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Harnessing Technology to Improve Continuum of Care for Non-Communicable Diseases in Urban Mysore, Karnataka

Introduction

With around 6 million deaths annually, India shares more than two-third of the mortality due to non-communicable diseases (NCD) in the South-East Asia Region. The future scenario is even grimmer; for instance, in case of diabetes alone, India has close to 82 million cases now (i.e. a staggering one-fifth (~20%) of the disease burden in the entire world) and is expected to surpass 150 million by the year 2045[1]. Undoubtedly there is a greater need than ever for integration of NCD prevention, promotion, treatment and care at the primary health care level. While strengthening primary care is pivotal in achieving optimal outcomes of NCD prevention and control, technology plays an important role in complementing these efforts by ensuring efficiency, reach and effectiveness. The recent Astana declaration in 2018 recognises that at least 80% of the healthcare needs can be addressed through primary care[2]; hence is foundational in achieving universal health coverage and sustainable development goals. Technology can potentially drive equity, quality

and efficiency of primary care. Innovations in technology could improve access to health care, especially for vulnerable and marginalized people. Digital technologies in particular can be harnessed to improve health literacy, enabling people and communities be educated and take control of their own health. Advances in information systems offer new avenues for transparency and accountability.

We are currently implementing a project aimed at developing a comprehensive model to strengthen continuum of care for select NCDs (diabetes and hypertension) in an urban primary health centre (UPHC) in Mysore city. In this project, we are exploring the role of technology with the following objectives:

- To improve efficiency and quality of health services across the NCD care continuum
- To promote equitable health services by facilitating access and coverage of services to all eligible beneficiaries

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[1] IDF India, available at: https://www.idf.org/our-network/regions-members/south-east-asia/members/94-india.html Accessed on 22-03-2019

[2] Astana Declaration on Primary Health Care. Available at: https://www.who.int/primary-health/conference-phc/DRAFT_Declaration_on_Primary_Health_Care_28_June_2018.pdf Accessed on 22-03-2019

Description about technology solutions

As a first step, we reviewed and finalized the continuum of care approach to NCDs through in depth situation assessments, secondary literature review and consultation with key stake holders. We adapted a continuum of care framework, originally used in identifying gaps in NCD services in South Africa, to the local context during this initial assessment.

As the next step, we explored integration of technology in each phase of the care continuum. Evidence, simplicity and feasibility of integration, cost-effectiveness were critical criteria that informed the finalization of the technology solutions. Broadly, all the technology solutions that were integrated fall under the following categories (Fig 1):

Screening

- Point-of-care tests such as the digital glucometer, digital BP apparatus, digital weighing machine to conduct a population based screening of NCDs and its risk factors.

- Computer assisted personal interview (CAPI) platform hosted in mobiles to capture screening data.

Confirmation, treatment and management

- Point-of-care test to measure adherence to treatment among known diabetics through HbA1c levels.

- Point-of care test to detect early risks to heart and kidney through Lipid profile and Albumin Creatinine Ratio tests.

- Advanced retinopathy screening device to detect early eye complications arising due to diabetes.

- ECGs among diabetics and hypertensive patients to evaluate cardiovascular risks at regular frequencies.

- Advanced drug stock management system by the pharmacist.

Health education

- Integrated Voice Response System (IVRS) to provide beneficiaries with educational messages on healthy lifestyle and importance of treatment adherence

Health record, monitoring and follow- up

- Electronic health record is used to capture vital health information of beneficiaries and facilitates efficient follow-up.

