FLEXIBILITY IN PRIMARY HEALTH CARE DESIGN IN MARGINAL AREAS

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This research focuses on the analysis of Primary Health Care facilities located in rural areas. The health facility for primary care is the minimum unit of a complex system since it can be extended and implemented with other services and functions in the future. The most helpful method to develop the basic health unit in a small hospital will mainly depend on the nature of the expertise area, the living conditions of the community and its particular needs, and the prevalence of specific diseases and socio-cultural conditions.

This study adopted a mixed-methods focused on analyzing the literature review of the principles of flexibility and evaluating the design of ten international primary care facilities. The factors that influence the design of the architectural space have been analyzed under three macro requirements: expansibility, versatility, reversibility. These macro aspects have been investigated in three criteria relating to form, space, and structure. The intersection of each case study with the three requirements of expansibility, versatility, and reversibility highlighted the flexibility requirements met.

The expansibility requirement was not achieved, as the buildings analyzed were designed as finished units with no possibility of extension in the future. Therefore, it is necessary to pay more attention to the architecture of the primary health care facilities during the planning and design phase to accommodate changing needs. Only an integrated approach can make steady progress on social and health care conditions improving community’s needs in marginal areas.

Keywords: Expansibility, Versatility, Reversibility, Health facilities, Rural areas.

1 INTRODUCTION

This contribution focuses on some specific measures to be highlighted in the design phase of primary healthcare facilities in marginal areas through the concept of flexibility. Remote and rural areas often do not have adequate access to basic health services, such as primary care, which is generally provided by hospitals, causing them to become overcrowded. The topic relates to a complex sector that presents variables depending on the extent of the user base, the types of diseases present, and the rules on the management of health facilities in the specific locations of intervention.

The Primary Health Care center is the minimum unit of a complex architectural system. Responding to changes is particularly difficult in the health sector; therefore, a rural health facility should be constructed as a multi-purpose space that can be adapted as a social facility for different tasks and activities. It could host several functions according to the context in which it is located, and the needs of the population served (Chizzoniti et al. 2020). The demographic and geographical characteristics are essential for understanding which services will be used the most and how the situation might change in the future.
A multi-purpose space requires a flexible construction suitable for different territorial situations, providing an alternative to the types and technological systems used so far.

Flexibility is threefold, and these three aspects coincide with those the primary healthcare center should have: expansibility, versatility, and reversibility. Hence, the objective of the research is to demonstrate to which extent flexibility must be an essential prerequisite in Primary Health centers. In order to ensure the versatility of the structure, a health facility must be previously conceived and designed according to technological and structural guidelines and change over time according to social needs (National Institute of Building Sciences 2015).

2 THE THREE ASPECTS OF FLEXIBILITY

Flexibility in primary healthcare architecture is the ability of a building to adapt to spatial, functional needs that change in the short, medium, and long term. Its propensity to transformation, to the structure's versatility, can be guaranteed by a previously designed and planned building system according to the study of spaces, activities, and technological and structural criteria aimed at its flexibility. The first strategies used in the healthcare sector to respond to the need for flexibility date back to the 1960s, and refer to the increase in structures conceived in a modular way. Since then, the principle of flexibility has become increasingly important regarding both the volumetric increase and the flexibility of the interior spaces to carry out various diagnosis and treatment activities. Today the primary health facilities evolve quickly, reaching a rapid change following the social, economic, and scientific development, and this means that the structure is already inadequate a few years after its construction (Capolongo 2012). Therefore, ensuring a flexible building means ensuring continuous usability of the architecture over time, avoiding renovations that impact health care (Kendall 2012).

The primary health care facility has to be designed for future expansion, providing flexibility to the physical environment and the intended use. Dividing the space into smaller compartments involves greater flexibility of use. In case of limited resources, the possibilities for service rotation are the best way to provide in the same space different services on different days of the week. In this way, it 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 flexibly on average dimensions and with a flexible arrangement of outfitting (Cox and Groves 1995).

There are different opinions on the use and meaning of the term flexibility. For this research, flexibility will refer to three requirements that the primary health care center should have: expansibility, versatility, and reversibility.

- **Expansibility**: an architectural structure can grow with increasing demand according to the community’s needs. By enlarging the health facility with modular spaces, it can acquire more functions becoming a small clinic or hospital.
- **Versatility**: the rooms should be planned to accommodate a range of compatible activities. The versatility should be typological and functional to incorporate different tasks by modulating the space to the needs of form and figuration.
- **Reversibility**: the architectural system should be designed to be demountable to configure a flexible space. This characteristic of flexibility refers to the reversibility of the connection systems between the parts and should be conceived in the first design phase, guiding the construction choices (Tecnologos 2006). Reversibility also has an environmental value, ensuring that the components of the building, at the end of their useful life, can be disassembled, facilitating the recoverability of its parts (Chizzoniti et al. 2015). Each part that constitutes the building system would be formed by independent elements...
both functionally and technologically so that they are readily separable materials (Bologna 2002).

