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Selecting a target population for type 2 diabetes lifestyle prevention programs: A cost-effectiveness perspective

Joohyun Park[1], **Ping Zhang**[1], **Hui Shao**[2], **Michael Laxy**[3,4], **Giuseppina Imperatore**[1]

[1]Division of Diabetes Translation, Centers for Disease Control and Prevention, Atlanta, Georgia, USA

[2]College of Pharmacy, University of Florida, Gainesville, Florida, USA

[3]Institute of Health Economics and Health Care Management, Helmholtz Zentrum München GmbH, Neuherberg, Germany

[4]Department of Sports and Health Sciences, Technical University of Munich, Munich, Germany

Abstract

Aims: Cost-effectiveness (CE) of lifestyle change programs (LCP) for type 2 diabetes (T2D) prevention is influenced by a participant's risk. We identified the risk threshold of developing T2D in the intervention population that was cost-effective for three formats of the LCP: delivered in-person individually or in groups, or delivered virtually. We compared the cost-effectiveness across program formats when there were more than one cost-effective formats.

Methods: Using the CDC-RTI T2D CE Simulation model, we estimated CEs associated with 3 program formats in 8 population groups with an annual T2D incidence of 1% to 8%. We generated a nationally representative simulation population for each risk level using the 2011–2016 National Health and Nutrition Examination Survey data. We used an incremental cost-effectiveness ratio (ICER), cost per quality-adjusted life year (QALY) gained in 25-years, to measure the CEs of the programs. We took a health care system perspective.

Results: To achieve an ICER of $50,000/QALY or lower, the annual T2D incidence of the program participant needed to be ≥5% for the in-person individual program, ≥4% for the digital individual program, and ≥3% for the in-person group program. For those with T2D risk of ≥4%, the in-person group program always dominated the digital individual program. The in-person individual program was cost-effective compared with the in-person group program only among persons with T2D risk of ≥8%.

Conclusions: Our findings could assist decision-makers in selecting the most appropriate target population for different formats of lifestyle intervention programs to prevent T2D.

Correspondence: Joohyun Park, PhD, Division of Diabetes Translation, Centers for Disease Control and Prevention, 4770 Buford Hwy NE, F-75 Atlanta, GA 30341, USA. ppw6@cdc.gov.

SUPPORTING INFORMATION

Additional supporting information may be found in the online version of the article at the publisher's website.

CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

Keywords

cost-effectiveness; lifestyle change program; prevention; type 2 diabetes

1 | INTRODUCTION

Diabetes imposes substantial burdens on US society through reduced life-expectancy, loss of productivity, reduced quality of life, and high medical expenditures.[1] The Diabetes Prevention Program (DPP) in the US and trials in other countries have shown that lifestyle change programs (LCPs) are effective in preventing type 2 diabetes (T2D)[2,3] and also cost-effective.[4,5] To reduce the national health and economic burden imposed by T2D, the US Congress has authorized the Centers for Disease Control and Prevention (CDC) to establish and manage the National DPP to scale DPP intervention nationwide.[6] Through the National DPP, CDC provides evidence-based curriculum and participant materials to organizations that deliver LCPs in community. The CDC approves and recognizes organization's LCP that meets the requirements of programs' curriculum, intensity, and duration; nearly 2000 organizations offer CDC-recognized LCPs nationwide.[6]

The implementation of the LCP in the National DPP can vary in delivery formats such as in-person versus virtually, or individual versus group coaching.[7] Such variations in intervention LCP delivery formats are likely to influence the cost, effectiveness, and sustainability of program. More intensive and more costly programs (e.g., more sessions, more frequent contacts, longer duration, or individual coaching) are likely to be more effective in reducing body weight and preventing T2D.[8]

The potential health benefits of LCPs also depend on T2D risk level in the intervention population.[9] An LCP with the same relative risk reduction would yield greater health benefits among those at high T2D risk due to their high absolute level of diabetes risk than among those at low risk. Thus, the various combinations of LCPs, along with the differing risk levels within the intervention population, are likely to yield divergent overall health and economic benefits and cost-effectiveness.

