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DOI
10.1016/j.ijcard.2021.04.007

Publication date
2021

Document Version
Final published version

Published in
International Journal of Cardiology

International Journal of Cardiology 332 (2021) 195–201

Contents lists available at ScienceDirect

International Journal of Cardiology

journal homepage: www.elsevier.com/locate/ijcard

The influence of partners on successful lifestyle modification in patients with coronary artery disease

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ARTICLE INFO

Article history:
Received 23 November 2020
Received in revised form 16 March 2021
Accepted 2 April 2021
Available online 3 April 2021

Keywords:
(Mesh): Secondary prevention
Risk reduction behaviour
Coronary artery disease
Spouses
Social support

ABSTRACT

Background: Marital status is associated with prognosis in patients with cardiovascular disease (CVD). However, the influence of partners on successful modification of lifestyle-related risk factors (LRFs) in secondary CVD prevention is unclear. Therefore, we studied the association between the presence of a partner, partner participation in lifestyle interventions and LRF modification in patients with coronary artery disease (CAD).

Methods: In a secondary analysis of the RESPONSE-2 trial ($n = 711$), which compared nurse-coordinated referral to community-based lifestyle programs (smoking cessation, weight reduction and/or physical activity) to usual care in patients with CAD, we investigated the association between the presence of a partner and the level of partner participation on improvement in >1 LRF (urinary cotinine <200 ng/l, ≥5% weight reduction, ≥10% increased 6-min walking distance) without deterioration in other LRFs at 12 months follow-up.

Results: The proportion of patients with a partner was 80% (571/711); 19% women (108/571). In the intervention group, 48% (141/293) had a participating partner in ≥1 lifestyle program. Overall, the presence of a partner was associated with patients' successful LRF modification (adjusted risk ratio (aRR) 1.93, 95% confidence interval (CI) 1.40–2.51). A participating partner was associated with successful weight reduction (aRR 1.73, 95% CI 1.15–2.35).

Conclusion: The presence of a partner is associated with LRF improvement in patients with CAD. Moreover, patients with partners participating in lifestyle programs are more successful in reducing weight. Involving partners of CAD patients in weight reduction interventions should be considered in routine practice.

1. Introduction

Compared with married couples, being unmarried, divorced or widowed is associated with a higher risk of developing cardiovascular disease (CVD), and with worse prognosis in individuals with established CVD [1–3]. In patients with coronary artery disease (CAD), lifestyle modification and aggressive risk factor management, including cardiac rehabilitation, is recommended by all major guidelines [4–6]. In these patients, the presence of a partner and partner participation may also prevent a proportion of subsequent CAD-related events. However, the guidelines are unclear on how partners should be involved and little is known about the effects of partner participation [6].

Involving partners in smoking cessation, weight reduction and physical activity increase seems pivotal, as household partners often share lifestyle habits and health risks [2,7–9]. Furthermore, it has been demonstrated that when one individual initiates a lifestyle change, for example stops smoking, the partner is likely to follow suit [10]. The EUROACTION trial showed positive effects of a family-based approach on lifestyles and improvement in lifestyle related risk factors (LRFs) in patients at high risk of CAD and in those with CAD and their partners [11]. Interventions targeting couples instead of individuals could lead to greater success in improving LRF profiles [12].

Few studies exist on the role of partners in secondary prevention of CVD. In the RESPONSE-2 trial, we found a positive association between partner participation and successful LRF modification in CAD patients referred to community-based lifestyle programs [13]. The aim of our

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[1] All authors take responsibility for all aspects of the reliability and freedom from bias of the data presented and their discussed interpretation.

https://doi.org/10.1016/j.ijcard.2021.04.007

current study was to investigate the association between the presence of partners, partner participation in lifestyle interventions and patients' LRF modification.

2. Methods

2.1. Study design

We performed our analysis in the RESPONSE-2 study, a randomized clinical trial conducted in 15 medical centres in the Netherlands [13]. The study was designed to evaluate the effect of nurse-coordinated referral of patients with CAD and their partners to a comprehensive set of up to three community-based lifestyle programs aiming to improve LRFs. The three lifestyle programs targeted smoking cessation, weight reduction, and physical activity increase. Details of the protocol and the main study results have been published elsewhere [13,14]. Briefly, we analysed data of all patients with completed outcome data at 12 months follow-up ($N = 711$). Review boards of all participating hospitals approved the RESPOSNE-2 protocol, which is in line with the 1975 Declaration of Helsinki [13]. All included patients provided written informed consent.

