Annex 19A. Methods, Framework, and Results

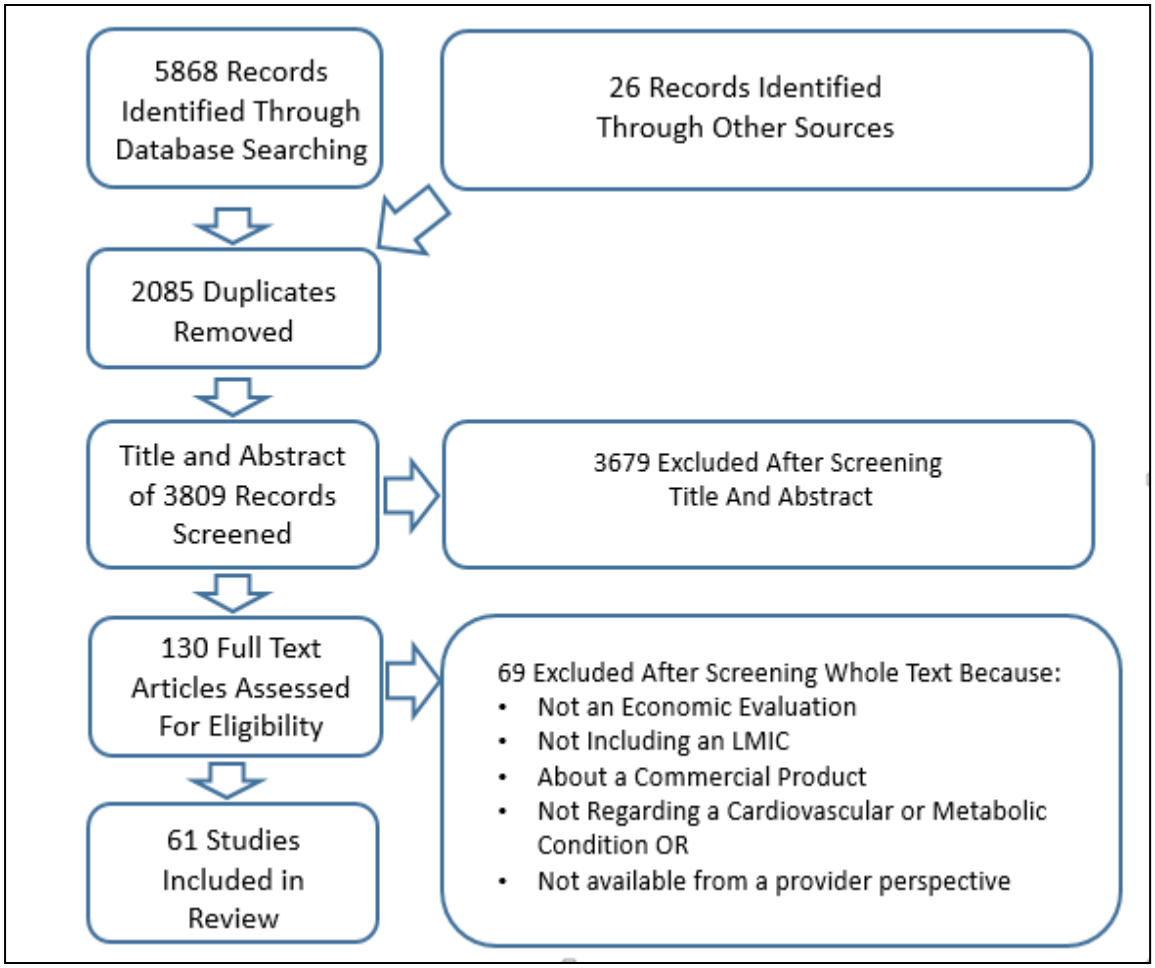
Supplementary material for: Gaziano, T., M. Suhrcke, E. Brouwer, C. Levin, I. Nikolic, and R. Nugent. 2017. "Summary of Costs and Cost-Effectiveness of Interventions and Policies to Prevent and Treat Cardio-Metabolic Diseases." In *Cardiovascular, Respiratory, and Related Disorders* edited by D Prabhakaran, S Anand, TA Gaziano, J-C Mbanya, Y Wu, and R Nugent. Volume 5 of *Disease Control Priorities, third edition.* Washington, DC: World Bank.

