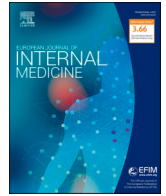




Contents lists available at ScienceDirect

European Journal of Internal Medicine

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

The 3Ds – Discussion, diagnosis and direction: Elements for effective obesity care by healthcare professionals

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

^a Obesity Research Center and the Department of Internal Medicine, College of Medicine, King Saud University, P.O. Box 2925 (98), Riyadh 11461, Saudi Arabia

^b Boden Collaboration, Charles Perkins Centre, D17, University of Sydney, NSW 2006, Sydney, Australia

^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 Department of Internal Medicine D, Hasharon Hospital-Rabin Medical Center, Petah-Tikva, Israel

^f Sackler School Of Medicine, Tel Aviv University Tel Aviv, Israel

^g School of Psychology, University of Leeds, University Road, Woodhouse, Leeds LS2 9JZ, UK

^h Weight Management Service, Fakenham Medical Practice, Meditrina House, Trinity Road, Fakenham, NR21 8SY, UK

ⁱ Department of Diabetes and Metabolic Diseases, The University of Tokyo, 7-3-1, Hongo, Bunkyo-ku, Tokyo, 113-0033, Japan

^j Department of Family Medicine, Kangbuk Samsung Hospital, Sungkyunkwan University School of Medicine, Seoul 03181, South Korea

^k The Weight Care Clinic, Dubai Healthcare City, Building 64, Block A, 2nd Floor, 2004, P.O. Box: 505042, Dubai, United Arab Emirates

^l Novo Nordisk Health Care AG, Thurgauerstrasse 36/38, 8050 Zürich, Switzerland

^m Department of Bariatric Surgery, St George Private Hospital, Suite 3, Level 5, 1 South St, Kogarah, Sydney, Australia

ⁿ Department of Endocrinology & Nutrition, Clínica Universidad de Navarra, Pamplona, Spain

^o CIBER Fisiopatología de la Obesidad y Nutrición (CIBEROBN), Instituto de Salud Carlos III, Madrid, Spain

^p 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

^q University of Rome Tor Vergata, Department of Systems Medicine, Via Montpellier,1, I-00133 Rome, Rome, Italy

ARTICLE INFO

Keywords:

Obesity
Healthcare
Weight
Consultation
Diagnosis
ACTION-IO

ABSTRACT

Background: The care of people with obesity is often suboptimal due to both physician and patient perceptions about obesity itself and clinical barriers. Using data from the ACTION-IO study, we aimed to identify factors that might improve the quality of obesity care through adoption of the 3D approach (Discussion, Diagnosis and Direction [follow-up]) by healthcare professionals (HCPs).

Methods: An online survey was completed by HCPs in 11 countries. Exploratory beta regression analyses identified independent variables associated with each component of the 3D approach.

Results: Data from 2,331 HCPs were included in the statistical models. HCPs were significantly more likely to initiate weight discussions and inform patients of obesity diagnoses, respectively, if (odds ratio [95% confidence interval]): they recorded an obesity diagnosis in their patient's medical notes (1.59, [1.43–1.76] and 2.16 [1.94–2.40], respectively); and they were comfortable discussing weight with their patients (1.53 [1.39–1.69] and 1.15 [1.04–1.27]). HCPs who reported feeling motivated to help their patients lose weight were also more likely to initiate discussions (1.36 [1.21–1.53]) and schedule follow-up appointments (1.21 [1.06–1.38]). By contrast, HCPs who lacked advanced formal training in obesity management were less likely to inform patients of obesity diagnoses (0.83 [0.74–0.92]) or schedule follow-up appointments (0.69 [0.62–0.78]).

Abbreviations: ACTION-IO, Awareness, Care, and Treatment In Obesity maNagement International Observation; HCP, healthcare professional; PwO, people with obesity.

* Corresponding author at: Obesity Research Center and the Department of Internal Medicine, College of Medicine, King Saud University, P.O. Box 2925 (98), Riyadh 11461, Saudi Arabia.

E-mail address: aalfadda@ksu.edu.sa (A.A. Alfadda).

<https://doi.org/10.1016/j.ejim.2021.01.012>

Received 24 September 2020; Received in revised form 6 January 2021; Accepted 11 January 2021

Available online 23 January 2021

0953-6205/© 2021 The Authors. Published by Elsevier B.V. on behalf of European Federation of Internal Medicine. This is an open access article under the CC

BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Conclusion: Specific actions that could improve obesity care through the 3D approach include: encouraging HCPs to record an obesity diagnosis; providing tools to help HCPs feel more comfortable initiating weight discussions; and provision of training in obesity management.

Clinical trial registration: NCT03584191.

1. Introduction

Obesity is a chronic disease associated with multiple health complications [1]. Furthermore, the COVID-19 pandemic has made evident the impact obesity can have on health outcomes, whereby people with obesity (PwO) are more likely to require hospitalisation, require mechanical ventilation and suffer serious complications from the infection than those without obesity [2-6]. As a multifactorial disease, successful weight management requires multidisciplinary care [7-9]. In practice, the care received by PwO is frequently suboptimal, owing to differing perceptions about obesity of healthcare professionals (HCPs) and patients, and clinical barriers such as unavailability or cost of certain treatments and services, and time pressures faced by HCPs [10, 11].

HCPs in primary care are uniquely positioned to engage in weight management discussions with PwO, and evidence indicates that HCP–patient engagement and obesity diagnosis can facilitate weight loss [12-15]. In large studies utilising data from the National Health and Nutrition Examination Survey, participants who were advised by their HCP of their weight status and had been diagnosed with obesity had a 2.2-fold increased odds of attempting to lose weight and a 1.8-fold increased odds of losing at least 5% body weight [12]. Additionally, a meta-analysis of 12 studies examining the impact of HCP counselling on real changes in patient behaviour revealed that patients with overweight or obesity were 3.85 times more likely to attempt weight loss when given weight loss advice by an HCP [15]. In line with these findings, weight loss counselling delivered by an HCP was associated with 3.5-fold increased odds of attempting to lose weight in patients with overweight or obesity [13], and discussion with an HCP who recognised previous weight management efforts was associated with improved odds of a successful weight loss attempt [14]. Additionally, continued patient contact after initial weight loss was associated with improved weight loss maintenance [8]. Overall, discussions between HCPs and patients about weight, provision of an obesity diagnosis, and subsequent direction through a follow-up appointment appear to be key elements to increase the chances of clinically beneficial weight management.

