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Evaluation of a combined lifestyle intervention for overweight and obese patients in primary health care: a quasi-experimental design

Lisa D M Verberne[a,*], Marike R C Hendriks[b], Geert M Rutten[c], Inge Spronk[a], Hans H C M Savelberg[b], Cindy Veenhof[d] and Mark M J Nielen[a]

[a]Netherlands Institute for Health Services Research (NIVEL), Utrecht, The Netherlands [b]Department of Human Movement Science, School of Nutrition and Translational Research in Metabolism (NUTRIM), Maastricht University Medical Centre, Maastricht, The Netherlands [c]Department of Health Promotion, School of Nutrition and Translational Research in Metabolism (NUTRIM), Maastricht University Medical Centre, Maastricht, The Netherlands [d]Department of Rehabilitation, Nursing Science and Sport, University Medical Center Utrecht, Utrecht, The Netherlands

*Correspondence to Lisa DM Verberne, Netherlands Institute for Health Services Research (NIVEL), P.O. Box 1568, 3500 BN Utrecht, The Netherlands; E-mail: l.verberne@nivel.nl

Abstract

Background. Combined lifestyle interventions (CLIs) are designed to reduce risk factors for lifestyle-related diseases through increasing physical activity and improvement of dietary behaviour.
Objective. To evaluate the effects of a CLI for overweight and obese patients on lifestyle-related risk factors and health care consumption, in comparison to usual care.
Methods. Data on anthropometric and metabolic measurements, morbidity, drugs prescriptions and general practitioner (GP) consultations were extracted from electronic health records (timeframe: July 2009–August 2013). Using a quasi-experimental design, health outcomes of 127 patients who participated in a 1-year CLI were compared to a group of 254 matched patients that received usual care. Baseline to post-intervention changes in health outcomes between intervention and comparison group were evaluated using mixed model analyses.
Results. Compared to baseline, both groups showed reductions in body mass index (BMI), blood pressure, total cholesterol and low density lipoprotein cholesterol in year post-intervention. For these outcome measures, no significant differences in changes were observed between intervention and comparison group. A significant improvement of 0.08 mmol/l in high density lipoprotein (HDL) cholesterol was observed for the intervention group above the comparison group ($P < 0.01$). No significant intergroup differences were shown in drugs prescriptions and number of GP consultations.
Conclusion. A CLI for overweight and obese patients in primary health care resulted in similar effects on health outcomes compared to usual care. Only an improvement on HDL cholesterol was shown. This study indicates that implementation and evaluation of a lifestyle intervention in primary health care is challenging due to political and financial barriers.

Key words: Health behaviour, life style, multicenter study, primary health care, public health, obesity

Introduction

Worldwide, the proportion of adults with a body mass index (BMI) of 25 kg/m^2 or greater has increased from approximately 30% in 1980 to almost 40% in 2013 (1). Overweight and obesity contribute to a large proportion of lifestyle-related diseases, such as diabetes type 2 and cardiovascular diseases (CVD), and places a high burden on the health care system (2). Combined lifestyle interventions (CLIs) are designed to prevent or treat lifestyle-related diseases, by improving nutritional and physical activity behaviour. Medium to high intensity diet and physical activity counselling in adults with known CVD risk factors contribute to good cardiovascular and overall health, as shown in the evidence synthesis of Lin *et al.* (3)

In the Netherlands, a CLI called 'BeweegKuur' (exercise on prescription) was developed with the objective to achieve health benefits through increased physical activity and improved dietary behaviour. The development of the 'BeweegKuur' was based on theories regarding the level of motivation (Theory of Planned Behaviour), and type of motivation (Self-Determination Theory) in changing physical activity and/or diet. The objectives of the CLI were based on the main determinants of sustained changes in physical activity and dietary behaviour, including autonomous motivation, enjoyment of exercise, self-efficacy, health consciousness, knowledge on serving sizes and diet–disease relationships (4). Initially the CLI was focussed on patients with (pre) diabetes, and later on overweight and obese patients at high risk for, or established CVD and/or diabetes (5). Commissioned by the Dutch government, this CLI was implemented in 150 primary care practices in the Netherlands in 2010, offered by a multidisciplinary team of health care providers. Dependent on the level of weight-related health risk, participants could be involved in one of the three programs, differing in extent and intensity of physical activity support.

