

Cardiovascular risk reduction with integrated care: results of 8 years follow up

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Abstract

Background

Care groups organize integrated cardiovascular risk management programs in primary care for high risk patients. Results of risk reduction with long-term participation are scarce. The aim was to evaluate the effects of participation in integrated CVRM care on LDL cholesterol, systolic blood pressure and smoking between 2011 and 2018.

Methods

A protocol was developed for delegated practice nurse activities. A multidisciplinary data registry was used for uniform registration. The care group organized annual education, feedback meetings and intervision for general practitioners and practice nurses. From 2015 onwards, the care group has started with practice visitations to discuss performance and support practices with improving integrated CVRM care.

Results

Participants grew from 34,628 patients (mean age 67 years, 53% women, 29% with a previous CVD) in 2011 to 48,397 patients (mean age 70 years, 51% women, 44% with a previous CVD) in 2018. In patients eligible for primary prevention as well as for secondary prevention similar trends were observed: lipid modifying and blood pressure lowering medication increased, mean LDL-cholesterol and mean systolic blood pressure decreased, patients on target for LDL cholesterol and systolic blood pressure increased and the proportion of non-smokers with both LDL-cholesterol and SBP on target increased.

Conclusion

In patients participating in an integrated CVRM care program, we saw considerable improvements in 3 important cardiovascular risk factors between 2011 and 2018.

Introduction

Cardiovascular disease (CVD) accounts for 45% of deaths and 64 million disability adjusted life years (DALY) in Europe (1), with reduced quality of life in patients after a myocardial infarction and stroke (2, 3). The occurrence of CVD can be largely attributed to modifiable risk factors such as elevated blood pressure, unfavourable lipids, obesity, smoking, physical inactivity, unhealthy diet and alcohol intake of which it has been suggested that adjustment to normal levels could prevent 80–90% of all CVD events (4). Addressing these risk factors with a multifactorial and multidisciplinary approach is recommended by national and international guidelines (5, 6). With a long tradition in programmatic prevention and a longstanding relationship with patients and their families, general practitioners (GPs) play a key-role in a multidisciplinary approach for the prevention of CVD. Both patients and GPs endorse the usefulness of prevention in primary care (7). The National Guideline for cardiovascular risk management (CVRM)

indicates how to identify patients with an increased risk of CVD and advised on cardiovascular risk reduction with lifestyle improvements and drug therapy (5). Moreover, the guideline provides advice on task delegation, such as to the practice nurse (PN), a registered nurse with an additional 1 year training. Having their own consultation hours, PNs perform protocolized programmatic CVRM care, focusing on life style and treatment of blood pressure and cholesterol. Involvement of trained nurses has shown to be equivalent to physician care regarding health outcomes for patients, process of care, referrals to specialists and costs (8, 9). Additionally, compared with GPs, nurse-delivered CVRM in primary care led to better outcome measures on systolic blood pressure, total cholesterol and LDL-cholesterol after 1 year (10).

Surveys carried out in several European countries showed poor implementation of international CVRM guidelines in primary care and disappointing rates of cardiovascular risk factor control (11, 12). A comprehensive approach is generally needed to overcome many barriers for following guidelines and treatment targets (13). Successful introduction and implementation of a guideline depends highly on a rigorous preparation and evaluation (14). Between 2005 and 2010 in the Netherlands, many GPs organized themselves in care groups, offering high-quality, guideline based CVRM care (15). Care groups support with guideline implementation and negotiate with regional health insurance organizations about a bundled payment contract. PoZoB (Praktijk ondersteuning Zuid oost Brabant), a large care group in and around Eindhoven, Netherlands, implemented programmatic CVRM care in 137 practices between April 1st 2010 and January 1st 2013. Since long term results of its effect on cardiovascular risk factors are scarce, we describe the effects of the implementation of programmatic CVRM care on LDL cholesterol, systolic blood pressure (SBP) and smoking between 2011 and 2018.

Methods

Design

The CVRM implementation program was designed as a dynamic observational cohort study, with a run in period (2010–2015) for optimizing data collection and protocol development, aiming at improvements in registration and outcomes identical for all participating practices. From 2015 to 2018 the care group focused on visitation of individual practices to discuss practice organization and outcomes of integrated care.

