



Contents lists available at ScienceDirect

Research in Social and Administrative Pharmacy

journal homepage: www.rsap.org

Geographical accessibility to community pharmacies by the elderly in metropolitan Lisbon

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ARTICLE INFO

Article history:

Received 3 February 2017

Received in revised form

19 June 2017

Accepted 29 July 2017

Keywords:

Community pharmacy

Geographic access

Elderly

Portugal

ABSTRACT

Background: In ageing societies, community pharmacies play an important role in delivering medicines, responsible advising, and other targeted services. Elderly people are among their main consumers, as they use more prescription drugs, need more specific health care, and experience more mobility issues than other age groups. This makes geographical accessibility a relevant concern for them.

Objectives: To measure geographical pedestrian accessibility to community pharmacies by elderly people in the Lisbon Metropolitan Area (LMA).

Methods: The number of elderly people living within a 10- and 15-min walk was estimated based on the exploitation of population census data, the address-based location of 801 community pharmacies, and a Google Maps Application Programming Interface (API) method for calculating distances between pharmacies and the centroids of census statistical subsections. Results were compared to figures attained via traditional methods.

Results: In the LMA, 61.2% of the elderly live less than a 10 min walk from the nearest pharmacy and 76.9% live less than 15 min away. This opposes the common view that pharmacies are highly accessible in urban areas. In addition, results show a high spatial variability of proximity to pharmacies.

Conclusions: Despite the illusion of good coverage suggested at the metropolitan scale, accessibility measures demonstrate the existence of pharmaceutical deprivation areas for the elderly. The findings indicate the need for more accuracy in both access measurements and redistribution policies. Measurement methods and population targets should be reconsidered.

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1. Introduction

Contemporary societies are ageing. UN projections indicate that in 2040, the world's old-age dependency ratio (people aged 65 and over relative to those aged 15–64) will reach 21.6%. In Europe, the numbers are even higher, with an expected rise from 29.0% in 2020 to 41.5% in 2040.¹ In an increasingly urbanised and mobile world, population ageing will challenge urban policies more than ever. Elderly people—defined hereafter as individuals aged 65 or older—are more likely than others to experience mobility issues. This is a result of their diminishing levels of disposable income and physical-based driving cessation,^{2–6} as well as difficulties with walking long-distances.^{7–9} Since more than half of total health expenditure is allotted to people over 65,¹⁰ proximity to healthcare services is a relevant concern

for this particular age group.

Community pharmacies are probably the most readily accessible category of healthcare providers,¹¹ and the most widely sought after service. More than 90% of adults visit a pharmacy at least once a year.¹² Pharmacies not only dispense medicines, but also deliver valuable and increasingly diversified services, including responsible counselling, blood pressure and arterial tension measurements, and several other targeted services; thus, contributing to efforts to reduce morbidity.^{13–15} Pharmacies are particularly needed by elderly people,^{16,17} as this demographic spends more money on prescribed drugs than other age groups.¹⁸ According to the US Centre for Medicare and Medicaid Services, in 2012, people aged 65 and over accounted for 28% of total prescription drug-related spending in that country. They are also more vulnerable to seasonal illnesses and adverse drug effects, and require more follow up care linked to multiple chronic diseases.^{19,20}

Geographical accessibility is generally defined as the ease with which an individual reaches a given destination.²¹ Pedestrian

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<http://dx.doi.org/10.1016/j.sapharm.2017.07.014>

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accessibility thus refers to the walking time it takes for one to reach a given area. Accessibility to pharmacies is a major issue, as having to travel great distances to reach them might threaten elderly access to medicines and healthcare advice.^{22–25} A considerable portion of the elderly experience mobility limitation, defined as difficulty to walk over a given distance, which might range from 100 m,²⁶ or one-quarter mile (400 m),⁹ to 800 m.⁷ It has been frequently observed that people living further from a healthcare service location tend to utilise it less than people living in the immediate vicinity.^{6,25,27,28} This is particularly relevant in European cities, where urban fabrics tend to be more compact, relying more on public transit and including more mixed uses, walkable, narrow and irregular non-grid shaped streets. As a result, in European cities, people tend to use cars less than in the United States, thereby reinforcing the importance of pedestrian access to local resources.