The primary analysis from the Awareness, Care, and Treatment In Obesity maNagement International Observation (ACTION-IO) study found that the frequencies of discussion, diagnosis and follow-up were suboptimal; only 54% of PwO had discussed their weight with an HCP in the past 5 years, only 36% had received a diagnosis of obesity, and only 21% had been scheduled a follow-up appointment regarding their weight [11]. Moreover, while many PwO and HCPs said they agreed with the statement that obesity is a chronic disease, their reported perceptions and behaviour were contradictory to this statement [11]. Thus, there is significant room for improvement in engaging HCPs in facilitating weight management discussions, and for improving access and quality of obesity care.

From the results of this study [11] we were able to propose a “3D approach” with the components **Discussion**, **Diagnosis** and **Direction**, which aims to improve obesity care by encouraging HCPs to take the following actions: 1. Initiate Discussions about weight (including the biology of obesity) proactively with their patients; PwO generally believe that weight loss is their own responsibility and do not always recognise the impact of weight on their health [11]. 2. Diagnose obesity formally to aid its recognition as a chronic disease, help motivate their patients to lose weight, and reduce the prevalence of stigmatising attitudes towards PwO. 3. Schedule regular follow-up appointments to monitor their patients’ weight loss and to provide sustained support and guidance.

Given the possible value of the 3D approach and the benefits it can provide to PwO, this beta regression analysis of HCP data from the ACTION-IO study [11] aimed to identify independent variables that might increase the likelihood of HCPs adopting the components Discussion, Diagnosis and Direction in their approach to obesity care.

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) with an online survey [11]. The study was registered with ClinicalTrials.gov (NCT03584191). The primary objective was to identify perceptions, attitudes, behaviours and potential barriers to effective obesity care across PwO and HCPs treating obesity. Eligible HCPs were physicians in a participating country who had been in practice for 2 years or more with at least 70% of their time involved in direct patient care and who had seen 100 or more patients during the past month, at least ten of whom had a body mass index (BMI) of ≥ 30 kg/m² (≥ 25 kg/m² in Japan and South Korea) per country-specific definitions of obesity [16]. HCPs specialising in general, plastic or bariatric surgery were excluded.

HCPs were recruited through email where possible, with telephone and in-person recruitment also used for HCPs in Chile, Japan, Israel, Mexico, Saudi Arabia, South Korea and the UAE. Respondents completed the survey in their native language. Analysis of de-identified data was conducted by KJT Group using SPSS (IBM, version 23.0), Stata (StataCorp LLC, version IC 14.2) and Excel (Microsoft, version 2016).

Three beta regression models were developed with the aim of identifying independent variables that might improve the quality of obesity care by encouraging HCPs to adopt the following components of the 3D approach: **Discussion:** with what proportion of their patients with obesity did HCPs initiate a discussion about weight, and are there any variables that might increase this proportion? **Diagnosis:** with what proportion of their patients with obesity did HCPs provide a formal diagnosis, and are there any variables that might increase this proportion? **Direction:** with what proportion of their patients with obesity did HCPs schedule a follow-up appointment to discuss their weight, and are there any variables that might increase this proportion?

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 data set of 2,331 records and 226 variables was obtained from a starting dataset of 2,785 records and 769 variables. All data were analysed using the R statistical language [17].

A systematic process was created to ensure reproducibility and consistency across the three models. For each dependent variable (Discussion, Diagnosis and Direction): 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 beta regression model was created. Variables were iteratively removed from the model with the largest p-value above 0.05. 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 Discussion this yielded 66 models in total, for Diagnosis this yielded 53 models in total, and for Direction there were 56 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], 2,785 HCPs completed the survey in line with the target sample size for the 11 participating countries. Of these HCPs, 2,331 had complete data for the variables included in the model and were included in this analysis. Demographics and characteristics of participating HCPs are summarised in Table 1.

3.1. Discussion about weight

Variables associated with significant changes in the proportion of their patients with obesity with whom HCPs initiated a discussion about weight are presented in Fig. 1. Typically, recording a diagnosis of obesity in a patient's medical notes, or being very or extremely comfortable discussing weight, were associated with the greatest odds of HCPs initiating discussions about weight with their patients (odds ratios 1.59 [95% confidence interval {CI}, 1.43–1.76] and 1.53 [95% CI,

1.39–1.69], respectively). Being motivated to help their patients lose weight or recognising the impact of obesity on their patients' overall health, also had impacts on the odds of HCPs initiating discussions about weight with their patients, increasing them by factors of 1.36 (95% CI, 1.21–1.53) and 1.30 (95% CI, 1.17–1.45), respectively. The proportion of the HCPs' patients who have obesity, or the proportion of patients seen primarily for obesity, compounded with every percentage point increase, so the small odds ratios were associated with a substantial increase in the proportion of patients with whom an HCP initiated a conversation about weight (Supplementary Fig. S1–S2). Not considering themselves as experts on obesity reduced the odds of HCPs initiating discussions about weight with their patients, decreasing them by a factor of 0.92 (95% CI, 0.84–1.01).