2.2. Study population

Patients were eligible to participate in the RESPONSE-2 trial if they were within eight weeks after hospitalization for an acute coronary syndrome and/or coronary revascularization, and if they had one of the following LRFs: 1) self-reported current smoking or stopped within 6 months before hospital admission; 2) body mass index (BMI) ≥ 27 kg/m^2; 3) self-reported physical inactivity (< 30 min activity of moderate intensity 5 times per week), and if they were motivated to attend ≥1 lifestyle program [13,14]. Patients were excluded if they had a planned revascularization after discharge, a life expectancy ≤2 years, congestive heart failure New York Heart Association functional class III or IV, were unable to visit the outpatient clinic and/or lifestyle program; had no internet access, or a Hospital Anxiety and Depression Scale >14. Patients were randomized either to the intervention (on top of usual care) or usual care alone group. Usual care, offered to all patients irrespective of randomization, consisted of visits to the cardiologist and cardiac rehabilitation according to national and international guidelines [4,15]. Furthermore, usual care included up to four visits to a nurse-coordinated secondary prevention program, consisting of risk factor counselling and medication control/titration [14].

2.3. Intervention

Patients in the intervention group were referred by nurses with experience in cardiovascular care to up to three existing community-based lifestyle programs. The number and sequence of the lifestyle programs were determined by the patient's risk profile and preference [13,14].

Nurses were trained in a systematic referral approach, consisting of risk status assessment, discussing the current risk status with patients, and assessing the level of motivation to change. Depending on motivation, participation in lifestyle program(s) was advised, followed by referral to the lifestyle program after patient consent. Partners were invited to participate in the lifestyle programs irrespective of their own lifestyle or risk factors, and free of charge. Patients were considered to have a partner if they confirmed having a partner during the 12 months follow-up based on the question “do you have a partner?”, regardless of whether they lived together. Partners were considered ‘participating’ if they attended >1 lifestyle program(s) during at least one session. Patients and partners could follow multiple programs simultaneously.

Three lifestyle programs, Luchtsignaal®, Weight Watchers®, and Philips Direct Life®, were used in their existing format, uniformly, in all participants and their partners. The lifestyle programs have been described in detail elsewhere [13,14]. In brief, Luchtsignaal® is a telephone-based smoking cessation program based on motivational interviewing by trained professionals. Pharmacological therapy for smoking cessation was prescribed on indication. Weight Watchers® aims at weight reduction through a healthy diet, changing unhealthy behaviours, and physical activity. A Weight Watchers' coach provided weekly group-based sessions. Philips Direct Life® aims to improve physical activity, and includes the use of an accelerometer to measure the participant's level of activity combined with an online coach, who provides personalized feedback. Participating partners also received an accelerometer to evaluate their activity level.

2.4. Data collection and measurements

Data were collected by a nurse at baseline (first visit ≤8 weeks after discharge) and at 12 months follow-up, and included cardiovascular risk factors, cardiovascular history, partner status, physical activity, smoking status, medication use and partner's cardiovascular risks (self-reported). Smoking status was evaluated by a urinary cotinine test with a detection limit of 200 ng/ml (UltiMed one step, Dutch Diagnostic, Zutphen, the Netherlands), body mass index (BMI) was calculated by weight and height, waist circumference was measured, and physical activity was evaluated by the 6-min walking distance (6MWD). At follow-up, in addition to partner status, we evaluated partner participation in the lifestyle programs.

2.5. Outcomes

The primary outcome of the current analysis was ‘overall success’ in achieving LRFs to target and improvements in LRFs separately, according to partner status (dichotomous). Overall success was defined as improvement of ≥1 LRF, without deterioration in the remaining LRFs. Improvement per LRF was defined as: 1) urinary cotinine level < 200 ng/ml; 2) weight loss of ≥5%; and 3) ≥ 10% increase on the 6MWD. Deterioration was defined as: 1) a positive cotinine test (> 200 ng/ml) in non-smokers at baseline; 2) any weight gain in combination with a BMI > 25 kg/m^2; and 3) any decrease in 6MWD compared to baseline. In addition, we analysed the association of having a partner on the improvement of ≥2 LRFs. Sex differences were analysed by a stratified analysis.

