



## RESEARCH ARTICLE

**REVISED** **A descriptive study of potential participant preferences for the design of an incentivised weight loss programme for people with type 2 diabetes mellitus attending a public hospital in Lima, Peru [version 2; referees: 2 approved]**

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**v2** First published: 03 May 2018, 3:53 (<https://doi.org/10.12688/wellcomeopenres.14552.1>)

Latest published: 27 Sep 2018, 3:53 (<https://doi.org/10.12688/wellcomeopenres.14552.2>)

**Abstract**

**Background:** Weight loss is important for the control of type 2 diabetes mellitus but is difficult to achieve and sustain. Programmes employing financial incentives have been successful in areas such as smoking cessation. However, the optimum design for an incentivised programme for weight loss is undetermined, and may depend on social, cultural and demographic factors.

**Methods:** An original questionnaire was designed whose items addressed respondent personal and health characteristics, and preferences for a hypothetical incentivised weight loss programme. One hundred people with type 2 diabetes mellitus were recruited to complete the questionnaire from the endocrinology clinic of a public hospital in Lima, Peru. A descriptive analysis of responses was performed.

**Results:** Ninety-five percent of subjects who had previously attempted to lose weight had found this either 'difficult' or 'very difficult'. Eighty-five percent of subjects would participate in an incentivised weight loss programme. Median suggested incentive for 1 kg weight loss every 2 weeks over 9 months was PEN 100 (~USD \$30). Cash was preferred by 70% as payment method. Only 56% of subjects would participate in a deposit-contract scheme, and the median suggested deposit amount was PEN 20 (~USD \$6). Eighty percent of subjects would share the incentive with a helper, and family members were the most common choice of helper.

**Conclusions:** The challenge of achieving and sustaining weight loss is confirmed in this setting. Direct cash payments of PEN 100 were generally preferred, with substantial scope for involving a co-participant with whom the

**Open Peer Review**

Referee Status:

	Invited Referees	
	1	2
<b>version 2</b> published 27 Sep 2018	 report	 report
<b>version 1</b> published 03 May 2018	 report	 report

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incentive could be shared. Employing direct financial incentives in future weight loss programmes appears to be widely acceptable among people with type 2 diabetes mellitus.

### Keywords

Diabetes, Obesity, Motivation, Weight loss, Public health

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**Competing interests:** No competing interests were disclosed.

**Grant information:** This study was funded by the DFID/MRC/Wellcome Global Health Trials (MR/M007405/1). AB-O (103994) and JJM (107435) are supported by the Wellcome Trust. JJM acknowledges receiving additional support from the Alliance for Health Policy and Systems Research (HQHSR1206660), DFID/MRC/Wellcome Global Health Trials (MR/M007405/1), Fogarty International Center (R21TW009982, D71TW010877), International Development Research Center Canada (106887, 108167), Inter-American Institute for Global Change Research (IAI CRN3036), Medical Research Council (MR/P008984/1, MR/P024408/1, MR/P02386X/1), National Cancer Institute (1P20CA217231), National Heart, Lung and Blood Institute (HHSN268200900033C, 5U01HL114180, 1UM1HL134590), National Institute of Mental Health (1U19MH098780), Swiss National Science Foundation (40P740-160366), and the World Diabetes Foundation (WDF15-1224).

*The funders had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript.*

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**How to cite this article:** Akehurst H, Pesantes MA, Cornejo SdP *et al.* **A descriptive study of potential participant preferences for the design of an incentivised weight loss programme for people with type 2 diabetes mellitus attending a public hospital in Lima, Peru [version 2; referees: 2 approved]** Wellcome Open Research 2018, 3:53 (<https://doi.org/10.12688/wellcomeopenres.14552.2>)

**First published:** 03 May 2018, 3:53 (<https://doi.org/10.12688/wellcomeopenres.14552.1>)

**REVISED Amendments from Version 1**

- A revision of references in the introduction in accordance with peer review recommendations.
- On request of both peer reviewers, a paragraph added to introduction summarising diabetic care in Peru.
- Revision of statement of aims and objectives to improve clarity.
- Structure of methods revised for clarity.
- Provided main questionnaire in English and Spanish ([Supplementary File 1](#) and [Supplementary File 2](#))
- Substantial modification to discussion section on recommendations from both peer reviewers:
  - Further discussion of the finding that more participants would participate in unincitised than incitised programmes
  - Further discussion of the reservations which some participants expressed regarding the morality of financial incitives
  - Elaboration of limitations of study, in particular the absence of anthropomorphic and laboratory data.
  - Discussion of the problem of weight loss maintenance in the proposed 9-month incitised programme
 Numerical errors in [Table 3](#) corrected.

See referee reports

## Introduction

Weight control is critical for both prevention and treatment of type 2 diabetes mellitus (T2DM)<sup>1-3</sup>. Self-management programmes for people with T2DM commonly include the promotion of lifestyle changes, such as dietary modifications and increasing physical activity, to reduce weight<sup>4-6</sup>. However, sustained weight loss is a challenge to both patients and providers: failure to sustain weight loss in formal diet programmes varies between 21–54%, and many people fail repeatedly<sup>7-9</sup>.

A major challenge in any lifestyle intervention programme is the willingness to join, and sustain, participation. Better understanding of what motivates people to engage with such programmes is therefore fundamental to their design<sup>10</sup>. Financial incitives have emerged as strategies which can initiate and sustain positive health behaviours during the incitive period and beyond. Sustained changes have been achieved through incitization in the field of smoking cessation, but trials of financial incitives have previously failed to achieve sustained weight loss<sup>11-14</sup>.

Social and cultural factors influence participants' engagement with weight control: for example, among adolescents, weight loss attempts were more frequent in Latinos than Whites or African Americans; desire to lose weight is more common in Latino females than males; and intention to lose weight is related to the number of social contacts trying to lose weight<sup>15-17</sup>. Successful completion of both short- and long-term weight loss programmes has been associated with age, ethnicity, family structure, educational level and employment<sup>18,19</sup>. Additionally,

a recent study testing a behavioural weight loss intervention for Latinos in the United States concluded that companionship for physical activity appears to support weight loss<sup>20</sup>. It is possible that the success of an incitised weight loss intervention might be optimised by accounting for the social and cultural characteristics of its target population, and by incorporating beneficial social support by design.

Healthcare in Peru is funded publicly and privately: approximately 30% in the lowest socioeconomic stratum is covered by public health insurance (SIS); a further 25% are covered by social security (EsSalud) linked to their employment; 2% have private health insurance; and 38% have no health insurance. Separate military, police and other systems account for the remainder. Insulin, metformin and glyburide are available through SIS and EsSalud, while many further agents are available privately. Glucose testing strips are available for insulin-dependent diabetes through SIS and EsSalud, or through private insurance. There is no national strategy for diabetes care which integrates medical therapy with promotion of exercise or healthy diet<sup>21</sup>.