3.2. Diagnosis of obesity

Variables associated with significant changes in the proportion of their patients with obesity for whom HCPs provide a formal diagnosis of obesity are presented in Fig. 2. Discussing weight with a greater percentage of their patients, or typically recording a diagnosis of obesity in a patient's medical record, had the greatest impact on the odds of HCPs communicating the diagnosis of obesity to their patients, increasing them by factors of 2.87 (95% CI, 2.40–3.42) and 2.16 (95% CI, 1.94–2.40), respectively (Fig. 2, Supplementary Fig. S3). Proposing weight loss-related goals, using waist circumference as a criterion for initiating a discussion about weight, or considering themselves as obesity non-experts, had modest impacts on the odds of HCPs providing their patients with a formal diagnosis of obesity. Variables with smaller impacts on the odds of HCPs providing their patients with a formal diagnosis of obesity included being comfortable discussing weight and considering treating patients with obesity as a productive use of their time. The proportion of patients primarily seen for obesity compounded with every percentage point increase, so the small odds ratio was associated with a substantial increase in the proportion of patients with whom an HCP provided a formal diagnosis of obesity (Fig. 2, Supplementary Fig. S4). Not receiving advanced formal training in the treatment of obesity, and being of female gender, reduced the odds of HCPs providing their patients with a formal diagnosis of obesity, decreasing them by factors of 0.83 (95% CI, 0.74–0.92) and 0.83 (95% CI, 0.75–0.92), respectively. The proportion of males and females who received advanced formal training was the same (52% each for the 2,331 HCPs included in the model analyses; 50% each for the 2,785 HCPs who completed the survey).

3.3. Direction

Variables associated with significant changes in the proportion of their patients with obesity being scheduled a follow-up appointment to discuss their weight are presented in Fig. 3. Recording a diagnosis of obesity in a patient's medical record, perceiving that discussing weight with their patients was helpful, and believing that their patients could lose weight easily, had the greatest impact on the odds of HCPs scheduling a follow-up appointment with their patients, each increasing them by factors of 1.62 (95% CI, 1.45–1.81), 1.39 (95% CI, 1.25–1.55) and 1.36 (95% CI, 1.12–1.64), respectively. Believing that their current healthcare system met the needs of PwO, setting short-term (less than 6 months) weight loss targets, or being motivated to help patients lose weight, had modest, but significant impacts on the odds of HCPs scheduling a follow-up appointment with their patients, increasing them by factors of 1.24 (95% CI, 1.09–1.41), 1.23 (95% CI, 1.11–1.36) and 1.21 (95% CI, 1.06–1.38), respectively. Variables with smaller impacts on the odds of HCPs scheduling a follow-up appointment with their patients to discuss their weight included being likely to prescribe new medications for weight loss, understanding that fear of failure was a barrier to weight loss, monitoring the effectiveness of treatment by changes in their patients' comorbidities, believing that treating patients

Table 1
HCP demographics

	HCPs (N = 2331)
Mean age, years (range)	48 (26–98)
Gender, n (%)	
Male	1646 (71%)
Female	685 (29%)
HCP category, n (%) ^a	
Primary care physician ^b	1186 (51%)
Specialist	1145 (49%)
Diabetologist/endocrinologist	435 (19%)
Cardiologist	237 (10%)
Internal medicine (non-PCP)	138 (6%)
Gastroenterologist	123 (5%)
Obstetrician/gynaecologist	110 (5%)
Other ^c	102 (4%)

HCP, healthcare professional; PCP, primary care practitioner.

^a At least one of the following criteria were met by 1611 (69%) of the HCPs: at least 50% of their patients were seen for obesity/weight management, or they had advanced formal training in treatment of obesity/weight management beyond medical school, or they considered themselves to be an expert in obesity/weight loss management, or they worked in an obesity service clinic.

^b Specialty is family practice, general practice or internal medicine, as applicable in each country.

^c Includes nutrition specialist (n = 6 [$<1\%$]), bariatrics/obesity medicine (n = 3 [$<1\%$]), hepatologist (n = 2 [$<1\%$]) and other (n = 91 [4%]).