A systematic search of English language articles examining the cost-effectiveness of the prevention and treatment of cardiovascular, respiratory, renal, and endocrine disorders and published between 2000 and 2014 was undertaken using Medline, EMBASE, NHS Economic Evaluation Database (EED), Health Economic Evaluations Database (HEED), and Econlit. The details are presented in table 19A.1, and the process is described in figure 19A.1. The search identified 5,868 studies, of which 61 were included in the review. All cost-effectiveness results are presented in 2012 U.S. dollars, unless noted otherwise. The quality of the economic evaluation studies was assessed using the Drummond Checklist.

Table 19A.1 Details of the Search Strategy

Search No.	Date	Database searched	Hits (before duplicate removal)
1	18/07/2014	Medline (OVID)	1,982
2	26/06/2014	EMBASE (OVID)	3,358
3	27/06/2014	NHS-EED (Cochrane)	156
4	27/06/2014	HEED (Cochrane)	19
5	2706/2014	Econlit (EBscoHost)	353
FINAL NUMBER OF REFERENCES IN ENDNOTE AFTER DELETING DUPLICATES = 3,809			

Figure 19A.1 PRISMA Flow Diagram



A systematic search was also conducted to identify articles examining the costs of interventions to prevent and treat cardiovascular and related conditions from the provider's perspective. The search identified 3,809 unique articles, of which 130 were retrieved for full-text review. Of these, 61 studies met the criteria for inclusion, presenting approximately 185 unit costs. The majority of articles were excluded after the initial screening because they were duplicates or did not meet basic inclusion criteria.

The available cost data came mainly from Asian countries (41 studies), primarily India and China (14). One-third of the cost data concerned diabetes, which was a considerably higher proportion than any other condition, and two-thirds of those costs were from Asian-based studies. Sub-Saharan Africa, by contrast, produced data mainly regarding stroke and hypertension. Other regions did not produce noteworthy cost trends by condition. Detailed results are presented in table 19A.2.

Table 19A.2 Cost-Effectiveness of Population-Level Health Interventions

Study	Country, region, or territory	Intervention	Cost per outcome	Unit of outcome	Currency (year)	Cost per outcome converted to 2012 US$
Rubinstein and others 2010	Argentina	Population-based health interventions: reducing salt in bread (1 gram of salt per 100 grams of bread)	1,406.93	DALY	Int$ (2007)	1,581.76
Salomon and others 2012	Mexico	Heavy alcohol use intervention: aggressive taxation vs. doing nothing	72.00	DALY	Int$ (2005)	11.18
	Mexico	NCD interventions: ban on advertising	320.00	DALY	Int$ (2005)	49.69
Mason and others 2014	Tunisia	Salt reduction policy vs. doing nothing: health promotion	15,377.00	LY	Int$ (2010)	26,791.75
	Syrian Arab Republic	Salt reduction policy vs. doing nothing: reformulation	5,453.00	LY	Int$ (2010)	21,214.69
	Syrian Arab Republic	Salt reduction policy vs. doing nothing: reformulation and labeling	2,125.00	LY	Int$ (2010)	8,267.23
	Syrian Arab Republic	Salt reduction policy vs. doing nothing: reformulation and health promotion	2,201.00	LY	Int$ (2010)	8,562.91
	Palestine	Salt reduction policy vs. doing nothing: reformulation	132.00	LY	Int$ (2010)	513.54
Rubinstein and others 2009	Argentina	CVD reduction package: reducing the amount of salt in bread	122.68	DALY	Arg$ (2005)	44.79
	Argentina	CVD reduction package: mass media campaign	547.56	DALY	Arg$ (2005)	199.90
Ferrante and others 2012	Argentina	Salt reduction: high-impact salt reduction	0.01	QALY	US$ (2012)	0.01
	Argentina	Salt reduction: low-impact salt reduction	0.01	QALY	US$ (2012)	0.01
Murray and others 2003	South-East Asia	Legislation to lower salt content in processed foods and appropriate	19.00	DALY	Int$ (2000)	3.47

