

1 **A cost-effectiveness analysis of teledietetics in short-, intermediate-, and**  
2 **long-term weight reduction.**

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### **Word Count**

6

Abstract: 206 words

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2 **Abstract**

3 *Objective:* To evaluate the effectiveness of teledietetics in weight loss for 24 weeks and the  
4 cost-effectiveness of weight loss between face-to-face and teledietetics services.

5 *Study setting:* The study was conducted at a community health center and a community  
6 dietetics clinic.

7 *Study design:* The study was a quasiexperimental design.

8 *Methods:* Fifty adults aged 20–50 with a BMI  $\geq$  23 participated in the study. The face-to-face  
9 (FD) group received 12 dietary counseling sessions and recorded their diet in a log book. The  
10 teledietetics (TD) group attended three group nutrition seminars and recorded their diet on a  
11 Web-based platform. Changes in variables were compared using an independent t-test. Direct  
12 and indirect costs were applied to compute cost-effectiveness ratios.

13 *Results:* At week 6, the FD group showed greater reductions in all variables than did the TD  
14 group. At week 12, the effects reversed. At week 24, the accumulated reductions in weight  
15 and fat in the TD group were significantly higher than those in the FD group (all at  $p <$   
16 0.0001). The observed direct costs for 1% weight loss and 1% fat loss were USD 28.24 and  
17 USD17.09, respectively.

18 *Conclusion:* Dietetic service delivered as a teledietetics model is more cost-effective than as  
19 the face-to-face dietetics model in weight reduction.

20 *Keywords:* cost-effectiveness analysis, teledietetics, weight reduction, sustainability, obesity

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1

## 2 **Introduction**

3 In the recent exponential development of Web and Internet applications, the delivery model  
4 of health care services has undergone restructuring [1-3]. Based on evidence-based research  
5 and practice, the emerging dietetics service sector of the health care system is transitioning  
6 from face-to-face consultations to teledietetics, which involves using Web sites and mobile  
7 devices [4-7]. Dietitians can provide dietary consultation and assessment efficiently by using  
8 Internet technology [5]. Dietary records and nutrient analysis can be automated by integrating  
9 the Web and Internet as a communication platform [8]. Such integration promotes patients'  
10 awareness of dietary intake and disease management [9], thus benefiting dietitians by  
11 reducing the time spent on nutrient analysis [8]. In addition, technology-integrated dietetics  
12 services, when designed to provide personalized feedback, promote self-reflection by patients  
13 regarding their eating behaviors [10]. This empowers patients to make better food choices  
14 and reduce portion sizes according to recommended dietary values and, specifically, their  
15 individual nutritional requirements [11].

16

17 Recently, Chung et al. [4] determined that incorporating teledietetics with individual  
18 feedback and self-monitoring functions was effective in reducing weight. Thus, regarding  
19 weight reduction, the technology-driven model in dietetics services is more effective than the

1 common face-to-face model. Although the difference between the effect size of the electronic  
2 dietary recordings' outcome measurements and the food diary was small, electronic dietary  
3 recordings show significant results in body fat reduction, which is the most desirable  
4 indicator of weight reduction [4]. Obesity has been associated with insulin resistance and  
5 considered as the primary factor in the development of metabolic syndrome; therefore,  
6 minimizing body fat is critical [12-13]. Regarding the 6-week intervention and 6-week  
7 observation period in the previous studies, further study is necessary to confirm the effect of  
8 weight reduction or weight maintenance. Therefore, it is of utmost importance to determine  
9 the effectiveness of weight reduction through teledietetics over longer periods, thus  
10 constituting the main goal of the current study.