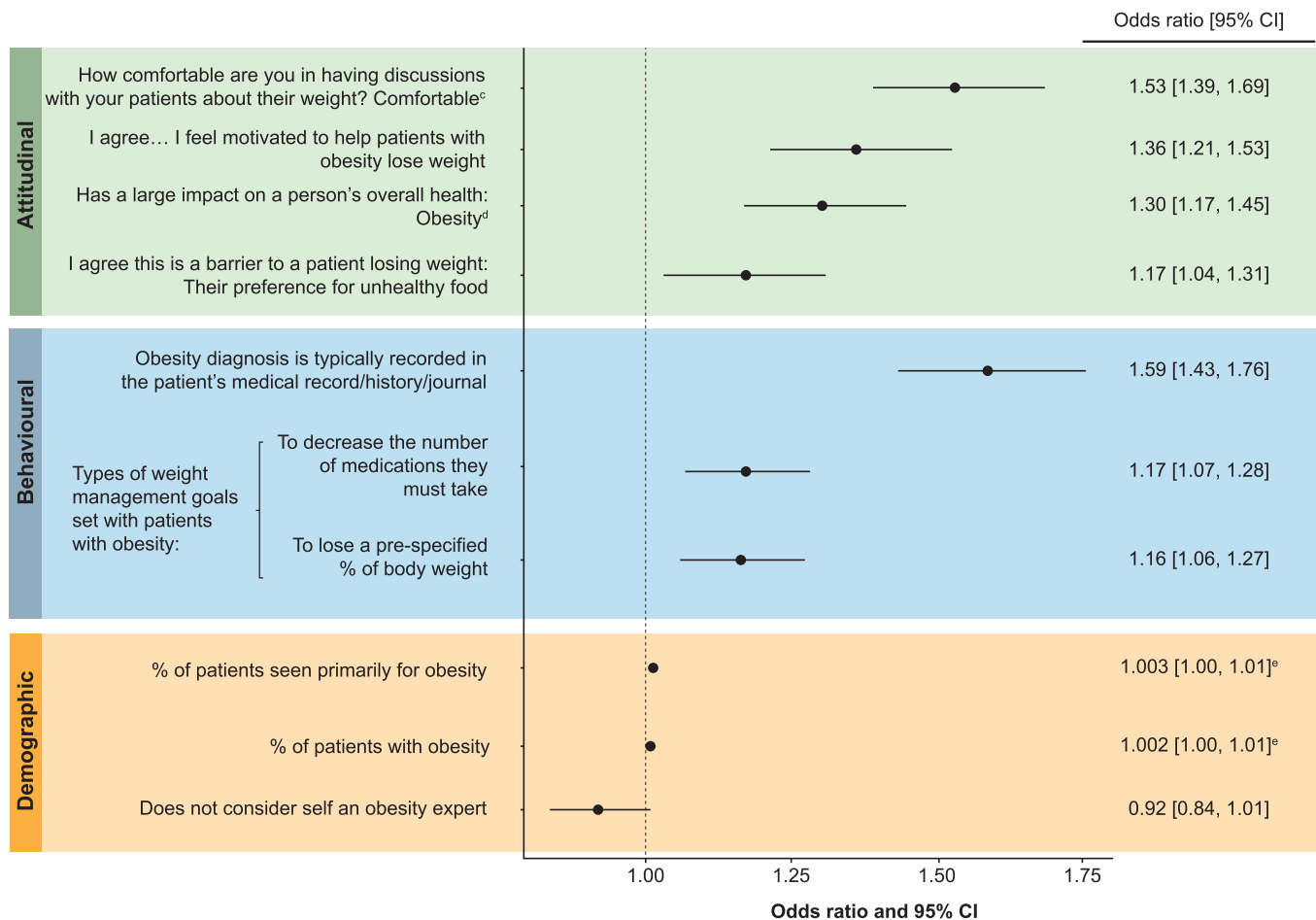


Fig. 1. Discussion about weight. Variables associated with a significant change in the proportion of patients with obesity with whom HCPs initiated discussions about weight.^{a,b}

CI, confidence interval; HCP, healthcare professional.

^aThis is a model of the exact percent, not a binary category. Odds ratios are interpreted as a change in the proportion $P/(1-P)$; therefore, an odds ratio of 1.10 indicates a 10% increase in the ratio of the percent of patients with whom an HCP discusses their weight compared to the percent with whom weight is not discussed.

^bVariables associated with a non-significant change in the proportion of patients with whom HCPs initiated discussions about weight are provided in the appendix.

^cSelections of 4 or 5 on a scale where 1 meant “not at all comfortable” and 5 meant “extremely comfortable” were counted as comfortable.

^dSelections of 4 or 5 on a scale where 1 meant “very little impact” and 5 meant “an extreme impact” were counted as a large impact on a person’s overall health.

^eVariable compounds with every percentage point increase; see Supplementary Fig. S1 and S2.

with obesity was a productive use of time, and considering exercise tracking as an effective method for long-term weight management. An HCP’s number of years in practice, and the percentage of patients seen primarily for obesity, compounded with every unit increase and therefore had substantial effects on the proportion of patients with whom a follow-up appointment was scheduled (Fig. 3A, Supplementary Fig. S5–S6). Specialising in endocrinology or general practice had impacts on the odds of HCPs scheduling a follow-up appointment with their patients to discuss their weight, increasing them by factors of 1.26 (95% CI, 1.04–1.52) and 1.23 (95% CI, 1.03–1.46), respectively. By contrast, specialising in cardiology or obstetrics/gynaecology reduced the odds of scheduling follow-up appointments to discuss weight.

Age of the HCP, not considering themselves experts in obesity, and having received no advanced formal training in the treatment of obesity, all reduced the odds of HCPs scheduling a follow-up appointment with their patients, decreasing them by factors of 0.99 (95% CI, 0.98–1.00), 0.73 (95% CI, 0.65–0.82) and 0.69 (95% CI, 0.62–0.78), respectively. The age of the HCP compounded with every unit increase and therefore the small odds ratio had a substantial impact on the proportion of patients with whom an HCP scheduled a follow-up appointment about weight management (Supplementary Fig. S7).

Acknowledging obesity as a chronic disease did not have a significant

effect in either of the three final models (Discussion, Diagnosis or Direction).

4. Discussion

These beta regression analyses aimed to identify HCP-related factors that could significantly influence the quality of obesity care provided by HCPs to their patients with respect to **Discussion** of weight, **Diagnosis** of obesity, and provision of further **Direction** through scheduling a follow-up appointment related to weight management. Key variables associated with significant changes in these three elements for effective treatment of obesity are highlighted in Fig. 4. The results show that HCPs who recorded an obesity diagnosis in a patient’s medical record and recognised the impact of obesity on overall health were significantly more likely to have discussions about weight with their patients and to provide them with a formal diagnosis of obesity. HCPs who recorded an obesity diagnosis in a patient’s medical record were also more likely to schedule follow-up appointments with their patients. Interestingly, recognising the impact of obesity on health and coding obesity diagnoses may be more important for HCP engagement with patients than recognition of obesity as a disease *per se*. Officially recording obesity diagnoses is also important for fully assessing and communicating the

