medical care should be represented by one person for each village. The main activity is the midwife of the place, equipped with some drugs, and it has the task of imparting the rudiments of hygiene and basic medical care.

The dimension of Health Post depends on the conditions of life of the community and its particular needs, the prevalence of specific diseases and socio-cultural conditions. The unit-base must be designed for future *expansion*, and should provide some *flexibility* to change the intended use and to vary the number of beds for men and women.

Independently from the dimension of the structure, the Health Post will be managed by fewer staff than the health centres, and there will be a minor specialization of tasks.

The Health Post must be regarded as the first element of a larger unit because in the future may need to expand it, especially if the project is implemented within a regional or national health plan. At the beginning the construction could consist of little more than a room for medical examination and treatment (examination of blood, urine and stool sample is needed for identification of most common parasites in blood and for doing simple tests for common illnesses) with an outdoor waiting area form by a covered veranda. Essential is a space for the protection of the drugs. Drug storing, preparation and delivery need a secure and visually controllable space. It can also work as a little pharmacy in the more developed PHC Centres. However, it's best to prepare a small service room in the centre, so that the department is divided into separate sections for men and women. Dividing the space into smaller compartments involves greater flexibility of use. The rooms of the services are reduced to the essentials and the *restrooms* will be separated for the two sexes, but all concentrated in the

same place.

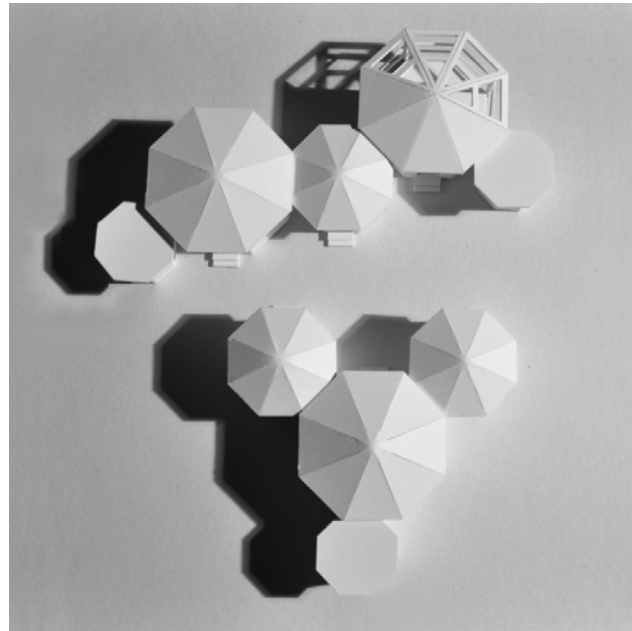


Fig. 1 View of the cardboard model (1:100)

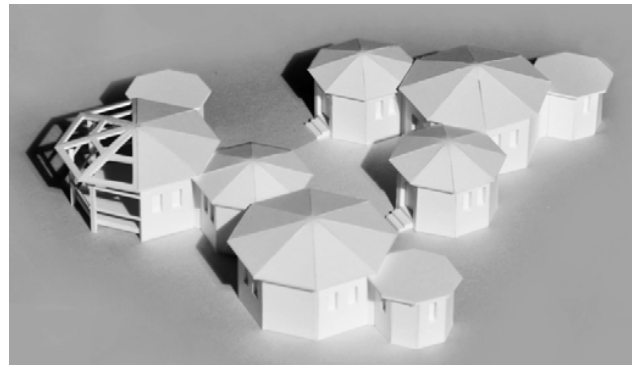


Fig. 2 View of the cardboard model (1:100)



Fig. 3 View of the wood model (1:100)

In focusing on sewage disposal systems as the basic support service to be provided in a health care facility, it's very important to notice that the choice of the system (waterborne, pit latrine, etc.) has to be made versus the broad characteristics of a tropical country. These may be summarized in a scarcity of clean water, difficulties in transportation and a climatic situation marked by heat and humidity which create ideal conditions for pathogen survival.

