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DELESIE, Michiel; DESTEGHE, Lien; Bertels, Marianne; Gerets, Noor; Van Belleghem , Florence; Meyvis, Jasper; Elegeert, Ivan; DENDALE, Paul & HEIDBUCHEL, Hein (2021) Motivation of overweight patients with atrial fibrillation to lose weight or to follow a weight loss management program: a cross-sectional study. In: Acta cardiologica (Imprimé), 76 (5), p. 494-503.

DOI: 10.1080/00015385.2020.1848274
Handle: http://hdl.handle.net/1942/33061

Motivation of overweight patients with atrial fibrillation to lose weight or to follow a weight loss management program: a cross-sectional study.

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Word count: 3295 words (excluding abstract, references)

Acknowledgements: This research is part of the Limburg Clinical Research Center (LCRC) UHasselt ZOL-Jessa, supported by the foundation Limburg Sterk Merk, province of Limburg, Flemish government, Hasselt University, Jessa Hospital and Ziekenhuis Oost-Limburg.

Keywords: Atrial fibrillation – rehabilitation – overweight – telemedicine

Abstract

Aims: Overweight increases the risk of recurrence and progression of atrial fibrillation (AF). This study assesses the knowledge of overweight AF patients about the relation between their weight and AF, to gauge their motivation losing weight and/or following weight reduction programs.

Methods: A multicenter cross-sectional descriptive study was performed at three Belgian hospitals. A validated self-developed questionnaire was presented to AF patients with a Body Mass Index (BMI) >27kg/m^2 and it addressed: motivation to reduce weight and its related factors; knowledge about the relation between weight and AF; and interest in weight reduction programs.

Results: 143 patients completed the questionnaire. 75.5% was currently motivated to reduce weight. Multivariate regression analysis showed that a higher BMI, a college/university degree, male gender, without hypertension, previous weight loss attempt(s) and living with a partner, were significantly associated with greater motivation for weight reduction. Only 69.9% of the patients was aware of the positive effect of weight reduction on the progression of AF. A completely home-based/telerehabilitation program was the preferred approach for 57.9% of the patients.

Conclusions: AF patients with overweight need to be better informed about overweight as a risk factor for AF. Female AF patients with a lower degree of education, hypertension, living alone, who have never attempted to reduce weight and with a lower but still elevated BMI need more external motivation to lose weight. A tailored weight reduction program (home-based) is the preferred option for patients. This will require further development and validation of telecoaching programs for this patient group.

Keywords: Atrial fibrillation – rehabilitation – overweight – telemedicine

1. Introduction

Recent data showed that lifestyle and cardiovascular risk factor management is becoming an increasingly important aspect to optimize outcomes in atrial fibrillation (AF) patients and especially in obese AF patients.(1) It is shown that an increased body mass index (BMI) is independently associated with the progression from paroxysmal to permanent AF.[2] Risk factor management, weight reduction and more exercise can improve AF burden, symptoms, success rates of rhythm restoring procedures and the quality of life in these patients.(3-5) A recent meta-analysis in AF patients with overweight or obesity, evidenced that already modest (≥10%) weight loss is associated with less recurrent AF, improvement in AF burden and lower AF symptom severity.(6) Despite this evidence, it is very hard in daily practice to convince and motivate overweight/obese AF patients to take care of their weight and to improve their cardiorespiratory fitness. Although some hospitals offer rehabilitation programs for these patients, only a minority of the AF patients is included in these programs. Moreover, in many countries reimbursement for rehabilitation of AF patients is non-existent, or as in Belgium, is restricted to patients who underwent an invasive cardiac procedure or who were recently admitted to the hospital with heart failure.

To ensure optimal care, it is therefore important to gain insights in the motivation of overweight AF patients to lose weight, in their beliefs about weight in relation to their arrhythmia, the motivation to follow weight reduction programs, and barriers to effectively do so. This will provide opportunities to adjust education and weight reduction programs to the specific needs of AF patients with overweight or obesity.

2. Methods

2.1 Questionnaire development

A new questionnaire has been developed by our study team to evaluate the factors related to weight loss motivation (or lack of it) and attitudes toward weight loss management programs in AF patients (English translation in supplement). The questionnaire was validated for its content by a panel of experts, i.e. one electrophysiologist, two cardiologists specialized in cardiovascular rehabilitation, a physician specialized in telerehabilitation of cardiovascular patients, an AF nurse specialist, two psychologists specialized in the guidance of obese patients and an endocrinologist. The comprehensibility of the questionnaire was then revised by 7 healthy volunteers (between 19 and 84 years old) so that uncertainties and misinterpretations could be corrected.

The first objective of the questionnaire was to gain insight in prior efforts to reduce weight. A second objective was to investigate which factors play a role in the motivation of patients regarding weight loss. The third objective was to (i) evaluate patients' knowledge about the relation between overweight and AF and (ii) evaluate their interest in following a weight reduction program and what kind of program they would prefer.

2.2 Study population

A multicenter descriptive cross-sectional study was performed from January 2018 until May 2018 at three Belgian hospitals: the University Hospital of Antwerp, Jessa Hospital Hasselt and AZ Groeninge in Kortrijk. Overweight or obese AF patients (i.e. BMI>27 kg/m^2, cut-off based on weight reduction studies in AF patients (3, 4, 7, 8)) hospitalized at the cardiology department or seen at the outpatient clinic were recruited for this study. Exclusion criteria were: age below 18 or above 80 years, too mentally or physically impaired, inability to read or understand Dutch, life expectancy <1 year, and not capable to sign the informed consent. Clinical data and patients' AF history were collected from their medical record.

Questions about socio-demographic status and additional questions about patients' Internet access, possession of different multimedia devices and independent usage of the Internet were integrated at the end of the questionnaire. The study complied with the Declaration of Helsinki. Ethical approval was obtained from all the local ethical committees and patients provided written informed consent.

2.3 Measured parameters

The questionnaire consisted of 3 broad topics. The first topic contained 7 questions regarding patients' prior efforts to reduce weight and their motivation. Secondly, the current motivation to lose weight was assessed by 3 questions in which the underlying reasons to do (or not to do) so were evaluated. The third topic contained 11 questions evaluating the patients' knowledge about the positive impact of weight reduction on the progression of AF, their interest to participate in a weight reduction program, the influence of reimbursement on participation, and the preferred type of program. The proposed weight reduction programs were a completely home-based program (in which advise about diet and physical activity is provided on paper/online); a completely hospital-based program, a combination of a hospital-/home-based program, or a telerehabilitation program (in which the patient is telemonitored and receives feedback). The clinical parameters (height, weight and waist circumference) were measured by trained nurses.