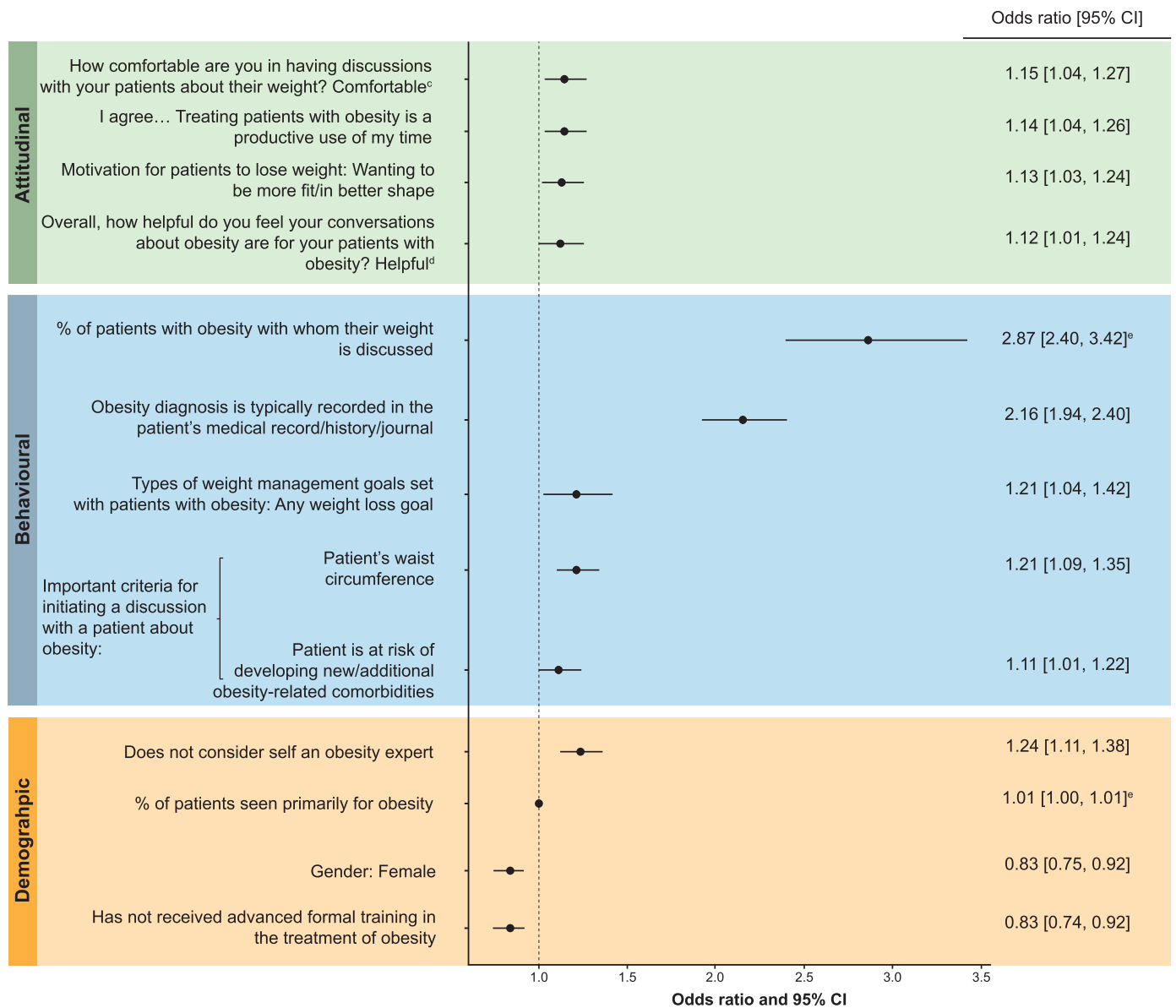


Fig. 2. Diagnosis of obesity. Variables associated with a significant change in the proportion of patients with obesity with whom HCPs provided a formal diagnosis of obesity.^{a,b}

CI, confidence interval; HCP, healthcare professional.

^aThis is a model of the exact percent, not a binary category. Odds ratios are interpreted as a change in the proportion P/(1-P); therefore, an odds ratio of 1.10 indicates a 10% increase in the ratio of the percent of patients provided a formal obesity diagnosis by their HCP compared to the percent with whom a formal obesity diagnosis is not provided.

^bVariables associated with a non-significant change in the proportion of patients whom HCPs provided a formal diagnosis of obesity are provided in the appendix.

^cSelections of 4 or 5 on a scale where 1 meant “not at all comfortable” and 5 meant “extremely comfortable” were counted as comfortable.

^dSelections of 4 or 5 on a scale where 1 meant “not at all helpful” and 5 meant “extremely helpful” were counted as helpful.

