A computer-guided quality improvement tool for primary health care: cost-effectiveness analysis based on TORPEDO trial data

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The known: Inadequate evidence-based risk assessment and prescribing of indicated medications in primary health care are major barriers to preventing cardiovascular disease (CVD) in people at high risk. Health information technology could both improve care for people at high risk of CVD and reduce its cost.

The new: The estimated costs of averting one CVD event over five years were $7406 for primary prevention (no prior CVD events) and $17 988 for secondary prevention (patients with established CVD).

The implications: Robust cost-effectiveness analyses can guide primary health networks when considering adopting technology-enabled quality improvement programs.

Abstract

Objective: To assess the cost-effectiveness of a computer-guided quality improvement intervention for primary health care management of cardiovascular disease (CVD) in people at high risk.

Design: Modelled cost-effectiveness analysis of the HealthTracker intervention and usual care for people with high CVD risk, based on TORPEDO trial data on prescribing patterns, changes in intermediate risk factors (low-density lipoprotein cholesterol, systolic blood pressure), and Framingham risk scores.

Participants: Hypothetical population of people with high CVD risk attending primary health care services in a New South Wales primary health network (PHN) of mean size.

Intervention: HealthTracker, integrated into health care provider electronic health record systems, provides real time decision support, risk communication, a clinical audit tool, and a web portal for performance feedback.

Main outcome measures: Incremental cost-effectiveness ratios (ICERs): difference in costs of the intervention and usual care divided by number of CVD events averted with HealthTracker.

Results: The estimated numbers of major CVD events over five years per 1000 patients at high CVD risk were lower in PHNs using HealthTracker, both for patients with prior CVD events (secondary prevention; 259 *v* 267 with usual care) and for those without prior events (primary prevention; 168 *v* 176). Medication costs were higher and hospitalisation costs lower with HealthTracker than with usual care for both primary and secondary prevention. The estimated ICER for one averted CVD event was $7406 for primary prevention and $17 988 for secondary prevention.

Conclusion: Modelled cost-effectiveness analyses provide information that can assist decisions about investing in health care quality improvement interventions. We estimate that HealthTracker could prevent major CVD events for less than $20 000 per event averted.

Trial registration (TORPEDO): Australian New Zealand Clinical Trials Registry, ACTRN 12611000478910.

High quality health systems are a major focus for health care reform in Australia.[1] In July 2015, Medicare Locals were replaced by 31 primary health networks (PHNs) with the aim of improving population health. From 2016–17, PHNs have played a major service commissioning role, working with health service providers and others to eliminate gaps in health care delivery.[2]

In 2015–16, the level of health care expenditure related to cardiovascular disease (CVD) was the second highest for any disease group in Australia.[3] It has been estimated that about one-fifth of Australians aged 45–74 years (1.4 million people) are at high risk of a CVD event within five years.[4] A large proportion of these events could be prevented by interventions that include assessment of absolute CVD risk.[5]

A major barrier to reducing CVD rates is the lack of evidence-based risk assessment and prescribing of recommended medications for people at high risk.[6,7] Clinical guidelines recommend assessing and managing a combination of risk factors (an absolute risk approach) rather than treating individual factors.[8,9]

Interventions that assist practitioners with clinical decision-making and communicating with patients about CVD risk are needed. HealthTracker, a computer-based decision support tool for improving CVD risk management at the practitioner, patient, and organisational levels, was evaluated in Australian primary health care by the TORPEDO (Treatment of Cardiovascular Risk using Electronic Decision Support) study, a randomised controlled trial including 38 725 people at 40 general practices in New South Wales (mostly metropolitan) and 20 Aboriginal Community Controlled Health Services in metropolitan and regional NSW and Queensland.[10] CVD risk factor screening improved by 25% at intervention sites; prescribing rates for people at high risk of CVD not previously prescribed guideline-recommended medicines improved by 33%, but this change was not statistically significant.[11]

Cardiovascular health-related costs can be reduced considerably by health information technology (IT) strategies for managing major risk factors.[12] Health IT is regarded internationally as a useful tool for improving health care services while reducing their cost,[13,14] leading to considerable investment in the approach in Organisation for Economic Co-operation and Development (OECD) countries.[15] However, data on the cost-effectiveness of health IT strategies that could inform decisions about their routine implementation are limited.[16]

We therefore undertook a modelled cost-effectiveness analysis of the health and economic effects of HealthTracker were it implemented in all NSW PHNs. Based on this simulation, we estimated the total costs of the intervention and its cost-effectiveness over five years for managing people with high CVD risk.