In a secondary analysis in the intervention group only, we analysed the proportion of patients with a partner who participated in the lifestyle programs (participating partner) compared with patients with a partner not participating in the lifestyle programs (non-participating partner), on overall success (improvement of ≥1 LRF), on improvement of ≥2 LRFs (super responders) and for each LRF separately. Analyses were stratified by sex.

2.6. Statistical methods

Categorical data are presented as frequencies and percentages. Continuous data are presented as means and standard deviations (SD) for normally distributed data, and as medians with interquartile ranges (IQR) for non-normally distributed data.

In the primary outcome analysis, the association of the presence of a partner on patients' LRF modification was evaluated using logistic regression analysis. Independent variables were ‘having a partner’ (yes/no), allocation (intervention/usual care), and an interaction term for these two variables. The interaction term allowed us to evaluate the extent to which the presence of a partner modifies the intervention effect [16]. Interaction was deemed present if the p-value of the interaction term was <0.10. If the interaction p-value was ≥0.10, the interaction term was deleted from the model. Potential confounders were one by one tested and considered at a cut-off point of a minimum of 10% change in the beta-coefficient in the partner variable [16]. The identified

confounders included age, sex, level of education, history of cardiovascular disease, and baseline BMI, 6MWD and smoking status. These variables were included in the logistic regression model and compared with the unadjusted results. Both adjusted and unadjusted odds ratios (OR) with 95% confidence intervals (CI) were converted into relative risks (RR) with 95% CI [17].

In the secondary analyses, the association between partner participation (participating partner vs. non-participating partner) and LRF modification was tested in an unadjusted and adjusted logistic regression analysis, using the same set of confounders as in the primary analysis. The secondary analysis was performed in the intervention group only. Comparisons in the secondary analysis were made between patients with participating partners vs. patients with non-participating partners. Resulting (adjusted) ORs were converted into RRs with 95% CI [17].

IBM SPSS statistics version 24.0 (IBM Corp., Armonk, New York, USA) was used for the analyses and a p-value <0.05 was considered significant, unless otherwise specified.

3. Results

3.1. Population characteristics

In total, 711 patients included in the RESPONSE-2 trial completed the 12 months follow-up and were available for the outcome analysis. Population characteristics are presented in Table 1. 80% of the patients had a partner (571/711), of whom 19% (108/571) were women. Overall, patients with a partner were less likely to be smokers (43% vs. 66%), and reported lower levels of physical activity at baseline (64% vs. 55%). In partners, the most frequently self-reported LRF was overweight (44%), followed by inactivity (40%) and smoking (26%).

Of the patients with a partner, 51% (293/571) were in the intervention group. In total, 41 of these patients participated in the smoking cessation program Luchtsignaal®, 164 in the weight reduction program Weight Watchers®, and 141 in the physical activity program Direct Life®. Of those with a partner, 48% (141/293) had a participating partner (participation in ≥1 lifestyle program). Compared with men, women less frequently had a participating partner (51% vs. 36%) (Table 1).

Of the partners in the intervention group, 80 reported smoking, 118 reported overweight and 116 reported a low activity level. In total, 11% (16/141) of the participating partners participated in the smoking cessation program, 64% (90/141) in the weight loss program and 57% (81/141) in the physical activity program (Table 1).

3.2. Influence of the presence of a partner on patient's lifestyle modification

Fig. 1 presents the percentages of patients with overall success on lifestyle modification and individual LRFs, stratified by the presence of a partner and level of partner participation (intervention group only). Patients with a partner were more successful in improving ≥1 LRF than patients without a partner (35% vs. 21%, p-value <0.001). After controlling for potential confounders, patients with a partner were almost twice as likely to achieve overall success in lifestyle modification than those without a partner (aRR 1.93, 95% CI 1.40–2.51) (Table 2). We found no indication of important effect modification according to sex (interaction term for sex and the presence of a partner, p-value 0.44). Patients with a partner were also more likely to improve on ≥2 LRFs [10% vs. 6%, (aRR 2.11, 95% CI 1.03–4.03)].

Table 1
Population characteristics.