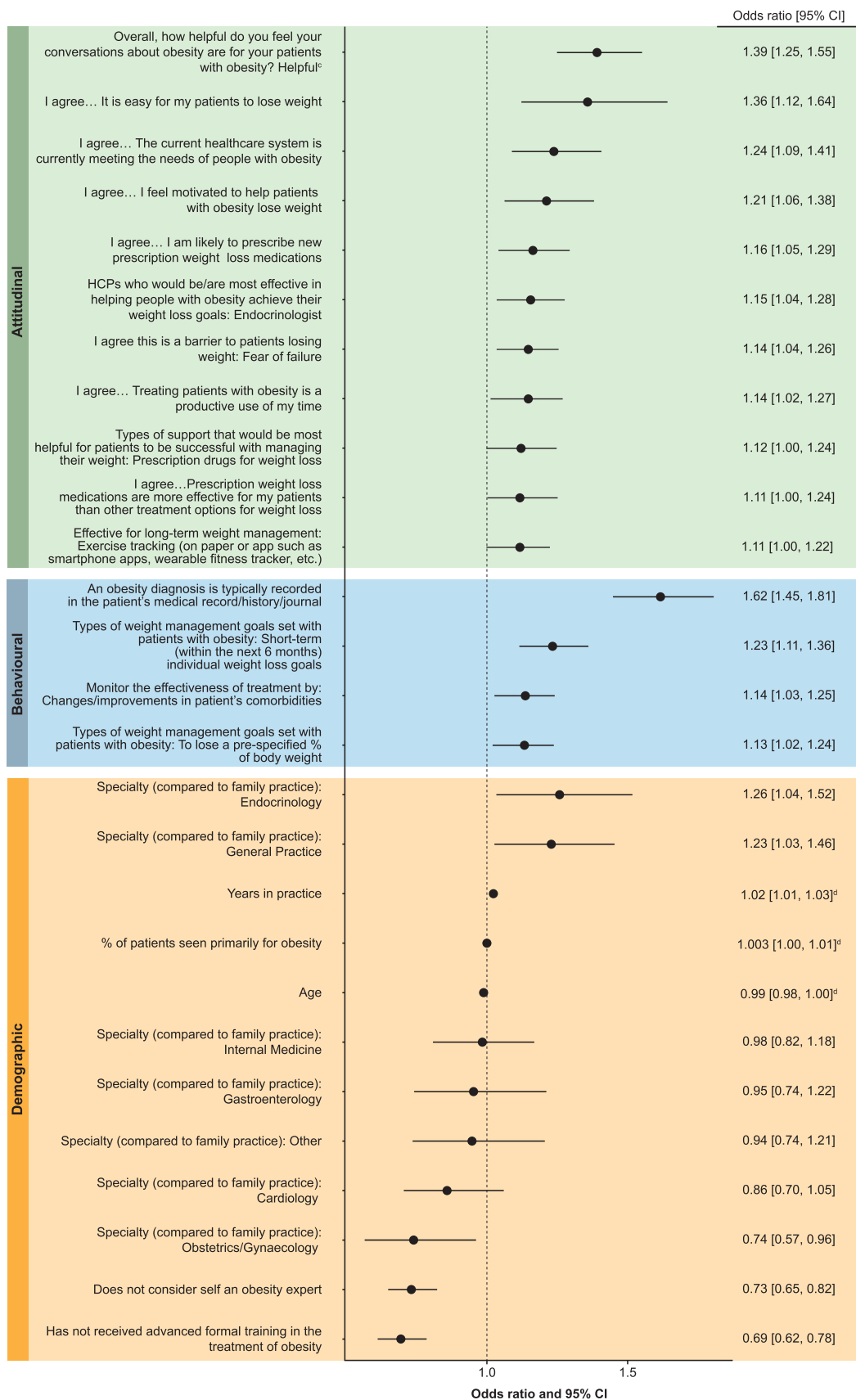
^eVariable compounds with every percentage point increase; see Supplementary Fig. S3 and S4.

susceptibility of PwO to diseases. For example, having obesity diagnoses in medical records could enable quicker identification of patients at increased risk of COVID-19 morbidity and mortality [2-4] so that shielding measures could be put in place earlier.

Not considering themselves as an expert on obesity decreased the likelihood of an HCP initiating discussions about weight with their patients. The primary reason of a consultation with the non-obesity expert is often to discuss issues apparently unrelated to weight, and thus raising the topic of weight can be a complex issue [18, 19]. Not being an expert on obesity also decreased the likelihood of HCPs scheduling follow-up appointments. Similarly, HCPs who had received no advanced formal training in obesity treatment were less likely to schedule follow-up

appointments with their patients for discussion of their weight. This highlights the need to stress the importance of a multidisciplinary approach in the management of obesity across all levels of care. HCPs play a strategic role in initiating a conversation about weight, performing an assessment and referring patients to appropriate services [19]. Although not being an expert on obesity did not appear to be a barrier to patients receiving a formal diagnosis of obesity, HCPs lacking advanced formal training in the treatment of obesity were less likely to provide such diagnoses, reinforcing the need for such training.

HCP comfort and motivation also appear to be key factors for patient engagement. HCPs who were comfortable discussing weight were significantly more likely to have discussions about weight with their



(caption on next page)

Fig. 3. Direction. Variables associated with a significant change in the proportion of patients with obesity with whom an HCP scheduled a follow-up appointment to discuss weight.^{a,b}

CI, confidence interval; HCP, healthcare professional.

^aThis is a model of the exact percent, not a binary category. Odds ratios are interpreted as a change in the proportion P/(1-P); therefore, an odds ratio of 1.10 indicates a 10% increase in the ratio of the percent of patients with whom an HCP schedules a follow-up appointment compared to the percent with whom a follow-up appointment is not scheduled.

^bVariables associated with a non-significant change in the proportion of patients with whom an HCP scheduled a follow-up appointment are provided in the appendix.

^cSelections of 4 or 5 on a scale where 1 meant “not at all helpful” and 5 meant “extremely helpful” were counted as helpful.

^dVariable compounds with every percentage point or year increase; see Supplementary Fig. S5, S6 and S7.

patients and to provide them with a formal diagnosis of obesity. HCPs who were motivated to help their patients lose weight were significantly more likely to initiate discussions with their patients about their weight and schedule follow-up appointments for weight management. Ways to increase HCP comfort and motivation for weight management discussions could include encouraging and supporting more training for HCPs on obesity, increasing financial support for obesity management and availability of referral pathways in healthcare systems, in addition to increased access to medical and surgical treatments. Furthermore, the finding from the primary ACTION-IO analysis that it is uncommon for PwO to find offence from an HCP discussing the management of their weight should be emphasised.

Negative weight biases among some HCPs have been observed in the past, which may have contributed to a reduced desire to treat their patients, perception of less patient adherence to treatments, and impairment of the quality of healthcare delivered [20, 21]. The models presented herein show that HCPs who took an active role in their patients’ weight loss (for example, by setting weight loss targets), saw it as a productive use of their time, and regarded holding conversations with their patients was helpful, were significantly more likely to provide a formal diagnosis of obesity and schedule follow-up appointments. Therefore, HCP attitudes regarding obesity are important for active engagement with patients. Setting weight loss targets could contribute

to response to treatment on the proviso that the patient feels supported. The European Association for the Study of Obesity (EASO) 2015 Guidelines recommend a weight loss target of 5–15% over 6 months through lifestyle treatment strategies [22], although even 3–5% reductions in weight can provide clinically meaningful health benefits [23].

