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Clinical Research Study

Coaching People with Cardiovascular Disease to Close Their "Treatment Gaps" Reduces Hospital Utilization, Saves Lives, and Delivers Net Cost Savings Over 10 Years

Joshua Byrnes[a], Margarite J. Vale[e,*], Clifford Afoakwah[a,c], Pippa Grant[d], Sharmani Barnard[b,d]

[a] Centre for Applied Health Economics, School of Medicine and Dentistry, Griffith University, Nathan, Australia
[b] School of Population Health, Curtin University, Perth, Western Australia, Australia
[c] Australian Centre for Health Services Innovation, School of Public Health and Social Work, Queensland University of Technology, Kelvin Grove, Australia
[d] HBF Health Fund, Perth, Western Australia, Australia
[e] Department of Medicine, The University of Melbourne, Melbourne, Australia

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ABSTRACT

Background: Disease management programs are an essential tool in the fight against rising prevalence and costs associated with cardiovascular disease (CVD). However, there is a lack of evidence on the long-term impact of these programs on clinical outcomes, healthcare utilization, and cost. This study presents a long-term follow up of clinical, healthcare utilization and cost, and mortality consequences of The COACH Program, a 6-month telephone delivered CVD prevention program.

Methods: We conducted 10-year retrospective propensity score matched cohort study of potentially eligible participants comparing individuals that participated to those that did not receive the Program. Primary outcomes of interest were differences in mortality, private healthcare utilization and cost of private healthcare utilization sourced from private health insurance claims data.

Results: Of the 24,932 potentially eligible participants, 11,988 were invited to participate in The COACH Program between July 1, 2010, and December 31, 2020. The COACH Program participants (n = 2,271) were 1:1 matched with individuals who did not participate in the Program. Participation in The COACH Program was associated with a 34% reduction in the risk of mortality (HR: 0.66, 95% CI: 0.54, 0.79), an 8% reduction in the number of hospitalizations (IRR: 0.92, 95% CI: 0.85, 0.98), and an annual reduction in healthcare costs of $1,499 (95% CI: $1,909, $1,087). Results were robust to sensitivity analyses.

Conclusions: A structured 6-month telephone delivered coaching program focused on closing "treatment gaps" in people with a history of CVD saves lives and reduces hospital utilization, health care costs over 10-years follow-up.

Clinical Significance

- This is the first study to investigate survivorship and financial outcomes of a CVD prevention program over a 10-year follow-up.
- The COACH Program was associated with:
  - improved survival
  - reduction in hospitalizations
  - improvement in biomedical indicators
  - reduced healthcare costs
- The COACH Program is a value-based strategy to close the evidence-practice gap in the management of patients with CVD.

Introduction

Cardiovascular diseases (CVDs) are the leading cause of morbidity, mortality and cause extensive social, economic and public health impact across health systems globally.[1] Over the past 30 years, the prevalence of CVD has doubled, resulting in a substantial increase in health care utilization and social and economic costs associated with the disease.[2]

* Requests for reprints should be addressed to Margarite J. Vale, The COACH Program, PO Box 499, Camberwell, Victoria, 3124, Australia.
E-mail address: m.vale@unimelb.edu.au (M.J. Vale).

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Biomedical and lifestyle factors are a major contributor to cardiovascular risk.[3,4] Reducing biomedical and lifestyle-related risk factors and improving patient adherence to cardioprotective medications can substantially reduce overall CVD risk and CVD related morbidity and premature mortality.[2-6]

However, despite the fact we possess highly effective therapies for the prevention of CVD, risk factor control remains inadequate in a large proportion of people with CVD.[2-5] One of the key reasons for this is "clinical inertia," a lack of treatment intensification in patients not meeting evidence-based goals for care, and nonadherence or discontinuation of treatment in practice.[7-9] This gap between the management of CVD as defined by clinical guidelines and the reality of clinical management of CVD, is referred to as the "evidence-practice gap" or "treatment gap."[10] CVD focused disease management programs aim to provide additional support to patients to reduce risk factors, make positive changes to lifestyle and/or to improve medication adherence in community settings.[11,12]

Telehealth delivered primary and secondary CVD prevention programs offer an accessible and cost-effective method of supporting patients to reduce cardiovascular risk.[13] However, evidence relating to the efficacy of such programs is inconsistent. While there is some evidence that programs can improve some lifestyle risk factors,[11,14] there is less evidence for CVD programs closing the evidence-practice gap through treatment intensification that enables patients to meet risk factor targets and reduce overall CVD risk.[14-17] Furthermore, there is a dearth of evidence relating to the long-term impact of CVD programs in relation to mortality, risk factor management and health care costs.[18,19] The duration of follow-up for interventions targeting CVD prevention is typically not more than 12 months,[19] whereas the life expectancy of people with CVD is over 15 years,[20] therefore longer-term follow-up is required to understand the full potential of such interventions.

