CDSS (Clinical Decision Support Software)

Digital Solutions for Improving NCD Care

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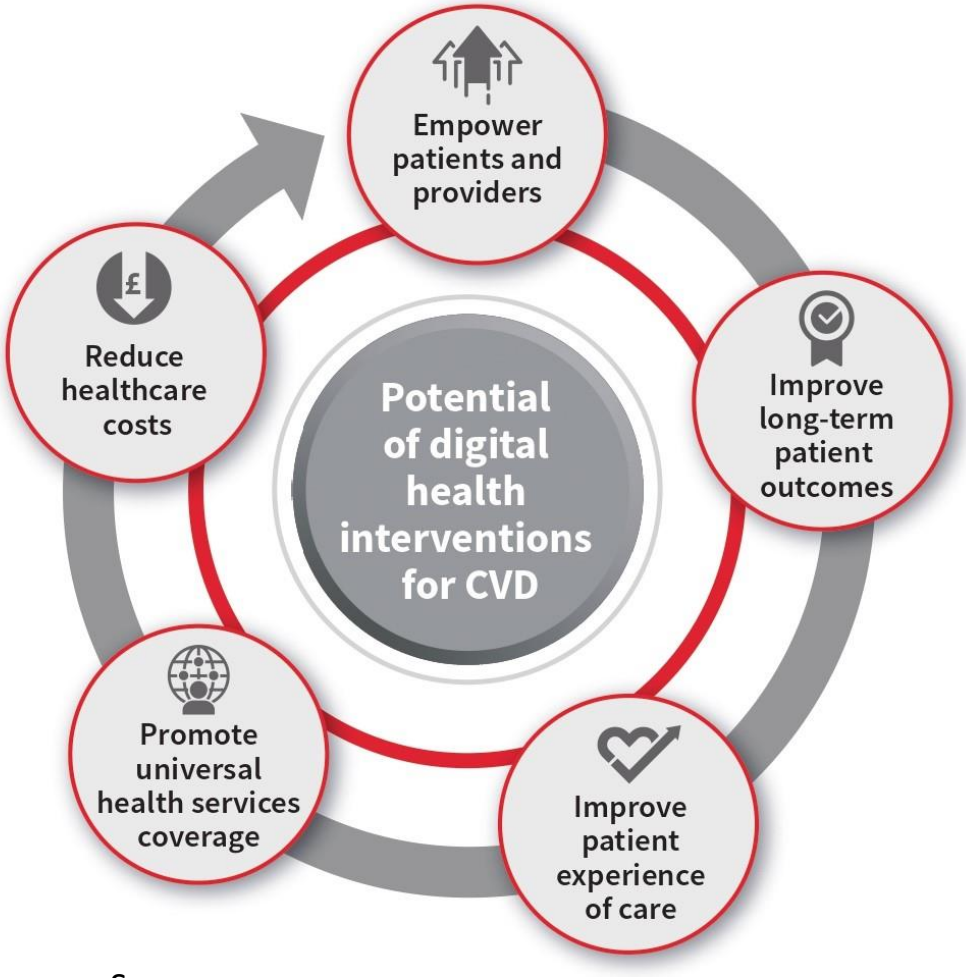
Healthcare Technologies

- Medicines, medical devices, assistive technologies, techniques and procedures developed to solve health problems and improve the quality of life.
- Technology can act as an interface between various stakeholders
- Substantial evidence exists on the diverse role technology can play in several aspects of delivering Healthcare, saving cost and improving quality of care

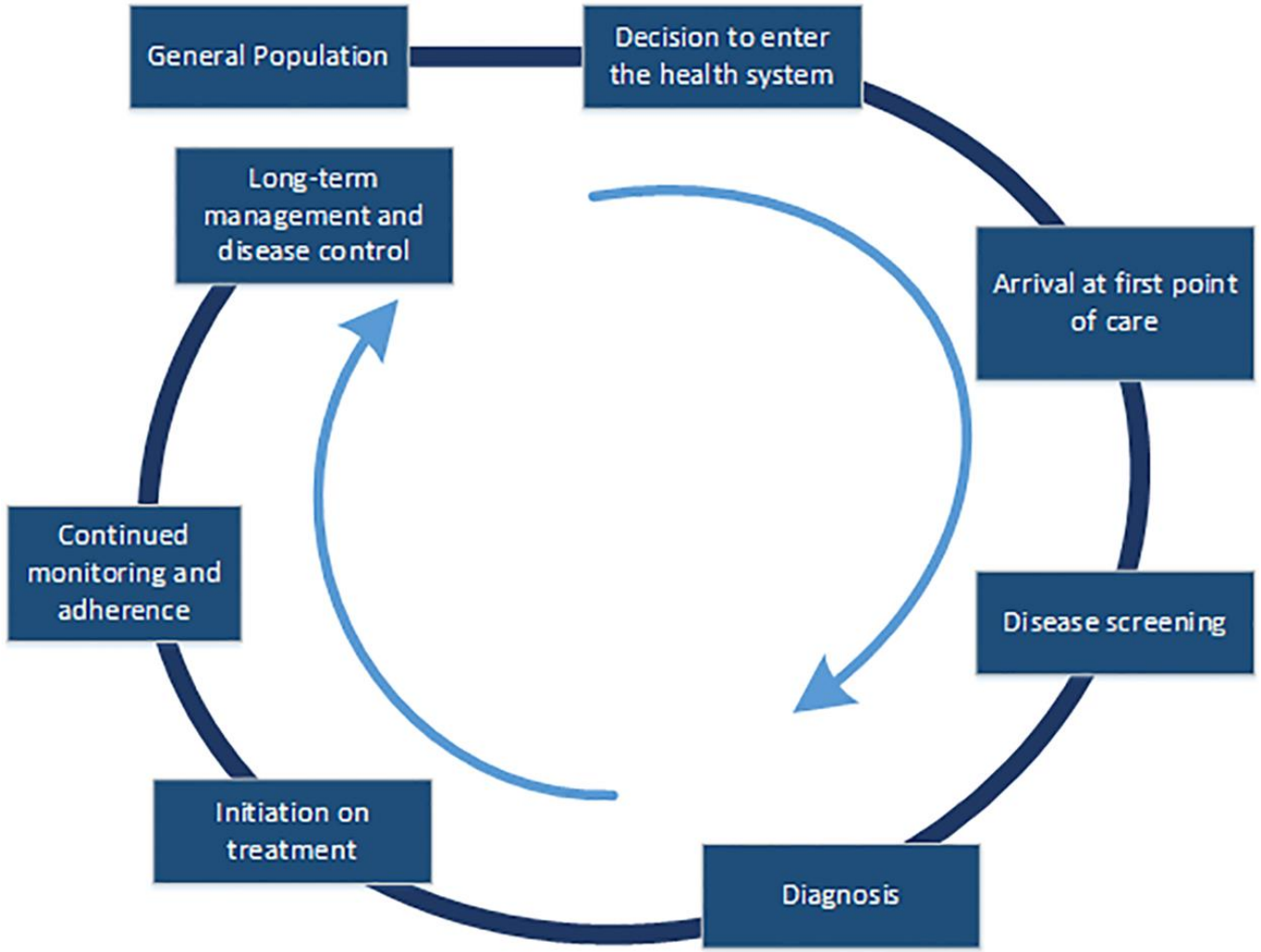
Source:
https://www.who.int/europe/news-room/fact-sheets/item/health-technologies



Source:
https://globalheartjournal.com/articles/10.5334/gh.1141/

NCDs: Continuum of Care

- NCDs (Hypertension & Diabetes) lifelong diseases
- Interventions only at one level will not achieve desired results
- Integration of technology/interventions across levels of the healthcare system to screen, diagnose, track patient outcomes, improve referral linkages, and retain patients in care will ensure continuum of care



doi: https://doi.org/10.1371/journal.pone.0192603.g001

Diabetes

Targets by World Health Organization (WHO):

For the first time ever, WHO Member States have supported the creation of global targets for diabetes

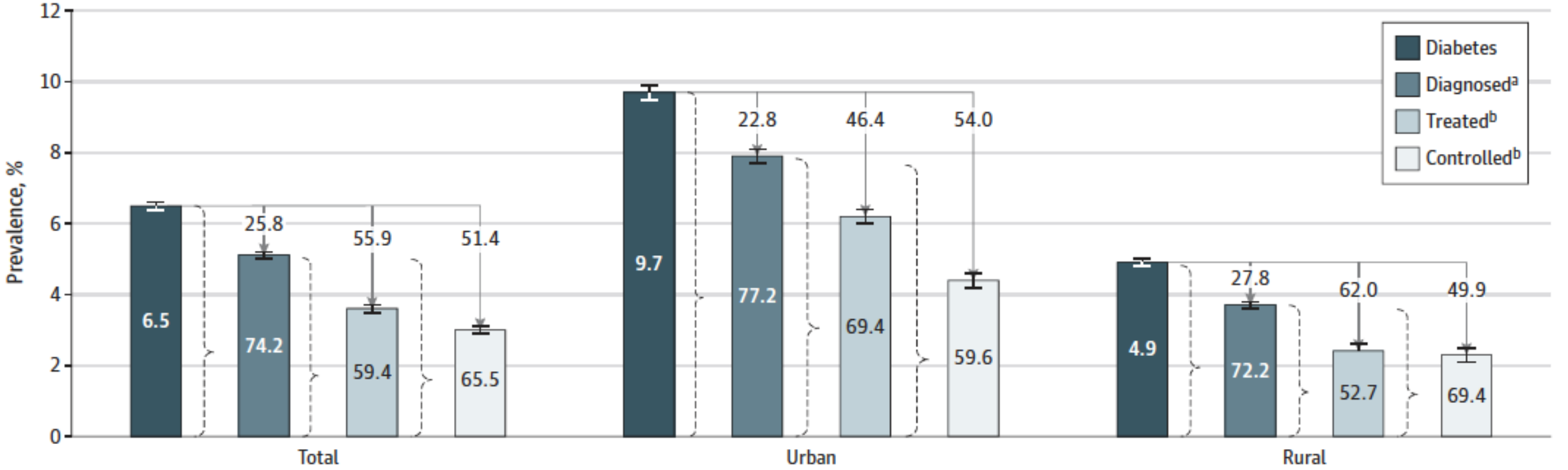
The five new targets (by 2030):

- 80% of people living with diabetes are diagnosed
- 80% have good control of glycaemia
- 80% of people with diagnosed diabetes have good control of blood pressure
- 60% of people with diabetes of 40 years or older receive statins
- 100% of people with type 1 diabetes have access to affordable insulin and blood glucose self-monitoring.

JAMA Internal Medicine | Original Investigation | HEALTH CARE POLICY AND LAW

National Estimates of the Adult Diabetes Care Continuum in India, 2019-2021

Figure 1. National-Level Diabetes Care Cascade in Analytic Sample by Urban and Rural Residence



Varghese et al, 2023

CLINICAL DECISION SUPPORT SYSTEM (CDSS)

- **What is a CDSS?**
  - Computer-based programs that analyze data within EHRs to provide prompts and reminders to assist health care providers in implementing evidence-based clinical guidelines at the point of care.
- **What are key functions of a CDSS in CVD care?**
  - reminding providers to screen for risk factors
  - flagging cases of hypertension or hyperlipidemia
  - providing information on treatment protocols
  - prompting questions on medication adherence
  - providing tailored recommendations for health behavior changes
- **Does a CDSS improve outcomes?**
  - Implementing CDSS is among the Best Practices/Health Care System Interventions
  - Evidence base demonstrating the effectiveness of CDSS is very strong.