HCPs who believed their patients could lose weight easily and who recognised that fear of failure was a barrier to patients losing weight were more likely to schedule follow-up appointments. It’s important for HCPs to arrange follow-up appointments, even if they believe the patient could lose weight easily, due to both the chronic nature of the disease process and the emergence of physiological adaptations that favour weight regain [1, 24]. Continued support of PwO who may be vulnerable to fear of failure, and who may find weight management more challenging than anticipated, also require follow-up appointments. Follow-up appointments were also more likely to be scheduled if HCPs believed their current healthcare system met the needs of PwO, suggesting that adequate provision of services/obesity care is important.

Interestingly, a higher proportion of their patients being seen primarily for obesity increased the odds of HCPs scheduling a follow-up appointment for weight management. This could be due to the expertise of the HCP or could be related to financial considerations. However, a patient could be seen for a medical issue that is a complication of

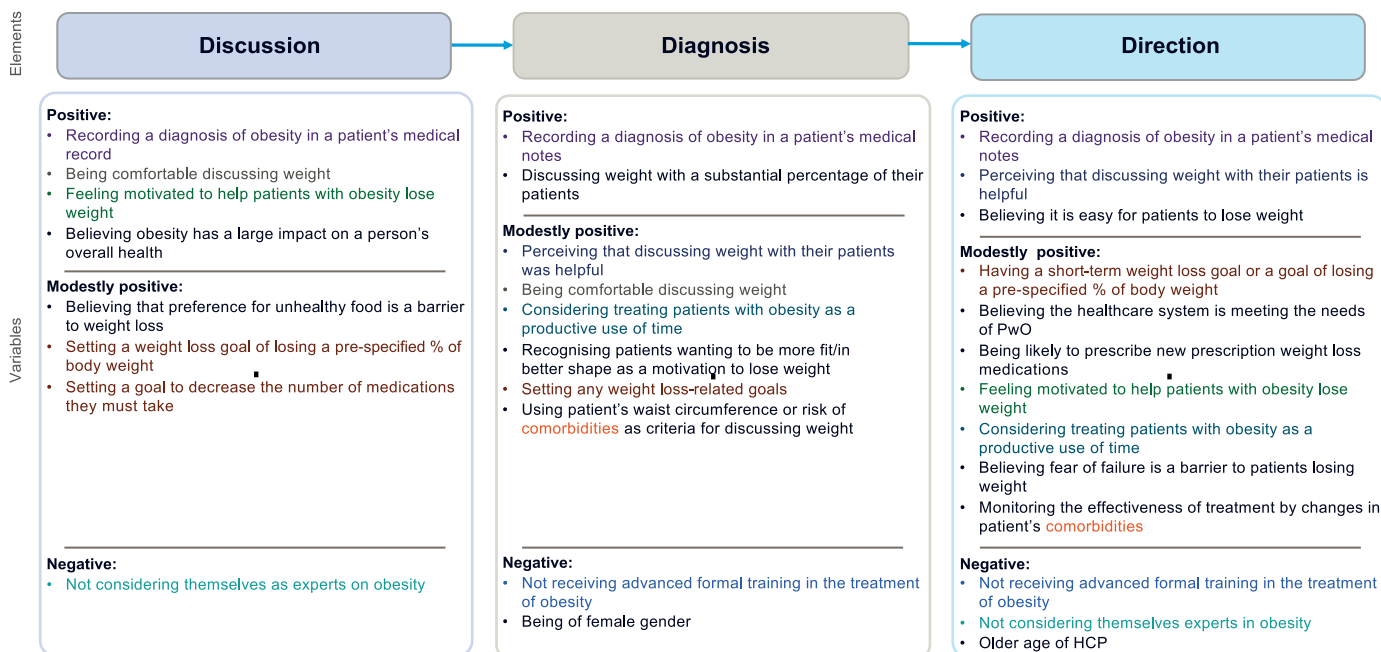


Fig. 4. Summary of key variables that significantly influence the three elements for successful obesity care. Identical or related variables are presented in the same colour.

HCP, healthcare professional; PwO, people with obesity.

obesity. Indeed, evidence suggests that conventional studies may underestimate the health consequences of a high BMI [25]. Therefore, even if patients are not being specifically seen for obesity, HCPs should consider arranging a separate follow-up appointment to discuss their weight and how it is affecting their health.

Increasing patient–HCP engagement regarding obesity could encourage appropriate weight management strategies and thus reduce the development of obesity-related comorbidities and lessen the economic burden of the disease [26, 27]. Agreeing and recording a formal diagnosis of obesity may be an effective way of initiating discussions about losing weight [18]. In addition, the opportunity for the HCP to explain the genetic and biological components of the disease could help to diminish feelings of self-blame among PwO and provide a source of encouragement for weight management [7, 28]. Further HCP training on the genetic and biological basis of obesity is required to facilitate these discussions and to reduce the stigmatising attitudes that persist among a subset of the healthcare profession [29, 30].

Limitations of this study include the cross-sectional design and reliance on self-reported data [11]. Causation between the factors cannot be determined from this hypothesis-generating dataset. Strengths include the rigorous study design, large and international dataset, and use of statistical modelling to determine independent variables associated with HCP behaviours.

5. Conclusions

The 3D approach of **Discussion, Diagnosis and Direction** was more likely if the treating HCP was comfortable discussing weight with their patient, understood the health consequences (and therefore the value) of treating obesity, was motivated to help (and play an active role) in their patients' treatment, and was prepared to record a diagnosis of obesity. Non-experts and HCPs who had received no advanced formal training in how to treat obesity were less likely to fulfil the 3D criteria, emphasising the importance of providing adequate training for HCPs with the aim of benefitting and improving the quality of care for patients. In conclusion, the following actions will facilitate the provision of effective obesity care through increased **Discussion, Diagnosis and Direction**: making the recording and communicating of obesity diagnoses mandatory; increasing HCP access to advanced formal training in obesity management that includes an understanding of the science underlying obesity; and increasing the support for follow-up appointments, referrals and evidence-based treatments within healthcare systems.

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 interests

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

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.

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, SFI and Australian Eggs outside the submitted work, and personal (lecture) fees 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.