Only a few previous studies on lifestyle interventions in primary health care settings evaluated the baseline to post-intervention changes on lifestyle-related risk factors, by comparing it to a patient group receiving usual care (6–10). One of these studies was on the BeweegKuur intervention for (pre) diabetes patients, that evaluated changes in lifestyle-related risk factors, by comparing a patient group that participated in the intervention to a matched group of patients receiving usual care. However, no significant or clinical relevant effects were found (8). For this evaluation, data were extracted from electronic health records (EHRs) from general practices, which is an easy method to obtain longitudinal and objective information on health outcomes (11,12).

The BeweegKuur intervention for overweight and obese patients has been evaluated on behaviour change and protocol adherence (13,14), and will be evaluated on cost-effectiveness, by comparing two programmes of the intervention (15). However, an evaluation on health outcomes in comparison to usual care was not yet performed. Therefore, the aim of the current study was to examine the effects of the BeweegKuur intervention for overweight and obese patients on lifestyle-related risk factors and health care consumption, in comparison to usual care, using longitudinal data of EHRs.

Methods

Study design

A quasi-experimental design was used in this study, including an intervention group and a comparison group. For the intervention group, patients were selected from general practices that participated in one of the two studies: a Prospective Multicentre Cohort Study (PMCS) (13) and a clustered Randomized Controlled Trial (cRCT) (15). In these two studies, patients were involved in one of the three programmes of the BeweegKuur intervention. Main inclusion criteria were: BMI >25 kg/m^2, and a large waist circumference (≥88 cm for women, ≥102 cm for men). Having one or more comorbidities (hypertension, dyslipidemia, impaired fasting glucose, osteoarthritis, sleep apnea, diabetes and/or CVD), was also allowed as inclusion criteria (5). The intervention took 1 year and is previously described by Helmink *et al.* (4) (see also Supplementary data for a detailed description of the intervention). All health care providers who were involved in the intervention were offered a training in motivational interviewing, consisting of 48-h sessions. During monthly telephone contacts between research team and health care providers, number of drop-outs and reasons were discussed.

A comparison group of 'usual care' patients was selected from general practices, of which continuous data has been collected from 2008 within the NIVEL-Primary Care Database (NIVEL-PCD). These general practices did not participate in one of the two studies (13,15) on the BeweegKuur intervention and were supposed to deliver usual care. According to the Dutch general practitioner (GP) guidelines for management of obesity (16), cardiovascular risk (17) and diabetes mellitus type 2 (18), in usual care, non-pharmacological treatment is recommended in patients having modifiable risk factors. Non-pharmacological treatment primarily consists of lifestyle advises by a GP or practice nurse, on nutrition, physical activity, and smoking. Sometimes these patients are advised to consult a dietician and/or a physiotherapist for more intensive guidance on improving nutritional and physical activity behaviour. Additional pharmacological treatment is advised to patients if target values of blood glucose cannot be reached by non-pharmacological treatment only, or to patients at high risk for CVD.

Data collection

In 2013, the GPs connected to the 29 general practices that participated in the two initial studies (13,15), were asked by (e-) mail to sign a permission form for extracting data of the EHRs of their patients who participated in the CLI. EHRs are used in Dutch general practices to file patient information on consultations, morbidity, drugs prescriptions and anthropometric and metabolic measurements, using the International Classification of Primary Care—version 1 (ICPC-1), and the Anatomical Therapeutic Chemical (ATC) classification system. Information on sex, age, BMI, blood pressure, cholesterol, drugs prescriptions, diagnoses of diabetes and CVD and the number of GP consultations, were evaluated in this study. The date of completing the baseline questionnaire of the initial studies (13,15), was used as the start date of the CLI (between July 2010 and August 2011). For every patient, data were selected of 1 year before the start of the CLI (baseline), and of 1 year after the end of the CLI (post-intervention). Total timeframe of data collection was from July 2009 to August 2013.

Since data collection was part of usual care, measurements were not specific registered for this study. Therefore, mean values of BMI, blood pressure and cholesterol measurements were calculated of all available recorded outcome measures for each patient, over baseline year and post-intervention year. Three lifestyle-related drug types were established based on the ATC-classification system: (i) drugs for diabetes (A10), (ii) lipid modifying drugs (C10) and (iii) antihypertensive drugs (C02, C03, C07, C08 and C09). A patient was classified as 'user' if at least one prescription within the drug category was given in the specific year. The number of GP-consultations was calculated as the sum of consultations at the general practices, home visits, telephone consultations and e-mail consultations in the

specific year (only consultations with the GP were counted, with a maximum of 1 per day).

