

Costs and Cost Effectiveness of an Enhanced Web-Based Physical Activity Intervention for Latinas: 12- and 24-Month Findings from Pasos Hacia La Salud II

Britta Larsen, Dorothy Pekmezi, Sheri Hartman, Shira Dunsiger, Todd Gilmer,
Erik Groessl, Bess Marcus

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Britta Larsen¹ PhD; Dorothy Pekmezi² PhD; Sheri Hartman¹ PhD; Shira Dunsiger³ PhD; Todd Gilmer¹ PhD; Erik Groessl^{1, 4} PhD; Bess Marcus³ PhD

¹ Herbert Wertheim School of Public Health University of California, San Diego San Diego US

² Department of Health Behavior School of Public Health University of Alabama Birmingham US

³ Department of Behavioral and Social Sciences School of Public Health Brown University Providence US

⁴ VA San Diego Healthcare System San Diego US

Corresponding Author:

Britta Larsen PhD

Herbert Wertheim School of Public Health
University of California, San Diego
9500 Gilman Dr.
San Diego
US

Abstract

Background: Increasing adherence to physical activity (PA) guidelines could prevent chronic disease morbidity and mortality, save considerable healthcare costs, and reduce health disparities. We previously established the efficacy and cost-effectiveness of a web-based PA intervention for Latina women, which increased PA but few participants met PA guidelines and long-term maintenance was not examined. A new version with enhanced intervention features was found to outperform the original intervention in long-term guideline adherence.

Objective: to determine the costs and cost-effectiveness of the enhanced multi-technology PA intervention vs. the original web-based intervention in increasing minutes of activity and adherence to guidelines

Methods: Latina adults (N=195) were randomly assigned to receive a Spanish language individually tailored web-based PA intervention (Original), or the same intervention additional phone calls and interactive text messaging (Enhanced). PA was measured at baseline, 12 months (end of active intervention), and 24 months (end of tapered maintenance) using self-report (7-Day Physical Activity Recall Interview) and ActiGraph accelerometers. Costs were estimated from a payer perspective and included all features needed to deliver the intervention, including staff, materials, and technology. Cost effectiveness was calculated as the cost per additional minute of PA added over the intervention, and the incremental cost effectiveness ratios of each additional person meeting guidelines.

Results: at 12 months, the costs of delivering the interventions were \$16/person/month and \$13/person/month in the Enhanced and Original arms, respectively. These costs fell to \$14 and \$8 at 24 months. At 12 months, each additional minute of self-reported activity in the Enhanced group cost \$0.09 vs. \$0.11 in Original (\$0.19 vs. \$0.16 for ActiGraph), with incremental costs of \$0.05 per additional minute in Enhanced beyond Original. At the end of maintenance (24 months), costs per additional minute fell to \$0.06 and \$0.05 (\$0.12 vs. \$0.10 for ActiGraph), with incremental costs of \$0.08 per additional minute in Enhanced (\$0.20 for ActiGraph). Costs of meeting PA guidelines at 12 months were \$705 vs. \$503 in Enhanced vs. Original, and increased to \$812 and \$601 at 24 months. The ICER for meeting guidelines at 24 months was \$1837 (95% CI \$730.89-\$2673.89) per additional person in the Enhanced vs. Original arm.

Conclusions: As expected, the Enhanced intervention was more expensive, but yielded better long-term maintenance of activity. Both conditions were low costs relative to other medical interventions. The Enhanced intervention may be preferable in high risk populations, where more investment in meeting guidelines could yield more cost savings. Clinical Trial: NCT03491592

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Original Paper

Costs and Cost Effectiveness of an Enhanced Web-Based Physical Activity Intervention for Latinas: 12- and 24-Month Findings from *Pasos Hacia La Salud II*

Britta Larsen, PhD,¹ Dorothy Pezmezi, PhD,² Sheri Hartman, PhD,¹ Shira Dunsiger,³ PhD,