2.4 Statistics

Data were analyzed using SPSS 25.0 (IBM, Armonk, NY, USA). Variables were described as numbers and percentages or as mean ± standard deviation, as appropriate. Normal distribution was assessed using the Shapiro-Wilk test. For continuous variables, differences between two or three groups were compared using the independent T-test or ANOVA respectively (parametric) and the Kruskal-Wallis test (non-parametric). The Pearson χ^2 test was used for categorical variables. p-values <0.05 were considered statistically significant. For significant categorical predictors of motivation for weight reduction and type of weight reduction program, the relative risks (RR) and odds ratios (OR) were

calculated and reported with their 95% confidence intervals (CI). For continuous variables, univariate logistic regression models were used to calculate the ORs (with their 95% CI), and p-values were derived from the likelihood-ratio test. Candidate variables, categorical as well as continuous, with a p-value <0.10 were considered for the multivariate regression analysis and the optimal regression model was composed using a backward elimination strategy.

3. Results

3.1 Patient characteristics

A total of 560 AF patients were screened (66.4% male; 69.7 ± 12.0 years old). These patients had a mean BMI of 27.8 ± 5.3 kg/m^2 and 299 (53.4%) had a BMI>27kg/m^2.

Figure 1 depicts the enrollment procedure. The final analysis was made on 143 questionnaires. About half of the patients were hospitalised at the time of the questionnaire (47.6%). Table 1 presents the characteristics of the patients whose questionnaires were analyzed (n=143) per participating centre. Of these patients, 68.5% had a modified European Heart Rhythm Association AF symptom score (mEHRA) ≥ 2a.

3.2 Prior efforts to reduce weight

Of the 143 patients who completed the questionnaire, 109 (76.2%) had already attempted to lose weight. Their mean BMI was significantly higher compared with those who did not try to lose weight before (32.8 ± 5.0kg/m² vs 30.8 ± 2.9kg/m²; p=0.004). Weight loss was mostly attempted by dieting (75.2%) and/or more physical activity (53.2%), both without professional assistance. A dietician was consulted by 42.2% of these patients and only a minority followed a hospital-based weight reduction program (9.2%) or a structured fitness program (10.1%). In summary, of all patients attempted to reduce weight, 41.3% only took dietary measures, 5.5% were only more physical active and 49.5%

combined dieting and more physical exercises to lose weight. Only 47,2% of patients reported a frequency >2 days per week of physical activity (session of minimum 10 minutes).

Of the measures taken, 78.9% of the patients stated that these had been effective and 67.4% indicated that the weight reduction was sustained for ≥6 months. The main motivating factor to lose weight was health-related, cited by 65.1% (Figure 2A). Of the study patients who negatively answered the questions of effectiveness or sustainability (46.8%), the majority admitted that they had a lack of motivation (54.9%) or their attempt had insufficient results (29.4%).

3.3 Factors related to motivation to reduce weight

At the time the questionnaire was taken, 108 patients (75.5%) were motivated to lose weight. Health considerations were the main motivating reason, cited by 85 patients (78.7%; Figure 2B). 'Income' (>2000 euro/month), 'educational degree' (college/university), 'living with a partner', 'previous weight loss attempt' and 'higher BMI' were positively correlated with the current motivation to reduce weight ($p<0.05$). Age, male gender and arterial hypertension were also correlated with the motivation to reduce weight but these factors did not reach statistical significance (Table 2A). In multivariate regression analysis, a higher BMI, male gender, no history of arterial hypertension, a college/university degree, previous weight loss attempt(s) and living together were associated with greater motivation for weight reduction (Table 2B). (tested variables for univariate and multivariate analysis are described in the supplement)

3.4 Patients' knowledge and interest in a weight reduction program

A total of 100 patients (69.9%) was aware of the positive effect of weight reduction on the progression of AF. Of these patients, 82.0% indicated that this information was given primarily by a physician. Recent diagnosis of AF (i.e. $\leq$ 1 year) was negatively correlated with patients' awareness about this relation (OR = 0.46; 95% CI 0.22 – 0.99; p=0.044). Also, knowing about the positive effect of weight

reduction on AF was correlated with (more) physical activity than not being aware of this relation (OR = 2.54; 95% CI 1.05 – 6.11; p=0.035).

Only 41.5% of the patients was aware of the existence of an in-hospital based weight reduction program. More patients would be motivated to follow a weight-loss program if such program would be reimbursed (p = 0.001). More specifically, 67.0% (71/106) of the motivated patients would participate in a reimbursed weight-loss program.

Four types of weight reduction programs were proposed: 54 of 133 patients who answered this question would prefer a completely home-based program (40.6%), 33 (24.8%) a combined hospital/home-based program, 23 (17.3%) a completely hospital-based program and 23 (17.3%) a telerehabilitation program. Age (OR=0.93; 95% CI 0.89 – 0.98; p=0.005), independent use of the Internet (OR=11.00; 95% CI 1.43 – 84.90; p=0.005), a higher educational degree (OR=3.27; 95% CI 1.30 – 8.23; p=0.009) and ongoing professional activity (OR=3.22; 95% CI 1.24 – 8.35; p=0.013) were significant univariate predictors for the preference for a telerehabilitation weight reduction program.

The only significant predictor for preference of a completely hospital-based program was unemployment/retirement (OR = 8.35; 95% CI 1.08 – 64.74; p=0.017).

Of the included patients, 64.8% were willing to participate in an intensive weight reduction program for at least 3 months. Of the patients who were interested in additional specific sessions, 60.8% chose a consultation with a dietician, followed by an educational session about weight control (43%).

4. Discussion

This is the first study evaluating the motivation for weight reduction in AF patients with overweight. It provides insights for developing weight reduction programs for this target group.