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Methods

Study design and setting

We conducted a modelled cost-effectiveness analysis, from the perspective of the Australian health system, of the HealthTracker intervention and of usual care for adults at high risk of CVD. The reporting of our economic evaluation conforms with the Consolidated Health Economic Evaluation Reporting Standards (CHEERS) 24-item checklist.[17]

HealthTracker intervention

In the TORPEDO trial (ACTRN 12611000478910), HealthTracker was integrated into the electronic health record systems of the health care providers participating in the intervention.[10] The key features of HealthTracker are real time decision support based on evidence-based national guidelines, a patient risk communication interface, an automated clinical audit tool, and a website providing anonymised feedback comparing practice performance with that of the other trial sites. The primary outcomes of the TORPEDO trial were the proportion of patients screened for CVD risk factors (smoking, systolic blood pressure, total cholesterol and high-density lipoprotein cholesterol levels), and the proportion of patients at high CVD risk prescribed guideline-recommended medications by the end of the trial.

Modelled population

The modelled population comprised NSW adults who were at least 45 years old (Aboriginal and Torres Strait Islander Australians: at least 35 years) and at high risk of CVD. The proportions of people at high CVD risk used (20.3% of non-Indigenous, 6.3% of Indigenous patients) were derived from TORPEDO trial prevalence data.[11] Consistent with Australian guidelines,[8] patients were deemed to be at high risk if they had a history of CVD, had been diagnosed with certain clinical conditions (diabetes, chronic kidney disease, hypertension, total serum cholesterol exceeding 7.5 mmol/L), or their 5-year CVD risk (Framingham risk equation) exceeded 15% (Supporting Information, part 1). We calculated the mean number of people at high CVD risk per NSW PHN using 2015 PHN demographic data (Supporting Information, part 2).[18]

Health economic model

We developed a decision analytic model to estimate the costs and benefits of HealthTracker over five years, comparing TORPEDO-based findings of reduced CVD risk factor levels (LDL-C, systolic blood pressure) with frequency of cardiovascular disease-related events and health care costs (Supporting Information, part 3). We distinguished between people at high CVD risk who had not had a CVD event (primary prevention group) and those with a prior CVD event (ie, established CVD; secondary prevention group). The model was run in annual cycles and a 3% annual discount rate applied to costs.[19] Incremental cost-effectiveness ratios (ICERs) — the difference in mean costs divided by the difference in mean effects (CVD events) between HealthTracker and usual care — were calculated to estimate the cost over five years for each averted CVD event.

Major health outcome

The major health outcome for our cost-effectiveness analysis was the estimated number of major CVD events — coronary heart disease, cerebrovascular disease, peripheral vascular disease — during the five years following the end of the TORPEDO trial, a period selected to match the 5-year absolute CVD risk estimated with the Framingham risk equation.[8] Estimated 5-year CVD risk was adjusted according to measured changes in the levels of intermediate risk factors — low-density lipoprotein cholesterol (LDL-C) and systolic blood pressure levels — during the TORPEDO trial (Box 1). Small