Todd Gilmer, PhD,¹ Erik Groessl, PhD,^{1,4} & Bess Marcus, PhD³

¹Herbert Wertheim School of Public Health & Human Longevity Science, University of California, San Diego, CA

²Department of Health Behavior, School of Public Health at University of Alabama, Birmingham, AL

³Department of Behavioral and Social Sciences, School of Public Health, Brown University, Providence, RI

⁴VA San Diego Health Care System, San Diego, CA

Corresponding Author:

Britta A. Larsen
Herbert Wertheim School of Public Health
University of California, San Diego
9500 Gilman Dr.
San Diego, CA 92093-0725
858.534.8429
Email: blarsen@ucsd.edu

ABSTRACT

Background: Increasing adherence to physical activity (PA) guidelines could prevent chronic disease morbidity and mortality, save considerable healthcare costs, and reduce health disparities. We previously established the efficacy and cost-effectiveness of a web-based PA intervention for Latina women, which increased PA but few participants met PA guidelines and long-term maintenance was not examined. A new version with enhanced intervention features was found to outperform the original intervention in long-term guideline adherence. **Objective:** to determine the costs and cost-effectiveness of the enhanced multi-technology PA intervention vs. the original web-based intervention in increasing minutes of activity and adherence to guidelines. **Methods:** Latina adults (N=195) were randomly assigned to receive a Spanish language individually tailored web-based PA intervention (Original), or the same intervention additional phone calls and interactive text messaging (Enhanced). PA was measured at baseline, 12 months (end of active intervention), and 24 months (end of tapered maintenance) using self-report (7-Day Physical Activity Recall Interview) and ActiGraph accelerometers. Costs were estimated from a payer perspective and included all features needed to deliver the intervention, including staff, materials, and technology. Cost effectiveness was calculated as the cost per additional minute of PA added over the intervention, and the incremental cost effectiveness ratios of each additional person meeting guidelines. **Results:** at 12 months, the costs of delivering the interventions were \$16/person/month and \$13/person/month in the Enhanced and Original arms, respectively. These costs fell to \$14 and \$8 at 24 months. At 12 months, each additional minute of self-reported activity in the Enhanced group cost \$0.09 vs. \$0.11 in Original (\$0.19 vs. \$0.16 for ActiGraph), with incremental costs of \$0.05 per additional minute in Enhanced beyond Original. At the end of maintenance (24 months), costs per additional minute fell to \$0.06 and \$0.05 (\$0.12 vs. \$0.10 for ActiGraph), with incremental costs of \$0.08 per additional minute in Enhanced (\$0.20 for ActiGraph). Costs of meeting PA

guidelines at 12 months were \$705 vs. \$503 in Enhanced vs. Original, and increased to \$812 and \$601 at 24 months. The ICER for meeting guidelines at 24 months was \$1837 (95% CI \$730.89-\$2673.89) per additional person in the Enhanced vs. Original arm. **Conclusions:** As expected, the Enhanced intervention was more expensive, but yielded better long-term maintenance of activity. Both conditions were low costs relative to other medical interventions. The Enhanced intervention may be preferable in high risk populations, where more investment in meeting guidelines could yield more cost savings.

Keywords: cost-effectiveness, physical activity, Latino health, health disparities, mHealth

Clinical Trials Registration: [NCT03491592](https://clinicaltrials.gov/ct2/show/study/NCT03491592)

INTRODUCTION

There is a critical need for scalable, cost-effective interventions to address high rates of physical inactivity and related chronic diseases, especially in underserved/at risk populations. In fact, the WHO estimates that further inaction could lead to 500 million new global cases of preventable non-communicable diseases, with associated direct health care costs of INT\$ 520 billion, by 2030.¹ Internet-based physical activity (PA) interventions have great potential for widespread dissemination and have already been shown to improve PA levels.²⁻⁴ Yet most of this work was conducted in the general population and not extended to those most at risk, including underrepresented minorities.

