"Estimating spatial accessibility of public primary health care precisely."

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Abstract:

According to the Alma-Ata Declaration of 1978 Primary Health Care (PHC1) was described as the "…the first level of contact …with the national health system bringing health care as close as possible…". Forty years later in 2018 this study estimates the spatial accessibility of public primary health care precisely at granular village level. Primary Health Care (PHC) in India is provided thru the Primary Health Centers (PHC2) and attached Sub Centers (SC). Spatial accessibility provides a summary measure of two important and related components of access - firstly the volume of services provided and secondly the proximity of services provided relative to the location of the population.

Anecdotes exist in our country that PHC2's and attached SC's are few in number, are not optimally distributed and hence do not provide universal coverage.

In the district of Nalgonda, Telangana the study team sourced geo coordinates data of all 566 villages, 257 SC's from ground level health care professionals by requesting them to share geo tagged images. The study team visited all 32 PHC's to source geo

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coordinates. The data was analyzed using ArcGIS spatial analyst software module.

The total population of new Nalgonda district in 2016 was 1618416. As per IPHS standards the district should have 32 PHC's which was present. However they were not optimally distributed - Figure 1; there were 5 clusters where two or more PHC's were found in close spatial proximity. Figure 2 shows universal coverage with the 20 kilometer catchment access area using two methods: Euclidean and travel distance.

As per IPHS standards SC's should be present within 3 km access distance of villages. Figure 3 shows all villages and sub centers spatially plotted. A 3 kms Euclidean catchment access area ring was generated around them. 25% or 142 villages were found to be out of catchment area. When the same area was arrived based on travel distance, 225 villages or 39.7% of the total villages were found to be outside catchment access area.

This study shows that spatial visualization and optimization methods can help in designing universal health care coverage and go beyond anecdotal thoughts

(Word Limit of the Paper should not be more than 3000 Words = 7/8 Pages)

Introduction

The Alma-Ata Declaration of 1978 emerged as a major milestone of the twentieth century in the field of public health, and it identified primary health care as the key to the attainment of the goal of Health for All. Primary health care is essential health care based on practical, scientifically sound, and socially acceptable methods and technology made universally accessible to individuals and families in the community through their full participation and at a cost that the community and country can afford to maintain at every stage of their development in the spirit of self-reliance and self-determination. It forms an integral part both of the country's health system, of which it is the central function and main focus, and of the overall social and economic development of the community. It is the first level of contact of individuals, the family, and community with the national health system bringing health care as close as possible to where people live and work, and constitutes the first elements of a continuing health care process. According to the Alma-Ata Declaration of 1978, Primary Health Care (PHC1) was described as the "…the first level of contact …with the national health system bringing health care as close as possible…"[1]

In India, the 6th Five year Plan (1983-88) proposed reorganization of PHCs on the basis of one Primary Health Center (PHC2) for every 30,000 rural populations in the plains and one PHC for every 20,000 population in hilly, tribal and desert areas for more effective coverage. The Minimum Needs Program (MNP) was introduced in the country with the objective to provide certain basic minimum needs and thereby improve the living standards of the people. In the field of rural health, the objective was to establish: one Sub-center for a population 5000 people in the plains and for 3000 in tribal and hilly areas. A Sub-center provides interface with the community at the grass-root level, providing all the primary health care services. It is the lowest rung of a referral pyramid of health facilities consisting of the Sub-centers, Primary Health Centers, Community Health Centers, Sub-Divisional/Sub-District Hospitals and District Hospitals. The purpose of the Health Sub-center is largely preventive and promotive, but it also provides a basic level of curative care. PHCs are the cornerstone of rural health services- a first port of call to a qualified doctor of the public sector in rural areas for the sick and those who directly report or referred from Sub-Centers for curative, preventive and promotive health care. It acts as a referral unit for 6 Sub-Centers and refers out cases to Community Health Centers (CHCs-30 bedded hospital) and higher order Public hospitals at sub-district and district hospitals. It has 6 indoor beds for patients [2].