Similar information was collected from EHRs of the general practices included in the comparison group. Out of the data of these general practices, two matched patients per intervention patient were selected. Matching criteria were: sex, age (± 2 years), BMI category (≤25; >25 and ≤30; >30 and ≤35; >35 kg/m^2) and having a GP consultation or prescription for diabetes (ICPC-1 code: T90) and/or CVD (ICPC-1 codes: K74-K76, K89-K92, K99) in baseline year. For intervention patients with missing BMI in baseline year, matched patients with a BMI >25 and ≤35 kg/m^2 and a BMI >25 and ≤40 kg/m^2 were selected for intervention patients from respectively the PMCS and the cRCT (mean BMI of patients in the cRCT was higher than in the PMCS).

Statistical analyses

Data management and statistical analyses were performed using STATA 13.0. Descriptive statistics were used to present baseline and post-intervention values. Only patients from whom at least one measurement of the particular outcome measure was recorded in their EHR could be incorporated in the analyses. Differences in changes in outcome measures between the intervention and comparison group were evaluated by mixed model analyses (also for changes within groups over time). To test for intergroup differences, three level models were constructed including a group variable (intervention/comparison group), a time variable (baseline/post-intervention), an interaction term (group*time) and random intercepts to account for clustered data of patients within general practices, and for repeated measurements within patients. In the models for BMI, blood pressure and cholesterol levels, additional adjustments were made for sex and age. Further analyses were conducted, stratified by baseline BMI category (≤30; >30 and ≤35; >35 kg/m^2). Additional analyses (using same models) were executed to examine whether results were different by (i) excluding patients with missing data at baseline or post-intervention year, and (ii) excluding intervention patients (and their matched patients) who were known to be drop-out during the intervention. Drop-outs were defined as patients that did not complete the whole intervention period according to the lifestyle advisor. For all analyses, a P value of <0.05 was considered as significant.

Results

Of the 29 general practices participating in the PMCS and the cRCT, GPs of 12 general practices gave permission for data extraction. Data extraction from 3 out of 12 general practices could not be performed because permission form was received too late, or due to failures in the data extraction method. Selected patients with unknown starting date of the intervention or with incomplete data extraction (i.e. not registered in general practice for 3-year follow-up period) were excluded from this study. Eventually, data on health outcomes of 127 intervention patients were identified from EHRs in 9 general practices (Fig. 1). From 11 general practices participating in the NIVEL-PCD, a comparison group of 254 matched patients was selected.

Mean baseline age of the 127 patients and their 254 matched patients was 55 years, 39% were men, and 77% of the patients was classified as obese (BMI >30 kg/m^2) (Table 1). Within both intervention and comparison group, mean BMI, blood pressure, total