The aim of this study was to investigate the optimal design for an incitised weight loss programme which is planned for people with T2DM in Lima, Peru (to be funded by research grants). The objectives of the study were: to determine the acceptability of financial incitives for weight loss among type 2 diabetics in Lima, Peru; and to determine the optimal amount and delivery method for such an incitive.

## Methods

### Design and data collection

We performed a cross-sectional exploratory study using an original questionnaire. Interviews were conducted and data recorded by JP.

### Questionnaire development and design

The questionnaire was developed by the authors and not validated separately. It consisted of 82 items (see [Supplementary Material](#) for the instrument in original Spanish and translation) addressing socio-economic circumstances, health characteristics and preferences relating to a proposed incitised weight loss programme. Items relating to the programme included a suggested incitive amount and identifying a threshold incitive amount.

Two methods were employed to identify threshold incitive amounts for participation in a weight loss reduction programme: direct questioning and fixed-increment questioning ([Supplementary Table 1](#) and [Supplementary Table 2](#)).

For the first method, a hypothetical situation was explained to the participant, which consisted of inviting them to participate in a 9-month programme whose purpose was to pay a monetary incitive only if they lost 1 kilogram every two weeks, and that we were interested in knowing the exact amount of money that would motivate them to lose that kilogram. For the second method, amounts of money from 0 PEN to 250 PEN in fixed increments of 50 PEN were specified and the participant

was asked whether each of these amounts would motivate them to lose 1 kilogram over two weeks.

Participants were also asked about their willingness to participate in a hypothetical ‘deposit-contract’ programme in which they would be required to deposit a certain amount of money in a saving account and such amount would be doubled if they lost 1 kilogram over a two-week period, but would lose the deposited amount if they failed to reach the weight loss goal.

Finally, participants were asked if they would be willing to share the money won in a weight loss programme with a co-participant, defined as a relative or friend selected by the participant to support their efforts to lose weight, their preferred co-participant, and the proportion of the incentive that the participant would be willing to share with this co-participant.

### Participants

Patients were recruited by convenience sampling from the Hospital Nacional Arzobispo Loayza, a public tertiary hospital serving mostly low-income people from Lima, the capital city of Peru, whose endocrinology department provides over 2500 outpatient appointments annually to patients with T2DM<sup>22</sup>.

Inclusion criteria were age  $\geq 18$  years and self-reported diagnosis of T2DM. Incapacity to provide written informed consent was the only exclusion criterion. As patients were attending an endocrinology clinic it was not considered necessary to verify their self-reported T2DM status independently, while the research team did not have access to participants’ medical records. Due to the exploratory nature of the study, only 100 subjects were invited to participate. Participants were recruited in the waiting room of the Endocrinology Department during April 2016.

### Data analysis

A descriptive analysis of questionnaire items was undertaken, employing 95% confidence intervals for selected items whose measurement was considered particularly important. For non-parametric continuous variables, a bootstrap confidence interval of the median was attempted. Hypothesis testing was not performed due to the large number of possible comparisons relative to the sample size and the consequently elevated risk of type 1 error. Statistical analysis was performed using R version 3.4.3<sup>23</sup>.

### Ethics

This study was approved by the Institutional Review Boards of the Universidad Peruana Cayetano Heredia (SIDISI 64789) and the Hospital Nacional Arzobispo Loayza (Expediente 04974-2015), in Lima, Peru. Written informed consent for participation was obtained from all subjects.

### Results

One hundred people with T2DM participated in the study. Two subjects did not respond to questions relating to incentives; the data were otherwise complete. Demographic and socioeconomic characteristics are presented in [Table 1](#). Health-related responses

are presented in [Table 2](#). Measures previously taken to improve health are presented in [Table 3](#).

Ninety-eight subjects (98%) responded to questions about financial incentives. Ninety-two subjects (94%; 95% CI 87 – 97%) responded that they would participate in an unincented weight loss programme. Eighty-three (85%; 95% CI 76 – 91%) would participate in a 9-month incentivised weight loss programme. Reasons given for not participating included: insufficient time to attend biweekly follow-up visits; because they thought it would be difficult to avoid “antojitos” (cravings) for 9 months; or because the participant did not think they needed to lose weight. Seventy-eight subjects (78%) answered the question “how much money would motivate you to lose 1 kg every 2 weeks?”. Responses were positively skewed with median PEN 100 ( $\approx$  USD \$30) and range PEN 50 to 500 ( $\approx$  USD \$15 to 150) ([Figure 1](#)). Bootstrap confidence intervals could not be constructed because all resampled medians = PEN 100 (10,000 simulations).

Subjects were then asked whether they would participate in an incentivised weight loss programme with incentive amounts from PEN 50 to 250 in PEN 50 increments. Six subjects (6%) would not participate for any amount, while 91 (93%) would participate for all amounts. One subject changed from a positive to negative response at the PEN 200 threshold.

Asked about their preferred method of payment, 69 subjects preferred (70%) cash, 24 (25%) deposit into a bank account, 3 (3%) as vouchers and the remainder not responding.

Fifty-five subjects (56%; 95% CI 46 – 66%) would participate in a deposit-contract scheme whereby their deposit would be doubled if they succeeded but lost if their failed to lose weight. Ninety-seven (97%) subjects answered a question on preferred deposit amount. Preferred deposit amount was positively skewed with median PEN 20 ( $\approx$  USD \$6) and range PEN 0 to 50 ( $\approx$  USD \$0 to 15) ([Figure 2](#)). Again, equality of all resampled median precluded construction of bootstrap confidence intervals.

Subjects were then asked whether they would participate in a deposit-contract scheme with deposit amount in increments between PEN 25 – 250. Forty-three subjects would participate with any deposit amount (43%); 32 would not participate with any deposit amount (32%); and 22 identified a threshold deposit amount for participation (22%). Among subjects who identified a threshold deposit amount above which they would not participate, the maximum acceptable amount was positively skewed with median PEN 25 (range PEN 25 to 100).

Regardless of their answers to the previous questions, subjects were also asked for their views of participating in such a program. Out of the 73 who responded, 14 (19%) considered that it was not good to receive money for taking care of their own health, with one saying that this would be “like selling yourself”, since people should lose weight for their own sake and not for money. Sixteen (22%) said it was a good idea and were

**Table 1. Demographic and socioeconomic characteristics of patients with type 2 diabetes included in the study.**

Characteristic		Count (%) or Mean (Standard deviation)
Female sex		67 (67%)
Age		55 years (11.8)
Education	Primary completed	7 (7%)
	Secondary incomplete	4 (4%)
	Secondary completed	46 (46%)
	Further non-university incomplete	19 (19%)
	Further non-university completed	13 (13%)
	University incomplete	9 (9%)
	University completed	2 (2%)
Employed		55 (55%)
Household monthly income	< PEN 750 [< US \$228]	3 (2%)
	PEN 751 – 1500 [US \$228 – 456]	14 (14%)
	PEN 1501 – 2000 [US \$456 – 608]	22 (22%)
	PEN 2001 – 2500 [US \$608 – 760]	24 (24%)
	> PEN 2501 [> US \$760]	11 (11%)
	Refused to answer	26 (26%)
Health insurance	None	34 (34%)
	Sistema Integral de Salud (most basic insurance)	64 (64%)
	Essalud (state-provided insurance for the employed)	2 (2%)
Self-rated economic status	Very bad	1 (1%)
	Bad	19 (19%)
	Fair	47 (47%)
	Good	33 (33%)

even excited at the prospect of participating in the program. Six (8%) found it amusing that such a program was even possible, and five (7%) were concerned that such a program will achieve only short-term results that would not be sustained after the program ended. Other answers revolved about the doubts they had about the program, or they did not understand the idea behind receiving money, that it was a good idea for “poor” people but not for everybody or that it might not work since not all diabetics needed to lose weight.