- Digital platform to capture data from concurrent monitoring of the intervention progress.
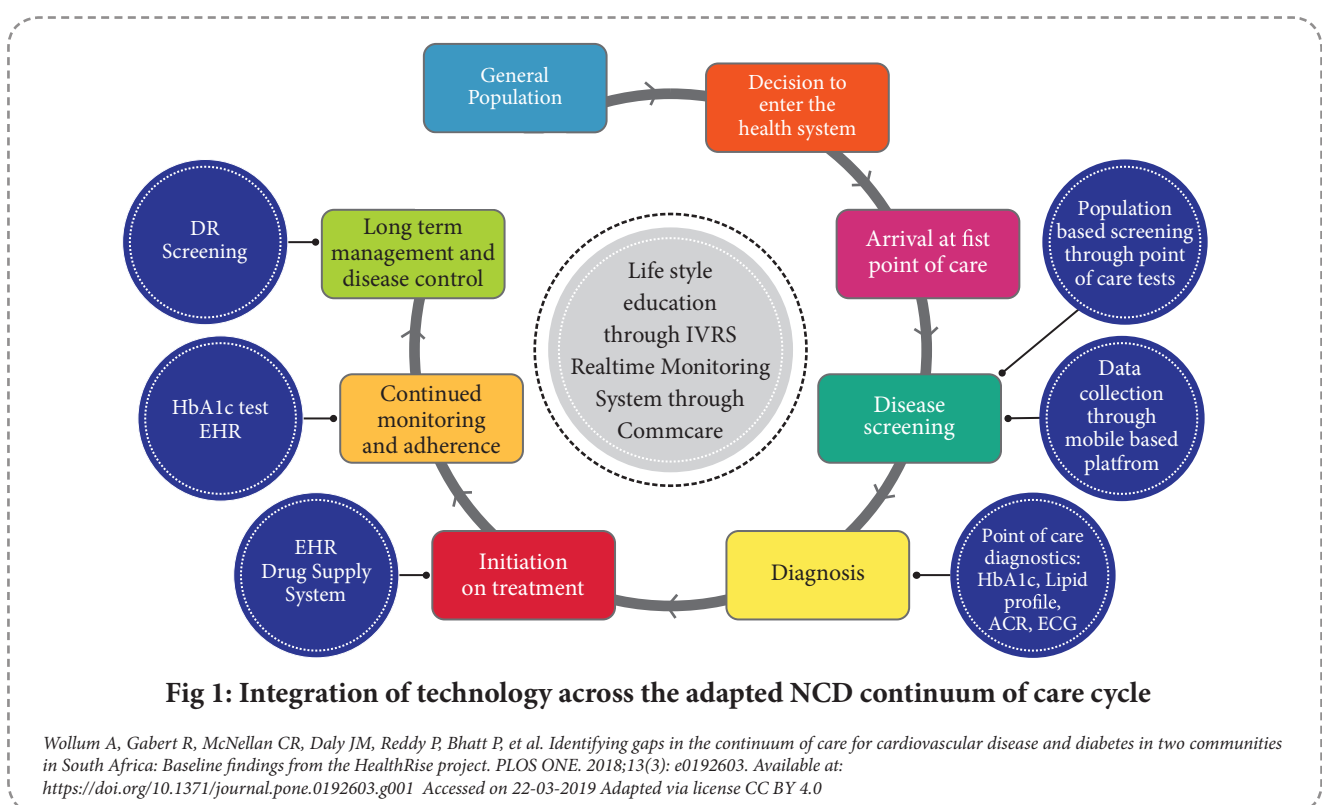

Fig 1: Integration of technology across the adapted NCD continuum of care cycle

Implementation process

Training

Training of community resource persons (CRP) on use of CAPI (Computer Assisted Personal Interviewing) and CommCare application

We had trained a group of CRPs on the use of point of care devices to conduct the door-to-door screening for diabetes and hypertension. We trained them to capture screening data using the CAPI interface installed in mobile phones and use the 'CommCare' application to collect routine monitoring data.

Training of service providers at the facility

The project trained the service providers on advanced diagnostics and use of technology. The laboratory technician is trained on standard diagnostic protocols and steps of tests to be performed at the UPHC. The training is conducted by the project staff and suppliers of diagnostic kits. A combined training manual for both lab technicians and pharmacists has been developed in line with existing training guidelines as per the National NCD programme.

Training of the UPHC pharmacist

The UPHC pharmacist has been trained on advanced drug stock management at the UPHC. The training focused on essentials of drugs procurement, inventory management, prediction of drugs stocks and optimal indenting of drugs. The pharmacist is regularly supported by project staff at the UPHC on drug stock management.

