Policy Brief

A comprehensive HTA of Project Lifeline – A portable ECG facility at PHCs of Ahmedabad district of Gujarat

Summary

Background: Ahmedabad Zilla Panchayat, Gujarat introduced Project Lifeline, 12-lead portable ECG devices across all Primary Health Centres (PHC) in the district for the screening of cardiac abnormalities among high-risk and symptomatic adults for providing primary management and proper timely referral. Objective of the study was to assess the cost-effectiveness of portable ECG for the screening of Cardiovascular Disease (CVD) among high-risk and symptomatic adults at Primary Health Centre in Ahmedabad, Gujarat.

Methods: Cost-effective analysis was conducted using a societal perspective. An incremental costing approach was adapted and cost-effectiveness analysis was done using decision-analytic model. We surveyed seventy-three patients who were screened positive for cardiac abnormality, to document the type of ECG abnormalities and if they were diagnosed for CVD. The program cost was obtained from the implementers. 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.

Results: Introduction of ECG screening at PHCs saved 2.90 life years at an incremental cost of 89.97 USD (6,657.47 INR), yielding a cost-effectiveness ratio of 31.07 USD (2,299.06 INR) per life-year saved which is below the willingness to pay threshold. Results are sensitive to the relative risk reduction associated with non-participation and the cost of initial screening.

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

Policy recommendations

At an additional cost of Rs. 2,299 for saving an additional life year, the ECG screening facility at primary health centres for high risk group is cost-effective and acceptable for replication in other districts and states. Further, the initiative can be linked with existing e-Sanjeevani (telemedicine) program which allow the utilization of physician available on e-Sanjeevani platform.

INTRODUCTION

Cardiovascular diseases (CVD) progress silently. There are requirement of specific expertise for early diagnosis and referral of the disease at primary health care level. In Gujarat, primary health centres (PHCs) are not yet equipped with these facilities. With an aim to screen all the high-risk and symptomatic adults, the District Health Team at Zilla Panchayat Ahmedabad, Gujarat introduced a 12-lead portable ECG machine across 40 PHCs in the district for the first time in the State. Linkage was established with a medicine specialist for reading ECG through a web-based interface for identification and confirmation of Cardiovascular Diseases and provides primary management (with thrombolytic and anti-platelet like Aspirin) coupled with timely referral.

Figure 1: ECG Device used in Project Lifeline

The objective of the present study was to assess cost-effectiveness introducing portable ECG facility at PHCs for the screening of cardiovascular disease among high risk and symptomatic adults and estimate budgetary implications for the scale-up of the ECG facility.

METHODS

Cost-effectiveness analysis was done using decision-analytic modelling with a societal perspective on health care costs and benefits. The target population for the study were high-risk and symptomatic adults which included adults having diabetes, hypertension, cardio-metabolic syndrome, family history of cardiac disease or signs and symptoms suggestive of cardiovascular disease. Intervention scenario viz. screening of population with portable ECG machine for early detection of cardiac abnormalities at PHC, was compared with no intervention scenario/ routine care scenario. Early diagnosis, prompt treatment of CVD, and life years saved were the outcome measures.

The type of ECG abnormalities identified during screening were categorised into five major disorders based on the primary data and expert opinion of the practitioners. The five cardiovascular disorder reported in the high-risk adults mentioned in the table 1 were considered for building the decision tree model. Data of 12,105 individuals screened for CVD using portable ECG device during 2018-19 were assessed. Of this, 208 individuals were screened with abnormality were selected from the database maintained at Zilla Panchayat, Ahmedabad.

Of the 208 patients screened positive, 73 were high risk symptomatic adults. Further follow-up of 73 high risk symptomatic adults led to 54 individuals who were diagnosed positive for CVD.

Table 1: 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	• Atrial Hypertrophy • Ventricular
Atria or Ventricles	Hypertrophy
Myocardial Ischemia	• Myocardial Ischemia or Infarction
Others	• Valvular Issues

Cost data

Both the program cost i.e. the cost borne by the health system for implementing ECG program as well as the direct and indirect medical cost incurred by the patients were taken into consideration. All costs were reported in Indian Rupees and USD at 74 INR per dollar.

For deriving the cost of treatment, 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.[1] 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.

Clinical outcome

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. Three experts included two prominent Cardiologists from Gujarat and one community medicine expert from Maharashtra with substantive experience in the subject. We used following indicators for calculating transition probabilities:

1. Total number of high-risk and symptomatic adults underwent ECG screening at PHC
2. Number of patients referred and underwent diagnostic test
3. Type of ECG abnormality
4. Type of treatment

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

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 (LYs) 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 i.e., average age of cohort in intervention arm. From literature we found in usual condition mean average age is 57.5 years as mentioned in the CREATE registry.[3] The ECG screening programme resulted in people getting diagnosed on an average 2.9 years in advance.