Previous studies examined and found that the cost-effectiveness of LCPs differed by program intensity and by subpopulations, defined by different categories of intermediate hyperglycemia or different characteristics on T2D risk.[10-12] However, no studies examined the cost-effectiveness of various program-risk combinations to match the existing LCPs with the T2D risk of intervention populations. This study examined the cost-effectiveness of three primary delivery formats of LCPs in populations with varying risk levels of T2D to identify the threshold of the underlying T2D risk to which each LCP format can be cost-effective. We also compared the cost-effectiveness across the LCPs formats when there are more than one cost-effective formats available at a given risk level.

2 | METHODS

We estimated the cost-effectiveness associated with 24 program-population combinations to identify the risk levels of the intervention population that make the LCP cost-effective.

The 24 combinations were a result of 3 formats of LCPs and 8 intervention populations with an annual risk of developing T2D, ranging from 1% to 8%. We also compared the cost-effectiveness of different LCP formats among the participants with T2D risk level greater than the identified risk threshold.

2.1 | Simulation samples

We used the 2011–2016 National Health and Nutrition Examination Survey to generate a nationally representative sample of US adults without diabetes aged 18–84 years. The baseline characteristics included age, race/ethnicity, sex, serum cholesterol level, smoking status, and status of diabetes-related comorbidities (Appendix A). The annual risk of T2D ranged from 1% to 8%, which was estimated based on HbA1c levels at baseline, ranging from 5.2% to 6.5% (Appendix B).[13] This estimation was based on a systemic review study that modeled the HbA1c level as a function of diabetes incidence using data from previous cohort studies.[13]

2.2 | Lifestyle change programs

We grouped LCPs into three formats: program with in-person individual coaching, in-person group coaching program, and digitally delivered program with individual coaching.

The in-person individual program was based on the DPP trial. It included a 16-lesson core curriculum addressing dietary changes, increased physical activity, and behaviour modification, delivered by case managers on a one-to-one basis during the first 6 months.[5] A subsequent adherence/maintenance phase was followed to provide individual and group sessions at regular intervals, which continued throughout the 3 years.[14]

The in-person group program was the DPP-like program as implemented in community settings, which were designed to translate key elements of the DPP trial to the community level at a lower cost using a group-based approach.[15,16] The program began with 16 group-based core sessions over 4–5 months, followed by 6 monthly group sessions as a maintenance phase. In the following two years, we assumed that the participants would attend eight maintenance sessions every year.[17]

Lastly, the digital individual program was based on a digital intensive behavioural counselling program, which retains the core components of the DPP trial but is delivered in a digital, online format using internet-enabled devices.[18,19] Participants first received 16 weekly core sessions, followed by 8 monthly maintenance sessions during the first year. The maintenance phase, which took 8 lessons per year, lasted for the next 2 years. Participants received several behavioural tools and regular, individualized counselling from a lifestyle coach.

2.3 | Program costs and effectiveness

The costs of LCPs included supplies, personnel time, and program administration base on previous studies. The costs of the in-person individual program were obtained from the DPP study.[5] The costs of in-person group and digital individual programs were based on published literatures.[4,17,18,20,21] Table 1 summarizes the details.

We estimated the effectiveness of the LCPs in reducing the annual incidence of T2D onset using published literature. The 55% annual risk reduction in T2D incidence for in-person individual program was from the DPP study.[22] The risk reduction for the in-person group program was estimated at 40% in the first year of intervention.[17,23,24] Given the limited information on the effectiveness of the group program after the first year, we assumed that the intervention would lead to a diabetes risk reduction of 20% in the second and 12% in the third year. For the digital individual program, we estimated the risk reduction by 35% in the first year using average percentage weight change during the DPP-based digitally delivered program.[25] The risk reductions in the second and third years were estimated in the same way as the in-person group program: 17.5% and 10.5% in the second and third years, respectively. Details are described in Appendix C.

