

# Equity in Healthcare Accessibility

## A purpose of Urbanity

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### Introduction

Mobility and accessibility policies should be understood within a wider context which relates urban life (access to opportunities: public/private services, work, education and leisure) and economic vitality, assuming that these factors, together with the principles of efficiency, sustainability and equity, are imperatives in the search for reasonable and efficient political measures [1,2]. Within this scope, the implementation of sustainable urban mobility measures, anchored in solid planning policies which contemplate the principle of proximity, is today a priority [3]. They should guarantee equal access to basic goods and services involving short-distance travelling on foot and/or using public transport [1,3].

The present financial crisis, together with urban strain, forces the reformulation of location policies in relation to health centres, in such a way as to improve access through the implementation of environmentally sustainable forms of mobility, which themselves represent healthier behavioral patterns [1,3]. Health system infrastructures – health centres (HCs.), HC extensions and, more recently, Family Health Units – should be located in such a way as to efficiently cover the spatial distribution of those who are their target population, which is not always the case [4]. The consequences of inefficient solutions are an inadequate use of health services [1,3,4] and the excessive dependency on private transport, in contrast with sustainable mobility modes, as public transport and walking, when going to a health unit [3].

Geographical Information Sciences (GIS) have contributed, as a decision-making tool, to a greater equity in access to the health system [6]; this has mainly been achieved through the use of optimization algorithms which guarantee an adequate distribution of infrastructures. GIS provide the means to calculate the catchment area for a given health system infrastructure (or for a set of infrastructures), at the same time to calculate geographical accessibility of population located within these areas. This provides the solution for the complicated equation which tries to balance supply and demand, taking into account the specific needs of certain population

groups (e.g. elderly people) and adjust the type of service provided according to these [6,7].

## Objectives

The study-area of the present study is the local council of Coimbra, located in the center of Mainland Portugal (figure 1). It is intended to demonstrate how GIS tools provide an adequate framework in the process of spatial reorganization of the health centres system/network in the local council of Coimbra. More precisely, it is intended to: i) analyze the characteristics of supply within the existing health units; ii) quantify and understand the differences between potential, expressed and effective demand; iii) adjust the location of HCs in order to answer the needs of resident population and individuals actually registered in the health units; iv) build analytical mathematical models which quantify gains in terms of geographical accessibility, paying particular attention to soft and public means of transportation [8].

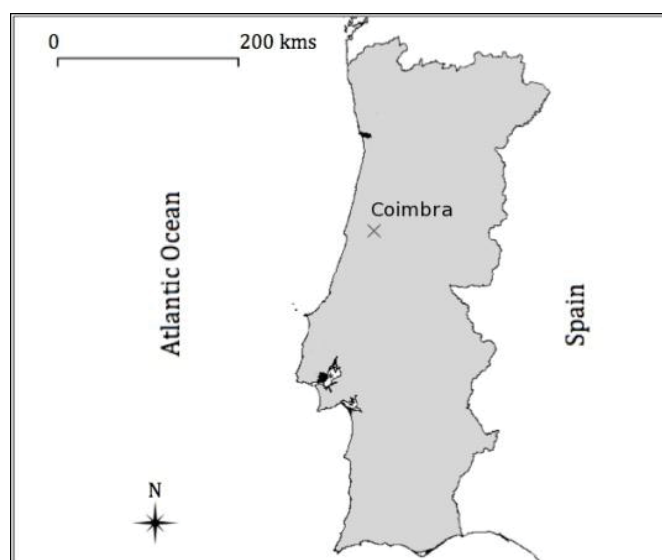


Figure 1: Location of Coimbra within Mainland Portugal.

## Data and methods

The reallocation assessment of three HCs located in the Coimbra local council – the optimal location - was performed using GIS methodologies; this allows the analysis of a vast and diversified set of information that is directly associated with HC use: socioeconomic and demographic variables, supply characteristics, geographical accessibility, etc. This is done in a multilevel environment, with distinct geographical levels of analysis: individuals, health units, census tracts, wards and local council.

The information was obtained from: 1) local council authority (digital cartography); 2) Health Administration of Centre Region (HCs patients database); 3) Statistics National Institute (socioeconomic and demographic variables); 4) NavTeq (road network).

Accessibility was modelled as an estimate of real time-distance to pre-defined locations. In this study, the primary means of transportation taken into account were walking and public transport. Accessibility surfaces were computed using an anisotropic cost surface, in which impedance (or traction) varied with road typology (in the case of public transport accessibility) and with differences in orography (in the case of walking accessibility).

The accessibility surface is the outcome of a GIS raster model, which represents the study-area. Since the choice of grid resolution is a function of geographical detail and the size of the study-area, a 5 meters resolution was chosen, assuming a commitment between precision and computer hardware capacity.

In order to characterize the geographical accessibility scenarios, the location of each patient was associated to the census tracts layer and summary statistics for each of these obtained. This allowed the joint-analysis of socioeconomic and demographic variables (Census 2001) and geographical accessibility to HC analysis (time-distance) [8].

### **Outcomes of health centres reorganization**

The current and alternative scenarios were modeled in agreement with criteria from the Health Administration of Centre Region. The alternative scenario includes the spatial reorganization of HCs. Figure 2 shows the corresponding accessibility surfaces – present situation and alternative scenario. The geographic accessibility was analyzed with respect to potential demand - 171,527 residents in the HCs' geographic catchment area - and expressed demand - 209,624 HCs patients - for time-distance travel to HCs (walking and public transport).

