Original article

Patient motivation to lose weight: Importance of healthcare professional support, goals and self-efficacy

Dror Dicker [a,q,*], Assim A. Alfadda [b], Walmir Coutinho [c], Ada Cuevas [d], Jason C.G. Halford [e], Carly A. Hughes [f], Masato Iwabu [g], Jae-Heon Kang [h], Rita Nawar [i], Ricardo Reynoso [j], Nicolai Rhee [k], Georgia Rigas [l], Javier Salvador [m,r], Paolo Sbraccia [n], Verónica Vázquez-Velázquez [o], Ian D. Caterson [p]

[a] Director, Department of Internal Medicine D, Hasharon Hospital-Rabin Medical Center, Petah-Tikva, Israel
[b] Obesity Research Center and the Department of Internal Medicine, College of Medicine, King Saud University, P.O. Box 2925 (98), Riyadh 11461, Saudi Arabia
[c] Pontifícia Universidade Católica do Rio de Janeiro (PUC-Rio), Instituto Estadual de Diabetes e Endocrinologia (IEDE), Rio de Janeiro, RJ, Brazil
[d] Center for Advanced Metabolic Medicine and Nutrition (CAMMYN) Avda Las Condes 9460, office 501, Santiago, Chile
[e] School of Psychology, University of Leeds, University Road, Woodhouse, Leeds LS2 9JZ, UK
[f] Weight Management Service, Fakenham Medical Practice, Meditrina House, Trinity Road, Fakenham, NR21 8SY, UK
[g] Department of Diabetes and Metabolic Diseases, The University of Tokyo, 7-3-1, Hongo, Bunkyo-ku, Tokyo, 113-0033, Japan
[h] Department of Family Medicine, Kangbuk Samsung Hospital, Sungkyunkwan University School of Medicine, Seoul 03181, South Korea
[i] The Weight Care Clinic, Dubai Healthcare City, Building 64, Block A, 2nd Floor, 2004, P.O. Box: 505042, Dubai, United Arab Emirates
[j] Novo Nordisk Health Care AG, Thurgauerstrasse 36/38, 8050 Zürich, Switzerland
[k] Novo Nordisk Health Care AG, Thurgauerstrasse 36/38, 8050 Zürich, Switzerland
[l] Department of Bariatric Surgery, St George Private Hospital, Suite 3, Level 5, 1 South St, Kogarah, Sydney, Australia
[m] Department of Endocrinology & Nutrition, Clínica Universidad de Navarra, Pamplona, Spain
[n] University of Rome Tor Vergata, Department of Systems Medicine, Via Montpellier,1, I-00133 Rome, Rome, Italy
[o] Clínica de Obesidad y Trastornos de la Conducta Alimentaria, Instituto Nacional de Ciencias Médicas y Nutrición Salvador Zubirán, Vasco de Quiroga 15, Tlalpan, Belisario Domínguez Sección XVI, 14080 Ciudad de México, Mexico
[p] Boden Collaboration, Charles Perkins Centre, D17, University of Sydney, NSW 2006, Sydney, Australia
[q] Sackler School Of Medicine, Tel Aviv University Tel Aviv, Israel
[r] CIBER Fisiopatología de la Obesidad y Nutrición (CIBEROBN), Instituto de Salud Carlos III, Madrid, Spain

A B S T R A C T

Background: People with obesity (PwO) often struggle to achieve and maintain weight loss. This can perpetuate and/or be influenced by feelings of low motivation. This analysis from ACTION-IO data identified factors associated with PwO motivation to lose weight.
Methods: PwO completed an online survey in 11 countries. Exploratory multinomial logistic regression analyses identified independent variables associated with self-report of feeling motivated versus not motivated to lose weight.
Results: Data from 10,854 PwO were included (5,369 motivated; 3,312 neutral; 2,173 not motivated). Variables associated with feeling motivated versus not motivated included (odds ratio [95% confidence interval]): acknowledgement of healthcare professional (HCP) responsibility to contribute to weight loss (2.32 [1.86–2.88]), comfort in talking to their HCP about weight (1.46 [1.24–1.72], agreement that it is easy to lose weight (1.73 [1.30–2.31]), and a goal of reducing risks from excess weight (1.45 [1.22–1.73]). Conversely, if PwO considered obesity less important than other diseases they were less likely to report feeling motivated (0.49

---

* Corresponding author: Department of Internal Medicine D, Hasharon Hospital-Rabin Medical center, Keren Kayemet St. 7, 49100, Petah-Tikva, Israel.

E-mail addresses: daniel3@013.net (D. Dicker), aalfadda@ksu.edu.sa (A.A. Alfadda), wcoutinho@globo.com (W. Coutinho), acuevas@cammyn.cl (A. Cuevas), J. Halford@leeds.ac.uk (J.C.G. Halford), carlyannahughes@gmail.com (C.A. Hughes), iwabu_tky@me.com (M. Iwabu), jhkang100495@gmail.com (J.-H. Kang), rita. nawar@gmail.com (R. Nawar), ramz@novonordisk.com (R. Reynoso), ncrh@novonordisk.com (N. Rhee), drgeorgiarigas@gmail.com (G. Rigas), jsalvador@unav. es (J. Salvador), sbraccia@med.uniroma2.it (P. Sbraccia), verovelazquez@yahoo.com (V. Vázquez-Velázquez), ian.caterson@sydney.edu.au (I.D. Caterson).

[0.41–0.58]). PwO who reported being motivated to lose weight were more likely to exercise ≥5 times a week versus <1 time a week (2.77 [2.09–3.68]) than those who reported they were not motivated.

Conclusions: Positive interactions with HCPs, self-efficacy, setting goals and knowledge of the importance of weight management, in addition to regular exercising, may increase PwO motivation for weight loss. Appropriate HCP support may help PwO who are ready to engage in weight management.