In rural areas, it is likely that patients arrive on foot, sometimes with their families. If the treatment involves several visits, it is unlikely that they will return home, but will seek shelter near the medical center. The admission often means that other relatives are present and play a very important role: for example, the shelter of a child involves the presence of the mother. In this regard, there are examples where this crowd is controlled with the construction of a village or simple hostels near the health center. These accommodations can also be used by not contagious self-sufficient patients.

IV. SUSTAINABLE CONSTRUCTION MATERIALS

One of the main principles of the Health Post is the cultural, environmental and economic sustainability.

The choice of construction materials is different and depends on the climatic conditions of the place, but it is important to use materials that can be adapted to all types of temperature and humidity, such as wood, terracotta and brick. However it is necessary to refer to *local material* to involve local workers in construction site, who have knowledge of traditional building techniques related to materials characteristic of the area [4].

The wood and the materials of vegetable origin are the most used and usable indifferently on the local climatic conditions, because they are almost always available on-site and ensure an efficient thermal insulation. Furthermore they have a low environmental impact, are accepted by the local population, promote labor allowing the reuse of traditional building techniques and lowers costs of production and transport.

In PHC the dimensions and environmental characteristics should be defined for each homogeneous spatial field. Building materials, parts and technical solutions are based on ambient characteristics [5]. These solutions can help to filter the outdoor climate as to create a new climate for human well being. Materials and technologies play an important role on the quality of the building, on its comfort level and privacy. In order to choose the appropriate materials, the performance specifications such as acoustic privacy or hygienic characteristics must be defined for each comfort level. For this reason it is important to define the requisites of material which have to be used in order to set the characteristics of the building elements which allow the performance of sanitary activities in a comfortable way. Traditionally such requisites have been drawn up as series of standards to be met by the designer. Concerning comfort needs, materials play an important role in regulating factors such as air temperature, radiation and air movements.

The main parameters on which the materials can be chosen

are absorptency / emissivity, porosity, insulation value and thermal capacity or heat storage value.



Fig. 4 View of the project



Fig. 5 View of the project



Fig. 6 View of the project

Health facilities in emergency situations can be designed with different technologies; it would be better to have *hybrid structures* characterized by traditional technologies [6]. These local technologies' performance could be improved through the use of innovative materials mainly imported. It is not necessary to use the latest materials, but simply combine human labor and equipment. Consequently the local manpower does not require a high degree of specialization, reducing construction costs and obtaining the realization times faster. It's essential to consider these devices to allow greater simplicity of the technology to be used and thus reduce the negative aspects related to the construction of a new building, such as excessive consumption of the territory, waste of energy, emission and dispersion of pollutants, production of waste.

On the other way, it is not undervaluing the *didactic nature that the construction site assumes* in these areas: it becomes the place of acquisition and transmission of, technical and theoretical construction knowledge, in which practical skills are the basis of the building.

The fundamental characteristic aspects of great construction are: the reaching of *environmental objectives*, the implementation of compatible solutions and the use of available resources. These concepts must be kept in mind especially during the design of external walls and their structural equipment.

V. A WOODEN PROTOTYPE

The idea is to create a prototype of a medical facility to be placed in the Third World countries, giving special attention to Africa. The prototype designed is inspired by the gabled structure. The hut is the type of Africa traditional housing, built with *raw materials* [7].

The Health Post is composed by wood frame structure. The wood has been used not only for the frame of the building, but also especially for the roofing structure covered by fully recyclable metal coverage. Energy-efficient due to the fact it reflects the sun's rays and keeps fresh the structure during the hot summer months. In general metal roofs weight very little and can sometimes even be installed over temporary roofing systems.

The gabled structure becomes the core of the prototype and collects inside the different functions of the health facilities.

The *modular system* for the health centre has many advantages. First of all it facilitates the design process and gives the project an interesting architectural quality, since the whole structure is going to be based on one single module changing functions. The aim is to create other structures for different function that are not only for health, but also public spaces with different community services [8].