Budget Impact Analysis was performed to estimate the cost for scaling up of the ECG program at the District, State and National levels at 2020 prices. The Budget Impact Analysis depicted the allocation of budget for 1st year, 2nd year, 5th year and 10th year.

RESULTS

We surveyed seventy-three patients who screened positive for abnormality, to document the type of ECG abnormalities as well as if their further diagnosis was CVD.

Program cost

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. The time-motion study was used to estimate shared human resource costs. It was found that an approximate time of 12 minutes of staff nurses was used towards the ECG program and its estimated annual cost was 209.38 USD (15494.43 INR).

Cost-effectiveness Analysis

The cost of intervention arm was 97.07 USD (7,183.64 INR) with 14 life years saved, while the cost incurred in the comparator arm (routine care scenario) was 7.11 USD (526.16 INR) for 11 life-years saved. The ECG screening intervention in primary care has proved itself to be extremely cost-effective for high risk adult and symptomatic population resulting in saving of around 2.896 life-years at an incremental cost of approximately 89.97 USD (6657.47 INR) with ICER of 31.07 USD (2299.06 INR) per life-year saved.

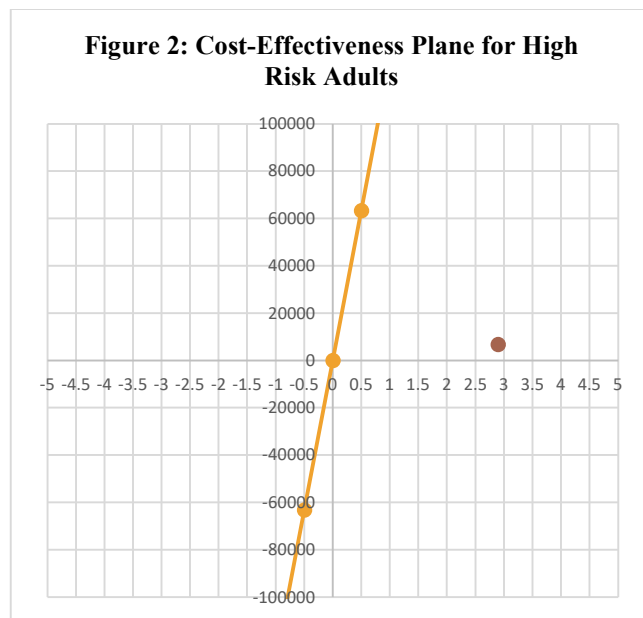**Figure 2: Cost-Effectiveness Plane for High Risk Adults**

Figure 2 depicts the Cost-effectiveness plane with ICER (orange dot) lying in the first quadrant as incremental cost of 89.97 USD is incurred for saving 2.9 incremental life years. The intervention is found to be cost-effective as the ICER lies well below the CE Plane or willingness to pay threshold which is fixed at GDP per capita. The intervention is considered cost-effective. The One-Way Sensitivity Analysis indicate that parameters have the largest effect on ICER when they are varied individually.

Budget Impact Analysis (BIA)

While performing BIA, the budget of 1st year incorporated major capital investment required in the first year of program scale-up. The budget for 2nd, 5th, and 10th year depicted the incurred annual implementation cost. In addition, the budget of 5th year was estimated by taking into account the need for short refresher training to the health workers.

The state-wide scale up cost across 1,474 PHCs in 33 districts of Gujarat for the ECG programme is estimated to be around INR 155.2 million for the first year while nation-wide scale up cost was calculated for 24,029 PHCs across 720 districts was INR 2,706 million in the first year. This budget was calculated by projecting the annualized cost of implementing in Ahmedabad district.

CONCLUSION

The ECG screening facility at primary health care level for high risk group is cost effective and can be replicable in other districts and states. It can be linked with program which allow the utilization of physician available on e-Sanjeevani platform.

A standardized risk-stratification tool (such as Framingham risk score or CBAC) may assist in identifying high-risk population and only those identified for high risk should be subjected to ECG. screening. Further, cost data should be validated on larger cohort on prospective manner.

References

1. Ayushman Bharat. Pradhan Mantri Jan Arogya Yojana Health Benefit Package. Available at https://pmjay.gov.in/sites/default/files/2020-01/HBP_2.0-For_Website_V2.pdf

2. Lindekleiv H, Løchen ML, Mathiesen EB, Njølstad I, Wilsgaard T, Schirmer H. Echocardiographic screening of the general population and long-term survival: a randomized clinical study. JAMA internal medicine. 2013 Sep 23;173(17):1592-8.

3. Xavier D, Pais P, Devereaux PJ, Xie C, Prabhakaran D, Reddy KS, Gupta R, Joshi P, Kerkar P, Thanikachalam S, Haridas KK. Treatment and outcomes of acute coronary syndromes in India (CREATE): a prospective analysis of registry data. The Lancet. 2008 Apr 26;371(9622):1435-42.