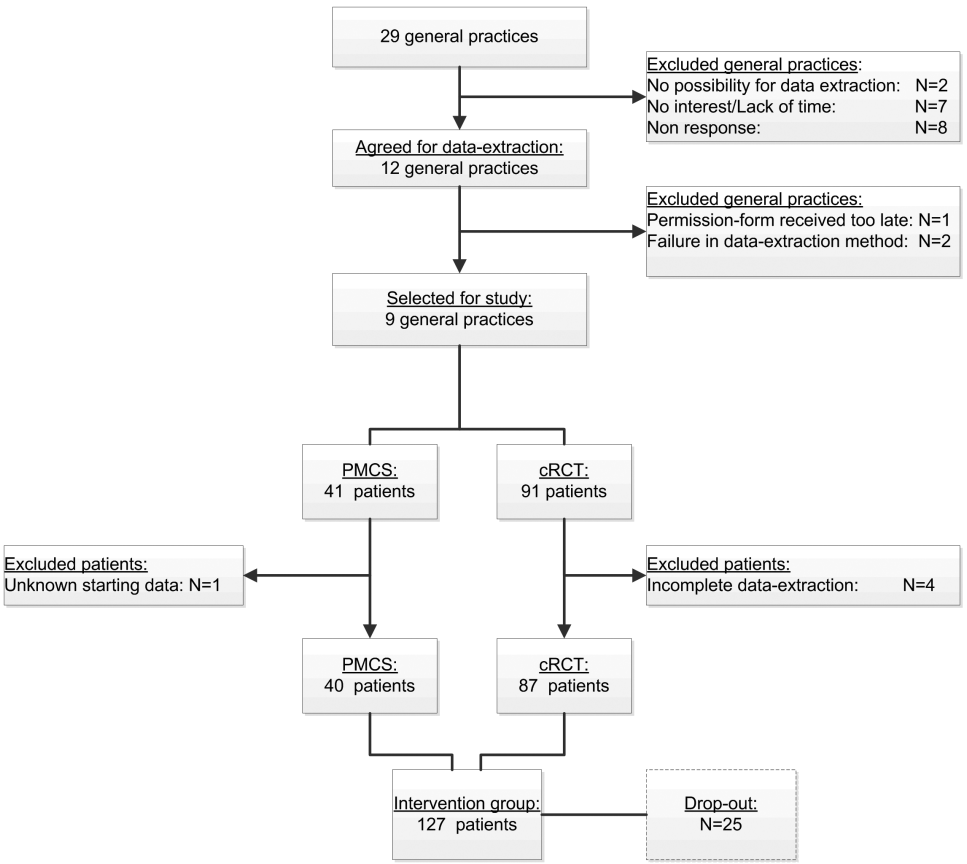

Figure 1. Flow diagram of intervention patients.

Table 1. Characteristics of the study population in year before start of the BeweegKuur intervention (timeframe: July 2009–August 2011)

	Intervention group (n = 127)	Comparison group (n = 254)
Sex (% men)	39.4%	39.4%
Age, years [mean (SD)]	54.9 (11.9)	54.8 (11.8)
BMI category, (% patients)		
≤25 kg/m²	2.0%	2.0%
>25 and ≤30 kg/m²	21.0%	22.8%
>30 and ≤35 kg/m²	39.0%	37.4%
>35 kg/m²	38.0%	37.8%
Diabetes (% patients)[a]	29.9%	29.5%
CVD (% patients)[a]	9.5%	6.3%

[a]Having a GP consultation or drug prescription for this disease in year before start of the intervention.

cholesterol and low density lipoprotein (LDL) cholesterol were reduced from baseline to post-intervention (Table 2). However, for these outcome measures no significant differences in changes were observed between the intervention and comparison group. For high density lipoprotein (HDL) cholesterol, a significant increase of 0.08 mmol/l in HDL cholesterol was shown in the intervention group above the comparison group ($P < 0.01$, intergroup difference). Within both groups, the proportion of patients who received drug prescriptions for lipid modifying drugs increased over time ($P = 0.02$, within intervention group). However, no significant intergroup differences were shown for drugs prescriptions and yearly number of GP consultations.

Further analyses (intergroup only) were performed by stratification on baseline BMI category (Table 3). In these analyses, 27 patients and their 54 matched patients could not be incorporated due to an unknown baseline BMI. In patients who were severely obese at baseline (BMI >35 kg/m²), a significant increase in HDL cholesterol of 0.13 mmol/l was shown in the intervention group above the comparison group ($P < 0.01$, intergroup difference). In the other BMI groups, no significant intergroup differences were found for HDL cholesterol. In none of the BMI groups significant intergroup differences were shown for BMI, blood pressure, total cholesterol, LDL cholesterol and drug prescriptions. In patients with a BMI >30 and ≥35 kg/m², the median number of yearly GP consultations decreased more in the comparison than in the intervention group ($P = 0.03$, intergroup difference). However, no significant intergroup differences were found in the other two BMI-groups.

The drop-out rate of patients participating in the intervention was 20%. Additional analyses, i.e. exclusion of patients with missing data and exclusion of drop-out patients, did not alter the results (see Supplementary data).

Discussion

Overall, this study did not show improvements on lifestyle-related risk factors, or differences in drugs prescriptions and number of GP consultations in a patient group that participated in the BeweegKuur intervention, compared to a group of overweight or obese patients that received usual care. Only for HDL cholesterol an improvement was found.

Comparison with existing literature

Over time, mean BMI in the intervention group was reduced (−0.9 kg/m²), but not significantly more compared to the usual care group (−0.5 kg/m²). These modest reductions in BMI in both groups during follow-up were in line with results of previous West-European studies (9,10), and even better than results of two studies conducted in study populations including mostly patients with already established CVD or diabetes type 2, that did not find a change in BMI during follow-up (7,8). A similar BMI reduction was found in an observational study in a Dutch primary health care setting that evaluated treatment of overweight patients given by dietitians, showing an average BMI reduction of −0.94 kg/m² at end of treatment. However, since only 6% had reached a healthy BMI of <25 kg/m² in this study, many patients did not achieve clinically relevant outcomes (19).