1 TORPEDO trial: prescribing rate and intermediate outcomes for patients at high risk of cardiovascular disease (CVD)

	TORPEDO group		
	HealthTracker	Usual care	Difference (95% CI)
Prescribed treatments			
Patients with established CVD (secondary prevention)			
Lipid-lowering therapy	1893 (71.8%)	1598 (65.9%)	5.8% (3.3–8.4%)
Blood pressure-lowering therapy	2039 (77.3%)	1789 (73.8%)	3.5% (1.1–5.9%)
Antiplatelet/anticoagulant therapy	1863 (71.8%)	1641 (67.7%)	4.1% (1.5–6.6%)
Patients with CVD risk > 15% or relevant clinical condition (primary prevention)			
Lipid-lowering therapy	1610 (58.5%)	1339 (53.7%)	4.7% (2.0–7.4%)
Blood pressure-lowering therapy	1943 (70.6%)	1692 (67.9%)	2.7% (0.2–5.2%)
Mean reduction in laboratory values, baseline to end of study			
Patients with established CVD (secondary prevention)			
Low-density lipoprotein cholesterol (mmol/L), mean (SD)	0.11 (0.81)	0.06 (0.63)	0.05 (0.01 to 0.10)
Systolic blood pressure (mmHg), mean (SD)	0.54 (18.8)	0.42 (19.7)	0.12 (–0.98 to 1.23)
Patients with CVD risk > 15% or relevant clinical condition (primary prevention)			
Low-density lipoprotein cholesterol (mmol/L), mean (SD)	0.18 (0.80)	0.13 (0.74)	0.05 (0.00 to 0.09)
Systolic blood pressure (mmHg), mean (SD)	4.01 (19.4)	2.92 (20.5)	1.09 (–0.03 to 2.21)

CI = confidence interval; SD = standard deviation; TORPEDO = Treatment of Cardiovascular Risk using Electronic Decision Support trial. ◆

but statistically significant differences between the intervention and usual care groups in the reduction in LDL-C level from baseline were found for both the primary and secondary prevention groups; for systolic blood pressure, the differences were not statistically significant.[11] The relative risk reductions associated with reduced LDL-C and systolic blood pressure levels were based on systematic reviews and meta-analyses (Supporting Information, parts 4 and 5).[20,21]

Model assumptions

We assumed that the effects of the HealthTracker intervention (compared with usual care) on prescribing patterns and changes in intermediate risk factors in people with high CVD risk at the end of the TORPEDO trial were maintained during the five years following the trial. It was assumed that the price of lipid-lowering drugs (statins) would drop by 50% with expiry of the applicable patents.

Baseline 5-year absolute CVD risk was estimated at randomisation according to Framingham risk scores derived from mean population characteristics: 20% for the primary prevention group and 30% for the secondary prevention group.

By focusing on blood pressure and lipid levels at baseline and at the end of the TORPEDO trial, incomplete adherence to blood pressure- and lipid-lowering medication prescribing was taken into account.[11] The adherence rate for aspirin recommended as secondary prevention was assumed to be 66%, based on a meta-analysis of 376 162 patients in 20 studies that assessed adherence according to prescription refill frequency.[22]

Cost estimation

Intervention costs associated with implementing and maintaining HealthTracker in health services and with patient-level costs to the health system (hospitalisation with major CVD, medications) were derived from TORPEDO data (Box 2). Estimated annual software licensing costs were provided by the PenCS, the developer, and were assumed to be borne by the PHNs. The licence cost, estimated at $500 per health service per year or $141 500 per PHN per year, covered long term implementation costs (implementation, training, support, and maintenance), but excluded development and research costs. CVD medications were categorised as lipid-lowering, blood pressure-lowering, and antiplatelet and anticoagulant drugs. We used the dispensed price for maximum quantity and number of dispensed scripts listed by the Pharmaceutical Benefits Schedule[23] to estimate the annual weighted mean cost for each medication group during the 2015 calendar year. Estimated hospital costs related to major vascular events were based on Australian Institute for Health and Welfare data for 2015–16.[24]

2 Costs of implementing HealthTracker and patient-level costs

Cost	Unit price (2015)	Comments
Pharmaceutical costs[23] (annual)		
Lipid-lowering medications	$292.42	Mean annual cost weighted by scripts for standard daily dose for all lipid-lowering drugs
Blood pressure-lowering medications	$217.11	Mean annual cost weighted by scripts for standard daily dose for all types of blood pressure-lowering drugs
Antiplatelet medications	$288.32	
Hospitalisation costs for cardiovascular disease events		
Major events (per person per year)[24]	$10 872.29	Weighted mean cost
Intervention implementation (annual)		
Software licence (per health service)	$500	283 health services per primary health network

Sensitivity analyses

Model inputs were varied in one-way sensitivity analyses: baseline 5-year absolute risk (5% lower or higher for primary and secondary prevention); cost discounting rate (0%, 7%); the effect of patent protection expiry on the price of statins (25%, 75% reduction); and substituting the mean difference between the HealthTracker and usual care groups in LDL-C level change with the lower or upper limits of the 95% confidence interval (CI) for the difference. Corresponding sensitivity analyses for systolic blood pressure values were not conducted because the difference in change during the TORPEDO trial was not statistically significant.