	Total group $N = 711$		p-value	Intervention group with partner $n = 293$		p-value
	No partner	Partner		Participating partner	Non-participating partner	
	n = 140	n = 571		n = 141	n = 152	
Demographics						
Age, years	58 ± 9	59 ± 9	0.32	59 ± 8	58 ± 10	0.32
Female	41 (29)	108 (19)	0.007	21 (15)	38 (25)	0.03
Cohabiting	NA	542 (95)	NA	132 (94)	141 (93)	0.93
Lower education (≤13 years)	92 (66)	338 (59)	0.15	77 (55)	83 (55)	0.99
Patient risk profiles						
Smoking[a] or quit ≤6 month of baseline	93 (66)	246 (43)	<0.001	55 (39)	76 (50)	0.06
BMI, kg/m^2	29 ± 5	30 ± 4	0.48	30 ± 4	29 ± 4	0.06
Overweight (BMI ≥27 kg/m^2)	94 (67)	428 (75)	0.07	116 (82)	105 (69)	0.009
Physical inactivity (<30 min per day)	77 (55)	366 (64)	0.05	98 (70)	91 (60)	0.09
6MWD, m	474 ± 118	490 ± 107	0.15	449 ± 100	506 ± 117	0.22
History of CVD	43 (31)	202 (35)	0.30	45 (32)	46 (30)	0.76
Number of lifestyle related risk factors, patients						
1						
Smoking only	25 (18)	40 (7)	<0.001	3 (2)	15 (10)	0.006
Overweight (BMI ≥27 kg/m^2) only	20 (14)	107 (19)	0.22	24 (17)	28 (18)	0.75
Physical inactivity only	4 (3)	61 (11)	0.004	14 (10)	16 (11)	0.87
2						
Smoking and overweight	18 (13)	59 (10)	0.39	16 (11)	18 (12)	0.90
Smoking and physical inactivity	17 (12)	43 (8)	0.08	8 (6)	16 (11)	0.13
Overweight and physical inactivity	23 (16)	158 (28)	0.006	48 (34)	32 (21)	0.01
3						
Smoking and overweight and physical inactivity	33 (24)	104 (18)	0.15	28 (20)	27 (18)	0.65
Partner risk profiles						
Smoking partner (self-reported)	NA	147 (26)	NA	30 (21)	50 (33)	0.03
Overweight partner (self-reported)	NA	249 (44)	NA	71 (50)	47 (31)	0.001
Physical inactivity partner (self-reported)	NA	231 (40)	NA	61 (43)	55 (36)	0.17
Referred to a lifestyle program						
Luchtsignaal®, smoking cessation, $N = 76$	NA	NA	NA	16 (21)	25 (33)	0.64
Weight Watchers®, weight reduction, $N = 222$	NA	NA	NA	90 (41)	74 (33)	0.23
Direct Life®, physical activity, $N = 177$	NA	NA	NA	81 (46)	60 (34)	0.008

Abbreviations: BMI, body mass index; 6MWD, six minute walk distance; kg, kilogram; m^2, square meters; m, meter. Data is presented as N, number (%), mean ± SD, standard deviation.
[a] Urinary cotinine level ≥ 200 ng/ml.

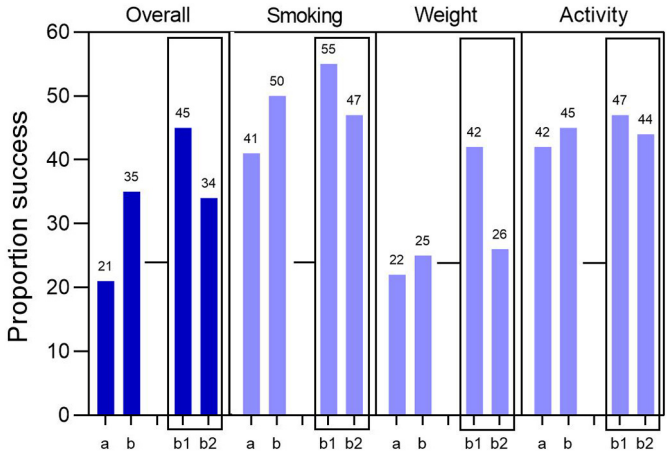

Fig. 1. Proportion of patients with overall success on lifestyle related risk factor (LRF) modification (defined as improvement on one LRF without deterioration of the other two) and proportion success on modification of LRF separately, smoking cessation (cotinine <200 ng/ml), weight reduction (≥5%) and improvement of physical activity (≥10% 6MWD).

a	Total group, patients without a partner	$n = 140$	b1	Intervention group, with a participating partner	$n = 141$.
b	Total group, patients with a partner	$n = 571$	b2	Intervention group, with a non-participating partner	$n = 152$

Table 2
Primary and secondary outcomes of partner influence on successful lifestyle modification.