Hispanic adults report the highest rates of inactivity outside of work (32.1% vs. 23% for non-Hispanic Whites) and suffer disproportionately from associated conditions (obesity, diabetes).^{5,6} In fact, 79% of Latinas are overweight/obese, compared to 64% of non-Hispanic white women.⁵ Thus, in the *Pasos Hacia La Salud* study, we tested a web-based, Spanish-language physical activity intervention for Latinas (N=205) and found significantly greater increases in weekly minutes of moderate to vigorous physical activity (MVPA) compared to a control condition (mean difference = 50.00, $p < 0.01$).^{7,8} Moreover, the costs associated with providing the intervention were low at 6 months (US \$17 per person per month) and further decreased (US \$12 per person per month) at 12 months.⁹ While the *Pasos* program was shown to be effective and low cost, most intervention participants (69%) did not meet national PA guidelines at 6 months,^{7,8,10} and longer-term maintenance was not evaluated.

To help sedentary Latinas achieve and maintain health-enhancing levels of PA, the intervention was refined by adding text messages and further targeting key Social Cognitive Theory¹¹

variables (self-efficacy, enjoyment, social support). Then, in the *Pasos Hacia La Salud II* study, the new technology- and theory- enhanced version was tested vs. the original *Pasos Hacia La Salud* intervention in a randomized controlled trial (N=205).¹² There were no significant between-group differences in physical activity at 6 or 12 months; however, the enhanced intervention arm had higher PA levels than the original intervention arm at 18 and 24 months.¹³

While both programs have been shown to be beneficial, the enhanced intervention appears to have an advantage in terms of long-term behavior change. Yet, these enhancements (e.g., text messages, discussion board, additional staff contacts) likely come at additional expense (vs. original arm). An evaluation of intervention costs is needed to determine which program is feasible and the best fit for clinical and community setting and resources. Thus, to inform future dissemination and implementation efforts, the current study examined additional costs associated with intervention enhancements and how they influence cost effectiveness.

METHODS

Pasos Hacia La Salud II was a fully powered randomized trial of two physical activity interventions: the original web-based PA intervention (Original), and an enhanced arm that included additional elements to support increasing activity (Enhanced). Participants were adult Latinas aged 18-65 who were underactive (engaging in <60 minutes of MVPA per week), could read and write in Spanish, had access to technology to use the study website and receive text messages, and were healthy enough for unsupervised exercise. A full description of the study protocol, measures, and participants has been published previously.^{13,14}

Intervention Description

In the original arm of the web-based intervention participants attend a baseline session led by

trained bilingual interventionists who explained MVPA and helped participants set incremental goals. Participants also completed goal-setting sessions over the phone at month 1 and 9, and at follow-up visits (6 and 12 months). Participants were encouraged to accumulate MVPA on most the days of the week and encouraged to achieve the goal of 150 minutes of MVPA by 6 months. All participants were given a pedometer and were encouraged to use it to self-monitor daily activity.

The interventionist also oriented participants to the study website, which participants could access throughout the whole intervention period (24 months). The website included tools to help participants increase their MVPA, such as self-monitoring, goal setting, social support, instruction about how to be physically active, problem solving, motivational stage-matched PA manuals and individually tailored feedback. Further details about the tailored intervention content are described elsewhere.¹⁴ Participants were encouraged to regularly access the website, log their PA on the website, and receive a tip of the week. Participants were also prompted to complete online surveys to customize their intervention content. Most web-based content was automated and did not require staff time. However, staff regularly checked the message boards to answer questions as necessary and were available to help with any technology issues participants had.

In addition to the intervention components described above, the Enhanced intervention included: (1) text messages, (2) additional phone calls at months 2, 3, 15, and 21, (3) additional in-person visits at 18 and 24 months, and (4) additional data driven content and website features that encouraged user participation. Participants were also provided with nonmonetary incentives for their website use. Participants earned points by logging into the website and using certain features, like the goal setting calendar. Once participants earned a given number of points, they were sent prizes, such as water bottles, phone cases, and t-shirts.