Ethics approval

This study was approved by the University of Sydney Human Research Ethics Committee (reference, 2012/2183) and the Aboriginal Health and Medical Research Council of New South Wales (reference, 778/11).

Results

We estimated the mean number of people in NSW with high CVD risk in 2015 to be 62 723 per PHN (Supporting Information, part 2). The prescribed medications profile of our model population, based on TORPEDO data, is summarised by treatment category in Box 3. In the primary prevention category, 7732 of 15 963 people (48.4%) in the HealthTracker group and 7065 of 15 963 (44.3%) in the usual care group received optimal therapy (lipid- and blood pressure-lowering medications); in the secondary prevention category, 8517 of 15 398 (55.3%) in the HealthTracker group and 7445 of 15 398 in the control group (48.5%) received optimal therapy (all three of lipid-lowering, blood pressure-lowering, and antiplatelet/anticoagulant therapies).

The estimated number of major CVD events per 1000 patients over 5 years was 168 in primary prevention using HealthTracker and 176 for usual care; in secondary prevention, the estimated numbers of events were 259 with the intervention and 267 with usual care (Box 4).

Medication costs were higher for the HealthTracker intervention than for usual care, but the hospitalisation costs were lower for both primary and secondary prevention. The net difference in health care costs was estimated to be $59.25 per patient for primary and $142.11 per patient for secondary prevention. The estimated ICER for one averted CVD event was $7406 for primary and $17 988 for secondary prevention (Box 4).

One-way sensitivity analyses indicated that ICERs were sensitive to changes in LDL-C level, because LDL-C level influences the number of CVD events and

3 Model population for ten New South Wales primary health networks: prescribed medications, by TORPEDO group and cardiovascular disease (CVD) risk type*

Medications	TORPEDO group	
	HealthTracker	Usual care
Patients with established CVD (secondary prevention)	15 398	15 398
No treatment	1817 (11.8%)	2094 (13.6%)
Antiplatelet/anticoagulant therapy	493 (3.2%)	585 (3.8%)
Blood pressure-lowering therapy	354 (2.3%)	493 (3.2%)
Blood pressure-lowering and antiplatelet/anticoagulant therapies	816 (5.3%)	1032 (6.7%)
Lipid-lowering therapy	1216 (7.9%)	1540 (10.0%)
Lipid-lowering and antiplatelet/anticoagulant therapies	1355 (8.8%)	1355 (8.8%)
Lipid-lowering and blood pressure-lowering therapies	832 (5.4%)	862 (5.6%)
Lipid-lowering, blood pressure-lowering, and antiplatelet/anticoagulant therapies	8517 (55.3%)	7445 (48.5%)
Patients with CVD risk > 15% or relevant clinical condition (primary prevention)	15 963	15 963
No treatment	3097 (19.4%)	3608 (22.6%)
Blood pressure-lowering therapy	1596 (10.0%)	1516 (9.5%)
Lipid-lowering therapy	3528 (22.1%)	3767 (23.6%)
Lipid-lowering and blood pressure-lowering therapies	7732 (48.4%)	7065 (44.3%)

* Data source: Treatment of Cardiovascular Risk using Electronic Decision Support trial.[11] ◆

4 Outcomes, costs, and the incremental cost-effectiveness ratio (ICER), by trial intervention group and cardiovascular disease (CVD) risk type

