

Are the subcenters adequately equipped to deliver primary healthcare? A study of public health manpower and infrastructure in the health district in Andhra Pradesh, India

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ABSTRACT

Background: India has a vast public health infrastructure, with 23,391 primary health centers (PHCs) and 145,894 subcenters (SCs) providing health services to 72.2% of the country's population living in rural areas. Although the numbers look impressive, their functional status needs to be studied in terms of physical infrastructure, manpower, equipment, drugs, and other logistical supplies that are greatly needed for ensuring quality services. This work aims to study the infrastructure facilities and manpower in a sample of SCs in the district of Nellore in the state of Andhra Pradesh in India. **Methods:** Thirty SCs selected by multistage sampling have been studied using a structured and pretested performance standard questionnaire. Data have been analyzed with reference to the Indian Public Health Standards (IPHS) for SCs. **Results:** Many deficiencies were identified in the infrastructure and manpower in the SCs studied. Some of the important findings were that the deficiency of health workers (HWs) (male) was 76.7%. Only 6.7% of the SCs operate in a designated government building. Communication facilities, such as telephones, are present in only 3.3% of the SCs. About 73% of the SCs were located more than 5 km from the remotest village in the coverage area. Residential accommodations for HWs (female) were available in only 3.3% of the SCs. There is also a severe deficiency of drugs and equipment in the SCs as per the IPHS. **Conclusion:** SCs lack the manpower and vital infrastructure necessary to function and deliver services effectively to the rural population.

Keywords: Indian Public Health Standards, National Rural Health Mission, subcenters

Introduction

The subcenters (SCs) are the peripheral institutions that provide primary healthcare to the people at grassroots level, and they are vital for implementation of the Government of India's public health programs.^[1] SCs are the first point of contact with a qualified health worker (health worker) within the primary healthcare system for the people in rural India.^[1] Each SC serves a population of 5,000 in plain areas and a population of

3,000 in hilly, tribal, and underdeveloped areas.^[2] SCs constitute an important part of the three-tier healthcare system in India, which comprises primary health centers (PHCs) including SCs, secondary district hospitals, and tertiary hospitals.^[2] An SC provides interface with the community at grassroots level, delivering all primary healthcare services from maternal and child healthcare to the treatment of minor ailments.^[2]

Rural healthcare in India faces a crisis unmatched by any other sector. Only 20% of the population seeking outpatient services and 45% of those seeking inpatient treatments make use of public services due to their run-down infrastructure and poor

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supply of drugs and equipment.^[3] In Andhra Pradesh (AP), India, there are significant deficiencies in access to outpatient services in the private sector due to the lack of coverage by the state health insurance program; consequently, the public primary health infrastructure, which is free to the public, handles the majority of the outpatient care needs.^[4] The primary health infrastructure needs to be adequately equipped with the manpower and infrastructure necessary for effective service delivery.

The National Rural Health Mission (NRHM) was launched by the Government of India in 2005. NRHM aims to improve the rural health infrastructure, and thereby improve the health of the rural population in India. Indian Public Health Standards (IPHS) were established under the NRHM as a set of quality metrics that all the SCs in India should satisfy.^[1] The NRHM seeks to strengthen the SCs so that they meet the IPHS. IPHS help assess and monitor the SCs, as well as help improve their functionality.^[2] One of the important goals of the NRHM is to develop effective human resource management that can generate more manpower and equip health personnel with multiple adequate skills.^[5]

Standards compel continuous improvements in quality. The performance of SCs can be assessed against the set standards to provide the optimal level of quality healthcare.^[1] Keeping in view the resources available in India, with respect to the functional requirements of certain minimum standards such as buildings, manpower, instruments, equipment, drugs, and other facilities, these standards can help monitor and improve the functioning of the SCs. The overall objective of the IPHS for SCs is to provide healthcare that is quality-oriented and sensitive to the needs of the community. Structural problems, such as lack of infrastructure and manpower, may affect service delivery to rural people. The available literature across different parts of the country paints a dismal picture of SCs. At many locations, SCs do not have their own buildings for providing services to the beneficiaries.^[6,7] Even when a rented building is available, having a separate clinic or labor room is not always possible.^[8] The lack of infrastructure and manpower has a significant effect on the quality and performance of the SCs.^[2] Hence, this study aims to assess the infrastructure and manpower of the SCs using the IPHS as a reference. The objectives of the study are to examine the availability of infrastructure facilities at SCs, investigate the availability of adequate manpower in SCs, and assess the findings by comparing them to the IPHS.