In a country as large as India, availability does not always translate to access. One PHC per 30,000 populations may hypothetically translate to one PHC for hundreds of square kilometers. Moving beyond number of facilities based on population, access to health care, presently is widely accepted internationally as a key goal in meeting the health needs of individuals. Access to health care services is multidimensional. Assessing the extent to which adequate access to health care services is achieved is difficult because there is no single agreed definition of access. Healthcare access is such a complex concept that Norris and Aiken went as far as

to state that "It is as if everyone is writing about 'it' [access] but no one is saying what 'it' is"[3, 4]. Health service planners have tended to adopt Penchansky and Thomas' five main dimensions of access – specifically availability, accessibility, affordability, accommodation and acceptability. The first two dimensions are spatial in nature. The last three are essentially aspatial, and reflect healthcare financing arrangements and cultural factors. Availability refers to the number of local service points from which a client can choose. Accessibility is travel impedance (distance or time) between patient location and service points [5]. While the distinction between availability and accessibility can be useful, in Indian context the two dimensions should be considered simultaneously. We refer to this fusion as "spatial accessibility" (SA), a term that is common in the geography and social sciences literature and is gaining some favor in the healthcare geography literature.

Studies in developing countries have demonstrated that physical proximity of health services is strongly linked to primary health care utilization. Spatial accessibility provides a summary measure of two important and related components of access - firstly the volume of services provided and secondly the proximity of services provided relative to the location of the population [3, 6, 7].

According to the recent Global Burden of Diseases study published in "The Lancet" India ranks 145th among 195 countries in terms of quality and accessibility of healthcare, behind its neighbors like China, Bangladesh, Sri Lanka and Bhutan[8]. Forty years later after the Alma-Ata Declaration of 1978, our study in 2018 estimates the spatial accessibility of public primary health care precisely at granular village level. Anecdotes exist in our country that PHC2's and attached SC's are few in number, are not optimally distributed and hence do not provide universal coverage.

Methods

In the district of Nalgonda, Telangana the study team sourced geo coordinates data of all 566 villages, 257 SC's from ground level health care professionals by requesting them to share geo tagged images. The study team visited all 32 PHC's to source geo coordinates as part of a larger study, with due permission from all concerned state government health system authorities.

ArcGIS spatial analyst software module offers a suite of spatial tools and methods that allow the user to analyze the spatial dimensions of health service location. GIS can be used to map sites, as well as build scenarios of different service arrangements.

Catchment area is determined by a choice of maximum travel distance for a given time, where PHC2's and SC's with in the catchment are considered accessible and equally proximate to the particular population and all locations and population outside of the catchment are not accessible[3].

Catchment area was calculated based on euclidean distance also considering road network. 30 minutes travel time which is considered as the optimal time for best health facility access, and 10 kilometers and 20 kilometers was considered as the parameters for determining the catchment area for PHC's and 3 kilometers distance was considered as parameters for SC's. According to Indian Public Health Standards "As far as possible, no person (should) travel more than 3 kilometers to reach the Sub Center".

Results

The total population of new Nalgonda district in 2016 was 1618416. As per IPHS standards the district should have 32 PHC's which was present. However they were not optimally distributed - Figure 1; there were 5 clusters where two or more PHC's were found in close spatial proximity. Figure 2 shows universal coverage with the 20 kilometer catchment access area using two methods: Euclidean and travel distance. As per IPHS standards SC's should be present within 3 km access distance of villages. Figure 3 shows all villages and sub centers spatially plotted. A 3 kms Euclidean catchment access area ring was generated around them. 25% or 142 villages were found to be out of catchment area. When the same area was arrived based on travel distance, 225 villages or 39.7% of the total villages were found to be outside catchment access area.