Characteristic	TORPEDO group		
	HealthTracker	Usual care	Difference
Patients with established CVD (secondary prevention)			
CVD events* (5 years), per 1000 people	259	267	–8
Medication costs,† per person	$2576.86	$2411.61	$165.25
Hospital costs,† per person	$2269.55	$2338.64	–$69.09
Intervention costs,† per person	$45.95	NA	$45.95
Net costs difference, per person			$142.11
ICER for one averted CVD event (3% discounting)			$17 988.16
Patients with CVD risk > 15% or relevant clinical condition (primary prevention)			
CVD events* (5 years), per 1000 people	168	176	8
Medication costs,† per person	$1571.51	$1486.61	$84.90
Hospital costs,† per person	$1468.43	$1538.40	–$69.97
Intervention costs,† per person	$44.32	NA	$44.32
Net costs difference, per person			$59.25
ICER for one averted CVD event (3% discounting)			$7406.38

ICER = incremental cost-effectiveness ratio; NA = not applicable. * Coronary heart disease, cerebrovascular disease, peripheral vascular disease, or death. † Based on 283 health services per primary health network. ◆

therefore hospitalisation costs. Should statin costs decline by 75% following patent expiry, the ICER would fall to $5104 per CVD event averted by primary prevention and $14 661 per CVD event averted by secondary prevention (Box 5).

Discussion

We evaluated the impact of the modest but statistically significant reduction in LDL-C levels measured in the TORPEDO trial, with potentially important consequences for the incidence of CVD events. Our modelled cost-effectiveness analysis of introducing HealthTracker in all NSW PHNs estimated that the health system cost per patient would be $59.25 for primary and $142.11 for secondary prevention; the estimated cost for averting one CVD event (ICER) was $7406 for primary and $17 988 for secondary prevention. One-way sensitivity analyses indicated that the ICER was sensitive to changes in LDL-C level and change in statin price after patent expiry.

Evidence for the cost-effectiveness of quality improvement interventions at the PHN level that could inform investment decisions is scant. Funding for PHNs is based on local health needs and is intended to improve health outcomes through population health planning and the appropriate commissioning of services. Our study provides important evidence about the cost-effectiveness of investing in quality improvement interventions such as HealthTracker. The strength of our study was its basis in high quality clinical trial data; it provides population-level estimates of the costs and effects of implementing a computer-supported quality improvement intervention in NSW. Our findings can assist PHN decision makers considering investing in health IT services.

Limitations

The daily operating costs of the HealthTracker intervention, including those for staff and other resources, were not included in our analysis because of their complexity and variation between health services. However, the HealthTracker intervention could improve care processes and reduce resource demand once it has been fully established. Our model estimated changes to CVD events over a 5-year period, not taking into account CVD- and non-CVD-related mortality. Most importantly, we assumed that the risk factor improvements during the clinical trial would be sustained after its conclusion. We also assumed no subsequent changes in compliance with prescribing; medication adherence primarily declines during the first six months of treatment.[25] Finally, primary health care organisations would incur transition costs during the introduction of HealthTracker, distinct from those for infrastructure and staffing, and such costs are not easily measured with cost-effectiveness analytic methods. We have documented the determinants of transition costs for HealthTracker in a previous article,[26] but they could not be included in this evaluation.

5 Incremental cost-effectiveness ratio (ICER) for 1000 people over 5 years: one-way sensitivity analyses

Scenario for sensitivity analysis	CVD events averted	Difference in costs between intervention and control groups		ICER
		Medications	Hospitalisations for CVD events	
Patients with established CVD (secondary prevention): main analysis	**8**	**$165 252.72**	**–$69 092.30**	**$17 988.16**
1. Baseline 5-year absolute risk: 25%	6	$165 252.72	–$53 349.75	$12 437.40
2. Baseline 5-year absolute risk: 35%	10	$165 252.72	–$88 333.19	$4047.99
3. LDL-C level: lower limit of 95% CI for difference	7	$165 252.72	–$63 844.78	$27 667.72
4. LDL-C level: upper limit of 95% CI for difference	14	$165 252.72	–$124 191.21	$6127.29
5. Costs: 0% discounting	8	$175 163.53	–$71 142.74	$18 983.14
6. Costs: 7% discounting	8	$153 695.88	–$66 507.89	$16 852.41
7. Statin costs: 25% reduction	8	$161 536.88	–$69 092.29	$17 517.80
8. Statin costs: 75% reduction	8	$134 283.59	–$69 092.29	$14 068.02
Patients with CVD risk > 15% or relevant clinical condition (primary prevention): main analysis	**8**	**$84 896.65**	**–$69 966.88**	**$7406.38**
1. Baseline 5-year absolute risk: 15%	6	$84 896.65	–$53 349.75	$12 437.40
2. Baseline 5-year absolute risk: 25%	10	$84 896.65	–$88 333.19	$4047.99
3. LDL-C level: lower limit of 95% CI for difference	8	$84 896.65	–$69 092.29	$7610.83
4. LDL-C level: upper limit of 95% CI for difference	12	$84 896.65	–$103 201.15	$2204.81
5. Costs: 0% discounting	8	$89 988.22	–$72 043.28	$7783.27
6. Costs: 7% discounting	8	$78 959.46	–$67 349.76	$6991.37
7. Statin costs: 25% reduction	8	$82 151.43	–$69 966.88	$7063.22
8. Statin costs: 75% reduction	8	$66 477.86	–$69 966.88	$5104.03

