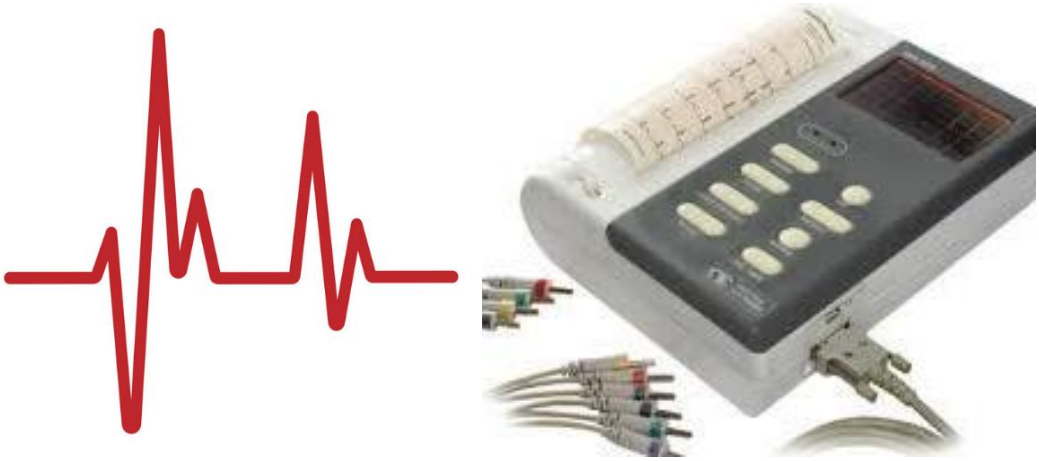
Health Technology Assessment of Project Lifeline – ECG Facility at Primary Health Centre Level in Ahmedabad District of Gujarat



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CONTENTS

List of Abbreviations

Abbreviations	**Full Form**
AI	Artificial Intelligence
CBAC	Community Based Assessment Checklist
CHC	Community Health Centre
CVD	Cardiovascular Disease
DH	District Hospital
ECG	Electrocardiogram
GDP	Gross Domestic Product
ICER	Incremental cost-effectiveness ratio
LYs	Life Years saved
MC	Medical College
NCD	Non-Communicable Disease
OOPE	Out-of-pocket Expenditure
PMJAY	Pradhan Mantri Jan Arogya Yojana
PHC	Primary Health Centre
QALY	Quality Adjusted Life Years
SDH	Sub-district Hospital

ABSTRACT

Background

The prime purpose of the report is to assess the appropriateness and feasibility for scale up of Project Lifeline. The report summarizes cost involved with implementation of the project from societal perspective. Under this initiative, District Panchayat Ahmedabad introduced electrocardiogram (ECG) machines among all 40 primary health centres (PHCs)for screening of cardiac abnormalities. Linkage for ECG reading were set up with physicians through IT/Web-base (WhatsApp/App) for identification and confirmation of cardiovascular diseases (CVDs) and for providing primary management (with thrombolytic and anti-platelet like Aspirin) coupled with proper timely referral.

Methods

Cost data Project Lifeline was assessed using societal. An incremental costing approach was adapted for the study. The cost-effectiveness analysis was done using decision analytic modelling. The program cost was obtained from the implementers under various heads - device cost, training cost and private physician costs, whereas out-of-pocket cost was documented from secondary sources. Transition probabilities were derived from primary data supported by expert opinion for the intervention arm while systematic search of literature was undertaken to derive transition probabilities for the control arm.

Findings

The study results found that though proportion of patient opting for any further management of disease after positive screening through ECG is relatively low, availability of the screening facility at primary health care level have enabled early identification of the disease in relevant high-risk cases that has resulted in prompt management.

The cost-effectiveness of the intervention is evaluated based on Life Years saved due to early screening of cardiac abnormalities. The initiative was found to be cost-effective for screening of high-risk symptomatic adults (ICER **2,299.06**)

Conclusion

Cost-effectiveness analysis clearly shows that the facility to screen cardiac abnormality at PHC level is highly recommended for high risk adult and symptomatic cases. The screening facility at

primary health care level may lead to early identification of the disease and result in prompt management.

INTRODUCTION

Globally 70% of all deaths are due to Non-Communicable Diseases (NCDs).[1] Cardiovascular disease (CVD) is responsible for premature deaths (<70 year) among four major NCDs accounting 80% mortality. In India, 26% risk of death can be attributed to CVDs. 23% of those with heart attacks do not survive due to delay in treatment leading to death of around 1.7 million Indians.[2]

The first hour after the onset of heart attack is called the golden hour. Appropriate action within the first 60 minutes of a heart attack can reverse its effects and if the person reaches the hospital and gets treated within this period she/he can expect near-complete recovery. Hence to reduce the damage, it is important to get to the hospital as soon as possible. An Electrocardiogram (ECG) monitor can help to assess the heart rhythm, so that they can be given prompt screening and timely referral. Prompt screening & Early identification of true cases and prompt management especially with thrombolytic and aspirins with timely referral in "GOLDEN HOUR'' is of utmost important to prevent permanent heart damage and thereby deaths. Ahmedabad contributes average 25% of all state CVD cases attended by an emergency health service - 108 EMRI.