This study evaluates the long-term impact of a CVD prevention program called The COACH Program. The COACH Program consists of a structured telephone and mail-out delivered coaching program delivered to patients over 6 months. Our hypothesis is that The COACH Program will improve survival, reduce hospitalizations and reduce costs over a 10-year follow-up period. This study builds on the existing body of literature to investigate the impact of evidence-based disease management programs on survival, hospital utilization, and costs to the health insurer and the individual over a 10-year follow-up period.

Methods

Study Design, Data source, and Participants

This retrospective matched cohort study used data between July 1, 2010, and December 31, 2020. Data was sourced from the Hospital Benefit Fund (HBF) databases (demographics, policy information, death, hospital episodes, and costs) and linked to The COACH Program database (program participation and risk factor outcomes).

Potentially eligible participants were identified within the insurers' database if they were aged 18 years and above who had active hospital cover and claims evidence of a previous cardiovascular related procedure (see Appendix A1a for MBS procedure codes). Individuals were excluded if they had a severe mental health diagnosis, palliative care, had end-stage renal disease, or were actively undergoing cancer treatment, identified using International Classification of Disease version 10 (ICD-10) (principal or secondary), diagnosis related group and procedure items (see Appendix A1b).

The 24,932 potentially eligible participants were either invited to participate (n = 11,988) or not (n = 12,944) based on capacity constraints at the time of identification. The invited group were sent a postal invitation to participate. Where capacity permitted, postal invitations were followed with up to three contact attempts via telephone. Upon making contact, individuals were further assessed for clinical suitability to participate based on whether they had atherosclerotic CVD. Individuals who did not or who exhibited advanced cognitive deficits were excluded from participating. Those that were invited or sent an invitation letter but were either uncontactable, declined or were excluded based on eligibility criteria were considered nonparticipants. Data for the reason for nonparticipation was not collected. For those not invited, participants were not contacted and received usual care.

Ethics

Participants provided signed consent prior to participation including permission for their deidentified data to be used for research purposes. This evaluation was approved by Griffith University Human Research Ethics Committee (GU ref no: 2021/859).

The COACH Program Intervention

The participants in the treated group received usual care plus The COACH Program. The COACH Program aims to deliver up to 6 coaching sessions over 6 months but adapts to individual patient needs regarding number of sessions and the period over which these are provided. Trained health professionals conducted a "treatment gap analysis," and informed participants of how their treatment and risk factors compared with guideline recommendations. Participants were given recommendations to discuss with their doctors regarding treatment intensification and medication changes, were coached to know how often their risk factors should be checked, to keep a record of test results, and to follow guideline-recommended lifestyle measures. Each verbal coaching session was followed by a structured written report that summarized the session.

Primary Outcomes

Three primary outcomes were evaluated in this study: survival, private healthcare utilization, and private healthcare costs. Survival was defined from date of invitation to the Program to date of death for both participants and nonparticipants as reported in the HBF database. Private healthcare utilization was measured using annual number of overnight hospital episodes from the date of invitation and length of stay (average total number of nights per year alive) in private hospital. Measures were from the date of initial invitation to enable subsequent comparison with those who were potentially eligible but did not participate. All cost data are reported in Australian dollars, including total benefit (amount the health insurer pays toward hospital episodes claim), hospital fees (amount charged by the hospital for an episode of care), medical fee (fee charged by attending specialist physician), and out-of-pocket fee (the amount paid by patients for hospital episodes). We adjusted for inflation using consumer price index (CPI) data from Australian Bureau of Statistics,[23] and 2020 was used as the reporting year. For cost analysis we estimated three measures: the average annual claims savings over the total period of follow-up among all participants; the annual claims savings per year following intervention; and the total claims savings over a 10-year period. Measures of utilization and cost were for all cause hospital episodes, impactable CVD related and non-CVD related episodes, or nonimpactable episodes. Impactable episodes were defined using the Australian Refined Diagnosis Related Group (AR-DRG) Version 10.0 (details of all impactable and nonimpactable DRGs available in Appendix A2) and confirmed with input from clinical cardiologists.