11

12 Apart from weight loss effect, there are other reasons that may support the adoption of  
13 teledietetics, for instances, clients may save more time in transportation in making  
14 appointments with dietitians and they could have dietary review at anytime and anyplace.  
15 Arguably, if fat reduction, not weight reduction in teledietetics is significantly effective than  
16 current face-to-face dietary consultation, the findings may not strongly support the  
17 implementation of teledietetics. To address this research gap, performing a cost-effectiveness  
18 analysis (CEA) on both dietetics delivery models became the second goal of the current study.  
19 CEA is defined as a systematic process of comparing the efficiency of two or more

1 competing alternatives by accounting for costs and outcomes [14]. CEA is used to allocate  
2 the highest potential interventions to crucial outcomes because of limited health care and  
3 human service resources. Making a decision involving more than one possible intervention is  
4 difficult; hence, accurately predicting the outcomes and costs of all involved options could  
5 facilitate decision making. This study compared current face-to-face dietary practices with  
6 the proposed teledietetics regarding the effects on weight reduction after 6, 12, and 24 weeks.  
7 In addition, this study evaluated the effect of weight loss between these two delivery models  
8 of dietetic services in short, intermediate, and long terms. CEA was conducted to evaluate the  
9 costs and outcomes of each delivery model, thereby facilitating the implementation of  
10 teledietetics.

11

## 12 **Method**

13 This study was conducted at a community health center and a community dietetics clinic in  
14 Hong Kong from January 2013 to February 2014. The study was a quasiexperimental design  
15 in which participants recruited from the community health center were assigned to the dietary  
16 counseling services of the teledietetics model (TD), whereas the participants recruited from  
17 the community dietetics center were assigned to the dietary counseling services of the  
18 commonly adopted face-to-face model (FD). All participants were exposed to 12 weeks  
19 intervention period and 12 weeks observational period. TD group received 6 hours group

1 seminars and dietetic feedback completely through electronic platform while FD group  
2 received one 1-1.5 hours dietetic counseling session every week.

3

#### 4 **Samples and sampling**

5 Fifty adults aged 20–50 years with a body mass index (BMI) of more than 23 were included.

6 The inclusion criteria for BMI of more than 23 was based on the overweight cut-off points

7 defined from the World Health Organization for Asian population [15]. BMI over 23 Adults

8 who were mentally ill, intellectually disabled, undergoing treatment for chronic diseases,

9 pregnant, or currently participating in other weight reduction programs were excluded.

10 Twenty-five participants were recruited from a community health center by using snowball

11 sampling. Clients currently attending the community health center were given a recruitment

12 notice and an e-mail message. The clients were instructed to refer their family members,

13 friends, or colleagues who met the inclusion criteria and wished to reduce body weight by

14 seeking dietetics counseling services, to the clinic. The interested participants were registered

15 by telephonic confirmation. When the number of participants reached 25, participant

16 recruitment to the teledietetics model ceased accordingly. The recruitment method was

17 applied to the community dietetics clinic and the interested participants registered to join

18 the project were assigned to the dietetics counseling services for the face-to-face model. The

19 community health center was designated to provide teledietetics services, and the community

1 dietetics center was designated to provide face-to-face dietetics services. This was because  
2 the teledietetics model was new and thus required dieticians who were trained by the research  
3 team to apply it in the community, whereas the face-to-face dietetics model was commonly  
4 adopted in practice, and it was expected that dieticians working at their clinics would be  
5 familiar with this face-to-face dietetics model.

6

## 7 **Procedure**

8         The study proposal, protocol, and administered questionnaires were approved by the  
9 Human Research Ethics Committee of the Hong Kong Institute of Education. All of the  
10 participants were given an information sheet describing the purpose, system of group  
11 allocation, and period of the study. The participants were asked to sign a consent form before  
12 the study commenced, and were then asked to complete a demographic questionnaire. A  
13 researcher measured the height, weight, and fat percentage of each participant before the  
14 study and recorded them as the baseline data (Week 0). The same researcher measured these  
15 physical measurements again at Weeks 6, 12, and 24. Body weight was measured with a  
16 standing scale Tanita BC-418 (Tanita Corporation, Japan) and measured to the nearest 0.1  
17 kilogramme (kg). Body height was measured with a Seca stadiometer 213 (Vogel & Halke,  
18 Germany) and was measured to the nearest centimeters (cm). Fat percentage was measured  
19 by the Tanita BC-418 bioelectrical impedance analyser (Tanita Corporation, Japan) and