Portable, hand-held ECG machines are evaluated for its use for screening of cardiac abnormalities in primary care settings in various high-risk population. It was found be cost and clinically effective strategy of screening in patients of atrial fibrillation and aged population (>70 years) as it significantly reduces risk of stroke and any other cardiac event.[3]

Economic evaluation studies have been undertaken for the use of ECG mainly for screening of atrial fibrillation in various parts of the world. Studies reported that opportunistic screening for atrial fibrillation in primary care has potential to be cost-effective.[4,5] However, the competency of primary care practitioners and nurses for interpreting the ECG readings needs to be considered for implementing such screening program. Begg et al., 2016 in their study suggested that primary care practitioners were less experienced and less confident with ECGinterpretation than cardiologists, and requiresupport in this area.[6] In cases with limited capabilities, solutions such as telemedicine should be thought-out. Tele cardiology, by bringing expert ECG interpretationto primary care, has the potential to save time, money and lives. It empowers primary care practitioners, providing arobust diagnostic tool to facilitate the managementof cardiac patients in the community. Both physiciansand patients benefit in terms of ease of access,speed of diagnosis, efficiency of management andthe freeing up of resources.[7]

Usage of portable ECG facility in various forms such as single led, 12 led hand held instruments has been studied by many for effective management and early identification of cardiac abnormalities in various health care settings.[3,8,9]

Current Scenario

- ECG facility is available only in Medical Colleges (MC), District Hospitals (DH) and Sub-District Hospitals (SDH) & Community Health Centers (CHC) in government.
- Primary Health Centers (PHC) are not equipped with ECG facility
- Ahmedabad District in Gujarat initiated a pilot project to equip all its PHCs with ECG facility – first time in Gujarat.

Project Lifeline

ECG Device and Beneficiaries

Figure 1: ECG Device used in Project Lifeline

The 12-Lead Digital ECG is compact A4 size resting electrocardiograph system perfect as m-health applications because it makes patient diagnostic information more readily available for both the clinician and remote consulting physician using an app. With automatic ECG measurements and flexible on-screen reporting functions, this digital ECG enables clinicians to spend less time documenting and more time collaborating with the physician reviewing the results. The device has 5" Colour Thin Film Transistor (TFT) and display enables reviewing of the report and also it has inbuilt PDF convertor which facilitate transfer of ECG from the device to USB in PDF format Interpretation Facility. Various printing formats 12 Lead simultaneous acquisition are available. More than 50 ECG can be carried out on fully charged battery.

All 40 Primary Health Centre of Ahmedabad districts were equipped with 12 Channel Electro Cardiogram machine. Linkage was established with physicians for reading ECG through IT/Web-based interface (WhatsApp/App) for identification and confirmation of Cardiovascular Diseases and provide primary management (with thrombolytic and anti-platelet like Aspirin) coupled with timely referral. Incentives were provided to the private physicians involved in the project for timely ECG reading and guidance.

The Project Lifeline aims to screen all the adults having diabetes, hypertension, cardio-metabolic syndrome, family history of cardiac disease or signs and symptoms suggestive of cardiovascular disease.The purpose of this evaluation study was to assess the appropriateness and feasibility for scale up of Project Lifeline.

Training for Project Lifeline

The PHC Medical Officers across all the 40 PHCs of Ahmedabad district were given one-day training (6 hours) where they were informed of the objectives of Project Lifeline, basic signs and symptoms of cardiovascular disease, identifying abnormalities based on ECG reading. Apart from this they were trained to operate the ECG device from the very basics of switching on the device, assembling its parts, loading ECG strip into the device, placement of 12 leads and how to transmit the readings to the technical experts for the purpose of reporting using mHealth application.The Medical Officers then trained the PHC staff on the same within 2 to 3 days of receipt of ECG device at the PHCs.

Aims and Objectives

Policy Question

Is Project Lifeline cost-effective and feasible for scale up?

Aim

To undertake Health Technology Assessment of Project Lifeline

Objectives

1. Assessing the cost of introducing portable ECG facility at PHC for screening of cardiovascular disease
2. Assess key outcome indicators for measuring intervention impact
3. Estimate cost-effectiveness and budget implications of Project Lifeline

METHODS

The study, aimed to determine the feasibility and cost-effectiveness of Project Lifeline wherein PHCs are equipped with portable ECG technology to identify CVD.

Cost-effectiveness analysis for Project Lifeline was done using decision analytic modelling for high risk adult and symptomatic patients. A decision tree was parameterized on MS-Excel spreadsheet to estimate the incremental cost-effectiveness ratio.