Rolling out of intervention

Procurement of diagnostic devices and consumables

Devices and consumables for point-of-care diagnostics for diabetes and hypertension such as HbA1c, ECG, lipid profile, ACR and DR screening device are procured through a competitive bidding process. The vendor is finalised on the grounds of technical accuracy of the products supplied, sensitivity and specificity of particular tests and cost of the products.

Implementation of advanced diagnostic services at the UPHC

A number of diagnostic services (HbA1c, lipid profile, albumin-creatinine ratio, ECG and diabetic retinopathy) are being offered at the Kumbarakoppalu UPHC from early August 2018. Advanced diagnostic tests are being conducted using point-of-care tests with high levels of precision and validity. The laboratory technician hired from the project, performs all these tests following standard diagnostic protocols and standard operating procedures of performing these tests. This technician works in coordination with the government technician present at the UPHC. While HbA1c are meant for quarterly follow-up among diabetics; lipid tests, kidney tests, ECG and diabetic retinopathy are for annual follow-ups. All these investigations are being offered free of cost to the beneficiaries, from the project. With this project, we have tried to make advanced diagnostic services for diabetes and hypertension available at the PHC level which is otherwise found only at higher facilities. The HbA1c test was not available at any of the government facilities across all levels during the time we introduced the test at the UPHC.

Implementation of IVRS system

We host the IVRS server at the KHPT central office in Bangalore; customised health education messages on healthy lifestyle and treatment adherence are being sent as modules of voice messages to beneficiaries. Beneficiaries are pre-selected for this service based on their consent to receive such calls at a date and time of their choosing.

Supportive supervision

Supportive supervision by Quality Improvement Specialists

Quality Improvement Specialists visit the facility every month to provide supportive supervision to the facility staff and project staff. Supportive supervision focuses on assessment and feedback on regular use of technology and challenges that arise during implementation.

Monitoring of drug stock and logistics

The pharmacist in coordination with the project coordinator monitors drug stock record using advanced Excel functionalities which in turn helps in smooth indenting of drugs from the district warehouse. The project coordinator maintains the stock register of indent and supply of consumables required for these tests.

Monitoring health records through EHR

Complete health information of beneficiaries with diabetes and/or hypertension visiting the UPHC are being monitored through the EHR system; follow-up reminders are being sent directly from the EHR to such beneficiaries to improve regular visits to the UPHC for diagnostics, consultation and timely refill of the medicines.

Experience so far

With more than a year of implementation on the ground, several best practices supported by data are observed.

Advanced care and treatment at primary care level

We found making specialised services available at the level of the PHC has its advantages. The footfalls for NCD services in the UPHC has significantly improved since the project inception.