1 the fat mass was measured to the nearest 0.1 kilogramme (kg). Participants were requested to  
2 stand on the stadiometer with heads positioned horizontally when the trained research  
3 assistant measuring their body height. Participants were then requested to stand on the  
4 bioelectrical impedance analyser in barefoot for measuring fat percentage and body weight.  
5 The same stadiometer and bioelectrical impedance analyser were used in all participants in  
6 both face-to-face dietetics group and teledietetics group. Same trained research assistant was  
7 responsible to measure the body height, body weight and fat percentage for participants in  
8 each group.

9

10

#### 11 *Face-to-face dietetics group*

12 Participants allocated to the face-to-face group received once a week face-to-face dietary  
13 counseling services in consecutive 12 weeks, which were provided at the dietary clinic. The  
14 dietitian provided the services on a one-on-one basis as is common in private dietetics  
15 services. Each dietary counseling session lasted for 1 to 1.5 hour. Exact time spending on  
16 each dietary counseling session for each participant was recorded. During the 12 sessions of  
17 dietary counseling, the dietitian calculated the metabolic requirement for each participant  
18 based on their body height, body weight, sex, occupation and hysical activity level. With the  
19 metabolic requirement, the dietitian designed a daily dietary plan for each participant. The



1 dietitian also questioned the participants about their daily life and regime to identify problem  
2 areas. Advice on food choices, cooking methods, shopping tips, meal planning, and exercise  
3 was offered to the participants. The participants were asked to record their diet intake in a log  
4 book, which facilitated diet review in the next dietary counseling session. Details of food  
5 intake recorded by the participants included food items, amount of each food item consumed  
6 and any condiments or sauce added to the food items. These dietary records served were  
7 reviewed by the dietitian but the food items were not analyzed in nutrients and calories.  
8 Considering the food history of the participants, the dietitians addressed their dietary  
9 problems and recommended dietary modifications based on weight reduction goals. The  
10 dietetics counseling sessions were conducted once a week for 12 weeks. Each session lasted  
11 for approximately 1 h, and the total number of hours the dietitians spent in the 12 sessions  
12 was recorded for each participant by the dietitians and included in the CEA analysis. The  
13 number of hours the participants spent in recording the dietary records was not included in  
14 the CEA analysis as the study was to compare if there was cost saving from the  
15 implementation of teledietetics.

16

### 17 *Teledietetics group*

18 A new model of dietetics counseling was suggested by the research team. The participants  
19 allocated to the teledietetics group attended three seminars on nutrition education as part of a  
20 group nutrition education program. The seminars were 2 hours each and they were held in the

1 week 1, week 2 and week 3. The total hours conducted for the seminars were 6 in this TD  
2 group. The seminars covered the same topics as those administered in the face-to-face  
3 dietetics model, except for the specific, identified areas of lifestyle and diet. Because clear  
4 understanding on healthy eating and exercise was encouraged, seminars were conducted by a  
5 dietitian in live lectures. This allowed the participants having chance to question and the  
6 dietitian having chance to answer their queries. The participants were asked to start recording  
7 their dietary intake on an electronic Web-based platform [11,16] at the first week. The  
8 electronic platform was programmed to calculate basal metabolic rate and energy  
9 requirements once the demographic data of the participants were input. The daily input of  
10 dietary records was analyzed by the dietitians, and the data were compiled as an energy  
11 balance report and a nutrient balance report online. Discrepancies between the daily food  
12 intake values and the recommended values were identified and commented on for the  
13 participants' self-reflection. The participants were asked to modify their food choices and  
14 portion sizes according to the recommendations on the feedback reports. The participants  
15 were requested to input their daily dietary intake and review their diet from week 1 to week  
16 12. This intervention period of teledietetics group was the same as the face-to-face  
17 counselling period with the dietitians in the face-to-face dietetics group. In the teledietetics  
18 group, the number of hours the dietitians spent on conducting the group nutrition education  
19 seminar and the time they spent on the nutrient analysis of the food-intake recorded by each  
20 participant were documented as direct costs for CEA analysis. Similar to the face-to-face  
21 dietetics group, the time the participants spent on recording their dietary intake was not  
22 included in the CEA analysis.

