



Raj Reddy Center for Technology & Society

Position Paper on

Last mile in healthcare- opportunities, challenges & technologies

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Raj Reddy Center at IIIT Hyderabad organised a brainstorming roundtable meeting on 'Technology to address the last mile in Healthcare'. This meeting was to understand the gaps in the rural healthcare service today and identify prevailing solutions or innovation possibilities that can be deployed in the grassroots to address those gaps. Policy makers in public health, grassroot NGOs, medical practitioners, healthcare corporates, med-tech startups for rural and policy/impact investors were in the panel of the roundtable conference. This position paper summarises the deliberations of the round table.

Grassroot healthcare, especially in rural settings, is a hard problem and very different from those in urban settings. Even as governments continue to invest in PHCs and other structures, actual on-ground availability of care is very minimal. Therefore to understand the prospect the conference was broadly on 3 crucial topics: Challenges/healthcare gaps in rural healthcare services; Ideas on how (models) healthcare can be provided cost-effectively at the doorstep (rural); Solution Needs/Technologies (AI, devices, ++) that can help provide quality healthcare at scale. This roundtable has tabled the prevailing challenges, and explored possibilities to build new models and technology-powered-solutions to address this gap in rural healthcare.

A. Major hurdles/gaps in rural healthcare services

Government schemes like: Anaemia Mukh Bharat very actively carried out in Telangana; free giving of medications; skilling of ANMs; Pradhan Mantri Surakshit Matritva Abhiyan, where 9th of every months all the women from a particular place are picked up in 102 vehicle and brought for health checkup, Janani Suraksha Yojana, etc., are making tremendous impact on ground but lack of mechanism to track or monitor them is making it fail somewhere. This is aggravated by severe resource and capability constraints on all fronts.

Low skills results in inadequate services

Only if the government hospitals are near to the headquarters more monitoring is available but as we move far from the headquarters and go more into the rural and tribal areas, there is no monitoring available for which the total dependency is on the medical/nursing staff. The challenge here is the continuous skilling and upgradation of the staff to be able to provide quality healthcare services even to the last mile. Now, how to ensure that the last mile workers are aware of so many diseases and the right diagnosis for those or even to connect the one to the right channel to direct the patients for the right treatment? Recent news of Vijayawada says PHCs to get equipment through which reports of 14 tests will be possible to generate at a time, but how will this help until the staff on ground are trained to augment



such devices? Can we look at the systematic approaches to introduce the right tech to really capacitate and empower the frontline workers to use that and get to the right decisions?

Localised and specific solutions not possible because of insufficient data

Systems to record/capture every visit and every interaction is required, both health & operational information. A way of decision prompting system also should be enabled which can prompt what should happen next for every individual for follow up care or referral, especially for patients who need long term continuous healthcare treatment. Also this data records should be able to generate evidence of the govt programs and push policy in the right direction. In all the publicly available Genomic datasets, 97% is western data but India being such a populated country its datasets are intangible. There are existing models which preserve security in a viable manner, then can we record data systems without hampering the privacy or identification of individuals?

Missing links in last mile delivery leading to incomplete services

Last mile logistics to ensure availability of medical supplies & continuous services for chronic illness is another area of concern. Sometimes even if the detection or diagnostics happens the medication is not available, the prescription is not available, the referral facilities are not there, and the follow-up does not happen. As there are a lot of missing links, the whole process/journey of a patient should be treated as a system to be able to deliver the last mile care.

Long-term treatments suffer due to fragmented solution models

Though many sectors are towards making sincere efforts in bridging the gap between the haves and the have nots through their own designed models of interventions, curated solutions is the need of the hour. So, few questions to ponder upon are: how to work in collaboration with the government as it is the center of everything in some or the other way? How to connect patients through a journey through electronic records? How do we communicate to people on a regular basis on the positive and negative behaviours? What is the pathway for referral to something more of a serious health condition? Should we have a connection between primary, secondary and tertiary healthcare? How do we build simple technology to deal with the significant amount of illiteracy? How do we make sure that we have agency and power with the people whom we are trying to support?

No training on critical/emergency care resulting in avoidable disabilities

There are huge problems with the health systems itself from the administrative level. Staff on ground are understaffed, overworked and also undertrained, but the question is are the managers of the asha workers well equipped to train the ashas. For example, India has the highest no. of road deaths and injuries with just 1% of the world's vehicles but 11% of road crashes and deaths. Most accidents result in some permanent disability, much of which is avoidable if timely treatment was possible. The rural roads form a substantial coverage of the country's road network about 3 quarters of the Indian roads pass through the rural areas, where 40-50% of the deaths are due to bleeding. Primary preventive healthcare can help in avoiding these longterm disabilities. Much of the prevention is possible only through good training of the on ground health workers like Asha and ANM.