Secondary Outcomes

To explore causal pathways through which the Program improves survival and reduces healthcare utilization, we assessed the change in biomedical risk factors from the first biometric measure (obtained during the first coaching session) to the final biometric measure (obtained during the last coaching session) among individuals in the treated group.

Specifically, whether the following targets, based on clinical guidelines and set within the Program, were achieved: LDL-cholesterol (<1.8 mmol/L), triglycerides (<2.0 mmol/L), fasting glucose in people without known diabetes (<5.5 mmol/L), HbA1c in people with diabetes (≤7.0%), smoking status (not current), waist circumference (<80 cm for females; <94 cm for males), BMI (18.5-24.9 kg/m^2), alcohol intake (≤2 standard drinks per day) and physical activity (≥150 minutes per week). Data for biometric risk was collected as part of the intervention. Data for biomedical risk factors was not available for the control group as they did not take part in the intervention.

Statistical Analysis

To address the potential selection bias between the two cohorts, 1:1 nearest neighbor propensity score matching without replacement was used.[24] Matching was performed using 10-year age groups, sex, level of private health insurance (PHI) cover at time of invitation (three government mandated tiers indicating service coverage[25]), history of atherosclerosis based on Medicare item codes (presented in Appendix A3), number of hospital episodes 12-months prior, diagnosis-related group code for last hospital episode before invitation and whether any cardiovascular admission prior to invitation. The final matching algorithm was identified using a backward stepwise approach with a *P*-value cut-off of .10. Postcode of residence, continuous variable for age, month and year of invitation, and ICD-10 classification were also tested but were found to not improve matching. The chi-square, student t-test, common support and standardized percentage bias plots were used to check for balance in baseline distribution between groups after matching.

The association between The COACH Program and individual survivorship was visually assessed using Kaplan–Meier survival curves and formally investigated using Cox proportional hazard model, Weibull, and Log-logistic survival models. Akaike information criterion (AIC) and Bayesian information criterion (BIC) were used to select the model that best fit the data.

Healthcare utilization: number of hospital episodes and length of stay in hospital; was investigated using Poisson regression. Healthcare costs was investigated using a generalized linear model (GLM) with gamma family and log link. The modified Park test was used to confirm the model specification. The cost analysis was repeated after stratification by calendar year to examine cost-differences over time. Control variables, sex, age, level of insurance coverage, number of months an individual held hospital insurance cover, and the number of times an individual changed their cover during the study period were included based on prior identified relationships.

Among Program participants, pre- and post-participation differences in biomedical risk factors was first investigated using student t-test. Logistic regression was used to estimate the odds of achieving the predefined risk factor targets after participation. Standard errors were clustered at the individual level. All data analyses were conducted using Stata v13 (StataCorp, College Station, TX, USA).

Sensitivity Analyses

Sensitivity analyses included: (1) 1:5 nearest neighbor matching approach; (2) kernel matching with a bandwidth of 0.1;[21,22] (3) survival analysis based on a truncated follow-up period of 5-years; and (4) impact associated with variation in the number of coaching sessions a participant received. All sensitivity analyses are reported in Appendix E.

Results

A total of 25,404 participants met the initial eligibility criteria, of these, 254 had died prior to the time invitations were sent and 218 had no active PHI policy cover and were not eligible to participate in The COACH Program. A total of 24,932 had an active hospital policy and were eligible to participate in the Program. Of those potentially eligible, 11,988 were prioritized invitations and 2,283 (19.0%) accepted the invitation. After matching, the final sample for the analysis included 4,542 individuals; 2,271 each from treated and control groups (Figure 1). Twelve of The COACH Program participants and 20,378 of the not invited group were unable to be matched and excluded from the analysis. The average follow-up period for both groups was 48 months (range: 12-120 months).