Clinical trial registration: : NCT03584191.

1. Introduction

Obesity is a global health concern [1]. Multiple complications are associated with overweight and obesity including diabetes, heart disease, musculoskeletal disorders and some cancers, and people with obesity (PwO) are at an increased risk of disability and suffer social stigma [2-5]. In the current time, the risk that obesity poses has been highlighted; it increases the risk for serious complications from viral infections, and in particular is associated with high mortality risk of COVID-19 and H1N1 infections [6-9]. Losing weight and maintaining weight loss is a struggle for PwO due to the complexity of obesity and the range of contributing factors – physiological, genetic, environmental and psychosocial [10]. We have reported previously that only 11% of 14,502 PwO surveyed had a loss of 5% body weight or more that was maintained for at least 1 year [11].

Adherence to weight loss interventions and sustained motivation for weight loss is important for weight management. A study by Webber et al. showed that individuals who achieved 5% weight loss after a 16-week intervention had sustained motivation for the whole of the 16-week study [12]. Participants who did not achieve 5% weight loss had shown decreased motivation over time [12]. The study also found that motivation at 4 weeks was a predictor of adherence to self-monitoring and 16-week weight loss [12]. Good mental health may contribute to motivation and adherence, since better mental health has been associated with sustained weight loss outcomes [13]. Incorporating aspects of social support showed high adherence rates for weight loss interventions and even had a reduced risk of premature mortality in some studies [10]. However, it should be noted that once someone has lost some weight, a cascade of events take place in the body to prevent further weight loss, including a reduction in energy expenditure [14] and changes in the hormones that regulate energy reserves and satiety in the body and, subsequently, appetite control [15]. As a result of these biological mechanisms, people find it difficult to continue to lose and maintain their weight loss [15], even if they are still adhering to weight loss interventions [4, 16].

In order to determine which factors might contribute to motivation for weight loss and be associated with a successful response to weight loss efforts, we performed exploratory regression analyses of PwO data from the Awareness, Care, and Treatment In Obesity maNagement International Observation (ACTION-IO) study.

2. Methods

2.1. Study design

ACTION-IO was a cross-sectional, non-interventional, descriptive study that collected data from 11 countries (Australia, Chile, Israel, Italy, Japan, Mexico, Saudi Arabia, South Korea, Spain, the UAE, and the UK) via an online survey [11]. The study aimed to identify perceptions, attitudes, behaviours and potential barriers to effective obesity care amongst PwO and healthcare professionals (HCPs). Eligible PwO were at least 18 years of age and had obesity based on self-reported height and weight and per country-specific definitions (body mass index [BMI] ≥25 kg/m^2 in Japan and South Korea and ≥30 kg/m^2 in all other participating countries) [17]. PwO were recruited through email in all participating countries, with telephone and in-person recruitment also used in Saudi Arabia and the UAE. Email recruitment was conducted via

online panel companies to participants whom had given permission to be contacted for research purposes. Prior to participation, PwO were blinded to the specific study goals, being informed that the purpose was "to determine treatment experiences of patients with a specific condition". A stratified sampling approach for PwO was used, whereby recruitment into the study was according to pre-determined demographic targets based on gender, age, income, race/ethnicity (in select countries) and region. Targets were monitored throughout data collection to ensure population representativeness. A set of screening questions were used to determine eligibility based on the demographic targets, BMI requirements and other study eligibility criteria, and only those who qualified for the study completed the full survey. All respondents provided electronic informed consent prior to initiation of the screening questions and survey. To ensure that the group was largely representative of the general population, the PwO sample, including those failing to qualify for the survey, was also weighted to the representative demographic targets within each country. Weights were calculated using the statistical method of raking, which adjusts sampling weights to match population totals along each demographic margin. The representative demographic targets were based on data from the 2011 International Standard Classification of Education, the US Census Bureau International Data Base and other public data, and included age, gender, household income, education and region. The data from each individual country were weighted to the representative demographic targets for that particular country. Questionnaire items were carefully phrased and presented in the same order for each respondent and items in a list were displayed alphabetically, categorically, chronologically or randomly, as relevant for each response set and to avoid bias. The study was registered with ClincalTrials.gov (NCT03584191) and conducted in accordance with the Guidelines for Good Pharmacoepidemiology Practices and the Declaration of Helsinki.

A multinomial logistic regression model was used to investigate independent variables associated with feeling motivated versus not motivated, and feeling neither motivated nor unmotivated (neutral) versus not motivated, to lose weight. The PwO subgroups were arbitrarily established and derived based on responses to a survey question asking the participants to indicate how much they agreed with the statement "I am motivated to lose weight". PwO selected their answer based on a scale where 1 means "Do not agree at all" and 5 means "Completely agree". Those responding with 4 or 5 were considered to be motivated to lose weight, 3 to be neutral, and 1 or 2 to be not motivated to lose weight. The neutral group was not combined with either the motivated or not motivated groups to ensure these populations were distinct from each other. The neutral group was included in the model, rather than being omitted, to investigate whether there were independent variables associated with a neutral versus not motivated disposition. As such, a multinomial logistic regression model was required for inclusion of all three groups.

Logistic regression models were used to investigate independent variables associated with at least a (a) 5% or (b) 10% weight loss in the past 3 years that was maintained for at least 1 year. Percentage weight loss was calculated from responses to questions asking the participants' current weight and the most they have weighed in the past 3 years. If the participants' current weight was less than their maximum weight within the past 3 years, they were asked how long they had been able to maintain the weight loss. Responses to these questions were used to apportion the PwO into the relevant subgroup. Inaccuracies due to the

self-reported nature of the data cannot be precluded.