The project is a way to produce a central plan, using basic elements like sets to create different spaces. It's a simple intersection of hexagonal shapes with different dimensions linked to each other in various arrangements.

The project involves the wooden floor, raised forty centimeters from the ground in order to avoid flooding and soil infiltration. Each hexagon represents a cell that can be

isolated from the others by a door placed in an intermediating position between the sides of the structure.

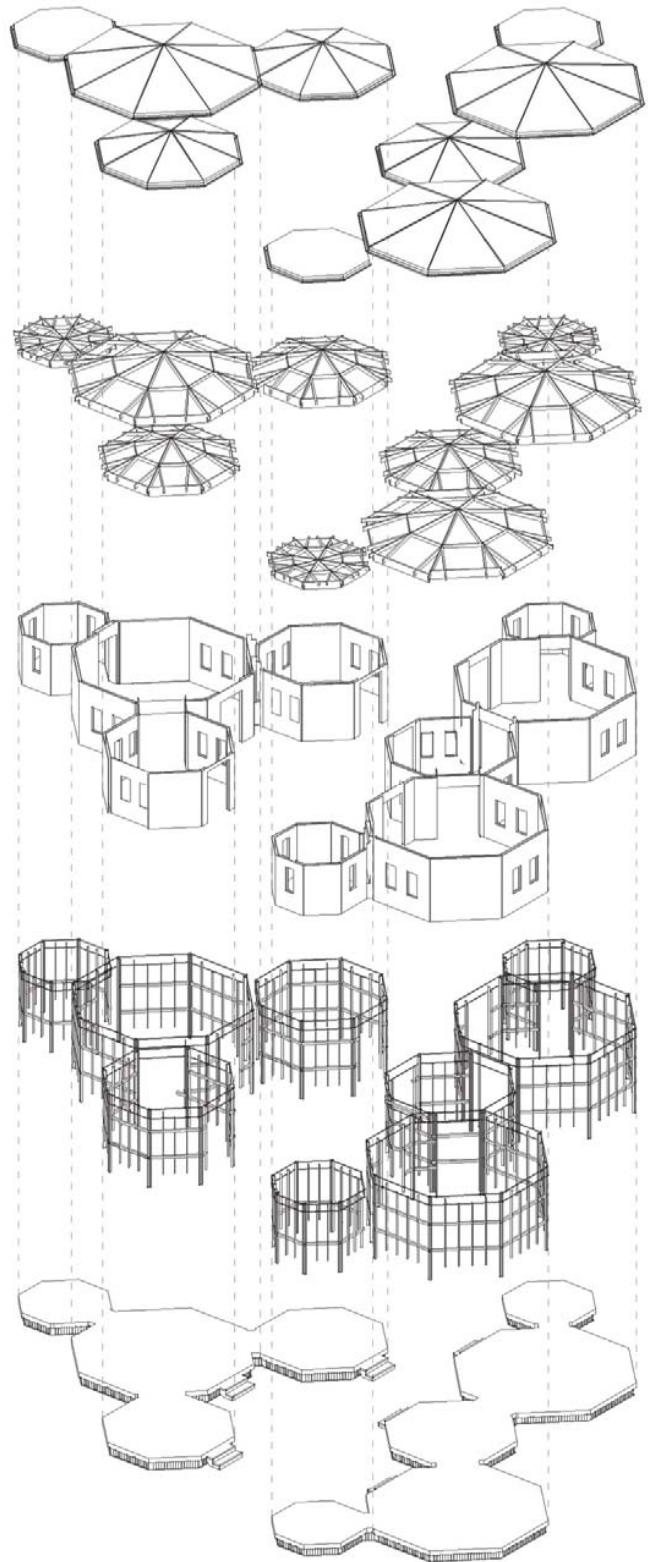


Fig. 7 Exploded axonometric view

The small rooms can be used for support functions like medical facilities, drugs and water storage, tanks. The largest rooms can host function related to the care for treatment or clinical rooms. All the reception or waiting areas are outside of the structures according to the idea to produce these structures with few resources.