Subjects were asked who they would choose to help them to lose weight. Five (5%) chose a friend; 42 chose a partner (42%); 23 chose a child (23%); 1 chose a neighbour (1%); 4 chose a sibling (4%); and 12 would not choose a helper (12%). Eighty subjects would share the incentive with a helper (80%). Eight (10%) of these would share less than half, 71 (89%) half exactly, and 1 (1%) more than half of the incentive.

## Discussion

This pilot study aimed to characterise people with T2DM attending a public hospital in Lima, Peru, and their preferred

amount and delivery method for a financial incentive to be used in a future incentivised weight loss programme.

The proportion of participants who would participate in an incentivised weight loss programme was high (85%) but the proportion who would participate in an unincentivised programme was even higher (94%). A similar pattern was observed in a mixed-methods study of acceptability of incentives for a weight loss maintenance programme, in which 93.9% supported the programme generally but only 77% supported cash incentives<sup>24</sup>. The finding may indicate that in our sample weight loss as a goal was a more powerful motivator than the financial incentive. However, this does not negate the potential utility of incentives, which might contribute to participant retention and sustained weight loss achievement in addition to recruitment. It is possible another group exists, but was not accessed in this study, who do not wish to lose weight but could be motivated by financial incentives to do so. Such a group might be the most appropriate target for an incentivised weight loss intervention, but its access could constitute a significant challenge.

**Table 2. Health characteristics of patients with type 2 diabetes included in the study.**

Variable		Count (%) or Mean (standard deviation)
Self-rated health status	Very bad	11 (11%)
	Bad	52 (52%)
	Fair	37 (37%)
Time since diagnosis of diabetes		6.9 years (5 years)
Most recent blood glucose measurement (self-reported)	Reported (n = 94)	151 mg/dL (49 mg/dL)
	Did not know	6 (6%)
Most recent HbA1c measurement (self-reported)	Reported (n = 59)	8.9% (1.6%)
	Did not know	41 (41%)
Current medical treatment for diabetes	Any	95 (95%)
	Insulin	10 (10%)
	Metformin	71 (71%)
	Glibenclamide	32 (32%)
	Glimepiride	1 (1%)
	Weight loss tablets	1 (1%)
Monthly expenditure on medical treatment for diabetes	PEN	63 (44)
	[US \$]	19 (14)

That fewer respondents would participate in an incentivised than in an unincentivised programme may also be due to unacceptability of financial incentives in this population for moral reasons: 14 thought it wrong to accept money in exchange for taking care of your own health, with one describing this as “selling yourself”. Similar concerns were expressed in focus groups in a recent study, in which discussion of financial incentives conveyed “distrust and indignation”, where the idea was reiterated that improved health should be sufficiently motivating for weight loss<sup>24</sup>. These comments may represent a significant cultural attitude towards financial incentives for health which could constitute a barrier to their success, and which deserve further attention. However, such reservations may not necessarily preclude participation: 85% of subjects nonetheless indicated that they would participate in an incentivised intervention, and a recent systematic review found that participation may actually be increased by financial incentives for weight loss<sup>14</sup>.

Median suggested incentive amount was PEN 100. Based on a national disposable income of USD \$175.7bn<sup>25</sup> and population of 30,565,431 in 2013<sup>26</sup>, a maximum reward of PEN 100 every 2 weeks for 9 months would represent 10% of personal disposable income (PDI). Previous interventions have employed a broad range of incentive sizes (from 0.2% to 10.2% of PDI<sup>13</sup>), and experimental evidence suggests that insufficient incentives may paradoxically produce less motivation than no incentive at all<sup>27</sup>. The suggested amount therefore appears adequate and appropriate for an intervention in this setting.

The fixed-increment questioning method to identify a suitable incentive amount (asking whether the participant would accept amounts of increasing PEN 50 increments) was not successful. Sixty-two percent of participants in a previous study felt that financial incentives undermined individual responsibility for health<sup>28</sup>, and participants may have been reluctant to engage with these questions to avoid weighing a moral position against financial advantage.

Fewer respondents would participate in a deposit-contract scheme, which concurs with previous findings<sup>24</sup>. Because such schemes weigh a certain short-term price against a possible long-term advantage, they fail to take advantage of the established health economic principle that individuals overvalue present relative to future costs<sup>29</sup>. In contrast, an approach described as *asymmetric paternalism*, which aims to assist individuals with health-improving behaviours without limiting freedom<sup>30</sup>, might produce in an intervention in which individuals commit to future behaviours without present costs, such as receiving up-front an incentive which would be returned or doubled depending on achievement of a future weight goal. Cash or bank transfer were generally preferred over vouchers. This is in accordance with the finding that rewards are more motivating when separated from larger payments, such as household shopping (in the case of vouchers) and insurance premiums (in the case of discounts)<sup>31</sup>.

Our findings show that most participants had found it challenging to adopt health-improving behaviours. In particular,

**Table 3. Measures previously taken to control health of patients with type 2 diabetes included in the study.**

Health control measures attempted since diagnosis of diabetes		Count (%) or Mean (standard deviation)
Regular exercise		53 (53%)
Difficulty of attempt to regularly exercise	Very easy	1 (2)%
	Easy	21 (40%)
	Difficult	21 (23%)
	Very difficult	19 (40%)
Reduction of sugar intake		75 (75%)
Difficulty of attempt to reduce sugar intake	Very easy	1 (1%)
	Easy	32 (43%)
	Difficult	32 (43%)
	Very difficult	9 (12%)
	Did not answer	1 (1%)
Quit alcohol		31 (31%)
Difficulty of attempt to quit alcohol	Very easy	1 (3%)
	Easy	19 (61%)
	Difficult	9 (29%)
	Very difficult	2 (6%)
Reduce fat intake		77 (77%)
Difficulty of attempt to reduce fat intake	Easy	27 (35%)
	Difficult	38 (49%)
	Very difficult	12 (16%)
Increase vegetable intake		57 (57%)
Difficulty of attempt to increase vegetable intake	Very easy	17 (30%)
	Easy	32 (56%)
	Difficult	8 (14%)
Weight loss		42 (42%)
Difficulty of attempt to lose weight	Easy	2 (5%)
	Difficult	23 (55%)
	Very difficult	17 (40%)
Methods for health maintenance or improvement for people with diabetes (all participants asked to name three)	Alternative medication	1 (1%)
	Attend appointments	4 (4%)
	Avoid appointments	1 (1%)
	Exercise	72 (72%)
	Foot care	6 (6%)
	Glycaemic control	13 (13%)
	Healthy diet	38 (38%)
	Intake control	17 (17%)
	Medications	38 (38%)
	Obey doctors	2 (2%)
	Reduce alcohol	1 (1%)
	Reduce carbohydrate	36 (36%)
	Reduce fat	19 (19%)
	Reduce protein	1 (1%)
	Relaxation	3 (3%)

