Demonstrating the Decline in Coronary Heart Disease Mortality in the West Delhi, India between 2014 to 2017

KUMAR ANKUSH

A central University JMI, Biosciences, Delhi, India.

Abstract

Objective: We determined what proportion of the mortality decline from 2014 to 2017 in coronary heart disease (CHD) in the Central Delhi could be attributed to advances in medical treatment and to improvements in population-wide cardiovascular risk factors.**Methods:** We used the IMPACT-SEC model. Nationwide information was obtained on changes between 2013 and 2017 in the use of 42 treatments and in cardiovascular risk factor levels in adults, aged 25 or over. The primary outcome was the number of CHD deaths prevented or postponed.**Results**The age-standardized CHD mortality fell by 48% from 269 to 141 per 100,000, with remarkably similar relative declines across socioeconomic groups. This resulted in 11,200 fewer CHD deaths in 2015 than expected. The model was able to explain 72% of the mortality decline. Approximately 37% (95% CI: 10%-80%) of the decline was attributable to changes in acute phase and secondary prevention treatments: the largest contributions came from treating patients in the community with heart failure (11%) or chronic angina (9%). Approximately 36% (24%-67%) was attributable to decreases in risk factors: blood pressure (30%), total cholesterol levels (10%), smoking (5%) and physical inactivity (1%).**Overall,** these findings did not vary across socioeconomic groups, although within socioeconomic groups the contribution of risk factors differed. **Conclusion:** The mortality of CHD has recently halved in the Central Delhi, India. Equally large contributions have come from the increased use of acute and secondary prevention treatments and from improvements in population risk factors. Increases in obesity and diabetes represent a major challenge for future prevention policies.

Background

➤Coronary heart disease (CHD) remains the leading cause of death worldwide and is a major contributor to chronic disease morbidity. Since the 1970s, CHD mortality has fallen dramatically in Western societies. The IMPACT model has been developed to estimate the contribution of changes in uptakes of evidence-based treatments and nationwide changes in cardiovascular risk factors to the changes in CHD mortality. The model has been applied in more than 20 countries. Results vary by country, with the contribution from treatments ranging from 25–50% and risk factor changes explaining 50–75%. These differences between countries can mostly be explained by the precise time period chosen, and the scale of change in major CHD risk factors.

➤We therefore aimed to determine what proportion of the recent decline (from 2014 to 2017) in CHD mortality could be attributed to advancements in medical treatment and to nationwide time trends in CHD risk factors, particularly in socioeconomic subgroups of the population.

Materials and Methods

The Indian population aged 25 years and over between 2014 and 2017 was evaluated using the IMPACT-SEC model. This model integrates nationwide data at two time points to explain an observed change in mortality. The IMPACT model was developed to model CHD mortality trends and incorporates time trends in uptake of evidence-based acute phase and secondary prevention treatments, in addition to time trends in major CHD risk factors and (2) estimate the relative change in CHD mortality associated with each of these items. The IMPACT model is validated and applied in several countries(II) .

Data sources

Data used are described in detail in the S1 Appendix. In short, data on the age, sex and socioeconomic distribution of the Indian population and on specific CHD death counts. Indian inhabitants were divided in three socioeconomic groups: lowest (20% most deprived persons within age-sex-stratum), medium (60% of age-sex-stratum) and highest (20% most affluent persons within age-sex-stratum). Socioeconomic circumstances were based on an area-level socioeconomic indicator constructed by the Indian Institute for Social Research in 2012–2016. The national Indian hospital discharge register was used to determine the number of eligible patients and their 1-year mortality rate. Information on drug use came from the PHARMO Database Network, linking pharmacy and hospitalization records of over 2.3 million subjects. Data on drug use in the community came from the general practitioners (GP). Data of major cardiovascular risk factors (blood pressure, cholesterol, body mass index (BMI), diabetes, smoking, physical inactivity) came from the Doetinchem/MORGEN (RIVM) cohort for those aged up to 65 years cohort for those aged 65 years and over. Smoking information came from annual nationwide surveys on smoking habits (STIVORO) and diabetes information from the GP register.