2.2. Data analysis

Potential independent variables were grouped into three domains: attitudinal, behavioural, and demographic. Relevant variables for the models were identified and necessary transformations for use in the models were outlined. Prior to model development, the data were cleaned and transformed (see the supplementary appendix for more details). An analytics dataset of 10,854 records and 141 variables was obtained from a starting dataset of 14,502 records and 683 variables. All data were analysed using the R statistical language [18].

A systematic process was created to ensure reproducibility and consistency across the models. All potential independent variables were identified, and bi-variate odds ratios and confidence intervals were calculated; all significant odds ratios were ordered by their absolute impact and quartile thresholds were calculated; all variables with significant odds ratios in the 3rd and 4th quartiles were kept, and an initial multi-variable model (multinomial or logistic as appropriate) was created. The number of variables was algorithmically reduced in the models: for the multinomial model, variables were iteratively removed from the model with the largest p-value above 0.05; for the logistic models, Bayesian variable selection [19] was used to calculate marginal posterior inclusion probabilities for each variable and variables with an inclusion probability greater than 0.25 were kept. Variables with uninterpretable effects were manually removed (see the supplementary appendix for variables removed per this criterion). Variables of clinical relevance or significance, not already in the model, were added to the model and kept if they were significant and improved model fit. Model diagnostics were performed on residuals, general fit, and predictive accuracy (assessed over five-hundred training/test splits); models that adequately passed were kept. For motivation this yielded 13 models in total, for maintenance of 5% body weight loss this yielded 8 models in total, and for maintenance of 10% body weight loss this yielded 7 models in total. The final models were selected for model fit and predictive capacity.

2.3. Role of the funding source

This study was designed by the study steering committee members (all are authors and include representatives of the study sponsor) and KJT Group (Honeoye Falls, New York, USA). Data collection and analysis was undertaken by KJT Group. All authors interpreted the data, contributed to manuscript development, and approved the submitted version. The corresponding author had full access to all the study data and had final responsibility for the decision to submit for publication.

3. Results

As previously described [11], 14,502 PwO completed the survey, in accordance with the target sample size for the 11 participating countries. Of these PwO, 10,854 had complete data for the variables in the models and were included in the regression analyses.

3.1. PwO motivation

Half of the PwO ($n = 5369$) reported that at the time they took the survey, they were motivated, and the rest reported they were not motivated ($n = 2173$) or provided a neutral response ($n = 3312$). Demographics and characteristics of the participating PwO are summarised in **Table 1**. Variables significantly associated with PwO reporting they were motivated for weight loss are presented in **Fig. 1**. The data for the neutral group are presented in **Supplementary Fig. S1**, and were largely consistent with being an intermediate group between the motivated and not motivated groups. PwO who agreed that they are motivated to lose weight were more likely to report that they exercise for at least a 20-minute period at least once a week compared to never or less than once a week. The odds were increased by a factor of 2.12 (95% confidence interval [CI], 1.79–2.52) for 1 to 4 times a week and 2.77 (95% CI, 2.09–3.68) for 5 or more times a week.

PwO who acknowledged that their HCP had a responsibility to actively contribute to a successful weight loss effort, who reported feeling comfortable talking about their weight with their HCP, and who regarded their HCP as a source of information for managing their weight, were more likely to consider themselves as motivated, increasing the odds by a factor of 2.32 (95% CI, 1.86–2.88), 1.46 (95% CI, 1.24–1.72) and 1.36 (95% CI, 1.17–1.58), respectively. When asked which types of HCPs with whom PwO have discussed or would consider discussing their weight, those who selected 'Internal Medicine Physician' (in countries where this was provided as an option in the survey)

Table 1
Participant demographics and characteristics.

	Motivated ($n = 5369$)	Neutral ($n = 3312$)	Not motivated ($n = 2173$)	Total PwO ($N = 10,854$)
Mean age, years (range)	43 (18–88)	45 (18–86)	45 (18–87)	44 (18–88)
Gender, n (%)				
Male	2747 (51%)	1774 (54%)	1127 (52%)	5648 (52%)
Female	2618 (49%)	1536 (46%)	1042 (48%)	5196 (48%)
Other	4 (< 1%)	2 (<1%)	4 (<1%)	10 (<1%)
BMI classification for Australia, Chile, Israel, Italy, Mexico,				
Saudi Arabia, Spain, UAE and UK, n (%)[a]	2692 (50%)	1622 (49%)	1021 (48%)	5335 (49%)
Obesity Class I (30–34.9 kg/m^2)	861 (16%)	582 (18%)	415 (19%)	1858 (17%)
Obesity Class II (35–39.9 kg/m^2)	554 (11%)	336 (11%)	395 (17%)	1285 (12%)
Obesity Class III ($\geq$40 kg/m^2)				
BMI classification for Japan and South Korea, n (%)[b]				
Obesity Class 1 (25–29.9 kg/m^2)	976 (19%)	600 (18%)	266 (13%)	1842 (17%)
Obesity Class 2 (30–34.9 kg/m^2)	193 (3%)	108 (3%)	41 (1%)	342 (3%)
Obesity Class 3 (35–39.9 kg/m^2)	53 (1%)	31 (1%)	14 (1%)	98 (1%)
Obesity Class 4 ($\geq$40 kg/m^2)	40 (1%)	33 (1%)	21 (1%)	94 (1%)
$\geq$5% weight loss in past 3 years, maintained for $\geq$1 year, n (%)	696 (13%)	318 (10%)	196 (9%)	1210 (11%)
$\geq$10% weight loss in past 3 years, maintained for $\geq$1 year, n (%)	400 (7%)	155 (4%)	85 (4%)	640 (6%)

Numbers are reported for the final unweighted sample; percentages for demographic data are unweighted; percentages for BMI and 5% weight loss are weighted to demographic targets.
BMI, body mass index; PwO, people with obesity.
[a] Classes I (BMI 30–34.9 kg/m^2), II (BMI 35–39.9 kg/m^2) and III (BMI $\geq$40 kg/m^2) apply to Australia, Chile, Israel, Italy, Mexico, Saudi Arabia, Spain, the UAE and the UK.
[b] Classes 1 (BMI 25–29.9 kg/m^2), 2 (BMI 30–34.9 kg/m^2), 3 (BMI 35–39.9 kg/m^2) and 4 (BMI $\geq$40 kg/m^2) apply to Japan and South Korea.