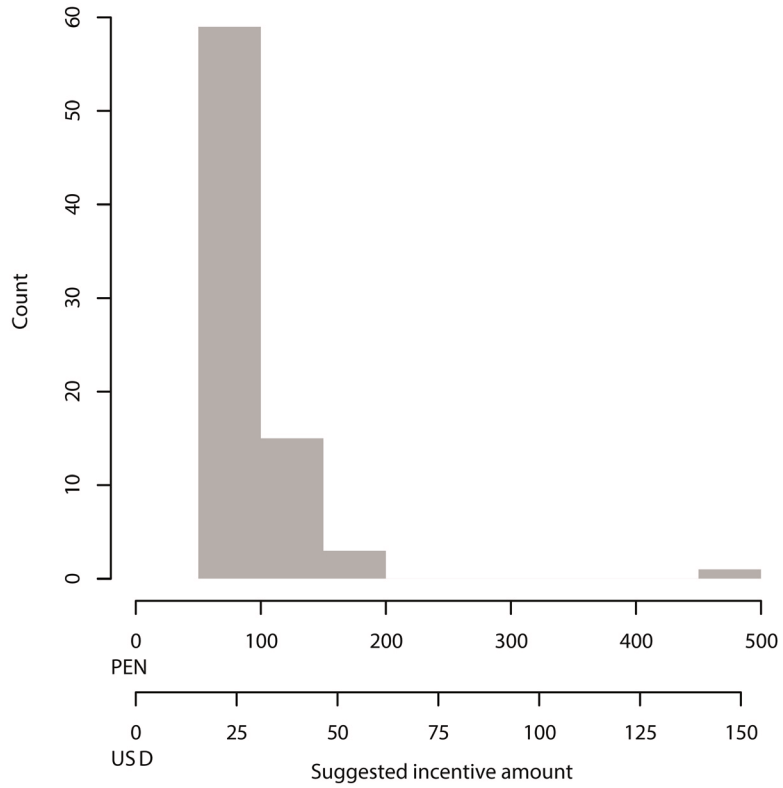


Figure 1. Suggested simple incentive amounts.

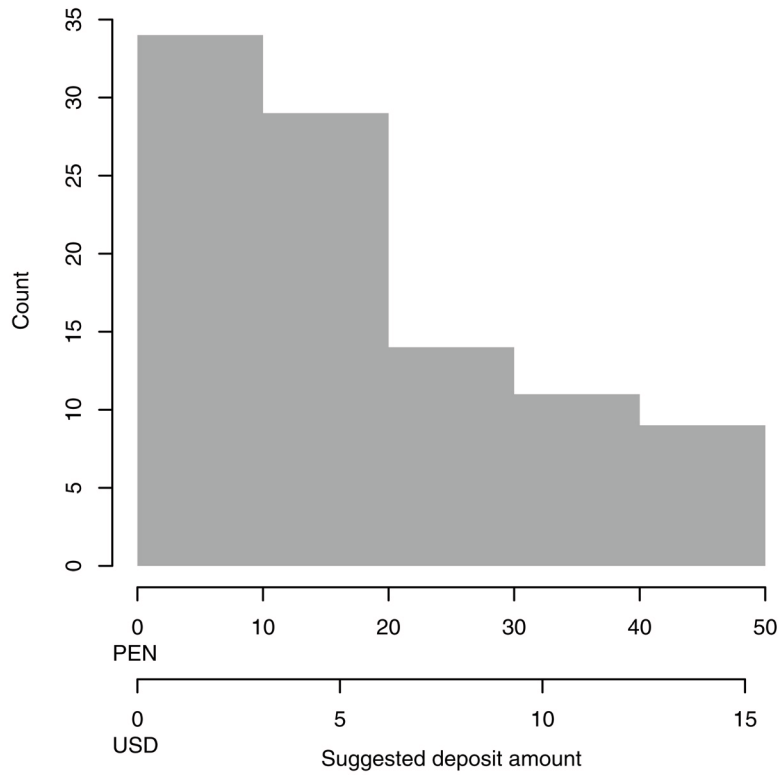


Figure 2. Suggested deposit amounts.



42% of participants had previously attempted to lose weight but 95% found this “difficult” or “very difficult”, suggesting that people with failed previous weight loss attempts will constitute a substantial subgroup of this population. The question of what makes behavioural change difficult has been addressed by Kelly & Barker, who note the mistakes which policy-makers commonly make in understanding the drivers of behaviour<sup>32</sup>. One of these mistakes is the economic utility theory which presumes that individuals make rational choices to maximise gain and minimise loss. The theory behind the use of financial incentives is essentially an extension of this. However, health behaviours are frequently automatic responses to social and environmental cues, not subject to particular conscious reflection, and often in spite of adequate understanding of health implications<sup>33–35</sup>. These findings inform interventions that target ‘choice architecture’, comprising the “interaction between individual human agency and both the immediate and broader environment that make up the social structure”<sup>36</sup>. Financial incentives are much more likely to achieve persisting behavioural change in synergy with such interventions.

Asked about who they would choose to help them to lose weight, most selected a family member. In prospective studies, family support was associated with reduced HbA1c in males, but increased HbA1c in females. Informal support seeking is often different in males and females. Females seek and receive more support from friends and extended family, while males often seek and receive more support from their spouse<sup>37</sup>. Other studies found that seeing friends more frequently, having a well-functioning social network and a sense of good social support from the social network was associated with higher patient activation levels, less diabetes-related emotional distress and more health-promoting self-management behaviours among patients with T2DM. When providers felt more emotionally engaged, their support exerted a large, positive effect on their well-being, as well as on recipients’ well-being<sup>38,39</sup>. These findings imply that the incorporation of social support into an intervention may be crucial for its success, but also that its precise form may need to adapt to the sex (and potentially other characteristics) of the participant.

Five participants additionally raised concerns over the sustainability of weight loss in such a programme, and indeed this obstacle remains to be overcome: thus far, incentivised weight loss programmes have failed to achieve sustained weight loss beyond the incentivised period<sup>13,14</sup>. The Stages of Change model proposes pre-contemplation, contemplation, preparation, action and maintenance stages to behavioural change<sup>40</sup>. To participate in the hypothetical 9-month intervention proposed to participants, they would necessarily have reached the ‘preparation’ stage but at the conclusion of the intervention might have spent only a maximum of 3 months in ‘maintenance’, presuming no relapses. Sustained weight loss would therefore not be incentivised for a long period in such an intervention. Indefinite incentive payment is unlikely to appeal to insurers or healthcare providers, nor is it likely to be evaluated due to its likely limited appeal to research funding bodies. Incentives may ultimately prove most valuable in initiating and achieving short to medium term change but will need to be integrated into a multimodal approach for treating T2DM and obesity more

generally, including psychological, medical and potentially surgical methods (although these are unlikely to be available to this demographic for some time yet).