2.4 | Simulation model

We used CDC-RTI T2D Cost-Effectiveness Simulation (CDC-RTI T2D CE) Model to project the 25-year costs and health consequences of implementing each of the 24 program-population combinations, compared with no intervention.[26] The CDC-RTI T2D CE model is Markov cohort simulation model, which simulated the progression of the disease through different health states, including T2D, comorbidities, diabetes complications, and death.[22,26] The model has been validated and used for evaluating the cost-effectiveness of various interventions for preventing T2D and diabetes-related complications.[17,22,26] Details of the simulation model are described in Appendix G.

People in the simulated intervention group received three formats of LCPs for a 3-year time window. The T2D progression of the study population was based on their annual incidence of Tdiabetes, and the LCPs was assumed to reduce the risk of T2D onset. People in the comparison group did not receive LCPs and their T2D progression would follow the annual incidence of diabetes.

We estimated incremental cost-effectiveness ratio (ICER), expressed in costs per quality-adjusted life year (QALY), to measure the cost-effectiveness of each program-population combination. We adopted a threshold of $50,000/QALY to determine whether a program-population combination is cost-effective.[27] We took a health care system perspective and considered only the intervention costs and the direct medical costs associated with treating T2D and diabetes-related complications. All costs were expressed in 2018 US dollars. Costs and QALYs were discounted at an annual rate of 3%.

2.5 | Sensitivity analysis

We conducted multiple univariate sensitivity analyses (SA). First, we assumed that the effectiveness of intervention lasts up to 5 years instead of 3 years (SA1). Second, we examined if the ICERs differed by age group (<65 and ≥65 years) (SA2 and SA3).[2] Third, we applied lower and upper bounds of costs and effectiveness of interventions (SA4 and SA5). Fourth, we estimated the 10-year (SA6) and lifetime (SA7) cost-effectiveness of each of the 3 formats of LCPs. Lastly, we varied a discount rate of costs and QALYs, 0% and 5% (SA8 and SA9). Details appear in Appendix E.

3 | RESULTS

3.1 | Main analysis

Figure 1 shows the ICERs of the three formats of LCPs associated with each of the T2D risk levels among the intervention population. Overall, ICERs were higher in the in-person individual program, followed by the digital individual program and the in-person group program. Compared to no intervention group, the QALYs gained were the highest in the in-person individual program, followed by the in-person group program and the digital individual program (Table 2). Using the $50,000/QALY threshold, a program was deemed cost-effective when it was implemented among people with the following annual risk levels: over 5% (HbA1c ≤5.9%–<6.1%) for the in-person individual program, over 4% (HbA1c ≤5.8%–<5.9%) for the digital individual program, and over 3% (HbA1c ≤5.6%–<5.8%) for the in-person group program.

Table 3 shows the incremental cost-effectiveness of the three LCP formats by comparing one format to the next more effective format, which were conducted among individuals with T2D risk above the identified thresholds (i.e., 3% for in-person group, 4% for digital individual, and 5% for in-person individual programs). For the individuals with T2D risk levels between 3% and 7%, the in-person group programs dominated the digital individual programs; the ICERs of in-person individual programs were greater than $50,000 per QALY compared to the in-person group program. The in-person individual program was cost-effective compared with the in-person group program among participants at risk ≥8%.

3.2 | Sensitivity analysis

Table 4 summarizes the results of the univariate sensitivity analyses for 9 scenarios for each of the three LCPs. All three program formats were sensitive to changes in the costs and effectiveness of the interventions (SA5), changes in the time-horizon (SA6 and SA7) and change in the discount rate (SA8). However, except for SA6, there were no substantial differences in the diabetes risk threshold at which the program became cost-effective. When the time horizon was 10 years (SA6), the in-person group program was not cost-effective at any risk level and the other two programs were cost-effective at higher risk levels than in the base-case. More detailed results are described in Appendices E and F.