Methods

A cross-sectional study was conducted in Nellore district in AP, India. The duration of the study was 2 years, between August 2010 and July 2012. Nellore district has a total of 60 PHCs distributed in three divisions, namely, Nellore, Gudur, and Kavali. Multistage random sampling was used to select the SCs. About 25% of the PHCs in Nellore district (a total of 15 PHCs) were selected by choosing five PHCs from each division randomly. Thirty SCs were selected for the study by choosing two SCs from each of the PHCs that had been selected in the previous stage

[Table 1]. Permission was obtained from the District Medical and Health Officer (DMHO) for studying the infrastructure and manpower of the SCs. A list of HWs and their phone numbers were obtained from the DMHO office. The HWs were informed the previous day about the visit. After confirming their availability and setting a convenient time for the visit, the SCs were visited and studied with the help of the study instruments, and data were collected using the questionnaires that were developed using the IPHS for SCs. Data were analyzed using SPSS software.

Results

The availability of manpower in the SCs is shown in Table 2. The study of the manpower showed that all the SCs had a HW (female), and around 24% had a HW (Male), per IPHS. None of the SCs had a voluntary worker to keep the facility clean and to assist the HW.

IPHS for SCs mandate the presence of important drugs. The study of SCs in Nellore district revealed that 100% of the SCs had more than 75% of the drugs in Drug Kit A available. Around 37% of the SCs had between 50% and 75% availability of the drugs in Drug Kit B, and around 63% of the SCs had more than 75% availability of the drugs in Drug Kit B. Vaccines and other drugs were more than 50% and less than 75% available in 60%

Table 1: List of subcenters selected for the study

PHC	SC
A.S. Peta	Hasanapuram Ponugolu
Mohammadapuram	Ammavaripalem Mohammadapuram
Varigonda	South Amuluru Varakavipudi
Podalakur	Mogallur Degapudirajupalem
Mahimalur	Atmakur Bit-1 Karatmapadu
Ozili	Ozili Kurugunda
Ramapuram	Ramapuram Venadu
Kota	Chittedu Unuguntapalem
Griddalur	Griddalur Kalichedu
Pernadu	Illupuru Mannarpoluru
Ramatheerdham	Kancherlapalem Vavilla
Marripadu	Kampasamudram Budavada
Yellayapalem	Kothavangallu Pemmaredypalem
Jaladanki	Jammalapalem Brahmanapraka
S.R.Puram	Ayyavaripalem Basinenipalli

Table 2: Availability of manpower in subcenters

Personnel	Recommended	Present, frequency (%)
Health worker (female)	1 or 2	30 (100)
Health worker (male)	1 or 0 (optional - may be replaced by female health worker)	7 (23.3)
Voluntary worker to keep the SC clean and assist the health worker	1 (optional)	0

SC: Subcenter

of the SCs, and more than 75% available in 40% of the SCs. Contraceptives had an availability of less than 50% in around 7% of the SCs, and around 93% of the SCs had between 50% and 75% availability. None of the SCs had more than 75% availability of contraceptives [Table 3].

Table 4 shows the general information of the SCs. All the SCs were located within the local village. Around 97% of the SCs were located in an easily accessible area. Only 10% of the SCs had a designated government building. All the SCs had electricity, and around 57% of the SCs had HWs staying in the headquarters village. The distance to the SCs from the remotest village in the area and the distance to the SCs from the PHC are shown in Table 5. Around 27% of the SCs were located less than 5 km from the remotest village in the coverage area, while around 73% of the SCs were located more than 5 km from the remotest village in the coverage area. Around 23% of the SCs were located less than 5 km from the PHC, while around 77% of the SCs were located more than 5 km from the PHC.