For the purpose of assessing the impact of Project Lifeline, various outcome indicators were measured. Number of patients screened using portable ECG device and number of patients identified with abnormality were derived from the secondary data maintained at District Panchayat, Ahmedabad. We conducted a survey of the patients screened positive for abnormality to document the type of ECG abnormalities and if they were diagnosed for CVD. Table 1 presents details of target groups underwent screening.

	Total	Pregnant Women	High Risk and Symptomatic Adults	Children
Cases Screened	12105	10241	1836	26
Abnormal Cases	208	127	73	10
Cases underwent any treatment (medical management and angiography & medical management)	29	1	20	08

Based on the Systematic Review findings, feedback from TAC members and stakeholder consultation, we did not take pregnant women and children for modelling.

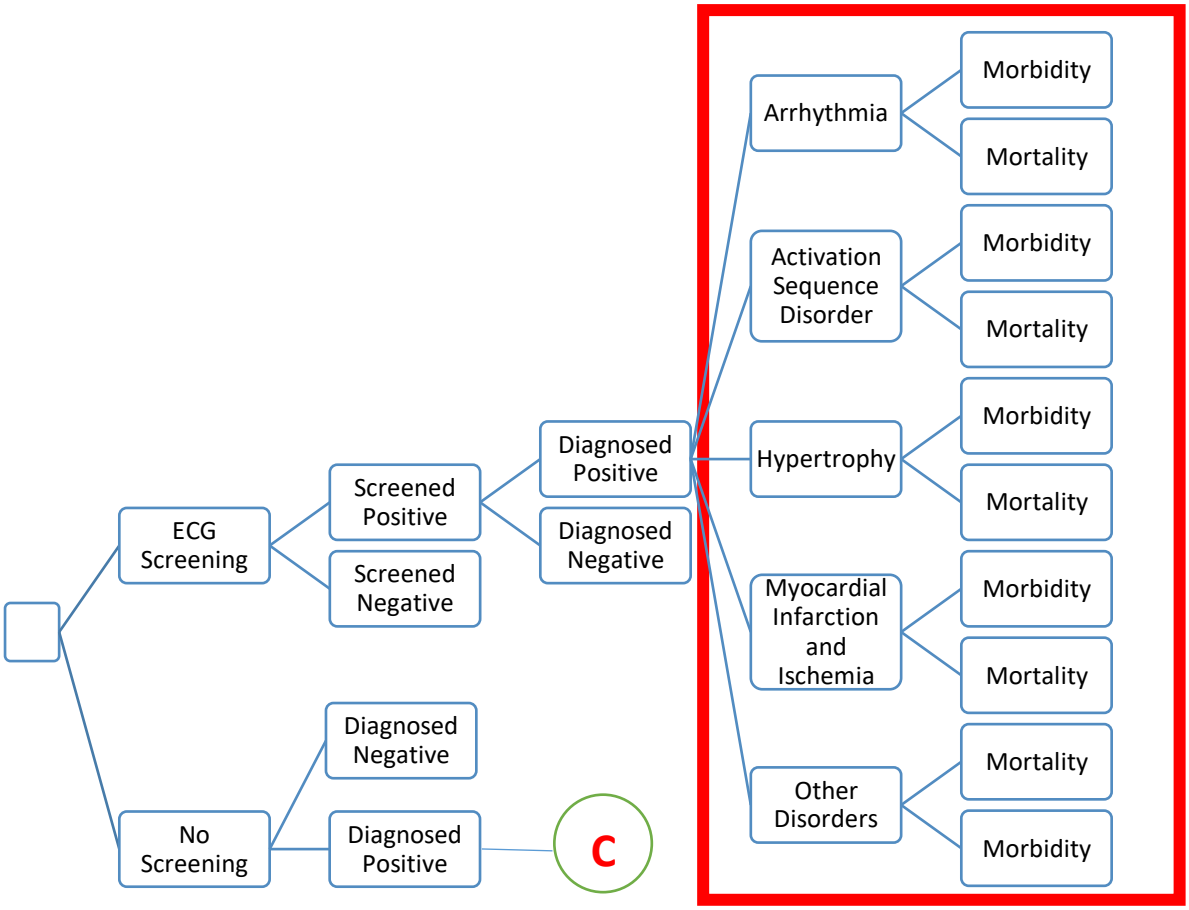
The type of ECG abnormalities identified during screening were categorised into five major disorders based on the primary data and opinion from the practitioners. The table below shows various ECG abnormalities found in our primary data and their categorization in various disorders. The five cardiovascular disorder reported in the high-risk adults mentioned in the table 2 were considered for building the decision tree model.