3 METHODOLOGY

The methodology adopted in the research is a mixed-methods that systematically integrates quantitative and qualitative data to facilitate a more comprehensive understanding of health issues in flexibility and potential resolutions. This is an analysis of the literature on the principles of flexibility and the evaluation of the design of ten international primary care facilities. From the literature review focused on the different aspects of the flexibility of healthcare structures, the factors that influence the design of the architectural space have been analyzed under three macro requirements: expansibility, versatility, reversibility. Each of these macro aspects has been investigated in three criteria relating to form, space, and structure, which have been divided into two main architectural elements deriving from the review of the literature and the different aspects of the meaning of flexibility (Table 1).

Table 1. Criteria for analyze the flexibility in primary health care design.

<table>
<thead>
<tr>
<th>FLEXIBILITY REQUIREMENTS</th>
<th>ARCHITECTURAL DEFINITION IN PRIMARY HEALTH CARE</th>
<th>ARCHITECTURAL ELEMENTS</th>
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<tbody>
<tr>
<td>EXPANSIBILITY</td>
<td>Expandable space over time to ensure adequate coverage of the population.</td>
<td>Form</td>
</tr>
<tr>
<td>VERSATILITY</td>
<td>Ability of the health facility to accommodate several activities.</td>
<td>Space</td>
</tr>
<tr>
<td>REVERSIBILITY</td>
<td>Ensure flexibility in building materials, components and systems.</td>
<td>Structure</td>
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The selection of ten primary health units has allowed the acquisition of a wide range of facilities in different contexts: two projects in Latin America, four in West Africa, three in East Africa, and
one in Asia (Figure 1). A literature study of primary health care facilities in poorly developed rural areas was conducted to identify these health facilities.

Figure 2. Selection of ten case studies: form, space, structure.

The selection criteria of the ten units were based on qualitative analysis of the form, space, and structure. Each health unit was analyzed through architectural and construction drawings, such as diagrams, plans, sections (Figure 2), and evaluated through a structured matrix. The three flexibility requirements were assessed for each health facility with a qualitative classification system:

- Low = the flexibility requirement is not completely satisfied;
- Medium = a medium degree of flexibility has been achieved;
- High = the flexibility level is reached.

The intersection of each case study with the three requirements of expansibility, versatility, and reversibility highlights the flexibility requirements met.
4 RESULTS
Evaluating the flexibility requirements through a comparative matrix (Figure 3) made it possible to identify the levels of flexibility satisfied by the health facilities analyzed by the research. The x-axis shows the ten health facilities, while the y-axis is assigned the three requirements of flexibility evaluated for each health facility with a qualitative grading system: low, medium, high. From the superimposition of the matrix data, the flexibility requirements were fulfilled only in some of the three criteria. The case studies showed greater versatility in functional flexibility and a lack of expandability, both in the possibility of extension and modular expansion (Figure 4). Some of these projects were designed as finished units, planning an internal service rotation, although with no possibility of extending the structure later. The comparative matrix is essential to understand the level of flexibility achieved so far, to improve the requirements that are more lacking than others in the future.

Figure 3. Assessing flexibility requirements.

5 ACHIEVING EXPANSIBILITY IN PRIMARY HEALTH CARE
According to the results achieved, primary healthcare facilities in rural areas should transform and change over time from a spatial, functional, and structural point of view. This research highlights the main criteria for achieving expandability in healthcare design (Figure 5):
- The development of a standard unit designed both as single units and as aggregated units;
- The modularity of the architectural building;
- Choice of materials and construction elements easily combined and disassembled.
CONCLUSION

This study is based on the continuing need to improve livability experience in the built environment in rural and remote communities through greater flexibility of first health units. Although this study is limited to ten case studies, it allowed to critically reflect on building systems and spatial conditions to accommodate changes in the physical space. Further studies could be made on a larger sample of facilities in other rural locations worldwide. Changes in primary health care are occurring at an ever-accelerating pace due to a growing range of forces impacting health care facilities. The space flexibility, both in terms of the form of the building, the different activities carried out, and its construction aspect should be the result of the design and construction phase. It is essential to build primary health care facilities based on the principles of flexibility that adapt to physical transformations over time and to the population's health needs to which they relate. Therefore, the health building built in the future should be designed with simple structural modules for subsequent adaptations and extensions and to accommodate changing needs, both those that can be anticipated and those that cannot even be imagined. It is necessary to implement guidelines on the issues of changes in flexible primary health care facilities in remote areas. These guidelines must be adopted and supported by professional design, construction, and health care bodies to be fully implemented. It is recommended that architects and their collaborators address the issues mentioned above during the planning and design phase in the future.

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