23

## 24 **Data Analysis**

25 Descriptive statistics regarding age and baseline physical measurements were computed for

1 the participants in both groups. An independent t-test was used to determine whether the  
2 characteristics of the participants in both groups were significantly different. Changes in body  
3 weight and fat mass at weeks 6, 12, and 24 were calculated by subtracting the values from the  
4 corresponding baseline measurements (week 0). These changes in variables were compared  
5 using the independent t-test. The same statistical analysis was conducted with the changes in  
6 the percentage of the variables because they reflected the extent of weight or fat loss with  
7 reference to their original measurements. Significant level was set at  $p < 0.05$ . Direct and  
8 indirect costs of the two delivery models were used to perform the CEA regarding  
9 cost-effectiveness ratios. Direct costs included the hours spent by the dietitians in conducting  
10 nutrition seminars and nutrient analysis in TD group and the hours spent by the dietitians in  
11 conducting face-to-face counselling with each private session and evaluating the the  
12 participants' dietary records in FD group. Direct costs also included the computing hardware  
13 and software costs involved in the implementation of teledietetics model. Since other  
14 overhead costs such as rent, tax, administrative salaries, legal and accounting expenses were  
15 the same in both groups, these costs were excluded in the CEA analysis. Unlike other  
16 countries, Hong Kong is a very small city and the public transportation network is well  
17 developed. Most of the participants could attend the community centre or clinic from their  
18 living or working places within 30 minutes, therefore, the travelling costs were not included  
19 in the CEA analysis.

20

1 Apart from the cost-effectiveness ratios, incremental cost-effectiveness ratios (ICER) were  
2 also calculated to provide a practical comparison in the change of costs to incremental effects  
3 of an intervention (TD group in this study). The formula of  $ICER = (C1 - C2) / (E1 - E2)$  was  
4 applied. C1 and E1 were the cost and effect in the TD group respectively and where C2 and  
5 E2 were the cost and effect in the FD group respectively. ICER was best described the  
6 implications of intervention at different stages. Since ICER was defined as the ratio of costs  
7 per measured effect, the lower the ICER ratio, the better the stage of the intervention in a  
8 defined effect.

9

## 10 **Results**

11 Table 1 lists the age and baseline physical measurements. The mean age of FD group was  
12 higher than that of TD group ( $p > 0.05$ ) while the body height, body weight, BMI and fat mass  
13 of TD group were higher than those of FD group ( $p > 0.05$ ). At a confidence level of 0.05, no  
14 statistically significant difference was found in the age, height, weight, or BMI of the  
15 participants. However, the body fat of the participants in the TD group was determined to be  
16 significantly higher than that of the participants in the FD group ( $P < 0.05$ ). During the study  
17 period, one subject from the FD group was found to be pregnant and could not continue with  
18 the rest of the study. Therefore, the final number of participants remaining for statistical  
19 analyses was 24 in the FD group. As all participants in the TD group completed the 24 weeks  
20 study period, the number of participants was 25.