Under conditions of limited resources, the possibilities for service rotation are the best way to provide in the same space different services in different days of the week. In this way is possible to reduce the total required surface for the facility and the construction costs. The interchange of services into one space means that rooms must be planned in a flexible way on average dimensions and with adaptable arrangement of outfitting.

Flexibility has three aspects, which are also the aspects that the PHC Centre should have:

- the rooms should be planned on the basis of activities performed in them to avoid discomfort. It will be necessary to accommodate in a given room compatible sets of activities, this aspect of flexibility is called *versatility*.
- if this substitution of activities becomes permanent it's called *convertibility*, which implies that some adaptations of building parts are possible and easy.
- if a facility is able to grow with an increasing demand, it's called *expansibility*. Expansibility is one of the most important characteristics that a PHC Centre should have, by enlarging it can gain more functions and therefore more importance in the zone where it will exist.

The idea is to find a module that must be easily repeatable for a future expansion. Following the idea to enhance the Health Post, it is necessary to consider first of all the location in order to facilitate the supplying system (energy and water). The nodal point should be located in a rational way, in order to have sufficient growth [9].

Particular attention is given to the open spaces as much as inside, considering that the outdoor spaces could be dedicated to common activities and could form a comfortable space for people.

The aim is to create a prototype that could be used in the whole African continent. This prototype, which is interpreted as a module has to be easily adaptable in different countries, changing simple characteristic elements and materials based on the local supplies.

VI. CONCLUSION

This project has the aim to emphasize the importance of social sustainability, understood as the ability to ensure conditions of human well-being, through sustainable building that is able to guarantee at the same time the protection and renewal of natural resources and of the environmental heritage of the place.

The design approach for a PHC center should have a goal far more extensive than that relating only to health care as the construction will be the engine for a new conception of "social structure" [10].

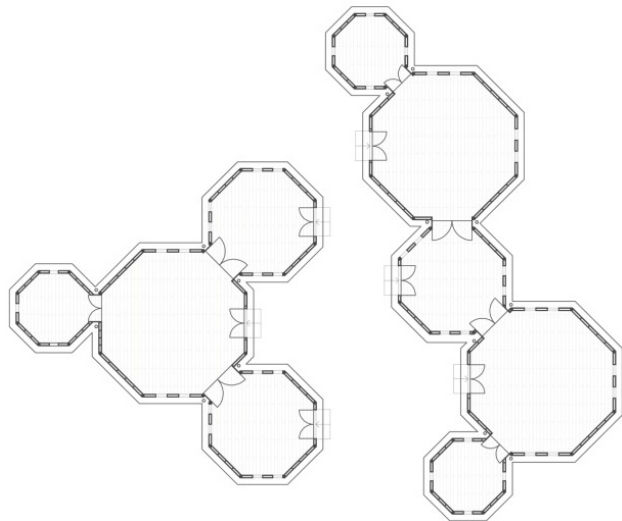


Fig. 8 Ground floor plan: intersection of hexagonal shapes



Fig. 9 Health Post: sections



Fig. 10 Health Post: facades



Fig. 11 3D model: future expansion

The intention of the project was therefore to go beyond the health centre, creating a space structured by social relations

and placing the patient in the active position with respect to the context.

It is an important goal of the project to search the quality of the environment, because the quality of construction permits, together with the improvement of the wellbeing of the population, to arouse greater interest in the architectural and environmental aspects.

Africa is a continent hungry for growth, development, modernity. It's necessary to find modern *solutions that are sustainable*, not only from an environmental perspective but also from the cultural one. It's better to let local workers participate on the construction, and teach them how to build an efficient structure (educational aspect of the construction site), rather than using modern machinery, that reduce construction time, but are very expensive and do not allow them to learn new construction techniques. It's also demonstrated that a structure built by able and willing local workers is more efficient than a structure imported and built with modern machinery.