Source: https://www.cdc.gov/dhdsp/pubs/guides/best-practices/clinical-decision-support.htm

Creating Algorithms
Glucose Control

Table 1: Decision Support Table for Glycemia Control

	Fasting Blood Glucose (mg/dl)			
Hba1c (%)		<110	110-130	>130
	<7	Good control Continue with existing regimen	Fair control (maybe inconsistent HbA1c and FBG) Reinforce lifestyle counseling	Likely poor control (inconsistent HbA1c and FBG) Check post-prandial blood glucose levels Increase* treatment (Take steps to reduce FBG)
	7-8	Likely poor control -Re-check HbA1c -Check post-prandial blood glucose levels -If high, mealtime interventions[$]	Insufficient control Increase* treatment Check post-prandial glucose levels and control	Poor control Greater** increase in treatment Check post-prandial glucose levels and control
	>8	Likely poor control -Re-check HbA1c -Check post-prandial blood glucose levels -If high, mealtime interventions[$]	Poor control Greater** increase in treatment Check post-prandial glucose levels and control	Very poor control Greater** increase in treatment

***Increase** = 1 of the following possible changes:

- Increase in Metformin dose by 500 mg
- Increase in SU dose by 25% of maximum dose of the sulfonylurea in use[#]
- Increase in pioglitazone by 15 mg *(Rosiglitazone not used widely)*

[$] Consider adding one increment of alpha glucosidase inhibitors: 25 mg of acarbose; 25 mg of miglitol; 0.2 mg of voglibose

[#] 5 mg of glibenclamide; 2 mg of glimepiride; 80 mg of gliclazide; 30 mg of modified release gliclazide

****Greater Increase** = 2 of the following possible changes (2 of the same OR 2 different):

- Increase in Metformin dose by 500 mg
- Increase in SU dose by 25% of maximum dose of the sulfonylurea in use[#]
- 33% increase in maximum pioglitazone

[#] 5 mg of glibenclamide; 2 mg of glimepiride; 80 mg of gliclazide; 30 mg of modified release gliclazide

Creating Algorithms
Blood Pressure Control

Table 2: Decision Support Table for blood pressure control					
	Systolic BP				
Diastolic BP		<130	130-140	140-160	>160
	<80	Good control Continue with existing regimen	Fair control -Re-check BP at next visit -Reinforce lifestyle counseling	Likely poor control -Systolic hypertension -Increase treatment (1-2 increment, Consider CCB)	Urgent -Immediate and greater medication (at least 2 increments, consider CCB)
	80-90	Likely poor control -Re-check BP -Reinforce lifestyle counseling	Insufficient control Increase treatment (1 increment)	Poor control Increase treatment (1-2 increments)	Urgent -Immediate and greater medication (at least 2 increments, consider CCB)
	>90	Likely poor control Increase treatment (1 increment)	Poor control Increase treatment (1 increment)	Very poor control Increase treatment (1-2 increments) -earlier follow-up, in 4 weeks	Very urgent -Immediate and greater medication (at least 2 increments) -earlier follow-up, every 2 weeks

Concept of "unit" increment similar to that for OHA: e.g. 5 mg amlodipine; 50 mg atenolol

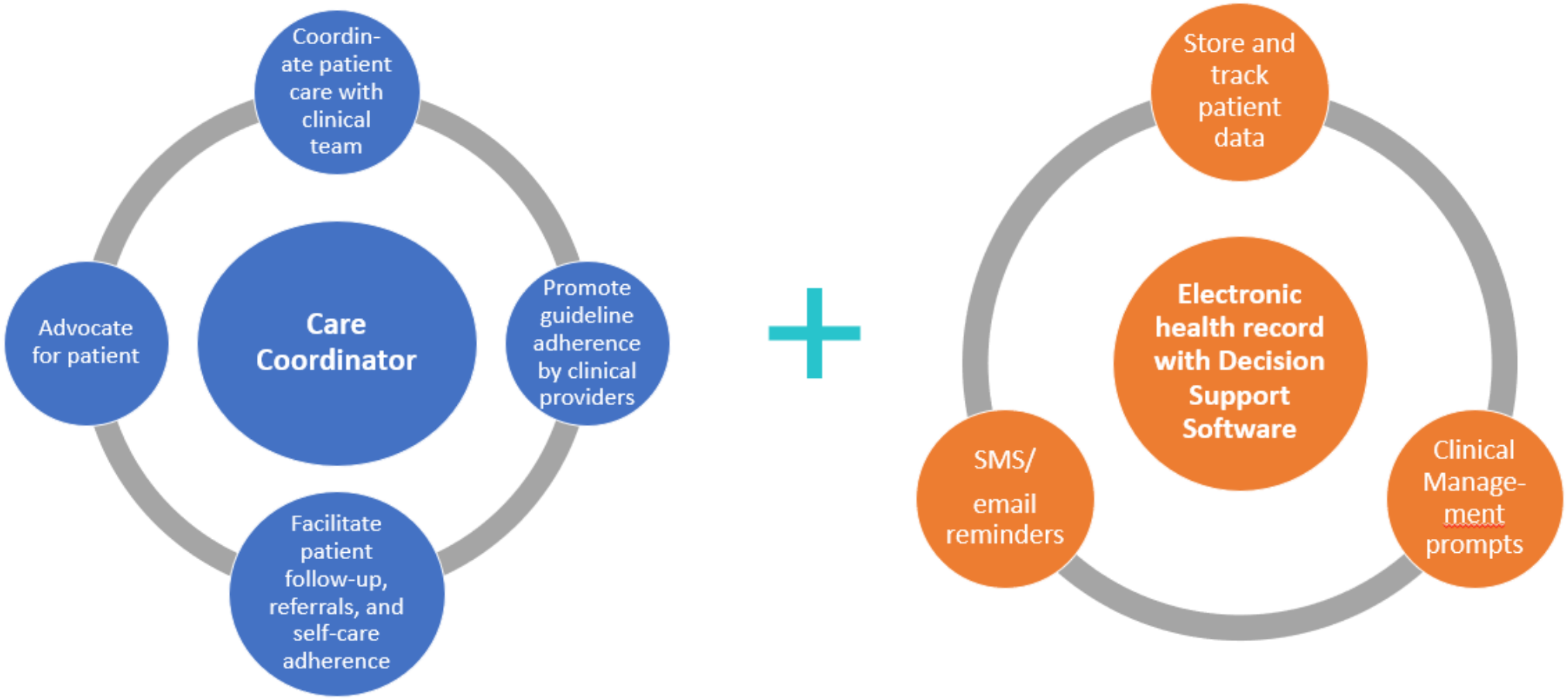
Creating Algorithms
Lipid Management

Table 3: Decision Support Table for lipid control			
	LDL cholesterol level (mg/dL)		
With history of previous CVD event	<70	70-100	>100
Without history of previous CVD event	<100	100-130	>130
	Good control Continue with existing regimen	Poor control Increase treatment (1 increment)	Very poor control Greater increase in treatment (2 increments)

Concept of "unit" increment similar to that for OHA: e.g. 10 mg atorvastatin; 20 mg simvastatin

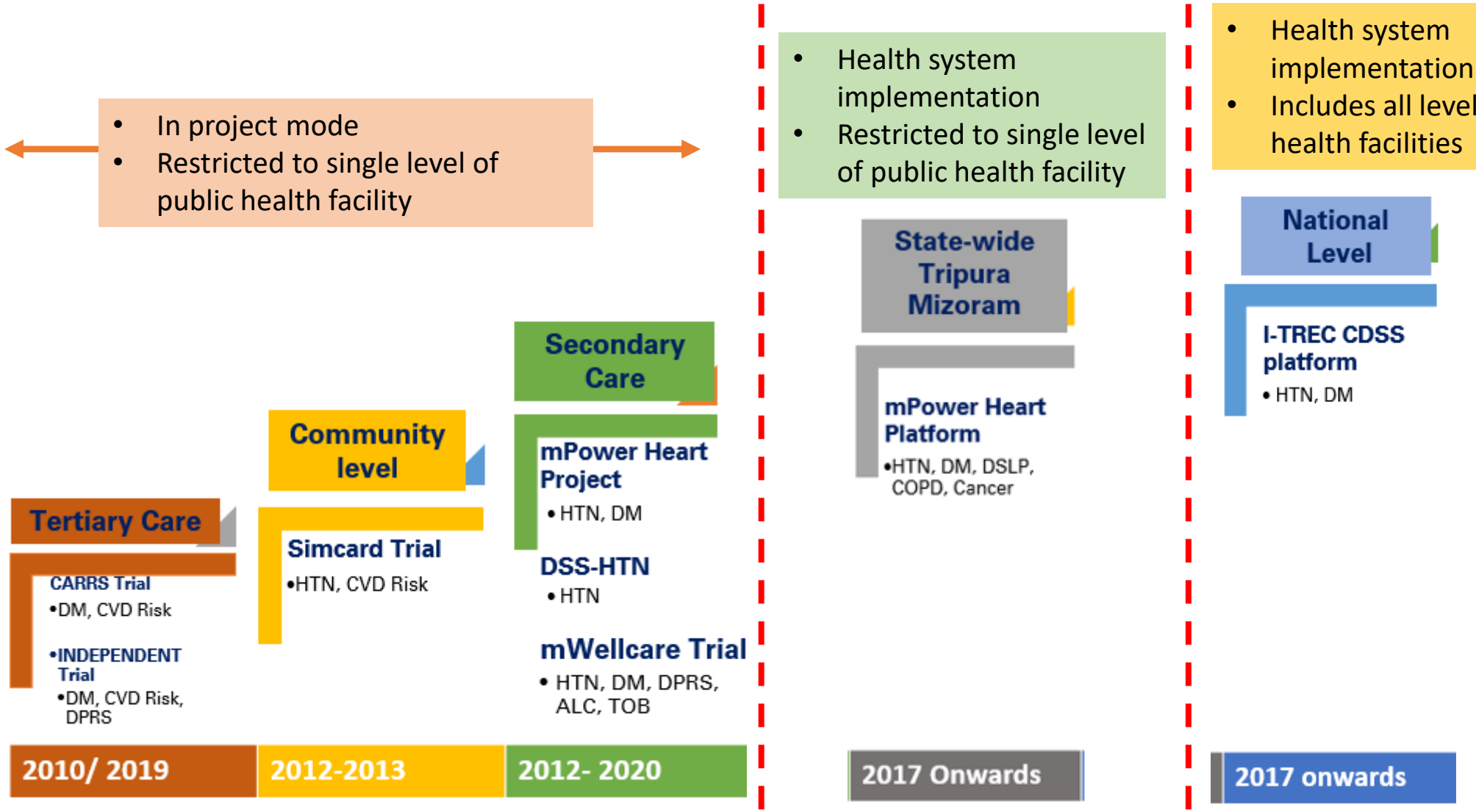
Implementing model of care involving technology and existing health system infrastructure

Key Ingredients of the Intervention Package



Task Shifting + Technology:
Chronic diseases (Hypertension & Diabetes)

Based on evidence accumulated over the past decade in India



HTN: Hypertension, DM: Diabetes Mellitus, DPRS: Depression, ALC: Alcohol, TOB: Tobacco, DSLP: Dyslipidemia