21

### 22 *Effects of weight and fat loss*

23 Regarding the weight loss results at Weeks 6, 12, and 24, Table 2 lists the comparisons of  
24 both the weight and fat loss from the baseline to the respective period. It was found that body  
25 weight reduction in the FD group was higher than that of the TD group from the baseline to

1 Week 6. The percentage change in the first 6 weeks in the FD group was significantly higher  
2 than in the TD group ( $P = 0.037$ ). For fat reduction and the relative percentage change in the  
3 first 6 weeks, the results of the FD group were no different from those of the TD group. When  
4 the study progressed to Week 12, the effects of weight and fat reduction were reversed.  
5 Reduction in body weight, fat loss, percentages of weight change and fat change from the  
6 baseline to Week 12 were higher in the TD group than in the FD group, although the  
7 differences were not statistically significant. However, when the study progressed to Week 24,  
8 the accumulated weight reduction in the TD group was significantly higher than in the FD  
9 group ( $P < 0.0001$ ); so was the relative percentage change in body weight ( $P < 0.0001$ ).  
10 Similarly, the accumulated fat loss in the TD group was more than that in the FD group ( $P <$   
11  $0.0001$ ), as was the relative percentage change in body fat ( $P < 0.0001$ ).

12

### 13 *Cost-effectiveness ratios*

14 Hours spent by the dietitians in consultation and dietary evaluation on each arm are listed in  
15 Table 3. The accumulated hours spent by the TD group were more than those of the FD group  
16 because daily dietary evaluations were required for the dietitians to give online individualized  
17 feedback to the participants of TD group while daily dietary evaluation were given weekly to  
18 the participants of FD group during the dietary counselling sessions. In TD group, general  
19 nutrition education in group-based sessions was conducted for the new teledietetics model to  
20 save time in nutrition education. However, the teledietetics model required a one-line budget  
21 for server setup, software licenses, and system development. This indirect cost was  
22 documented as USD 4,148.43 for the TD group.

23

24 The direct costs of both groups were calculated by multiplying the hourly rates by the total  
25 hours spent in each group. In addition to this, the TD group required technical support in

1 granting access rights, trouble-shooting the software, and system administration. Separate  
2 costs per patient were calculated by combining the direct and indirect costs. This provided  
3 clear comparisons of the costs involved at the first startup of the teledietetics model and in the  
4 long run when the hardware and software costs would lessen by virtue of being distributed  
5 evenly over the years (Table 3).

6  
7 In comparing the effects of direct and indirect costs, at weeks 6 and 12 the total cost per 1 kg  
8 of weight loss and the total cost per 1% initial weight loss in the FD group were lower than  
9 those in the TD group. This situation started to reverse when the study progressed to 24  
10 weeks; the total cost per observed 1 kg of weight loss and the total cost per 1% initial weight  
11 loss in the TD group were marginally lower than those in the FD group (Table 3). If only  
12 direct costs were used for effect comparisons, similar results as those with direct and indirect  
13 costs were found, but the total cost per observed 1 kg of weight loss and the total cost per 1%  
14 initial weight loss in the TD group were much lower than those in the FD group. When fat  
15 loss effect was compared, the total (direct and indirect) costs per observed 1kg fat loss and  
16 the total (direct and indirect) costs of 1% initial fat loss favored the FD group at weeks 6 and  
17 12. But the direct and indirect costs per observed 1 kg fat loss were lower in TD group at  
18 week 24 while these costs per 1% initial fat loss in TD group at week 24 were still higher  
19 than those in FD group. When comparing the fat loss effect with direct costs only, the direct  
20 costs of observed 1kg fat loss in TD group were lower than those in FD group as early as at  
21 week 12 while the direct costs per 1% initial fat loss of TD group started to get lower at week  
22 24 (Table 3).

23  
24 *Incremental cost-effectiveness ratio*

25 ICER on weight loss and fat loss of TD group at week 6, week 12 and week 24 were

1 described in Table 4. Regarding to weight loss effect, ICER was found negative at week 6  
2 which indicated FD group had better effect than the TD group. ICER then decreased from  
3 week 6, to week 12 and to a larger extent at week 24. Regarding to fat loss, ICER was also  
4 found negative at week 6, however, the decrease of ICER decreased drastically from week 6  
5 to week 12 and decrease further to week 24. ICER was found the lowest at week 24, in  
6 weight loss effect, as well as in fat loss effect.