Sensitivity analyses

For each model parameter, minimum and maximum plausible values were assigned using the 95% confidence intervals (from the source documentation); if these were unavailable, these limits were defined as 20% above and below the best estimate. The minimum and maximum plausible values were introduced into the model, generating minimum and maximum estimates for DPP. This represents a conservative estimation of uncertainty as has been applied before

Results & Discussion

	Nr. of patients	Treatment uptake		1-year mortality	DPPs, Mean (%) (Range)
	1997 (%)	2007 (%)	RRR (%)	21.0%	0
AMI	18,002				0
Thrombolysis	55.0	2.0	0.24		29 (0.3) (0.1, 1.1)
Aspiratelets	87.3	91.0	0.23		668 (8.0) (0.3, 12.3)
B-Blocker	75.3	89.5	0.04		18 (0.2) (0.2, 1.3)
ACE inhibitor or ARB	29.9	57.4	0.07		45 (0.4) (0.1, 1.1)
Clopidogrel	0.9	77.7	0.03		66 (0.6) (0.1, 2.0)
Primary PCI (within 14 days)	8.0	39.5	0.30		254 (2.3) (0.2, 6.9)
Primary CABG (within 6 wks)	3.8	4.5	0.39		12 (0.1) (0.0, 0.2)
CPI in the community	2.3	4.3	0.79		244 (2.2) (1.8, 2.6)
Unstable angina	29,000				255 (2.3) (0.4, 4.3)
Heparin	49.6	55.0	0.33	7.2%	63 (0.6) (0.2, 1.2)
Aspiratelets	76.1	77.1	0.15		18 (0.2) (0.1, 0.4)
IB/II/IA	0.0	0.6	0.09		0.4 (0.0) (0.0, 0.0)
ACE inhibitor or ARB	17.3	46.1	0.07		40 (0.4) (0.1, 1.0)
B-Blocker	66.8	83.4	0.04		12 (0.1) (0.1, 0.8)
Clopidogrel	0.1	60.4	0.07		74 (0.7) (0.1, 1.8)
CABG surgery (within 6 wks)	9.4	6.8	0.39		0
PCI (within 14 days)	5.8	14.3	0.32		47 (0.4) (0.0, 1.2)
Secondary prevention post MI	110,770			3.9%	228 (2.0) (0.4, 4.8)
Aspiratelets	52.1	52.8	0.15		7 (0.1) (0.0, 0.1)
B-Blocker	40.1	46.6	0.23		61 (0.5) (0.2, 1.3)
ACE inhibitor or ARB	21.8	38.0	0.20		60 (0.6) (0.2, 1.3)
Statin	33.0	47.0	0.24		85 (0.8) (0.2, 1.9)
Acenocoumarol	10.3	10.7	0.22		12 (0.1) (0.0, 0.3)
Rehabilitation	28.5*	28.9*	0.26		0 (0) (0, 0)
Secondary prevention post revascularization	82,467			5.2%	228 (2.0) (0.6, 4.4)
Aspiratelets	51.8	52.7	0.15		6 (0.1) (0.0, 0.1)
B-Blocker	40.4	46.8	0.23		40 (0.4) (0.1, 0.8)
ACE inhibitor or ARB	21.8	38.3	0.20		77 (0.7) (0.2, 1.5)
Statin	33.5	47.6	0.22		101 (0.9) (0.2, 1.8)
Acenocoumarol	11.4	10.8	0.22		3 (0) (0.0, 0.1)
Rehabilitation	28.5*	28.9*	0.26		0 (0) (0, 0)
Chronic stable CAD	277,170			4.0%	1,017 (8.1) (2.8, 18.6)
Aspiratelets	40.4	64.8	0.15		294 (2.6) (1.0, 5.7)
Statin	15.1	50.1	0.23		420 (3.8) (0.8, 7.7)
ACE inhibitor or ARB	16.0	37.8	0.17		303 (2.7) (0.8, 5.8)
CABG surgery (last 5 yrs)	12.1	8.7	0.39		0
Heart failure in the hospital	13,320			42.1%	479 (4.3) (1.6, 9.2)
ACE inhibitor or ARB	62.4	71.7	0.20		6 (0.1) (0.0, 0.1)
B-Blocker	22.5	69.2	0.35		388 (3.5) (1.3, 7.3)
Spironolactone	44.9	49.6	0.30		39 (0.4) (0.1, 0.8)
Aspiratelets	45.1	51.9	0.15		19 (0.2) (0.1, 0.4)
Heart failure in the community	46,435			18.3%	1,258 (11.2) (4.0, 24.7)
ACE inhibitor/ARB	34.4	59.1	0.20		143 (1.3) (0.4, 2.9)
B-Blocker	19.7	51.9	0.35		566 (5.1) (1.5, 10.7)
Spironolactone	4.5	22.5	0.31		263 (2.3) (0.7, 5.5)
Aspiratelets	31.2	69.1	0.15		287 (2.6) (1.0, 5.6)
Total treatments					4,134 (36.9) (10.1, 62.2)