In both intervention and comparison group systolic blood pressure levels were decreased below target level of ≤140 mmHg in year post-intervention. Though, no intervention effects were shown on blood pressure levels. Previous studies on lifestyle interventions in primary health care that evaluated blood pressure levels showed varying results. A similar conducted Dutch study did not find changes in blood pressure in a population of patients with (pre) diabetes (8). Two other studies that evaluated blood pressure in patients at high risk for, or with established CVD, showed similar reductions in blood pressure in both intervention and comparison group (7), or greater reductions in the intervention group (6), although baseline blood pressure levels were higher in these studies (~145/90 mmHg), compared to our study (140/85 mmHg).

Other studies on lifestyle interventions in primary health care did not show intervention effects on total, LDL and HDL cholesterol (6,8). These outcomes on total and LDL cholesterol are in line with results found in our study. However, in our study an increase of 0.08 mmol/l on HDL cholesterol was found in the intervention group above the usual care group. Increased HDL cholesterol levels positively influence the total/HDL cholesterol ratio, which is used to estimate cardiovascular risk. Furthermore, a trend towards an increase in prescriptions for lipid modifying drugs (and a lowering of LDL cholesterol over time) was shown in both groups, which might be caused by the revision of the guidelines for cardiovascular management for Dutch GPs since January 2012, in which the targets for LDL-cholesterol became stricter (≤ 2.5 mmol/l) (17). So overall, lipid levels were improved during follow-up, even though baseline values were not unfavourable. Lipid-modifying drugs and high dietary fat intake mainly affect LDL cholesterol and not HDL cholesterol, while exercise training of longer than 12 weeks is associated with increased levels of HDL cholesterol from 0.05 to 0.20 mmol/l (20). Possibly the increase in HDL cholesterol in the intervention group was attributable to improved physical activity behaviour. Information on physical activity behaviour was not available in this study, as it is mostly not registered in EHRs. However, an earlier study on the BeweegKuur intervention showed improvements on the motivation of overweight and obese participants with respect to physical activity behaviour, but not for healthy dietary behaviour (13). Furthermore, Berendsen *et al.* (14) showed in their process evaluation of the BeweegKuur intervention that although the number of meetings with healthcare providers was approximately half of that according protocol, mainly the amount of dietary guidance was lower than planned, and decreased with increasing exercise guidance by the physiotherapist.

In the previous, international studies (6–10), healthcare consumption was not evaluated. National reports on the evaluation of lifestyle interventions in primary healthcare settings in the Netherlands focusing on increment of physical activity did not show a substantial change in the number of GP consultations, which is comparable to the results in our study (21,22).

Table 2. Baseline to post-intervention changes in risk factors, drugs prescriptions and GP consultations in intervention and comparison group (timeframe: July 2009–August 2013)

	Intervention group		Comparison group		Intergroup difference	
Risk factors	***N***	**Mean (SD)**	***N***	**Mean (SD)**	**β (95% CI)**	***P*[a]**
BMI, kg/m^2						
Baseline	100	33.4 (4.2)	254	33.1 (4.3)		
Post-intervention	87	32.5 (4.6)*	162	32.6 (4.4)	−0.40 (−1.00 to 0.20)	0.19
Systolic blood pressure, mmHg						
Baseline	97	140.0 (16.2)	222	141.5 (16.2)		
Post-intervention	92	136.5 (14.3)	181	138.5 (14.6)*	0.25 (−3.06 to 3.57)	0.88
Diastolic blood pressure, mmHg						
Baseline	97	85.2 (8.7)	222	86.9 (8.8)		
Post-intervention	92	81.8 (9.3)*	181	83.3 (8.0)*	0.15 (−1.75 to 2.06)	0.88
Total cholesterol, mmol/l						
Baseline	101	5.21 (1.10)	179	5.04 (1.17)		
Post-intervention	84	4.92 (0.92)*	155	4.92 (1.06)	−0.15 (−0.40 to 0.09)	0.22
HDL cholesterol, mmol/l						
Baseline	101	1.21 (0.30)	179	1.27 (0.35)		
Post-intervention	84	1.28 (0.29)*	154	1.25 (0.36)*	0.08 (0.03 to 0.13)	<0.01
LDL cholesterol, mmol/l						
Baseline	97	3.17 (0.87)	177	2.93 (1.05)		
Post-intervention	80	2.87 (0.80)*	149	2.84 (0.98)	−0.19 (−0.40 to 0.09)	0.09
Drug prescriptions	***N***	**% Users**	***N***	**% Users**	**OR (95% CI)**	***P*[b]**
Drugs for diabetes						
Baseline	127	23%	254	23%		
Post-intervention	127	26%	254	25%	1.41 (0.25–7.88)	0.70
Lipid-modifying drugs						
Baseline	127	35%	254	35%		
Post-intervention	127	43%*	254	39%	2.45 (0.64–9.42)	0.19
Antihypertensive drugs						
Baseline	127	58%	254	59%		
Post-intervention	127	57%	254	63%	0.35 (0.09–1.37)	0.13
GP consultations	***N***	**Median**	***N***	**Median**	**IRR (95% CI)**	***P*[c]**
Baseline	127	6.0	254	6.0		
Post-intervention	127	6.0	254	6.0	1.02 (0.91–1.14)	0.76