Table 2: Categorization of ECG abnormalities based on expert opinion

Cardiovascular Disorders	ECG Abnormalities
Arrhythmia	➢ Supraventricular Arrhythmia ➢ Ventricular Arrhythmia
Action Sequence Conduction Defect	➢ Atrioventricular Conduction Defect (Block) ➢ Bundle Branch Block
Increase in wall thickness or size of Atria or Ventricles	➢ Atrial Hypertrophy ➢ Ventricular Hypertrophy
Myocardial Ischemia	➢ Myocardial Ischemia or Infarction
Others	➢ Valvular Issues

The model structure of decision-tree model is as shown in the figure below

Figure 2: Decision Tree for High Risk Population



For cost-effectiveness analysis, the data on cost and transition probabilities were gathered to populate the decision-tree model.

Derivation of Cost Data

The cost-effectiveness analysis was done using societal perspective. Hence, both the program cost i.e. the cost borne by the health system for implementing Project Lifeline as well as the direct and indirect medical cost incurred by the patients were taken into consideration.

The program cost was estimated under two cost heads i.e., capital cost and annual implementation cost. Capital costs included start-up costs such as ECG equipment and Orientation training cost since the launch of the program. The capital cost including start-up cost was annualized assuming life year of ECG device to be 10 years. Whereas the recurrent costs consist of annual maintenance cost, incentives provided to physicians for interpretation of ECG reading, shared human resource cost and other contingency costs.

In order to estimate the programmatic cost, financial records of District Panchayat, Ahmedabad were used except for shared human resource cost. Time-motion study was undertaken to estimate the shared human resource cost.

Both the recurrent and capital costs were collected and summed up to arrive at total cost. All costs are presented in INR. Costs were converted to constant values and reported as annualized cost in 2018- 2019 price.

In addition to the programmatic cost, the Out-of-pocket expenditure (OOPE) incurred by the patient was estimated using published literature[10]which comprised of cost of medications, transportation cost, wage loss of the patient and the care-taker.

For deriving the cost of treatment, a group of physicians were consulted for their opinion on the line of treatment. The cost of interventions (as suggested by the experts) were taken from Pradhan Mantri Jan Arogya Yojana (PMJAY) Package.[11] Since the cost for undergoing diagnostic test was already included in the PMJAY, we have not added additional diagnostic cost to avoid over-calculation of the treatment cost.

Derivation of data on Transition Probabilities

Transition Probabilities for the intervention arm were derived based on the data collected and the expert opinion sought from various practitioners on indicators mentioned below-

- Total number of high-risk adult and symptomatic patient underwent ECG screening at PHC
- Number of patients screened for abnormality through ECG screening
- Number of patients referred and underwent diagnostic test
- Type of ECG abnormality
- Type of treatment

However, the data on survival rates for each abnormality were derived on applying hazard ratio[12]to the survival rates reported in the published literature for each cardiovascular disorder mentioned in the table 2.

Whereas the transition probabilities in the control arm were derived through systematic search of published literature. Indian data was used for all the transition probabilities except for survival rate of Action Sequence Conduction Defect which was obtained in global context. In addition to this, due to unavailability of disorder specific data on QALY, the cost-effectiveness analysis was done using Life Years saved as an outcome indicator.

For the purpose of estimating Life Years saved, the average age of high-risk adults who underwent the ECG screening was 54.6 years (average age of cohort in intervention arm) as per the collected data while that for the control arm was considered as 57.5 year as mentioned in the CREATE registry.[19]

It was assumed that the loss to follow-up of abnormal cases screened was negligible considering that the patients were highly motivated to seek healthcare for their condition as they themselves came to the PHCs for treatment. In addition to this, PHC Medical Officer were asked to follow-up the cases screened positive for abnormality to ensure they visited higher healthcare centres and have undergone diagnostic tests and were on treatment.

We also conducted one-way sensitivity analysis of various variables in the model to determine the impact of changes on incremental cost-effectiveness ratio. Sensitivity analysis was conducted using upper and lower estimates for mortality and the cost of treatment.

We have also performed the Budget Impact Analysis for nation-wide scale-up. The cost

projections have been made for 1st Year, 2nd Year, 5th Year and 10th year considering the useful life of ECG device to be 10 years. We have not considered OOPE in the Budget Impact Analysis. Additional costs included shared HR and tertiary care cost (diagnostic & management). In contrast to cost-effectiveness analysis, which measures both cost and clinical outcomes without regards to underlying disease prevalence, budget impact models focus exclusively on cost and adjust for the underlying prevalence of disease. Depending on the overall budget, structured plans can be made as to whether the roll-out is made in a single phase or in multiple phases.

FINDINGS

Cost details

Program cost: The table below details the cost incurred towards implementing this program. The cost of ECG machine has been annualized in order to estimate the programmatic cost.

Table 3: Details of the Program cost (2018-19 Prices)

Items	Units	Unit price	Annualized cost (INR)
ECG Machines	40	70,000	4,20,000
Maintenance and Consumables	40	3500	1,40,000
Expert Consultation	12,105	30	3,63,150
Contingency	-	-	75,000
Training	-	-	75,000
Shared HR Cost			6,19,777
Total			**16,92,927**

The time-motion study was used to estimated shared human resource cost. It was found out that an approximate time of 12 minutes of staff nurses was used towards Project Lifeline and its estimated annual cost was 15494.43 INR.