Total group analysis N = 711	Explanatory variable	RR	95% CI	aRR[a]	95% CI	Interaction *p*-value[*]
Primary outcome						Partner by treatment
Overall success[b]	Partner	1.94	1.43–2.49	1.93	1.40–2.51	0.18
						Partner by sex
Men overall success[b]	Partner	1.83	1.26–2.51	1.85	1.24–2.57	0.44
Women overall success[b]	Partner	2.74	1.25–4.80	2.96	1.32–5.13	
						Partner by treatment
Success ≥2 LRF[c]	Partner	1.80	0.90–3.44	2.11	1.03–4.03	0.68
Smoking cessation						
Urinary cotinine <200 ng/ml	Partner	1.23	0.94–1.52	1.22	0.93–1.51	0.30
Weight reduction						
≥ 5% weight reduction	Partner	1.10	0.71–1.60	1.06	0.67–1.60	0.13
Physical activity						
≥ 10% increase in 6MWD	Partner	1.08	0.79–1.37	1.12	0.82–1.47	0.11
Intervention group analysis N = 293						
Secondary outcome						
Overall success[b]	Participating partner	1.33	1.00–1.67	1.25	0.92–1.62	NA
						Participating partner by sex
Men overall success[b]	Participating partner	1.45	1.05–1.86	1.35	0.94–1.78	0.35
Women overall success[b]	Participating partner	1.02	0.48–1.64	0.95	0.41–1.62	
Success ≥2 LRF[c]	Participating partner	1.87	1.04–3.12	1.81	0.98–3.12	NA
Smoking cessation						
Urinary cotinine <200 ng/ml	Participating partner	1.15	0.79–1.50	1.07	0.70–1.44	NA
Weight reduction						
≥ 5% weight reduction	Participating partner	1.64	1.13–2.18	1.73	1.15–2.35	NA
Physical activity						
≥10% increase in 6MWD	Participating partner	1.07	0.76–1.39	1.10	0.77–1.44	NA

Abbreviations: (a)RR, (adjusted) risk ratio; CI, confidence interval, LRF, lifestyle-related risk factor.
[*] Interaction was not present and interaction terms were therefore not included in the final models.
[a] Analyses are adjusted for age (continues), sex, level of education (≤13 years), history of cardiovascular disease, body mass index, six minute walking distance, pre-event (<6 months before hospital admission) or current smoker (except for smoking cessation analysis).
[b] Improvement in overall success is defined as improvement on ≥1 LRF without deterioration of the other two.
[c] Defined as improvement of ≥2 LRF without deterioration of another.

For individual LRFs, more patients with a partner stopped smoking than patients without a partner [50% vs. 41%, p-value 0.12, (aRR 1.22, 95% CI 0.93–1.51)] although this difference was not statistically significant. The presence of a partner was not associated with attaining ≥5% weight reduction (aRR 1.06, 95% CI 0.67–1.60), or improvement of physical activity as measured by the 6MWD (aRR 1.12, 95% CI 0.82–1.47) (Table 2).

3.3. Influence of partner participation on the probability of successful lifestyle modification by patients

In the intervention group, patients with a participating partner (i.e. partners who attended ≥1 lifestyle program), more frequently achieved ≥1 LRF on target than patients with a non-participating partner (45% vs. 34%, *p*-value 0.05) (Fig. 1), although this difference ceased to be

statistically significant after adjustment for confounders (aRR 1.25, 95% CI 0.92–1.62) (Table 2). The interaction term between sex and partner participation was not statistically significant (p-value 0.35). A positive, yet non-significant association was found between participating partners and improvement of ≥2 LRF (aRR 1.81, 95% CI 0.98–3.12) (Table 2).

For individual LRFs, patients with a participating partner were more successful in attaining ≥5% weight loss (42% vs. 26% p-value 0.01, aRR 1.73, 95% CI 1.15–2.35). The association for smoking cessation was weak and not statistically significant (aRR 1.07, 95% CI 0.70–1.44) which was also the case for improvement in physical activity (aRR 1.10, 95% CI 0.77–1.44) (Fig. 1 and Table 2).