REFERENCES

- [1] W. Van Lerberghe, Y. Lafort, "The Role of the Hospital in the District, Delivering or supporting primary care?", in *Current Concerns*, n. 2, Antwerp, Belgium.
- [2] P. Stone, *British Hospital and Health-Care Buildings, Design and Appraisals*, Londra: The Architectural Press Ltd, 1980.
- [3] Enrico Orofino, *Primary Health Care Centres Under Conditions of Limited Resources, A methodology for an integrated planning*, Torino: C.L.U.T., 1983.
- [4] A. Arecchi, *La Casa Africana*, Milano: Città Studi, 1991, pp. 58-94.
- [5] A. Cox, P. Groves, *Ospedali e Strutture Sanitarie*, Palermo: Dario Flaccovio Editore, 1995, pp. 2-23, 34-38, 68-79.
- [6] Aimee De Back, Sabine Berendsen, Camiel Berns, *A Space of Their Own, The servants' house by J. Duiker at Zonnestraal sanatorium*, Rotterdam: Uitgereij 010, 1996.
- [7] M. Lindelöw, P. Ward, N. Zorzi, "Primary Health Care in Mozambique, Service Delivery in a Complex Hierarchy", in *African Region Human Development Working Paper Series*, April 2004.
- [8] M. Berrini, A. Colonetti, *Green Life, Costruire città sostenibili*, Bologna: Editrice Compositori, 2010, pp. 60-63.
- [9] M. Biolcati Rinaldi, L. Venturi, *Architettura Sanitaria di Emergenza, Strutture Permanenti Realizzate con Tecnologie Appropriate*, Bologna: CLUB, 2011.
- [10] C. Funzamo, A. Assane, F. Vaz, P. Bendix, S. Noormahomed, S. Bickler, E. Noormahomed, "Surgical Research in Rural Mozambique", in *MEPI (Medical Education Partnership Initiative)*, Addis Adaba, Ethiopia, August 8, 2012.

Domenico Chizzoniti. Born in Vibo Valentia in 1969, he graduated in 1996 at the Faculty of Architecture of the Politecnico di Milano (100/100 with honour). He obtained a PhD degree in Architectural Composition in 2001 at IUAV of Venice. He has been an Assistant Professor at the Department of Architectural Design of the Politecnico di Milano since 1996. Between 2002 and 2005 he worked as a Lecturer at Faculty of Architecture of the Università degli Studi Parma and at the Faculty of Civil Architecture of the Politecnico di Milano. In 2008 he became an Assistant Professor in Architectural Composition at the Department of Architectural Design, Politecnico di Milano.

He is a coordinator of group of the scientific board of the publications of TECA "Teorie della Composizione Architettonica".

He has published more than 50 scientific papers, (10 peer reviewed international papers) in the field of Architectural Composition.

He took part as an author in several books and he also collaborated in various architectural and urban design, as a teacher at the Politecnico and in

other universities, and his work has been published in catalogues and magazines.

Among the books published: D. Chizzoniti and L. Monica (eds.), Guido Canella. Sulla composizione architettonica e sui progetti, Leonardo International, Milan 2003; D. Chizzoniti (ed.), L'altra idea di Parigi, Librarsi Viaggi, Cuneo 2007, D. Chizzoniti (ed), Ideologia e Iconologia. Architettura e Rivoluzione, Clean, Napoli 2008, D.Chizzoniti (ed), Josef Gocar. Memoria della tradizione e poetica d'avanguardia, Clean, Napoli 2011, D.Chizzoniti (ed), Carlo Aymonino. Teoria dell'Architettura, Clean, Napoli 2012.

He took part in various national and international competitions, and some of his jobs were mentioned in international papers.

This project was made in collaboration with: Dore Blay, Chiara Rezzi, Mattia Talarico.