After matching, treatment and control groups were similar in terms of their age groups, sex, PHI policy type, hospital episodes 12-months prior, indication of atherosclerosis, prior impactable hospital episodes, and diagnosis-related group of prior hospital episodes (Table 1). On average, the treated group received 6 (range: 2-9) coaching sessions over 6 months (Further detail available in Appendix C). The common support and standardized percentage bias graphs (Appendix B) show strong matching between the treated and control groups.

Mortality

The treated group (participants in The COACH Program) were associated with a lower proportion of deaths over the study period (Treated = 8.49%; Control = 16.11%; *P*-value = .001). The Kaplan–Meier survival curves demonstrate the association between treatment and greater survival compared with the control group over the follow-up period (Figure 2). Based on the Weibull specification (preferred model based on AIC and BIC estimates) the treated group were associated with a 34% reduction in the hazard of mortality (Table 2).

Private Healthcare Utilization

Over the 10-year follow-up, participants of The COACH Program were associated with, on average, 8% (95% CI: 0.85, 0.98) fewer hospital episodes per year (a reduction of 0.24; 95% CI: 0.04, 0.44 hospital episodes per year) and a 12% (95% CI: 0.83, 0.94) reduction in length of hospital stay (0.30; 95% CI: 0.15, 0.45 fewer bed days per year) when compared with the control group (Table 3; Complete regression model outputs are presented in Appendix D).

Impactable Versus Nonimpactable Healthcare Utilization

Participants in The COACH Program were associated with fewer impactable (IRR = 0.66 95% CI: 0.60, 0.71) and nonimpactable (IRR = 0.94 95% CI: 0.88, 0.99) hospital episodes compared to their peers who did not participate in the Program (Appendix D) equating to approximately, 0.68 (95% CI: 0.82, 0.55) and 0.16 (95% CI: 0.32, 0.01) fewer impactable and nonimpactable hospital episodes per annum. Similar findings were found for number of impactable and nonimpactable hospital days (Appendix D). The significant reduction in both impactable and nonimpactable hospital services suggest a potential positive spill-over effect of The COACH Program.

Private Healthcare Costs

The COACH Program participants saw a significant reduction in healthcare cost to the health insurer and the participants (Table 4). Specifically, there was a significant reduction of A$1,499 (95% CI: -1,909, -1,087) in the annual total benefits paid by the insurer, a reduction of A$1,289 (95% CI: -1662, -916) in hospital fees, a reduction of A$462 (95% CI: -575, -349) in medical specialist fees and A$201 (95% CI: -268, -135) reduction in annual out-of-pocket costs paid by the participants. In each year, for those who were hospitalized, The COACH Program was associated with nine years of significant cost savings, totaling A$11,342 (95% CI: -19,657, -3,031) per participant to the insurer and of A$1,204 (95% CI: -2252, -154) to the participant (Appendix