Odds ratio [95% CI]
Motivated vs not motivated

Attitudinal

Variable	Odds ratio [95% CI]
I agree… My HCP has a responsibility to actively contribute to a successful weight loss effort	2.32 [1.86, 2.88]
I agree… If I lost weight, it would be easy for me to keep the weight off	1.77 [1.47, 2.14]
I agree… It is easy for me to lose weight	1.73 [1.30, 2.31]
I agree… My weight loss is completely my responsibility	1.66 [1.38, 2.01]
Important goal as part of weight management: To lose a pre-specified number on the scale	1.60 [1.25, 2.04]
Motivation for losing weight: Encouragement, support from others who are trying to lose weight	1.55 [1.11, 2.16]
Important goal as part of weight management: To lose a pre-specified % of my body weight	1.51 [1.23, 1.86]
I agree… I feel comfortable talking to my HCP about my weight	1.46 [1.24, 1.72]
Important goal as part of weight management: To reduce the risks associated with excess weight/prevent a health condition	1.45 [1.22, 1.73]
I agree… I know how to keep the weight off	1.38 [1.15, 1.65]
I agree… I know how to lose weight	1.36 [1.15, 1.62]
I agree… No matter what I do or how hard I try, I just can't seem to overcome my weight issues	0.66 [0.56, 0.78]
I agree… Obesity is less important to me than other diseases	0.49 [0.41, 0.58]

Behavioural

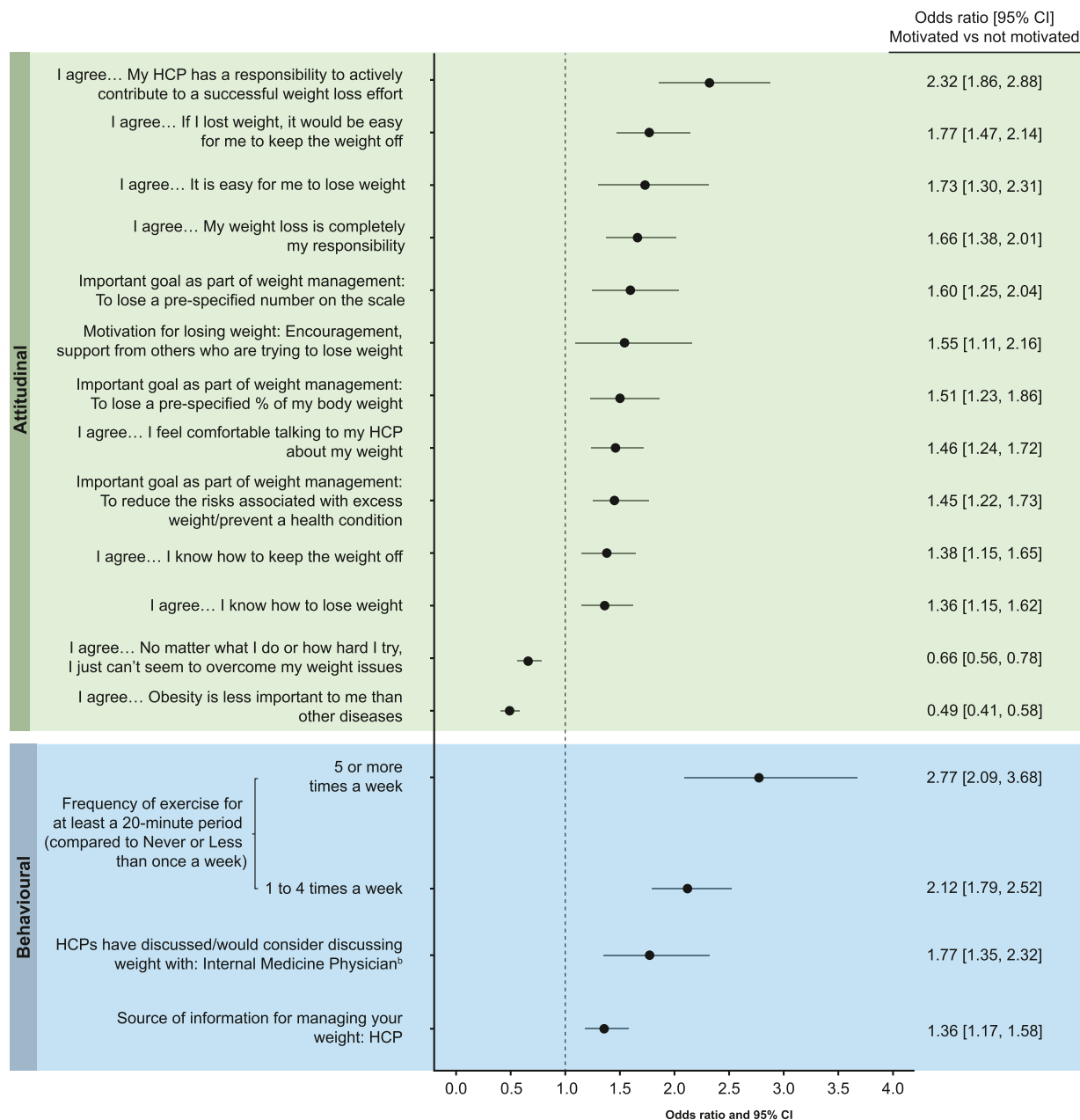| Variable	Odds ratio [95% CI]
Frequency of exercise for at least a 20-minute period (compared to Never or Less than once a week): 5 or more times a week	2.77 [2.09, 3.68]
Frequency of exercise for at least a 20-minute period (compared to Never or Less than once a week): 1 to 4 times a week	2.12 [1.79, 2.52]
HCPs have discussed/would consider discussing weight with: Internal Medicine Physician[b]	1.77 [1.35, 2.32]
Source of information for managing your weight: HCP	1.36 [1.17, 1.58]