End- to- end care for beneficiaries

Services provided are not limited to diagnostic and primary care services; quality specialist care is being ensured to beneficiaries to provide them with an end-to-end care (Fig 2), which has been the hallmark of this project. Services that requires specialist care such as retinopathy screening and ECG are good examples. Process flow for diabetic retinopathy screening is presented in Fig 2. Diagnosis of diabetic retinopathy is done by ophthalmologists through a remote operated system. Patients carry the report to nearby KR Hospital which is a tertiary care Government facility. We have established referral linkages between Kumbarakoppalu UPHC and KR Hospital for provision of quality treatment free of cost.
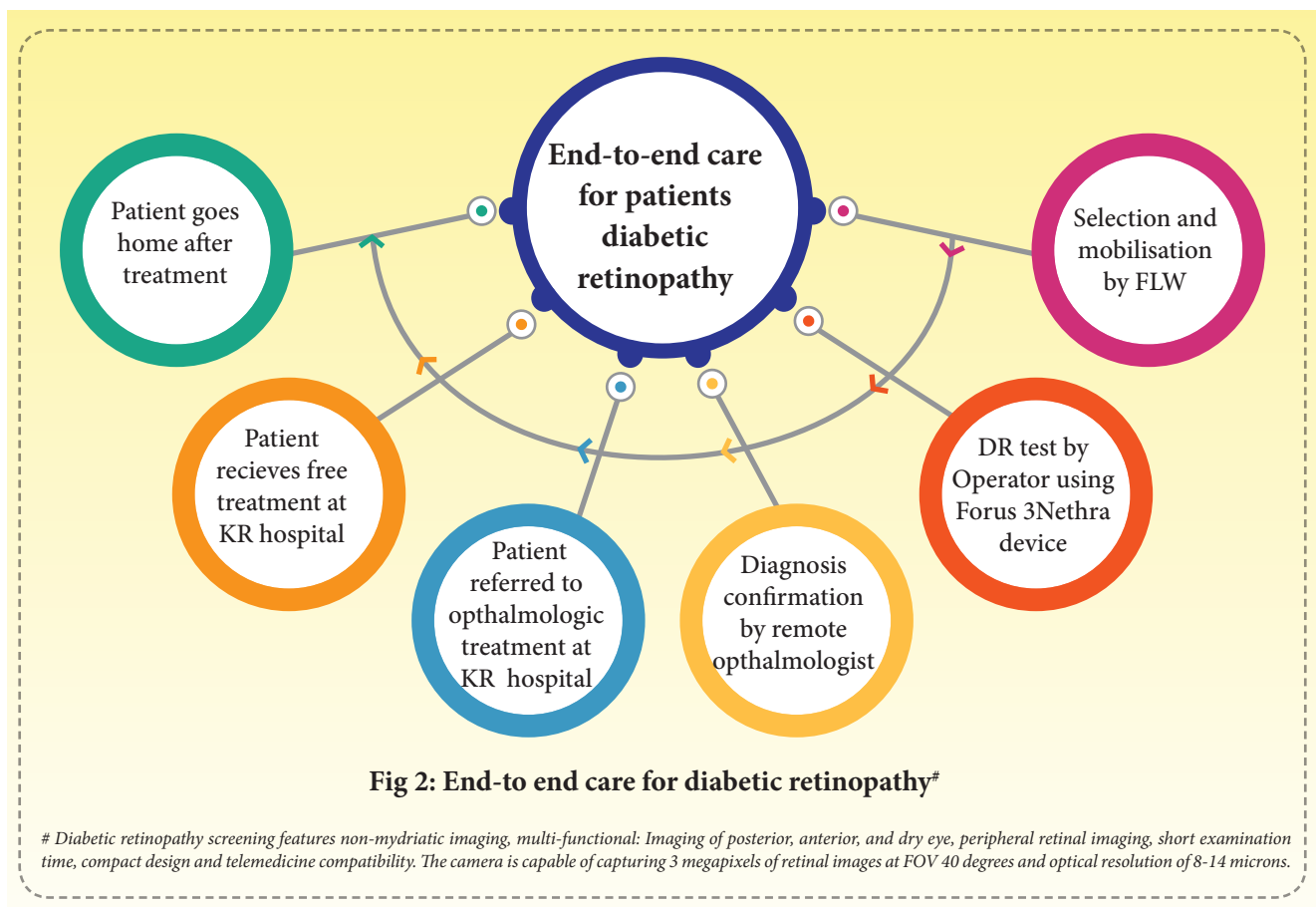

Fig 2: End-to end care for diabetic retinopathy#

Diabetic retinopathy screening features non-mydriatic imaging, multi-functional: Imaging of posterior, anterior, and dry eye, peripheral retinal imaging, short examination time, compact design and telemedicine compatibility. The camera is capable of capturing 3 megapixels of retinal images at FOV 40 degrees and optical resolution of 8-14 microns.

Digitisation of beneficiary health information

Through the EHR service, all beneficiary details are captured electronically and available to programme managers and service providers on a real-time basis to take efficient decisions for programme management and service provision. Beneficiaries also have access to these details readily through text messages in their mobile phones which in turn aims to enhance treatment adherence and health seeking behaviour among them. Beneficiary follow-ups are also being made easy through reminder alerts being sent through text messages

to the beneficiaries. Digitisation of health records also simplifies the process of referrals to higher facilities.