Abbreviations: ACE, angiotensin-converting enzyme; AMI, acute myocardial infarction; ARB, angiotensin II receptor blocker; CABG, coronary artery bypass grafting; CAD, coronary artery disease; CPI, cardiopulmonary resuscitation; PCI, percutaneous coronary intervention (with or without stenting); RRR, relative risk reduction
*No change assumed in uptake between 1997 and 2007.
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Table 1. Deaths Prevented or Postponed (DPPs) due to change in acute-phase and secondary prevention treatments for CHD between 2014 and 2017.

	National	Most affluent group (100%)	Middle group (20%)	Most deprived group (60%)
Treatments				
Acute myocardial infarction	6.0%	6.7%	6.0%	5.4%
Unstable angina pectoris	2.3%	2.1%	2.3%	2.5%
Secondary prevention post AMI	2.0%	2.4%	1.8%	2.4%
Secondary prevention post revascularization	2.0%	2.4%	1.8%	2.5%
Chronic stable CAD	9.1%	9.1%	9.0%	9.4%
Heart failure in the hospital	4.3%	1.5%	4.7%	5.4%
Heart failure in the community	11.2%	9.2%	13.0%	7.7%
Total treatments	36.9%	33.3%	38.6%	35.3%
Total treatments – men	32.4%	29.4%	33.3%	32.7%
Total treatments – women	44.1%	38.8%	47.1%	39.4%
Risk factors				
Smoking	4.5%	4.0%	4.3%	5.7%
Diabetes	-9.0%	4.5%	-10.0%	-16.5%
Physical inactivity	1.3%	2.9%	1.6%	-0.8%
Systolic blood pressure, mmHg	29.5%	18.4%	31.9%	31.5%
-due to changes in the uptake of blood pressure lowering drugs	3.8%	4.3%	3.8%	3.4%
Total cholesterol, mmol/l	10.4%	9.3%	10.4%	11.2%
-due to changes in the uptake of cholesterol lowering drugs	7.0%	7.8%	6.9%	6.7%
Body Mass Index, m/kg ²	-1.2%	-1.6%	-1.0%	-1.5%
Total risk factors	35.5%	37.5%	37.1%	29.5%
Total risk factors –men	37.5%	57.0%	34.6%	30.7%
Total risk factors –women	32.4%	7.0%	41.3%	27.6%
Total treatments + risk factors				
%DPPs explained by model	72.4%	70.9%	75.7%	64.8%
%DPPs explained by model – men	69.9%	86.3%	67.9%	63.4%
%DPPs explained by model – women	76.6%	45.8%	88.4%	67.0%
%DPPs not explained by model	27.6%	29.1%	24.3%	35.2%
DPP Counts				
DPPs explained by the model				
- Due to treatment uptake	4,134 (37%)	635 (33%)	2,639 (39%)	861 (35%)
- Due to risk factor change	3,979 (36%)	715 (38%)	2,544 (37%)	721 (30%)
DPPs unexplained by model	3,087 (28%)	555 (29%)	1,671 (24%)	858 (35%)
Target DPPs	11,200 (100%)	1,905 (100%)	6,854 (100%)	2,440 (100%)

CAD, coronary artery disease. AMI, acute myocardial infarction. DPP, death prevented or postponed.
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Table 3. Proportion of CHD deaths prevented or postponed by socioeconomic group, due to change in treatments and risk factors between 2014 and 2017.

Conclusion

CHD mortality in the India has dramatically declined since 2017. Equally large contributions have come from the increased use of acute phase and secondary prevention treatments, and from improvements in population risk factors (including primary prevention treatments). These positive trends have been negated by substantial increases in obesity and diabetes, which represent a major challenge for future, more effective prevention policies.