4 | DISCUSSION

Several LCP delivery formats have been implemented in real-world settings based on the core content of the National DPP. Since these intervention program formats differ in both cost and effectiveness, applying different program formats to populations with a same risk level of T2D may not be an efficient approach to use the limited heath care resources. Using a cost-effectiveness analysis framework, we identified the diabetes risk threshold in the intervention population to which a program format is considered to be a cost-effective use of resources. Our findings show that, in order for a program to be cost-effective at a threshold of $50,000/QALY, T2D risk in the intervention population should be 5% or higher for in-person individual program, 4% or higher for the digital individual program, and 3% or higher for the in-person group program. Additionally, when all three LCP formats are

available, the in-person group program should be considered for adoption if participants' risk levels were between 3% and 7%, and the in-person individual program could be selected if participant's risk levels were ≥8%.

For a high-cost program format to remain cost-effective, high program costs need to be compensated by a higher health benefit. With the same level of program's effectiveness in terms of relative risk reduction, the health gained would be larger in a higher-risk population due to a high absolute level of T2D risk. A highly effective program can remain cost-effective even with smaller health benefits, thus, such a program can be applied to a population with a lower level of T2D risk. Although the in-person individual program format is the most effective in reducing T2D incidence, its high cost makes it cost-effective only among those at risk level of 5% or greater (HbA1c ≥ 5.9%) using the $50,000/QALY threshold. By comparison, while the digital individual program format is the least effective, its lower costs (compared to the in-person individual program) allow for its use with a lower risk population. With lower costs and greater effectiveness than the digital individual program format, the in-person group program format remains cost-effective even at the 3% risk level.

While comparing the cost-effectiveness of the three LCP formats, the in-person group program always dominated the digital individual program. This is mainly because the digital individual program had a slightly higher cost and lower effectiveness than the in-person group program. The digital individual program has an advantage of reaching more people, especially those who live in remote areas. Efforts to improve the effectiveness of the digital individual program while reducing costs would make this program more attractive. Although the in-person individual program is the most costly, it may be an attractive option for those at very high risk of T2D. The absolute health benefits from LCPs would be larger for individuals with a higher T2D risk, which could offset the additional costs of the program, making the program cost-effective. Our findings of comparisons between the program formats can help in choosing an LCP from cost-effectiveness standpoint if all three formats are available.

Although we used the $50,000/QALY threshold to determine the cost-effectiveness of the LCP, there is no universal agreement on what threshold should be used for adopting an intervention.[27] When using a lower cost-effectiveness threshold ($20,000/QALY), the risk thresholds for each program format were higher; 6% for the digital individual program, 5% for the in-person group program, and not cost-effective at any risk level for the in-person individual program. On the other hand, using a $100,000/QALY as advocated recently,[27] LCPs were cost-effective at even lower risk levels; ≥3% for the in-person individual program and ≥2% for the digital individual and the in-person group programs. As the threshold would reflect the level of a decision-maker's willingness-to-pay for an intervention, decision makers could find the T2D risk thresholds for selecting the target intervention populations based on their willingness-to-pay from the information in Figure 1.

To utilize our study results for selecting the appropriate population for LCPs, it is necessary to know the risk of developing T2D of the intervention population. If participants' HbA1c levels are known, the risk could be estimated by the information provided in Appendix B.

Another way to predict participants' T2D risk could be using diabetes risk equations. For example, the T2D risk can be estimated based on age, sex, race/ethnicity, body mass index, family history of diabetes, smoking, blood pressure, and cholesterol status.[28] Future studies are needed to develop other risk stratification tool (e.g., mapping of all different risk factors and diabetes risk levels) to estimate the probability of T2D onset based on individuals' risk factors.