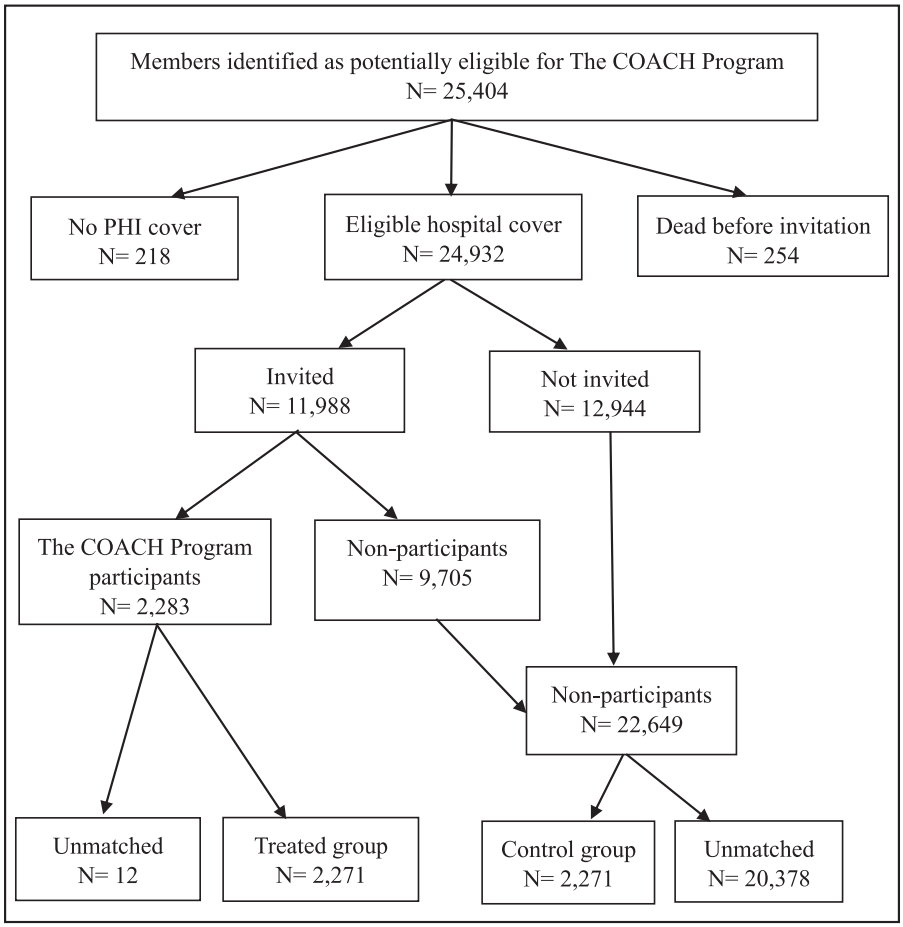

Figure 1. Study flow chart.

Table 1
Baseline Demographic and Characteristics of Previous Hospitalization: All Versus Matched.

	All Sample *n* (%)			Matched Sample *n* (%)		
	Treated	Control	*P*-Value	Treated	Control	*P*-Value
Participants	2283 (9.16)	22649 (90.16)	NA	2271 (50)	2271 (50)	NA
Female	491 (21.51)	8705 (38.43)	.001	490 (21.58)	508 (22.37)	.519
Male	1792 (78.49)	13944 (61.57)		1781 (78.42)	1763 (77.63)	
Age group (years)						
<71	1168 (51.16)	11861 (52.37)	.001	1158 (50.99)	1155 (50.86)	.951
71-79	921 (40.34)	6447 (28.46)		919 (40.47)	916 (40.33)	
80 and above	194 (8.50)	4341 (19.17)		194 (8.54)	200 (8.81)	
Hospital insurance policy tier						
Gold	1491 (65.31)	17191 (75.90)	.001	1482 (65.26)	1485 (65.39)	.822
Silver	700 (30.66)	4700 (20.75)		699 (30.78)	704 (31.00)	
Bronze	92 (4.03)	758 (3.35)		90 (3.96)	82 (3.61)	
Presentation history						
Atherosclerosis prior to invitation	58 (2.54)	481 (2.12)	.192	58 (2.55)	44 (1.94)	.161
Hospital admissions 12 months prior to invitation (mean)	3.43	11.47	.001	3.44	3.33	.680
Impactable admission before invitation	425 (18.62)	4096 (18.08)	.530	424 (18.67)	415 (18.27)	.731
Nonimpactable admission before invitation	1858 (81.38)	18553 (81.92)		1847 (81.33)	1856 (81.73)	
Diagnosis-related group at prior admission (AR-DRG code)						
Circulation disorders (F42)	215 (9.42)	2152 (9.50)	.001	214 (9.42)	207 (9.11)	1.000
Colonoscopy (G48)	146 (6.40)	1624 (7.17)		146 (6.43)	148 (6.52)	
Lens procedure (C16)	141 (6.18)	917 (4.05)		141 (6.21)	142 (6.25)	
Interventional coronary procedure (F24)	111 (4.86)	920 (4.06)		111 (4.89)	100 (4.40)	
Other contact with health service with endoscopy (Z40)	79 (3.46)	935 (4.13)		79 (3.48)	79 (3.48)	
Complex endoscopy (G46)	75 (3.29)	893 (3.94)		75 (3.30)	71 (3.13)	
Gastroscopy (G47)	47 (2.06)	585 (2.58)		47 (2.07)	50 (2.20)	
Other knee procedures (I18)	28 (1.23)	500 (2.21)		28 (1.23)	30 (1.32)	
Subcutaneous tissue & breast procedure (J11)	42 (1.84)	464 (2.05)		42 (1.85)	43 (1.89)	
Nonsurgical spinal disorder (I68)	16 (0.70)	480 (2.12)		16 (0.70)	18 (0.79)	
All other	1383 (60.58)	13,179 (58.19)		1372 (60.41)	1383 (60.90)	

Note: NA is not applicable, *n* is number in sample.
Note, this table does not include detail on participant biometrics because this is only available for the treated group.