To further enhance social support for PA, a discussion board was used to facilitate meetups among participants. Research staff posted details about free and low-cost PA events in the area so that participants could meet up, discuss coordinating attendance with others, overcome barriers to PA, and motivate each other to attend these events.

Physical Activity Measures

The main outcomes used to determine cost effectiveness were change in minutes of MVPA from baseline to 12 months and 24 months as measured by ActiGraph accelerometers and self-report, and the percent of participants meeting national guidelines at 12 and 24 months. Self-reported activity was measured using the 7-Day Physical Activity Recall Interview (7-Day PAR), an interviewer-administered measure that has shown good reliability and validity in adult populations, including in Spanish.¹⁵⁻¹⁷ Adherence to national guidelines was defined as engaging in ≥ 150 minutes/week of MVPA as measured by the 7-Day PAR.¹⁸

Costs

Cost calculations followed the model used in our previous publications.⁹ Costs were calculated from a payer perspective to estimate the amount it would cost to deliver the intervention in a clinical or community setting. This included all costs associated with personnel, materials, and use and maintenance of technology to deliver the intervention, sourced from actual costs incurred during the trial.

Costs associated with research, such as recruitment, baseline and follow-up measurement visits, obtaining consent, or compensation for research participation, were not included. We also did not include costs associated with intervention development, as community or clinical settings would deliver the existing, developed intervention.

Personnel Time. Staff time logs were used to determine the time needed to complete each activity associated with intervention delivery. This included training time (for both the trainer and the trainee), time to compile study materials, time for study visits and phone calls (depending on study condition), and time for study maintenance activities, such as checking the online message board, resending pedometers to participants who lost them, calling the website developer with technical questions, or (in the enhanced group) offering text message support. Study maintenance activities were conducted during a set time each week, rather than calculated as a per participant activity.

Costs for personnel were calculated by determining the total time needed to deliver the intervention per participant in each condition, and multiplying by actual staff salary rates, including benefits. Staff delivering the intervention were entry-level research staff with an undergraduate degree (\$54,080 yearly salary + 31% benefits, \$34.05 total per hour). Training staff were master's level behavioral scientists (\$68,640 yearly salary + 31% benefits, \$43.20 total per hour). Overhead was estimated as an additional 10% of all personnel costs to account for use of shared space.

Technology. Web hosting was \$75 per month for both study arms. The automated text messaging was supported through the study website, and thus did not incur any additional costs.

Materials. Costs for materials were based on actual costs incurred during intervention delivery. All participants in both study arms received an Acusplit pedometer to record their daily steps at a cost of \$20 each. Participants in both arms also received a study binder at their baseline visit with information about exercise, tip sheets, and logs for using their pedometers. Total cost for the binders and printed materials were \$4.95 each.

Total cost for prizes in the Enhanced group were calculated based on actual cost of the items and the number of each item that was distributed. Because not all participants earned all prizes, we calculated an average cost per participant for prizes to allow for an estimate of the actual cost of delivering prizes at varying rates based on participant engagement. Prize costs ranged from \$1.11 each for water bottles to \$12.50 for a yoga mat. Total cost for prizes in the Enhanced arm was \$2038.

A computer was also purchased for study staff to use to conduct baseline study visits, check the study website message boards, etc. Cost of the computer was \$1200.

Analysis

To allow for comparison, we used the same analysis approach as in the parent study.⁹ Costs were calculated from a payer perspective to estimate the cost of implementing the intervention in a community or clinical setting. Total costs were calculated separately for each study arm, and included the total of personnel time (including benefits and use of shared space), materials, and web hosting. Total costs for each arm were divided by the number of participants in each to calculate the cost per person to deliver each intervention. Costs were calculated in US dollars for 2024.