Table 6 shows the general infrastructure of the SCs. Only 6.7% of the SCs were in good condition, with a display board written in the local language and a floor in good condition. In addition, only 3.3% of the SCs had a boundary wall with a gate, separate toilets for men and women, and an overhead tank and pump. None of the SCs had a labor room, clinic room, and examination room.

Communication and residential and transportation facilities are shown in Table 7. Around 97% of the SCs did not have telephones; all the HWs used personal mobile phones. None of the SCs had specific transportation services from the PHCs such as vehicles owned by the PHCs or SCs, yet all of them had public transportation. Based on the requirements mandated by the IPHS, the SCs showed a dire lack of residential facilities for HWs. None of the SCs had a residential facility for HW (male), and only 3.3% of the SCs had a residential facility for HW (female).

The availability of equipment in the SCs is shown in Table 8. Around 87% of the SCs had a stethoscope. However, the SCs in Nellore district lacked some of the other important pieces of equipment. None of the SCs had a delivery table or sufficient delivery equipment. Only about 7% of the SCs had a hemoglobinometer, and around 47% had a blood pressure apparatus.

Discussion

The SCs in Nellore district are assessed for their manpower and infrastructure. The results from Nellore district are compared

Table 3: Availability of drugs in subcenters

Drugs	Frequency (%)		
	<50%	50%-75% availability	>75% availability
Drug Kit A	0	0	30 (100)
Drug Kit B	0	11 (36.6)	19 (63.3)
Vaccines and other drugs	0	18 (60)	12 (40)
Medicines under National Disease Control Programs	0	11 (36.6)	19 (63.3)
Contraceptives	2 (6.6)	28 (93.3)	0

Table 4: General information of subcenters

Parameters	Present, frequency (%)
Location within headquarters village	30 (100)
Location in an easily accessible area in headquarter village	29 (96.7)
Designated government building	2 (6.7)
Health worker staying in headquarters village	17 (56.7)
Electricity	30 (100)

Table 5: Distance to subcenters

Distance	<5 km, frequency (%)	5 or more km, frequency (%)
Distance of SC from remotest village in cover area	8 (26.6)	22 (73.3)
Distance of SC from the PHC	7 (23.3)	23 (76.6)

PHC: Primary health center; SC: Subcenter

Table 6: General infrastructure of subcenters

Parameters	Present, frequency (%)
Good condition of the building	2 (6.6)
Boundary wall with gate	1 (3.3)
Board in local language	2 (6.6)
Separate toilets for men and women	1 (3.3)
Labor room	0
Power supply in labor room	0
Clinic room	0
Examination room	0
Overhead tank and pump	1 (3.3)
Floor in good condition	2 (6.6)

with the results from studies assessing the infrastructure and manpower in different parts of India. The IPHS mandate that all SCs should have their own designated government building. In Nellore district, the percentage of SCs that have their own government building was 6.7%, and the majority of the SCs (i.e., around 93.3%) were operating from rented houses and other types of rented buildings. A study assessing public

Table 7: Communication and residential and transport facilities of subcenters

Facility	Present, frequency (%)
Communication facilities	
Telephone	1 (3.3)
Personal mobile phones	30 (100)
Transport facility from PHC	0
Public transport facility	30 (100)
Residential facility for staff	
Health worker (male)	0
Health worker (female)	1 (3.3)

PHC: Primary health center

Table 8: Availability of equipment in subcenters

Equipment	Present, frequency (%)
Stethoscope	26 (86.7)
Delivery table	0
Sufficient delivery equipment	0
Hemoglobinometer	2 (6.7)
Blood pressure apparatus	14 (46.7)

health infrastructure for the entire state of AP reported that 18% of the SCs did not function from their own government building.^[9] A study by Sunder Lal reported that nearly 50% of the SCs in India have their own building, while the remaining are located in rented and rent-free buildings.^[10] Another study reported that the percentage of SCs functioning in their own government building were 61.7%, 53.4%, 91.7%, 75%, 8.3%, 91.7%, and 100% in Uttar Pradesh (UP), Madhya Pradesh (MP), Assam, Jammu and Kashmir (J and K), Chhattisgarh, Himachal Pradesh (HP), and Rajasthan respectively.^[11] The findings of our study were much lower than the findings for the states of UP, MP, Assam, J and K and HP. Even one of the newly formed states in India, Chhattisgarh (which is facing a number of developmental issues), had a slightly higher percentage of SCs in government buildings compared with Nellore district. The percentage of SCs in Karnataka and Tamil Nadu with their own building was 92% and 100% respectively.^[12] A study in Mandla district of MP showed that 27.5% of the SCs had government buildings.^[13] In Chittoor district, 50% of the SCs were housed in government buildings and the rest operated in rented buildings.^[14] The findings in Nellore district regarding the ownership of government buildings for SCs were quite low, even compared with many of the poorer states; however, the government was paying the rent for the rented buildings in which the SCs were operating.