### Limitations

The sampling approach employed may have exposed the study to participation bias. Most participants were female, middle-aged, and had at least completed secondary education. Although most rated their economic status as at least ‘fair’, almost all had either the most basic or no health insurance at all. Although the prevalence of T2DM is greater in males than females worldwide<sup>41</sup>, the higher proportion in our study may be explained by the fact that females are more likely than males to engage with healthcare seeking behaviours and respond to questionnaires<sup>42,43</sup>. The study setting in a Peruvian public hospital is likely to have determined participants’ socioeconomic profile, which should not be interpreted as representative of people with diabetes in Peru more generally. However, the prevalence of T2DM is inversely proportional to socioeconomic status<sup>44,45</sup>, and therefore the majority of people with T2DM in Peru will fall into the low-income group surveyed in this pilot and targeted by our planned intervention. Higher-educated subjects have previously been found to make more attempts to lose weight<sup>46</sup>, which may imply a greater need for intervention in this low-income group.

Anthropomorphic and laboratory data relating to participants’ weight and diabetic control were not recorded and it was therefore not possible to examine whether responses were influenced by these. It is also unknown what proportion of participants were overweight or obese. The possibility exists that although participants reported that had T2DM and were attending an endocrinology clinic they may not have had T2DM, as this was not verified by laboratory testing because the authors did not have access to participants’ medical records.

The questionnaire used was original and not previously validated. Important parameters for an incentivised weight loss programme were not explored in our questionnaire. A ‘lottery’ form for payments, in which successful weight loss would allow entry into a regular lottery for a larger payment (and which is anticipated to be more motivating than direct payments because people tend to over-value small odds of large rewards<sup>31,47</sup>) was not proposed to participants. Participants were also not asked about their preferred frequency of payment. Higher-frequency payment have been shown to be more effective in the drug-abstinence setting<sup>48</sup>, and the finding that experimental subjects prefer to segregate than to integrate gains has been used to support the argument for direct rewards over insurance premium adjustment<sup>31,49</sup>. These factors are important for the planning of any intervention and the preferences of potential participants should be the subject of future investigation.

Although the difficulty which participants had experienced in adopting health control behaviours was quantified, participants were not asked why each behaviour was difficult. This information could be usefully obtained through qualitative research, and might point to other potential targets for intervention, such as psychological, environmental and social factors.

Although multivariate associations could not be investigated due to insufficiency of sample size and sampling design, the study was not designed to investigate these, but rather to develop an improved understanding of the potential use of incentives in this setting.

## Conclusion

The use of direct financial incentives in a future weight loss programme for people with T2DM in Lima, Peru was acceptable to the majority of participants in this study, although some expressed reservations regarding the morality and sustainability of such a programme.

## Data availability

Original and translated data files are available on Open Science Framework: <http://doi.org/10.17605/OSF.IO/8NQQVW><sup>49</sup>

Data are available under the terms of the [Creative Commons Zero “No rights reserved” data waiver](#) (CC0 1.0 Public domain dedication).

## Supplementary material

Supplementary Table 1: Questions asked to identify the maximum amount participants would accept as a financial incentive for weight loss [English translation].

[Click here to access the data.](#)

Supplementary Table 2: Questions asked to identify the maximum amount participants would be willing to invest, in order to double their money upon meeting the weight loss target [English translation].

[Click here to access the data.](#)

Supplementary File 1: Main questionnaire [English translation].

[Click here to access the data.](#)

Supplementary File 2. Main questionnaire [Spanish].

[Click here to access the data.](#)

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## Grant information

This study was funded by the DFID/MRC/Wellcome Global Health Trials (MR/M007405/1). AB-O (103994) and JJM (107435) are supported by the Wellcome Trust. JJM acknowledges receiving additional support from the Alliance for Health Policy and Systems Research (HQHSR1206660), DFID/MRC/Wellcome Global Health Trials (MR/M007405/1), Fogarty International Center (R21TW009982, D71TW010877), International Development Research Center Canada (106887, 108167), Inter-American Institute for Global Change Research (IAI CRN3036), Medical Research Council (MR/P008984/1, MR/P024408/1, MR/P02386X/1), National Cancer Institute (1P20CA217231), National Heart, Lung and Blood Institute (HHSN268200900033C, 5U01HL114180, 1UM1HL134590), National Institute of Mental Health (1U19MH098780), Swiss National Science Foundation (40P740-160366), and the World Diabetes Foundation (WDF15-1224).

*The funders had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript.*

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# Open Peer Review

Current Referee Status:  

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## Version 2

Referee Report 16 October 2018

<https://doi.org/10.21956/wellcomeopenres.16187.r33985>



**Luzia Valentini**<sup>1</sup>, **Sara Ramminger**<sup>2</sup>

<sup>1</sup> Institute of Evidence-based Dietetics, University of Applied Sciences Neubrandenburg, Neubrandenburg, Germany

<sup>2</sup> University of Applied Sciences Neubrandenburg, Neubrandenburg, Germany

The authors implemented most of the relevant comments, but still do not offer any hint in regard to the non linearity of weight loss and the monetary advantage of people with higher BMI in the applied incentivized program. The authors claim that that they have alluded to it in the revised version but we were not able to identify anything on it. Also some suggestions on who is going to provide the funding for monetary incentives in future is still missing and would be beneficial to add to the discussion part.

**Competing Interests:** No competing interests were disclosed.

**We have read this submission. We believe that we have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.**

Referee Report 15 October 2018

<https://doi.org/10.21956/wellcomeopenres.16187.r33986>



**Ramfis Nieto-Martínez**  <sup>1,2,3</sup>

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<sup>2</sup> Department of Global Health and Population, Harvard TH Chan School of Public Health, Harvard University, Boston, MA, USA

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Thanks for considering the suggestions. The author changes are sufficient to amend the status of Approved with Reservations that I previously.

**Competing Interests:** No competing interests were disclosed.

**Referee Expertise:** Obesity, diabetes prevention, cardiovascular health, cardio-metabolic risk factors, nutrition

I have read this submission. I believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.

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**Version 1**

Referee Report 15 August 2018

<https://doi.org/10.21956/wellcomeopenres.15839.r33690>**Ramfis Nieto-Martínez**  1,2,3

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This article explores the acceptability and preferences of a group of 100 patients with type 2 diabetes who attended the endocrinology service in a public hospital in Peru, regarding a hypothetical monetary-incentivized weight loss program to be applied in the future. One of the gaps that, in the view of the authors, warrant obtaining this information is the necessity of strategies that increase the adherence to and sustainability of a weight loss intervention. Considering the innovation of the information based on an original questionnaire this article deserves publication. However, several important observations need to be considered:

## INTRODUCTION

### 1. Number and quality of references

The authors should avoid loading the introduction of references. The introduction 22 references. All of them are necessary? 4 to 5 good quality (primary sources, review or meta-analyses) references is enough. For example:

a) **Page 3, left column, paragraph 1, line 2:** "Weight control is critical for both the prevention and treatment of type 2 diabetes mellitus (T2DM) (1-4)."