Ignorance of Mental Health conditions aggravated in rural settings

In case of mental healthcare, detecting or even screening becomes extremely complex as it is one of the most ignored and avoided areas in healthcare. In public hospitals many times the patients are treated in a manner which distresses them, for e.g. mothers are left with a very negative psychic impact after having a traumatic birth experience. This adds to the unwillingness of coming back to the hospitals for any other health treatments.

Tracking is hard due to absence of monitoring systems

Due to no tracking or impact report the practitioners are not aware whether the composition of the medications need to be changed/replaced or whether the equipment are working properly or whether a patient is required to be referred to a hospital, which pediatrician for an underweight child/pregnant lady, and many more. For example: given that the government has made it mandatory for women to give birth in hospitals, the volume has increased by almost 40% causing a lot of complications but very low visibility.

B. Suggested solutions that could accelerate the impact if scaled

While there are a lot of explorations done by different entities to make sustainable solutions and scalable models, there are few existing already which are able to bring impact on ground.

Need to move from Sick-care to Health-care

There is a need to focus on primary prevention which can solve a majority of the problem. Primary prevention can help in early detection of diseases. Lot of ground work needs to be done for creating awareness and lifestyle modifications to propagate the importance of this. For secondary prevention early diagnosis is possible only if there are structured screening programs possible for last mile access. Through the past mobile cancer screening campaigns data has shown that now the first time diabetes detection rate is more than 10%; first time hypertension detection rate is more than 13%; cancer detection rates are as high as 1.6% which is heading towards a very hopeful future for the rural.

Incentivise the frontline workers to sustain the solution models

Incentivising the system, starting from all the frontline workers to the managers only can lead to a self-sustaining ecosystem. This can generate continuous longitudinal data which can become a wellness space. We need a demarcated intervention/solution with two aspects, a) No routine checkup required, where there are no followup visits either to the patient or to the referred hospital. b) For prevention of noncommunicable diseases like hypertension, diabetes, cancer, these are the aspects where the rural people don't have awareness of the procedural visits or checkups they need to make for the long term treatment. Due to the nature of monotonous workload many frontline individuals are demotivated to provide the long term care required, here incentivisation will motivate them for the needed supervision.

Well integrated solutions needed to fill the missing links

Not understanding the business model of players on the ground is a barrier in the healthcare systems themselves. While private systems are making immense effort to reach to the village levels to provide quality care, there is a kind of trust built between them and rural communities; which is very different from the public health system. While the private sector struggles with the funding support, the government sector struggles with quality training and service delivery. Therefore, a joint effort or partnership is required among both the sectors. For the public healthcare programs or schemes of the government the private models, like, skilling/training models of the ANMs, GNMs, paramedics and other frontline staff can help. Same for door-step delivery of the rural and for funding the solution areas an engaging model from the government may help. An additional level of collaboration is required through hospital networks and professional associations to reduce this friction or fill in gaps and form a solution chain.

Low cost and Local solutions are imperative

Well known fact that equipment donated by the global donors are often idle or lost or out of service. These equipment are often very complex and not designed for the operating conditions of the rural environment- rugged, erratic power, no trained manpower. Technology can help build multiplex diagnostics devices at low cost and minimal expense to detect severe illness at an early stage to measure multiple antigens in one shot. Low cost local solutions, like bringing the cost down to the lowest possible, then developing short quick and easy training modules, utilisation of the resources available in and around us, is needed to reach the last mile. For e.g. like in The Bleeding Control Project kits of rs.1000 were brought down to as low as rs.50 or even less for around 1100 trainees. This can help us evaluate or measure the key indicators we use to decide whether to continue or improvise, develop or drop a designed model.

C. Technology at the grassroots can help

AI & other technologies cannot replace anybody, but they could be effectively and efficiently used to enhance the productivity of the existing resources.

Non-invasive diagnostic devices to equip the frontline workers

While a lot of private sector interventions are able to reach the interior areas with trained personnels, the diagnostic devices they have are only capable of doing a few basic tests. Carrying different devices for conducting different tests to diagnose different diseases is highly burdensome. Therefore, there is a significant need for non-invasive devices to be able to diagnose various critical health problems at one go, for e.g., image recognitions, x-rays, ECG, CT scan, etc. Though a lot of such latest devices are available in the market, bringing it's cost down to the lowest possible is another need. Only till the generation of the report is not going to help unless there is a tracking mechanism integrated. Tracking the health condition at different intervals will ensure the progression from critical to a better level.