4. Discussion

In our study the presence of a partner was associated with a higher rate of successful lifestyle modification. In addition, partner participation in the lifestyle programs was associated with a higher success rate for weight reduction. Although our patient population was predominantly male, the improvements on LRFs associated with having a partner and partner participation was in our analysis not sex dependent. Our findings suggest that partners have an important role in secondary prevention of CAD, and should be included when referring patients to lifestyle programs aiming at weight reduction.

Guidelines on secondary prevention currently advocate the involvement and support of partners in secondary prevention programs, but remain unclear about the practical implications [5,6]. The ESC guideline indicates 'partner support' as an important contributor to smoking cessation, and in the Dutch national guideline 'partner involvement' is defined as partners attending the information sessions in the cardiac rehabilitation program [5,6]. Our findings constitute several steps towards formulating evidence-based recommendations for integrated partner participation in lifestyle programs focussing on weight reduction, and should be considered for future guidelines on secondary prevention aiming to stimulate successful lifestyle modification in patients with CAD.

The positive association of participating partners on weight reduction was not found for smoking cessation and physical activity, either separately or combined. Based on our data, we can only speculate as to mechanisms explaining these findings. In smoking cessation, the impact of Luchtsignaal® on patients' smoking cessation was limited and therefore, the participating partner influence may have been limited as well [18,19]. In addition, non-smoking partners could have less easily participated in the smoking cessation program Luchtsignaal® due to the telephone approach, focussing on individual's smoking behaviour. However, of the smoking partners in the intervention group, the majority did not participate in the smoking cessation program (see Table 1). This seems a missed opportunity, while the social support at home and at work is reported to be of critical importance to change smoking habits [18]. The exposure to environmental tobacco smoke, reduces the likelihood of smoking cessation up to 70% [20]. Smoking partners are important contributors to environmental tobacco smoke at home and therefore, their role is critical to achieve sustainable change in patient's smoking bevaviour [11,21]. However, further exploration on how partners can be motivated to participate in smoking cessation programs is needed.

From our data, we were unable to find an association between the presence of (participating) partners and the improvement of patient's physical activity. This is in contrast to results of studies focussing on other populations or other types of lifestyle interventions. For example, just the presence of a partner was already positively associated with physical activity in the study of Green et al. [22] They found a 20% lower activity level ($p = 0.008$) in patients without a partner compared to those with a partner, at one month after an acute coronary syndrome. Other intervention programs targeting LRFs in CAD patients focussing on a family-based lifestyle intervention [11] and a couple-based approach [23], showed positive effects on the level of physical activity. The interventions targeting physical activity within both programs, worked from a centre-based approach where patients and partners were guided by a physical therapist [11,23]. It may be possible that our outcome definition, where a successful improvement was defined as >10% increase in 6MWD between baseline and 12 months [13], might not have been sensitive enough to detect smaller increases in levels of physical fitness. Furthermore, the 6MWD does not measure overall increases in non-sedentary behaviour, which might positively impact weight management, but not per se lead to large improvements in 6MWD. Finally, the way that the individual lifestyle programs were offered could impact partner participation in different ways. For instance, Weight Watchers® included real-life coaching sessions for patients and partners, whereas DirectLife® included digital feedback on the results from the activity tracker for each individual. The participating partner role may have been stimulated more in the Weight Watchers program and could explain the contrast in participating partner effect between weight reduction and physical activity.

Environmental influences on lifestyle modification are complex and changing social environments is challenging [24]. For sustained modification of lifestyle habits, integration of modified lifestyles in daily routines and social systems has been shown to be necessary [25,26]. The partner role can be highly influential, but this influence can however both work positively and negatively on the process of behavioural change and prognosis in patients with CVD [27]. For instance, household partners are often concordant in lifestyle and cardiovascular risk factors [7,9]. In a somewhat older general population with unhealthy lifestyles (smoking, overweight and inactivity) an individual's lifestyle modification was shown to be associated with lifestyle modification of the partner [28]. The interplay between individual risk factor improvement and partner participation is however complex. Significant interaction was found between relationship satisfaction and patient's LRF improvement [23]. Patients who were satisfied in their relationship had a significantly higher long-term survival rate after coronary artery bypass graft compared to those not satisfied with their relationship [29]. Dalteg et al. described the high impact of cardiac disease on multiple levels within the relationship, affecting partner role, communication and overprotectiveness [30]. The importance of not only involving couples in lifestyle interventions targeting patients with cardiac disease, but also considering the relationship itself within the intervention to achieve sustainable results has been emphasized [27,31]. This might be an important factor which could have affected our current study results.