CARRS Translation Trial
Center for cArdiometabolic Risk Reduction in South Asia

CARRS Translation Trial
First Study (CDSS + Task Sharing)

Annals of Internal Medicine ORIGINAL RESEARCH

Effectiveness of a Multicomponent Quality Improvement Strategy to Improve Achievement of Diabetes Care Goals
A Randomized, Controlled Trial

Mohammed K. Ali, MBChB, MSc, MBA; Kavita Singh, MSc; Dimple Kondal, PhD; Raji Devarajan, MSc; Shivani A. Patel, MPH, PhD; Roopa Shivashankar, MD; Vamadevan S. Ajay, MPH, PhD; A.G. Unnikrishnan, MD, DM; V. Usha Menon, PhD; Premlata K. Varthakavi, MD, DNB; Vijay Viswanathan, MD, PhD; Mala Dharmalingam, MD, DM; Ganapati Bantwal, MD, DM; Rakesh Kumar Sahay, MD, DM; Muhammad Qamar Masood, MBBS; Rajesh Khadgawat, MD, DM; Ankush Desai, MD, DM; Bipin Sethi, MD, DM; Dorairaj Prabhakaran, MD, DM; K.M. Venkat Narayan, MD; and Nikhil Tandon, MD, PhD; on behalf of the CARRS Trial Group

PATIENT

CLINIC

Registration

Labs, Vital Signs, Anthropometrics

PHYSICIAN:
Exam,
Lab test,
Prescriptions

Billing

Follow-up

Lifestyle Advice

Reminders (SMS)

Advocacy

CARE COORDINATOR

Feedback

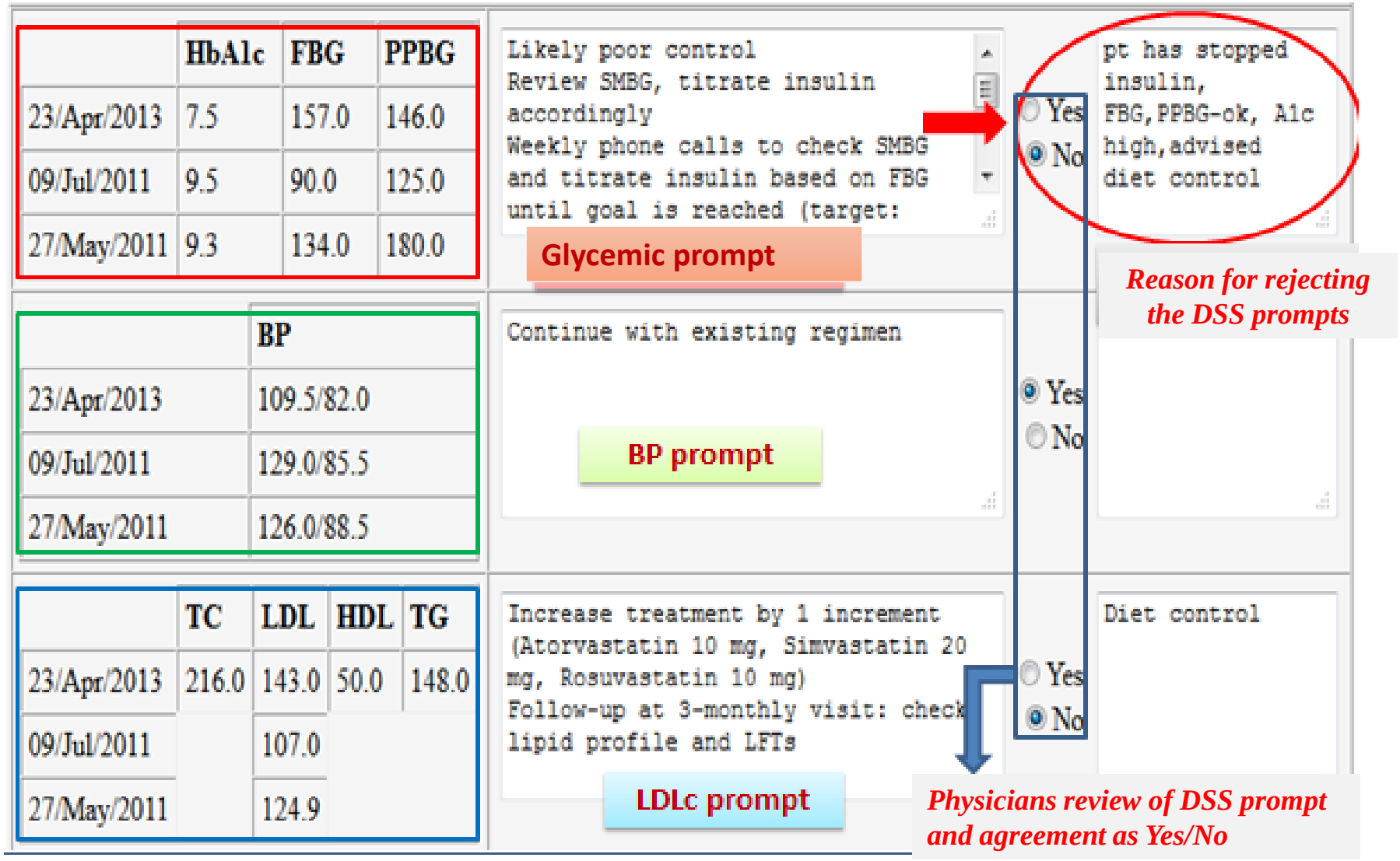
Prescription Changes

Prompts, reminders

EHR-DSS

Data input:
Paper clinic records
Lab results

DSS management plan



CARRS: CDSS & Result

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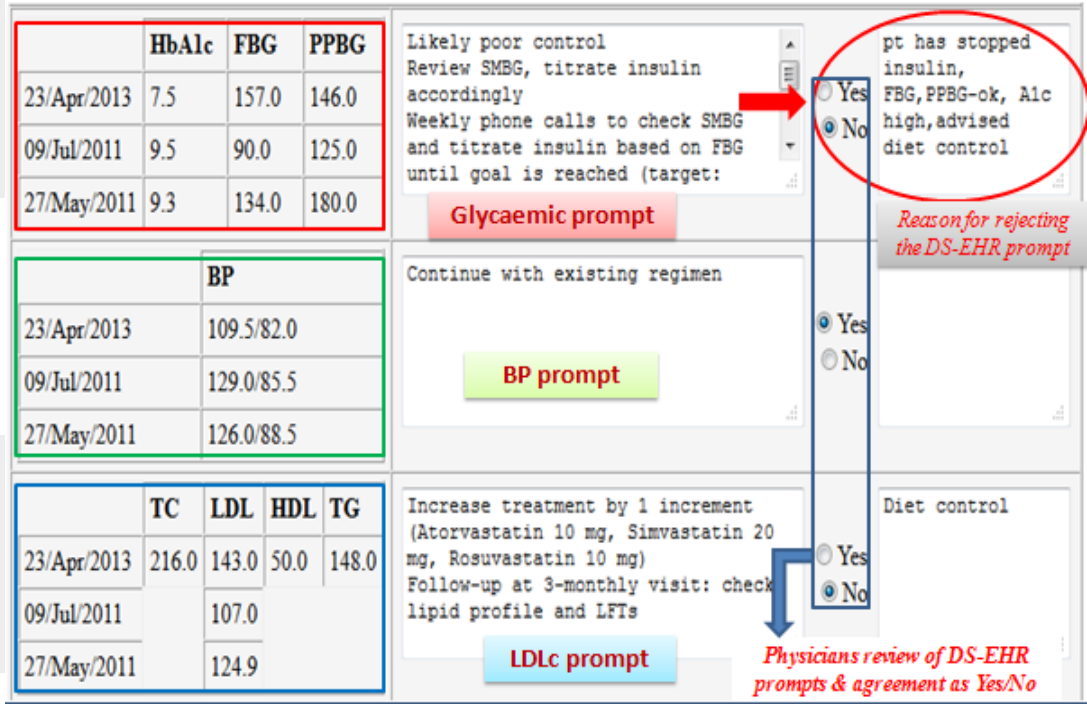
Outcomes	Intervention group (N = 575) %	Usual care (N=571) %	Treatment Effect, [95% CI]
Multiple risk factor control HbA1c <7% & either BP <130/80 or LDLc <100 (<70 with history of CVD)	17.7	7.5	**2.4** [1.7, 3.3]
HbA1c <7%	20.2	9.6	**2.1** [1.5, 2.8]
BP <130/80 mmHg	48.5	38.9	**1.2** [1.1, 1.4]
LDLc <100 (<70 with h/o CVD)	51.7	43.3	**1.2** [1.1, 1.3]



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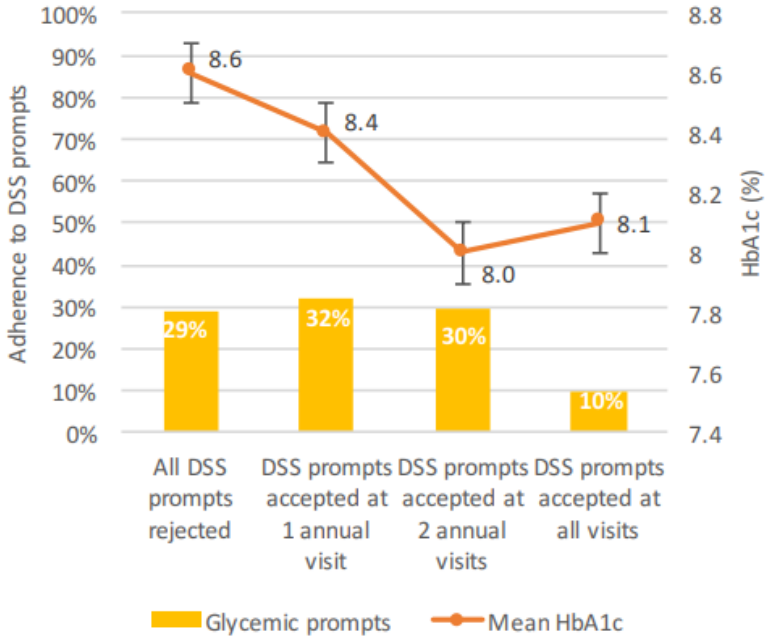
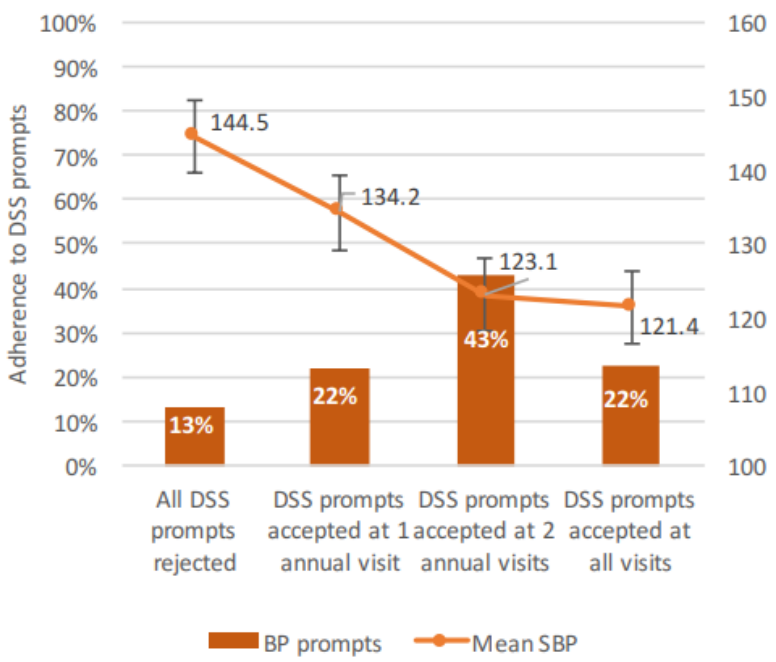
CARRS:

Acceptance of CDSS recommendations and impact on clinical parameters

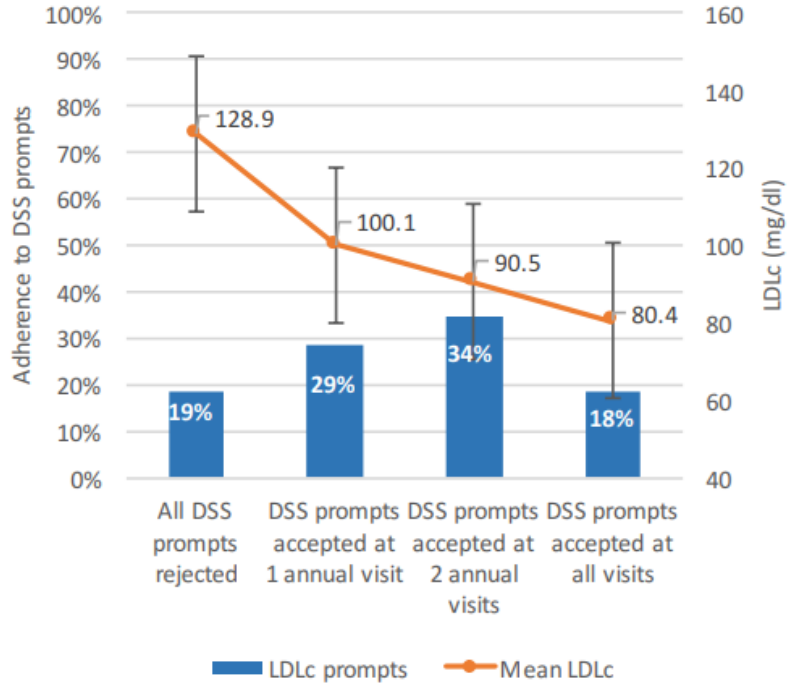
HbA1c



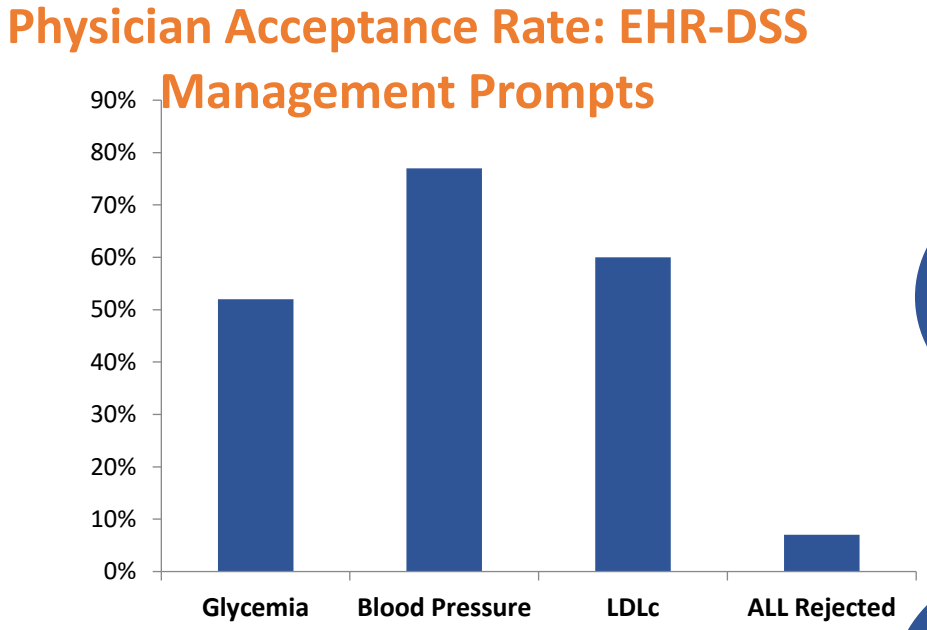
sBP



LDL

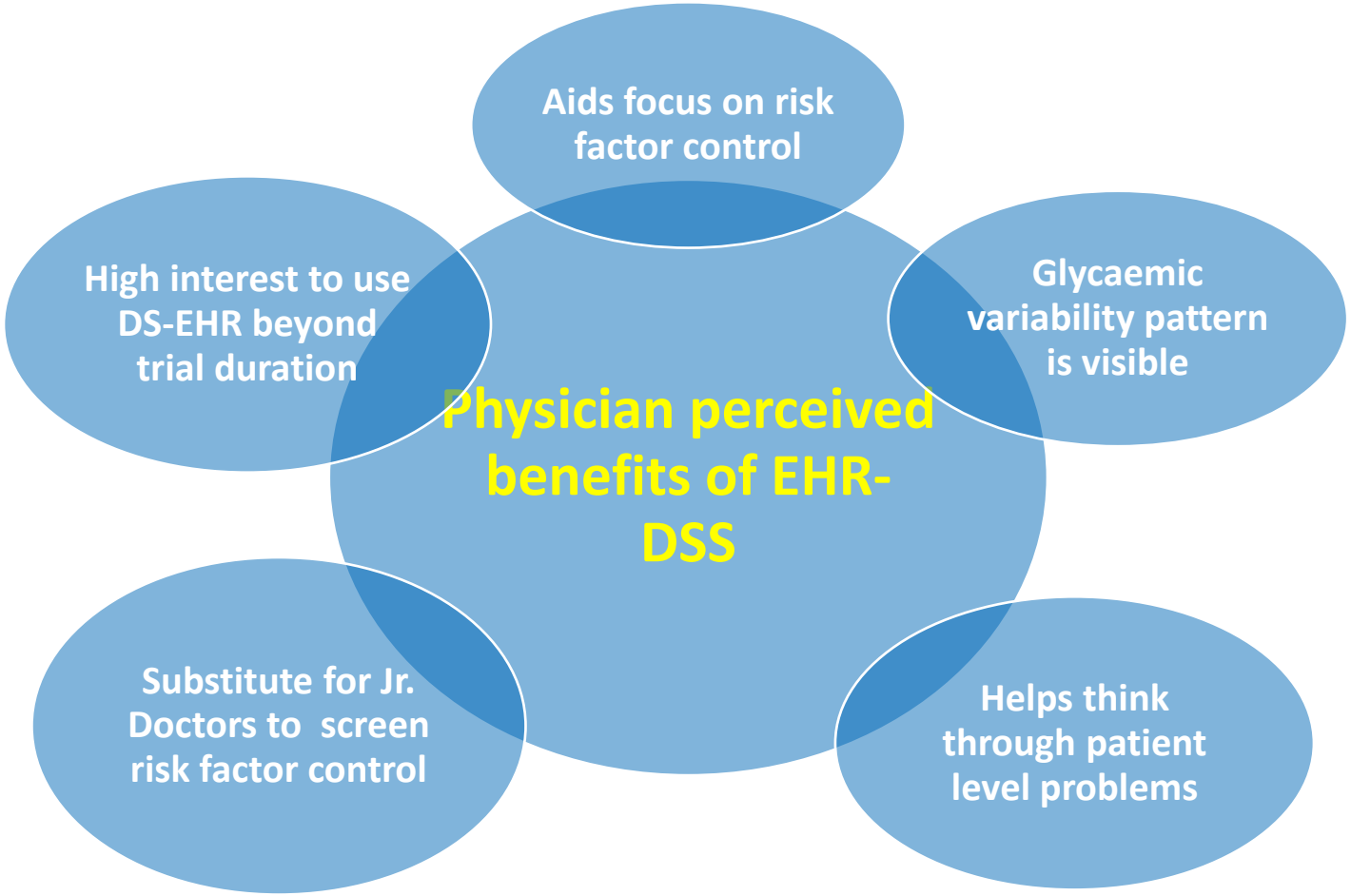


Physicians acceptability of EHR-DSS



- Acceptance rate across trial sites:
  - **41-93%** for glycaemic prompts
  - **53-98%** for lipids and BP prompts

Results (cont..)



Results from another CDSS project
mPower Heart Project: Himachal Pradesh

21	5	6
Time Period (months)	Government Hospitals	Outpatient Clinics

21,000	6,800	50%
Patients Screened	Patients treated	First Time Detections

Results sustained after 18 months

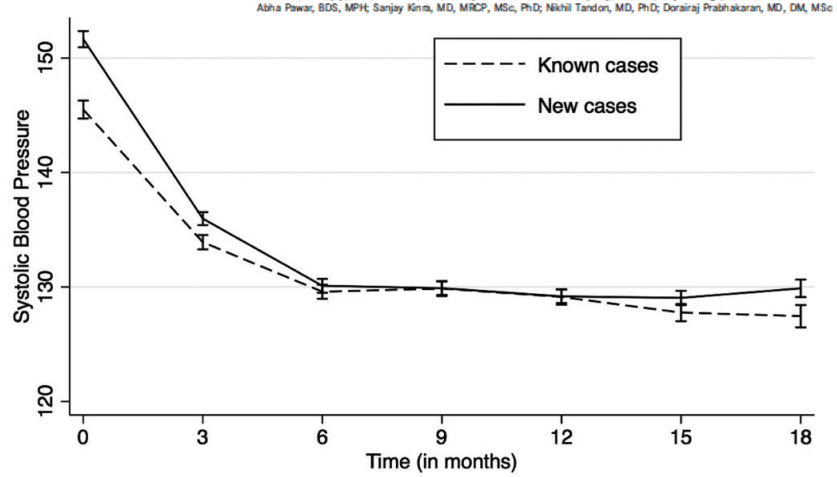
15 mmHg	7 mmHg	50 mg/dl
Drop in Systolic BP	Drop in Diastolic BP	Drop in Glucose Levels

In 2017, adopted by Tripura and Mizoram for state-wide implementation.