4.1 Impact of overweight on atrial fibrillation

There is established evidence that overweight and obesity are associated with an increased risk of incident AF.(9, 10) A meta-analysis showed that there is: i) a 19%-29% additional risk of incident AF for every 5-unit BMI increase; and ii) a 10%-13% greater risk of post-operative and post-ablation AF for every 5-unit increase in BMI.[11] AF is associated with a higher mortality, higher morbidity and a decreased quality of life.(12) In patients already diagnosed with AF, BMI is associated with more rapid progression of AF.(2, 13) Weight loss and an increased cardiorespiratory fitness in overweight patients resulted in a reduction in the symptomatic AF burden.(4, 7) After hypertension, obesity is the second most common modifiable risk factor for AF, more important than other modifiable or treatable risk factors (obstructive sleep apnea, diabetes, smoking and excess alcohol intake).(14)

The impact of overweight or obesity on mortality and major nonfatal outcomes (stroke, heart failure) of AF patients requires further research as this factor could adversely affect these clinical outcomes.(5)

As recommended by the 2016 ESC guidelines for the management of AF, there is need for structured and integrated care for all AF patients.(12) Patient involvement, education and empowerment for self-management of risk factors forms one of the main pillars of this model.

As our study shows, 30% of the patients with a BMI>27 was not aware of the beneficial effect of weight reduction on disease progression and quality of life. Further analysis also showed that overweight or obese patients with a recent diagnosis of AF ($\leq$ 1 year) were significant more unaware of this fact and overweight AF patients knowing about the beneficial effect of weight reduction on their disease progression were more physical active. Prior Belgian and Polish surveys have shown that an even larger proportion of the overall AF population (47.2% to 54.9%) was not aware about the impact of overweight on AF.(15, 16) The higher percentage of awareness in this study can be explained due to the fact that the question itself could influence overweight patients to positively answer this question as they may already know that their overweight is not good for their general health and thus also for different

diseases such as AF. This proves that AF patients in general need to be better educated about the importance of tackling modifiable risk factors. The best tools for providing this information need to be better explored. Prior trials with online tools or applications have shown a positive impact on patients' knowledge.(17-19) Such approaches should be structured, universal, and likely specifically tailored to target groups like overweight AF patients.

4.2 Motivation for weight reduction

As stated above, patients need to be empowered and motivated to adopt a healthy lifestyle. In our study health reasons was the main motivating factor for losing weight and lower motivation was mainly present in those living alone, with a lower income, and/or lower degree of education, so that motivational efforts should explicitly address these subgroups of AF patients.

There is not much literature evaluating factors related to pre-treatment motivation to engage in weight reduction, especially in cardiovascular patients. An Australian study, conducted in primary care patients, identified 'health reasons' as the top reason for wanting to lose weight in overweight and obese patients and also concluded that overweight, obese, younger, females, with a high degree of education had higher odds of intending to lose weight.(20) Besides sex, these results are in line with our results.

If patients would start with a weight reduction program, pre-treatment factors that predict successful weight management are already more defined. In a review article including patients with obesity in general (i.e. not AF), motivation itself was investigated as a predictor of weight control but due to limited studies and a high level of heterogeneity between the included studies no conclusions could be drawn.(21) In the same review, fewer prior weight loss attempts was the most consistent pre-treatment predictor of weight loss.(21) However, in our study this factor was positively correlated with motivation for active weight (self-)management. Explanatory factors for this could be that the included patients were older, already had a cardiovascular history and were more aware of the health benefits of weight and thus had a higher chance of prior weight reduction efforts.

A recent study in pre-diabetic, overweight patients identified several social-cognitive variables associated with greater weight loss, i.e. encouragement for changing eating habits by family, temptations to eat unhealthy by family/friends, less discouragement to eat healthily by family and friends.(22) As our study also showed, the influence of the patients' environment (partner, family, friends) should not be underestimated and their involvement can contribute to their motivation and reaching weight loss goals.

4.3 Weight reduction programs

Several studies have shown the beneficial effect of weight reduction programs in AF patients with overweight or obesity. One study showed a significant reduction in AF symptom burden, AF symptom severity, number of episodes and cumulative duration, compared with lifestyle advice alone.(7) Another weight reduction study, conducted in AF patients undergoing a first ablation, resulted in a significantly greater reduction of AF frequency, duration, symptoms, and symptom severity and thus improved symptomatic success of AF ablation compared with the control group.(3) The LEGACY study showed that progressive weight loss had a dose-dependent effect on long-term freedom from AF, while weight fluctuations were associated with greater likelihood of recurrent arrhythmia.(8) Lastly, the CARDIO-FIT study showed that a higher cardiorespiratory fitness on top of weight loss was associated with greater freedom of AF.(4)

The common approach in these studies is a strict diet combined with a physical exercise plan as recommended by several guidelines (supplemented with specific risk factor management for cardiovascular risk patients).(23, 24) Three studies about patients' preference regarding weight reduction strategies, respectively conducted in overweight or obese adult cancer survivors, patients undergoing or who underwent a knee replacement, and Australian general practice patients, identified that the majority preferred nutrition counselling and specific physical exercise guidance.[20, 25, 26] One of these studies also concluded that 68% preferred a home-based weight management program.(25) These findings are comparable with our results in which 60.8% was interested in a consultation with a dietician and 57.9% of patients preferred a completely home-based or telerehabilitation program.

Also in our study, 75.3% of the patients preferred a partially or even completely home-based weight reduction program or telerehabilitation program. The above-mentioned weight reduction programs in AF patients with overweight were also mainly home-based.(3, 4, 7, 8) Notably, one study showed that a higher participation grade was associated with higher weight loss maintenance, indicating that adherence to a (tailored) weight loss program is important.(8)

Several reviews have identified that location and accessibility of centre-based rehabilitation programs are barriers for participation and adherence to these programs.(27, 28) Alternative approaches such as home-based cardiac rehabilitation programmes have to be explored. Home- and centre-based cardiac rehabilitation seem to be similarly effective in improving clinical and health-related quality of life outcomes, although data on weight loss were not available.(29) Moreover, several studies in coronary artery disease and heart failure patients have demonstrated that a home-based or telerehabilitation approach is more cost-effective than centre-based programs.(30, 31)

As our data show, providing reimbursement for structured weight-loss programs would definitely increase motivation for AF patients since 57% would only consider it if reimbursed. Nowadays, there are no weight reduction programs reimbursed for AF patients with overweight or obesity. In Belgium, cardiovascular rehabilitation programs, which consist mostly of exercise training in combination with lifestyle education (including dietary advice), are only available for patients who experienced myocardial infarction, a cardiac intervention, or having heart failure. These programs have shown improvement in risk profile and outcomes in these patients and are reimbursed.(32-34) However, overweight or obese patients often fail to lose enough weight to significantly reduce their cardiovascular risk.(35-37)

Moreover, most of our patients (70.9%) actively used the Internet. Herein lays an opportunity to develop tailored tele-coached weight reduction programs that guide overweight AF patients with less need for centre-based visits. The use of E-health and m-health tools (e.g. activity trackers) can contribute in this development and may reduce the burden on the healthcare system in chronic patient populations such

as AF, but these tools need to be validated in clinical practice before implementation. There is an urgent need for development and evaluation of such programs for AF patients.

