

ORIGINAL ARTICLE

Cost of intervention delivery in a lifestyle weight loss trial in type 2 diabetes: results from the Look AHEAD clinical trial

J. Rushing¹, R. Wing², T. A. Wadden³, W. C. Knowler⁴, M. Lawlor⁵, M. Evans⁶, T. Killean^{7,8}, M. Montez⁹, M. A. Espeland¹, P. Zhang¹⁰ and The Look AHEAD Research Group[†]

¹Department of Biostatistical Sciences, Wake Forest School of Medicine, Winston-Salem, NC, USA; ²Weight Control and Diabetes Research Center, Brown Medical School/The Miriam Hospital, Providence, RI, USA; ³Center for Weight and Eating Disorders, University of Pennsylvania, Philadelphia, PA, USA; ⁴Diabetes Epidemiology and Clinical Research Section, National Institute of Diabetes and Digestive and Kidney Diseases, Phoenix, AZ, USA; ⁵Department of Economics, Wake Forest University, Winston-Salem, NC, USA; ⁶National Institute of Diabetes and Digestive and Kidney Diseases, Bethesda, MD, USA; ⁷Southwest American Indian Center, National Institute of Diabetes and Digestive and Kidney Diseases, Phoenix, AZ, USA; ⁸Southwest American Indian Center, National Institute of Diabetes and Digestive and Kidney Diseases, Shiprock, NM, USA; ⁹University of Texas Health Science Center at San Antonio, San Antonio, TX, USA; ¹⁰DDT Health Economics Workgroup, Centers for Disease Control and Prevention, Atlanta, GA, USA;

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Address for correspondence: JT Rushing, Department of Biostatistical Sciences, Wake Forest Baptist Medical Center, Medical Center Boulevard, Winston-Salem, NC 27157. E-mail: jrushing@wakehealth.edu

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[†]Julia T. Rushing, MS; John P. Bantle, MD; George A. Bray, MD; Lawrence Cheskin, MD; Jeanne M. Clark, MD, MPH; Mace Coday, PhD; Gareth Dutton, PhD; Caitlin Egan, MS; Mark A. Espeland, PhD; Mary Evans, PhD; John P. Foreyt, PhD; Dana P. Goldman, PhD; Valerie Goldman, MS, RD; Frank L. Greenway, MD; Edward W. Gregg, PhD; Helen P. Hazuda, PhD; James O. Hill, PhD; Edward S. Horton, MD; John M. Jakicic, PhD; Robert W. Jeffery, PhD; Karen C. Johnson, MD,

Summary

Objective

The Action for Health in Diabetes (Look AHEAD) trial was a randomized controlled clinical trial to compare the effects of 10 years of intensive lifestyle intervention (ILI) with a control condition of diabetes support and education (DSE) on health outcomes in over 5,000 participants with type 2 diabetes. The ILI had significantly greater weight losses than DSE throughout the trial. The goal of this analysis is to describe the cost of delivering the intervention.

Methods

The ILI was designed to promote weight loss and increase physical activity. It involved a combination of group plus individual intervention sessions, with decreasing frequency of contact over the 10 years. The intervention incorporated a variety of strategies, including meal replacement products, to improve weight loss outcomes. The costs of intervention delivery were derived from staff surveys of effort and from records of intervention materials from the 16 US academic clinical trial sites. Costs were calculated from the payer perspective and presented in 2012 dollars.

Results

During the first year, when intervention delivery was most intensive, the annual cost of intervention delivery, averaged (standard deviation) across clinical sites, was \$2,864.6 (\$513.3) per ILI participant compared with \$202.4 (\$76.6) per DSE participant. As intervention intensity declined, costs decreased, such that from years 5 to 9 of the trial, the annual cost of intervention was \$1,119.8 (\$227.7) per ILI participant and \$102.9 (\$33.0) per DSE participant. Staffing accounted for the majority of costs throughout the trial, with meal replacements and materials to promote adherence accounting for smaller shares.