7

## 8 **Discussion**

9 Because improved nutritional support is increasingly available to in- and outpatients,  
10 countries such as the United States, the United Kingdom, and Australia are requiring dietetics  
11 workforces to provide cost-effective dietetics services. Technological applications are  
12 exhibiting an upward trend in health services and could possibly be an option in health care  
13 reform. The concept of teledietetics is not about replacing dietitians' expertise but about  
14 optimizing the use of professional time to provide services to as many patients in the  
15 community as possible. Regarding dietary assessment, Web-based platforms and mobile  
16 devices are equipped with additional innovative features that conventional instruments cannot  
17 offer. Group nutrition education provides general nutrition knowledge necessary for  
18 facilitating change in eating behaviors. However, such knowledge cannot be transformed into  
19 desirable change without feedback and reflection. Food preferences and exercise choices are  
20 highly individualized, and inculcating healthy eating and exercise habits can be complex,  
21 because doing so entails determining a balance between a healthy lifestyle and personal

1 interests. Thus, people must acquire the skill of matching energy input with output by  
2 consuming calories sufficient for body growth maintenance, and exercise, in addition to  
3 modulating food groups to obtain all necessary nutrients. In a conventional face-to-face  
4 dietetics consultations, dietetics comments or feedback are based on dietary logbooks.  
5 Dietitians review food-intake records and advise patients on their eating problems. The main  
6 task of dietitians is to discuss diets with patients, with healthy food choices and proper  
7 portion sizes being mutually agreed on for the next plan of action. The time spent by the  
8 dietitians is suggested to shift from nutrition education to dietary feedback because nutrition  
9 education included basic nutrition facts which could be conducted in a group of participants.  
10 However, individual eating problem varies one another and the participants require dietary  
11 analysis for self-reflection in their dietary feedback.

12

13 Equipping people with the aforementioned skills cannot be achieved through one-way  
14 education. Therefore, it is critical that behavioral feedback of self-monitoring be a component  
15 of any healthy eating and exercise program to allow education and practice to be linked to  
16 self-reflection. The main goal of the self-monitoring and dietary assessment process is to  
17 supplement education by providing two-way evaluative feedback that assists people in  
18 making informed food and exercise decisions. This is another reason to introduce the concept  
19 of teledietetics. Using an electronic dietary recording system in conjunction with tailor-made



1 feedback, online reports, and self-monitoring leads to improved eating and exercise behavior.

2

3 The results of this study indicated that face-to-face dietetics services offer superior effects  
4 and cost-effectiveness ratios in short-term weight reduction. This could be the result of the  
5 intensive weekly consultation sessions with the dietitians. However, this effect was found to  
6 have disappeared at Week 12, immediately after the completion of the intensive weekly  
7 consultation provided by the dietitians in 12 consecutive weeks. As the cost-effectiveness  
8 ratios show, the TD group with the teledietetics model was more cost-effective when the costs  
9 considered were only the direct costs. This indicated that if the dietetics services were  
10 delivered with technical support, the cost effects could outweigh those of using the intensive  
11 face-to-face approach.

12

13 Sustainability of weight loss is critical because many overweight and obese patients regain  
14 weight after achieving some extent of weight reduction. Weight regain may discourage obese  
15 patients from continuing their self-monitoring. Weight regain may also adversely affect obese  
16 patients by causing them to lose confidence in future attempts at losing weight. Therefore, an  
17 intervention test of sustainability is highly desirable to confirm a behavioral change in weight  
18 management. Based on the results of this study, the effects of weight reduction and fat loss  
19 were significantly higher in the TD group than in the FD group, demonstrating that long-term

1 weight reduction could be maintained in both groups. However, the effects of teledietetics  
2 were improved even 12 weeks after the dietetics services were provided. This implies that the  
3 participants in the TD group may reflect more on their dietary reports and attempted to  
4 modify their food choices and portion intake to fit those of the suggested healthy eating  
5 principle. This 12-week trial-and-error training was adequately long for the participants to  
6 incorporate healthy eating habits into their own diet; therefore, they showed improved weight  
7 reduction at Week 12.