IPHS mandate that the building and floors in the SCs must be in good condition. In Nellore district, the percentage of SCs whose building and floors were in good condition was 6.7%. In AP, 73% of the SCs had floors in good condition.^[9] In Punjab, the condition of the building was good in 96.2% of the SCs.^[15] In Chittoor district, 26.4% of the SCs were in good condition.^[14] The condition of the buildings in Nellore district was much poorer than the northern state of Punjab, AP state average, and

the neighboring Chittoor district. The presence of a separate compound wall or fencing in the SCs is mandated in the IPHS. In Nellore district, the percentage of SCs that had a compound wall was only 3.3%. This is much lower when compared with the state average for all of AP, which is 24%.^[9] The presence of a display board containing the name of the health center expressed in the local language of the state is also mandated under IPHS. Display boards were present in only 6.7% of the SCs in Nellore district. However, 78.5% of the SCs in AP have prominent display boards written in the local language.^[9] Even in the neighboring Chittoor district, 70.6% of the SCs had prominent display boards in the local language.^[14] The presence of a suggestion/complaint box is an important tool for the beneficiaries to voice their opinions and feedback about the services provided by the SCs, yet none of the SCs in Nellore district had a complaint/suggestion box. In AP, 16% of the SCs have a complaint box.^[9] This shows that the SCs in Nellore district were not responsive to the needs of the people.

IPHS require the presence of a functional labor room in the SCs. However, none of the SCs in Nellore district had a labor room. In all of AP, labor rooms were only available in 8.6% of the SCs, on average.^[9] The availability of labor rooms in SCs was 36.7%, 22.4%, 16.7%, 4.2%, 8.3%, 0%, and 37.5% in UP, MP, Assam, J and K, Chhattisgarh, HP, and Rajasthan respectively.^[11] In Punjab, the availability of a labor room was 1.96%.^[15] In the southern states of Karnataka and Tamil Nadu, labor rooms were available in 0% and 87% of the SCs respectively.^[12] The availability of labor rooms in Nellore district is very low, and only HP and Karnataka are at the same level as Nellore. All other states in India had a higher level of labor room availability. The availability of toilets in the SCs is vital, both for the HWs working there as well as for the patients. In Nellore district, the availability of toilets in the SCs was only around 6.7%. In Punjab, the reported availability of toilets was 21.6%.^[15] In addition, 45% of the SCs had a toilet facility in Mandla district of MP.^[12] Our findings indicate that the availability of toilets in Nellore is very low compared with other districts.

Communication and transportation facilities are vital for grassroots public health facilities such as SCs. It is mandated that SCs should have telephone landlines. In Nellore district, a telephone was present in only 3.3% of the SCs, but 100% of the HWs used personal mobile phones. This is better than Chittoor district, where a landline was available in 2.9% of the SCs; however, like in Nellore district, 100% of HWs used personal mobile phones.^[14] The SCs should be accessible from all the PHCs, and from the entire village in the coverage area, by public transportation. In Nellore district, the availability of public transportation to reach the SCs from both the PHCs and the villages covered was 100%. In Chittoor district, private transportation from the SC to the village was available in only 76.4% of the SCs.^[14] The findings of our study showed that the SCs in Nellore district were accessible by public transportation, while the majority of the SCs in Chittoor district were accessible only through forms of private transportation.