There are 4 references supporting it. The first reference is a report. The second is appropriate. References 3 and 4 are secondary sources belonging to sections of the American Diabetes Association Guidelines. I suggest looking for a systematic review supporting the importance of weight control in the prevention and treatment of T2D.

b) **Page 3, left column, paragraph 1, line 2-5.** "Self-management programs for people with T2DM commonly include the promotion of lifestyle changes, such as dietary modifications and increasing physical activity, to reduce weight (5-7)."

There are 3 references but none of them is a primary source. The reference 5 is ADA guidelines and the other 2 are web-pages containing information for patients. I suggest retiring these references (5,6,7) and include primary sources of studies demonstrating the effectiveness of structured weight loss interventions (not only self-management programs) on diabetes management. The most important structured interventions evaluating the effect of lifestyle changes

on T2D management are the Look AHEAD study using HbA1c as main outcome and the Why Wait Study whose primary outcome was the weight<sup>1,2</sup>.

c) **Page 3, left column, paragraph 1, line 5-6.** "However, sustained weight loss is a challenge to both patients and providers (8,9)."

References 8 and 9 do not mention directly a sustained weight loss as a challenge. Both studies are interviews with physicians. In the reference 8, 14 GP were interviewed in focus groups. Five dilemmas were identified for primary physicians, but none of the 5 referred to difficulties of their patients in losing or maintaining weight loss. Reference 9 was an interview to 19 physicians to understand their challenges when treating social and emotional difficulties in T2D patients, but not the challenge of sustained weight loss to both patients and providers.

It is very laborious as a reviewer to check all references one by one. I strongly recommend that all references be carefully reviewed to establish if they are relevant, useful and what is more important if they support the written statements.

## 2. Background

In the introduction, the authors have to create a strong background that explains the reasoning behind why the study goal was built. In the introduction, the authors broadly mention sustainability as one of the possible benefits of adding incentives to a weight loss program. However, a probably greater sustainability of the loss of weight generated by the addition of incentives should not be proposed without bases that sustain it.

**Page 3, left column, paragraph 2, line 7-9.** "Sustained changes have been achieved through in the field of smoking cessation, although this remains a challenge to weight loss interventions."

I consider that the comment regarding that sustainability in weight loss interventions is a challenge is very conservative. Two of the references cited deserves attention. In the reference 15, financial incentives in 66 US veterans with BMI between 30 and 40 and age between 30 and 70 years produced significant weight loss over an 8-month intervention; however, participants regained weight post-intervention. The reference 16 is a systematic review included nine randomized controlled trials of behavioral treatments for obesity and overweight involving the use of financial incentives with reported followup of at least 1 year. No study was analyzed on an intention to treat basis, participants were mostly women recruited through media advertisements, mean age ranged from 35.7 to 52.8 years, and mean body mass index from 29.3 to 31.8 kg/m<sup>-2</sup>. Results from metaanalysis showed no significant effect of the use of financial incentives on weight loss or maintenance at 12 months and 18 months.

With this background (under-registered in the article), the first important question in the introduction would be: In previous studies, monetary incentives have shown some benefit in patients who are in a weight loss program? If the answer is NO. Is it justified to evaluate it in this population since it has very different characteristics than those evaluated previously, and the results could be different? The same participants question the usefulness of the incentives to increase the willingness to participate since 92% of them reported agreeing to participate in a weight loss program without incentives. Also, 19% considered that. This aspect should be mentioned in the discussion.

## 3. The gap of knowledge

In the introduction, the authors must highlight the existing knowledge gap that this study will fill and the relevance of the research question. What is the gap? The need a questionnaire (or the

generated information) to determine the acceptance of incentives or to explore the opinion of potential patients regarding the incentives? This gap must be the prelude the research question and the aim.

#### 4. The aim

It should be brief and should make clear what is the question that your study tries to respond.

The need for a questionnaire to determine the acceptability of monetary incentives and their characteristics within a weight loss plan? Although the introduction was designed to create the need for information on the design of a monetary incentive program for diabetic patients who would join a weight loss program, the first objective mentioned was the characterization of the population. I believe that they should be more direct and go to the main objective. Reconsider: we performed a questionnaire study of potential participants with the aim of defining their demographic, social, cultural and health characteristics...

## METHODS

- a) I suggest including a sub-heading to explain the structure of the questionnaire and a summary of how was developed.
- b) Inclusion criteria should be T2D diagnosed by laboratory tests available in the files of the endocrinology clinic and / or the use of antidiabetic drugs, and not only by self-report of the participant
- c) Considering that the program is aimed at overweight and obese patients, why you did not consider a BMI <25 as an exclusion criterion? The perspective of the problem is different in a person of normal weight with respect to an overweight / obese person. How many of the included participants have a normal weight?

## RESULTS

- a) The results describe the demographics and socioeconomic characteristics of the T2D patients commonly seen in the endocrinology clinic, considering that was a convenience sample
- b) Table 2 should include BMI, most recent glucose and HbA1c measurement taken from the hospital files instead of self-reported data
- c) Table 3 shows that 53 participants reported regular exercise as a health control measure attempted, but when the frequency of difficulty of attempt to regular exercise is reported, the total of participants is 34. I observed the same discrepancy, in the reduction of sugar intake (75/65), to quit alcohol (31/29), to reduce fat intake (77/65). In the case of the increase of vegetable intake (57/57) and weight loss (42/42) no discrepancies between the number of participants reporting the behavior and the total of the three categories of difficulty. Please, correct it if it is a mistake.
- d) In table 3 methods are included for weight loss control (3 for each participant). Why to avoid appointments and foot care are included? These methods have not a relationship with weight loss.

## DISCUSSION

The discussion includes 1. How much the intervention (incentives) represent the proportion of personal disposable income (PDI)? 2. Explanation of the answers of participants about the methods of payment, 3. Comparison with other studies regarding the effect of a helper. I recommend:

- a) Re-organize the discussion
- b) Explain the economic utility theory more clearly
- c) Consider including in the discussion important topics below

### 1. Topic 1. Potential implementation

To provide some clues about the implementability, could you include a paragraph mentioning how is the usual care of the diabetic in the hospital and if the endocrinology clinic has a structured program of weight loss? How would monetary incentives be inserted into that program? Who could be the provider of the funds? If you plan to start as a research project?

A Mayo Clinic group proposed a multispecialty outpatient Obesity Treatment Research Program for weight loss to be implemented in the next 5 years that initially will start with research funds<sup>3</sup>.

