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Uses of Spatial Analysis in Oral Health Research

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Abstract

Spatial analysis provides an innovative decision- support tool in health informatics with a substantial potential to harness in oral epidemiology, planning, monitoring and evaluation of public health care services such as dental care. In this context the application of innovative technologies promote the use of available tools that enhance the design of the health sector based on a spatial approach. This scenario involves the appropriation of available technologies and strategies that strengthen differentiated and modern management with the focus on making health decision. Mapping and spatial analysis in oral health conditions couple with population characteristics becomes important in this context. The aim of this study, besides presenting the uses of spatial analysis in oral health, is to discuss some representative applications of methods that deal with the analysis of spatial patterns of oral health events, analyzing advantages, disadvantages, and applicability of the spatial analysis in oral health status and planning.

Keywords: Epidemiology; Oral health; Spatial analysis

Modern data analysis technology, based on the spatial distribution of diseases and injuries, has been increasingly valued in the management of health systems [1]. It is an innovative and powerful technology for the investigation of oral health events [2]. Through computational systems of spatial analysis it is possible to plan and execute specific actions at locations identified with greater need, risk or vulnerability [1-3]. First question in Spatial Analysis (SA) is: what should be considered as "spatial analysis" in health application? In conceptual terms, the phrase identifies the subset of techniques that are applicable when, as a minimum, data can be referenced on a two-dimensional frame and relate to terrestrial activities [3]. The results of geospatial analysis will change if the location or extent of the frame changes, or if objects are repositioned within it: if they do not, then "everywhere is nowhere", location is unimportant, and it is simpler and more appropriate to use conventional, a spatial techniques [4]. Descriptive statistics, such as cell counts, means, variances, maximum,

minimum, cumulative values, frequencies and a number of other measures and distance computations are also often included in this generic term "spatial analysis" [2].

The methods used in SA are considered quantitative in studies in which the object of interest is geographically defined [1]. Such as the analysis of the spatial distribution of disease occurrence and its relationship with health services, aiming to identify spatial patterns of morbidity or mortality and associated factors, to describe processes of disease diffusion and to generate knowledge about disease etiology, its prediction and control [5,6]. The analysis of disease distribution is done through three pillars: people, time, space. In this sense, it is a field of health research that requires the ability to connect different areas of knowledge such as computation, geography, cartography, demography, statistics, epidemiology and sociology [1,2,6,7]. In addition, wide range of techniques of spatial analysis that were developed during the last

half century to associate contextual, individual variables and identify patterns of inequalities. However, most oral health researchers and public health professionals are not familiar with either the techniques or the specific SA software [1-3].

Currently, there are SA software and yours package sometimes are offered freely but are not for the exclusive use of the health area [1-5]. Furthermore, the quality, variety and efficiency of spatial analysis tools facilities provide an increasingly choice for open software use. Plus, tutorials, videos and handouts are offered [1]. Many study materials allow for self-learning in a step-by-step manner and with an accessible language for health technicians [8]. However, computer resources and knowledge are needed [3,8]. In addition, a wide variety of web-based or web-deployed tools have become available, enabling datasets to be analyzed and mapped, including dynamic interaction and drill-down capabilities, without the need for local spatial analysis software installation. Furthermore, the rapidly increasing number of spatial analysis software packages including complex analytical tools including add-ins or analysis can make it difficult to use for health professionals that have none or little knowledge of technological resources [3,8].

Spatial analysis uses in oral health studies aims to develop tools that integrate processing functions and analysis of geo-referenced information, whose implementation will depend however, the demand for spatial analysis methods in the public health community studies [9-13]. To beginning of any spatial analysis you need hardware, specific software, digital cartographic database and one or more variables (attributes). Currently there are several software available freely to perform spatial analysis in oral health. If you are performing a spatial analysis by area will require that the attribute is added in the same way that the digital cartographic database. Basically there are three ways to perform spatial analysis in oral health data vector based: points, polygons, lines and mixed [14-16].

The visualization data by maps utilized in SA throughout many parts of the analytical process provides the exploration of data, identification of patterns and relationships and communication facilities of results. The SA is more applied in three oral health researches fields: oral epidemiology through the spatial distribution of oral diseases or individuals/areas with greater vulnerability and risk; planning and evaluation of oral health policies; monitoring the results of oral health actions and oral

health surveillance [9-16]. In this sense, maps are powerful visual resource that allows the visualization of quantitative and qualitative health information [11,14,16]. Limiting the use of spatial analysis to 2D mapping operations remains too restrictive for our purposes. A further important aspect of SA (or visualization) — the use, creation and manipulation of images, maps, diagrams, charts, 3D static and dynamic views, high resolution satellite imagery and digital globes, and their associated tabular datasets [1,2,8].

It is expected an explosion of information, data and tools to analyze the health situation of the population around the world. Despite the favorable technological scenario, there are many doubts on the part of researchers and professionals of oral health services, as the advantages, disadvantages and applicability of spatial analysis. The spatial analysis approach provides a useful decision- support tool in health with a substantial potential to application in oral health planning and decision in developing countries as well and implementation of effective public health responses. The issues discussed are spatial analysis techniques in the field of oral health, identified as main areas of bottleneck in the dissemination of technology, as well as presenting possible contributions to researchers without an international scenario.

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