Cost effectiveness was calculated as the cost per additional minute of MVPA per person over the course of the study. Total increase in minutes was calculated by using linear interpolation of minutes across measurement timepoints (baseline, 6 months, 12 months, 18 months, 24 months), and subtracting out baseline minutes. Main outcomes for costs and cost effectiveness were calculated at 12 months (main study outcome) and cumulatively at 24 months). Cost of intervention delivery per person was divided by cumulative increased minutes per person over the course of the study to estimate the cost per additional minute per person. This was done both for self-reported activity (7-Day PAR) and objectively measured activity (ActiGraph

accelerometer). Similarly, the cost of each intervention was divided by number of participants in that group meeting national guidelines at each timepoint to estimate the cost of moving one person from being inactive to successfully meet guidelines for activity at 12 and 24 months.

Incremental cost effectiveness ratios (ICERs) were also calculated to determine the additional cost per minute in the Enhanced group beyond MVPA minutes achieved by the Original group, and the cost per additional individual meeting guidelines in the Enhanced group beyond the number meeting guidelines in the Original group. ICERs were calculated by dividing the difference in the costs between the two study arms by the difference in cumulative minutes between the two arms, and, separately, by the difference in the number of people meeting guidelines. For ICERs for guidelines, confidence intervals were computed using the non-parametric bootstrap with 1000 replications.

RESULTS

Participants (N=195) were 43.3 years old on average (SD = 10.29), and mostly of Dominican (41%) and Colombian (17%) descent. Approximately half had a high school education or less. A full description of baseline characteristics, and a CONSORT diagram, have been published previously.¹³

Physical Activity Changes

As published previously,¹³ participants in the Enhanced group (N=103) increased self-reported weekly MVPA from 57.9 minutes at baseline to 106.8 minutes at 12 months, and 135.3 at 24 months, while the Original group (N=92) increased from 55.2 minutes at baseline to 111.7 at 12 months and 93.9 at 24 months.¹³ ActiGraph-measured weekly MVPA in the Enhanced group changed from 19.7 minutes at baseline to 44.5 minutes at 12 months, and 47.4 minutes

at 24 months. In the Original group, ActiGraph-measured weekly MVPA changed from 20.6 minutes at baseline to 55.9 minutes at 12 months and 31.2 minutes at 24 months.

No participants met national MVPA guidelines at baseline. At 12 months, 28% and 29% of participants met guidelines according to self-report in the Enhanced and Original conditions, respectively. At 24 months, this increased to 37% and 31%, respectively.

Costs

Total costs associated with delivering the interventions are shown in Table 1. Total cost of delivering the Original intervention at 12 months was \$15,741, or \$171 per person (\$14 per person per month). The Enhanced intervention cost \$20,435 to deliver over the first 12 months, which was \$198 per person (\$16 per person per month).

At 24 months, cumulative costs for the Original intervention increased slightly to \$17,428, or \$189 per person (\$8 per person per month). Cumulative costs for the Enhanced intervention, however, increased to \$30,862 at 24 months, or \$300 per person (\$12 per person per month). The largest source of the difference was personnel cost for intervention delivery between 12 and 24 months (see Table 1 and Table 2).

Table 1. Costs of delivering the Enhanced and Original interventions.				
	Enhanced N= 103		Original N=92	
	12 Months	24 months (cumulative)	12 Month	24 Month (cumulative)
Personnel				
Training	\$510	\$510	\$510	\$510
Intervention delivery	\$13,495	\$21,845	\$10,387	\$10,723
Website				
Hosting	\$900	\$1800	\$900	\$1800
Technical support	\$449	\$899	\$449	\$899
Materials				

Computer	\$1200	\$1200	\$1200	\$1200
Pedometers	\$2060	\$2060	\$1840	\$1840
Paper, binders, etc.	\$510	\$510	\$455	\$455
Prizes	\$1311	\$2038		
Total costs	\$20,435	\$30,862	\$15,741	\$17,428
Average cost per participant	\$198	\$300	\$171	\$189
Average cost per participant per month	\$16	\$13	\$14	\$8