Future implementation of a monetary incentive strategy for weight loss must consider different elements. Identification of stakeholders and funding is essential. The Reach, Effectiveness, Adoption, Implementation, Maintenance (RE-AIM) Model for the evaluation of the effectiveness of interventions can be a proper framework to estimate the future impact of the incentive program. RE-AIM elements follow a sequence beginning with adoption and reach, followed by implementation and efficacy and finally maintenance. For this, it is important to establish the difference between the weight loss program and the incentive program. Please [find attached](#) a table summarising the possibilities of RE-AIM components being met by the incentives included in the weight-loss program.

### 2. A model of behavioral changes to explain the effect of the intervention

Obesity is a chronic disease that, as hypertension or diabetes, must be treated for life. *The article does not mention the components of the future intervention.* Assuming that the intervention will be guided by current Obesity Clinical Practice Guidelines, lifestyle and behavioral changes (dietary and physical activity) and the use of obesity medications should be included. Behavioral changes are one of the cornerstones of the obesity management.

The Stages of Change Model initially developed based on the experience of smokers who quit, propose that change in behavior occurs continuously through a process with several steps. Each step has a duration: pre-contemplation (6 mo), contemplation (6 mo), determination (1 mo), action (6 mo) and maintenance (6 mo). There are strategies that are more effective for each stage of change, and the goal is to reach the maintenance, the ideal stage of behavior. In the maintenance stage, people have sustained their behavior change (e.g. weight loss) for more than 6 months and intend to maintain the behavior and avoid relapsing. *Monetary incentives for 9 months as is proposed in the article could accelerate the initial steps but do not guarantee maintenance of behavioral changes that effectively let them maintain a healthy weight.* This is related to the



comments about sustainability mentioned above. Please [find attached](#) a figure depicting the Stages of Change Model.

### 3. Obesity as a complex disease

The present article is exploring the possible components of program but fail to mention the complexity of factors involved in the process of implementing this strategy to increase the adherence. The obesity per se is a complex disease with multiple pathways controlling individual feeding behavior. Also, there are physiological adaptations occurring after weight loss such as changes in body composition, hormonal environment, energy expenditure, and control of food intake that predispose to regain the weight loss. The only options showing sustainable results and low food availability and access that have occurred during crisis and famine periods, and the forced modification of gastrointestinal anatomy by bariatric surgery. To offer money to participants to stimulate their adherence need to be tested in the future compared with a group without incentives in a well-designed randomized clinical trial. It is possible that the strategy can be effective for a short time but difficult to maintain.

### CONCLUSION

The conclusion is very direct and only mentions that incentives seem to be a strategy widely accepted by the diabetic population of Lima. This is an excessive generalization considering the sampling and the observations I made in the last paragraph on the background.

Remembering: Participants question the usefulness of the incentives to increase the willingness to participate since 92% of them reported agreeing to participate in a weight loss program without incentives. Also, 19% considered that is not good to receive money for taking care of the own health.

### LIMITATIONS

Based on my previous observations, review the limitations again. I leave it to your discretion to reconsider the need to include some additional aspect.

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**Is the work clearly and accurately presented and does it cite the current literature?**

Yes

**Is the study design appropriate and is the work technically sound?**

Partly

**Are sufficient details of methods and analysis provided to allow replication by others?**

Partly

**If applicable, is the statistical analysis and its interpretation appropriate?**

Yes

**Are all the source data underlying the results available to ensure full reproducibility?**

Yes

**Are the conclusions drawn adequately supported by the results?**

Partly

**Competing Interests:** No competing interests were disclosed.

**Referee Expertise:** Obesity, diabetes prevention, cardiovascular health, cardio-metabolic risk factors, nutrition

**I have read this submission. I believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.**

Author Response 22 Sep 2018

**Harold Akehurst**, Great Western Hospitals NHS Trust, UK

Dear Dr Nieto-Martinez,

Many thanks for taking the time to offer your review of our paper. We have revised the manuscript and hope that we have addressed your concerns. We have revised the references in the introduction largely in accordance with your suggestions. We did not revise refs 5-7 (in the version you reviewed), which are intended to support the assertion that self-management programmes do incorporate lifestyle changes, rather than their efficacy, which is the subject of the preceding sentence. You express very understandable concern that anthropometric and laboratory data are not reported. We agree entirely that these are desirable. Our study did not have access to medical records, and to do so would have required significantly more manpower than could justifiably be expended for a small pilot study (the setting does not benefit from electronic medical records). The decision to restrict to a questionnaire was pragmatic. We have nonetheless elaborated on this limitation in the revised manuscript. Although the absence of independent verification of diabetes disease status does mean that theoretically respondents might not have actually been diabetic, we do consider this unlikely given their recruitment from a diabetes clinic, and that 95% were able to state that they were taking antidiabetic treatment. We are especially grateful for your scrutiny of Table 3, in which there were indeed a number of numerical errors which have been corrected. We have also corrected an error which you noticed in Table 3 about participants suggested methods for health control. You ask specifically about the response "Avoid appointments", which I must confirm is correctly rendered. The logic is the participant's own. You kindly offer three additional topics for discussion, some of which you will find included in the revised manuscript. Your suggestions about the logistics of weight loss interventions, the RE-AIM model, and the holistic management of obesity are clearly critical to the design and evaluation of an intervention such as that planned by our research group. Nevertheless, it is difficult to integrate these issues into a

discussion of the data which our questionnaire study has generated. The discussion section is already as long as the introduction, methods and results combined, and out of concern not to 'bury the lede' we are reluctant to expand it beyond the scope of our exploration of participant preferences. Again, we are very grateful for your kind review.

Yours sincerely, Harold Akehurst

**Competing Interests:** No competing interests were disclosed.

Referee Report 02 July 2018

<https://doi.org/10.21956/wellcomeopenres.15839.r33312>



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The present report deals with a patient survey on potential monetary incentives to increase adherence in future weight loss programs to address type 2 diabetic in poorer section of the population in Peru. To address the topic is thoughtful as well as important and it clearly deserves publication.

Nevertheless, the survey itself leads to no clear solution. On one hand it shows clear results on the missing attractiveness of the deposit-contract scheme and that cash/bank transfer is preferred over vouchers. But on the other hand it offers also important insights into the prejudices towards monetary incentives as well as its potential benefits. Interestingly, the participants themselves addressed the potential short-lived nature of monetary incentives during the weight loss without addressing incentives to maintain weight afterwards. These results, therefore, are ambiguous and not disputed in the discussion section. The discussion and conclusion parts do not sufficiently address major points of the result section. In hindsight the authors might have designed the questionnaire differently, offering more options, possibly also ones that address intrinsic motivation and not only extrinsic motivation, as shown in this report.

### Major points:

#### Ad 2) Study design:

- Anthropometric data of the participants are missing. What was the mean BMI (standard deviation)? As BMI was not an inclusion criterion: How many respondents were in the normal weight, overweight, obese I, II and III range?
- There was a bias in the selection of participants, which was addressed in the discussion section. Apparently those who intended to lose weight agreed more often to participate in the survey as seen by the 94 %age who agreed to the unincentivised weight loss program and the skewed, high percentage of participating women. The selection bias might be unavoidable but means, that the researchers addressed "the converted" in the survey and not those who do not want to lose weight but, nevertheless, might be motivated by the monetary payment. It might also mean, that motivation to participate in a weight loss program might not be achieved by alone by "money for kilos". We miss the dispute on this issue in the discussion part. Is there a way to reach the so far unreachable group and can it be achieved by monetary incentives at all?