Study	Country, region, or territory	Intervention	Cost per outcome	Unit of outcome	Currency (year)	Cost per outcome converted to 2012 US$
		labeling				
	South-East Asia	Legislation to lower salt content in processed foods and appropriate labeling and health education through broadcast and print media focusing on body mass index and cholesterol concentrations	17.00	DALY	Int$ (2000)	3.10
	South-East Asia	Cooperation between government and the food industry for stepwise decrease in salt content of processed foods and for labeling	37.00	DALY	Int$ (2000)	6.75
	Americas	Legislation to lower salt content in processed foods and appropriate labeling	13.00	DALY	Int$ (2000)	2.60
	Americas	Legislation to lower salt content in processed foods and appropriate labeling and health education through broadcast and print media focusing on body mass index and cholesterol concentrations	14.00	DALY	Int$ (2000)	2.80
	Americas	Cooperation between government and the food industry for stepwise decrease in salt content of processed foods and for labeling	24.00	DALY	Int$ (2000)	4.81
	South-East Asia	Health education through broadcast and print media focusing on body mass index and cholesterol concentrations	14.00	DALY	Int$ (2000)	2.55

Study	Country, region, or territory	Intervention	Cost per outcome	Unit of outcome	Currency (year)	Cost per outcome converted to 2012 US$
	Americas	Health education through broadcast and print media focusing on body mass index and cholesterol concentrations	—	DALY	Int$ (2000)	—
Ortegon and others 2012	East Africa and South-East Asia	CVD-1: salt reduction in processed foods via voluntary agreement with industry; CVD-2: salt reduction in processed foods via legislation; CVD-3: health education through mass media	—	DALY	—	—
Cecchini and others 2010	Brazil, China, India, Mexico, Russian Federation, South Africa	Fiscal measures affecting the price of fruits, vegetables, and foods high in fat	Cost saving	DALY	US$ (2005)	Cost saving
	Brazil, China, India, Mexico, Russian Federation, South Africa	Regulation of food advertising to children	556–13,241	DALY	US$ (2005)	653.66–15,566.73
	Brazil, China, India, Mexico, Russian Federation, South Africa	Mandatory food labeling	71–9,962	DALY	US$ (2005)	83.47–11,711.79
Chow, Darley, and Laxminarayan 2007	India	Legislation to limit trans fats in processed foods over 10 years	38	DALY	US$ (2001)	71.1

Note: DALY = disability-adjusted life year; Int$ = international dollar; NCD = noncommunicable disease; LY = life year; CVD = cardiovascular disease; Arg$ = Argentine peso; US$ = U.S. dollar; — = not available.

Table 19A.3 Cost-Effectiveness of Individual-Level Care and Management at Community or Primary Health Centers

Study	Country, region, or territory	Intervention	Cost per outcome	Unit of outcome	Currency (year)	Cost per outcome converted to 2012 US$
Gaziano and others 2005	South Africa	Drug therapy initiation strategies: starting at AR for CVD > 40% compared with no treatment	700.00	QALY	US$ (2001)	1,377.86
	South Africa	Drug therapy initiation strategies: starting at AR for CVD > 30% compared with 40%	1,600.00	QALY	US$ (2001)	3,149.40
	South Africa	Drug therapy initiation strategies: starting at AR for CVD > 20% compared with 30%	4,900.00	QALY	US$ (2001)	9,645.02
	South Africa	Drug therapy initiation strategies: starting at AR for CVD > 15% compared with 20%	11,000.00	QALY	US$ (2001)	21,652.09
Rubinstein and others 2010	Argentina	Individual (clinical) interventions: treatment of high blood pressure (lifestyle change promotion and pharmacological therapy for blood pressure)	2,908.86	DALY	Int$ (2007)	3,270.33
	Argentina	Individual (clinical) interventions: treatment of high cholesterol (promotion of diet and statins)	14,431.46	DALY	Int$ (2007)	16,224.79
	Argentina	Individual (clinical) interventions: treatment based on population absolute risk approach (polypill strategy)	246.45	DALY	Int$ (2007)	277.08
Wang and others 2014	China	Guideline-oriented primary health care hypertension management: primary care practice guideline	24.50	Per patient treated	US$ (2002)	42.93