Conclusions

The sustained weight losses produced by the Look AHEAD intervention were supported by intervention costs that were within the range of other weight loss programmes. Future work will include an evaluation of the cost-effectiveness of the ILI and will contain additional follow-up data.

MPH; Steven E. Kahn, MB, ChB; Tina Killean, BS; Mary Korytkowski, MD; Anne Kure, BS; William C. Knowler, MD, DrPH; Michael S. Lawlor, PhD; Cora E. Lewis, MD, MSPH; Barbara J. Maschak-Carey, MSN, CDE; Sara Michaels, MD; Maria G. Montez, RN, MSHP, CDE; David M. Nathan, MD; Jennifer Patricio, MS; Anne Peters, MD; Xavier Pi-Sunyer, MD; Henry Pownall, PhD; Helmut Steinburg, MD; Thomas A. Wadden, PhD; Rena R. Wing, PhD; Holly Wyatt, MD; Ping Zhang, PhD.

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Introduction

Recent clinical trials have shown that lifestyle interventions using behavioural counseling to induce weight loss and increase physical activity can have important health benefits (1,2). The Diabetes Prevention Program (DPP), e.g. lifestyle intervention, reduced the risk of developing diabetes by 58% compared with a placebo intervention (3). In Look AHEAD, intensive lifestyle intervention (ILI) did not reduce cardiovascular morbidity and mortality in persons who were overweight or obese with type 2 diabetes (4), but it produced improvements in sleep apnea, incontinence and erectile dysfunction, reduced the incidence of high-risk kidney disease and resulted in better long-term diabetes control and some remission of diabetes, as well as fewer hospitalizations, compared with the control group (5–10). An important concern often raised (11) is that these interventions are costly to provide: data are needed on the costs involved in offering different types of weight loss programmes. Such information will serve as the basis for cost-effectiveness analyses that will inform decisions about the types of lifestyle interventions that should be offered in clinical and public health approaches to obesity.

The cost of offering weight loss programmes is highly variable. A recent review of commercial programmes provided information about monthly costs of programmes for participants (12). Whereas participation in self-directed programmes may be free or cost less than \$20 per month, weight loss programmes that include counseling, meal replacement products and medical monitoring cost \$400–\$700 per month. Similarly, although the lifestyle intervention provided in the DPP study was estimated (in year 2000 dollars) to cost \$1,399 in year 1 (\$162 per month) (13), the DPP has been translated into community-based programmes (e.g. YMCA) that typically last 1 year and cost \$400 to \$600 per participant (or \$33–\$60 per month) (14). Clearly, the variability in these costs relates to the intensity of the programme (i.e. the number of sessions and whether they are offered in groups or individually), the type of staff used to deliver

the programme (e.g. peers, nutritionists and physicians) and whether food products are provided. Costs also vary depending on what is included in the cost calculations. Some estimates focus on costs assessed from the perspective of the payer (which include labor costs and may or may not also include costs for renting space and for intervention materials). Other estimates target societal costs, which include both costs from the perspective of the payer and costs from the participant perspective (such as costs for the time spent in intervention sessions, time spent exercising and/or travel time). Costs of commercial programmes to the participant also include a profit margin to sustain the business model.

This paper presents an analysis of the costs involved in delivering the lifestyle intervention in Look AHEAD (15), a large multicentre clinical trial with an intensive weight loss and exercise intervention. The costs of delivering the ILI and its control conditions from the payer perspective are described. Costs associated with staffing group and individual sessions, providing intervention materials and supplying meal replacement products are differentiated. Methodological issues involved in estimating direct costs, especially costs related to space for conducting these interventions, are also discussed.