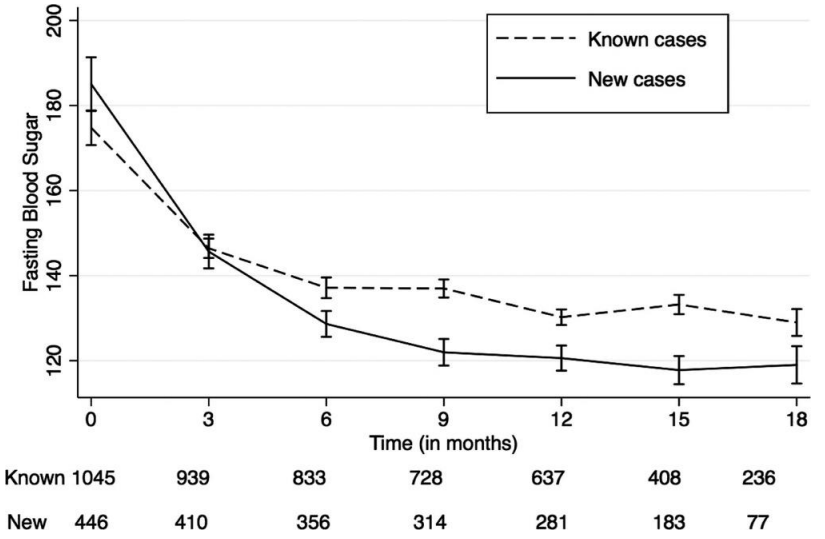
ORIGINAL RESEARCH

Development of a Smartphone-Enabled Hypertension and Diabetes Mellitus Management Package to Facilitate Evidence-Based Care Delivery in Primary Healthcare Facilities in India: The mPower Heart Project

Vamadevan S. Ajay, MPH, DLSHTM, PhD; Devraj Jindal, BDS, MPH; Ambuj Roy, MD, DM; Vidya Venugopal, MS, PhD; Rakshit Sharma, MBA; Abha Pawar, BDS, MPH; Sanjay Kinra, MD, MRCP, MSc, PhD; Nikhil Tandon, MD, PhD; Dorairaj Prabhakaran, MD, DM, MSc



Known	2864	2645	2456	2231	1987	1488	878
New	3152	2952	2614	2609	2417	1897	1124



Known	1045	939	833	728	637	408	236
New	446	410	356	314	281	183	77

Vamadevan et al. JAHA 2016

Integrated Tracking, Referral, and Electronic Decision Support, and Care Coordination (I-TREC)

AIIMS
Nikhil Tandon, PI

CCDC
Sailesh Mohan
D Prabhakaran

Emory
Shivani Patel
Mary Beth Weber
Mohammed K Ali
KM Venkat Narayan

NIH/NHLBI
Makeda Williams

National Advisory Board
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Nikhil Tandon
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AS & MD (NHM): Vandana Gurnani
JS NCD (MOHFW): Vishal Chauhan
Executive Director (NHSRC): Atul Kotwal
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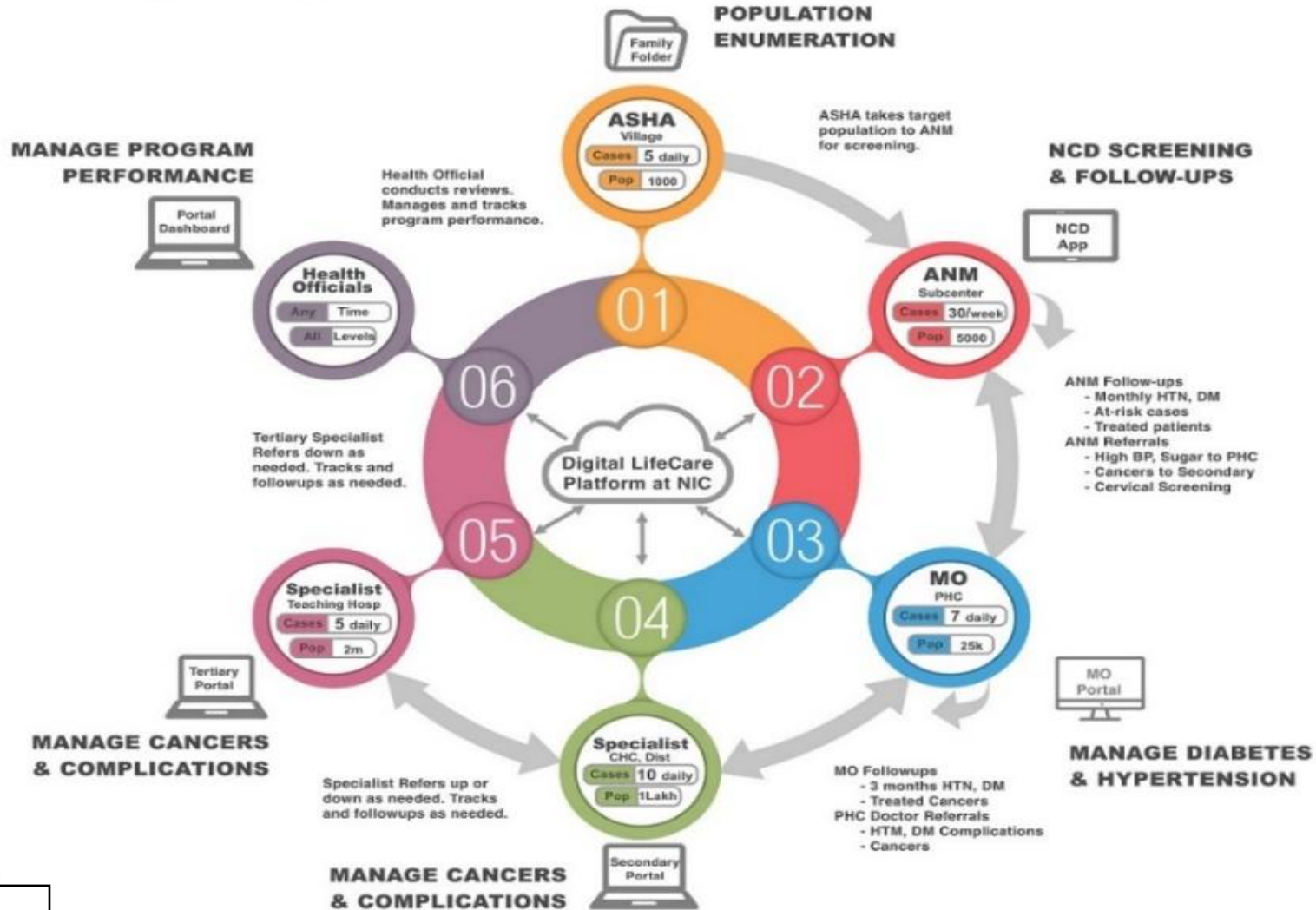
Neil Poulter (Imperial College, London)
Kamlesh Khunti (University of Leicester, UK)
Anil Kapur (World Diabetes Foundation)
Lara Fairall (University of Cape Town, South Africa

Ministry of Health & Family Welfare
Government of India

National NCD Program Workflow

Non-Communicable Diseases Screening & Management



Stakeholder Responisibility

ASHA Community Healthworker.
Family Folder, CBAC Forms, Health Cards, Community Mobilizing, Follow-ups

ANM - Healthworker
Screening, referrals, follow-ups. Update health records in tablet and health cards

MO - Medical Officer
Diagnosis and management of HTN and DM. Update health cards. DEO updates portal

Specialist Doctor - Secondary
Screen, diagnose and treat cancers. Update health cards. DEO updates portal for tracking

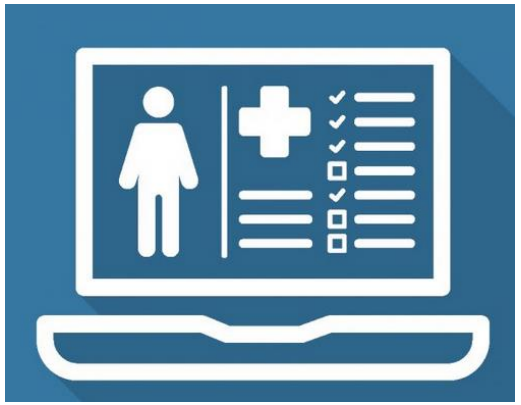
Specialist Doctor - Tertiary
Screen, diagnose and treat cancers. Update health cards. DEO updates portal for tracking

All Health Officials
Monitor dashbards, view reports, manage program performance, conduct reviews

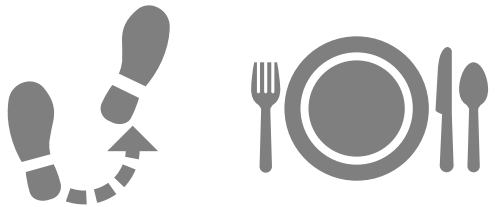
PROGRAM ACRONYMS	
NCD	Non Communicable Diseases
ASHA	Community Healthworker
ANM	Auxiliary Nurse Midwife
MO	Medical Officer
PHC	Primary Health Center
CBAC	Community Based Assessment Checklist
DEO	Data Entry operator
CHC	Community Health Center
HTN	Hypertension
DM	Diabetes Mellitus

The evidence-based intervention

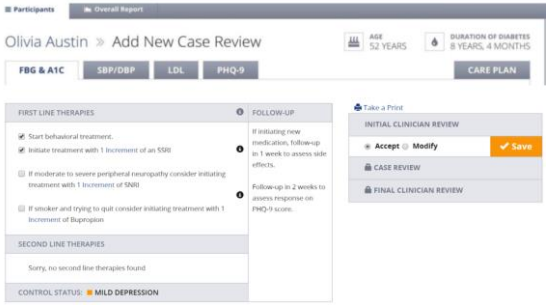
1. Electronic Case Record Form



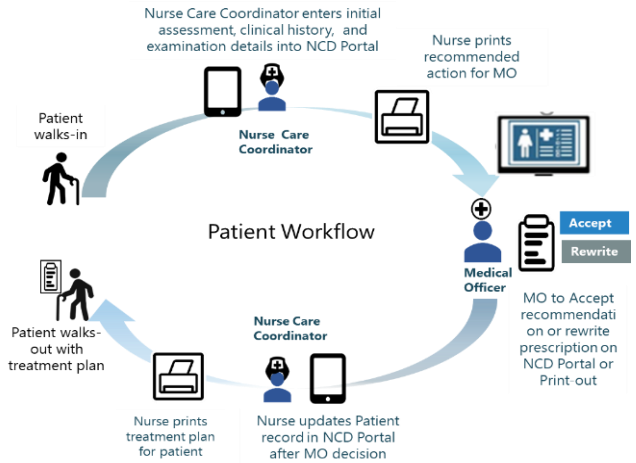
3. Healthcare provider training on lifestyle management of disease



2. In-built clinical decision support and referral prompts



4. Modified work flow in healthcare facilities (with task shifting)



Ali et al. *Annals of Internal Medicine* 2016

Need Assessment/Formative work/Experience/Literature

Jindal et al. BMC Health Services Research (2022) 22:688
https://doi.org/10.1186/s12913-022-08025-y

BMC Health Services Research

RESEARCH Open Access

Improving care for hypertension and diabetes in india by addition of clinical decision support system and task shifting in the national NCD program: I-TREC model of care

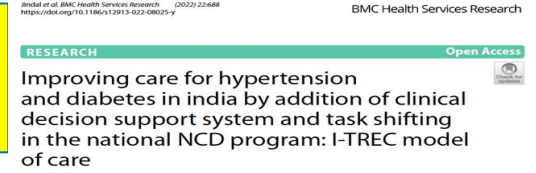
Identifying gaps in usual care

- Lack of integrated management of chronic conditions, addressing common multiple morbidities
- Inadequate human resource and capacity
- Lack of systematic patient assessment and long-term management of the chronic condition
- Low adherence to long-term care
- Limited patient lifestyle changes/behavioural modification
- Irregular/limited drug supply and lab investigations

Health facilities readiness for the uptake of digital health intervention

- **Infrastructure**
  - Hardware-tab/computers/printers etc.
  - Electricity and internet connectivity
  - Space
- **Use of digital intervention by healthcare providers**
  - Lack of time
  - Low/limited acceptance among doctors for using technology
  - Limited involvement of the non-physician healthcare workers in using the technology during the patient visits in the health facility

I-TREC Development Framework
Steps to develop a model of care incorporated within the current health system



Objective
To develop a "model of care" entirely incorporated within the current health system, spanning across all levels of healthcare, using the core principles of "task shifting and technology".