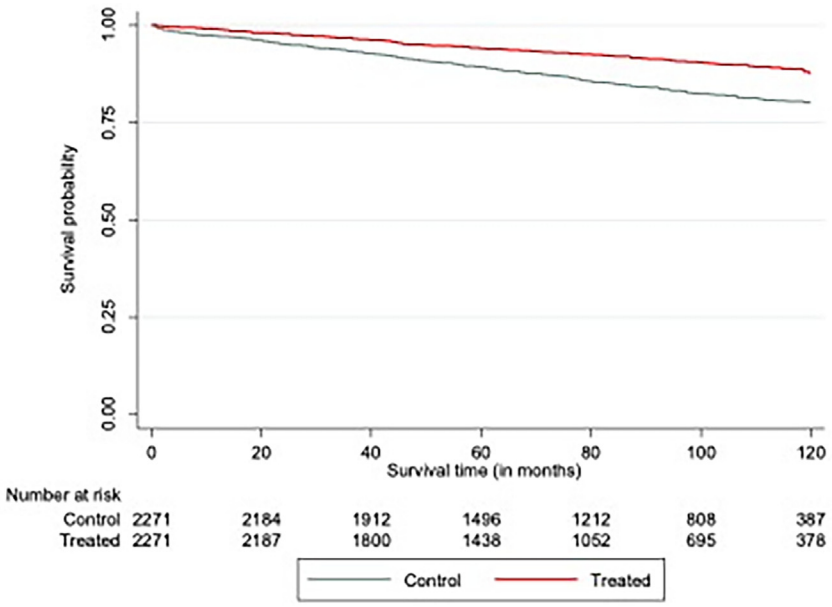

Figure 2. Kaplan–Meier survival curves for treated and matched comparison group.

Table 2
Survival Estimates for the Impact of The COACH Program.

	Cox Model Hazard Ratio	Weibull Hazard Ratio	Loglogistic Model Hazard Ratio
The COACH Program	0.66*** (95% CI: 0.55, 0.79)	0.66*** (95% CI: 0.54, 0.79)	0.45*** (95% CI: 0.25, 0.65)
N	4542	4542	4542
AIC	7476.64	3509.34	3525.48
BIC	7528.0	3573.56	3589.69

Note: N is total number of observations, AIC is Akaike information criterion, BIC is Bayesian information criterion. CI is confidence interval.
*** $P < \cdot 001$.

Table 3
Estimates for the Impact of The COACH Program on Annual Private Healthcare Utilization.

	Hospital Episodes		Length of Stay (Days)	
	Incidence Rate Ratio	Marginal Effects	Incidence Rate Ratio	Marginal Effects
The COACH Program	0.92** (95% CI: 0.85, 0.98)	-0.24** (95% CI: -0.44, -0.04)	0.88*** (95% CI: 0.83, 0.94)	-0.30*** (95% CI: -0.45, -0.15)
N	4542	4542	4542	4542

Note: N is total number of observations. Full results are available in Appendix C. CI is confidence interval.
*** $P \leq .001$.
** $P \leq .05$.

Table 4
Estimates for the Impact of The COACH Program on Annual Healthcare Costs.

	Total Benefit	Hospital Fee	Medical Specialist Fee	Out-of-Pocket Cost
The COACH Program	-$1,499*** (95% CI: -$1,909, -$1,087)	-$1,289*** (95% CI: -$1,662, -$916)	-$462*** (95% CI: -$575, -$349)	-$201*** (95% CI: -$268, -$135)
N	4542	4542	4542	4542

Note: N is total number of observations. CI is confidence interval.
*** $P \leq .001$.

D). For all participants, hospitalized or not each year, The COACH Program was associated with a statistically significant total cost savings of A$4,852 (95% CI: -5,872, -3,833) per participant to the insurer and of A$415 (95% CI: -494, -336) to the participant. The largest associated cost savings accrued in the first year of participating in The COACH Program, with estimated savings of A$3,506 (95% CI: -4,439, -2,574) per participant to the insurer and A$359 (95% CI: -483, -235) to the participant (Appendix D).