[a]Intergroup difference (β) calculated by mixed effects linear regression, two groups (general practice and patient) + adjustment for sex and age.
[b]Intergroup difference (odds ratio: OR) calculated by mixed effects logistic regression, two groups (general practice and patient).
[c]Intergroup difference (incidence rate ratio: IRR) calculated by mixed effects poisson regression, two groups (general practice and patient).
*Significant within group difference ($P < 0.05$) between baseline and post-intervention.

Strengths and limitations

A strength of this study is the use of medical record analysis by means of data from EHRs. It is a feasible method to evaluate the effectiveness of an intervention implemented in primary health care, and avoids the problem of bias by self-report (12). Furthermore, the use of the NIVEL-PCD enlarged the power of the study, by selecting a sample of comparable patients according to several matching criteria. Since the NIVEL-PCD contains routinely updated anonymous patients records, ethical approval for specific research purposes is unnecessary. This means that the patients selected for the comparison group were unaware of being part of this study. Herewith, our study differs from studies conducted in highly selected populations and study settings.

A limitation is that registration of anthropometric and metabolic measurements is not optimal in general practice, resulting in a high number of missing values. Though, by using mixed model analyses, all available data could be incorporated, including data from patients with missing data at baseline or follow up. Additional analyses (including only patients with complete information at both baseline and follow-up), yielded similar results, indicating that the high number of missing values did not bias the results.

Another limitation is the lack of engagement of the GPs with this study, probably due to a political decision. Initially, the Dutch government intended to extend the BeweegKuur intervention throughout the Netherlands from 2012, by reimbursement of the basic health insurance. However, after a change in government in 2010, this intention was abandoned. This decision influenced further implementation and did not support the sustainability of the BeweegKuur intervention in daily practice, as was initially planned (14). Although little effort was demanded for the current study in 2013, the political decision presumably demotivated GPs to collaborate, since less than half of them gave permission for data extraction. Additionally, data collection could not be performed for all patients due to technical problems during data extraction or incomplete data (e.g. change of GP during study period), resulting in only a small number of patients that could eventually be included in this study. Nevertheless, the 127 selected patients showed to be a representative sample of all patients who were included at baseline of the initial studies (13,15), by means of sex, age and BMI.

The GPs who implemented the BeweegKuur intervention and gave permission for data extraction for the current study were possibly more favourable to the intervention. Little is known about

Table 3. Baseline to post-intervention changes in risk factors, drugs prescriptions and GP consultations in intervention and comparison group, stratified by baseline BMI category (timeframe: July 2009–August 2013)