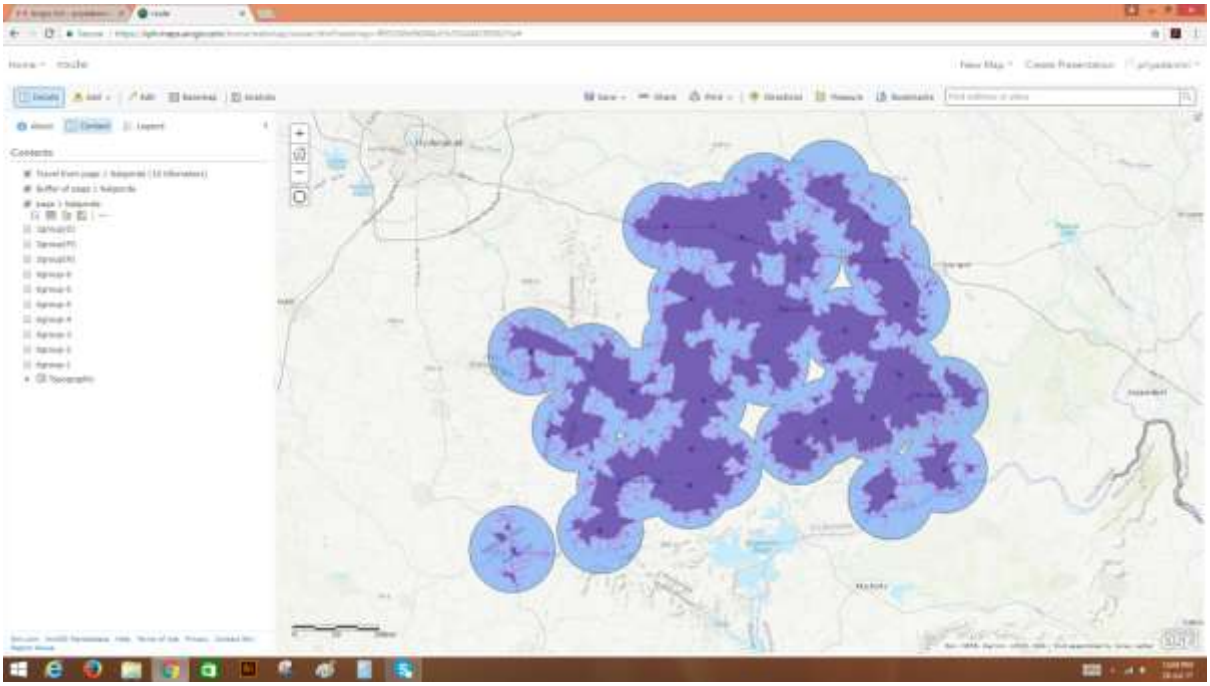

Fig: 1 – Spatial Distribution of all Primary Health Centers in Nalgonda District with a 10 Km buffer zone– Euclidean model versus actual driving distance model