Study population

The study was performed in the region Eindhoven, south-eastern part of the Netherlands, in general practices affiliated to the primary care group PoZoB. Between 2010 and 2013, 137 practices followed a stepwise implementation for integrated care and another 8 practices started implementation between 2013 and 2015. Eligibility for participation in integrated CVRM care was based on in- and exclusion criteria given in table 1. Details of the stepwise implementation have been described elsewhere (16).

Table 1 In- and exclusion criteria for enrollment in the programmatic CVRM program

Inclusion criteria for patients with CVD or kidney disease:

- Documented previous ischemic or atherosclerotic heart disease (myocardial infarction and angina pectoris), heart failure, atrial fibrillation, aneurysm of the abdominal aorta, peripheral arterial disease, transient ischemic attack, ischemic or hemorrhagic stroke, chronic kidney disease. (ICPC coded?)
- The patient is primarily treated in primary care and aged 18 years or above .

Inclusion criteria for patients with high risk of CVD, free from symptomatic CVD or kidney disease

- A 10 year cardiovascular mortality risk > 5%, based on the SCORE table from the 2006 CVRM guidelines of the Dutch Society of General Practice (5).
- Prescribed of blood pressure lowering or lipid modifying drugs in men aged ≥ 55 years and women aged ≥ 60 years.
- Systolic blood pressure > 180 mm Hg and/or total cholesterol > 8 mmol/l ever measured, independent of the 10 year mortality risk.
- The patient is primarily treated in primary care and aged 18 years or above.

Exclusion criteria for both groups were:

- Primarily treated for cardiovascular disease risk by a specialist in a hospital or at an outpatient clinic.
- Diabetes mellitus (patients receive cardiovascular risk management in a diabetes care program).
- Patients younger than 18 years.

Interventions between 2010 and 2018

Registration

A multidisciplinary registry for integrated care (Care2U), set up from April 1st 2010 onwards, collected data in routine clinical practice. In 2011, Care2U-data of 34,628 participating patients was available, increasing to data of 48,397 patients in 2018.

Data in Care2U automatically ended up in the GPs Electronic Health Record (EHR) and were visible for individual practices in real time. Laboratory test results ended up automatically in Care2U. Smoking status and all SBP measurements taken in one year were registered in Care2U, with the last measured SBP value visible in the data overview of every individual practice. Due to linking problems of Care2U with 8 different EHR systems, data from 2010 were incomplete but registration improved significantly in 2011 and 2012.

Integrated CVRM care

After assessment for eligibility patients started with life style improvements and drug therapy. If necessary referral to another health care professional was made, such as a dietician, physiotherapist or a medical specialist. Patients were monitored 1–4 times a year by the PN and once a year by the GP to evaluate cardiovascular risk factors. With the multidisciplinary information system all involved

disciplines had access to the patients' data, facilitating communication between care givers and exchange of information.

Protocols

From the start of integrated CVRM care in 2010, a working protocol for the PN was available in which all activities of the PN were recorded, supplemented in 2013 with a protocol for correct blood pressure measurements.

Education

Annual education for GPs and PNs was organized by the care group and based on the most recent guidelines (5, 17). PNs received additional education on motivational interviewing and data processing. During intervision meetings PNs discussed complicated case studies and shared problems on practice organization. In feedback meetings GPs and PNs discussed Care2U benchmark data on registration and outcomes.

Practice visitations

The care group started with practice visitations in 2015, carried out by care groups' staff members to support practices with drawing up an annual practice plan and by formulating one or more areas in which a practice wanted to improve. From 2016 onwards, practice visitations were also used to discuss performance based on data from the quarterly reports.

Quarterly reports

The care group started with quarterly reports in 2016 that enabled practices to compare individual practice performance with care group performance. The care group established indicators for the prevalence, registration and outcomes of cardiovascular risk factors for participating practices. Standards were set for mean value, minimal norm and best practice, an often used method to compare individual performance with peer group performance (18). Practices asking for support, having problems with organizing adequate CVRM care or performing below a minimal norm based on the care groups' standards were prioritized for visitation. In 2015 the care group started with visiting 52 practices and in 2016, 2017 and 2018 respectively, 98, 102 and 117 practices were visited at least once.

LDL-cholesterol toolkit

The LDL-cholesterol toolkit introduced in 2017 comprised two parts: a part for care givers to inform patients on the use and necessity of lipid lowering medication (e.g. statins) and "tips and tricks" in case of impaired patient adherence or side effects. The other part was written information for patients.