Steps
- Identification and engagement of key stakeholders
- Development of algorithms for CDSS to provide evidence-based care for diabetes and hypertension in accordance with the level of health facility
- Strengthening the referral pathways for appropriate care of patients at different levels of health care
- Changes in the GoI CPHC-NCD System and Workflow
- Development of CDSS platform and Integration of CDSS with the GoI CPHC-NCD System
- Training of healthcare providers

Expected Outcomes
- Increase use of CDSS-enabled GoI CPHC-NCD System in the health facilities
- Improved involvement of doctors
- Referral linkages for coordinated care delivery across all levels of the healthcare system hierarchy
- Task-shifting (nurses are involved in the screening of NCDs and initial examination)
- Data availability on important factors

Key Stakeholders
National Health Mission, Government of India; Department of Health & Family Welfare, Government of Punjab; Health System Staff (District SBS Nagar); Technology and implementation partners (Dell EMC/Tata Trusts); Investigators and study team (I-TREC Team)

CDSS: Clinical Decision Support System; GoI CPHC-NCD: Government of India Comprehensive Primary Health Care Non-communicable Diseases

I-TREC CDSS:
Algorithms designed for existing infrastructure

Diabetes:

- Algorithms based on availability of the test results and type of health facility (PHC, CHC, & DH)
  - HbA1C & FBG & PPBG
  - HbA1C & FBG
  - FBG & PPBG
  - Only FBG
  - Only RBG
- OHA & Insulin recommendations and dose titration

Hypertension:

- Algorithms based on blood pressure readings and type of health facility (PHC, CHC, & DH)
- Anti-hypertensive, Aspirin & Statin recommendation

Diabetes Management Algorithms: Logic

Basic principles in the management of T2DM:

- Modify Lifestyle
- Pharmacological Treatment: OHA or Insulin
- No anti-hyperglycemic medicines in use, start with metformin
- If a person is already on OHA, add another OHA (if already given 50% of a particular OHA) or increase the dose of current OHA
- Follow-up prompts: 2 unit/dose or more: after 1 month. 1 unit/ dose - after 3 months.
- In on insulin, SMBG is very important. (with or without SMBG)
- If FBS <70, Review the hypoglycaemic condition and manage accordingly.

Drug escalation suggestions

- Prompt 1: First increase from two choices [Metformin or SU]
- Prompt 2: If PPBG high but Fasting Normal: Acarbose will come as prompt 3rd or 4th drug
- If fasting also elevated: Pioglitazone will come as 3rd or 4th drug prompt
- If already on 3 drugs in maximum dose [open prompts for DPP4/SGLT2]
- After 3 drugs insulin will come as one of the option
- After 4 drugs, suggest only insulin
- Drug Priority: Metformin > SU > Pio > Acarbose > DPP4i > SGLT 2i

I-TREC CDSS:
Algorithms designed for existing infrastructure

FBS / PPBS	<130	131-160	161-200	>200
<180	Good control	Reinforce Lifestyle	+1 dose	+ 2 dose
181-250	Reinforce Lifestyle	+1 dose	+1 Dose	+ 2 dose
251-300	+1 dose	+1 dose	+2 dose	+ 2 dose
>300	+1 dose	+1 dose	+ 2 dose	Insulin*

FBS	<110	110-130	131-160	161- 200	>200*
	Good control	Reinforce Lifestyle	+1 dose	+ 2 dose	+ 3 dose

PPBS	<140	140-180	181-250	251-300	>300*
	Good control	Reinforce Lifestyle	+ 1 dose	+ 2 dose	+ 3 dose

Drug prompts based on HbA1c, FBS and PPBS

HbA1c < 7%

FBS / PPBS	<130	131-160	161-200	>200
<180	Good control	Reinforce Lifestyle	+1 dose	+ 2 dose
180-250	Reinforce Lifestyle	+1 dose	+1 dose	+ 2 dose
251-300	+1 dose	+1 dose	+2 dose	+ 2 dose
>300	+1 dose	+1 dose	+ 2 dose	Insulin*

Drug prompts based on HbA1c, FBS and PPBS

HbA1c 7-8%

FBS / PPBS	<130	131-160	161-200	>200
<180	Good control	+1 dose	+1 dose	+ 2 dose
180-250	+1 Dose	+1 dose	+ 2 dose	+ 2 dose
251-300	+1 dose [Check if PPBG has been done in right manner]	+2 dose	+2 dose	+ 2 dose
>300	+1 dose [Check if PPBG has been done in right manner]	+2 dose	+ 2 dose	Insulin*

Drug prompts based on HbA1c, FBS and PPBS

HbA1c >8%

FBS / PPBS	<130	131-160	161-200	>200
<180	Good control [reinforce lifestyle	+1 Dose	+1 dose *	+ 2 dose
180-250	+1 Dose	+2 dose	+ 2 Dose	+ 2 dose
251-300	+1 dose [Check if PPBG has been done in right manner]	+2 dose	+2 dose	+ 2 dose
>300	+1 dose [Check if PPBG has been done in right manner]	+2 dose	+ 2 dose	Insulin**

Insulin Algorithms
Insulin Algorithm [Which insulin to start and when]

- Add NPH at bedtime if PPBS-FBS <100
- **Will start Pre-Mixed** (2 times a day), if:
  - **HbA1c > 8.5**
  - **PPBS-FBS > 100**
  - **NPH > 0.5 unit/kg/day still not control**

- If Insulin in use/advised, stop Pioglitazone.

Insulin Dose Titration

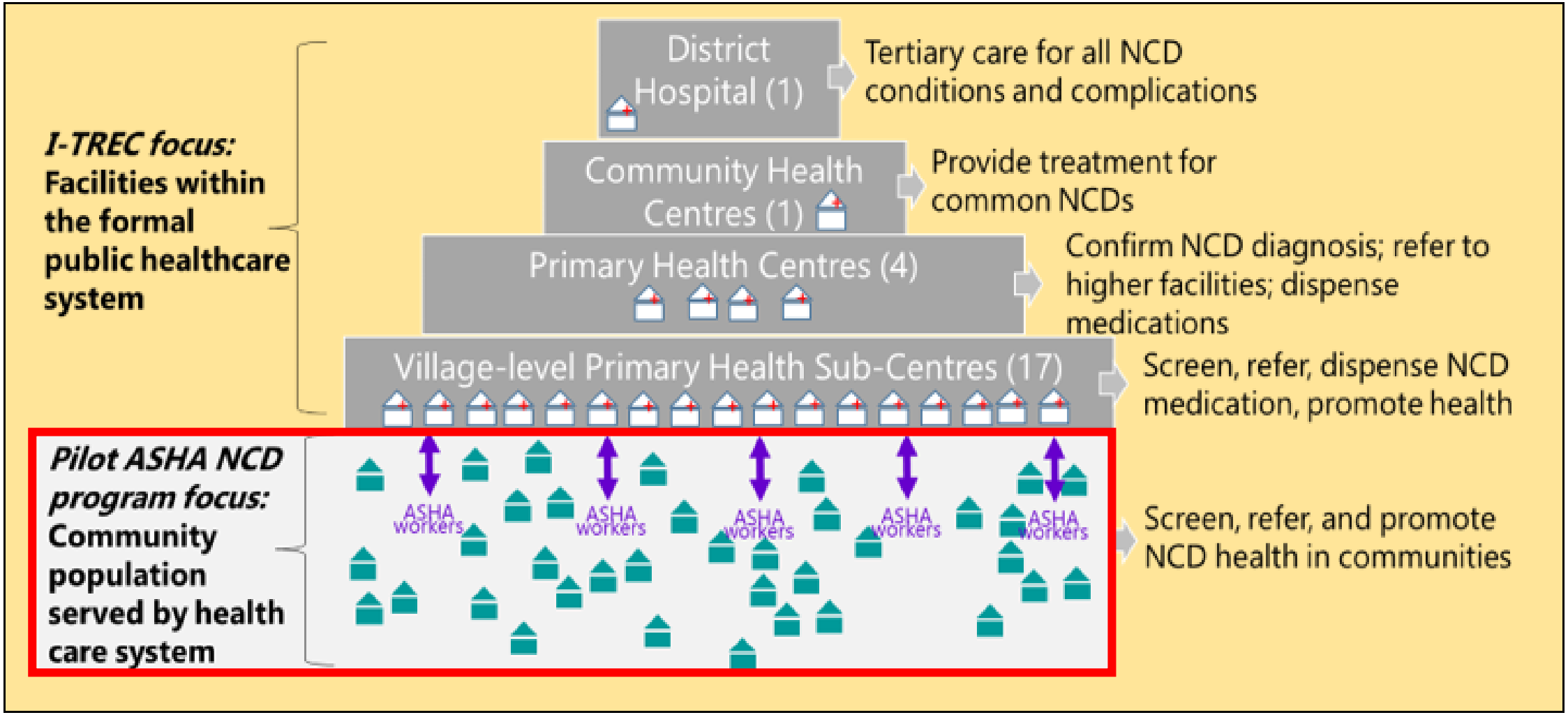
NPH [bedtime]

- Start by 0.1 units/kg [round off to nearest whole number]
- Continue same OHAs
- Target FPG 100-130
- Titrate by FPG [SMBG every 4th day]
- If Fasting plasma glucose 130-149: Increase by 1 unit, 150-169: increase by 2 units; 170-199: increase by 3 units; > 200 increase by 4 units
- Down titrate if BG <80 by 2 units ; 80-99 by 1 unit
- Ask patient to come after 2 weeks for first time than as per need