Table 2. Staff time needed for intervention activities (all times listed are in minutes)				
	Original Intervention		Enhanced Intervention	
	12 Months	24 Months (Cumulative)	12 Months	24 Months (Cumulative)
Training				
Trainee	360	360	360	360
Trainer	360	360	360	360
Intervention activities per person				
Assembling materials	5	5	5	5
Baseline goal setting	60	60	70	70
1-week call	10	10	15	15
1-month call	25	25	30	30
2-month call			10	10
3-month call			10	10
6-month goal setting	25	25	30	30
9-month call	25	25	30	30
12-month goal setting		25		30
15-month call				30
21-month call				30
18-month goal setting				30
Study Maintenance Activities (not per person)				
Technical support	720	1440	720	1440
Message board and injury check	360	720	360	720
Resending pedometers	180	360	180	360
Text message support			480	960

Cost Effectiveness

Cost per increased minute of activity is shown in Table 3. For self-reported activity, each additional minute gained over 12 months in the Enhanced group cost \$0.09, compared to \$0.11

per minute in the Original. Incremental costs of increased minutes in the Enhanced group were \$0.05 per minute beyond those reported those by the Original group.

As increases in MVPA measured by the ActiGraph was smaller, these also cost more, with each increased minute costing \$0.19 in the Enhanced group and \$0.16 in the Original. Because increases in the Original group were larger than the Enhanced group, ICERs could not be calculated.

Table 3. Costs of increases in physical activity				
	Enhanced		Original	
	7-Day PAR	ActiGraph	7-Day PAR	ActiGraph
Total increase per person minutes of MVPA				
Baseline to 12	2120	1029	1584	1038
Total 24 months	4935	2466	3491	1921
Costs per minute increase in MVPA				
Baseline to 12	\$0.09	\$0.19	\$0.11	\$0.16
Total 24 months	\$0.06	\$0.12	\$0.05	\$0.10
Incremental cost per minute of increase in MVPA				
Baseline to 12	\$0.05	*		
Total 24 months	\$0.08	\$0.20		
Costs per person meeting guidelines				
12 months	\$705		\$503	
24 months	\$812		\$601	
Incremental cost per person meeting guidelines				
12 months	*			
24 months	\$1837 (\$730.89 - \$2673.89)			
*Because the Original arm outperformed the Enhanced in these metrics, it was not possible to calculate ICERs				

Costs for cumulative increases over the 24-month period were lower: each self-reported increased minute cost \$0.06 in the Enhanced group, and \$0.05 in the Original. Incremental increases in the Enhanced beyond the Original were \$0.08 per additional minute of self-reported MVPA. ActiGraph-recorded minutes over the 24-month period were \$0.12 in the Enhanced group compared to \$0.10 in the Original, with incremental minutes costing \$0.20 each in the Enhanced group beyond that in the Original group.

Cost per person meeting guidelines was normalized per 100 people in each arm. This was higher in the Enhanced arm at 12 months (\$705) than the Original arm (\$503); these rose to \$812 and \$601 at 24 months, respectively. ICERs at 24 months were \$1837 (95% CI: \$730.89-\$2673.89) per additional person meeting guidelines in the Enhanced arm beyond those in the Original arm.

DISCUSSION

Principal Results

Analyses showed that the technology- and theory-enhanced PA intervention for Latinas was more costly than the original intervention, but still markedly less costly than most medical interventions. The Enhanced intervention cost \$300 per person for a 24-month program, or approximately \$12 per person, per month. The Original intervention cost \$189 per person, or approximately \$8 per person, per month. The largest expense by far was personnel time, which accounted for approximately 72% and 64% of costs in the Enhanced and Original groups, respectively. Most of the increased cost in the Enhanced intervention was attributable to additional personnel time for making additional monthly calls and providing text message support. The prizes also contributed to higher costs in the Enhanced group.

Costs and activity gains were similar throughout the first year, thus cost effectiveness was also similar, with minutes gained in the Enhanced group costing \$0.09 each compared to

\$0.11 in the Original. During the second year in the program, however, the Enhanced group continued to increase their MVPA, while gains in the Original group declined; however, the Original group had few costs incurred in the second year while the Enhanced group continued to deliver maintenance doses of intervention. Cost effectiveness thus remained similar over the full 24 months, with each additional minute costing just \$0.05 in the Original group and \$0.06 in the Enhanced. ICERs showed that, beyond the cost of the Original intervention, each additional minute in the Enhanced intervention cost just \$0.08 (\$0.20 for ActiGraph-measured minutes). While more individuals in the Enhanced group met guidelines at 24 months, the cost of meeting guidelines was also higher, costing \$812 per person vs. \$601 in the Original arm.