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.

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.

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

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

Acknowledgements

We gratefully acknowledge the study participants and all personnel involved in the study. We especially thank Chris Claeys, Lynn Clement and Rebecca Hahn of KJT Group for data analysis. This study was sponsored by Novo Nordisk, which also provided financial support for medical editorial assistance from Abbie Saunders, PhD, CMPP, of Articulate Science.

References

- [1] Bray GA, Kim KK, Wilding JPH, et al. Obesity: A chronic relapsing progressive disease process. A position statement of the World Obesity Federation. *Obes Rev* 2017;18:715–23.
- [2] Kassar R. Risk of COVID-19 for patients with obesity. *Obes Rev* 2020;21:e13034.
- [3] Kass DA, Duggal P, Cingolani O. Obesity could shift severe COVID-19 disease to younger ages. *Lancet* 2020;395:1544–5.
- [4] 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.
- [5] Garg S, Kim L, Whitaker M, et al. Hospitalization rates and characteristics of patients hospitalized with laboratory-confirmed coronavirus disease 2019 —

- COVID-NET, 14 States, March 1–30, 2020. *MMWR Morb Mortal Wkly Rep* 2020; 69:458–64.
- [6] Lighter J, Phillips M, Hochman S, et al. Obesity in patients younger than 60 years is a risk factor for COVID-19 hospital admission. *Clin Infect Dis* 2020;71:896–7.
- [7] Ghanemi A, Yoshioka M, St-Amand J. Broken energy homeostasis and obesity pathogenesis: The surrounding concepts. *J Clin Med* 2018;7:453.
- [8] Jensen MD, Ryan DH, Apovian CM, et al. 2013 AHA/ACC/TOS guideline for the management of overweight and obesity in adults: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines and The Obesity Society. *J Am Coll Cardiol* 2014;63. 2985–23.
- [9] Zolotarjova J, Ten Velde G, Vreugdenhil ACE. Effects of multidisciplinary interventions on weight loss and health outcomes in children and adolescents with morbid obesity. *Obes Rev* 2018;19:931–46.
- [10] Kaplan LM, Golden A, Jinnett K, et al. Perceptions of barriers to effective obesity care: Results from the national ACTION study. *Obesity* 2018;26:61–9.
- [11] Catterson 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] Kahan SI. Practical strategies for engaging individuals with obesity in primary care. *Mayo Clin Proc* 2018;93:351–9.
- [13] Jackson SE, Wardle J, Johnson F, Finer N, Beeken RJ. The impact of a health professional recommendation on weight loss attempts in overweight and obese British adults: a cross-sectional analysis. *BMJ Open* 2013;3:e003693.
- [14] Dhurandhar NV, Kyle T, Stevenin B, Tomaszewski K, Kaplan LM, Golden A, et al. Predictors of weight loss outcomes in obesity care: results of the national ACTION study. *BMC public health* 2019;19:1422.
- [15] Rose S, Poynter P, Anderson J, Noar S, Conigliaro J. Physician weight loss advice and patient weight loss behavior change: a literature review and meta-analysis of survey data. *Int J Obes (Lond)* 2013;37:118–28.
- [16] International Association for the Study of Obesity (IASO). The Asia-Pacific perspective: Redefining obesity and its treatment. Melbourne: Health Communications Australia; 2000. Accessed from, https://apps.who.int/iris/bits/tream/handle/10665/206936/0957708211_eng.pdf.
- [17] The R Foundation.. R: A language and environment for statistical computing. 2020. <https://www.R-project.org/>.
- [18] Speer SA, McPhillips R. Initiating discussions about weight in a non-weight specific setting: What can we learn about the interactional consequences of different communication practices from an examination of clinical consultations? *Br J Health Psychol* 2018;23:888–907.
- [19] McGowan BM. A Practical Guide to Engaging Individuals with Obesity. *Obes Facts* 2016;9:182–92.
- [20] Dietz WH, Baur LA, Hall K, et al. Management of obesity: Improvement of health-care training and systems for prevention and care. *Lancet* 2015;385:2521–33.
- [21] Rubino F, Puhl RM, Cummings DE, Eckel RH, Ryan DH, Mechanick JI, et al. Joint international consensus statement for ending stigma of obesity. *Nature Medicine* 2020;26:485–97.
- [22] Yumuk V, Tsigos C, Fried M, et al. European guidelines for obesity management in adults. *Obes Facts* 2015;8:402–24.
- [23] Donnelly JE, Blair SN, Jakicic JM, et al. American College of Sports Medicine Position Stand. Appropriate physical activity intervention strategies for weight loss and prevention of weight regain for adults. *Med Sci Sports Exerc* 2009;41:459–71.
- [24] Greenway FL. Physiological adaptations to weight loss and factors favouring weight regain. *Int J Obes (Lond)* 2015;39:1188–96.
- [25] Carslake D, Davey Smith G, Gunnell D, et al. Confounding by ill health in the observed association between BMI and mortality: Evidence from the HUNT Study using offspring BMI as an instrument. *Int J Epidemiol* 2018;47:760–70.
- [26] Tremmel M, Gerdtham UG, Nilsson PM, Saha S. Economic burden of obesity: A systematic literature review. *Int J Environ Res Public Health* 2017;14:435.
- [27] GBD 2015 Obesity Collaborators. Health effects of overweight and obesity in 195 countries over 25 years. *N Engl J Med* 2017;377:13–27.
- [28] van der Klaauw AA. The hunger genes: Pathways to obesity. *Cell* 2015;161:119–32.
- [29] Alberga A, Edache I, Forhan M, Russell-Mayhew S. Weight bias and health care utilization: A scoping review. *Prim Health Care Res Dev* 2019;20:e116.
- [30] Phelan SM, Burgess DJ, Yeazel MW, et al. Impact of weight bias and stigma on quality of care and outcomes for patients with obesity. *Obes Rev* 2015;16:319–26.