CI = confidence interval; CVD = cardiovascular disease; LDL-C = low-density lipoprotein cholesterol. ◆

Conclusions

Our economic evaluation of the HealthTracker computer-guided quality improvement intervention provides insights for decision makers considering strategies for achieving better value care for people at high risk of CVD. This could lead to broader benefits for the health system by reducing CVD-related disability and improving system performance. However, the effect sizes for health outcomes achieved with HealthTracker were modest, and system performance could be improved further by more intensive quality improvement programs. This, however, would require consideration of health system complexity at the macro-, meso- and micro-health system levels and of strategies that can influence adoption and sustainability.

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Competing interests: The George Institute for Global Health has a wholly owned social enterprise that conducts commercial projects that include aspects of the intervention tested in this study. The George Institute owns the intellectual property for HealthTracker. ■

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1 Australian Department of Health and Ageing. Improving primary health care for all Australians (Publications no. D0264). 2011. https://www.g21.com.au/sites/default/files/dmdocuments/ImprovingPHCforallAustralians.pdf (viewed Feb 2018).

2 Australian Department of Health. Primary health networks: grant programme guidelines. Feb 2016. https://www1.health.gov.au/internet/main/publishing.nsf/Content/F4F85B97E22A94CACA257F86007C7D1F/$File/Primary%20Health%20Network%20Grant%20Programme%20Guidelines%20-%20V1.2%20February%202016.pdf (viewed Dec 2017).

3 Australian Institute of Health and Welfare. Disease expenditure in Australia (Cat. no. HWE 76). 13 June 2019. https://www.aihw.gov.au/reports/health-welfare-expenditure/disease-expenditure-australia/contents/summary (viewed Feb 2020).

4 Banks E, Crouch SR, Korda RJ, et al. Absolute risk of cardiovascular disease events, and blood pressure- and lipid-lowering therapy in Australia. *Med J Aust* 2016; 204: 320. https://www.mja.com.au/journal/2016/204/8/absolute-risk-cardiovascular-disease-events-and-blood-pressure-and-lipid

5 Tonkin AM, Chen L. Where on the healthcare continuum should we invest? The case for primary care. *Heart Lung Circ* 2009; 18: 108–113.

6 Webster RJ, Heeley EL, Peiris DP, et al. Gaps in cardiovascular disease risk management in Australian general practice. *Med J Aust* 2009; 191: 324–329. https://www.mja.com.au/journal/2009/191/6/gaps-cardiovascular-disease-risk-management-australian-general-practice

7 Heeley EL, Peiris DP, Patel AA, et al. Cardiovascular risk perception and evidence–practice gaps in Australian general practice (the AusHEART study). *Med J Aust* 2010; 192: 254–259. https://www.mja.com.au/journal/2010/192/5/cardiovascular-risk-perception-and-evidence-practice-gaps-australian-general

8 National Vascular Disease Prevention Alliance. Guidelines for the management of absolute

cardiovascular disease risk. 2012. http://cvdcheck.org.au/pdf/Absolute_CVD_Risk_Full_Guidelines.pdf (viewed Nov 2012).