4.4 Study limitations

This study was conducted in 3 hospitals. Due to practical issues, there was an imbalance in number of inclusions and their demographics between the centers (Table 1). A large number of eligible AF patients could not participate due to several practical issues (e.g. overcrowded consultation, outpatients did not have the time to fill out the questionnaires, …). We cannot confirm the honesty with which patients fill out the questionnaire: there was no extra validation procedure, besides face and content validation of the questionnaire itself.

5. Conclusions

About 30% of AF patients with overweight do not realise that overweight is a risk factor for the progression of AF impacting their quality of life. Educational efforts need to be improved. Female AF patients with a history of arterial hypertension, a lower educational degree, living alone, who have never attempted to reduce weight and with a lower but still elevated BMI require more intensive focus on education and external motivation to lose weight. A tailored weight reduction program, mainly home based, is the preferred option for patients. This will require further development and validation of telecoaching programs that are effective and cost-effective.

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Potential conflicts of interest

Publication of this article was not funded. M.D. is working as a Ph.D. student on project T002917N of the Fund for Scientific Research, Flanders. None of the other authors has any personal conflicts of interest. H.H. and L.D. received unconditional research support through the University of Hasselt or University of Antwerp from Bayer, Daiichi-Sankyo, Boehringer-Ingelheim, Bracco Imaging Europe, Medtronic, Boston-Scientific, Biotronik, and St. Jude Medical.

Acknowledgements

This research is part of the Limburg Clinical Research Center (LCRC) UHasselt-ZOL-Jessa, supported by the foundation Limburg Sterk Merk, province of Limburg, Flemish government, Hasselt University, Jessa Hospital and Ziekenhuis Oost-Limburg.

Table 1: Baseline characteristics of the study population

	Total study population (n=143)	Hospital 1 (n=52)	Hospital 2 (n=61)	Hospital 3 (n=30)	P-value between centers
Age (years), mean ± SD	65.7 ± 9.2	62.0 ± 10.8	67.6 ± 7.5	68.1 ± 7.2	**0.007**
Male, n (%)	98 (68.5)	39 (75.0)	39 (63.9)	20 (66.7)	0.437
BMI (kg/m²), mean ± SD	32.3 ± 4.7	31.6 ± 4.0	32.3 ± 5.1	33.7 ± 4.6	0.064
Weight (kg), mean ± SD	96.8 ± 15.3	96.0 ± 13.9	95.4 ± 14.5	101.1 ± 18.6	0.423
Height (m), mean ± SD	173.1 ± 9.4	174.4 ± 8.5	172.1 ± 10.2	173.0 ± 9.6	0.459
Waist circumference (cm), mean ± SD	114.7 ± 12.7	112.2 ± 12.4	115.2 ± 12.7	117.7 ± 13.0	0.172
Hospitalized (%)	68 (47.6)	15 (28.8)	48 (78.7)	5 (16.7)	**<0.001**
Kind of AF, n (%)					0.125
First diagnosed	8 (5.6)	2 (3.8)	2 (3.3)	4 (13.3)	
Paroxysmal AF	89 (62.2)	34 (65.4)	40 (65.6)	15 (50.0)	
Persistent AF	30 (21.0)	12 (23.1)	14 (23.0)	4 (13.3)	
Permanent AF	16 (11.2)	4 (7.7)	5 (8.2)	7 (23.3)	
Time since AF diagnosis, n (%)					**0.001**
≤ 1 year	43 (30.1)	6 (11.5)	24 (39.3)	13 (43.3)	
> 1 year	100 (69.9)	46 (88.5)	37 (60.7)	17 (56.7)	
CHA_2DS_2-VASc score, mean ± SD	3.0 ± 1.9	2.7 ± 1.8	3.3 ± 2.0	3.1 ± 1.9	0.397
Arterial Hypertension, n (%)	85 (59.4)	31 (59.6)	47 (77.0)	7 (23.3)	**<0.001**
Diabetes, n (%)	39 (27.3)	14 (26.9)	15 (24.6)	10 (33.3)	0.677
Vascular Disease, n (%)	57 (40.0)	17 (32.7)	24 (39.3)	19 (53.3)	0.183
HAS-BLED score, mean ± SD	1.3 ± 1.1	1.0 ± 1.2	1.4 ± 0.9	1.4 ± 1.1	**0.030**
Anticoagulation therapy, n (%)					**0.013**
NOAC	96 (67.1)	30 (57.7)	44 (72.1)	22 (73.3)	
VKA	16 (11.2)	12 (23.1)	4 (6.6)	0 (0.0)	
None	31 (21.7)	10 (19.2)	13 (21.3)	8 (26.7)	
Anti-arrhythmic drugs, n (%)	80 (55.9)	29 (55.8)	38 (62.3)	13 (43.3)	0.231
Post PVI, n (%)	65 (45.5)	34 (65.4)	19 (31.1)	12 (40.0)	**0.001**
Lipid lowering drugs, n (%)	91 (63.6)	26 (50.0)	43 (70.5)	22 (73.3)	**0.036**
Betablockade	96 (67.1)	30 (57.7)	44 (72.1)	22 (73.3)	0.191
Highest level of education completed, n (%)					**0.001**
Primary/Secondary school	97 (68.3)	25 (49.0)	48 (78.7)	24 (80.0)	
College/University	45 (31.7)	26 (51.0)	13 (21.3)	6 (20.0)	
Living alone, n (%)	31 (21.7)	11 (21.2)	11 (18.0)	9 (30,0)	0.425
Childless, n (%)	22 (15.4)	11 (21.2)	6 (9.8)	5 (16.7)	0.258
Employment status, n (%)					**0.003**
Retired/unemployed	109 (76.8)	31 (60.8)	52 (85.2)	26 (86.7)	
Professional active	33 (23.2)	20 (39.2)	9 (14.8)	4 (13.3)	
Internet access, n (%)	119 (83.2)	48 (92.3)	50 (82.0)	21 (70.0)	**0.032**
Independent use, n (%)	100 (70.9)	44 (84.6)	41 (67.2)	15 (50.0)	**0.003**

AF: atrial fibrillation, BMI: body mass index, NOAC: non-vitamin K antagonist oral anticoagulant, VKA: vitamin K antagonist, SD: standard deviation.