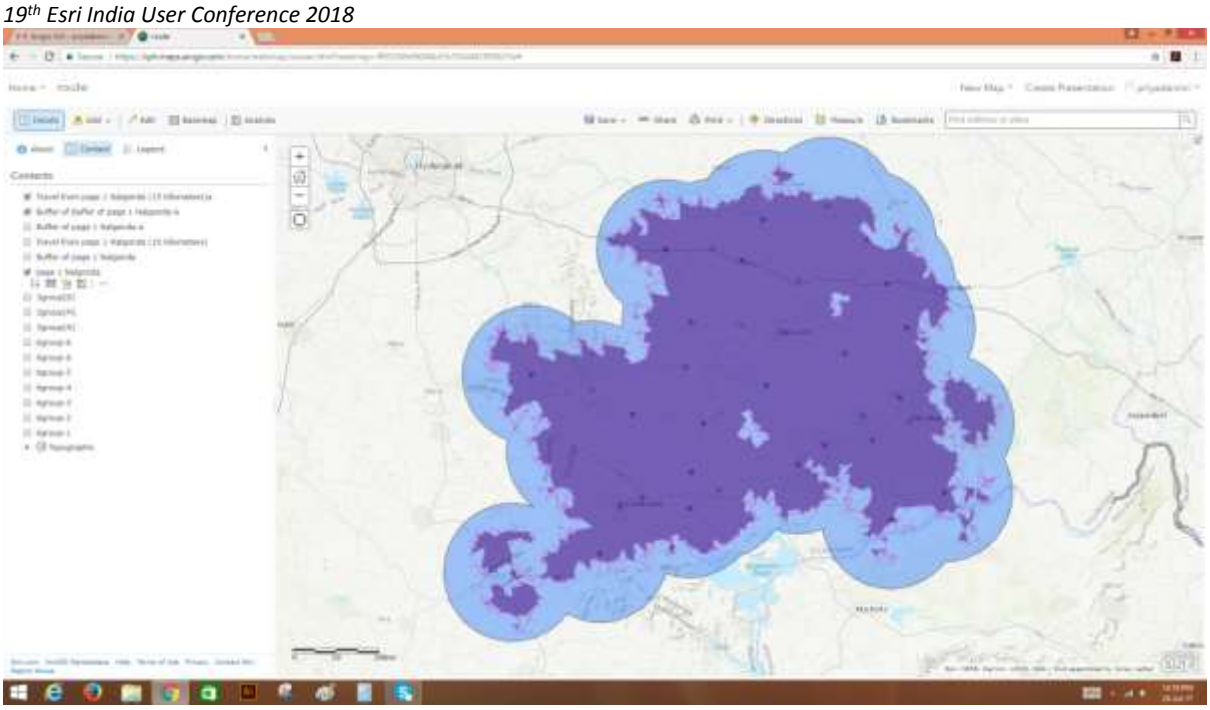

Fig: 2 – Spatial Distribution of Primary Health Centers in Nalgonda District with a 20 Km buffer zone– Euclidean model versus actual driving distance model

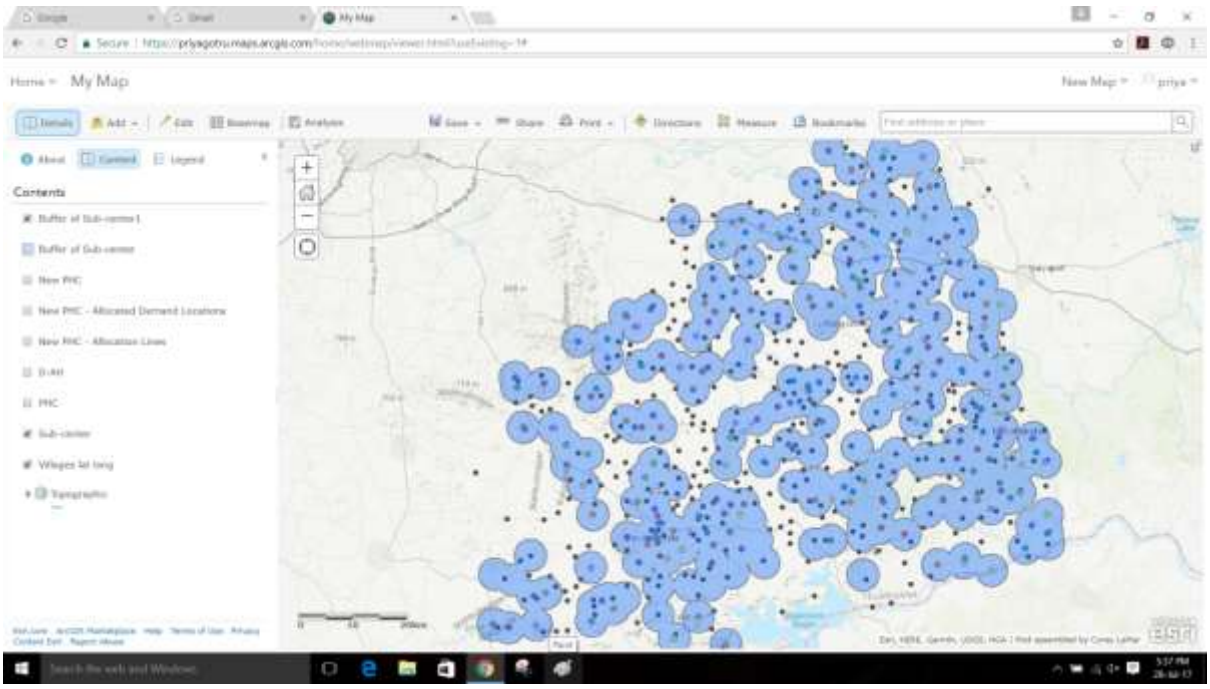

Fig: 3 – Spatial Distribution of all villages in Nalgonda District and Sub Center's with a 3 Km buffer zone– Euclidean model