Research design and methods

Look AHEAD was a multicentre, randomized controlled trial in individuals who were overweight or obese with type 2 diabetes that evaluated the effect of an ILI focused on weight loss and physical activity relative to a control condition. The primary outcome was incidence of major cardiovascular events (4). Secondary outcomes included many other markers of health (15). To be eligible for enrollment, participants were aged 45–76 years, with a body mass index of at least 25 kg m^{-2} (27 kg m^{-2} if using insulin), $\text{HbA}_{1c} < 11\%$, systolic blood pressure $< 160 \text{ mmHg}$, diastolic blood pressure $< 100 \text{ mmHg}$ and triglycerides $< 600 \text{ mg dL}^{-1}$ (15). They underwent a maximal graded exercise test (to ensure that exercise could be safely prescribed) and completed 2 weeks of monitoring food

intake and physical activity. They were then randomly assigned, with equal probability, to either the ILI or the control condition, referred to as diabetes support and education (DSE).

Participants were enrolled between 2001 and 2004. All informed consent procedures were approved by local Institutional Review Boards, and the consent forms were signed by the participants. The trial was registered at ClinicalTrials.gov Identifier: NCT00017953. The interventions continued through September 2012. Detailed descriptions of both the ILI and DSE interventions have been published elsewhere (16,17). A brief synopsis follows.

Intensive lifestyle intervention

The ILI was designed to achieve and sustain an average loss of 7% or more of initial weight, primarily through an intensive regimen including diet modification and increased physical activity (16). During the first 6 months of ILI, participants attended three group meetings and one individual session per month. For the remainder of the first year, participants were provided two groups and one individual meeting per month. In months 13–48, participants attended monthly individual meetings that were followed approximately 14 days later with phone calls or e-mails from interventionists. Optional monthly group meetings were also offered during these latter years.

The intervention sessions were typically led by registered dietitians (RDs) or exercise specialists. Individual sessions were planned to last about 30 min and usually were provided by a single interventionist. Group classes were often conducted by two or more staff members who might include a lifestyle interventionist and a research assistant or a combination of an RD and an exercise specialist. These sessions were scheduled for 60–90 min and were offered at several different times (day and evening sessions) to accommodate participants' schedules. Depending on the site, group classes varied from fewer than 10 participants to up to 20 members.

The ILI participants were asked to keep daily records of their food intake and physical activity. They were also instructed to attempt to reach behaviour and activity goals (described next) and turn in their diary records to the intervention staff at scheduled meetings. Intervention staff provided individualized feedback. The dietary goal of ILI participants included a calorie and fat gram prescription and use of meal replacement products to help participants adhere to their calorie goals. Goals were individualized on the basis of body weight. During the first 4 months, participants were provided servings of liquid meal replacement (e.g. Slim Fast, HMR, OPTIFAST and

Ensure) to replace two meals and one snack per day. The physical activity component of the ILI consisted mostly of home-based exercises with a goal of 175 min of moderate-intensity physical activity per week. Lifestyle strategies were provided to facilitate adherence to diet and activity goals. Beginning in month 7, a 'toolbox' algorithm was implemented: participants who had not lost 5% of initial weight in the first 6 months were offered more advanced behavioural strategies or the optional use of a weight loss medication (orlistat) (16).

Diabetes support and education

The DSE intervention was designed to retain participants in the trial and consisted of educational sessions focused on diet, physical activity and social support (17). Four meetings were offered in year 1, three per year in years 2–4 and one meeting per year thereafter. Attendance at these meetings was optional. Each meeting lasted 90–120 min and was typically taught by a team that might include an RD, an exercise specialist, and a nurse educator or behaviour therapist. Different team members attended different sessions, on the basis of the topics covered. Each session was offered at several different times (daytime and evenings) to accommodate participants' schedules.

Assessment of costs involved in intensive lifestyle intervention and diabetes support and education delivery

The data used to estimate personnel costs came from two sources: (i) salary data from sites (year 2007) and (ii) periodic surveys of sites (see Appendix 1 for further details on timing of surveys and Appendix 2 for common staffing types). The year 2007 was used as a benchmark because it was the midpoint of intervention delivery from 2001 to 2012. The survey queried the number of specific types of staff members at the centre (e.g. the number of RDs), the percent of individual or group lifestyle sessions that were conducted by this type of staff member (by an RD) and the time spent in delivery. Although extensive training was done to ensure proper completion of these surveys, a review of the data suggested that sites interpreted the questions in different ways. For example, among sites that had three RDs and where individual sessions were always conducted by an RD, sites differed in reporting that each RD conducted 33% of the individual sessions or 100% of the individual visits. The latter led to the unlikely conclusion that three RDs were present at each individual session. To clarify the staffing patterns that were used, a biostatistician at the

Coordinating Center called each site to verify the reported staffing pattern and correct errors. (See Appendix 4 for actual survey questions.)