In addition to cost and effectiveness of the intervention itself, it is necessary to consider participants' preferences or the availability of programs when selecting program and intervention populations. Selecting a program format that fits participants' preference may increase their adherence to the program; for example, participants may prefer individual consultation, as compared to counselling in groups of several participants.[29] Furthermore, not all program format selections are feasible in certain areas (e.g., rural areas) or circumstances (e.g., ongoing pandemic or difficulties with transportation). In this case, digitally delivered program format could be more appropriate, although interventions with more frequent in-person individual contact are more effective in diabetes risk reduction.[18]

This study is subject to several limitations. First, as in other simulation models, because the CDC-RTI T2D CE model and the parameters used in the simulation were developed based on data from multiple sources, our findings rely heavily on the assumptions in the model. However, the model has been widely used and validated in previous studies[17,22,26]; therefore, we believe that our incremental estimates are valid with reliable prediction accuracy. Second, since the CDC-RTI T2D CE model used cohort-based data, our findings represent the average expected effects of interventions among the general population rather than at the individual level. Thus, our findings may not apply to individuals with characteristics that differ from the average population. Third, we used HbA1c value alone to determine the progression of T2D due to the limited data and our model capacity. As more data emerge, future stratified analyses could provide insight into how risk thresholds will vary between different subpopulations based on other biomarkers or risk scores. Fourth, in our simulation, we did not account for participants' preference, uptake, and adherence explicitly to the LCPs, which are important factors that could affect the health benefits of an intervention.[7] However, since our model parameters were mostly based on data from translational trial in real word settings, we believe that our parameters of health benefits captured the individuals' uptake and adherence to the intervention. Fifth, our findings are based on the assumption that participants continue to enrol in the LCPs for 3 years, which may vary in actual programs. Lastly, due to our computational power constraints, we were not able to conduct a probabilistic sensitivity analysis. Ideally, each model parameter should be sampled from the distribution and reflected in the calculation of variations in lifetime costs and QALYs.

5 | CONCLUSIONS

Our study goal was to identify the target population to implement three formats of LCPs for T2D prevention from a cost-effectiveness perspective. Our findings suggest that LCPs would be more cost-effective by incorporating T2D risk levels of the target population. In-person individual program is cost-effective when implemented among a population at T2D risk of

≥5%. The digital individual and in-person group programs can be implemented in people with a relatively lower T2D risk (≥4% and ≥3%, respectively). If multiple LCP formats are available, the in-person group program may be given priority over the other two formats if the participants' T2D risks are between 3% and 7%; the in-person individual program is a cost-effective option if participant's T2D risk is ≥8%. Besides considering the availability of the program formats and participants' preferences, our findings could assist public health practitioners and decision-makers in defining the eligibility criteria for the target population or prioritizing recruitment for the program from a cost-effective perspective.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Disclaimer:

The findings and conclusions in this study are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

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What is already known?

- Lifestyle interventions are cost-effective in reducing the risk of developing type 2 diabetes (T2D) among high-risk individuals.
- The cost and effectiveness of intervention may vary depending on the delivery format of intervention program and the participant's T2D risk level.

What this study has found?

- We found participant's T2D risk threshold at which each intervention program can be cost-effective; T2D risk should be ≥5% for in-person individual program, ≥4% for digital individual program, and ≥3% for in-person group program, based on $50,000/QALY threshold.

What are the implications of the study?

- Our findings may help decision-makers define eligibility criteria for target populations that ensure efficient use of health care resources.