Data analysis

Data are presented as percentages and means with corresponding standard deviations, overall and in strata of primary and secondary prevention.

Results

Population studied

April 1st 2010 27 practices with 8,456 eligible patients, started with the implementation of integrated CVRM care. January 1st 2013, 137 practices with 38,675 eligible patients (mean age 67,8 years, 52,6% female, 43,6% \geq 70 y, 33,4% with previous CVD) completed the implementation process with 149 practices and 48,397 participating patients (mean age 69,8 years, 53,1% female, 52,8% \geq 70 years, 44,3% with previous CVD) participating in 2018. Because registration in Care2U was incomplete in 2010, annual results between 2011 and 2018 are shown. Baseline characteristics of participating patients eligible for primary and secondary prevention are given in table 2.

Table 2 Characteristics of the study population

Year	2011	2012	2013	2014	2015	2016	2017	2018
Registered patients in PoZoB care group (n)	378,099	402,623	406,119	416,433	422,296	401,077	407,661	416,648
Eligible for integrated CVRM care (n)	40456	43956	47,340	49,702	53,155	56,654	57,478	59,349
Participants (n)	34628	38675	39,503	42,551	45,138	48,222	46,400	48,397
Eligible but not participating in primary care	5858	5281	7,837	7,151	8,017	8,432	11,076	10,952
Participants on high risk for CVD (%)	24712(71,4)	25772 (66,6)	25,559 (64,7)	26,802 (63,0)	27,913 (61,8)	28,639 (59,4)	26,029 (56,1)	26,935 (55,7)
Mean age in years (SD)	66,3 (10,0)	66,6 (9,9)	66,7 (9,7)	66,9 (9,7)	67,2 (9,8)	67,5 (10,1)	67,3 (10,1)	67,6 (10,1)
Male (%)	43,9	43,6	43,5	43,7	43,6	44,0	43,6	44,0
≥ 70 years (%)	36,9	37,8	37,8	38,9	40,2	42,4	42,6	43,8
Mean LDL-cholesterol in mmol/l (SD)	3,34 (0,93)	3,31 (1,1)	3,25 (0,92)	3,13 (0,93)	2,96 (0,92)	2,97 (0,92)	2,88 (0,89)	2,62 (0,81)
Mean SBP in mm Hg (SD)	140,8 (19,8)	139,5 (16,5)	138,3 (15,7)	137,7 (15,9)	137,2 (15,3)	136,8 (15,0)	136,7 (15,1)	136,4 (14,9)
Smoking (%)	4,0	8,5	12,3	11,6	11,4	11,3	10,8	10,4
Non-smoking/stopped smoking (%)	55,2	65,5	78,5	78,9	80,4	80,5	81,1	81,7
LL medication prescribed (%)	22,8	32,4	35,6	37,5	41,1	42,9	49,9	49,6
BPL medication prescribed (%)	47,1	61,1	61,0	59,0	60,8	61,1	67,4	69,7
LDL-cholesterol ≤ 2,5 mmol/l (%)	15,0	19,6	22,7	27,9	35,9	34,0	39,5	51,8
SBD ≤ 140 mm Hg (%)	35,1	49,1	59,9	60,0	61,8	62,8	63,4	64,0
Non-smoking/stopped smoking, LDL-cholesterol ≤ 2,5 mmol/l and SBP ≤ 140 mm Hg (%)	3,7	7,5	11,4	14,2	18,5	18,8	20,8	29,5
Participants with previous CVD (%)	9916 (28,6)	12903 (33,4)	13,944 (35,3)	15,749 (37,0)	17,225 (38,2)	19,583 (40,6)	20,371 (43,9)	21,462 (44,3)
Mean age in years Age (y) (SD)	69,7 (11,8)	70,3 (11,3)	70,8 (10,8)	71,3 (10,9)	71,6 (10,8)	72,5 (10,9)	72,3 (10,8)	72,6 (10,7)
Male (%)	50,1	55,0	52,9	53,0	53,2	53,4	54,0	54,7
≥ 70 years (%)	53,3	55,3	57,2	58,7	59,7	62,4	62,8	64,1
Mean LDL-cholesterol in mmol/l (SD)	2,81 (0,91)	2,81 (0,90)	2,79 (0,90)	2,71 (0,90)	2,56 (0,89)	2,58 (0,88)	2,58 (0,87)	2,33 (0,82)
Mean SBD in mm Hg (SD)	138,1 (18,0)	137,1 (17,8)	136,5 (17,4)	135,9 (16,7)	136,1 (17,0)	135,6 (16,7)	135,2 (16,6)	135,0 (16,5)
Smoking (%)	4,2	9,8	14,4	13,5	13,4	12,8	12,2	12,2
Non-smoking/stopped smoking (%)	43,7	57,0	74,4	74,7	76,6	77,1	77,1	78,5
LL medication prescribed (%)	38,6	49,6	53,8	51,7	58,4	60,4	60,5	61,3
BPL medication prescribed (%)	49,6	58,8	62,8	60,8	65,8	66,9	66,7	68,6
LDL-cholesterol ≤ 2,5 mmol/l (%)	27,7	35,6	42,2	46,6	54,4	49,6	54,3	65,8
SBD ≤ 140 mm Hg (%)	32,9	48,3	62,6	61,8	62,2	63,2	63,4	64,5
Non-smoking/stopped smoking, LDL-cholesterol ≤ 2,5 mmol/l and SBP ≤ 140 mm Hg (%)	6,5	13,7	21,7	24,0	28,1	26,3	29,0	36,5