The annualized cost incurred by the program implementers was estimated to be 16.92 lakhs. With this investment, around 12,105 patients were screened. **The calculated cost per cases screened amounted to (INR) 139.85**

Data Used for Populating the Decision Tree Model

The table 3 below shows various costs that were considered for purpose of decision analytic modelling in intervention and control arm.

Table 4: Cost Data used to populate the model for High Risk Population

Parameter	Cost	Calculation
Intervention Arm		
Cost of Screening	139.85	Derived from Primary Data

Cost of Diagnosis	0	Included in PMJAY package
Out-of-pocket Expenditure (OOPE)	63,539	Chauhan & Mukherjee, 2016[10]
Cost of Treating Arrhythmia	1,28,728.85	Cost of Treatment as per PMJAY package data + OOPE + Cost of Screening and Diagnosis
Cost of Treating Action Sequence Defect	3,75,478.85	
Cost of Treating Hypertrophy	1,56,328.85	
Cost of Treating MI	1,73,478.85	
Cost of Treating Other Disorders	70,078.85	
Control Arm		
Cost of Treating Arrhythmia	1,28,589	Cost of Treatment as per PMJAY package data + OOPE+ Cost of Diagnosis
Cost of Treating Action Sequence Defect	3,75,339	
Cost of Treating Hypertrophy	1,56,189	
Cost of Treating MI	1,73,339	
Cost of Treating Other Disorders	69,939	

Table 5: Transition Probabilities used to populate the model for High Risk Population

Transition from	**Transition To**	**Transition Probabilities**	**Reference**
Intervention Arm			
ECG Screening	Screened Positive	0.04	Primary Data
ECG Screening	Screened Negative	0.96	Primary Data
Screened Positive	Diagnosed Positive	0.91	Primary Data
Screened Positive	Diagnosed Negative	0.09	Primary Data
Diagnosed Positive	Arrhythmia	0.158	Primary Data of ECG followed by Expert Opinion
Diagnosed Positive	Action Sequence Disorder	0.211	Primary Data of ECG followed by Expert Opinion
Diagnosed Positive	Hypertrophy	0.316	Primary Data of ECG followed by Expert Opinion

Diagnosed Positive	Myocardial Infarction and Ischemia	0.263	Primary Data of ECG followed by Expert Opinion
Diagnosed Positive	Others	0.053	Primary Data of ECG followed by Expert Opinion
Arrhythmia	Morbidity	0.776	Derived on applying Hazard Ratio on probabilities in the control arm
Arrhythmia	Mortality	0.208	
Action Sequence Disorder	Morbidity	0.955	
Action Sequence Disorder	Mortality	0.040	
Hypertrophy	Morbidity	0.886	
Hypertrophy	Mortality	0.104	
Myocardial Infarction and Ischemia	Morbidity	0.898	
Myocardial Infarction and Ischemia	Mortality	0.092	
Other Disorders	Morbidity	0.999	
Other Disorders	Mortality	0.001	
Control Arm			
No ECG Screening	Diagnosed Positive	0.1	Chauhan & Aeri,2013[13]
No ECG Screening	Diagnosed Negative	0.9	
Diagnosed Positive	Arrhythmia	0.3566	Bodhke et al., 2019[14]
Diagnosed Positive	Action Sequence Disorder	0.07	
Diagnosed Positive	Hypertrophy	0.3466	
Diagnosed Positive	Myocardial Infarction and Ischemia	0.1966	
Diagnosed Positive	Others	0.0302	

Arrhythmia	Morbidity	0.786	Sudan et al., 2018[15] (Derived Pmorbidity= 1-Pmortality)
Arrhythmia	Mortality	0.214	Sudan et al., 2018[15]
Action Sequence Disorder	Morbidity	0.959	Hayashi et al., 2016[16] (Derived Pmorbidity= 1-Pmortality)
Action Sequence Disorder	Mortality	0.041	Hayashi et al., 2016[16]
Hypertrophy	Morbidity	0.893	Bahl A, 2013[17] (Derived Pmorbidity= 1-Pmortality)
Hypertrophy	Mortality	0.107	Bahl A, 2013[17]
Myocardial Infarction and Ischemia	Morbidity	0.905	Sharma & Bhatt, 2018[18] (Derived Pmorbidity= 1-Pmortality)
Myocardial Infarction and Ischemia	Mortality	0.095	Sharma & Bhatt, 2018[18]
Other Disorders	Morbidity	0.999	(Derived Pmorbidity= 1-Pmortality)
Other Disorders	Mortality	0.001	Derived (Pother = 1-(Parrhythmia+ Pconduction defect+ Phypertrophy + Pmyocardial ischemia)
Hazard Ratio		0.97	Lindekleiv et al., 2013

Cost-effectiveness Analysis

Cost-effective analysis for the use of ECG screening device at primary care setting was done based using the decision tree model structure as shown in figure 2.