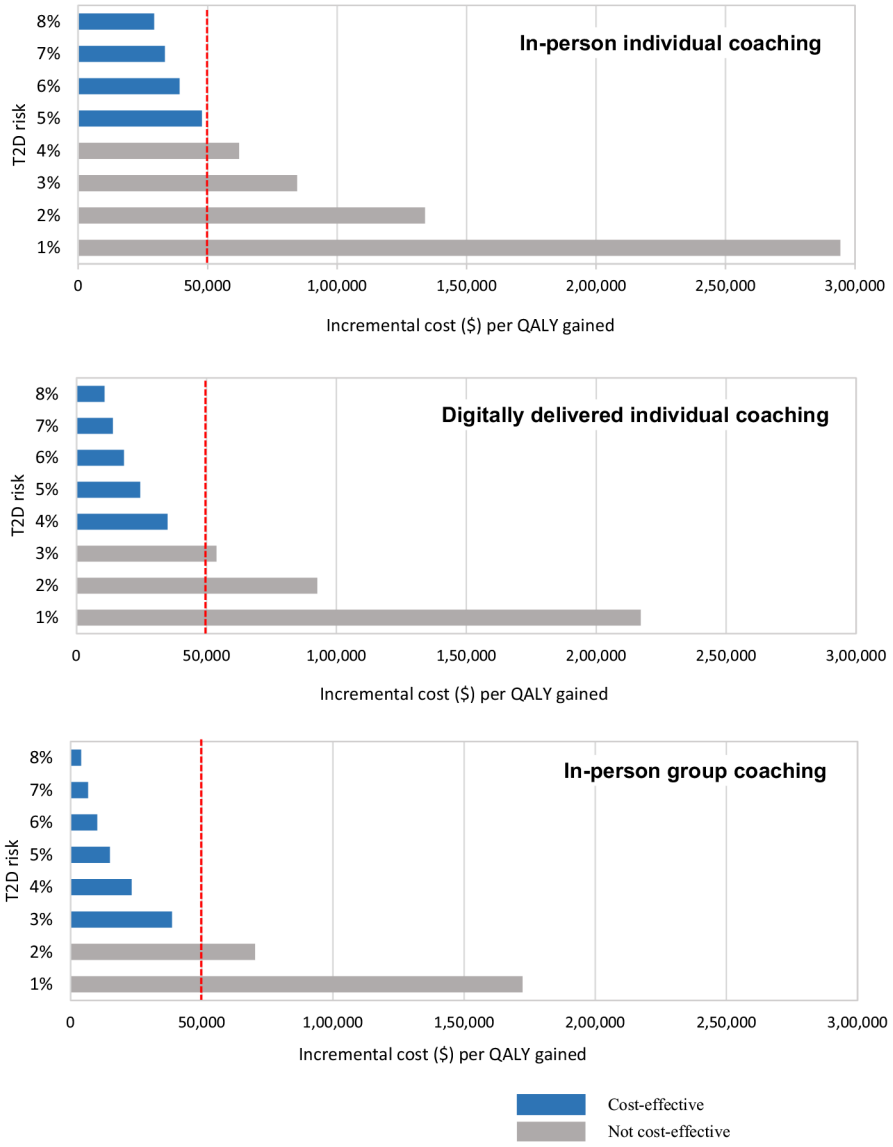

FIGURE 1.

Cost-effectiveness of three lifestyle change intervention programs by annual risk of type 2 diabetes (T2D) based on $50,000/QALY threshold

TABLE 1

Costs and effectiveness of three types of lifestyle change programs

	Cost/effectiveness	Base case value	Data source	Sensitivity analysis
Lifestyle intervention with in-person individual coaching	Costs ($)			
	Year 1	2600	Herman.[5]	1300–3900
	Year 2	1300		650–1950
	Year 3	1300		650–1950
	Year 4, beyond	0		0
	Reduction in diabetes risk (%)			
	Year 1	55.0	Herman et al.[22]	40–80
	Year 2	55.0	DPP Research Group[30]	25–65
	Year 3	55.0		25–65
	Year 4, beyond	0.0		
Lifestyle intervention with in-person group coaching	Costs ($)			
	Year 1	592	Li et al.[4] Lawlor et al.[21]	389–684
	Year 2	267	Zhuo et al.[17]	182–352
	Year 3	267	Lawlor et al.[21]	182–352
	Year 4, beyond	0		0
	Reduction in diabetes risk (%)			
	Year 1	40.0	Zhuo et al.[17] Mudaliar et al.[23] Vitolins et al.[24]	25.1–55.7
	Year 2	20.0	—	10–30
	Year 3	12.0	—	0–20
	Year 4, beyond	0.0	—	Y4: 0–5 Y5: 0
Lifestyle intervention with digitally delivered individual coaching	Costs ($)			
	Year 1	672	ICER[18]	336–891
	Year 2	334	Su et al.[20]	167–392
	Year 3	222	Su et al.[20]	111–337

	Cost/effectiveness	Base case value	Data source	Sensitivity analysis
	Year 4, beyond	0		0
	Reduction in diabetes risk (%)			
	Year 1	35.0	Joiner et al.[25]	25–45
	Year 2	17.5	—	10–30
	Year 3	10.5	—	0–20
	Year 4, beyond	0.0	—	Y4: 0–5 Y5: 0

Note: All costs were expressed in 2018 US dollars.