Abbreviations: SD: Standard Deviation; LL medication: Lipid Lowering medication; BPL medication: Blood Pressure Lowering medication.

Registration

Registration in Care2U of LDL-cholesterol, SBP and smoking status improved significantly in 2011 and 2012 and remained stable in the subsequent years with missing data for LDL-cholesterol, SBP and smoking status of less than 10%. Registration data are given in table 3.

Table 3 Registration of LDL-cholesterol, SBP and smoking status between 2011 and 2018

	2011	2012	2013	2014	2015	2016	2017	2018
LDL-cholesterol (%)	72,7	86,3	96,4	97,1	97,6	92,4	97,8	98,0
SBP (%)	58,9	79,0	93,8	91,7	92,8	92,4	91,6	91,9
Smoking status (%)	55,9	71,6	90,1	89,7	91,1	91,0	91,8	91,6

Risk factor trends in patients eligible for primary prevention

Cholesterol lowering prescriptions increased from 22,8% (2011) to 49,6% (2018). Blood pressure lowering prescriptions increased from 47,1% to 69,7%. Mean LDL-cholesterol decreased from 3,34 mmol/l to 2,62 mmol/l. Mean SBP decreased from 140,8 mmHg to 136,4 mmHg. The proportion of patients on target for LDL-cholesterol increased from 15,0% to 51,8%. The proportion of patients on target for SBP increased from 35,1% to 64,0%. The proportion of smoking patients decreased from 12,3% to 10,4% between 2013 and 2018. The proportion of non-smoking patients with LDL-cholesterol and SBP on target increased from 3,7% to 29,5%.

Risk factor trends for patients eligible for secondary prevention

Cholesterol lowering prescriptions increased from 38,6% to 61,3%. Blood pressure lowering prescriptions increased from 49,6% to 68,6%. Mean LDL-cholesterol decreased from 2,81 mmol/l to 2,33 mmol/l. Mean SBP decreased from 138,1 mm Hg to 135,0 mm Hg. The proportion of patients on target for LDL-cholesterol increased from 27,7% to 65,8%. The proportion of patients on target for SBP increased from 32,9% to 64,5%. The proportion of smoking patients decreased from 14,4% to 12,2% between 2013 and 2018. The proportion of non-smoking patients with LDL-cholesterol and SBD on target increased from 6,5% to 36,5%. The course of the risk factors, the proportion of patients on target and the proportion of prescriptions are visualized in Fig. 1.

Discussion

Summary

The study showed that with offering comprehensive support, consisting protocolized involvement of PNs, a multidisciplinary registration system, regular education and feedback, practice visitations, quarterly benchmark reports and a LDL-cholesterol toolkit, a considerable improvement in 3 important cardiovascular risk factors in patients on high risk for or with previous CVD was observed.

Strengths and limitations

There is a number of strengths related to this study. First, the multidisciplinary information system (Care2U) allowed us to include a large study population with information from routine clinical practice.

Second, all participating practices followed the same protocol for stepwise implementation and follow-up (16). Third, data collection did not interfere with day-by-day practice, resulting in real life monitoring of a large number of patients at high risk of CVD in primary care. Fourth, data were collected over a period of 8 years which allowed us to visualize a clear development of both registration and outcomes.