Table 2: Factors related to motivation to reduce weight

A Univariate factors correlated with motivation to reduce weight

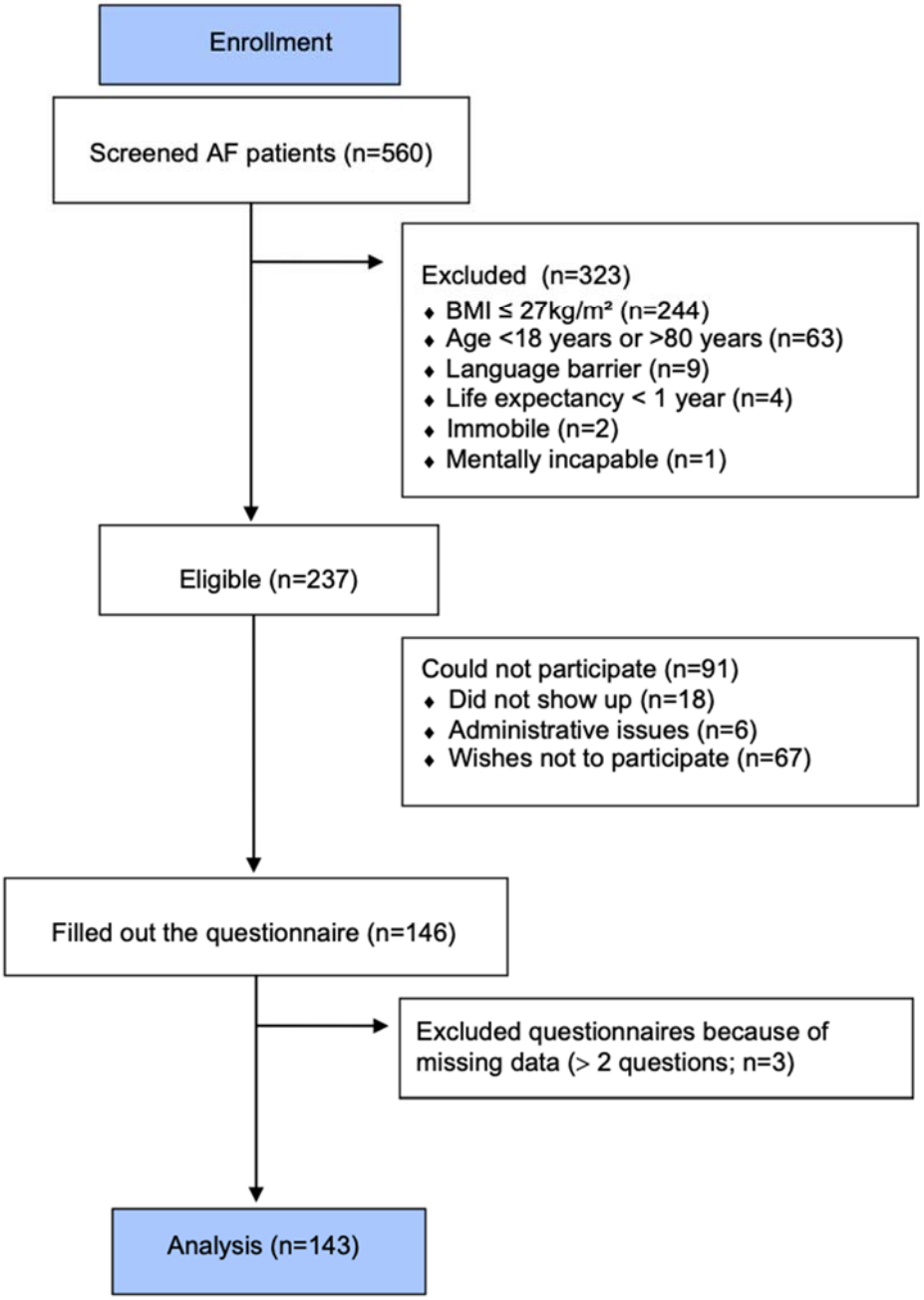
	RR	95% CI	OR	95% CI	P-value
Sex (male)	1.21	0.96-1.52	2.05	0.93-4.55	0.074
Income (>2000euro/month)	1.27	1.07-1.52	4.09	1.13-14.85	0.023
Arterial Hypertension	0.84	0.70-1.00	0.45	0.19-1.05	0.062
Living together	1.40	1.02-1.91	3.10	1.31-7.29	0.008
Degree (College/University)	1.31	1.11-1.53	4.44	1.45-13.53	0.005
Previous weight loss attempt	1.57	1.13-2.19	4.44	1.91-10.32	<0.001
BMI	/	/	1.11	0.99-1.24	0.046
Age	/	/	0.96	0.91-1.00	0.059

RR: Relative Risk, CI: Confidence Interval, OR: Odds Ratio – factors with a p-value < 0.10 are mentioned as they were considered in multivariate regression models

B Multiple regression model for motivation for weight reduction

	Coefficient	SE	OR	95% CI	P-value
BMI	0.19	0.078	1.20	1.03-1.40	0.006
Living together	1.59	0.563	4.91	1.63-14.81	0.004
Degree (College/University)	1.51	0.633	4.53	1.31-15.65	0.009
Previous weight loss attempt	1.59	0.513	4.89	1.79-13.38	0.002
Male sex	1.14	0.508	3.12	1.15-8.45	0.023
History of arterial hypertension	-0.99	0.521	0.37	0.13-1.03	0.050
Constant	-7.41	2.648	0.001	/	0.005