For the analysis of changes in terms of time-distances in relation to public transportation, there are important benefits in terms of the proposed scenario. For example, the percentage of residents that would have to walk less than 15 minutes rises from 14.6% to 17.2%; in relation to patients registered in a HC, the change would be from 18% to 19,2%. In relation to public transport, the alternative scenario also shows gains for the 15 minutes limit: from 27.7% to 45.7% - resident population - and from 28% to 45.8% - HCs' patients.

Each health centre has an administratively determined catchment area. For some HCs, these is larger than the geographically determined catchment area. These also benefit in aggregate terms from the alternative scenario. For example, the new location of *Fernão Magalhães'* HC implies that the resident population within 15 minutes walking distance doubled (from 4,477 to 8,213 residents). The HC' new location improves the access of the poorer and elder population that lives in the central urban area of Coimbra city.

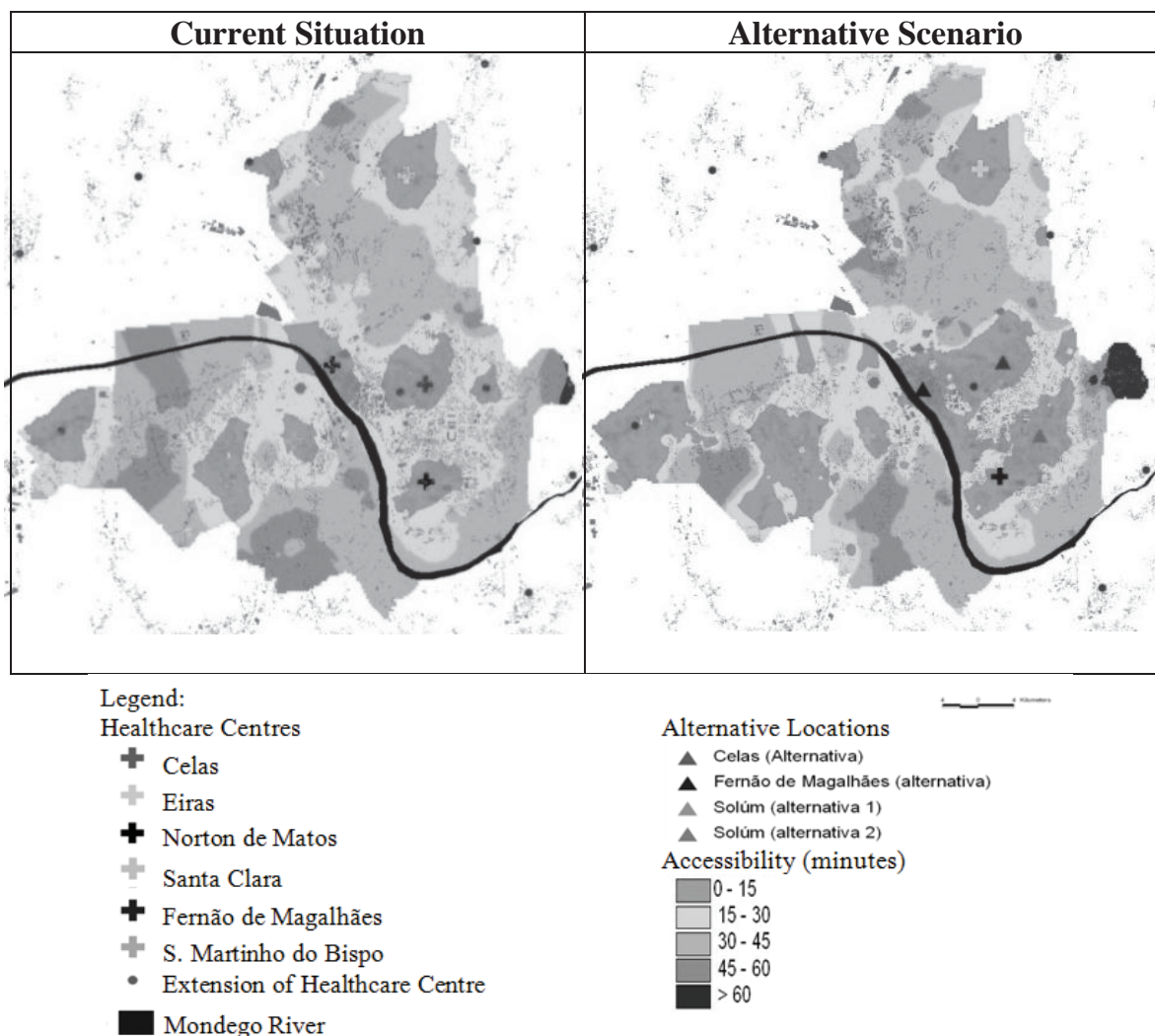


Figure 1: Public Transport Accessibility to Healthcare services: current situation and alternative scenario.

### Synthesis

This study uses GIS methodologies and was developed in different stages, the most important of which were modeling accessibility to HCs and the proposal of a set of alternative scenarios for the spatial reorganization of public health services (maintaining the number of HCs.).

The analysis of the two travel modes and accessibility gains and losses for residents and patients (potential and expressed demand), reveal that the alternative scenario implies gains for the population and that those accessibility gains are reached with sustainable mobility modes (gains of up to 18% in terms of access to the nearest unit using public transportation). Hence, the study concludes that the reorganization of the spatial distribution of HC in the local council of Coimbra will allow superior levels in terms of social equity and access to health.

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