There are also some limitations. First, because all affiliated practices started with programmatic CVRM care, this study contains no reference group. A causal relationship between care group support and outcomes therefore cannot be demonstrated. Long-term research, comparing integrated CVRM with care as usual would therefore be desirable. Second, some data on LDL-cholesterol, SBP and smoking status between 2010–2018 were missing, especially between 2010 and 2013. It remains uncertain whether this was solely due to technical problems or also lack of time for the PN or not delivered care. However, the number of missings between 2013 and 2018 was generally well below 10%, and its impact on the results may be small (19). Still, data registration could improve if PNs were given sufficient time to fulfill the administrative tasks.

Comparison with existing literature

To our knowledge this is among the first studies that evaluates comprehensive care group support and long-term outcomes of integrated CVRM care in the Netherlands. Comparison with other studies is difficult because the study design is often a randomized controlled trial (RCT) with a limited follow up period. Outcomes from RCTs comparing structured care delivered by PNs with care as usual show varying results. In two Dutch studies, PNs achieved equal or better results for the management of asthma, COPD, diabetes and cardiovascular risk factors after 1 year, compared to GP care (10, 20). A nurse-led, multifaceted risk assessment and management program (RAMP) in hypertension patients reduced mean SBP and LDL-cholesterol and increased the proportion of patients on target for SBP and LDL-cholesterol as well as medication prescriptions after 1 year if compared to care delivered by GPs. Baseline SBP was 148.7 mm Hg, leaving a lot of room for improvement (21). Another RCT, conducted in rural China, compared the delivery of a comprehensive intervention by family doctors (standardized medication, advice on both life style changes and medication adherence) with care as usual for hypertensive patients with or without diabetes. Increased prescribing rates of antihypertensive and lipid lowering medication were seen in the intervention group as well as significant reductions in smoking rates and salt intake but no differences in SBP and LDL-cholesterol after 1 year (22). Van Bussel and co-workers, assessing a nurse-delivered multicomponent cardiovascular prevention program in general practice for patients between 70 and 78 years without cardiovascular disease found no differences in cardiovascular risk profile after a mean follow up period of 6 years, although the intervention reduced SBP and the proportion of smokers in the first 2 years of the study (23). Marchal et al assessed the effect of integrated CVRM care delivered by PNs compared to usual care offered by the GP in a randomized setting. They found no differences in SBP and LDL-cholesterol between the intervention and care as usual group after 1 year (24). Yet, with mean baseline values for SBP and LDL-cholesterol of 136.7 mmHg and 2.8 mmol/l respectively, it seems difficult to improve within such a short period. It is known that implementation of a chronic care program and monitoring improvements is a lengthy process requiring regular adjustment

(25). With increasing awareness for CVRM and PNs participating in almost all general practices in the Netherlands, integrated CVRM care has become care as usual, thus reducing the contrast between study groups and partially explaining the lack of effectiveness in performed RCTs. This potential limitation could pave the way for long-term longitudinal cohort studies in the near future. Our study showed that in patients participating in integrated CVRM care between 2011 and 2018, we saw a substantial decrease in mean SBP, mean LDL-cholesterol and non-smoking participants, an increase in blood pressure lowering and lipid modifying prescriptions and an increase in patients on target for SBP and LDL-cholesterol. Finally, the proportion of non-smoking patients with SBP and LDL-cholesterol on target increased between 2011 and 2018 from 3,7% to 29,5% in patients on high risk and from 6,5% to 36,5% in patients with a previous CVD. Taking into account that with every mmol LDL reduction a reduction of 25% in major adverse cardiovascular events (MACE) can be achieved, a 10% reduction in MACE with every 5 mm Hg SBP reduction and a 32% reduction in MACE with smoking cessation (26, 27, 28), this implicates that for this large number of care group participants a considerable cardiovascular risk reduction is achieved. These findings indicate that with affiliation to a care group, adequate monitoring, subsequent treatment and long term follow up it is possible to realize clinically relevant improvements, resulting in a substantial risk reduction for CVD.

Implications for research

With aggregated data from 86 care groups in the Netherlands it is possible to compare registration and outcomes to further improve results of integrated CVRM care (29). Comparing components of integrated CVRM care regarding effectivity and introducing e-health strategies instead of face-to-face contacts may be promising (30).