Staffing models and time allocations were used to project personnel costs of delivering ILI and DSE. Research-related staffing costs and facility (building/rent) costs were excluded, but both time spent preparing and delivering sessions were considered. Actual salaries and fringe benefits for each type of staff member (e.g. RD, exercise specialist and nurse) were obtained from each site and were used to calculate personnel costs. From a separate database, we also determined the number and type of visits attended by each participant and for those in ILI, their use of meal replacement products and orlistat. Although the study received meal replacement products and orlistat free of charge (from institutional donors), the costs that would have been associated with these products in typical programmes were used.

Differences in the costs (in 2012 dollars) of delivery between the ILI and DSE interventions over 9 years of follow-up were examined. This cost estimate will be useful later in reporting the cost-effectiveness of the Look AHEAD intervention.

Statistical methods

Staffing effort was collected beginning in 2001. Salary data (including fringe costs) for these efforts were obtained in 2007 dollars (to adopt a common benchmark within the time span of the intervention). For consistency and comparison to a previous Look AHEAD publication (7), salaries were inflation-adjusted by 3% per year to be in 2012 dollars. Staff salaries associated with participant visits that occurred in 2001/2002 used this 2012 inflation-adjusted salary, whereas those associated with participant visits in 2003 and beyond not only received the inflation adjustment to 2012 but also received a 3% salary increase for each year beyond 2002.

Annual staffing costs per participant in Table 4 were obtained by first summing costs within individual and year. Next, these sums were averaged within clinic, and finally, an across-clinic average (and standard error) was obtained.

Meal replacement cost data were obtained at the clinic level by year. Costs were distributed equally among all ILI participants at the clinic during that year. Use of orlistat was collected on a per-participant basis. The cost of orlistat was summed across all participants within site and year and was then distributed equally among all participants. Toolbox funds were dollars made available to clinics to assist participants struggling with weight loss (ILI) and were used to provide DSE participants with

educational and other materials to aid in diabetes management.

Results

Participants' baseline characteristics and subsequent weight loss

Table 1 describes the demographic characteristics of participants. Nearly 60% of participants were women, and approximately one-third were from racial and ethnic minorities. As reported previously, ILI and DSE participants lost an average of 8.6% and 0.7% of initial weight, respectively, at year 1. Mean losses from baseline were 4.7% and 1.1%, respectively, at year 4 and 6.0% and 3.5%, respectively, at an average of 9.6 years of follow-up, when the intervention was terminated.

Staffing costs per session

Table 2 displays the protocol-specified and actual average number of sessions attended per year per participant for DSE and ILI participants. The DSE participants

Table 1 Baseline characteristics of Look AHEAD participants by intervention assignment

Baseline characteristic	Diabetes support and education <i>N</i> = 2,575	Intensive lifestyle intervention <i>N</i> = 2,570
	Mean (SD) or <i>N</i> (%)	Mean (SD) or <i>N</i> (%)
Age	58.8 (6.9)	58.6 (6.8)
Sex		
Female	1,537 (59.7)	1,526 (59.4)
Male	1,038 (40.3)	1,044 (40.6)
Race/Ethnicity		
African-American	404 (15.7)	400 (15.6)
Asian/Pacific Islander	21 (0.8)	29 (1.1)
Hispanic	340 (13.2)	340 (13.2)
Native American	128 (5.0)	130 (5.1)
Non-Hispanic White	1,631 (63.3)	1,621 (63.1)
Other/Multiple	51 (2.0)	49 (1.9)
Body mass index (kg m ⁻²)		
<30	362 (14.1)	403 (15.7)
30 to <35	899 (34.9)	918 (35.7)
35 to <40	740 (28.7)	672 (26.2)
>40	574 (22.3)	577 (22.5)
Fitness (METs)	7.18 (2.0)	7.2 (1.9)
HbA _{1c} (%)		
<7.0	1,154 (44.8)	1,197 (46.6)
7.0 to 8.9	1,189 (46.2)	1,185 (46.1)
9.0 to 11.0	232 (9.0)	188 (7.3)

METS, metabolic equivalents; SD, standard deviation.