Digitise health education platform for beneficiaries

Through the IVRS service, we are easily reaching beneficiaries with diabetes and hypertension with customised health education messages and recommendations on diet, physical activity, alcohol intake, tobacco consumption, treatment adherence, side effects of NCD medicines etc.

Preliminary results

- The IVRS service has reached around 600 beneficiaries (20% of all eligible beneficiaries with conditions) with messages on healthy lifestyle.

- Similarly, detailed health information of about 610 beneficiaries has been captured through the EHR system and alerts for follow-up visits are planned to be sent through text messages.

- On the advanced diagnostics, for lipid profile, more than half (50%) of beneficiaries were found to be in poor control for LDL and HDL; and for total cholesterol close to 40% were

found to be in poor control or with risk (Fig 3).

- We found that around 45% of beneficiaries (n=610) (among the people who have reached UPHC for accessing services) had poor control of diabetes as evident from their HbA1C levels (Fig 4).

- We were able to assess early stages of damage of the kidney function through the albumin-creatinine ratio (ACR) test. We found that 5% had poor prognosis for the test, and 28% had borderline values suggesting risk involved (Fig 5).
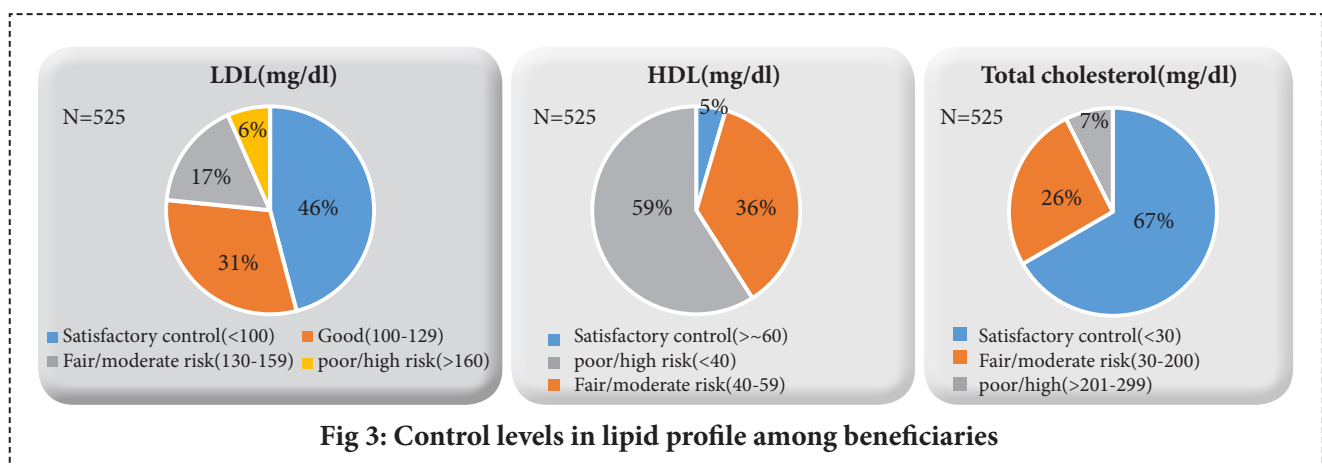