Abbreviations

PoZoB: Praktijkondersteuning Zuidoost Brabant; CVRM: Cardiovascular risk management; GP: General Practitioner; CVD: Cardiovascular diseases; PN: Practice Nurse; EHR: Electronic Health Record; RCT: Randomized Controlled Trial

Declarations

Ethical approval Not applicable. All methods including the care groups protocol for data extraction, identification, examination and follow up were based on the 2006 CVRM guidelines of the Dutch Society of General Practice and approved by the Julius Centre for Health Sciences and Primary Care, University Medical Center Utrecht, The Netherlands. Before starting with integrated CVRM care informed consent was given by patients to use anonymized data for evaluation and scientific research.

Consent for publication Not applicable

Availability of data and materials Anonymized patient data derived from the multidisciplinary information system (Care2U) are available on request.

Competing interests The authors declare that they have no competing interests

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Author Contributions Geert Smits drafted the first version of the manuscript, Sander van Doorn, Michiel Bots and Monika Hollander critically reviewed and revised the manuscript before providing final approval.

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References

1. Wilkins E, Wilson L, Wickramasinghe K, Bhatnagar P, Leal J, Luengo-Fernandez R, Burns R, Rayner M, Townsend N (2017). European Cardiovascular Disease Statistics 2017. European Heart Network, Brussels.
2. Berndt Schweikert , Matthias Hunger, Christa Meisinger et al. Quality of life several years after myocardial infarction: comparing the MONIKA/KORA registry to the general population. *Eur Heart J* 2009 Feb;30(4):436-443. doi:10.1093/eurheartj/ehn509
3. Dhamoon MS, Moon YP, Paik MC et al. Quality of life declines after first ischemic stroke. The Northern Manhattan Study. *Neurology* 2010 Jul 27;75(4):328-334
4. Yusuf S et al. Effect of potentially modifiable risk factors associated with myocardial infarction in 52 countries (the INTERHEART study): a case control study. *Lancet* 2004; 364: 937-52.
5. Smulders YM, Burgers JS, Scheltens T, van Hout BA, Wiersma T, Simoons ML; Guideline development group for the Dutch guideline for multidisciplinary cardiovascular risk management. Clinical practice guideline for cardiovascular risk management in the Netherlands. *Neth J Med.* 2008 Apr;66(4):169-74. Review. PubMed PMID: 18424866.
6. Piepoli MF, Hoes AW, Agewall S et al. 2016 European Guidelines on cardiovascular disease prevention in clinical practice. The Sixth Joint Task Force of the European Society of Cardiology and Other Societies on Cardiovascular Disease Prevention in Clinical Practice (constituted by representatives of 10 societies and by invited experts) Developed with the special contribution of the European Association for Cardiovascular Prevention & Rehabilitation (EAPCR). *European Heart Journal* 2016 August 1;37(29):2315-2381.
7. Drenthen AJM, Assendelft WJJ, Van der Velden J. Prevention in the general practice: get moving! *Huisarts Wet* 2008;51(1):38-41.
8. Laurant M, van der Biezen M, Wijers N, Watananirun K, Kontopantelis E, van Vught AJAH. Nurses as substitutes for doctors in primary care. *Cochrane Database of Systematic Reviews* 2018, Issue 7. Art. No.: CD001271. DOI: 10.1002/14651858.CD001271.pub3.
9. Sue Horrocks, Elizabeth Anderson, Chris Salisbury. Systematic review of whether nurse practitioners working in primary care can provide equivalent care to doctors. *BMJ* 2002;324:819–23