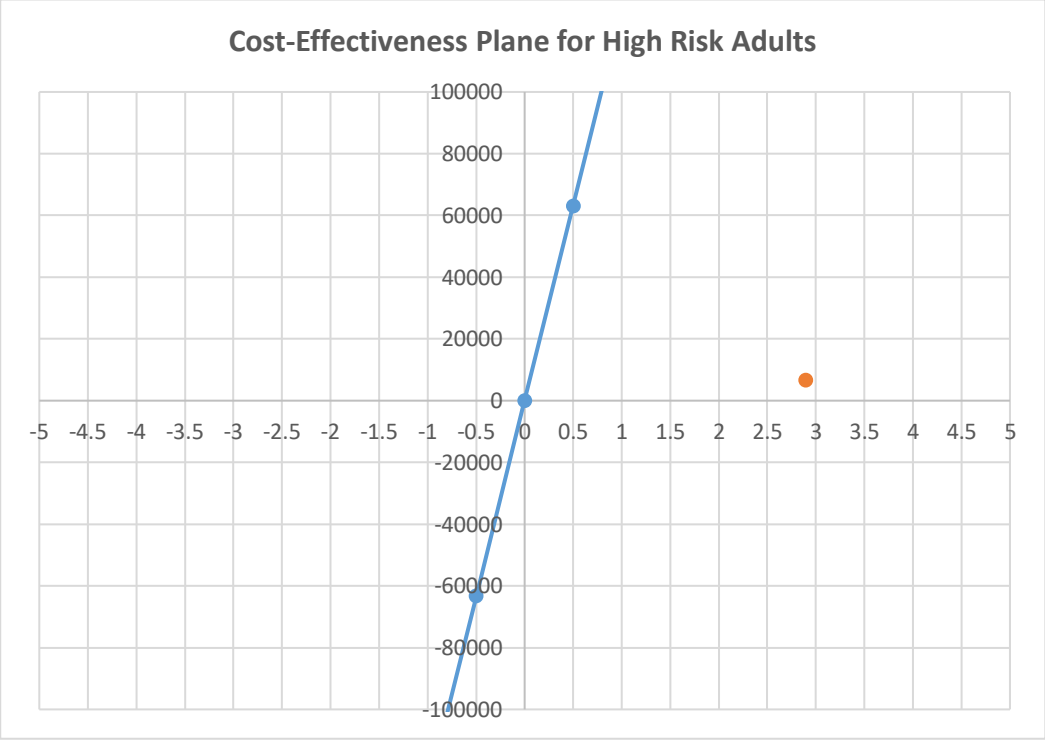
The results of Cost-effectiveness analysis are shown in table 6 and CE Plane in figure 3 shows the ICER in relation to the Cost-effectiveness threshold.

Table 6: Incremental Cost-Effectiveness Ratio (ICER) for ECG screening in High Risk Population

	Life Years Saved (LYS)	Costs
ECG Screening	14	7183.64
No ECG Screening	11	526.16
ICER	**2299.06**	

The ECG screening intervention in primary care has proved to be extremely cost-effective for high risk adult and symptomatic population resulting in saving of around 2.90 life-years at an incremental cost of approximately 6657.47