SE: Standard Error, OR: Odds Ratio, CI: Confidence Interval


Enrollment
Screened AF patients (n=560)
Excluded (n=323)
♦ BMI ≤ 27kg/m² (n=244)
♦ Age <18 years or >80 years (n=63)
♦ Language barrier (n=9)
♦ Life expectancy < 1 year (n=4)
♦ Immobile (n=2)
♦ Mentally incapable (n=1)
Eligible (n=237)
Could not participate (n=91)
♦ Did not show up (n=18)
♦ Administrative issues (n=6)
♦ Wishes not to participate (n=67)
Filled out the questionnaire (n=146)
Excluded questionnaires because of missing data (> 2 questions; n=3)
Analysis (n=143)

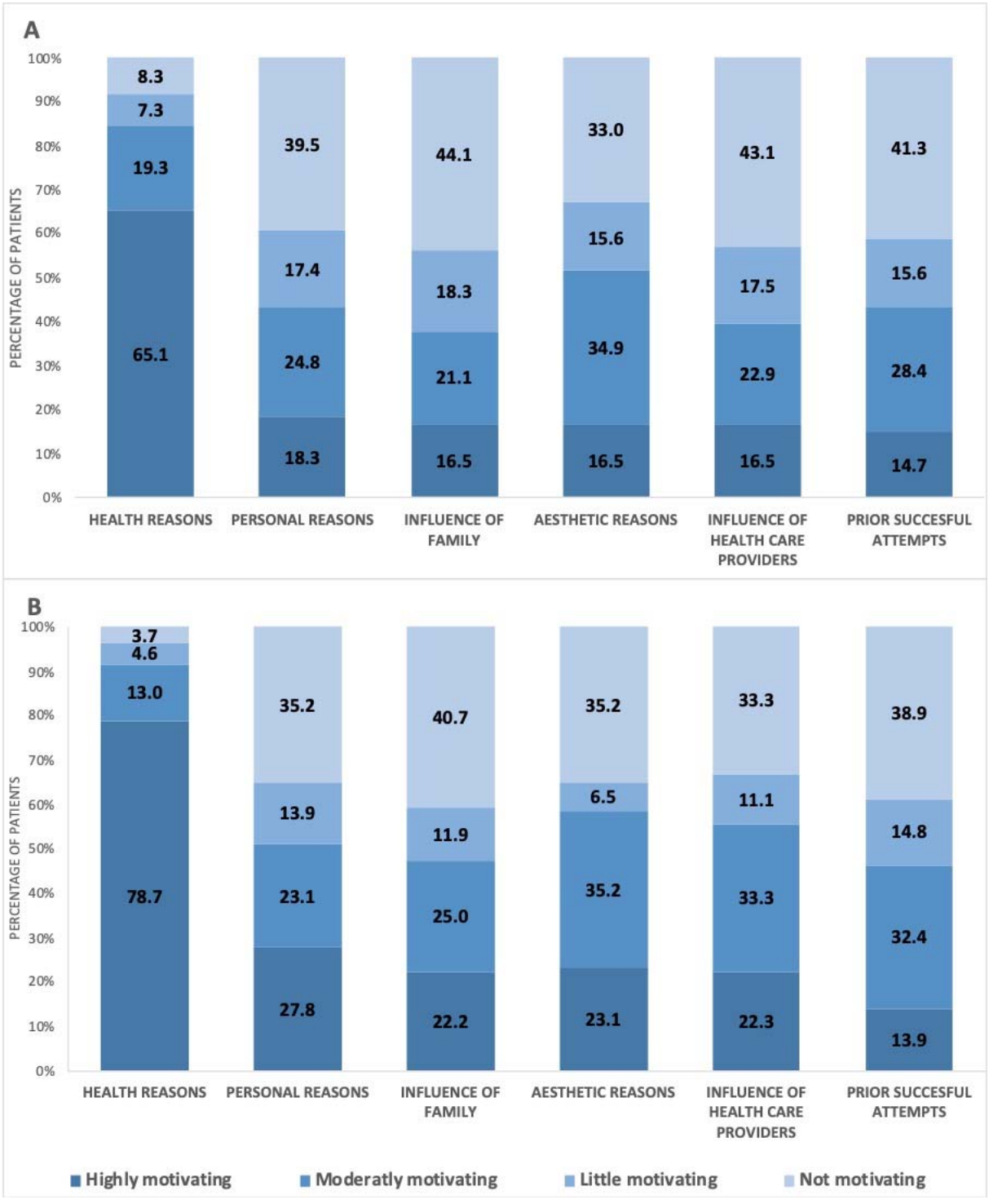

A
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
PERCENTAGE OF PATIENTS
8.3
7.3
19.3
65.1
39.5
17.4
24.8
18.3
44.1
18.3
21.1
16.5
33.0
15.6
34.9
16.5
43.1
17.5
22.9
16.5
41.3
15.6
28.4
14.7
HEALTH REASONS
PERSONAL REASONS
INFLUENCE OF FAMILY
AESTHETIC REASONS
INFLUENCE OF HEALTH CARE PROVIDERS
PRIOR SUCCESFUL ATTEMPTS
B
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
PERCENTAGE OF PATIENTS
3.7
4.6
13.0
78.7
35.2
13.9
23.1
27.8
40.7
11.9
25.0
22.2
35.2
6.5
35.2
23.1
33.3
11.1
33.3
22.3
38.9
14.8
32.4
13.9
HEALTH REASONS
PERSONAL REASONS
INFLUENCE OF FAMILY
AESTHETIC REASONS
INFLUENCE OF HEALTH CARE PROVIDERS
PRIOR SUCCESFUL ATTEMPTS
Highly motivating
Moderatly motivating
Little motivating
Not motivating

Figure 1: Enrolment procedure

Abbreviations: AF, atrial fibrillation; BMI, Body Mass Index

Figure 2: Prior (A) and actual (B) motivational reasons to reduce weight

Supplement 1: Questionnaire

1. History of weight loss

1.1. Have you ever attempted to reduce weight?

Yes ☐ No ☐

If no, proceed to question 2.1.

1.1.1. If yes, which measures did you take? (multiple options possible)

☐ Adapt your diet on your own initiative (without professional assistance)

☐ Doing more physical exercises and/or workout (without professional assistance)

☐ Nutritional advice (ex. dietician)

☐ Advice regarding physical exercise (ex. guidelines by a physician, physiotherapist)

☐ A structured diet program (ex. weight watchers)

☐ A structured fitness program (ex. fitness coach)

☐ A hospital-based weight reduction program

☐ A medical operation (ex. gastric bypass)

☐ Other: _____

1.1.2. Were these measures effective in reducing weight?

Yes ☐ No ☐

If no, proceed to question 1.1.2.2.