10. HR Voogdt Pruis, GHMI Beusmans, APM Gorgels et al: Effectiveness of nurse-delivered cardiovascular risk management in primary care: a randomised trial. *British Journal of General Practice* 2010; **60**: 40–46. DOI: 10.3399/bjgp10X482095.
11. Kotseva K, De Bacquer D, De Backer G, et al. Lifestyle and risk factor management in people at high risk of cardiovascular disease. A report from the european society of cardiology european action on secondary and primary prevention by intervention to reduce events (EUROASPIRE) IV cross-sectional survey in 14 european regions. *Eur J Prev Cardiol.* 2016;23(18):2007-2018.
12. Kotseva K, De Backer G, De Bacquer D, et al. Primary prevention efforts are poorly developed in people at high cardiovascular risk: A report from the european society of cardiology EURObservational research programme EUROASPIRE V survey in 16 European countries. *Eur J Prev Cardiol.* 2020:2047487320908698.
13. Grol R, Grimshaw J. From best evidence to best practice: effective implementation of change in patients' care. *Lancet* 2003; 362: 1225-30.
14. Grimshaw J, Russel IT. Effect of clinical guidelines on medical practice: a systematic review of rigorous evaluations. *Lancet* 1993; 342: 1317-22.
15. v Til JT, de Wildt JE, Struis JN: De organisatie van zorggroepen anno 2010. Huidige stand van zaken en de ontwikkelingen in de afgelopen jaren. RIVM rapport 260332001/2010 www.
16. Smits GHJM, Hollander M, v Doorn S, Bots ML: Stepwise implementation of a cardiovascular risk management program in Primary Care. Submitted for publication
17. Dutch College of General Practitioners Guideline Development Group. Guideline cardiovascular risk management (second revision). *Huisarts Wet.* 2012(55):14-28.
18. Gude WT et al: Clinical performance comparators in audit and feedback: a review of theory and evidence. *Implementation Science* (2019) 14:39. <https://doi.org/10.1186/s13012-019-0887-1>
<https://doi.org/10.1186/s13012-019-0887-1>
19. Sterne JA, White IR, Carlin JB, Spratt M, Royston P, Kenward MG, Wood AM, Carpenter JR. Multiple imputation for missing data in epidemiological and clinical research: potential and pitfalls. *BMJ.* 2009 Jun 29;338:b2393. doi: 10.1136/bmj.b2393. PMID: 19564179; PMCID: PMC2714692.
20. Van Son L, Vrijhoef VB, Crebolder H, Van Hoef L, Beusmans G. Support for the general practitioner. An exploration of the effect of the practice nurse on the care of asthma, COPD and diabetes patients. *Huisarts Wet* 2004;47(1):15-21.
21. Esther Y.T. Yu, Eric Y.F. Wan, Carlos K.H. Wong et al: Effects of risk assessment and management program for hypertension on clinical outcomes and cardiovascular disease risks after 12 months: a population-based matched cohort study. *J Hypertens* 2017 Mar; 35(3): 627–636. doi: [10.1097/HJH.0000000000001177](https://doi.org/10.1097/HJH.0000000000001177).
22. Wei X, Walley JD, Zhang Z, Zou G, Gong W, Deng S, et al. (2017) Implementation of a comprehensive intervention for patients at high risk of cardiovascular disease in rural China: A pragmatic cluster randomized controlled trial. *PLoS ONE* 12(8): e0183169. <https://doi.org/10.1371/journal.pone.0183169>

23. Emma F. van Bussel, MD, Marieke P. Hoevenaar-Blom, PhD, Wim B. Busschers, MSc et al: Effects of Primary Cardiovascular Prevention on Vascular Risk in Older Adults. *Am J Prev Med* 2018;55(3):368–375.
24. S Marchal, AWJ van het Hof, HJG Bilo et al: Integrated cardiovascular risk management program versus usual care in high CV risk patients: an observational study in general practice. *British Journal of General Practice Open*, 2021.
25. Willems N, Romeijnders A, Smits G: Verminderen van praktijkvariatie in de eerste lijn. *Huisarts Wet* 2017;60(11):580-3.
26. Cholesterol Treatment Trialists' (CTT) Collaborators: The effects of lowering LDL cholesterol with statin therapy in people at low risk of vascular disease: meta-analysis of individual data from 27 randomized controlled trials. *Lancet* 2012; 380: 581-90.
27. The Blood Pressure Treatment Trialists' Collaboration: Pharmacological blood pressure lowering for primary and secondary prevention of cardiovascular disease across different levels of blood pressure: an individual participant-level data meta-analysis. *Lancet* 2021; 397: 1625-36.
28. Critchley JA, Capewell S: Smoking cessation for the secondary prevention of coronary heart disease. *Cochrane Database of Systematic Reviews* 2003, Issue 4. Art. No.: CD003041. DOI: 10.1002/14651858.CD003041.pub2.
29. Ineen Transparante Ketenzorg Rapportage 2019 Zorggroepen Diabetes mellitus, VRM, COPD en Astma. Spiegel voor het verbeteren van chronische zorg, Juli 2020.
30. Richard E, Moll v Charante EP, Hoevenaars-Blom MP et al: Healthy aging through internet counselling in the elderly (HATICE): a multinational, randomized controlled trial. *Lancet Digital Health* 2019; 1: e424-34. Published Online November 14, 2019 [https://doi.org/10.1016/S2589-7500\(19\)30153-0](https://doi.org/10.1016/S2589-7500(19)30153-0).