Odds ratio and 95% CI

Fig. 1. Variables significantly associated with PwO reporting they are motivated to lose weight.[a]
CI, confidence interval; HCP, healthcare professional; PwO, people with obesity.
[a]Variables associated with a non-significant effect on PwO self-reported feelings of motivation to lose weight are provided in the Appendix.
[b]The option of 'Internal Medicine Physician' was not displayed for Chile and the UK.

were more likely to report feeling motivated (odds ratio [OR] 1.77; 95% CI, 1.35–2.32) versus not motivated.

The odds of feeling motivated to lose weight were increased if PwO agreed it was easy for them to lose weight (OR 1.73; 95% CI, 1.30–2.31) and if they lost weight it would be easy for them to keep the weight off (OR 1.77; 95% CI, 1.47–2.14). Agreeing that they know how to lose weight and know how to keep the weight off had a meaningful impact on the odds of PwO feeling motivated, increasing them by 1.36 (95% CI, 1.15–1.62) and 1.38 (95% CI, 1.15–1.65), respectively. Selecting the following goals as an important part of weight management also increased the odds of PwO reporting they were motivated to lose weight: losing a pre-specified number on the scale (OR 1.60; 95% CI, 1.25–2.04) or percentage of their body weight (OR 1.51; 95% CI, 1.23–1.86), or reducing the risks associated with excess weight or preventing a health condition (OR 1.45; 95% CI, 1.22–1.73).

When PwO agreed that their weight loss is completely their responsibility it increased the odds of feeling motivated versus not motivated by a factor of 1.66 (95% CI, 1.38–2.01). When PwO selected "encouragement and support from others who are trying to lose weight" as having motivated them the most to lose weight, there was a meaningful impact on the odds of reporting themselves to be motivated to lose weight, increasing them by a factor of 1.55 (95% CI, 1.11–2.16).

PwO who agreed that no matter what they do or how hard they try, they just can't seem to overcome their weight issues were less likely to report feeling motivated versus not motivated, with an OR of 0.66 (95% CI, 0.56–0.78). If PwO thought that obesity is less important than other diseases the odds were also decreased by a factor of 0.49 (95% CI, 0.41–0.58) for motivated versus not motivated.

A greater proportion of PwO who reported being motivated to lose weight versus not motivated had experienced a 5% or 10% weight loss in

the past 3 years that was maintained for at least 1 year, but there were PwO in the not motivated group who had also experienced a successful response to weight loss per these criteria (Table 1).

3.2. Response to weight loss efforts

While significant results were found, the models for determining variables associated with at least a 5% or 10% reduction in weight during the past 3 years, maintained for at least 1 year, did not meet the minimum thresholds for statistical reliability. Therefore, confidence in the results was low and no clear trend existed for differentiating successful responses to weight loss efforts from unsuccessful ones.

4. Discussion

These regression analyses aimed to determine the attitudes and behaviours of PwO associated with motivation for weight loss. Only half of PwO reported they were motivated to lose weight, highlighting the need to improve overall motivation to facilitate engagement with HCPs and adherence to weight management plans. Since PwO may go through periods of motivation and amotivation, support to both induce and maintain the motivation is required. In this study, level of exercise, which could be considered a motivational measure, was indeed associated with PwO motivation for weight loss. Other variables associated with the likelihood of PwO reporting that they were motivated to lose weight at the time of the survey fell broadly into three key themes: positive HCP interactions, self-efficacy, and weight loss goals.

4.1. Positive HCP interactions

PwO who acknowledged their HCP's responsibility to contribute to their weight loss efforts felt comfortable talking about their weight with their HCP, and who regarded their HCP as a source of information for managing their weight were more likely to report feeling motivated than not motivated. It would be interesting to determine if there are particular HCP approaches, such as empathy, that encourage PwO to feel comfortable discussing their weight and to seek HCP advice. Empathy is used in motivational interviewing, which has been suggested to enhance weight loss outcomes [20, 21]. Other studies have demonstrated the importance of active intervention from HCPs. Following referral to a weight management group and offer of follow-up, PwO were more likely to take effective weight management action compared with control participants who were advised that their health would benefit from weight loss [22]. In another study, PwO who had a weight loss of ≥10% over the past 3 years, versus those who did not, were more likely to have previously had weight loss discussions with their HCP and be diagnosed with obesity [23]. Given the adverse health effects from overweight and obesity [1], appropriate and regular HCP support is important to help with weight management and prevent or treat the complications of obesity.

4.2. Self-efficacy

Reporting finding weight loss easy and weight loss maintenance easy and knowing how to lose weight and how to keep the weight off, increased the odds of feeling motivated to lose weight. In contrast, PwO who reported not being able to overcome their weight issues no matter what they do or how hard they try were less likely to report feeling motivated. Therefore, self-efficacy appears to be a key factor in feeling motivated to lose weight, whereas a sense of failure and hopelessness can negatively impact motivation for weight loss. These feelings could be influenced by weight management history, for example, PwO who believe it is easy to lose weight may have the necessary tools for weight control, had successful weight loss responses previously and less experience of weight regain. These findings highlight the importance of identifying PwO who are struggling to lose weight and ensuring they

receive the support, guidance, and treatment options they need. Evaluation of a patient's determination, as part of the self-determination theory, may also help in identifying those who have the tools for weight management and those who need additional support [24]. Widespread education about the biology of obesity to increase public understanding will also be important for decreasing stigma and fostering a supportive society [5, 25, 26]. Interestingly, PwO who reported that their weight loss was completely their responsibility were also more likely to report feeling motivated to lose weight. It could be speculated that PwO who report being motivated and are taking steps to lose weight feel a sense of responsibility for their weight loss. These PwO may also have the opportunity and capability to achieve behavioural change [27]. This sense of responsibility, combined with appropriate support from an HCP, could increase motivation to lose weight. However, self-responsibility could also be a barrier to initiating weight management conversations with HCPs, emphasising the importance of HCPs initiating these discussions in a sensitive and non-judgemental manner.