8

9 Another relevant finding of this study was the lower cost-effectiveness ratios in the  
10 teledietetics model compared with the face-to-face dietetics model in long-term weight  
11 reduction. By implementing the teledietetics model on a large scale, the costs of hardware  
12 and software could be minimized in mass usage. Health care organizations could benefit from  
13 the cost effectiveness if the cost of 1% initial weight loss were USD28.24 and the cost of 1%  
14 initial fat loss were USD 17.09. This new dietetics model may allow more patients to receive  
15 dietitian services with limited manpower and resources. With a long term achievement in  
16 weight loss and its maintenance, eating behaviour must be reflected and practiced during the  
17 intervention and online reports in the dietary recording and self-monitoring process  
18 reinforced such reflection and action. The findings from the incremental cost-effectiveness  
19 ratio supported the implementation of teledietetics model for weight and fat loss during the

1 observation period.

2

### 3 **Limitation and future research**

4 This study evaluated the effect of teledietetics in 24 weeks which may not be long enough to  
5 confirm sustainability in weight loss. However, the observation period in 12 weeks with no  
6 intervention showed positive results in participants' self-monitoring and reflective learning in  
7 eating modification. The significant weight loss in TD group did provide evidence in the  
8 dietary modification after self-reflection in online dietary review. One caution should be  
9 taken that the participant recruitment and group assignment were not in random and this may  
10 cause sampling bias. Also, the comparisons of the teledietetic model and the face-to-face  
11 dietetic model here were based on the model implementation design that the exposures of  
12 dietetic time in the two models were different. However, the CEA analysis in 24 weeks in this  
13 study also supported the feasibility in teledietetic services implementation. The findings laid  
14 useful foundation in teledietetic research of weight loss maintenance in period over a year.

15

### 16 **Conclusion**

17 The face-to-face dietetics model is more cost-effective than the teledietetics model in  
18 short-term weight reduction. However, the teledietetics model is more cost-effective in the  
19 long-term weight reduction.

20

21

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Table 1: Comparison of age and physical measurements of participants in each group at baseline.

Physical measurements	<i>Face-to-face dietetic group (n=25)</i>		<i>Tele-dietetic group (n=25)</i>	
	Mean	s.d.	Mean	s.d.
age	34	8.9	32	12.9
Body height (cm)	159.9	7.16	162.7	8.10
Body weight (kg)	69.1	13.24	73.7	13.73
BMI	26.8	3.01	28.3	4.90
<sup>†</sup> Fat mass (kg)	22.7	5.15	28.6	12.04

BMI: body mass index; fat mass=body weight x fat%;

<sup>†</sup>t-test indicated significant difference between groups at  $\alpha=0.05$ .

**Table 2: t-test results on weight loss and fat mass loss between two groups at week 6, week 12 and week 24.**

Physical parameters	†Change at week 6			‡Change at week 12			#Change at week 24		
	Face-to-face dietetic group (n=24)	Tele-dietetic group (n=25)	p-value	Face-to-face dietetic group (n=22)	Tele-dietetic group (n=25)	p-value	Face-to-face dietetic group (n=24)	Tele-dietetic group (n=25)	p-value
Weight loss (kg)	-3.0	-2.00	0.064	-4.5	-5.1	0.497	-4.7	-10.8	<0.0001
*% change	-4.42	-2.59	0.037	-6.56	-6.94	0.790	-6.74	-14.96	<0.0001
Fat loss (kg)	-1.99	-1.73	0.67	-2.38	-3.97	0.118	-3.02	-7.79	0.001
#% change	-8.10	-5.12	0.138	-10.31	-12.19	0.546	-12.64	-24.72	0.001

† change =body weight (or fat mass) at week 6 - body weight (or fat mass) at baseline;

‡ change =body weight (or fat mass) at week 12 - body weight (or fat mass) at baseline;

