

A Hierarchical Facility Location-Allocation Model for the Maternal Healthcare in India

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Abstract

Maternal healthcare is very important for India from social, economic and development perspectives. Success in terms of decreasing mortality rate is directly related to the extent of provision of related healthcare facilities. In similar countries with more number of poor people, facility location decisions would naturally require the least expenses to be incurred on transportation cost by the facility-seekers for visiting these facilities. Maternal healthcare facilities are to provide primary care to all mothers-to-be, with some to provide facilities for routine birth, and some others for the non-routine birth and neonatal assistance to high-risk babies. In countries including India, where the funds for the development of such facilities are limited, each facility cannot be conceived to have all the care requirements and, besides, all the mothers-to-be may not require the services of the facilities with neonatal care. Due to these practical considerations, the governments may try to find right mix of these facilities each at different geographic location to provide primary healthcare support, basic support with facilities for normal birth, and with additional support for premature birth and neonatal care. Thus the capacity of a facility type at a location will be defined separately for each type of associated healthcare support provided. Depending upon the requirement, a mother-to-be may be taken from one facility type to another advanced one and this will also involve transportation cost. To avoid a mother-to-be to visit a far off health facility, a network design restriction is considered in terms of maximum distance to be covered by her. Within this distance itself, all the required facilities are to be available. To determine the location of such facilities and allocation of all mothers-to-be to these facilities, a successively inclusive hierarchical mathematical model has been proposed in this paper that aims to minimize the total of the cost of visiting the facilities by the mothers-to-be and the fixed cost of the facilities. A numerical example has been taken to illustrate the use of the model. A python program, linking the model with GUROBI 8.0.1 optimization software, has been developed to solve the numerical example. To prove the properness of the functionality of the proposed model, impact of the increase in the number of the mothers-to-be has been studied on the location and allocation decisions. The analysis carried out proves the validity of the model as the changes in the location and allocation decisions are supportive of the changes conceived.

Keywords

Maternal healthcare, Neonatal care, Hierarchical facility location-allocation model.

Biographies

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