4.3. Weight loss goals

Having goals to lose a pre-specified percentage of body weight or pre-specified number on the scale increased the odds of PwO reporting they are motivated to lose weight. Encouragement from HCPs to set such targets may help with patient motivation to lose weight. However, it may be that PwO reporting they are motivated are more likely to visit their HCP and agree on goal setting. Such targets should be realistic, achievable and adjustable, to avoid the negative impact from feelings of self-blame and failure [11, 28]. Moreover, unrealistic weight loss goals are associated with participant drop-out from weight loss treatment; in one study, the risk of treatment attrition at 12 months increased by 12% for every unit increase in expected BMI loss ($p = 0.0018$) [29]. Goals may also focus on specific targets associated with dietary intake or physical activity instead of weight loss *per se* [30, 31]. Reducing the health risks associated with excess weight or preventing a health condition was another goal associated with motivation and could be incorporated into HCP–patient discussions. In contrast, PwO who considered obesity as less important to them than other diseases were more likely to report feeling not motivated than motivated. PwO who were motivated the most to lose weight by "encouragement and support from others who are trying to lose weight" were also more likely to feel motivated to lose weight. This is consistent with studies showing that group-based obesity interventions can be more effective than individual-based interventions [32, 33]. Experts have also noted the importance of family support [34].

The data for the group of PwO who provided a neutral response largely fell between the data for the motivated and not motivated groups, showing that motivation is not dichotomous. Of note, motivation was not strongly associated with 3-year weight loss outcomes, suggesting that levels of motivation may instead reflect the same stage of the weight management cycle. In this cycle, PwO make weight loss efforts, lose weight, maintain the weight loss for a period, then due to biological adaptations, regain weight [35]. Previous studies have demonstrated an association between weight management and the importance of internal motivation factors to lose weight [36, 37]. It has been noted that PwO who are motivated to lose weight may attempt weight loss efforts multiple times, which can lead to successful weight loss and long-term weight maintenance with limited weight cycling [38]. Therefore, keeping PwO motivated is encouraged to help support long-term weight maintenance and improved health outcomes [38].

It should be noted that causation between the self-reported factors cannot be determined from this study; however, these data provided insights into factors that are associated with PwO feelings of motivation at the time of the survey. Due to the self-reported nature of the study, the results can only convey data for PwO who say they are motivated, rather than having an independent measure of motivation. Moreover, motivation was assessed by a single question, the response to which, as with

all questions in the survey, could be influenced by the environment and feelings of the PwO at the time of the survey. However, the association between frequency of exercise and motivation suggests that the PwO who reported they are motivated to lose weight were indeed actively taking steps for weight management. Other limitations include the need for internet access in most countries, which may have skewed participation, and reliance on self-reported data. While self-reported height and weight align with measured values in many cases, discrepancies have been identified that generally result in underestimation of BMI for PwO in a proportion of cases [39-45]. Thus, actual BMI measurements could have been slightly higher than those reported.

A global trend did not exist for differentiating successful responses to weight loss efforts from unsuccessful ones. This finding is in keeping with the general perspective that an individual's weight loss success is driven by a multitude of factors such as environment and culture, genetics, lifestyle, community and the healthcare system. As with any chronic disease, there is heterogeneity in the response to any particular form of treatment. Two PwO may have the same attitudes towards weight loss but encounter completely different cultural, institutional, and personal barriers which ultimately determine their response to treatment. When considering the wide variation in healthcare systems and cultures of the different countries in this study, it may not be surprising that a single unified set of factors associated with successful weight loss outcomes could not be identified at the global level. In the national ACTION study conducted in the Unites States, significant associations between independent variables and maintenance of 10% weight loss for at least 1 year were identified [46]. PwO who reported being motivated to talk to a diabetes educator about their weight, who had their weight loss efforts recognised by an HCP, and were provided a diagnosis of obesity were more likely to report having successful weight loss outcomes (defined as maintaining 10% weight loss for at least 1 year) [46]. Therefore, variables associated with successful responses to weight loss efforts might be identified from the ACTION-IO data when studying the different regions and countries.

5. Conclusions

Supportive HCP–patient dialogue, preferably initiated by the HCP, that is free of stigma and which incorporates the importance of obesity management for health and the biological basis of the disease is required. This allows for the setting of achievable weight loss targets and the provision of guidance and options to assist with a successful response to the weight loss efforts, which may help with PwO motivation to lose weight. Weight loss in the presence of counteracting biological mechanisms is extremely difficult and proactive support and treatment is required to improve self-efficacy. Recognising PwO characteristics associated with motivation may also identify patients ready for weight management, and appropriate HCP support may facilitate weight loss efforts. Further research is required to determine if strategies for improving response rates to weight loss efforts can be identified on a regional scale.

Contributors

All authors contributed to the design of the study. All authors participated in interpretation of the data and drafting and revision of the manuscript. All authors reviewed and approved the final, submitted version.

Declaration of Competing Interest

All authors received funding for travel expenses from Novo Nordisk to attend author meetings during the conduct of the study.