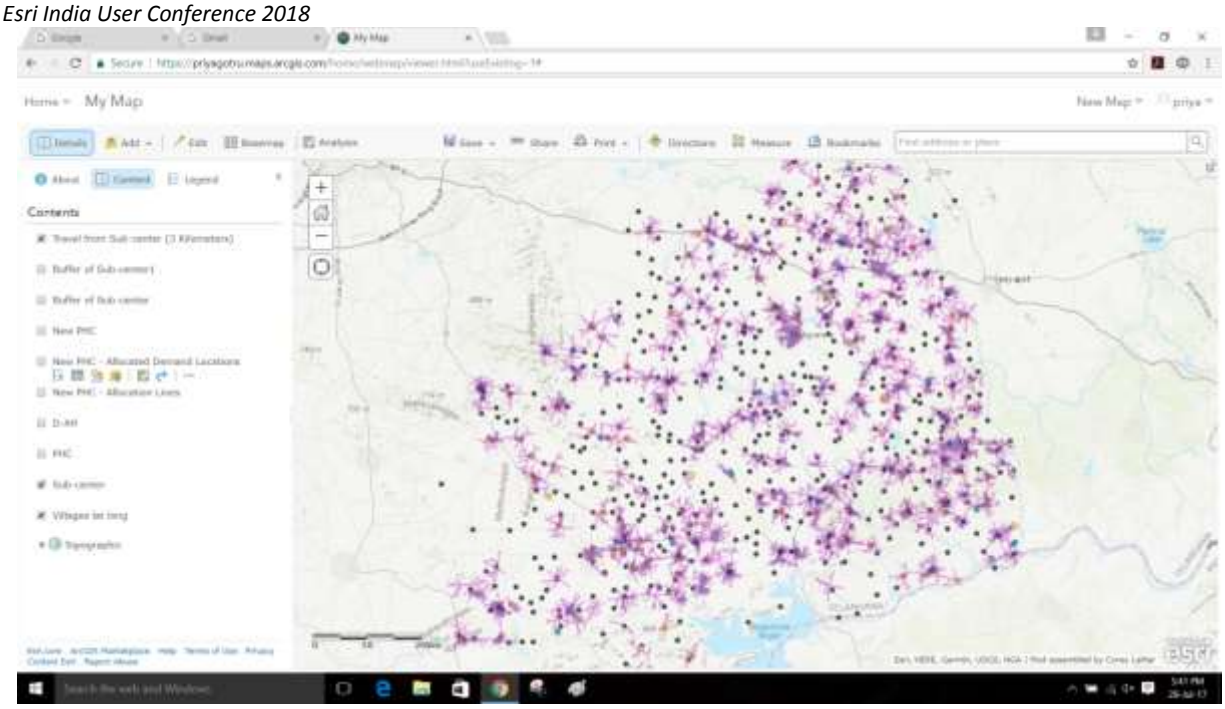

Fig: 4 – Spatial Distribution of all villages in Nalgonda District and Sub Center's with a 3 Km buffer zone– Euclidean model versus actual driving distance model.

Discussion and Conclusion

This study shows that spatial visualization and optimization methods can help in designing universal health care coverage and go beyond anecdotal thoughts. Clusters or Gaps in the healthcare delivery system can be precisely identified and addressed using maps. Relocating existing centers or setting up of new centers can be done for the better utilization of healthcare services. To our knowledge this paper provides the first evidence of the effect of applying catchment area analysis to highlight spatial accessibility or inaccessibility of public primary health care precisely in India and most certainly for Nalgonda, Telangana. Also this paper is the first to comprehensively study an entire district with no sampling and data on all PHC's, SC's and all villages. The key limitation to this study is the lack of available empirical data on 'real' health service, meaning the quality of service delivered, access behavior and its relationship to geography. One of the difficulties of calculating spatial accessibility is modelling across vastly different population densities and dispersions. Even in this paper population density has not been considered. Given the current health reform debate on the provision of Universal Health Care in India[9-11], there is a pressing need to have accurate empirical data on how and where patients access the services of health facilities with particular focus on spatial accessibility. There is also a need to reconceptualise the concept of Universal Health Care place and explore the role of time and distance geography.

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