# change =body weight (or fat mass) at week 24 - body weight (or fat mass) at baseline;

\*% change = (difference in body weight/body weight at baseline) x 100; # % change = (difference in fat mass/fat mass at baseline)

**Table 3: Costs, effects and cost-effectiveness ratios for weight loss dietary counselling alternatives.**

	Face-to-face dietetic group (n=24)			Tele-dietetic group (n=25)		
Week	6	12	24	6	12	24
<b>Accumulated hours spent</b>						
consultation hours	144	288	288	6	6	6
Dietary record evaluation	36	72	72	375	562.5	562.5
Sub-total	180	360	360	381	568.5	568.5
<b>Indirect Costs (USD)</b>						
Cost of server	NA	NA	NA	1,174.81	1,174.81	1,174.81
Cost of software	NA	NA	NA	660.00	660.00	660.00
Cost of system programming	NA	NA	NA	2313.62	2313.62	2313.62
Sub-total	0	0	0	4,148.43	4,148.43	4,148.43
<b>Accumulated Direct Costs (USD)</b>						
Total cost of dietitians	18.05 per hour x 180 = 3,249.00	18.05 per hour x 360 = 6,498.00	18.05 per hour x 360 = 6,498.00	18.05 per hour x 381 = 6,877.05	18.05 per hour x 568.5 =10,261.43	18.05 per hour x 568.5 =10,261.43
Cost of IT support	NA	NA	NA	150.00	300.00	300.00
Sub-total	3,249.00	6,498.00	6,498.00	7,027.05	10,561.43	10,561.43
Accumulated total Costs (direct costs & indirect costs)	3,249.00	6,498.00	6,498.00	11,175.48	14,709.86	14,709.86
Accumulated total Costs/Patient (excluding indirect costs)	135.38	270.75	270.75	281.08	422.46	422.46



Accumulated total	135.38	270.75	270.75	447.02	588.39	588.39
Costs/Patient (including direct and indirect costs)						
<b>Effects</b>						
Observed weight loss (kg)	3.0	4.5	4.7	2.0	5.1	10.8
% loss of initial body weight	4.42	6.56	6.74	2.59	6.94	14.96
Observed fat percentage reduced (%)	1.99	2.38	3.02	1.73	3.97	7.79
% reduced of initial fat percentage	8.10	10.31	12.64	5.12	12.19	24.72
<b>Cost-Effectiveness Ratios(Direct &amp; Indirect Costs) (USD)</b>						
Cost/Observed 1kg weight loss	45.13	60.17	57.61	223.51	115.37	54.48
Cost/1% initial weight loss	30.63	41.27	40.17	172.59	84.78	39.33
Cost/observed 1kg fat loss	68.03	113.76	89.65	258.39	148.21	75.53
Cost/1% initial fat loss	16.71	26.26	21.42	87.31	48.27	23.80
<b>Cost-Effectiveness Ratios (Direct Costs only) (USD)</b>						
Cost/Observed 1kg weight loss	45.13	60.17	57.61	140.54	82.84	39.17
Cost/1% initial weight loss	30.63	41.27	40.17	108.53	60.87	28.24
Cost/observed 1kg fat loss	68.03	113.76	89.65	162.47	106.41	54.23
Cost/1% initial fat loss	16.71	26.26	21.42	54.90	34.66	17.09

Table 4: Summaries of ICER on weight loss and fat loss across the study period.

<b>ICER</b>	<b>Weight loss (US\$.kg<sup>-1</sup>)</b>	<b>Fat loss (US\$.kg<sup>-1</sup>)</b>
<b>6 weeks</b>	-145.70	-560.38
<b>12 weeks</b>	252.85	95.42
<b>24 weeks</b>	24.87	31.81

ICER: incremental cost-effectiveness ratio;

ICER= (C1 – C2) / (E1 – E2) where C1 and E1 are the cost and effect in the TD group and where C2 and E2 are the cost and effect in the FD group;

Direct costs and indirect costs were used for ICER calculation.

1 *Global J Health Educ Promot* **2009**;12:123-134.