Equip & empower workforces like Asha workers

Technology can help build medical devices which will have as few human interventions as possible that can seamlessly transmit the data to an app or a smartphone; thereby eliminating any human error and time taken for cleaning the unclean data. From these longitudinal data points one could look for early disease signals detection in normal individuals, ability to monitor progression disease in individuals from a central location, locate & identify both general and non communicable diseases. Technology has the ability to replace the work of technical workforce for e.g. mammography reading by radiologists does take a lot of effort, here tech can help in giving mammographies, x-ray reports, diagnosis devices, simple image of oral cavity etc. in low cost and within no time.

AI (NLP, ML, ..) based solution models can offset lack of training

Building vernacular language integrated models through NLP can increase the capacity of acceptance and participation of the rural. Getting doctors or even their consultation to the rural area is challenging. While a lot of telemedicine services are available, still due to the hectic hours of doctors this hasn't been much successful for the rural category. Artificial Intelligence can help build a system through ML or so to make this easier; for e.g. when a doctor dictates a prescription from a remote area, there can be voice interface which may be able to auto print it accurately, directly reaches to the nearest physician records and get quick medication delivery at the doorstep.

Mobile Medical Services a new front

Mobile medical services have become the answer for many solutions as a pathway to reach the unreachable today. Both nonprofits and private organisations like Nirmaan, Grace Cancer Foundation, Nano Health, Vaccine on Wheels and Subhaarogya, and many have adopted mobile medical units models to make basic healthcare facilities available not only to the rural but the entire ITDA. Smartphones have the opportunity to become an information gateway to collect all the data at periodic intervals and store them safely.

Electronic health records will facilitate decision making for the ground staff

India needs 86000 midwives as per its population and percentage of pregnant mothers. Through technology the training systems have to be scaled up. There are innumerable apps available, each serving a different purpose and few overlapping. There needs to be a platform to integrate all these and make it a single platform to measure every other intervention's effectiveness and efficiencies. A complete sequence of links from recording individual identities, old health records, tests recommended, diagnostic reports, medication prescribed or further referrals, need for checkup on regular intervals, to every single visit and every interaction should be there. This kind of dataset can give insight from a granular level to a broader population level to facilitate public health policies and clinical to administrative decision making.



Simplified & integrated data collection platform for easy Monitoring

Data across the spectrum will help: 1) Self data collection - e.g. chronic patients provided with devices to test and monitor their own health data on a regular basis. 2) Asha worker based data collection - e.g. here the staff goes door to door by carrying certain medical devices to do some basic tests and record the data. 3) PHC center based data collection - with simpler to operate medical devices for both those who need general checkup for diseases like malaria and typhoid, and also for those who need routine checkup. 4) Mobile medical service based data collection - to provide a range of preventive, promotive and curative services, and enable referrals. Technology can help in pulling all of this longitudinal data in a central place for surveillance of health and monitoring of diseases.

Summary and Next Steps

The Raj Reddy Center will take up the efforts to build emerging research-based solutions that can address some of the gaps and needs discussed in the roundtable. To brainstorm on the needs the center will continue discussions by collaborating with the on-ground working entities like CARE India, Grace Cancer Foundation, Nirmaan, Fernandez Foundation and more. Based on the brainstorming, joint effort will be made to design the requirements and build the solutions that can help with upgrading PHC's, skilling frontline personnels, mobile medical services, non-invasive solutions, vision based solutions and last mile logistics. The designed prototype will be implemented on ground to develop it further in a more generalised manner which could be used by any entity having similar problems going ahead. Convergence of medical Sciences, domain project teams, development specialists, product designers and engineering will ensure the right solutions are built to solve relevant problems. Even as every endeavour will be made to create standards, reusable frameworks, and platforms to enable a much wider impact in the years to come.

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About Raj Reddy Center: This center is an initiative of IIIT Hyderabad to enable research and emerging technology led solutions for grassroot education and public health, with specific emphasis on rural. The problem faced by the bottom of the societal pyramid is huge and needs solutions that can be scalable to billions of underprivileged. Several NGOs have been doing a phenomenal job on ground but NGOs don't have access to research technology. This limits the scale amplification due to dependency on volunteers alone to scale. With access to the tech research institutions, the center will help leverage the good quality of emerging technologies (like AI and such) to amplify the impact of these organizations' efforts. The



centre will pursue two broad directions for high societal impact: Innovations in rural education, and Innovation in rural Healthcare for the Bottom of the pyramid.