Since pharmaceutical activity is not subject to general market conditions, in most countries, pharmacy locations are strongly regulated by demographic and geographic criteria that ensure high levels of accessibility for most people. Until recently, this has contributed to an illusion of good territorial coverage.^{15,28} As a result, geographical access to pharmacies might not have been studied as much as less ubiquitous healthcare services.^{25,29} In addition, as their distribution pattern is highly correlated with population distribution, urban areas are typically less analysed than rural regions, where distances are greater and concerns regarding access to healthcare are more apparent. Rural areas are prevalent in analyses of accessibility to community pharmacies. However, with the rise of GIS-based analyses and a growing concern over equity, significant progress has been made over the last two decades in measuring accessibility to healthcare services. On the one hand, many methodological improvements have been made to measurement and aggregation methods.^{30–35} On the other hand, due to the potential reduction of health inequalities represented by the principle of equal access for all,³⁶ several studies on access by vulnerable population groups—such as ethnic minorities,^{20,37} low-income groups,³⁸ and aged people^{17,29}— have contributed to a reconsideration of pharmaceutical territorial coverage. It is recognised that a high proportion of individuals living less than a given distance from a pharmacy does not mean that real needs are satisfied, especially for those experiencing major issues due to driving cessation or walking difficulties.¹⁹

Therefore, this paper aims to measure pedestrian accessibility to community pharmacies by elderly people in the Lisbon Metropolitan Area (LMA). The methodology is based on an exhaustive collection of the address-based locations of 801 community pharmacies, as well as a Google Maps Application Programming Interface (API)-based method for calculating real pedestrian distances between census statistical subsections and pharmacies. All in all, this paper seeks to determine: (i) how many elderly people live within a 10- and 15-min walk from the nearest community pharmacy; and (ii) whether pockets of poor access remain within the urban area.

2. Study area, data, and method

2.1. Study area

The LMA extends over approximately 3000 km² and includes 2.8 million inhabitants, among which 600,000 live in the central city. It is divided into 18 municipalities, which are in turn subdivided into 211 parishes. It constitutes a valuable study case for assessing accessibility to pharmacies. The almost uncontrolled demographic growth that occurred between the 1960s and the 1990s, and the resulting urban expansion, have shaped a strongly fragmented urban area with a high quantity of urban and functional barriers. These have

created many community severance issues, and now reinforce the relevance of local communities as the most suitable level for services provision. This is even more relevant after taking into account that Portuguese elderly suffer the adverse effects of lower incomes, qualification levels, and car ownership on a higher scale than their European counterparts. The 2008–2012 financial crisis has accentuated their economic vulnerability, and may have hampered their ability to drive and access unevenly distributed services.

After decades of sustained population growth, the LMA population has now stabilised. The LMA lost 0.51% of its population between 2011 and 2015. The region is expected to remain fairly stable in the future, and current forecasts indicate that it may even lose more population.³⁹ In one of Europe's most ageing countries,⁴⁰ forecasts indicate that the elderly will represent between 31.9% and 38.9% of the LMA population by 2060.³⁹ Such numbers might contribute to explaining the relatively high number of pharmacies available in Portugal, which is above the EU mean with 28 community pharmacies per 100,000 people in 2015.¹⁰

In recent years, Portuguese community pharmacies have faced a dramatic liberalisation process^{41,42}; mainly through two Decree-Laws approved in 2005 and 2007 (D.L. n.º 134/2005 and 307/2007). Among the main changes are: (i) pharmacies are no longer the exclusive sellers of non-prescription drugs; and (ii) non-pharmacists can now own a pharmacy, with a maximum of four establishments per owner. This has led to the opening of more than 900 new units between 2005 and 2011 that can sell over-the-counter medicines.⁴³ Nonetheless, the market share remains overwhelmingly favourable to community pharmacies (85% of drugs spending).⁴⁴

Despite these changes, the demographic and spatial criteria have been maintained, and the geographical distribution of pharmacies remains strongly regulated at the State level. Leaving aside a few exceptions and other criteria, a pharmacy can be established only when the following two criteria are met: (i) the municipal ratio must remain higher than 3500 inhabitants per pharmacy; and (ii) distance between pharmacies cannot be lower than 350 m. Such restrictions guarantee a homogeneous coverage within the national territory, saving public interest by avoiding concentrations around certain healthcare providers and specific neighbourhoods at the detriment of others.

The resulting distribution of pharmacies in Portugal is well balanced in a first analysis, with a high correlation between population and pharmacies at the municipal level.^{45,46} At the LMA scale, their geographical distribution is very similar to the pattern of urbanised areas (Fig. 1). Three main urbanisation corridors, historically linked to the expansion of the LMA's three main railway lines of Cascais (to the West), Sintra (Northwest) and Vila Franca de Xira (North), are clearly visible on the North bank. In the Lisbon City, the two empty areas apparent in the map are Monsanto Forest Park (West Lisbon) and the airport (one pharmacy, North Lisbon). In 2015, there were 2773 community pharmacies in mainland Portugal (INE data). In November 2016 (period of data collection), 801 community pharmacies were included in our database, representing 28% of the national total.

2.2. Sources of data

The research data in this paper is drawn from two main sources. First, data provided by the 2011 population census at the census statistical subsection level, which is the smallest spatial unit of available data and the equivalent of the US census block or British census tracts. The 34,937 LMA subsections vary in size and number of people included, with the largest subsections being located in rural and peri-urban areas (Table 1). In addition, address-based community pharmacies were exhaustively collected using the National Health System database and updating it, when necessary,

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