	BMI ≤ 30 kg/m²					BMI >30 and ≤ 35 kg/m²					BMI >35 kg/m²				
	Intervention group		Comparison group			Intervention group		Comparison group			Intervention group		Comparison group		
Risk factors	***N***	**Mean**	***N***	**Mean**	***P*[a]**	***N***	**Mean**	***N***	**Mean**	***P*[a]**	***N***	**Mean**	***N***	**Mean**	***P*[a]**
BMI, kg/m²															
Baseline	23	27.6	51	27.5	0.17	39	32.8	77	32.3	0.31	38	37.7	72	37.7	0.93
Post-intervention	21	27.7	37	28.0		31	32.3	54	32.2		29	36.7	47	36.8	
Systolic blood pressure, mmHg															
Baseline	22	141.6	49	136.5	0.42	34	142.7	69	144.3	0.88	36	136.7	60	142.2	0.98
Post-intervention	21	135.9	39	133.6		31	141.2	57	142.7		30	131.4	49	139.7	
Diastolic blood pressure, mmHg															
Baseline	22	82.5	49	83.8	0.77	34	86.8	69	87.8	0.76	36	84.9	60	88.7	0.53
Post-intervention	21	80.2	39	80.8		31	84.3	57	84.1		30	80.4	49	86.0	
Total cholesterol, mmol/l															
Baseline	21	5.51	40	4.94	0.19	36	5.03	57	4.83	0.32	33	5.34	47	5.27	0.86
Post-intervention	21	4.97	37	4.72		28	4.82	55	4.78		23	4.98	40	5.17	
HDL cholesterol, mmol/l															
Baseline	21	1.32	40	1.35	0.09	36	1.21	57	1.24	0.41	33	1.16	47	1.26	<0.01
Post-intervention	21	1.41	37	1.30		28	1.24	54	1.26		23	1.26	40	1.19	
LDL cholesterol, mmol/l															
Baseline	21	3.42	40	2.84	0.10	34	2.98	56	2.75	0.52	32	3.27	46	3.11	0.23
Post-intervention	21	2.90	37	2.70		28	2.86	51	2.71		21	2.81	39	3.10	
Drug prescriptions	***N***	**% Users**	***N***	**% Users**	***P*[b]**	***N***	**% Users**	***N***	**% Users**	***P*[b]**	***N***	**% Users**	***N***	**% Users**	***P*[b]**
Drugs for diabetes															
Baseline	23	44%	51	41%	0.62	39	31%	77	31%	1.00	38	13%	72	15%	0.61
Post-intervention	23	48%	51	41%		39	36%	77	36%		38	16%	72	17%	
Lipid-modifying drugs															
Baseline	23	39%	51	47%	0.13	39	41%	77	47%	0.28	38	32%	72	25%	0.69
Post-intervention	23	61%	51	51%		39	49%	77	48%		38	32%	72	28%	
Antihypertensive drugs															
Baseline	23	52%	51	49%	0.44	39	64%	77	69%	0.69	38	66%	72	61%	0.09
Post-intervention	23	57%	51	61%		39	64%	77	66%		38	58%	72	65%	
GP consultations	***N***	**Median**	***N***	**Median**	***P*[c]**	**N**	**Median**	***N***	**Median**	***P*[c]**	***N***	**Median**	***N***	**Median**	***P*[c]**
Baseline	23	7.0	51	5.0	0.09	39	6.0	77	7.0	0.03	38	7.0	72	6.5	0.58
Post-intervention	23	6.0	51	5.0		39	5.0	77	5.0		38	6.5	72	6.0	

[a]Intergroup difference calculated by mixed effects linear regression, two groups (general practice and patient) + adjustment for sex and age.

[b]Intergroup difference calculated by mixed effects logistic regression, two groups (general practice and patient).

[c]Intergroup difference calculated by mixed effects poisson regression, two groups (general practice and patient).

GPs who were not motivated to implement the intervention (4). Also, the selected general practices for the comparison group were possibly not a representative sample of all general practices in the Netherlands, since these general practices registered more adequate on anthropometric and metabolic measurements compared to other general practices in the NIVEL-PCD. Increased attention to lifestyle-related measurements in general practices might already have a positive effect on patients' lifestyle behaviour, since self-regulation skills, such as monitoring of weight, are identified as predictor of successful outcomes on obesity-related behaviour changes (23). Furthermore, it cannot be ruled out that patients in the comparison group also have been enrolled in a lifestyle programme as part of usual care, resulting in modest intervention effects above usual care.

Conclusions

This study showed that a lifestyle intervention for overweight and obese patients in primary health care resulted in similar reductions in lifestyle-related risk factors and changes in healthcare consumption compared to usual care. Only an improvement for HDL cholesterol was shown. Furthermore this study indicates that the implementation and evaluation of a lifestyle intervention in primary health care is challenging due to political and financial barriers resulting in poor collaboration of healthcare providers. Nevertheless, medical record analyses could be a decent method to evaluate lifestyle interventions in primary healthcare, on condition that health outcomes are routinely recorded.

Supplementary material

Supplementary material is available at *Family Practice* online.

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Declarations

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