Figure 4: Cost-effectiveness Plane

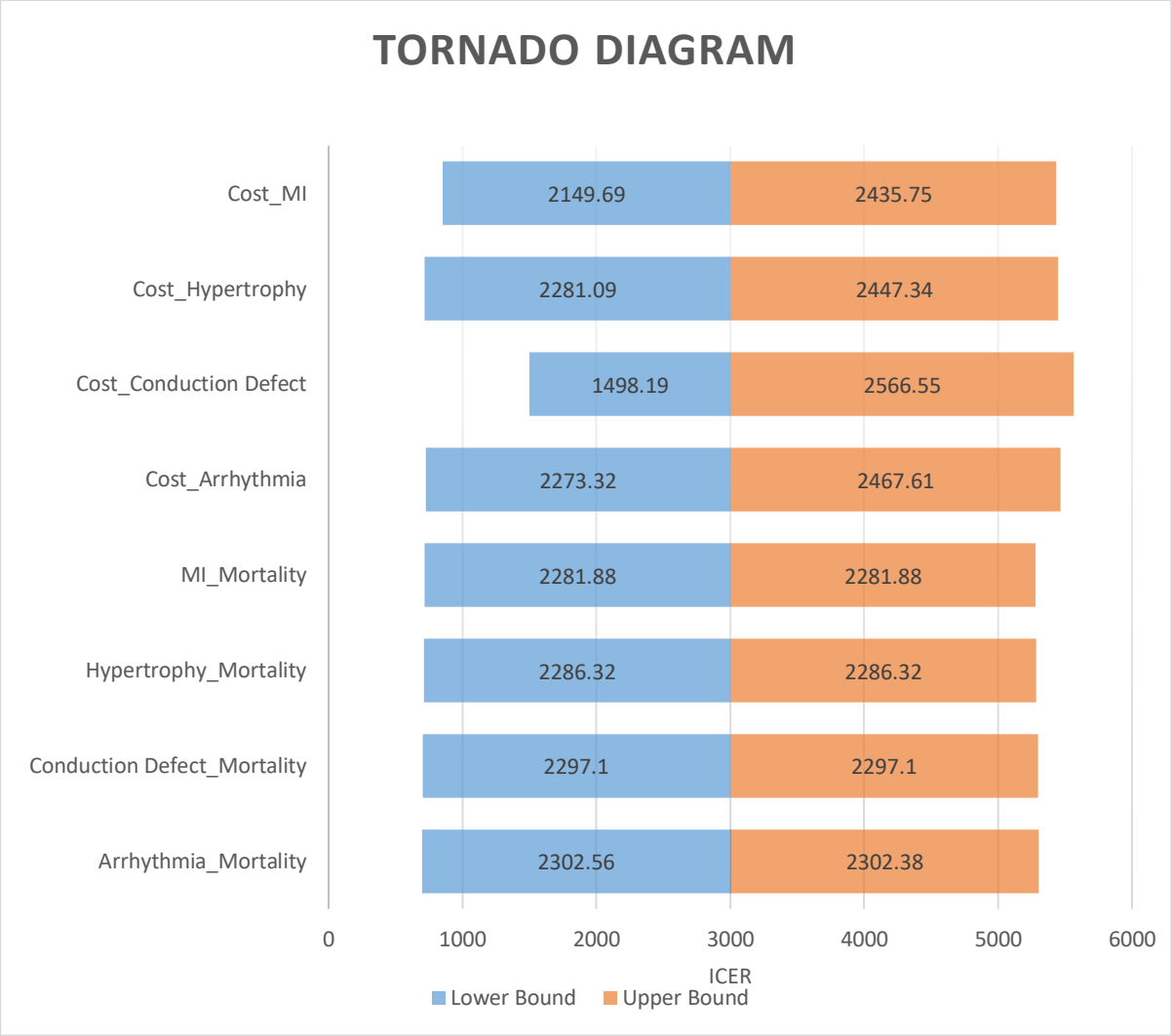


It is depicted in the figure above that ICER (orange dot) lies in the first quadrant as incremental cost of INR 6657.47 is incurred for saving 2.9 incremental life years.

One-Way Sensitivity Analysis

The results of One-Way Sensitivity Analysis are shown in the Tornado Diagram below

Figure 5: Tornado Diagram



Tornado graph showing results of one-way sensitivity analysis derived from probabilistic method. These figures indicating parameters which have the largest effect on ICER when they are varied individually.

Budget Impact Analysis

Budget Impact Analysis (BIA) have been performed to estimate the cost for roll-out of Project Lifeline at District, State and National levels.

The BIA has been performed at 2020 Prices.

Table 7: Budget Implication

Sr. No.	Budget Head	Items	Unit Definition	Units	Unit price	Cost at 1st year	Cost at 2nd Year	Cost at 5th Year	Cost at 10th Year
District Level (2020 Prices)									
A	Capital Cost	ECG Machines	PHC	40	79,000	31,60,000	-	-	-
		Training	District	1	84,647	84,647	-	46,082	-
Total (A)						**32,44,647**	**-**	**46,082**	**-**
B	Recurrent Cost	Maintenance and Consumables	PHC	40	3,950	1,58,000	1,61,397	1,72,033	1,95,452
		Expert Consultation	Individuals	73	34	2,482	2,535	2,702	3,070
		Contingency	District	1	84,647	84,647	86,467	92,165	1,04,712
		Human Resource Cost	District	1	6,99,495	6,99,495	7,14,534	7,61,620	8,65,303
		Additional Cost at Tertiary Care (Including Diagnosis and Management	Individuals	67	6,720	4,50,219	4,59,899	4,90,205	5,56,939
Total (B)						**13,94,843**	**14,24,832**	**15,18,724**	**17,25,476**
Grand Total						**46,39,490**	**14,24,832**	**15,64,806**	**17,25,476**