Table 2 Staffing effort and cost per session by intervention group

Year since randomization	DSE						ILI									
	Number of sessions proposed		Number of sessions attended		Staff time per session (h)		Cost per participant per session (\$)		Number of sessions proposed		Number of sessions attended		Staff time per session (h)		Cost per participant per session (\$)	
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
Year 1 sessions																
Group	up to 4		2.7 (1.1)	4.5 (2.4)	43.1 (33.4)	30	25.6 (5.8)	5.8 (2.8)	33.0 (16.1)							
Individual	0					12	10.7 (2.8)	1.5 (0.6)	63.7 (28.6)							
Phone	0						1.2 (0.5)	0.2 (0.1)	12.3 (6.5)							
Year 2 sessions																
Group	up to 3		2.3 (1.0)	4.8 (2.9)	39.4 (24.4)	(>12 in person plus 12 other, group and individual combined)	9.2 (6.4)	4.6 (2.2)	32.8 (12.4)							
Individual	0						9.4 (3.6)	1.4 (0.4)	61.3 (20.4)							
Phone	0						3.9 (2.8)	0.2 (0.1)	11.7 (5.7)							
Year 3 sessions																
Group	up to 3		2.1 (0.9)	5.2 (3.1)	39.2 (18.5)	(>12 in person plus 12 other, group and individual combined)	8.6 (6.7)	4.1 (1.4)	33.7 (11.8)							
Individual	0						8.4 (3.8)	1.4 (0.4)	57.1 (18.8)							
Phone	0						4.8 (3.9)	0.2 (0.1)	11.3 (6.6)							
Year 4 sessions																
Group	up to 3		2.0 (0.9)	5.2 (2.5)	40.0 (19.3)	(>12 in person plus 12 other, group and individual combined)	8.6 (6.8)	4.4 (1.4)	34.9 (11.4)							
Individual	0						8.2 (4.3)	1.3 (0.4)	55.4 (19.4)							
Phone	0						4.1 (3.9)	0.2 (0.1)	10.3 (4.3)							
Years 5–9 sessions																
Group	1 to 2		1.1 (0.1)	6.1 (2.1)	52.6 (27.6)	12 offered	6.6 (5.2)	6.8 (5.1)	51.8 (47.0)							
Individual	0					12 offered	4.7 (3.2)	1.1 (0.4)	48.7 (23.0)							
Phone	0						2.2 (1.7)	0.2 (0.1)	9.1 (4.5)							

For diabetes support and education (DSE), typical number of participants per group session ranged between 6 and 10 persons; for intensive lifestyle intervention (ILI), typical numbers ranged between 10 and 14 persons. Standard deviations (SDs) represent variability among clinical sites. Costs are expressed in 2012 dollars.

attended 2.7 of the four sessions offered during year 1 and 2.0 to 2.3 of the three offered during years 2–4. After 4 years, one session per year was offered, but participants could attend the session again if desired; on average, participants attended 1.1 sessions per year. The time involved in offering these sessions, which included both preparation time and actual delivery time, averaged 4–6 h per session, and two or more providers were typically involved. (See Appendix 2 for typical staffing patterns.)