1.1.2.1. If yes, could you maintain this weight reduction for at least 6 months?

Yes ☐ No ☐

If yes, proceed to question 1.2.

1.1.2.2. What was the reason that you could not maintain this weight reduction? (multiple options possible)

☐ Insufficient motivation

☐ Insufficient results

☐ Insufficient guidance

☐ Insufficient information

☐ Too difficult and time-consuming

☐ Insufficient understanding and support of relatives

☐ Other: _____

1.2. Explain to what extent the following aspects were motivating to reduce weight.

Health reasons:

Not motivating	Little motivating	Moderately motivating	Highly motivating
☐	☐	☐	☐

Personal reasons (emotional aspect, comments):

Not motivating	Little motivating	Moderately motivating	Highly motivating
☐	☐	☐	☐

Influence of family (stimulation):

Not motivating	Little motivating	Moderately motivating	Highly motivating
☐	☐	☐	☐

Aesthetic reasons (looking better):

Not motivating	Little motivating	Moderately motivating	Highly motivating
☐	☐	☐	☐

Influence of health care providers:

Not motivating ☐ Little motivating ☐ Moderately motivating ☐ Highly motivating ☐

Prior successful attempts:

Not motivating ☐ Little motivating ☐ Moderately motivating ☐ Highly motivating ☐

1.3. How many days a week do you exercise? (ex. cycling, swimming, walking; at least 10 minutes per session)

☐ Not

☐ 1-2 days a week

☐ 3-4 days a week

☐ > 4 days a week

2. Motivation

2.1. Are you currently motivated to reduce weight?

Yes ☐ No ☐

If no, proceed to question 2.1.2.

2.1.1. If yes, explain to what extent the following reasons are motivating to reduce weight.

Health reasons:

Not motivating ☐ Little motivating ☐ Moderately motivating ☐ Highly motivating ☐

Personal reasons (emotional aspect, comments):

Not motivating ☐ Little motivating ☐ Moderately motivating ☐ Highly motivating ☐

Influence of family (stimulation):

Not motivating ☐ Little motivating ☐ Moderately motivating ☐ Highly motivating ☐

Aesthetic reasons (looking better):

Not motivating ☐ Little motivating ☐ Moderately motivating ☐ Highly motivating ☐

Influence of health care providers:

Not motivating ☐ Little motivating ☐ Moderately motivating ☐ Highly motivating ☐

Prior successful attempts:

Not motivating ☐ Little motivating ☐ Moderately motivating ☐ Highly motivating ☐

2.1.2. If no, explain what affects your motivation in a negative way.

Health reasons:

No influence ☐ Some influence ☐ Moderate influence ☐ Strong influence ☐

Personal reasons:

No influence ☐ Some influence ☐ Moderate influence ☐ Strong influence ☐

Influence of family:

No influence ☐ Some influence ☐ Moderate influence ☐ Strong influence ☐

Aesthetic reasons:

No influence ☐ Some influence ☐ Moderate influence ☐ Strong influence ☐

Influence of health care providers:

No influence ☐ Some influence ☐ Moderate influence ☐ Strong influence ☐

Prior unsuccessful attempts:

No influence ☐ Some influence ☐ Moderate influence ☐ Strong influence ☐

Regaining weight in the past:

No influence ☐ Some influence ☐ Moderate influence ☐ Strong influence ☐

Regaining weight in the past:

No influence ☐ Some influence ☐ Moderate influence ☐ Strong influence ☐

Feeling of inability to lose weight:

No influence ☐ Some influence ☐ Moderate influence ☐ Strong influence ☐

3. Current knowledge about body weight and arrhythmias

3.1. Are you aware of the positive effect of weight reduction on the progression of atrial fibrillation?

Yes ☐ No ☐

If no, proceed to question 3.2.

3.1.1. Who informed you (or on what way were you informed) about this relation between weight reduction and atrial fibrillation?

☐ by a physician during a consultation or hospitalisation

☐ by a nurse during a consultation of hospitalisation

☐ by a family member

☐ by a friend or acquaintance

☐ through the Internet

☐ through an informational brochure

☐ by a patient with the same condition

☐ Other: _____

3.2. Are you aware of the existence of an in-hospital based weight reduction program?

Yes ☐ No ☐

If no, proceed to question 3.2.2.

3.2.1. Who informed you (or on what way were you informed) about this? (multiple options possible)

☐ by a physician during a consultation or hospitalisation

☐ by a nurse during a consultation of hospitalisation

☐ by a family member

☐ by a friend or acquaintance

☐ through the Internet

☐ through an informational brochure

☐ by a patient with the same condition

☐ Other: _____

3.2.2. Does the fact that an in-hospital based weight reduction program is not reimbursed (except after a hospitalisation), influences your choice to participate in such a program?

Yes ☐ No ☐

3.2.3. Do you like to receive more information about this in-hospital based weight reduction program? (multiple options possible)

☐ yes, about the health reasons why such a program is useful

☐ yes, about the different options of this program

☐ yes, about the provided guidance

☐ yes, about the time expenditure of this program

☐ yes, about the possible extra costs

☐ No

3.3. Which type of weight reduction program would you prefer?

☐ a completely hospital-based program consisting out of physical exercise sessions and advise about diet

☐ a completely home-based program (in which advise about diet and physical activity is provided on paper/online)

☐ a combination of a hospital-/home-based program

☐ a telerehabilitation program (in which the patient is telemonitored and receives feedback)

3.3.1. For how long would you be willing to participate in such an intensive weight reduction program?

Not ☐ 3 months ☐ 6 months ☐ 1 year ☐ >1 year ☐

3.3.2. Which of the following specific sessions would you participate? (multiple options possible)

☐ consultation with a dietician

☐ consultation with a social nurse (health education and motivation of self-care)

☐ consultation with a physiotherapist

☐ discussion group with patients with the same arrhythmia

☐ educational sessions about weight control

☐ consultation with a psychologist

☐ None

3.3.2.1. Would you consider a weight reduction program if reimbursement was provided?

Yes ☐ No ☐

3.4. Can we contact you if a new and free weight reduction program is available? (study related)

Yes ☐ No ☐

4. Additional information

Are you in possession of a multimedia device with connection to the internet?