Figures

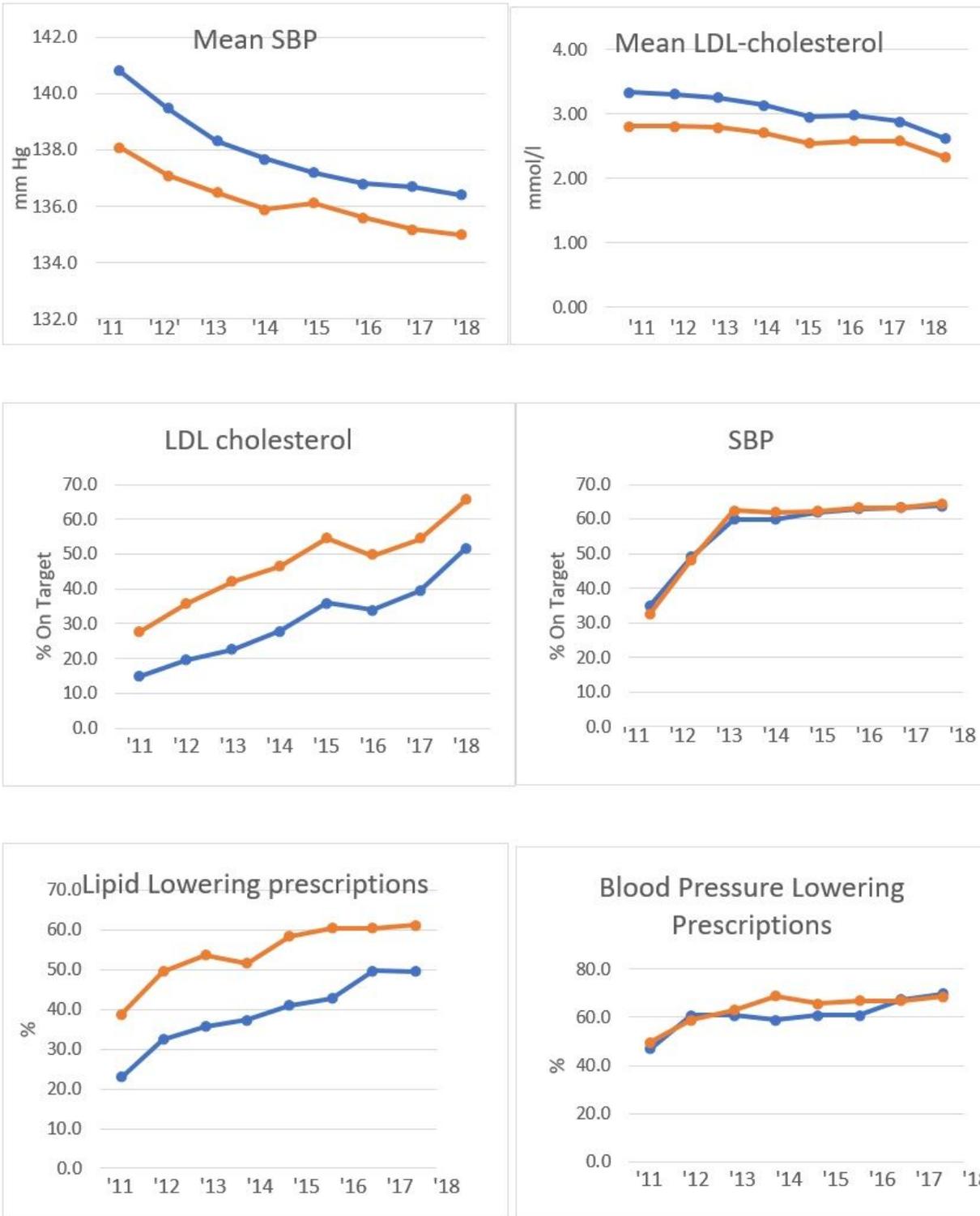


Figure 1

Mean LDL-chol and SBP, LDL-chol and SBP on target and Lipid Lowering and Blood Pressure Lowering prescriptions between 2011 and 2018

Blue line: Primary prevention; Yellow line: Secondary prevention