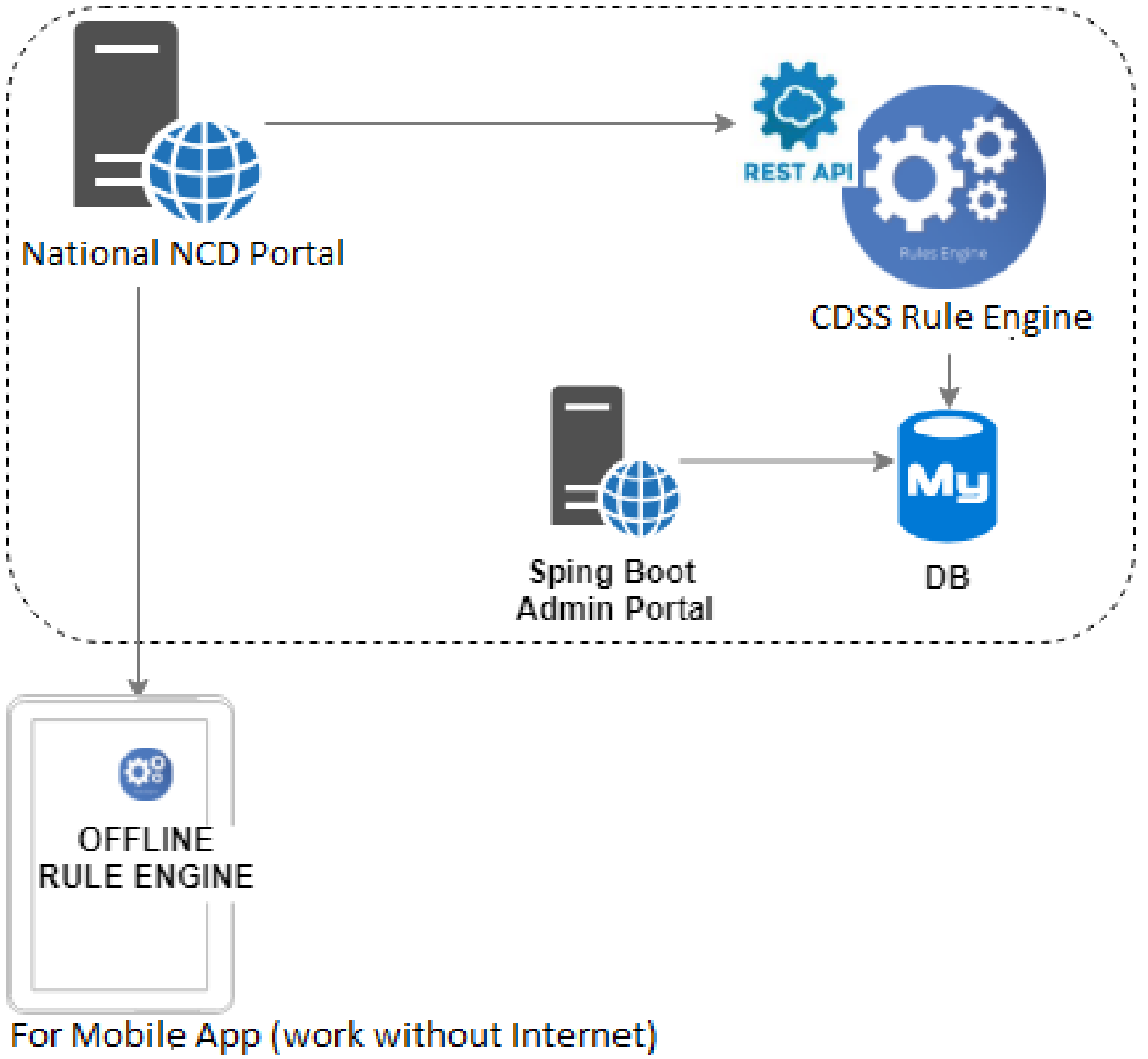
Premix

- Start by 0.2 units/kg [Stop SU/PIOZ]
- Divide; 2/3rd (M) and 1/3rd (E) 30 minutes before meals
- Target FPG 100-130, PPBG 140-180
- Titrate by FPG/PPBG, and pre/post dinner [SMBG every 4th day]
- If ABF> 180 **AND** ABF-BBF 40-59: Increase by 1 units; 60-79 by 2 units; 80-99 by 3 units and 100 or more > by 4 units [titration for morning dose]
- If AD> 180 **AND** AD-PREDINNER 40-59: Increase by 1 units; 60-79 by 2 units; 80-99 by 3 units and 100 or more > by 4 units [titration for evening dose]
- IF AD and predinner not available: Increase insulin before dinner dose - If FPG 130-149: Increase by 1 unit, 150-169: by 2 units; 170-199: by 3 units; > 200 by 4 units
- Down titrate if after meal is less than or equal to premeal: By 2 units or there is hypoglycemic symptoms.

Embedding intervention components within GoI physical and IT infrastructure



CDSS-enabled GoI CPHC-NCD System Architecture



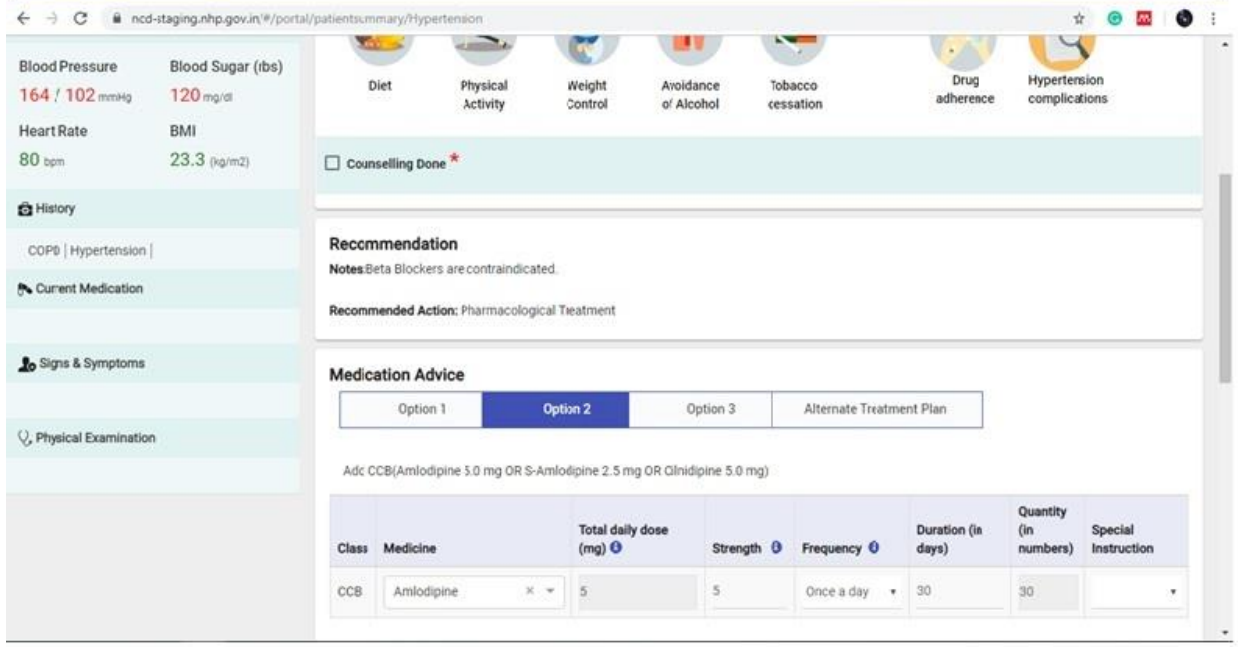
DB: Database; API: Application Programming Interface; CDSS: Clinical Decision Support System; GoI CPHC-NCD: Government of India Comprehensive Primary Health Care Non-communicable Diseases

CDSS enabled Government of India (GoI) CPHC NCD System
(No additional hardware/software requirement)

CDSS-enabled GoI CPHC-NCD System Data Flow

ASHA: Accredited Social Health Activist; ANM: Auxiliary Nurse Midwife; GoI CPHC-NCD: Government of India Comprehensive Primary Health Care Non-communicable Diseases

Screenshot of the GoI CPHC-NCD (Health facility) Sysetm



Technology embedded within usual workflow

No additional manpower requirement

Nurse Care Coordinator enters initial assessment and clinical history into CPHC NCD System

Nurse Care Coordinator

Patient walks-in

Patient Workflow

Medical Officer

Accept

Rewrite

- MO receives patient assessment on the NCD portal or as a printout
- MO accepts recommendation or rewrite prescription on NCD Portal or Print-out

Patient walks-out with treatment plan

Nurse Care Coordinator

Nurse prints treatment plan for patient

Nurse provides the Lifestyle advices and updates patient record in NCD Portal after MO decision (if required)

Provider recommendation and Patient Receives Print out

Date: 24th Feb 2019

Recommendation

Patient Name: XYZ | 45yrs | Female | Ph: 09793649823 | Patient ID: 1157XXX |
History: Diabetes| Liver Failure
Signs & Symptoms: Polydipsia | Polyuria
Pregnant: No
Current Medications: Metformin 500mg| Amlodipine 5mg| Paracetamol 200mg

Past readings

Date	Facility	FBG (mg/dl)	RBG (mg/dl)	PPBG (mg/dl)	HbA1c %	BP (S/D) mmHg	Weight (kg)	BMI
24th Feb 2019	PHC	120	160	140	6	120/80	60	24
10th Feb 2019	PHC	120	150	160	6	110/80	60	24
15th Jan 2019	CHC		160			110/70	60	24
1st Jan 2019	PHC					130/80	60	24
20th Dec 2018	PHC	160		200	7		60	24

DIABETES SECTION
Patient Status: Referred to CHC

Examination

Readings	FBG (mg/dl)	RBG (mg/dl)	PPBG (mg/dl)	HbA1c %
Nurse	125	220 Venous		
Doctor		• Capillary • Venous	• Capillary • Venous	

Diagnosis
Recommended Diagnosis: ☐ *Diabetes Mellitus (Control : Insufficient)*
You can override the above recommended diagnosis by choosing one of the following options
☐ *Normal (NAD)* ☐ Refer *Reason for override*

Treatment
Notes: Pharmacological Treatment
Recommended Action: Follow the current regimes
Medication Advice: *Please choose one of the options as suggested below or create new*

Option 1	Option 2		
Increase Metformin to max dose 2000.0 mg **AND** Add Sulfonylurea (Glimepiride 2.0 mg or Glipizide 10.0 mg or Gliclazide 80.0 mg or Modified Release Gliclazide 30.0 mg or Glipizide XL 5.0 mg)	Add Sulfonylurea (Glimepiride 4.0 mg or Glipizide 20.0 mg or Gliclazide 160.0 mg or Modified Release Gliclazide 60.0 mg or Glipizide XL 10.0 mg)		
Please specify: (frequency & dosage)			

Custom Plan *(Prescribe medicines in this section only if the above suggested options are not available)*

Reason for creating custom plan: ○ Recommended drugs not available ○ No drug recommended ○ Other:

Test
65 Years | Male

Patient ID:XXXXX4072

History: Diabetes | Hypertension

Past Readings

Date	FBS (mg/dl)	RBS (mg/dl)	PPBS (mg/dl)	HbA1c (%)	BP(s/d) (mmHg)	Weight (kgs)	BMI (kg/m2)
04-05-2021	200	-	280	-	160 / 100	-	-
15-04-2021	-	280	-	-	160 / 100	85	26.8

Diabetes Section

Diagnosis: Diabetes Mellitus — Prescribed on 04-05-2021, PHC
Medication Advice

Medicine Name	Strength	Frequency	Duration(in days)	Quantity	Special Instruction
Metformin	500	Twice a day	30	60	After Food

Instructions
- Next Visit : Follow up at PHC on 01 Jun 2021
- Referred To : NA

Hypertension Section

Diagnosis: Hypertension — Prescribed on 04-05-2021, PHC
Medication Advice

Medicine Name	Strength	Frequency	Duration(in days)	Quantity	Special Instruction
Enalapril	5	Once a day	30	30	

Instructions
- Next Visit : Follow up at PHC on 01 Jun 2021
- Referred To : NA

Other Complaints

Uptake of CDSS enabled CPHC NCD System in Health Facilities

Experience from Punjab: I-TREC Study

	Interview Round 1		Interview Round 2		Interview Round 3	
	Mukandpur (Intervention)	Sujjon (Control)	Mukandpur (Intervention)	Sujjon (Control)	Mukandpur (295)+ DH(503) (Intervention)	Sujjon (Control)
Lifestyle related advice	n=282	n=167	n=377	n=255	n=798	n=250
Lifestyle advice given by doctor, %	100%	98.8%	99.0%	97.3%	99%	61.6%
Diet/daily habits advised by nurse, %	98.9%	68.9%	96.0%	65.5%	91.9%	46.8%

	Interview round 1	Interview round 2	Interview round 3
Portal Usage (Only intervention block)	n= 282	n= 377	n= 798
Computer/tablet used by, %:			
Nurse	99.7%	100%	99.9%
Doctor	96.1%	91.8%	99.5%
Patient received printout, %	**87.2%**	**69.0%**	**93.4%**
Printout given by, % ***Restricted to those who received a printout**			
Nurse	0.4%	0.4%	0.1%
Doctor	99.6%	99.2%	99.1%
Other	0%	0.4%	0.8%

CDSS Features/Functionalities

- Generate personalized clinical management plan
- Identify high risk patients and assist in Diagnosis
- Strengthen Referral Mechanism
- Follow-up prompts and alert on Contrindication
- Prompts: optimal generic drug and dosage
  Drug escalation and down-titration
- Insulin, Hypoglycemia Identification and Management
- Secondary CVD prevention (Statin & Aspirin prompts)
- Consider co-morbidities

Push/Update evolving clinical management guidelines in the backend and Stable platform designed to cover other diseases in future

CDSS enabled GoI CPHC NCD System provides a cafeteria choice of medication thereby not straitjacketing the physician to choose only one drug! It provides generic drug options and includes drugs which are as per IPHS!