Study	Country, region, or territory	Intervention	Cost per outcome	Unit of outcome	Currency (year)	Cost per outcome converted to 2012 US$
		training and implementation to reduce blood pressure in primary care patients (urban)				
	China	Guideline-oriented primary health care hypertension management: primary care practice guideline training and implementation to reduce blood pressure in primary care patients (rural)	8.40	Per patient treated	US$ (2002)	14.72
Rubinstein and others 2009	Argentina	CVD reduction package: combined therapy 20% global CV risk	2,929.60	DALY	Arg$ (2005)	1,069.55
	Argentina	CVD reduction package: combined therapy 10% global CV risk	3,329.50	DALY	Arg$ (2005)	1,215.55
	Argentina	CVD reduction package: combined therapy 5% global CV risk	3,670.15	DALY	Arg$ (2005)	1,339.91
	Argentina	CVD reduction package: high-blood-pressure-lowering therapy	6,331.96	DALY	Arg$ (2005)	2,311.70
Gaziano, Opie, and Weinstein 2006	China	CVD prevention: primary (aspirin + calcium-channel blocker + ACEi + statin): primary regimen at AR > 5% (compared with no treatment)	1,214.00	QALY	US$ (2001)	2,111.12
	Turkey	CVD prevention: primary (aspirin + calcium-channel blocker + ACEi + statin): primary regimen at AR > 5% (compared with no treatment)	1,207.00	QALY	US$ (2001)	3,207.97
	Brazil	CVD prevention:	1,219.00	QALY	US$ (2001)	2,936.26

Study	Country, region, or territory	Intervention	Cost per outcome	Unit of outcome	Currency (year)	Cost per outcome converted to 2012 US$
		primary (aspirin + calcium-channel blocker + ACEi + statin): primary regimen at AR > 5% (compared with no treatment)				
	Egypt, Arab Rep.	CVD prevention: primary (aspirin + calcium-channel blocker + ACEi + statin): primary regimen at AR > 5% (compared with no treatment)	1,221.00	QALY	US$ (2001)	2,048.39
	India	CVD prevention: primary (aspirin + calcium-channel blocker + ACEi + statin): primary regimen at AR > 5% (compared with no treatment)	1,039.00	QALY	US$ (2001)	1,944.09
	Nigeria	CVD prevention: primary (aspirin + calcium-channel blocker + ACEi + statin): primary regimen at AR > 5% (compared with no treatment)	1,145.00	QALY	US$ (2001)	2,845.17
Gaziano, Abrahams-Gessel, Denman, and others 2015	South Africa	CHW-led CVD screening with mobile phone app for primary prevention	Cost saving	QALY	US$ (2013)	—
	Mexico	CHW-led CVD screening with mobile phone app for primary prevention	3.57	QALY	US$ (2013)	—
	Guatemala	CHW-led CVD screening with mobile phone app for primary prevention	565.00	QALY	US$ (2013)	—
Gaziano and others 2014	South Africa	Twice-yearly CHW home visits for hypertension education and adherence encouragement (general)	320.00	DALY	US$ (2012)	320.00

Study	Country, region, or territory	Intervention	Cost per outcome	Unit of outcome	Currency (year)	Cost per outcome converted to 2012 US$
	South Africa	Twice-yearly CHW home visits for hypertension education and adherence encouragement (urban setting)	17.00	DALY	US$ (2012)	17.00
	South Africa	Twice-yearly CHW home visits for hypertension education and adherence encouragement (rural setting)	772.00	DALY	US$ (2012)	772.00
	South Africa	Twice-yearly CHW home visits for hypertension education and adherence encouragement (deep rural setting)	1,529.00	DALY	US$ (2012)	1,529.00

Note: CVD = cardiovascular disease; QALY = quality-adjusted life year; US$ = U.S. dollar; AR = absolute risk; DALY = disability-adjusted life year; Int$ = international dollar; CV = cardiovascular; ARG$ = Argentine peso; ACEi = angiotensin-converting enzyme inhibitor; CHW = community health worker; — = not available.