In Nellore district, 3.3% of the SCs have residential accommodations for HW (female), while none of the SCs have residential accommodations for HW (Male). Sunder Lal (2001) reported that although residential facilities for the SCs were available in many states, they have been rarely used as most of the female HWs do not reside there for reasons of safety.^[10] The percentage of SCs with ANM quarters was 41.7%, 37.5%, 41.7%, 4.2%, 16.7%, 83.3%, and 58.3% in UP, MP, Assam, Jammu and Kashmir, Chhattisgarh, Himachal Pradesh, and Rajasthan, respectively.^[11] In Punjab, the availability of staff quarters was 21%.^[15] In Chittoor district, residential facilities for HWs were available in only 26.4% of the SCs.^[14] Residential accommodations for HWs were scarce in Nellore district compared with different parts of India. In our study, 3.3% of the SCs had residential accommodations, but the percentage of HWs staying in the same village was 56.7%. This indicates that more than half of the HWs were willing to stay in the same village in which the SCs were located, but they were not staying in the SCs because of the lack of residential accommodations.

The distance from the village to the SC is an important indicator of healthcare access. Increased distance acts as a significant access barrier. In Nellore district, 26.67% of the SCs were less than 5 km from the remotest village in the coverage area, while 73.33% of the SCs were located more than 5 km from the remotest village in the coverage area. At the AP state level, 30% of the SCs were located within a radius of 3 km from the farthest village, and only around 12% of the SCs were positioned 11 km or more from the farthest village in their coverage area.^[9] This shows that the SCs in Nellore district have significant barriers to patient access compared with the state average for AP. In Chittoor district, the average distance of the farthest village from the SC was 5.4 km.^[14] The findings of our study show that the majority (around 75%) of the SCs in Nellore district were more than 5 km from the remotest village in their coverage area, while the average distance from all the villages to the SCs in Chittoor district was around 5 km. People in the remotest villages in the coverage area of the SCs in Nellore district had great difficulty accessing health services.

Access to the PHC from the SCs is also important because it enables patients to benefit from the referral services, drugs, and physician consultations available in the PHCs. In Nellore district, 23.34% of the SCs were less than 5 km from the PHC, and 76.66% were farther than 5 km away from the PHC. At the state level in AP, the average distance of the SCs from a PHC was recorded as 12 km; about 28% of the SCs were located less than 5 km distance from the PHC.^[9] This is less than the state average for AP. In Chittoor district, the average distance between the SCs and the PHC was 6.5 km.^[14] The significant distance between the majority of the SCs and the PHCs may lead to barriers to referrals and physician visits because of the time and cost of travel. Considering the level of poverty in rural areas in India, especially in the remote villages, distance can cause significant access barriers for utilization of health services.

SCs are a sick person's first point of contact with the health system in the rural areas in India. SCs are mandated to have a certain basic set of medications by the IPHS. In Nellore district, Drug Kit A was available in all the SCs, with more than 75% availability of all the drugs in the kit. Drug Kit B was present in 100% of the SCs, with more than 50% availability of all the drugs in the kit. At the AP state level, Drug Kit A was available in 94.6% of the SCs, and Drug Kit B was available in 88.6%.^[9] The findings of our study in Nellore district show a much better result of 100% availability of Drug Kit A and Drug Kit B in the SCs, with a lack in the number of drugs inside the kit. In Mandla district, it was reported that more than 90% of the SCs had a regular and adequate supply of contraceptives like Nirodh, oral pills, and IUDs.^[13] The findings of our study in Nellore district also show that around 94% of the SCs had more than 50% of all the contraceptives recommended by IPHS. In Chittoor district, none of the SCs had a sufficient quantity of essential obstetric drugs such as methylethergometrine maleate, magnesium sulfate, oxytocin injections, and misoprostol.^[14] There was a similar finding in Nellore district, where none of the SCs had any essential obstetric drugs. Given the high rates of maternal mortality in India,^[16] especially in the rural areas, the lack of essential obstetric drugs in the SCs could cause serious problems during the time of delivery. However, most deliveries are referred to the nearest PHC, which has a physician and a trained nurse. This may be the reason why essential obstetric drugs are not available in the SCs. However, the IPHS mandate their presence, since the HWs, who are trained birth attendants, are expected to conduct normal deliveries in the villages when circumstance demands. In addition, none of the SCs in Nellore district had delivery kits.