- Weight loss is not linear but more at the beginning and less later on. The main weight loss is expected to happen in the first 3 months. Therefore, the rationale for the bi-weekly payment for 1 kg weight loss is not self-explanatory. It might demotivate at the beginning (when more than 1 kg is lost in the 2-week period) and at the end of the program (when weight loss slows down). Participants with higher BMI and more kg of potential meaningful weight loss can “earn” more money than participants in the overweight range, in whom a weight loss of 5-10 kg is adequate and this should be achieved in max. 20 weeks = 5 months according to the suggesting scheme (which is in line with international guidelines). Meaning that it is achieved prior to the program end. Is this motivating? We miss the discussion about these issues in the discussion part.
- Results mention that 85% would participate in an incentivized weight loss program, but even more (92%) responded that they would participate in an UNincentivised weight loss program anyway (page 3, right column, last two lines). This result should be mentioned in the abstract (and discussed in the discussion part).
- Who is going to provide the monetary incentive? Is it realistic that the money will be available in long-term? Also this should be mentioned somewhere in the manuscript.

### Ad 3) Methods – details:

- The main questionnaire is only available in the Spanish language – translation to the English language would be helpful
- The structure of the method section should be improved, for example there should be an extra bullet point for the questionnaire development
- The explanations about the questionnaire are sometimes confusing, maybe an overview/figure about the questioning techniques (direct and fixed increment) and the related issues could be helpful.
- Who conducted the interviews or were parts of the questionnaire completed by the participants themselves?
- Inclusions criteria: Why self-reported T2DM? The recruitment took place in the endocrinology department, so blood values could have been recorded (e.g. HbA1c)
- The body height and body weight was not documented and not asked?

### Ad 6) discussion

The discussion does not address all major results,. E.g. Results mention that 85% would participate in an incentivized weight loss program, but even more (92%) responded that they would participate in an unincentivised weight loss program (page 3, right column, last two lines). 14 participants (19%) further considered that it was not good to receive money for taking care of their own health and one explained that it was like “selling oneself” (page 7, left col, para 2, L3-109). Especially for women, being poor and “selling yourself” implies critical and serious connotations. Surprisingly, only 16 participants thought that payment was a good idea. We think these are rather unexpected and important results, which were not addressed in the discussion part. Furthermore, five participants addressed that payment will achieve only short-term results and this was also not mention in the discussion section. It is opening an important discussion if “payment per kilo” or incremental payment DURING weight loss is indeed a promising solution or if other models might be more promising (payment AFTER achieving weight loss goals or payment (or reduction /or extra money for health care costs) during the maintenance period and on long-term. We miss discussions and critical reflections on these issues in the discussion part.

Also the conclusion is irritating and does not reflect the results.

**Minor comments:**Abstract:

- The exact formulation of objectives is missing.
- Result on the 92% that responded that they would participate in an unincorporated weight loss program (page 3, right column, last two lines) should be added.
- Add “each” between “incentive for” and “1 kg”, otherwise it is unclear if the incentives incremental and paid every 2 weeks and not as one payment after 9 months.
- Conclusion is irritating and does not reflect results (see also above ad 6.)

Introduction:

- First paragraph focusses mainly on sustainability of weight loss, which is not addressed by the survey.
- At the beginning or rather in the rationale, it is initially not clear that the questionnaire deals with financial incentives
- You quoted an interesting systematic review about the financial incentive in treatment of obesity and overweight (John KL, et al., J Gen Intern Med 2011). Which results or conclusions were reached by the review?
- You say social and cultural factors influence the participant’s engagement with weight control, what exactly are the consequences?
- It would also be interesting to know how the T2DM patients are normally cared for in Peru in addition to medical treatment. Are there any dietetic interventions by dietitians? Are there accompanying weight loss programs common? What does basic health insurance cover and what have patients normally pay by themselves?
- Reading the title and the manuscript as a whole, the main aim as to our understanding was to investigate the attractiveness of monetary incentives in weight loss programs, whereas defining the demographic, social, cultural and health characteristics was secondary and only accessory (and therefore rather rough). Therefore, the phrasing of the aims is irritating to us.
- It is unclear if the incentivized weight loss program is intended for research purposes first and for integration in a regular health care program later on OR is it intended for research purposes only OR is it intended to start straight with a regular health care program? Information on this would be helpful.

Results:

- As already mentioned in major comment 1) we miss the BMI/body weight data of the participants.
- Page 4, left col, L4-5: wording “because they thought 9 months was a long time to avoid craving” is unclear
- Table 2: Why weren't the laboratory values taken from the hospital patient records?
- Table 3: it would have been also interesting to know the reason WHY the participants found it difficult to implement the health control measures, if they tried and even if they have not yet tried. We miss this point in the limitation section of the discussion. We also wondered about some answers on the methods for weight loss control. Why are “avoid appointment” and “foot care” listed? A short explanation would be helpful

Discussion:

- See also major point 6. Major issues are not discussed and the conclusion is irritating.
- Page 7, left col, last para: What is meant by “the second method”?

The discussion remains vague, for example it is nice to read about the different theories about behavior change, but where is the link to the results or the conclusion?

**Is the work clearly and accurately presented and does it cite the current literature?**

Yes

**Is the study design appropriate and is the work technically sound?**

Partly

**Are sufficient details of methods and analysis provided to allow replication by others?**

Partly

**If applicable, is the statistical analysis and its interpretation appropriate?**

Yes

**Are all the source data underlying the results available to ensure full reproducibility?**

Yes

**Are the conclusions drawn adequately supported by the results?**

No

**Competing Interests:** No competing interests were disclosed.

**Referee Expertise:** Human Nutrition, Nutrition Assessment, Clinical Nutrition, Nutritional and Metabolic Diseases, Clinical Trials, Malnutrition, Applied Nutrition, Cardiovascular Risk Nutritional Status, Functional Food, Nutrition Therapy, Functional Foods

**We have read this submission. We believe that we have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however we have significant reservations, as outlined above.**

Author Response 22 Sep 2018

**Harold Akehurst**, Great Western Hospitals NHS Trust, UK

Dear Professor Valentini,

Thank you very much for taking the time to offer your helpful report on our paper. We have revised the manuscript and hope that we have addressed your concerns.

You raise a very interesting point about how identical payments at equal intervals with the same target for all participants do not correspond to the non-linearity of weight loss over time, or to the differential weight loss requirements of people with different BMI. I have alluded to this in this revision but held back from a more detailed discussion which I think would exceed the scope of our results, which do not provide much material on which to base such a discussion.

Yours sincerely,  
Harold Akehurst

**Competing Interests:** No competing interests were disclosed.