D. D. reports personal fees for medical lectures and consultations from Novo Nordisk during the conduct of the study and personal fees for medical lectures and consultations from Teva Pharmaceutical Industries outside the submitted work; D. D. is a guest Editor of the *European Journal of Internal Medicine.*

A. A. A. reports financial support from Novo Nordisk to attend an obesity conference during the conduct of the study, and personal (consultancy) fees and non-financial support from Novo Nordisk outside the submitted work.

W. C. reports personal (consultancy and speaker) fees from Novo Nordisk, EMS, Germed Pharma and Janssen Pharmaceutica outside the submitted work.

A. C. reports personal fees from Abbott, Novo Nordisk, Teva Pharmaceutical Industries and Saval Pharmaceuticals during the conduct of the study; she is a member of the Strategic Centre for Obesity Professional Education (SCOPE) of the World Obesity Federation and a SCOPE International Fellow.

J. H. reports fees (honoraria) paid to the University of Liverpool from Novo Nordisk, Orexigen and Boehringer Ingelheim during the conduct of the study.

C. A. H. reports financial support from Novo Nordisk to attend an obesity conference during the conduct of the study, grants from the Rona Marsden Fund at Fakenham Medical Practice and personal fees from Alva, Orexigen Therapeutics, Consilient Health, Nestlé and Ethicon outside the submitted work; she was previously a member of the World Obesity education committee, is a current member of the Association for the Study of Obesity (ASO) and is involved in meetings to facilitate recognition of obesity as a disease in the UK.

M. I. reports receiving non-financial support from Novo Nordisk during the conduct of the study and personal fees from Novo Nordisk outside the submitted work.

J.-H. K. reports compensation from Novo Nordisk as a consultant during the conduct of the study.

R. N. reports financial support from Novo Nordisk to attend an obesity conference during the conduct of the study, and personal (consultancy and speaker) fees from Novo Nordisk outside the submitted work.

R. R. and N. R. are employees of Novo Nordisk, and own shares in Novo Nordisk.

G. R. reports personal (consultancy) fees and non-financial support from Novo Nordisk during the conduct of the study; personal (consultancy and lecture) fees and non-financial support from Novo Nordisk, iNova Pharmaceuticals, personal (lecture) fees from Johnson & Johnson, mdBriefCase Australia & Global, Medtronic (formerly Covidien), ReShape Lifesciences (formerly Apollo-Endosurgery) outside the submitted work and non-financial support from Device Technologies and W.L. Gore, outside the submitted work.

J. S. reports personal (consultancy) fees from Novo Nordisk during the conduct of the study.

P. S. reports personal fees (grants) from Novo Nordisk during the conduct of the study.

V. V. V. reports personal fees and non-financial support from Novo Nordisk during the conduct of the study.

I. D. C. reports personal fees from Novo Nordisk (as chair of the ACTION-IO steering committee) during the conduct of the study, grants from Novo Nordisk, Rhythm Pharmaceuticals, and SFI outside the submitted work, and personal (lecture) fees from Novo Nordisk outside the submitted work.

Refereces

[1] GBD 2015 Obesity Collaborators. Health effects of overweight and obesity in 195 countries over 25 years. N Engl J Med 2017;377:13–27.

[2] Guh DP, Zhang W, Bansback N, Amarsi Z, Laird Birmingham C, Anis AH. The incidence of co-morbidities related to obesity and overweight: a systematic review and meta-analysis. BMC Public Health 2009;9:88.

[3] Djalalinia S, Qorbani M, Peyraki N, Kelishadi R. Health impacts of obesity. Pak J Med Sci 2015;31:239–42.

[4] van der Klaauw AA, Farooqi IS. The hunger genes: pathways to obesity. Cell 2015; 161:119–32.

[5] Puhl RM, Heuer CA. Obesity stigma: important considerations for public health. Am J Public Health 2010;100:1019–28.

[6] Honce R, Schultz-Cherry S. Impact of obesity on influenza A virus pathogenesis, immune response, and evolution. Front Immunol 2019;10:1071.

[7] Kassir R. Risk of COVID-19 for patients with obesity. Obes Rev 2020;21:e13034.

[8] Kass DA, Duggal P, Cingolani O. Obesity could shift severe COVID-19 disease to younger ages. Lancet 2020;395:1544–5.

[9] Caussy C, Pattou F, Wallet F, et al. Prevalence of obesity among adult inpatients with COVID-19 in France. Lancet Diabetes Endocrinol 2020;8:562–4.

[10] Lemstra M, Bird Y, Nwankwo C, Rogers M, Moraros J. Weight loss intervention adherence and factors promoting adherence: a meta-analysis. Patient Prefer Adherence 2016;10:1547–59.

[11] Caterson ID, Alfadda AA, Auerbach P, et al. Gaps to bridge: misalignment between perception, reality and actions in obesity. Diabetes Obes Metab 2019;21:1914–24.

[12] Webber KH, Tate DF, Ward DS, Bowling JM. Motivation and its relationship to adherence to self-monitoring and weight loss in a 16-week internet behavioral weight loss intervention. J Nutr Educ Behav 2010;42:161–7.

[13] Brantley PJ, Stewart DW, Myers VH, et al. Psychosocial predictors of weight regain in the weight loss maintenance trial. J Behav Med 2014;37:1155–68.

[14] Leibel RL, Rosenbaum M, Hirsch J. Changes in energy expenditure resulting from altered body weight. N Engl J Med 1995;332:621–8.

[15] Sumithran P, Prendergast LA, Delbridge E, et al. Long-term persistence of hormonal adaptations to weight loss. N Engl J Med 2011;365:1597–604.

[16] Ghanemi A, Yoshioka M, St-Amand J. Broken energy homeostasis and obesity pathogenesis: the surrounding concepts. J Clin Med 2018;7:453.