Comparison with Prior Work

These results suggest that paying for more intervention yields commensurate increases in activity. Given the enormous benefits of PA,¹⁸⁻²¹ particularly if it is maintained over time,^{21,22} the additional cost of more intensive interventions that yield greater increases over time is likely preferable for implementation sites where it is feasible, particularly for populations at high risk of chronic disease. While the cost of each additional person meeting guidelines in the Enhanced group beyond the Original was \$1837 at 24 months, this, again, is a relatively small price to pay compared to the cost of managing chronic diseases associated with inactivity. The cost of managing diabetes, for example, was \$237 billion in the U.S. in 2017, with insulin alone costing approximately \$5000 per user annually.^{23,24} An analysis of healthcare use in Australia showed that those meeting activity guidelines were approximately one-third less likely to visit the emergency room or be admitted to the hospital and half as likely to be seen in outpatient settings, and cost approximately A\$1400 less per year.²⁵ Multiple studies have shown that PA programs are not only low cost but ultimately cost saving, saving considerably more in healthcare costs than the programs cost.^{26,27} One evaluation of a PA intervention for older community-dwelling adults found that, for those not initially meeting activity guidelines, the

program saved US\$143-\$164 per participant over six months beyond the cost of the intervention.²⁷ Paying for PA programs, then, could be seen as an investment not only in the health and wellbeing of the participants, but also in healthcare, particularly for high-risk populations.

Compared to the parent study, the Original intervention in the present student was slightly more expensive, costing \$14 per person per month at 12 months vs. \$12; this was due to increased personnel cost due to wage increases.⁹ Cost to implement the interventions will thus be largely dependent on staff salaries, which could vary broadly. Clinical sites could deliver the intervention via medical assistants or nursing staff, which would likely increase costs; if it were delivered by volunteers, or more automated to decrease staff time, it would reduce costs considerably.

Limitations

The current analysis had several limitations. Cost and cost effectiveness analyses were based on compiled vs. individual data, thus results should be interpreted as overall estimates for delivering the intervention rather than individual effectiveness. The costs also are limited to a payer perspective, and did not include healthcare or societal costs or quality-adjusted life years. These approaches, however, allow for direct comparability with the prior study, which used the same analytic approach. Also, some costs, such as overhead for shared space, could only be estimated, and would vary considerably based on the implementation site. Finally, we were unable to determine the effectiveness of each intervention component, so it was not possible to determine the added cost effectiveness of each channel.

The study had a number of strengths. Data were taken from a randomized trial with rigorous methodology, including multiple validated measures of PA. The trial focused on an underserved, high risk population, and included long-term follow-up. Costs were based on current market prices, including published pay scales and benefits for staff. We were also able

to directly compare costs and cost effectiveness to the prior parent RCT.

Conclusions

Findings highlight that additional intervention components, particularly those necessitating more staff time, yield higher intervention costs, yet may also yield great activity increases. In the current study, these differences were most apparent after long-term follow-up. This could suggest that greater investment may be most appropriate in individuals who would benefit the most from long-term adherence to activity guidelines, such as those at high risk for, or managing, chronic diseases that respond to lifestyle changes. As staff time was by far the most costly component, PA interventions may become more cost effective, and more widely disseminated, as they rely more on broad reach technology. Future research should investigate whether relying fully on automated technology without face-to-face intervention components yields similar long-term effectiveness.

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Conflicts of Interest

None to declare.

Abbreviations

ICER: incremental cost effectiveness ratio

MVPA: moderate-to-vigorous physical activity

PA: physical activity

PAR: physical activity recall

RCT: randomized controlled trial

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