Yes ☐ No ☐

Do you have:
(multiple options possible)

☐ a smartphone

☐ a tablet

☐ Laptop/PC

These devices use:
(multiple options possible)

☐ windows

☐ Android

☐ iOS

Do you have access to mobile internet and/or wireless internet (Wi-Fi) on one of these devices? Yes ☐ No ☐

Can you independently use the internet? Yes ☐ No ☐

Are you single? Yes ☐ No ☐

Do you have children? Yes ☐ No ☐

Your highest educational degree:

Primary school ☐
Secondary school ☐
College ☐
University ☐

Employment status:

Full time ☐
part-time ☐
Unemployed ☐
Retired ☐

Work status:

Employee ☐
Worker ☐
Self-employed ☐
Not applicable ☐

Net income/month:

<1000 euro ☐
1000-2000 euro ☐
2000-3000 euro ☐
>3000 euro ☐

Supplement 2: Univariate factors tested for correlation with motivation to reduce weight

	RR	95% CI	OR	95% CI	P-value
Sex (male)	1.21	0.96-1.52	2.05	0.93-4.55	**0.074**
Income (>2000euro/month)	1.27	1.07-1.52	4.09	1.13-14.85	**0.023**
Arterial Hypertension	0.84	0.70-1.00	0.45	0.19-1.05	**0.062**
Living together	1.40	1.02-1.91	3.10	1.31-7.29	**0.008**
Degree (College/University)	1.31	1.11-1.53	4.44	1.45-13.53	**0.005**
Previous weight loss attempt	1.57	1.13-2.19	4.44	1.91-10.32	**<0.001**
BMI	/	/	1.11	0.99-1.24	**0.046**
Age	/	/	0.96	0.91-1.00	**0.059**
Having children					0.884
Employment status (Professional active)					0.114
Place of inclusion (outpatient clinic)					0.777
CHA_2DS_2-VASc score					0.425
Time since AF diagnosis (> 1 year)					0.649
Congestive Heart failure					0.297
Diabetes mellitus					0.626
Post PVI					0.160
Anti-arrhythmic drug use					0.211
Lipid lowering drug use					0.554
Kind of AF (non-permanent)					0.916
mEHRA score (>1)					0.820
Alcohol use (>7 units/week)					0.769

AF: atrial fibrillation, mEHRA: modified European Heart Rhythm Association score of atrial fibrillation, RR: Relative Risk, CI: Confidence Interval, OR: Odds Ratio

Supplement 3: Stepwise composition of the multiple regression model

1 Selected factors = univariate factors correlated with motivation to reduce weight with $p<0.10$

	RR	95% CI	OR	95% CI	P-value
Male sex	1.21	0.96-1.52	2.05	0.93-4.55	**0.074**
Income (>2000euro/month)	1.27	1.07-1.52	4.09	1.13-14.85	**0.023**
History of arterial hypertension	0.84	0.70-1.00	0.45	0.19-1.05	**0.062**
Living together	1.40	1.02-1.91	3.10	1.31-7.29	**0.008**
Degree (College/University)	1.31	1.11-1.53	4.44	1.45-13.53	**0.005**
Previous weight loss attempt	1.57	1.13-2.19	4.44	1.91-10.32	**<0.001**
BMI	/	/	1.11	0.99-1.24	**0.046**
Age	/	/	0.96	0.91-1.00	**0.059**

2 Multiple regression model with all factors

Included in Analysis: 107

Missing Cases: 36

		Predicted		Percentage correct
		Motivation to reduce weight		
Observed		No	Yes	
Motivation to reduce weight	No	10	13	43.5
	Yes	4	80	95.2
Overall percentage				84.1

	Coefficient	SE	OR	95% CI	P-value
BMI	0.17	0.093	1.18	0.10-1.41	0.075
Living together	1.37	0.632	3.92	1.14-13.52	0.031
Degree (College/University)	1.31	0.766	3.69	0.82-16.55	0.088
Previous weight loss attempt	1.47	0.606	4.35	1.33-14.27	0.015
Male sex	1.00	0.636	2.71	0.78-9.41	0.117
History of arterial hypertension	-0.59	0.642	0.56	0.16-1.96	0.362
Income (>2000euro/month)	0.13	0.888	1.14	0.20-6.51	0.882
Age	-0.03	0.035	0.97	0.91-1.04	0.379
Constant	-4.67	3.500	0.01	/	0.182

SE: Standard Error, OR: Odds Ratio, CI: Confidence Interval

3 Multiple regression model without factor 'income'

Included in Analysis: 141

Missing Cases: 2

		Predicted		Percentage correct
		Motivation to reduce weight		
Observed		No	Yes	
Motivation to reduce weight	No	16	17	48.5
	Yes	4	104	96.3
Overall percentage				85.1

	Coefficient	SE	OR	95% CI	P-value
BMI	0.19	0.080	1.21	1.03-1.41	0.019
Living together	1.57	0.563	4.81	1.60-14.50	0.005
Degree (College/University)	1.48	0.634	4.39	1.27-15.22	0.020
Previous weight loss attempt	1.57	0.513	4.80	1.76-13.13	0.002
Male sex	1.10	0.512	3.01	1.10-8.20	0.032
History of arterial hypertension	-0.87	0.536	0.42	0.15-1.20	0.105
Age	-0.03	0.031	0.97	0.92-1.04	0.384
Constant	-5.71	3.286	0.003	/	0.082

SE: Standard Error, OR: Odds Ratio, CI: Confidence Interval

4 Multiple regression model without factors 'income' and 'age' (reported model)

Included in Analysis: 141

Missing Cases: 2

		Predicted		Percentage correct
		Motivation to reduce weight		
Observed		No	Yes	
Motivation to reduce weight	No	16	17	48.5
	Yes	4	104	96.3
Overall percentage				85.1

	Coefficient	SE	OR	95% CI	P-value
BMI	0.19	0.078	1.20	1.03-1.40	0.006
Living together	1.59	0.563	4.91	1.63-14.81	0.004
Degree (College/University)	1.51	0.633	4.53	1.31-15.65	0.009
Previous weight loss attempt	1.59	0.513	4.89	1.79-13.38	0.002
Male sex	1.14	0.508	3.12	1.15-8.45	0.023
History of arterial hypertension	-0.99	0.521	0.37	0.13-1.03	0.050
Constant	-7.41	2.648	0.001	/	0.005

SE: Standard Error, OR: Odds Ratio, CI: Confidence Interval