State Level (2020 Prices)									
A	Capital Cost	ECG Machines	PHC	1,474	79,000	11,64,46,000	-	-	-
		Training	District	33	84,647	27,93,351	-	15,20,719	-
Total (A)						**11,92,39,351**	**-**	**15,20,719**	**-**
B	Recurrent Cost	Maintenance and Consumables	PHC	1,474	3,950	58,22,300	59,47,479	63,39,399	72,02,417
		Expert Consultation	Individuals	706	34	24,004	24,520	26,136	29,694
		Contingency	District	33	84,647	27,93,351	28,53,408	30,41,438	34,55,487
		Human Resource Cost	District	33	6,99,495	2,30,83,335	2,35,79,627	2,51,33,446	2,85,55,007
		Additional Cost at Tertiary Care (Including Diagnosis and Management	Individuals	642	6,720	43,15,104	44,07,879	46,98,343	53,37,956
Total (B)						**3,60,38,094**	**3,68,12,913**	**3,92,38,762**	**4,45,80,561**
Grand Total						**15,52,77,445**	**3,68,12,913**	**4,07,59,481**	**4,45,80,561**
National Level (2020 Prices)									
A	Capital Cost	ECG Machines	PHC	24,049	79,000	1,89,98,71,000	-	-	-
		Training	District	720	84,647	6,09,45,840	-	3,31,79,326	-
Total (A)						**1,96,08,16,840**	**-**	**3,31,79,326**	**-**

B	Recurrent Cost	Maintenance and Consumables	PHC	24,049	3,950	9,49,93,550	9,70,35,911	10,34,30,257	11,75,10,812
		Expert Consultation	Individuals	14,017	34	4,76,578	4,86,824	5,18,905	5,89,546
		Contingency	District	720	84,647	6,09,45,840	6,22,56,176	6,63,58,651	7,53,92,436
		Human Resource Cost	District	720	6,99,495	50,36,36,400	51,44,64,583	54,83,66,095	62,30,18,325
		Additional Cost at Tertiary Care (Including Diagnosis and Management	Individuals	12,755	6,720	8,57,16,307	8,75,59,208	9,33,29,069	10,60,34,492
Total (B)						**74,57,68,675**	**76,18,02,702**	**81,20,02,977**	**92,25,45,611**
Grand Total						**2,70,65,85,515**	**76,18,02,702**	**84,51,82,302**	**92,25,45,611**

The Budget Impact Analysis depicts budget allocation for 1st year, 2nd year, 5th year and 10th year. The budget of 1st year is on the higher side as compared to the rest of the years as major capital investment is required in the first year of program scale-up. The budget for 2nd, 5th, and 10th year depicts the annual implementation cost that will be incurred. In addition, the budget of 5th year is estimated by taking into account the need for short orientation training to the health workers.

The state-wide scale up cost across 1474 PHCs in 33 districts of Gujarat for Project Lifeline is estimated to be around 15.52Crores while nation-wide scale up cost was calculated for 24029 PHCs (2012 data) and 720 districts. This budget is calculated by projecting the annualized cost of implementing Project Lifeline in Ahmedabad district.

DISCUSSION

Opportunities to screen coronary heart disease and its risk factors are missed at primary healthcare level.[20] Project Lifeline primarily addresses this concern and screens all the high risk cases for cardiac abnormalities in primary care setting.

Evidence on effectiveness of ECG technology for screening in primary care settings in developing countries are limited. Present study validates the evidence on the cost-effectiveness of ECG screening in primary care setting in Indian context when individuals at high risk of developing CVD undergo screening. To address the limited capabilities of primary care practitioners for interpreting ECG readings, expert consultation using mHealth application through cardiologist for confirming the interpretation was imbibed in the project. The study used decision tree modelling for assessing cost-effectiveness of the Project Lifeline high-risk adult and symptomatic population.

The cost-effectiveness analysis shows that the ICER lies in the 1st quadrant of CE plane which suggests, additional cost of 2299.06 INR is incurred for saving 1 additional life-year saved suggesting the intervention to be potentially acceptable.

Apart from that, it is assumed that with early screening and identification of cardiac abnormality, there may be initial spurt in the case-load at referral health care centres for seeking care but it may eventually lead to reduced burden due to timely management of cases.

Thus, active screening of high-risk population with ECG can be a clinical and cost-effective strategy. In population being characterized at high-risk, active screening through ECG can be an effective strategy.[4,21,22]

Limitations

For assessing the cost-effectiveness, there were several data gaps in terms of disorder specific data on QALY, OOPE and data on line of treatment in Indian context. Thus cost-effectiveness analysis was performed using Life Years saved as an outcome measure. Considering the project is not matured enough, we could not do follow-up of patients after treatment. Thus, long-term consequences could not be studied and decision analytic modelling was considered appropriate for modelling. The OOPE for CVD in general was considered for modelling. In addition to this, data gap in terms disorder specific management such as line of treatment for Arrhythmia, Action

Sequence Conduction Defect, increase in wall thickness of atria and ventricle, myocardial ischemia, and others disorders was sought by consulting a group of experts. More research is recommended for addressing these limitations in future.

CONCLUSION

Cost-effectiveness analysis clearly shows that the facility to screen cardiac abnormality at PHC level is found to be cost-effective of ICER **2299.06 INR** which is below the GDP per capita of India. The screening facility at primary health care level may lead to early identification of the disease and result in prompt management.

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