Table 19A.4 Cost-Effectiveness of Individual-Level Care and Management at Primary Health Centers, First-Level Hospitals, or Advanced-Level Hospitals

Study	Country, region, or territory	Intervention	Cost per outcome	Unit of outcome	Currency (year)	Cost per outcome converted to 2012 US$
Rachapelle and others 2013	India	Telemedicine diabetic retinopathy screening in rural area: screening once in a lifetime vs. no screening, provider perspective	1,320.00	QALY	US$ (2009)	1,593.46
	India	Telemedicine diabetic retinopathy screening program in rural area: screening twice in a lifetime vs. no screening, provider perspective	1,343.00	QALY	US$ (2009)	1,621.22
Gaziano and others 2005	East Asia and the Pacific	ACEi vs. no medication for heart failure				
		Hospital access	27	QALY	US$ (2003)	—
		Limited hospital access	Cost saving	QALY	US$ (2003)	—
	Europe and Central Asia	ACEi vs. no medication for heart failure				
		Hospital access	Cost saving	QALY	US$ (2003)	—
		Limited hospital access	30	QALY	US$ (2003)	—
	Latin America and Caribbean	ACEi vs. no medication for heart failure				
		Hospital access	Cost saving	QALY	US$ (2003)	—
		Limited hospital access	31	QALY	US$ (2003)	—
	Middle East and North Africa	ACEi vs. no medication for heart failure				
		Hospital access	Cost saving	QALY	US$ (2003)	—
		Limited hospital access	29	QALY	US$ (2003)	—
	South Asia	ACEi vs. no medication for heart failure				

Study	Country, region, or territory	Intervention	Cost per outcome	Unit of outcome	Currency (year)	Cost per outcome converted to 2012 US$
		Hospital access	Cost saving	QALY	US$ (2003)	—
		Limited hospital access	25	QALY	US$ (2003)	—
	Sub-Saharan Africa	ACEi vs. no medication for heart failure				
		Hospital access	Cost saving	QALY	US$ (2003)	—
		Limited hospital access	25	QALY	US$ (2003)	—
	East Asia and the Pacific	Beta blocker + ACEi vs. no medication for heart failure				
		Hospital access	189	QALY	US$ (2003)	—
		Limited hospital access	274	QALY	US$ (2003)	—
	Europe and Central Asia	Beta blocker + ACEi vs. no medication for heart failure				
		Hospital access	144	QALY	US$ (2003)	—
		Limited hospital access	275	QALY	US$ (2003)	—
	Latin America and Caribbean	Beta blocker + ACEi vs. no medication for heart failure				
		Hospital access	124	QALY	US$ (2003)	—
		Limited hospital access	275	QALY	US$ (2003)	—
	Middle East, North Africa	Beta blocker + ACEi vs. no medication for heart failure				
		Hospital access	128	QALY	US$ (2003)	—
		Limited hospital access	275	QALY	US$ (2003)	—
	South Asia	Beta blocker + ACEi vs. no medication for heart failure				
		Hospital access	219	QALY	US$ (2003)	—
		Limited hospital access	273	QALY	US$ (2003)	—
	Sub-Saharan Africa	Beta blocker + ACEi vs. no medication for heart failure				