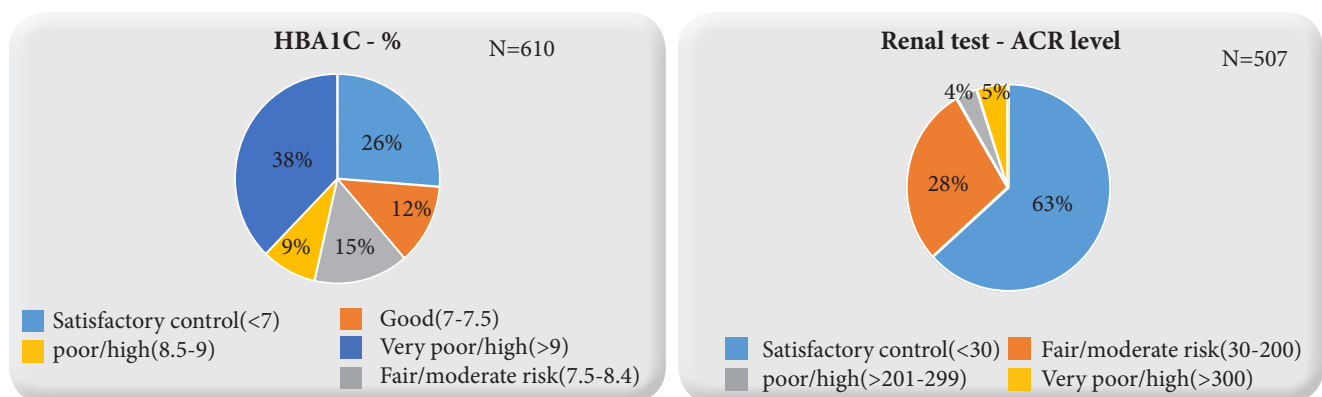**Fig 3: Control levels in lipid profile among beneficiaries**

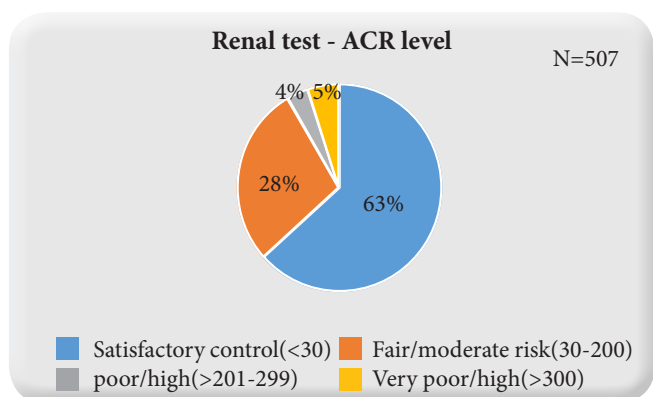**Fig 4: Control levels of blood sugar among confirmed diabetics- HbA1c measurement**

Fig 5: Levels of ACR suggesting control of kidney function

Data from 15th July 2018 to 31st March 2019

Challenges and solutions

- Identifying the best in class diagnostics which were expected to provide best quality results yet being cost effective was a challenge (e.g. HbA1c auto-analyser). We used a competitive bidding process and evaluated products from a number of vendors on the grounds of quality, efficiency and cost of implementation. Quality and efficiency (precision, sensitivity and specificity, validation of quality standards) was prioritised over cost during this identification phase.

- Procurement of technological solutions to in-house design of the system and actual implementation took some time (e.g. IVRS). Programme team and field team initially spent time to understand the structure and operational process of the technology in its' entirety; protocols on hosting data server and rules of data sharing, confidentiality and privacy were ascertained. The technological solutions were customised to address need of the beneficiaries (e.g. IVRS messages were designed as modules to be sent at a preferred time of end beneficiary).

- Delivering health messages through IVRS is still one directional (from project to beneficiary). However, since these technological solutions are iterative and flexible to change, we are working on enabling advanced modules for the IVRS system where a beneficiary response could also be captured and analysed.

- The EHR record was only available to providers and programme managers and not to beneficiaries. With latest initiatives, the EHR software is being customised to send key health information and follow-up reminders to end beneficiaries through text messages.

Key learnings and way forward

The initial experience in Mysore has shown that integrating technology into a primary level NCD care program is feasible and promising. The project team will continue to track the optimal performance and effectiveness of the technological solutions currently used. We will explore newer features to make the available technological solutions more robust. Several learnings and challenges have further informed refinement and simplification of solutions (e.g. EHR system). We are also exploring simpler technologies with improved cost-effectiveness for screening diabetic retinopathy. The stakeholders form the government have reviewed the program during their field visits and expressed appreciation. As a next step, we are going to reach up to more population at a secondary level with similar technological solutions across the continuum of care to provide effective, efficient and quality services.