All the calculations in the CDSS engine are happening at the back-end. Doctors/healthcare providers do not need to know all the rules. CDSS suggests the preferable drug and dose, along with information about contraindications/notes in a very simple/user-friendly manner.

Impact

CDSS enabled Government of India (GoI) CPHC NCD System

- Brings together **task-sharing and technology-**based interventions into a single package
- **Tracks individual patient progress through the various levels of the healthcare system**
- Provides an **electronic clinical decision support system** (CDSS) which assists providers to tailor guideline-based care to individual patient needs
- Strengthen continuum of care- objectively defines **referral thresholds,** strengthens available referral linkages and facilitates referral.
- Trains designated individuals at each level of healthcare in **care coordination** strategies to **improve** continuum of care for people with diabetes and hypertension in India
- Monitors system- and community-level screening and treatment outcomes
- **Standardization of care** across all health facilities (adequate opportunity for patients to explain their illness and complaints to a nurse)
- Reduced workload for medical officers
- Better control of hypertension/diabetes

Overall Improved Quality of Care

ORIGINAL RESEARCH

Strategies for Stakeholder Engagement and Uptake of New Intervention

Experience From State-Wide Implementation of mHealth Technology for NCD Care in Tripura, India

Devraj Jindal[1], Ambuj Roy[1], Vamadevan S. Ajay[1], Shailesh Kumar Yadav[1], Dorairaj Prabhakaran[1,2,*], Nikhil Tandon[2,*]

New Delhi and Agartala, India

Annals of Internal Medicine

ORIGINAL RESEARCH

Effectiveness of a Multicomponent Quality Improvement Strategy to Improve Achievement of Diabetes Care Goals

A Randomized, Controlled Trial

Mohammed K. Ali, MBChB, MSc, MBA; Kavita Singh, MSc; Dimple Kondal, PhD; Raji Devarajan, MSc; Shivani A. Patel, MPH, PhD; Roopa Shivashankar, MD; Vamadevan S. Ajay, MPH, PhD; A.G. Unnikrishnan, MD, DM; V. Usha Menon, PhD; Premlata K. Varthakavi, MD, DNB; Vijay Viswanathan, MD, PhD; Mala Dharmalingam, MD, DM; Ganapati Bantwal, MD, DM; Rakesh Kumar Sahay, MD, DM; Muhammad Qamar Masood, MBBS; Rajesh Khadgawat, MD, DM; Ankush Desai, MD, DM; Bipin Sethi, MD, DM; Dorairaj Prabhakaran, MD, DM; K.M. Venkat Narayan, MD; and Nikhil Tandon, MD, PhD; on behalf of the

ORIGINAL RESEARCH

Development of a Smartphone-Enabled Hypertension and Diabetes Mellitus Management Package to Facilitate Evidence-Based Care Delivery in Primary Healthcare Facilities in India: The mPower Heart Project

Vamadevan S. Ajay, MPH, DLSHTM, PhD; Devraj Jindal, BDS, MPH; Ambuj Roy, MD, DM; Vidya Venugopal, MS, PhD; Rakshit Sharma, MBA; Asha Pawar, BDS, MPH; Sanjay Kinra, MD, MRCP, MSc, PhD; Nikhil Tandon, MD, PhD; Dorairaj Prabhakaran, MD, DM, MSc

Background—The high burden of undetected and undertreated hypertension and diabetes mellitus is a major health challenge worldwide. The mPower Heart Project aimed to develop and test a feasible and scalable intervention for hypertension and diabetes mellitus by task-sharing with the use of a mobile phone–based clinical decision support system at Community Health Centers in Himachal Pradesh, India.

Circulation

ORIGINAL RESEARCH ARTICLE

Effectiveness of an mHealth-Based Electronic Decision Support System for Integrated Management of Chronic Conditions in Primary Care

The mWellcare Cluster-Randomized Controlled Trial

Editorial, see p 392

Dorairaj Prabhakaran,

Jindal *et al. BMC Health Services Research* (2022) 22:688
https://doi.org/10.1186/s12913-022-08025-y

BMC Health Services Research

RESEARCH Open Access

Improving care for hypertension and diabetes in india by addition of clinical decision support system and task shifting in the national NCD program: I-TREC model of care

Devraj Jindal[1*], Hanspria Sharma[2], Yashdeep Gupta[2], Vamadevan S. Ajay[3], Ambuj Roy[4], Rakshit Sharma[2], Mumtaj Ali[1], Prashant Jarhyan[1], Priti Gupta[1], Nikhil Srinivasapura Venkateshmurthy[1,5], Mohammed K. Ali[6], K M Venkat Narayan[7], Dorairaj Prabhakaran[1,5], Mary Beth Weber[8], Sailesh Mohan[1,5], Shivani A. Patel[8] and Nikhil Tandon[2]

HHS Public Access
Author manuscript
Circulation. Author manuscript; available in PMC 2016 September 01.

Published in final edited form as:
Circulation. 2015 September 1; 132(9): 815–824. doi:10.1161/CIRCULATIONAHA.115.015573.

A Cluster-Randomized Controlled Trial of a Simplified Multifaceted Management Program for Individuals at High Cardiovascular Risk (SimCard Trial) in Rural Tibet, China and Haryana, India

Maoyi Tian, Ph.D., MSc[1], Vamadevan S. Ajay, MPH[2,3], Danzeng Dunzhu, BM[4], Safraj S. Hameed, MSc[2], Xian Li, M.D., MSc[1], Zhong Liu, MEd[4], Cong Li, BM[1,5], Hao Chen, M.D.[6],

NIH Public Access
Author Manuscript
Diabetes Res Clin Pract. Author manuscript; available in PMC 2013 November 01.

Published in final edited form as:
Diabetes Res Clin Pract. 2012 November ; 98(2): 285–294. doi:10.1016/j.diabres.2012.09.023.

Improving diabetes care: Multi-component CArdiovascular Disease Risk Reduction Strategies for People with Diabetes in South Asia - The CARRS Multi-center Translation Trial

CARRS Trial Writing Group, Seema Shah, MD*,

Global Health Action

ISSN: 1654-9716 (Print) 1654-9880 (Online) Journal homepage: https://www.tandfonline.com/loi/zgha20

Development of mWellcare: an mHealth intervention for integrated management of hypertension and diabetes in low-resource settings

Srinivasapura Venkateshmurthy *et al. Trials* (2018) 19:429
https://doi.org/10.1186/s13063-018-2813-2

Trials

STUDY PROTOCOL Open Access

m-Power Heart Project - a nurse care coordinator led, mHealth enabled intervention to improve the management of hypertension in India: study protocol for a cluster randomized trial

n: CDSS + Task-sharing

Ministry of Health & Family Welfare
Government of India

OPERATIONAL GUIDELINES

NATIONAL PROGRAMME FOR PREVENTION AND CONTROL OF NON-COMMUNICABLE DISEASES

(2023-2030)

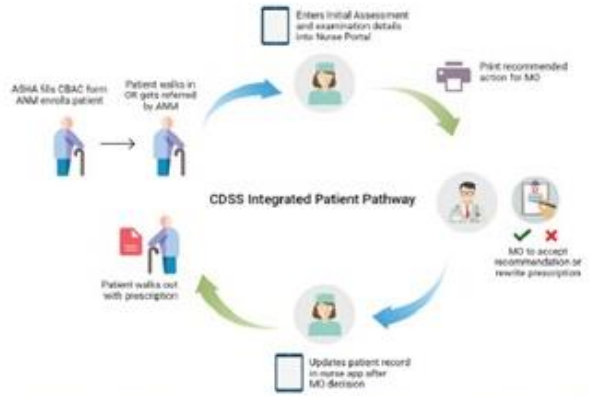


Figure 6: Clinical Decision Support System (CDSS) Integrated Patient Pathway

It is a robust system with adaptable algorithms which can be updated time-to-time. Additional, diseases or conditions under NP-NCD programme can be included on the platform. Details on the National NCD Portal architecture is placed as **Annexure 8.**

imary
Care

ver Heart
ct
, DM

HTN

ellcare Trial
, DM, DPRS,
, TOB

State-wide Tripura Mizoram

mPower Heart Platform
- HTN, DM, DSLP, COPD, Cancer

National Level

I-TREC CDSS platform
- HTN, DM

International Maldives

mPEN mPower Platform
- HTN, DM, COPD, Asthma, Cancer, ALC, TOB

Future Plans

- Scaling up by formal integration with GoI CPHC NCD system
- Integration with e-Hospital NIC
- Integration with Ayushman Bharat Digital Mission

2010/ 2019	2012-2013	2012- 2020	2017 Onwards	2017 onwards	2018-2019

HTN: Hypertension, DM: Diabetes Mellitus, DPRS: Depression, ALC: Alcohol, TOB: Tobacco, DSLP: Dyslipidemia

REVISED OPERATIONAL GUIDELINES NATIONAL PROGRAMME FOR PREVENTION & CONTROL OF CANCER, DIABETES, CARDIOVASCULAR DISEASES & STROKE

DRAFT

MINISTRY OF HEALTH AND FAMILY WELFARE

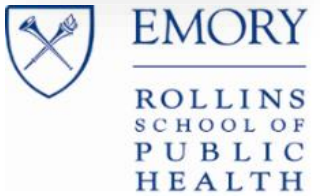
Annexure 7: **Clinical Decision Support Software enabled CPHC NCD system: Good practices**

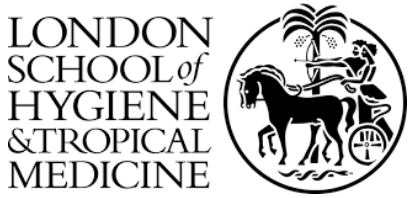
CDSS is a computer-based program/system embedded within the CPHC NCD application that analyzes patient data in real-time to provide prompts and reminders to assist healthcare providers in implementing evidence-based clinical guidelines during the clinic visit. Research has shown that the CDSS aided by task-shifting can facilitate guideline-based clinical management of patients and together improve patient outcomes across diverse clinic settings. The CDSS algorithms provide the clinician with a “real time” advisory regarding medication titration based on patient history and current clinical examination as inputted into the eCRF/CPHC NCD System.

States can opt for the CDSS enabled CPHC NCD system. Using the CDSS-enabled CPHC NCD System does not impair any other current data and functionalities of the CPHC NCD System. Also, it does not require any additional manpower or resources. More details about the CDSS enabled CPHC NCD system are given in ***Annexure # 7 (page # 109 of 126).***

Contributors

***We acknowledge the contributions of various government, academic, research, and technology institutions in supporting our endeavors to work towards* improving healthcare.**





This journey would not have been successful without the enthusiasm and support of several Primary Care Doctors, Nurses, Community Health Workers and Policy Makers. Finally, to the patients without whom we don't exist we express our deepest gratitude