TABLE 2

Incremental costs, QALYs gained, and incremental cost-effectiveness ratios for each program format (relative to no intervention)

	T2D risk	Incremental costs ($)	QALYs gained	ICER
In-person individual coaching	1%	4953	0.017	294,363
	2%	4417	0.033	133,954
	3%	3977	0.047	84,548
	4%	3619	0.058	62,181
	5%	3352	0.070	47,794
	6%	3163	0.081	39,164
	7%	2952	0.088	33,503
	8%	2769	0.094	29,335
Digitally delivered with individual coaching	1%	1454	0.007	217,125
	2%	1197	0.013	92,674
	3%	993	0.018	53,865
	4%	806	0.023	35,002
	5%	679	0.028	24,486
	6%	584	0.032	18,273
	7%	487	0.035	13,960
	8%	402	0.037	10,766
In-person group coaching	1%	1319	0.008	172,306
	2%	1039	0.015	70,340
	3%	816	0.021	38,676
	4%	615	0.026	23,297
	5%	476	0.032	14,975
	6%	373	0.037	10,190
	7%	265	0.040	6654
	8%	172	0.043	4031

Note: For each program format, incremental costs, QALYs gained, and incremental cost-effective ratios were calculated compared to no intervention group. The simulations were performed separately for each T2D risk level.

Abbreviations: ICER, incremental cost-effectiveness ratio; QALY, quality-adjusted life year; T2D, type 2 diabetes.

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TABLE 3

Total costs, QALYs, incremental cost-effectiveness ratios of three lifestyle change programs by type 2 diabetes risk level

T2D risk[a]	Intervention	Total cost ($)	Total QALYs	ΔCost ($)	ΔQALY	ICER[b]
3%	No intervention	67,074	9.560	—	—	—
	In-person Group	67,890	9.577	816	0.017	48,000
4%	No intervention	69,845	8.800	—	—	—
	Digital Individual	70,651	8.827	806	0.023	34,906
	In-person Group	70,460	8.830	−191	0.003	Dominant
5%	No intervention	70,579	8.500	—	—	—
	Digital Individual	71,258	8.523	679	0.028	24,517
	In-person Group	71,055	8.527	−203	0.004	Dominant
	In-person Individual	73,849	8.568	2794	0.041	68,313
6%	No intervention	70,768	8.131	—	—	—
	Digital Individual	71,351	8.163	583	0.032	18,219
	In-person Group	71,140	8.168	−211	0.005	Dominant
	In-person Individual	73,848	8.215	2708	0.047	57,987
7%	No intervention	72,237	8.070	—	—	—
	Digital Individual	72,724	8.105	487	0.035	13,954
	In-person Group	72,503	8.110	−221	0.005	Dominant
	In-person Individual	75,096	8.162	2593	0.051	50,645
8%	No intervention	73,553	8.016	—	—	—
	Digital Individual	73,955	8.053	402	0.037	10,777
	In-person Group	73,726	8.058	−229	0.005	Dominant
	In-person Individual	76,219	8.113	2493	0.055	45,410

Note: Abbreviations: ICER, incremental cost-effectiveness ratio; QALY, quality-adjusted life year; T2D, type 2 diabetes.

[a]ICERs were calculated only for the participants with T2D risk greater than the identified risk thresholds of the three program formats (3% for in-person group program, 4% for digital individual program, and 5% for in-person individual program).