[17] International Association for the Study of Obesity (IASO). The asia-pacific perspective: redefining obesity and its treatment. https://apps.who.int/iris/bitstre am/handle/10665/206936/0957708211_eng.pdf?sequence=1&isAllowed=y. February 2000.

[18] The R Foundation. R: a language and environment for statistical computing. 2020. https://www.R-project.org/.

[19] Scheipl F. spikeSlabGAM: bayesian Variable Selection, Model Choice and Regularization for Generalized Additive Mixed Models in R. J Stat Softw 2011;43 (14). https://doi.org/10.18637/jss.v043.i14.

[20] Armstrong MJ, Mottershead TA, Ronksley PE, Sigal RJ, Campbell TS, Hemmelgarn BR. Motivational interviewing to improve weight loss in overweight and/or obese patients: a systematic review and meta-analysis of randomized controlled trials. Obes Rev 2011;12:709–23.

[21] Barnes RD, Ivezaj V. A systematic review of motivational interviewing for weight loss among adults in primary care. Obes Rev 2015;16:304–18.

[22] Aveyard P, Lewis A, Tearne S, et al. Screening and brief intervention for obesity in primary care: a parallel, two-arm, randomised trial. Lancet 2016;388:2492–500.

[23] Look M, Kolotkin RL, Dhurandhar NV, Nadglowski J, Stevenin B, Golden A. Implications of differing attitudes and experiences between providers and persons wth obesity: results of the national ACTION study. Postgrad Med 2019;131: 357–65.

[24] Teixeira PJ, Sliva MN, Mata J, Palmeira AL, Markland D. Motivation, self-determination, and long-term weight control. Int J Behav Nutr Phys Act 2012;9:22.

[25] Alberga AS, Edache IY, Forhan M, Russell-Mayhew S. Weight bias and health care utilization: a scoping review. Prim Health Care Res Dev 2019;20:e116.

[26] Phelan SM, Burgess DJ, Yeazel MW, Hellerstedt WL, Griffin JM, van Ryn M. Impact of weight bias and stigma on quality of care and outcomes for patients with obesity. Obes Rev 2015;16:319–26.

[27] Michie S, van Stralen MM, West R. The behaviour change wheel: a new method for characterising and designing behaviour change interventions. Implement Sci 2011; 6:42.

[28] Bocquier A, Verger P, Basdevant A, et al. Overweight and obesity: knowledge, attitudes, and practices of general practitioners in France. Obes Res 2005;13: 787–95.

[29] Dalle Grave R, Calugi S, Molinari E, et al. Weight loss expectations in obese patients and treatment attrition: an observational multicenter study. Obes Res 2005;13: 1961–9.

[30] Kelley CP, Sbrocco G, Sbrocco T. Behavioral modification for the management of obesity. Prim Care 2016;43:159–75.

[31] Foster GD, Makris AP, Bailer BA. Behavioral treatment of obesity. Am J Clin Nutr 2005;82(1). Suppl. 230S–235S.

[32] Paul-Ebhohimhen V, Avenell A. A systematic review of the effectiveness of group versus individual treatments for adult obesity. Obes Facts 2009;2:17–24.

[33] Rodriguez-Cristobal JJ, Alonso-Villaverde C, Panisello JM, et al. Effectiveness of a motivational intervention on overweight/obese patients in the primary healthcare: a cluster randomized trial. BMC Fam Pract 2017;18:74.

[34] Gruber KJ, Haldeman LA. Using the family to combat childhood and adult obesity. Prev Chronic Dis 2009;6:A106.

[35] MacLean PS, Higgins JA, Giles ED, Sherk VD, Jackman MR. The role for adipose tissue in weight regain after weight loss. Obes Rev 2015;16(1):45–54. Suppl 1Suppl.

[36] Elfhag K, Rössner S. Who succeeds in maintaining weight loss? A conceptual review of factors associated with weight loss maintenance and weight regain. Obes Rev 2005;6:67–85.

[37] Soini S, Mustajoki P, Eriksson JG. Long-term weight maintenance after successful weight loss: motivational factors, support, difficulties, and success factors. Am J Health Behav 2018;42:77–84.

[38] Dandanell S, Ritz C, Verdich E, Dela F, Helge JW. Repeated lifestyle interventions lead to progressive weight loss: a retrospective review chart study. Scand J Public Health 2017;45:305–13.

[39] Ng CD. Errors in body mass index from self-reported data by sex and across waves of Add Health. Ann Epidemiol 2019;39:21–5.

[40] Wilson OWA, Bopp CM, Papalia Z, Bopp M. Objective vs self-report assessment of height, weight and body mass index: relationships with adiposity, aerobic fitness and physical activity. Clin Obes 2019;9:e12331.

[41] Blum KS, Büsch N, Beyer T, Rausch I, Freudenberg LS. In patients we trust: reliability of self-reported weight and height in nuclear medicine patients. J Nucl Med Technol 2019;47:133–6.

[42] Olfert MD, Barr ML, Charlier CM, et al. Self-reported vs. measured height, weight, and BMI in young adults. Int J Environ Res Public Health 2018;15:2216.

[43] Stommel M, Schoenborn CA. Accuracy and usefulness of BMI measures based on self-reported weight and height: findings from the NHANES & NHIS 2001-2006. BMC Public Health 2009;9:421.

[44] Maukonen M, Männistö S, Tolonen H. A comparison of measured versus self-reported anthropometrics for assessing obesity in adults: a literature review. Scand J Public Health 2018;46:565–79.

[45] Neermark S, Holst C, Bisgaard T, et al. Validation and calibration of self-reported height and weight in the Danish Health Examination Survey. Eur J Public Health 2019;29:291–6.

[46] Dhurandhar NV, Kyle T, Stevenin B, Tomaszewski K, ACTION Steering Group.. Predictors of weight loss outcomes in obesity care: results of the national ACTION study. BMC Public Health 2019;19:1422.