The ILI participants averaged 10.7 individual and 25.6 group sessions in their first year. This decreased to approximately nine individual and nine group sessions in year 2, eight group and eight individual sessions in years 3 and 4 and 6.5 contacts of each type thereafter. Phone sessions averaged one call per participant during the first year and four to five calls in subsequent years; each call lasted approximately 12 min. Preparation and delivery of the individual sessions were reported to take about 1.5 h per participant. Typically, one provider was involved. Group sessions, which typically involved two or more providers, required on average 5.8 h of effort (preparation and delivery) in year 1, 4.1 to 4.6 h in years 2–4 and 6.8 h in subsequent years. Although group sessions were longer than individual sessions, and involved more staff time, the costs involved in offering the group sessions were averaged across all participants who attended and were thus lower per participant than individual sessions.

Non-staffing costs

Table 3 displays the annual costs of such items as meal replacements, orlistat, donations and toolbox items by treatment group. For DSE participants, non-staffing costs were limited to donations and toolbox items alone (i.e. diabetes-related educational materials) and averaged \$86 per participant in year 1 and \$45 per participant in subsequent years.

For ILI participants, non-staffing costs included meal replacements, orlistat, donations and toolbox items (including small exercise and diet equipment) (Appendix 3). Of these, meal replacements were the major contributor to cost. Non-staffing costs were approximately \$1,322 in year 1, declining to \$529 in later years.

Total annual per participant costs

Table 4 displays the average annual cost per participant of intervention delivery, taking into account both staffing and non-staffing costs. For DSE participants, the average per participant cost was approximately \$202 during their first year, \$124 to \$136 during years 2–4 and thereafter, \$103 per participant per year. For ILI participants, the

Table 3 Annual non-staffing costs, ILI and DSE

	DSE cost per	ILI cost per
	participant per year	participant per year
	Mean	Mean (SD)
Year 1		
Donations and toolbox	86.0	479.7
Orlistat	0	44.7 (28.5)
Meal replacements	0	798.0 (114.8)
Total	86.0	1,322.4 (138.7)
Year 2		
Donations and toolbox	45.0	309.1
Orlistat	0	59.3 (40.9)
Meal replacements	0	651.1 (139.0)
Total	45.0	1,019.5 (152.9)
Year 3		
Donations and toolbox	45.0	309.1
Orlistat	0	52.3 (36.4)
Meal replacements	0	512.7 (124.3)
Total	45.0	874.1 (132.0)
Year 4		
Donations and toolbox	45.0	309.1
Orlistat	0	28.0 (21.1)
Meal replacements	0	366.0 (106.1)
Total	45.0	703.1 (103.2)
Years 5–9		
Donations and toolbox	45.0	309.1
Orlistat	0	12.7 (3.2)
Meal replacements	0	207.2 (44.7)
Total	45.0	529.0 (445.0)

DSE, diabetes support and education; ILI, intensive lifestyle intervention; SD, standard deviation.

Year 1 meal replacements averaged 360.8 units per person (19).

Table 4 Total annual cost of intervention delivery, staff and non-staff costs combined

Year since randomization	DSE total annual	ILI total annual
	cost (\$) per participant	cost (\$) per participant
	Mean (SD)	Mean (SD)
1	202.4 (76.6)	2,864.6 (513.3)
2	135.6 (44.5)	1,944.0 (315.3)
3	127.3 (40.2)	1,698.2 (317.2)
4	125.0 (39.2)	1,499.1 (300.2)
5–9	102.9 (33.0)	1,119.8 (227.7)

DSE, diabetes support and education; ILI, intensive lifestyle intervention; SD, standard deviation.

SDs represent variability among clinical sites.

Costs are expressed in 2012 dollars.

average per participant cost for year 1 totaled \$2,865. In later years, less attendance was required, and fewer meal replacements were used; thus, per participants costs declined. Per participant costs were \$1,944 in year 2, \$1,698 in year 3, \$1,499 in year 4 and \$1,120 in years 5–10.