9 Jackson R, Wells S, Rodgers A. Will screening individuals at high risk of cardiovascular events deliver large benefits? Yes. *BMJ* 2008; 337: a1371.

10 Peiris D, Usherwood T, Panaretto K, et al. The Treatment of cardiovascular Risk in Primary care using Electronic Decision supOrt (TORPEDO) study-intervention development and protocol for a cluster randomised, controlled trial of an electronic decision support and quality improvement intervention in Australian primary healthcare. *BMJ Open* 2012; 2: e002177.

11 Peiris D, Usherwood T, Panaretto K, et al. Effect of a computer-guided, quality improvement program for cardiovascular disease risk management in primary health care: the treatment of cardiovascular risk using electronic decision support cluster-randomized trial. *Circ Cardiovasc Qual Outcomes* 2015; 8: 87–95.

12 Payne TH, Bates DW, Berner ES, et al. Healthcare information technology and economics. *J Am Med Inform Assoc* 2013; 20: 212–217.

13 Black AD, Car J, Pagliari C, et al. The impact of eHealth on the quality and safety of health care: a systematic overview. *PLoS Med* 2011; 8: e1000387.

14 Kruse CS, Beane A. Health information technology continues to show positive effect on medical outcomes: systematic review. *J Med Internet Res* 2018; 20: e41.

15 The Organisation for Economic Co-operation and Development. Strengthening health information infrastructure for health care quality governance: good practices, new opportunities and data privacy challenges. Paris: OECD, 2013. https://www.oecd.org/publications/strengthening-health-information-infrastructure-for-health-care-quality-governance-9789264193505-en.htm (viewed Feb 2018).

16 Bassi J, Lau F. Measuring value for money: a scoping review on economic evaluation of health information systems. *J Am Med Inform Assoc* 2013; 20: 792–801.

17 Husereau D, Drummond M, Petrou S, et al. Consolidated Health Economic Evaluation Reporting Standards (CHEERS): explanation and elaboration; a report of the ISPOR Health Economic Evaluation Publication Guidelines Good Reporting Practices Task Force. *Value Health* 2013; 16: 231–250.

18 NSW Ministry of Health. HealthStats NSW: population by primary health networks. http://www.healthstats.nsw.gov.au/Indicator/dem_pop_phnmap/dem_pop_phn_age_trend (viewed Nov 2017).

19 Eichler HG, Kong SX, Gerth WC, et al. Use of cost-effectiveness analysis in health-care resource allocation decision-making: how are cost-effectiveness thresholds expected to emerge? *Value Health* 2004; 7: 518–528.

20 Jackson R, Lawes CM, Bennett DA, et al. Treatment with drugs to lower blood pressure and blood cholesterol based on an individual's absolute cardiovascular risk. *Lancet* 2005; 365: 434–441.

21 Law MR, Morris JK, Wald NJ. Use of blood pressure lowering drugs in the prevention of cardiovascular disease: meta-analysis of 147 randomised trials in the context of expectations from prospective epidemiological studies. *BMJ* 2009; 338: b1665.

22 Naderi SH, Bestwick JP, Wald DS. Adherence to drugs that prevent cardiovascular disease: meta-analysis on 376 162 patients. *Am J Med* 2012; 125: 882–887.e1.

23 Department of Human Services, Pharmaceutical Benefits Scheme. PBS expenditure and prescriptions: expenditure and prescriptions twelve months to 30 June 2012. http://www.pbs.gov.au/info/statistics/expenditure-and-prescriptions-30-06-2012 (viewed Nov 2017).

24 Australian Institute of Health and Welfare. Admitted patient care 2015–16: Australian hospital statistics (Cat. no. HSE 185). Canberra: AIHW, 2017.

25 Yeaw J, Benner JS, Walt JG, et al. Comparing adherence and persistence across 6 chronic medication classes. *J Manag Care Pharm* 2009; 15: 728–740.

26 Patel B, Usherwood T, Harris M, et al. What drives adoption of a computerised, multifaceted quality improvement intervention for cardiovascular disease management in primary healthcare settings? A mixed methods analysis using normalisation process theory. *Implement Sci* 2018; 13: 140. ■

Supporting Information

Additional Supporting Information is included with the online version of this article.