[b]For each T2D risk level, incremental costs, QALYs gained, and incremental cost-effective ratios were calculated compared with the next best alternative program format.

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TABLE 4

Incremental cost ($) per QALY gained of three lifestyle change programs in one-way sensitivity analyses

			One-way sensitivity analyses ($/QALY)[a]								
Lifestyle change interventions	**Annual T2D risk (%)**	**Base case ($/QALY)**	**SA1**	**SA2**	**SA3**	**SA4**	**SA5**	**SA6**	**SA7**	**SA8**	**SA9**
In-person individual coaching	1	294,363	270,983	304,601	241,083	289,855	324,807	950,811	131,436	196,627	374,700
	2	133,954	122,358	138,171	119,598	129,499	149,968	439,401	70,583	86,290	172,975
	3	84,548	76,653	86,959	86,547	80,384	95,940	276,860	51,075	52,799	110,427
	4	62,181	56,043	59,825	76,091	57,822	71,540	197,847	42,370	38,108	81,695
	5	47,794	42,817	45,178	59,594	43,709	55,624	149,999	35,182	28,780	63,177
	6	39,164	34,955	35,594	49,895	35,198	46,016	118,848	30,879	23,483	51,811
	7	33,503	29,711	30,045	43,780	29,642	39,799	100,345	27,079	19,691	44,614
	8	29,335	25,854	25,983	39,226	25,540	35,222	86,551	24,240	16,933	39,288
Digitally delivered with individual coaching	1	217,125	201,576	231,378	162,791	250,832	163,225	424,840	106,309	159,289	263,850
	2	92,674	85,164	96,984	78,029	104,772	67,354	182,076	52,141	64,782	115,139
	3	53,865	48,932	56,250	54,503	59,671	37,476	120,468	34,021	35,526	68,628
	4	35,002	31,376	34,285	45,578	37,162	23,184	79,763	24,568	21,578	45,814
	5	24,486	21,632	22,996	34,218	25,102	15,283	55,172	18,521	14,133	32,845
	6	18,273	15,932	15,696	27,581	17,778	10,814	39,484	14,874	9974	24,980
	7	13,960	11,901	11,194	23,267	12,928	7430	30,022	11,725	6822	19,742
	8	10,766	8918	7870	20,032	9318	4929	22,968	9345	4508	15,845
In-person group coaching	1	172,306	158,924	183,784	129,650	284,592	123,227	472,543	84,595	126,559	209,155
	2	70,340	63,901	73,424	61,082	122,050	47,081	205,056	39,512	48,518	87,896
	3	38,676	34,460	40,023	41,695	71,590	23,487	121,436	24,325	24,500	50,100
	4	23,297	20,215	21,997	34,236	46,506	12,200	79,121	16,333	13,103	31,541
	5	14,975	12,557	12,934	24,918	32,765	6260	55,172	11,397	7244	21,263
	6	10,190	8213	7248	19,551	24,346	3054	39,800	8486	4106	15,160
	7	6654	4918	3531	16,032	18,889	362	30,326	‰5848	‰1507	10,883
	8	4031	2477	782	13,385	14,827	−1632	23,262	3845	−402	7697

[a]SA1: interventions were assumed to be effective after year 3 (i.e., effectiveness of in-person individual program was 10% in year 4, 5% in year 5, and 0% thereafter; effectiveness of in-person group program was 6% in year 4 and 0% thereafter; and effectiveness of digital individual program was 5% in year 4 and 0% thereafter); SA2: participants aged <65 years only; SA3: participants aged ≥65 years only; SA4: used lower-bounds of costs and effectiveness of interventions; SA5: used upper-bounds of costs and effectiveness of intervention; SA6: estimated the 10-year costs and health benefits;

SA7: estimated the lifetime costs and health benefits; SA8: costs and QALYs were discounted at 0% per year; SA9: costs and QALYs were discounted at 5% per year. T2D, type 2 diabetes; QALY, quality-adjusted life year. Cost-effective based on $50,000/QALY threshold