The availability of certain pieces of medical equipment in the SCs is required under the IPHS. At the AP state level, about 40%–50% of the SCs possessed a stethoscope, clinical thermometer, disposable gloves, and mucus extractor.^[9] In Nellore district, there was a higher presence of a clinical thermometer, stethoscope, and disposable gloves, with 80%–90% availability, but a low presence of a mucus extractor (16.7%), which is essential for treating children. In Chittoor district, only 20.6% of the SCs had a blood pressure apparatus.^[14] The availability of a blood pressure apparatus in our study in Nellore district was 46.7%, which is much better than the findings of the study in Chittoor district. In Nellore district, only 53.3% had fetoscopes, which is less than the state average for AP. At the AP state level, about 28% of the SCs had a hanging scale for weighing babies, while none of the SCs in Nellore district had one. In Chittoor district, Sahli's hemoglobinometer was present in only 8.8% of the SCs.^[14] However, none of the SCs in Nellore district had a Sahli's hemoglobinometer. Considering the high prevalence of anemia among women in India,^[17] the lack of equipment to measure hemoglobin levels could adversely affect the health of the population. This shows that the SCs in Nellore district are significantly lacking in many of the vital equipment mandates issued by the IPHS, especially regarding some of the equipment necessary for maternal and child health.

Conclusion

The manpower and infrastructure in the SCs in Nellore district are severely lacking. The number of HW (males) in the SCs should be increased, along with the number of voluntary workers. Most of the SCs do not have their own government building, and for those that do, the quality of the building is poor. Therefore, designated government buildings of good quality should be provided to the SCs. Proper display boards for the SC buildings should also be provided to improve visibility and increase utilization of health services by the rural people for whom the services of the SCs are intended. A boundary wall should be constructed for all SC buildings to prevent the encroachment of the government land by individuals and private companies, which is very common in India. Communication and transportation facilities are severely lacking and need to be improved to enhance service delivery to the remotest villages. A complaint/suggestion box, which enables people to voice their opinions, needs to be placed in all the SCs to improve the responsiveness of the primary healthcare system at grassroots level to the needs of the local people. Access barriers due to travel distance to reach the SCs need to be addressed. Long travel distances are associated with higher travel costs and longer travel time and may affect worker productivity and cause wage losses, which will reduce utilization of health services. SCs should have facilities to provide treatment for minor ailments of the local people. The availability of drugs and medical equipment in the SCs has been found to be lacking; these insufficiencies need to be addressed to provide effective service delivery. SCs should be well-equipped to conduct deliveries, since they are first point of contact for pregnant women in rural areas. Given the poor transportation and communication facilities in rural India, SCs should be ready to conduct deliveries when needed. Labor rooms should be made functional and deliveries should be conducted in SCs since all the patients cannot be referred to the PHC or higher-tiered centers. Delivery tables and delivery equipment need to be provided in all the SCs. Residential accommodations for HWs should be made available in all the SCs, since having HWs reside in the same remote villages they serve will ensure their availability and thus improve service delivery. The majority of the population of India lives in rural areas, and since the SCs are the first point of contact with the Indian healthcare system for people in rural areas, improving the manpower and infrastructure of the SCs is vital. The primary health infrastructure in each state is operated by the respective state governments, since public health is a state subject under the constitution of India. Thus, the government of AP and the local district authorities should take appropriate steps to fill up the vacant HW posts and to improve the infrastructure of the SCs. The public sector hospitals in Nellore district already have long waiting lines, which affect service delivery.^[18] Thus, it is vital to provide adequate manpower and infrastructure for fast and effective service delivery at grassroots hospitals, because doing so will reduce the waiting lines in the primary, secondary, and tertiary public hospitals.

Limitations

In the absence of readily available official records, the HWs in the SCs furnished some of the information used in this study

from their knowledge and memory. Thus, there is the possibility that some of the information may be inaccurate due to the unreliability of recall. Although an appointment with the HWs was made in advance, some of them were not available at the time of our visit. Physical verification of the SCs was done by the investigator. Because few studies of the SCs have been conducted since the framing of IPHS, it was difficult to compare the results of our study in the discussion section.

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Conflicts of interest

There are no conflicts of interest.

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