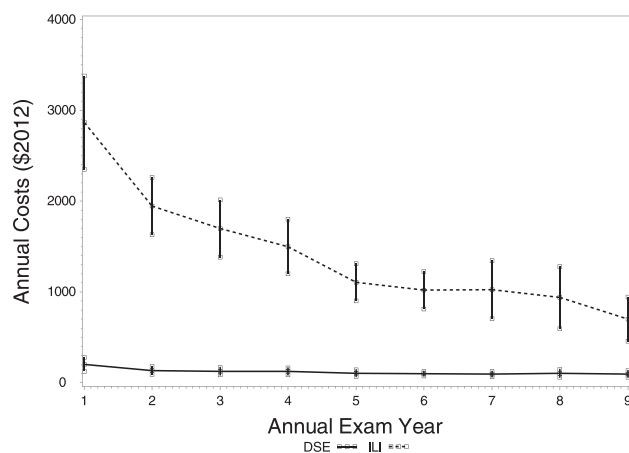


Figure 1 The average per participant cost of the ILI and the DSE programmes during each year of the intervention. DSE, diabetes support and education; ILI, intensive lifestyle intervention.

Figure 1 shows the average per participant cost of the ILI and the DSE programmes during each year of the intervention. Costs were higher for ILI participants, especially during year 1. In year 1, the cost per participant per kg lost was \$329.30.

Conclusions

This paper provides detailed information about the cost of offering the ILI in Look AHEAD and important data about the treatment components that contributed to this cost. The cost of offering ILI (including staffing costs for individual session and group sessions and costs for meal replacement products and intervention supplies) was \$2,865 per participant in year 1, \$1,944 in year 2 and decreased gradually to \$1,120 in years 5–9. In contrast, the DSE programme cost (including staffing and retention items) was only \$202 per participant in year 1, \$136 in year 2 and decreased to \$103 in years 5 to 9. The major contributor to this difference was the intensity of the treatment contact: ILI participants were offered 12 individual and 30 group sessions in year 1, as compared with only four group sessions for the DSE group.

The primary component of the cost of the ILI was the staffing, which accounted for 60–70% of the per capita annual cost across years. The variability between clinics in the total annual cost of conducting the interventions likely reflects differences in the type and number of staff members that were used to conduct the sessions and differences in attendance at these sessions. The Look AHEAD lifestyle intervention included both group and individual sessions in an effort to capitalize on the strengths of these two different approaches. Group treatment programmes have produced better weight losses than

individual programme (18), and thus, our programme relied primarily on group sessions, especially in year 1 of the programme when contacts were most frequent. Although group sessions were longer in duration and required more staff members than individual sessions, the fact that the costs are spread across many different individuals significantly reduces the per person cost. During year 1 of Look AHEAD, the per participant cost of an individual session was more than twice as much as a group class; however, by year 4, the study-wide costs of group and individual sessions were similar because of the lower attendance at group sessions in later years. On the basis of the findings from the literature, use of meal replacement products was included in our lifestyle intervention to promote greater weight loss and maintenance (19). Although greater use of meal replacement products was associated with better outcomes (20), it is likely that those who use the meal replacement products were also adhering to other aspects of the intervention. Although meal replacement products were donated to the trial, if purchased, they would have cost \$798 and \$650, respectively, per participant in years 1 and 2, \$513 in year 3, \$366 in year 4 and \$207 per participant in later years, because of the decreasing use of these items over time.

Costs of lifestyle intervention supplies, including items such as food scales and measuring cups, and exercise tools such as pedometers, fit stability balls and walking tapes, were estimated. These supplies cost approximately \$300 per participant per year. It is unclear if these items were related to weight loss outcomes, but they are believed to contribute to retaining interest in the trial and motivating participants to continue to change eating and exercise behaviours.

Although cost of purchasing or renting space is often included in the direct cost calculations for a programme, this was not included in our calculation because of the difficulty estimating this parameter, both for group and individual sessions. In many programmes, space is rented for each intervention session, and a rental cost (e.g. \$50 per room per hour) may be used to estimate this parameter. For example, Jakicic *et al.* conducted a group-based lifestyle programme, with 42 group sessions plus individual make-up meetings over 18 months. Their total per capita cost of space was estimated at \$122 (21). In other studies, a general estimate of overhead costs is provided by using a percentage of the personnel costs; using this approach, DPP estimated that the per capita cost of the lifestyle intervention was 69% of the cost of personnel or \$519 during year 1 (13). Whereas this latter calculation appears to include costs of the office space used by staff members, the approach taken by Jakicic *et al.* does not. Whether or not to include such space may depend on factors such as whether the staff

member is a full-time employee or comes to the site only to offer the treatment contacts. Other factors, such as where the space is located (within a hospital, in a commercial property or in space provided by a community partner; within or outside the city proper), will also influence the costs of space.