4.1. Strengths and limitations

Several strengths are relevant to our study. First, we are the first to study the association of the presence of a partner and partner participation in a large randomized trial including community-based lifestyle programs on LRF modification in a representative population of CAD patients. The study included a variety of patients with and without partners, and systematically registered participating partners in the lifestyle programs. Second, we did not limit the partner analysis to married couples, thereby increasing generalisability. Finally, the presence of a partner and partner participation was registered at baseline and was verified at 12 months follow-up to ascertain the role of the partner during the intervention and follow-up periods.

Some aspects of our study warrant consideration. First, while this study represents a secondary analysis of the RESPONSE-2 trial data, the study was not primarily powered for the comparison of partner influence on lifestyle modification. However, this has limited consequences for the calculated effect sizes, whose accompanying confidence intervals narrow. Second, participating partners in the lifestyle programs were (by definition) only present in the intervention group. Therefore, a comparison to investigate the participating partner effect could only be made with non-participating partners under the same treatment condition in the intervention group. Third, besides data on

the partners' LRFs and lifestyle program participation, we did not collect data on partner characteristics such as the level of education, health literacy and perception on the disease and the importance of lifestyle modification. These partner characteristics could potentially have affected the effects of partner participation. Fourth, we defined participating partners as those who joined patients in the RESPONSE-2 lifestyle programs. Although, information on the number of partners that participated in the lifestyle programs was registered (see Table 1), information on the number of sessions the partners attended, was not available. Analysis of 'dose response relation' between the number of sessions a partner attended and the likelihood of patient LRF modification, was therefore impossible. In addition, partners in the control group could have joined patients in the usual care treatments, e.g. nurse specialists' consultations, and could be considered as participating partners as well. The findings in the intervention group are in anyway not affected by this. Finally, while we found an association between the presence of a partner and partner participation on successful lifestyle modification, the results do not elucidate the psychological mechanisms which explain the positive association on weight reduction and not on smoking cessation and physical activity. Identifying these mechanisms could inform and further help improve community-based lifestyle programs for patients and partners.

5. Conclusion

The presence of a partner was associated with successful improvement on lifestyle related risk factors in patients with coronary artery disease. Moreover, patients with partners who participated in the lifestyle programs, were more successful in achieving clinically important weight loss compared to those with a non-participating partner. Involvement of partners in weight loss interventions should be considered in routine clinical practice.

Authors' contributions

Conceptualization: LV, HJ, and MS; Data curation: MS, MM, HJ; Formal analysis: LV, HJ, GT, and MS; Funding acquisition: LV, HJ, MM, RP, WSoR and MS; Methodology: LV, HJ, GT, and MS; Supervision: RP, WSoR and MS; Visualization: LV, HJ, GT, and MS; Writing - original draft: LV, HJ, and MS; Writing - review & editing: MM, GT, RP and WSoR.

Funding

The RESPONSE-2 trial was sponsored by WW International Inc. (formally Weight Watchers International, Inc.) (New York, New York, USA), Philips Consumer Lifestyle (Amsterdam and Eindhoven, The Netherlands). LV is supported by a research grant from the Netherlands Organization for Scientific Research (NWO), grant number 023.008.024.

Disclaimers

None.

Acknowledgements

We thank the participants in the RESPONSE-2 trial and the contribution of research nurses (C. de Jong, A. van Dullemen, W. van der Poel, J. Doornenbal, M. Smit, B. van der Linden, S. Tanovic, N. Tenbult-van Limpt, M. Leguit, E. Dijkstra, J. Fischer, H. Saarloos, H. van Lint, H. Groeneweg, I. Kremer, C. Coenjaerds, K. Lansink, A. van Goor, E. J. Wolf, E. de Haan, M. van Dijkhuizen, A. Meissner, M. van Steenbergen, Z. Aukema-Wouda, I. Sterk, M. Damen-de Vries, M. Zootjes-Mes, T. Eltink, W. Glas, A. Obbema, A. Reijenga and E. de Jong). We would also like to thank the management team, research nurses, interviewers, research assistants and other staff who were part of the RESPONSE-2 trial.

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