Lifestyle and Biomedical Risk Factor Targets

Participation in The COACH Program was associated with a significant decrease in participants' mean LDL-cholesterol, triglycerides, HbA1c, blood pressure (systolic and diastolic) waist circumference and BMI as well as an increase in physical activity after participation (Appendix D). Similarly, participants were associated with a greater likelihood to have met their threshold targets for LDL-cholesterol (2.88, 95%

CI: 2.54, 3.26), triglycerides (1.64, 95% CI: 1.32, 2.03), BMI (1.55, 95% CI: 1.28, 1.88), waist circumference (2.36, 95% CI: 1.76, 3.17), alcohol consumption (3.42, 95% CI: 2.49, 4.69) and physical activity (5.71, 95% CI: 4.52, 7.21) following The COACH Program (Table 5). There were only a small number of current smokers before (n = 75) and after (n = 67) The COACH Program, thus there was no statistically significant difference between the groups. There was no significant change in fasting glucose among participants without a diagnosis of diabetes.

Discussion

The COACH Program was associated with a significant long-term improvement in participants' survivorship and an overall reduction in healthcare costs to the private health insurer and participants. Program participation was associated with a 34% reduction in mortality over 10 years. On average program participants experienced 8% (95% CI: 0.85, 0.98) fewer hospital episodes per year (a reduction of 0.24; 95% CI: 0.04, 0.44 hospital episodes per year) and a 12% (95% CI: 0.83, 0.94) reduction in length of hospital stay (0.30; 95% CI: 0.15, 0.45 fewer bed days per year). This contributed to an average annual reduction in healthcare costs for the insurer of A$1,499 (95% CI: $1,909, $1,087) per participant per year alive. This resulted in an accumulated 10-year savings of A$4,852 (95% CI: $5,872, $3,833) per participant, exceeding the average program cost per participant of $800. Furthermore, contingent on being hospitalized in a year, the accumulated 10-year saving was A$11,342 (95% CI: A$19,657, A$3,031) suggesting potential for greater savings among those with higher frequency of hospitalization. Participants also gained financial benefit with a 10-year saving of AUD$415 in out-of-pocket costs and were associated with increased likelihood of achieving target risk factor levels for LDL-cholesterol, triglycerides, blood pressure, waist circumference, BMI, alcohol consumption, and physical activity.

This is the first study to investigate survivorship and financial outcomes of a CVD prevention program over a 10-year period. We investigated long-term outcomes for a CVD prevention program with clinical efficacy in the same study and demonstrated: improvements in survivorship, hospital utilization, and clinical measures. A possible limitation is that although we have employed matching to resolve selection bias, our choice of matching variables was limited to data within the database. Given that the Program was associated with fewer impactable and nonimpactable hospital episodes, albeit to a much lesser extent in the nonimpactable episodes, it is possible that those who received The COACH Program differ to the controls on some unobserved characteristic. The average annual claims saving estimates may be inflated as there were fewer participants with longer-term follow-up data and evidence to suggest there is a greater effect on claims savings in the first year of follow-up. Data does not take into consideration the effect of the Program on public hospital utilization or primary care. However, given that private hospital utilization decreased, along with improvements in clinical biomarkers, it is likely that the Program results in a reduction in hospital utilization generally. We identified all individuals that were eligible for the Program and did not participate as the control group. Individuals that were invited and did not participate may have either perceived themselves to be too healthy to participate, or too sick to participate and therefore may be systematically different from those that were not invited. We were not able to differentiate those that were invited and did not participate from those that were not invited; therefore, we cannot investigate the potential bias that this brings to our results, however, we believe this could be acting in opposing directions.

The significantly reduced mortality observed in this study is consistent with the results of a previous long-term follow-up of The COACH Program which showed that the Program significantly reduced mortality for up to 6.35 years after participation.[23] In-line with previous studies of The COACH Program, participation resulted in significant improvements in biomedical and lifestyle risk factor levels.[15,17,24,25] Inconsistencies in outcomes seen in meta-analyses of CVD prevention programs

Table 5
Odds Ratios of the Impact of The COACH Program on Meeting Lifestyle and Biomedical Risk Factor Targets.