As previously reported (4), the ILI in Look AHEAD produced a mean weight loss of 8.6% at year 1 and 6.0% at the end of the intervention (median of 9.6 years). This weight loss was significantly greater than the 0.7% and 3.5% weight loss in DSE at year 1 and the end of intervention, respectively. As noted earlier, the lifestyle intervention had a large number of both short-term and long-term health benefits relative to DSE (4–10). In addition, the lifestyle intervention was associated with a reduction in medical care costs, with a 10% savings related to hospitalizations and a 7% savings in medication costs. Over 10 years, the ILI led to a mean relative per person cost saving of \$5,280 (7). Future work, which will incorporate additional follow-up, will evaluate the overall cost-effectiveness of the intervention. This evaluation will weigh the contributions of three components: healthcare cost savings, the costs involved in offering the lifestyle intervention and the health benefits that are associated with the intervention.

Our study has some limitations. Estimates of personnel time were based on cross-sectional surveys. The rate that intervention tools (e.g. orlistat) were used by participants may have been increased because they were provided free of charge. Attendance rates in this clinical trial also may have been higher than those typically seen in clinical practice settings. Finally, we have used actual labor costs instead of Bureau of Labor Statistics national wage rates, which may limit generalization.

Recently, there have been a number of efforts to reduce the cost of lifestyle interventions, as provided in the DPP, by offering programmes at community centres, using lay community intervention staff (22), or by using digital media to deliver programmes (23). A meta-analysis of this literature showed that there were no differences in weight loss achieved by trained professionals vs. lay educators (24). Similarly, these authors noted that there were no data on the cost-effectiveness of 8, 12 or 16 treatment sessions, but that the more sessions participants attended, the greater their weight loss. Finally, the effectiveness, as well as the cost-effectiveness, of lifestyle interventions used in combination with contemporary technology (e.g. activity monitors) remains unclear (25).

In conclusion, the cost of the ILI used in Look AHEAD was \$2,864.60 per participant in the first year (or \$329 per kg weight loss) but decreased over the subsequent 8 years of the intervention. These costs were driven primarily by personnel costs. Look AHEAD investigators

currently are examining whether the costs of ILI in overweight and obese participants with type 2 diabetes are justified by a reduction in a variety of health problems and the associated medical care costs.

Central resources centres

DXA Reading Center, University of California at San Francisco Michael Nevitt, PhD (Principal Investigator); Ann Schwartz, PhD (Program Coordinator); John Shepherd, PhD (Co-investigator); Michaela Rahorst; Lisa Palermo, MS, MA; Susan Ewing, MS; Cynthia Hayashi; Jason Maeda, MPH.

Central Laboratory, Northwest Lipid Metabolism and Diabetes Research Laboratories Santica M. Marcovina, PhD, ScD (Principal Investigator); Jessica Chmielewski (Program Coordinator); Vinod Gaur, PhD.

ECG Reading Center, EPICARE, Wake Forest University School of Medicine

Elsayed Z. Soliman MD, MSc, MS (Principal Investigator); Ronald J. Prineas, MD, PhD (Principal Investigator); Charles Campbell (Program Coordinator); Zhu-Ming Zhang, MD (Co-investigator); Teresa Alexander; Lisa Keasler; Susan Hensley; Yabing Li, MD.

Diet Assessment Center, University of South Carolina, Arnold School of Public Health, Center for Research in Nutrition and Health Disparities Robert Moran, PhD (Principal Investigator).

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All other Look AHEAD staffs are listed alphabetically by site.

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