Study	Country, region, or territory	Intervention	Cost per outcome	Unit of outcome	Currency (year)	Cost per outcome converted to 2012 US$
		Hospital access	218	QALY	US$ (2003)	—
		Limited hospital access	273	QALY	US$ (2003)	—
Poggio and others 2012	Argentina	CRT: with optimal medical therapy vs. optimal medical therapy alone	34,185.00	QALY	Int$ (2009)	118.93
Bertoldi and others 2013	Brazil	CRT, including biventricular pacemakers: multisite pacing device with CRT capability only and optimal medical therapy vs. optimal medical therapy	17,723.00	QALY	Int$ (2013)	11,460.76
	Brazil	CRT, including biventricular pacemakers: cardioverter- defibrillator device and optimal medical therapy vs. optimal medical therapy alone	32,663.00	QALY	Int$ (2013)	21,121.86
Schulman-Marcus, Prabhakaran, and Gaziano 2010	India	Prehospital ECG by general practitioner vs. no prehospital ECG	12.65	QALY	US$ (2007)	15.67
Wang and others 2014	China	Hospital-based AMI treatment: PCI in tertiary hospitals and thrombolysis with streptokinase in secondary hospitals in patients with STEMI vs. current situation	8,900.00	QALY	US$ (2013)	8,511.71
Gaziano, Opie, and Weinstein 2006	China	CVD secondary prevention: secondary regimen (aspirin + beta blocker + ACEi + statin) vs. no treatment	336.00	QALY	US$ (2001)	584.30
	Turkey	CVD secondary prevention: secondary	365.00	QALY	US$ (2001)	970.10

Study	Country, region, or territory	Intervention	Cost per outcome	Unit of outcome	Currency (year)	Cost per outcome converted to 2012 US$
		regimen (aspirin + beta blocker + ACEi + statin) vs. no treatment				
	Brazil	CVD secondary prevention: secondary regimen (aspirin + beta blocker + ACEi + statin) vs. no treatment	388.00	QALY	US$ (2001)	934.59
	Egypt, Arab Rep.	CVD secondary prevention: secondary regimen (aspirin + beta blocker + ACEi + statin) vs. no treatment	341.00	QALY	US$ (2001)	572.07
	India	CVD secondary prevention: secondary regimen (aspirin + beta blocker + ACEi + statin) vs. no treatment	306.00	QALY	US$ (2001)	572.56
	Nigeria	CVD secondary prevention: secondary regimen (aspirin + beta blocker + ACEi + statin) vs. no treatment	312.00	QALY	US$ (2001)	775.28
Irlam and others 2013	South Africa	Primary prevention of acute rheumatic fever and rheumatic heart disease in children with GAS pharyngitis in urban primary care settings: clinical decision rule 2+ (vs. treating all)	136.00	QALY	US$ (2010)	134.59
Stanciole and others 2012	WHO East Africa	Low-dose inhaled corticosteroids for mild persistent asthma vs. current	2,686.00	DALY	Int$ (2005)	2,320.97
	WHO East Africa	Low-dose inhaled corticosteroids + long-acting beta agonists for moderate to persistent asthma vs. current	5,512.00	DALY	Int$ (2005)	4,762.92
	WHO East Africa	Inhaled bronchodilator for COPD stage II vs. current	12,868.00	DALY	Int$ (2005)	11,119.24

Study	Country, region, or territory	Intervention	Cost per outcome	Unit of outcome	Currency (year)	Cost per outcome converted to 2012 US$
	WHO South-East Asia, subregion D	Low-dose inhaled corticosterois for mild persistent asthma	2,420.00	DALY	Int$ (2005)	1,133.36
	WHO South-East Asia, subregion D	Influenza vaccine vs. current	4,010.00	DALY	Int$ (2005)	1,878.00
	WHO South-East Asia, subregion D	Inhaled bronchodilator for COPD stage II vs. current	11,424.00	DALY	Int$ (2005)	5,350.19
Rodriguez-Martinez, Sossa-Briceno, and Castro-Rodriguez 2013	Colombia	Inhaled steroids for pediatric asthma	19,835.28	QALY	UK£ (2007)	—

Note: QALY = quality-adjusted life year; US$ = U.S. dollars; ACEi = angiotensin-converting enzyme inhibitor; — = not available; CRT = cardiac resynchronization therapy; Int$ = international dollar; ECG = echocardiography; AMI = acute myocardial infarction; PCI = percutaneous coronary interventions; STEMI = ST segment elevation myocardial infarction; CVD = cardiovascular disease; DALY = disability-adjusted life year; GAS = group A streptococcal; WHO = World Health Organization; COPD = chronic obstructive pulmonary disease; UK£ = British pound.

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