	LDL-Cholesterol	Triglycerides	Fasting Glucose	HbA1c	Smoking	Waist Circumference	BMI	Alcohol Intake	Physical Activity
After The COACH Program	2.88*** (95% CI: 2.54, 3.26)	1.64*** (95% CI: 1.32, 2.03)	0.92 (95% CI: 0.83, 1.18)	0.72*** (95% CI: 0.54, 0.96)	1.41 (95% CI: 0.82, 2.43)	2.36*** (95% CI: 1.76, 3.17)	1.55*** (95% CI: 1.28, 1.88)	3.42*** (95% CI: 2.49, 4.69)	5.71*** (95% CI: 4.52, 7.21)
Wald chi square	1012.56***	581.00***	268.23***	206.60***	237.97***	245.67***	185.86***	1427.16***	736.73***
N	2357	2357	1406	876	2321	1281	2295	2356	2327

Note: N is number of observations. BMI is body mass index. CI is confidence interval. Targets based on clinical guidelines achieved prior to and on completion of The COACH Program: LDL-cholesterol (<1.8 mmol/L), triglycerides (<2.0 mmol/L), fasting glucose (<5.5 mmol/L), HbA1c (≤7.0%), smoking status (not a current smoker), waist circumference (<80 cm for females and <94 cm for males), BMI (18.5-24.9 kg/m^2), alcohol intake (≤2 standard drinks per day) and physical activity (≥150 minutes per week); control variables included are age (categorical), sex (binary), month and year of invitation dummies, and top ten diagnosis before invitation (categorical). Biomedical data was collected as part of the intervention. Data is only presented to individuals that had a valid measure at the first and final coaching session. Biomedical data is only available for the treated group.

*** $P \leq .001$.

** $P \leq .05$.

are likely to be a result of varying program characteristics.[18] Quality and content of any disease management program are pivotal to achieving outcomes.[26] A UK global evaluation of 118 CVD prevention programs concluded that The COACH Program "is employing the greatest number of strategies (9/11) that might increase the likelihood of a successful programme."[26] This study extends the evidence that a coaching program proven to close the evidence-practice gap for people with CVD shows benefits that are sustained for at least 10 years.

This study demonstrates that closing the evidence-treatment gap in CVD management results in considerable long-term health benefits including survivorship and associated cost savings to health funders and patients. The cost saving results are critical to health funders tasked with employing interventions that reduce unnecessary health care utilization and improve program participants' health outcomes. These findings are also useful for policy makers as they provide baseline estimates for designing cost-effective models of care for people with CVD.

Conclusion

Participants in The COACH Program achieved a statistically significant reduction in number of hospital episodes, length of stay in hospital, improved biometric measures and improved survivorship. In addition, the Program led to a substantive net reduction in healthcare costs paid by the insurer, reduced length of stay in hospital and lower out of pocket costs to patients over a 10-year period.

Declaration of competing interest

JB and CA were independent consultants and have no conflicts of interest. Researcher initiated grants and consultancy funding has been received by JBs employer (Griffith University) on his behalf from: BUPA, The BUPA Foundation, HBF health limited, The COACH Program Pty Ltd, 3M, Becton Dickinson, Navi Medical Technologies, Abbott, Edwards Life Sciences, and ICON Cancer Foundation. PG and SB are employees of HBF. MJV is the Director of The COACH Program. The COACH Program was provided to HBF's members by dietitians employed by HBF (Perth, Western Australia). The data used in this study are owned by HBF and were collected by HBF as part of the usual business conduct.

CRediT authorship contribution statement

Joshua Byrnes: Writing – review & editing, Writing – original draft, Methodology, Formal analysis, Data curation, Conceptualization. **Margarite J. Vale:** Writing – review & editing, Writing – original draft, Project administration, Funding acquisition, Conceptualization. **Clifford Afoakwah:** Writing – original draft, Visualization, Methodology, Formal analysis, Conceptualization. **Pippa Grant:** Writing – review & editing, Project administration, Funding acquisition, Conceptualization. **Sharmani Barnard:** Writing – review & editing, Methodology, Conceptualization.

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HBF Health Limited, The COACH Program. HBF Health Limited collected all the data. The COACH Program did not have access to any of the PHI primary outcome data (hospital utilization, costs, mortality) at any stage. Study sponsors were involved in the interpretation of data and writing the report but were not involved in the study design, data analysis or decision to submit the paper for publication.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at https://doi.org/10.1016/j.ajmo.2024.100075.

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